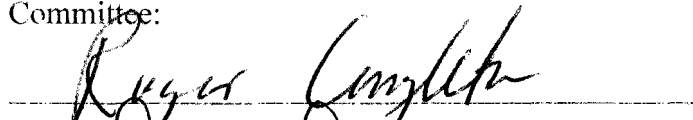
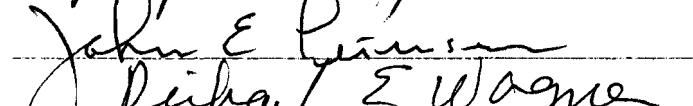

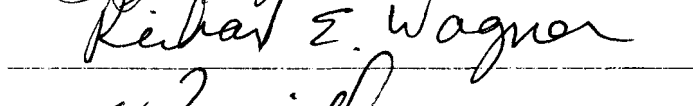
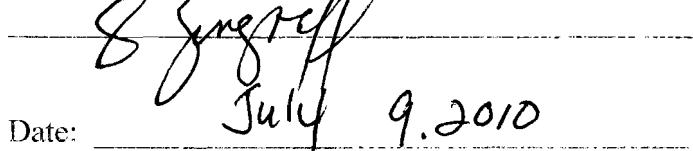


GROWTH OF SOCIAL SECURITY: DYNAMIC EFFECT OF PUBLIC CHOICE

by

Youngshin Kim  
A Dissertation  
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Graduate Faculty  
of  
George Mason University  
in Partial Fulfillment of  
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of  
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Growth of Social Security: Dynamic Effect of Public Choice

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## DEDICATION

This is dedicated to the God, and my loving families: parents JaeWoo Kim and MooJa Choi, my wife Hyun Kyoung Oh, and my two wonderful children Hamin and Gyum.

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## ABSTRACT

### GROWTH OF SOCIAL SECURITY: DYNAMIC EFFECT OF PUBLIC CHOICE

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Dissertation Director: Dr. Roger D. Congleton

This dissertation addresses the question: why expenditure on social security retirement benefit in the U.S. has increased dramatically since World War II., even after the increased number of retired persons and inflation are adjusted for. This dissertation investigates the growth of social security retirement benefit in the U.S. from the perspective of public choice through theoretical analysis as well as empirical analysis with relevant time-series data sets.

Chapter 1 explains the significance of social security, brief history of the U.S. Social Security, and its institutional features. Chapter 2 discusses relevant economics literature regarding the political economy of social security and empirical analysis including median voter theory and interest group theory. Chapter 3 develops the models used in this dissertation, based on the Congleton-Shughart approach. Chapter 4 examines data sets and replicates the Congleton-Shughart estimates, which are compared to new results using more advanced econometric techniques. Chapter 5 explores extended data

sets, and presents new estimates of U.S Social Security growth obtained through various time series methodologies. This paper finds that both the median voter's preference and political interest groups significantly influenced the growth of the real retirement benefits in the U.S. Social Security. It also shows the forecasted values by different models to find dynamic causal effect of a change in median voter's constraints and of special interest group's political influence on the benefit levels in Chapter 6. Chapter 7 analyzes legislation effects on social security from legislation adopted in 1983, the reform of the Greenspan Commission. It can be demonstrated that the Greenspan effect greatly improved the balance of the Trust Funds. Concluding remarks and useful policy implications are developed in Chapter 8. The analysis of this dissertation suggests that, although the politics may have changed, the political economy of social security implies that changes remain possible.

# **1 Introduction**

## **1.1 Background**

The U.S. Social Security Act was passed in 1935 and employers and workers began to register and acquire credits toward old-age insurance benefits in 1937. In 1940, the first person began to receive a monthly retirement benefit. However, the current Social Security Administration was started in 1946.<sup>1</sup> Expenditure on social security retirement benefits in the U.S. has increased dramatically since World War II. The pension part of the social security program was 0.36% of U.S. federal government spending in 1946 and had increased to about 22.4% of the total federal government outlays in 2008. Federal outlays were approximately 61.7 billion dollars in 1946 and were approximately 2,931.2 billion dollars in 2008.<sup>2</sup> Deflated with the all-item CPI in 1967, total expenditures<sup>3</sup> on the social security program in 1946 were 379 million dollars, and this amount had increased to about 102 billion dollars by 2008, a two hundred seventy-fold increase in expenditures.<sup>4</sup> The remainder of the increase reflected population growth during the same period: approximately, 141,389,000 in 1946 to 304,483,000 in 2008, which is about a

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<sup>1</sup> Additionally, World War II, which spanned several years during this period, ended in 1945. Thus, it is reasonable to analyze the period starting at 1946, rather than at 1935.

<sup>2</sup> U.S. Census Bureau, Statistical Abstract of the United States.

<sup>3</sup> In nominal terms, total expenditure was 222 million dollars in 1946 and 656 billion dollars in 2008.

<sup>4</sup> The estimate for the year 1946 is from 'The Historical Statistics of the United States, Colonial Times to 1970' and the estimate for the year 2008 from U.S. Census Bureau, of which the original source is U.S. Social Security Administration, Annual Statistical Supplement to the Social Security Bulletin; and unpublished data.

two-fold increase. In real terms, the average social security monthly benefit per recipient increased, from 42 dollars in 1946 to 179 dollars in 2008, more than a four-fold increase.<sup>5</sup> The social security program has clearly been one of the fastest growing federal programs.

Besides the growth of social security outlays, there is also concern about its effect on labor participation and personal savings. For example, people are inclined to retire earlier and retired individuals to live longer, while people tend to have fewer children. Labor force participation by older persons has declined over the past several decades. According to Gruber and Wise (1999), about 60 percent of men aged 65 to 69 participated in the labor force in 1950, but this had fallen to 26 percent by 1990.<sup>6</sup> One reason for this is that the Social Security Amendment of 1961 had changed men's eligibility for old-age insurance to age 62. Also, the Supplemental Security Income (SSI) program by the Amendments of 1972 increased benefits for early retirement at age 62 for men and women. Partly as a result of these changes, only 51 percent of 62-year old men participated in the labor force in 1995, which was far below the 81 percent participating in 1950 (Gruber and Wise 2004).

The salary replacement rate (the percentage of pre-retirement salary that is available to a worker in retirement) and program eligibility evidently play key roles in determining the age of retirement.<sup>7</sup> By comparing the expected income of continuous

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<sup>5</sup> In nominal terms, average social security benefit per month was 24.55 dollars in 1946 and 1,153 dollars in 2008.

<sup>6</sup> However, over the same period, the participation rate by older women in the labor force had increased. This is because women's roles had changed and because more working opportunities were provided (Gruber and Wise 2004).

<sup>7</sup> Replacement rate is the percentage of earnings replaced by benefits. More detailed explanation and examples are in Section 1.3 and Chapter 8.

employment with the expected social security retirement benefits, working people determine their retirement timing (Gruber and Wise 1999).<sup>8</sup>

Over the same period, longevity increased. Life expectation at birth in 1950 was 68.2 years, and had risen to 77.8 years by 2004. A 60-year old white male in 1950 was expected to live 15.8 years more, but the same aged person in 2004 was expected to live 20.9 years more. Taking account of the population difference of persons at age 60 between in 1950 and in 2004, such an increase in longevity clearly required a large increase in funds for old age benefits. Earlier retirement induced by rising social security benefits and eligibility and an increase in longevity tend to boost expenses while reducing the tax base available to support the program.

The problem of financing public pension programs has also been increased by the decline in fertility over the past several decades. For instance, the fertility rate in 1950 was 106.2 per 1,000 for women 15-44 years old in the United States; it fell to 87.9 in 1970 and to 66.3 in 2004.<sup>9</sup> Similar changes have occurred in other Western nations as well. As a consequence, there has been a significant reduction in the growth rate of young working people, and consequently, of the tax base (labor income) used to finance social security programs. Such demographic tendencies can generate a fiscal imbalance between promised payments to retired people and tax payments from working generations in the future.

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<sup>8</sup> A concept of present discounted value should be used to compare a series of benefits and costs through time.

<sup>9</sup> The Historical Statistics of the United States, Colonial Times to 1970 and Statistical Abstract of the United States 2008.

Due to earlier retirement, increased life expectancy, and a falling fertility rate, pay-as-you-go systems can become unsustainable. Under pay-as-you-go systems, taxes paid by working generations are not used to accumulate assets to provide for that generation's future consumption, but are directly transferred to persons who are currently retired (Hillman 2003).

Some social security estimates anticipate the outlays will exceed revenues for the U.S. social security program in approximately 2017 (Tanner 2005), just 7 years from now.<sup>10</sup> Baby boomers are beginning to retire, and their numbers imply that the social security program will require a great deal of more tax revenue than the current system produces in order to provide them with their promised benefits.<sup>11</sup> Because of the 2008-10 recession, current estimates expect a deficit in 2010. By some measure (net of interest payments) the OASDI program is already in deficit. In spite of growing concerns about funding the existing pension program, the demand for higher social security benefits has increased faster than tax revenues in the United States and throughout much of the West.

## **1.2 History of the U.S. Social Security Program**

Before analyzing the growth of the Social Security program in greater detail, it is useful to provide a short overview of its historical background and development. As specialization and economic uncertainty grew in the 19<sup>th</sup> century, European countries were in search of a safety net. In 1889, the German Chancellor Otto von Bismarck proposed the first nation-wide social security system funded as a pay-as-you-go system,

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<sup>10</sup> According to Smetters (2003), the most current 2003 Social Security Trustees' Report estimates that the trust fund will be depleted in 2042.

<sup>11</sup> This indicates a person who was born during the post-World War II baby boom (1946-1964), the period when birth rates were unusually spiked. (Wikipedia: [http://en.wikipedia.org/wiki/Baby\\_boomer](http://en.wikipedia.org/wiki/Baby_boomer))



and it was adopted in the German parliament by a coalition of conservatives and liberals in the same year. Bismarck's innovation was copied by many other countries around the world.<sup>12</sup> Thirty-four countries had adopted similar social insurance programs by the time the United States finally adopted its program in 1935, although details varied somewhat among countries.<sup>13</sup> Most of the programs were forms of social insurance that attempted to insure people against economic risks due to cessation of work activity (unemployment and disability) and also to provide for pensions when work was no longer possible because of old age. The programs were largely financed as pay-as-you-go programs.

With the outbreak of the Great Depression in the U.S., starting at the crash of the stock market on October 29, 1929, the wealth and income of many elderly people shrank dramatically. At that time, only a few states supported welfare systems that provided money benefits to the elderly and unemployed. As the Great Depression continued, President Franklin D. Roosevelt sought to relieve the poverty of such persons by proposing a program for social security in 1935. On January 17, the President introduced the report to both houses of Congress for simultaneous consideration. A coalition of Democrats and Republicans adopted the program. On August 9, the bill was cleared by the Senate and went to the President for signing. On August 14, 1935, the Social Security Act was signed into law by President Roosevelt.

The new program committed the federal government to provide a social insurance program. Of particular interest is that this program provided retired workers age 65 or

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<sup>12</sup> Great Britain adopted an Old-Age Pensions Act in 1908 and Sweden in 1913.

<sup>13</sup> Social Security Online, U.S. Social Security Administration:  
<http://www.ssa.gov/history/briefhistory3.html>.

older with a new source of income after retirement, although the first monthly retirement benefit check would not be distributed until 5 years after the bill was signed.

Part of the attraction of the new program was that it sought to address the long-range problem of economic security for the aged through a “contribution system” in which the workers themselves contributed to their own future retirement benefits by making regular payments into a joint fund. However, that fund was used to provide benefits to those already retired rather than for the purchase of assets to be used by persons making the contributions (e.g. paying their social security taxes).

On January 1, 1937 employers and workers began to register and acquire credits toward old-age insurance benefits. In 1939 the original Act was amended to add expanded dependents’ benefits and survivor’s benefits. More specifically, benefits were provided for the spouse and minor children of a retired worker, and the same family members in the case that a covered worker died earlier. The social security program became the Old Age and Survivors Insurance (OASI) program. The first taxes were collected in 1937 and monthly benefits would begin in 1940. The first social security tax rate was 1% each by employees and employers. On January 31, 1940, the first person received a monthly retirement benefit check (\$22.54).

After the end of World War II, the U.S. became a leading model for the social security systems around the world, in part because of the Atlantic Charter, which was drafted in August 1941 at the Atlantic Conference by British Prime Minister Winston

Churchill and U.S. President Franklin D. Roosevelt.<sup>14</sup> The Atlantic Charter was a published 8 point statement of agreement between the U.K. and the U.S., and became a foundation document for the postwar United Nations. The fifth point addressed the desire to bring about the fullest collaboration between all nations in the economic field with the object of securing improved labor standards, economic advancement and social security for all. The social insurance provision was a suggestion of the former U.S. Social Security Board Chairman, John Winant.

The Social Security Board (SSB), which began as an independent agency of the federal government with three members appointed by the President, was replaced by the current Social Security Administration in 1946. In 1950, amendments to the program increased the social security benefits for existing beneficiaries and paid for it with an increase in the social security tax rate, which became 1.5% each for employees and employers. In 1955, disabled workers aged 50-64 and disabled adult children began to receive benefits. As a result, the OASI was changed to the OASDI (Old Age, Survivors and Disability Insurance) program.

A variety of new benefits were added during the next two decades and the tax rates on labor income were adjusted, as was the extent of income on which persons paid their taxes. In 1956 women at ages between 62 and 65 began to get benefits. The 1961 Amendment allowed for the lowering of men's age to 62 for old-age eligibility insurance with reduced benefits.

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<sup>14</sup> On the sixth anniversary of the Social Security Act, Winston Churchill and Franklin Roosevelt announced a joint declaration containing the 383-word Charter.

A major new program was introduced on July 1, 1966, when all persons over 65 became entitled to receive medical benefits. The new “Medicare” program paid for medical expenses such as hospital insurance, covering 50% to 80% of the costs which was shared by the Federal Government and state governments.<sup>15</sup> The Social Security Amendments of 1972 introduced a new Supplemental Security Income (SSI) program for aged widows and widowers, a new minimum retirement benefit, and more benefits for early retirement at age 62 for men and women.

In 1972 the law was changed to index social security benefits, effective in 1975, to wages. This adjustment for inflation and productivity changes meant that real benefits would increase through time for those retired. The 1970s were a period of rapid inflation. To alleviate financing problems the 1977 amendments changed the benefit formula that was increasing initial benefits too rapidly (Kollmann, 2000). The 1977 amendments also raised tax rates to pay for the Cost-of-Living-Adjustments (COLAs) that reflect increase in inflation on fixed incomes,<sup>16</sup> and growth in retirement age populations. The amendments of 1977 increased social security tax<sup>17</sup> from 6.45% to 7.65% for employee and employer, respectively, while reducing the rate of increase in benefits and modifying COLAs. The technically flawed method that the 1972 amendments incorporated to provide automatic adjustments based on price growth was corrected.<sup>18</sup> Average real rate of increase in retirement benefit during the period 1973 to 1977 was about 1.72%, but fell

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<sup>15</sup> For more details, please see Vladeck (1999), p. 24.

<sup>16</sup> Due to the COLAs, social security benefits began to get larger for most years. Prior to 1975, social security benefit increases were set by legislation.

<sup>17</sup> It is for OASDI.

<sup>18</sup> The new formula still provided successive cohorts of retirees with increasing real benefit amounts.

to 0.61% in 1978. Scheduled increases in the payroll tax were also accelerated and ad hoc increases to taxable maximum amounts were possible.<sup>19</sup>

The 1977 reforms were not sufficient to solve the anticipated fiscal problems of the program. The 1983 Amendments further increased the tax rates and extent of labor income taxed, adjusted future retirement ages, and extended coverage of Federal employees under Social Security. The most prominent change was a phased increase in the normal retirement age from 65 to 67 by 2027. Through this legislation, the tax rate borne by the self-employed that was about three-fourth the sum of the tax rate borne by employees and employers became equal.

For the first time, the tax system that supported the various benefit programs attempted to produce a large reserve fund to pay for future benefits. The new reserve fund would consist of a special form of government bonds. That is to say, social security revenues above those paid out to current beneficiaries were “loaned” to the federal treasury and used to fund current expenditures. These social security surpluses have been accumulating in “trust funds” ever since, although that is expected to cease in 2017, as noted above (Tanner 2005) and further discussed below.

### **1.3 Institutional Features of the U.S. Social Security Program**

In 2010, the “pay-as-you-go” social security system in the U.S. is financed by a payroll tax that is levied equally on employees and employers.<sup>20</sup> The tax rate on each “payer” is 7.65%, which creates a marginal rate of 15.30% on labor income. Each half is composed

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<sup>19</sup> For more details, please see Martin and Weaver (2005), p 8.

<sup>20</sup> According to Diamond (2004), the U.S “pay-as-you-go” is a partially funded system, since not all the tax payments of the working generation are directly transferred to the retired generation to finance the retired generation’s consumption.

of 5.3% for the Old Age and Survivors Insurance (OASI) program, 0.9% for the Disability Insurance (DI) system, and 1.45% for Medicare's Hospital Insurance (HI) program. The tax schedule for social security benefits (OASDI) is digressive. The maximum labor income subject to OASI and DI taxation was \$87,900 in 2004 and is \$106,800 in 2009, while it is unlimited for the hospital insurance program (HI). The total marginal tax rate in 2009 was 14.3 percent for OASDI and HI programs for those with labor income below \$106,800.<sup>21</sup>

The social security benefit schedule is progressive, because the replacement rate falls with the level of lifetime earnings. 90 cents of the first dollar of earning is converted to benefits while only 15 cents of the last dollar of earnings up to the taxable maximum is so converted (Gruber and Wise 2004). However, the real benefit reflected by the national average wage index tends to rise through time. Normal retirement age has principally been 65. In the case of earlier retirement, benefits levels are decreased whereas they are increased in the case of delayed retirement. To be qualified for an OASI pension, an individual's work period should be at least forty quarters (ten years) in covered employment.

The trust funds associated with social security include the Social Security Trust Funds and Medicare Trust Funds. The former consists of Trust Funds for Old-Age and Survivors Insurance and Trust Funds for Disability Insurance, and the latter consists of Trust Funds for Hospital Insurance and Trust Funds for Supplementary Medical

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<sup>21</sup> Self-employed persons pay both "halves" of the tax for the social security programs, that is, 12.4% is the tax rate for OASDI contributions of self-employed persons (Gruber and Wise 2004, p. 694, and the Social Security's "2009 Electronic Fact Sheet Update," January 2009, SSA Publication No. 05-10003, <http://www.ssa.gov/pubs/10003.html>).

Insurance. These trust funds are principally invested in Treasury bills or special government bonds. In practice, most of them have been invested in special government bonds in order to prevent disturbance in the open market where treasury bills are traded.

#### **1.4 Significance and Feasibility**

The social security payment gradually became the largest government expenditure.<sup>22</sup> It accounted for about 22.4 percent of the total federal government expenditure in 2008. More than 90 percent of all workers are in jobs covered by Social Security.<sup>23</sup> About 50 million people are beneficiaries. About one in six Americans receives a social security benefit, and most of them are largely dependent on the benefit for their income. Social security benefits provided at least half the income for 64 percent of the aged in 2007.<sup>24</sup> In 2008, social security was cited as the only source of retirement income for 21% of seniors.<sup>25</sup> The social security is clearly one of the most important federal government systems.

This dissertation attempts to explain why real social security benefits have been increasing through time. Its approach is based on the methodology developed in Congleton and Shughart (1990). Congleton and Shughart develop and test three public choice models of the growth of social security benefits. One is an electoral model based on the median voter's interest in public pensions. Another public choice model is the

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<sup>22</sup> According to Economic Report of the President 2009, the outlay of Social security program became larger than that of national defense in 1991.

<sup>23</sup> The U.S. Social Security Online; <http://www.ssa.gov/history/briefhistory3.html>

<sup>24</sup> Fast Facts & Figures About Social Security\_2009.

<sup>25</sup> USA Today (newspaper), in October 16, 2008.  
[http://www.usatoday.com/money/perfi/retirement/2008-10-16-social-security-increase\\_N.htm?loc=interstitialskip](http://www.usatoday.com/money/perfi/retirement/2008-10-16-social-security-increase_N.htm?loc=interstitialskip)

interest group model, in which lobbying and block voting by interest groups explain pension benefit levels. For example, a good deal of lobbying is undertaken by organization representing retired person such as the AARP (American Association of Retired Persons). The last model suggests that electoral and interest group activities jointly determine social security benefit levels. That is to say, social security policies may be partly determined by voter demands and partly by interest group efforts.

The use of three separate models allows one to test the explanatory power of alternative theories of the politics of social security programs. Most subsequent work relies upon a single representation of the politics of social security programs.

#### *The Median Voter and Social Security*

Why does the median voter demand social security? There are two possible explanations. One explanation is associated with altruistic motivation of a median voter. A median voter's age in the U.S. has been in the mid-forties.<sup>26</sup> In general, such middle aged working people have higher incomes than most retired older people, many of whom are dependent on their retirement benefits. Thus, a median voter may have a charitable motivation that provides an intergenerational transfer through the social security tax, to help relatively poor retired persons.<sup>27</sup> The progressivity of the benefit schedule is, obviously, consistent with this possibility.

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<sup>26</sup> The estimated average median voter's age during the period from 1948 to 2004 is 46.2.

<sup>27</sup> In an overlapping generation model in Tabellini (2000) the old generation and the young generation are linked by mutual altruism.



Another explanation is related to consumption smoothing. A median voter also may want to save some of her/his income today for consumption when she/he is retired.<sup>28</sup> Although she/he can save without the social security system, requiring compulsory indirect saving it may secure her/his future consumption against future risk of income and asset uncertainty.<sup>29</sup>

However, through the pay-as-you-go system a median voter's saving (social security tax) is not directly transferred to her/his future retirement benefits. That is, the savings by the median voter is not accumulated to finance for herself/himself. A political equilibrium or a social contract is required to keep the chain of intergenerational transfers going, so that the program continues until the median voter retires (Browning 1975).

If there is any change in a median voter's constraint, the median voter model implies that it will cause a change in the demand for social security benefits.<sup>30</sup> This is the mechanism by which the median voter model affects the benefit level.

#### *Interest Groups and the Demand for Social Security*

Special interest groups may also have an influence over social security benefit levels. Some groups benefit as the program is expanded, while others are made worse off. A "tug of war," thus, may arise between the proponents and opponents of reform as in Becker (1983). The balance between them may ultimately determine benefit levels and eligibility, rather than voter interests.

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<sup>28</sup> Hillman (2003) discusses this consumption smoothing through intergenerational transfer satisfying Pareto efficiency.

<sup>29</sup> One example of the future risk of income uncertainty is that a median voter can mismanage her/his saving. That is, she/he may withdraw her/his money saved to use up today, so she/he would have no money for future consumption.

<sup>30</sup> More detailed explanation with equations is presented in later chapters.

Interest groups can affect policies within democracies in a variety of ways.<sup>31</sup> They may bargain with candidates for elective office, by providing campaign resources, votes, and information in exchange for promises (or implicit promises) to support legislation of particular interest to them (Congleton 1991, 2001; Mueller 2003). In modern elections, campaign resources are important for a candidate's chances of success, for many reasons, and for the most part "more is better." This provides candidates with an incentive to deviate from median voter's preference, when they can receive significant campaign resources for doing so (Congleton 1989).

Regarding social security benefit levels there are two interest groups to examine. One group is the elderly people who receive social security retirement benefits. Their strategic voting can influence the determination of social security benefit levels. The other consists of bureaucrats whose career prospects improve as social security benefits increase. For example, persons employed within the Social Security Administration in the U.S. may be such a group. The Social Security Administration has a nationwide network of over 1,400 offices and a presence in U.S. embassies around the globe, and its administrative expenditure in real terms increased more than seven times from 1946 to 2005.<sup>32</sup> Policy makers need information and advice from the skilled bureaucrats associated with the social security system beyond the factual information provided by the

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<sup>31</sup> Weingast and Marshall (1988) argues that Congress has designed an organization structure which ensures that the contracts between interest groups and legislators do not come unstuck and that legislators exercise monitoring and sanctioning of bureaucrats not to deviate from the contracts by establishing committees. The members of each committee generally constitute those who have strong interest in the legislations assigned to each committee. Such committee-vested rights can initiate and block legislation depending on their interest. Moreover, the process by which differences between House and Senate version of bills gets solved in joint committee gives key members of the original sponsoring committees the power to ensure that deals once made do not become unstuck.

<sup>32</sup> In nominal terms, the expenditure in 2007 was more than 3 billion dollars.

Social Security Administration that is accessible to the public. That is to say, the Social Security Administration has monopoly power to provide specific information about the cost of, and need for, social security benefits to both voters and legislators. In practice, strategically biased information and advice from skilled experts may affect the forming of policy makers' views regarding a specific program policy.<sup>33</sup> The more resources that are available to the agency, the stronger the ability it has to generate strategic information.

It is, therefore, quite feasible that candidates and policy makers are influenced by such groups. Within a special interest group model of social security, average benefits will tend to increase as the pro-benefit lobby becomes more effective, unless this is offset by an increase in the resistance of anti-social security groups. The pro-benefit lobby is likely to increase in effectiveness as with the number of beneficiaries and their wealth, and with administrative resources.<sup>34</sup>

## **1.5 Organization of the Dissertation**

The remainder of this dissertation is organized as follows. Chapter 2 discusses relevant economics literature regarding the political economy of social security and empirical analyses including median voter theory and interest group theory. Chapter 3 develops the models used in this dissertation, which as noted above are based on the Congleton-Shughart approach. Chapter 4 examines data sets and replicates the Congleton-Shughart estimates, which are compared to new results using more advanced econometric techniques. Chapter 5 explores extended data sets, and presents new estimates of U.S

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<sup>33</sup> In Congleton and Shugart (1990), "This process does not necessarily require falsifying data since selective emphasis of the facts is generally sufficient to push policy debates toward desired outcomes."

<sup>34</sup> Private pension data can be used as a proxy for "wealth."

Social Security growth obtained through various time series methodologies. Interval predictions and post sample forecasts regarding the empirical results are discussed in Chapter 6. Chapter 7 estimates the effects of the 1983 Greenspan reforms on the subsequent growth of the social security. Concluding remarks and useful policy implications are developed in Chapter 8.

## **2. Literature Review of Political Economy of Social Security**

Many scholars have attempted to analyze the economic effects of social security growth from the perspective of economics over the past thirty years, but not many have examined social security growth from the perspectives of political economy, especially using rational choice approaches. Governments collect payroll tax from working people and provide them with an income when they are retired and thus no longer earning a regular income from employment. In this regard, social security is associated with tax systems, and it directly affects disposable income. Accordingly, the social security programs influence on individual's consumption, savings, and labor supply choices. Furthermore, interest rate and investment are associated with capital accumulation from social security tax collection. Thus, such micro and macro factors related to social security affect economic growth in a variety of ways.

However, relatively little literature has attempted to investigate how the growth of social security has been legislatively determined, nor has much literature analyzed what agents have influenced the growth of social security. In this chapter, I survey the economics literature associated with the growth of social security in the U.S. from the viewpoint that both economic and political agents behave rationally and choose to maximize their utility. I first introduce the economics of social security literature that deals mainly with economic factors. Then, the political economy of electoral models of

social security literature is presented. Next, I survey the literature on the political economy of interest groups associated with social security. The literature attempting to explain combined models of social security literature follows. Finally, conclusions and relevance for the dissertation are explained.

## **2.1 Economics of Social Security**

A large part of the social security literature has dealt with individual choices that affect macroeconomic factors. The social security program has been associated with personal economic behaviors such as savings and labor supply affecting national income and economic growth (Feldstein 1974, 1995). Feldstein (1974) argues that the substitution effect of the social security program reduces personal savings while its wealth effect induces earlier retirement. Many scholars have attempted to examine the growth of social security from the perspective of conventional economics. Feldstein (1985) derives the optimal level of social security benefits for an economy where there is no saving and/or individuals with incomplete myopia. Zhang (1995) links increases in the social security to the steady-state growth of per capita income where agents care about their own consumption and children. He shows that an unfunded pay-as-you-go social security system may speed up per capita growth by reducing fertility and increasing the ratio of human capital investment per child to per family income when bequests are positive. Nishimura and Zhang (1992) demonstrate that gifts to the aged as social security contributions are always positive in the steady state.<sup>35</sup> Their question was whether the optimal steady state can be achieved if the government enforces a social security plan.

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<sup>35</sup> Gifts to the aged are actually viewed as social security contributions.

However, the optimal allocation is in general not sustainable although a government enforces a social security plan setting the pension level at the optimal gifts and individuals optimize under the pension constraint. In a similar vein, Yew and Zhang (2009) explore optimal pay-as-you-go (PAYG) social security in a dynastic family model associated with human capital externalities. They argue that PAYG social security increased with human capital investment per child. If the substitution effect outweighs the wealth effect on savings, it can bring about the demand for higher retirement benefits. Several theoretical and empirical papers suggest that the wealth effect induces voters to choose larger public expenditure.

Turner (1984) analyzes the effect of marginal changes in income and prices on the size of the social security program. Using a general overlapping generations model of social security, he demonstrates with time series data that the old-age dependency ratio acts as a shadow price for retirement benefits. His estimates suggest that average net social security benefits decrease due to the increased shadow price of benefits, implying that when the baby boomers retire, real benefits will be higher than currently, but benefits will be lower relative earnings.

However, such purely economic models neglect the legislative requirements of changing benefit levels. Ultimately, any change in social security appears through the legislative process by which political parties considering voters' preference determine the desired level of social security.

## 2.2 Political Economy of Electoral Models of Social Security

In contrast to the economic analysis of Feldstein, Zhang, and other public finance scholars, the political economy literature focuses on the politics of social security benefits. For example, Browning (1975), Meltzer and Richard (1981), Boadway and Wildasin (1989), Congleton and Shughart (1990), Perotti (1996), Breyer and Craig (1997), and Tabellini (2000) focus on changes in the median voter's constraints, which they suggest play a key role in the growth in the social security benefit level. In a democratic country where the majority voting rule is crucial to determine public policies, the circumstance of the median voter has been one of major objects paid attention to by politicians in most elections.

Browning (1975) used a majority voting model to analyze the determination of taxes and transfers in the social security system. He emphasizes that the politics of the median voter are associated with the social security system, a federal government program. Through the chain of intergenerational transfers with the social security program, the median voter can benefit. An implication of Meltzer and Richard (1981) is that a change in mean income relative to the income of the decisive voter affects the size of government in a general equilibrium model of a labor economy where voters rationally expect a tax on labor income that distorts choices of their fellow citizen.<sup>36</sup> Boadway and Wildasin (1989) provide a theoretical median voter on the determination of the level of social security based on the framework that sets a continuous time overlapping generation model with non-altruistic households facing borrowing constraints in the capital market.

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<sup>36</sup> The decisive voter implies a median voter since they assume majority rule, and the size of government is positively associated with the social security expenditure.



They analyze the sequence of social security levels chosen by median voters in a dynamic model.

The results reported in Congleton and Shughart (1990) provide evidence that the median voter plays a key role in the determination of a public program, which is consistent with a good deal of other research on the determination of public policies within democracies (Meltzer and Richard 1981;<sup>37</sup> Borcharding 1985; Boadway and Wildasin 1989; Congleton 2003). To be elected with more votes, prospective candidates are likely to make their position closer to the median voter's preference on a public program.<sup>38</sup> Borcharding (1985), for example, argues that about 73 percent of the rate at which public expenditure, excluding transfer, has replaced private expenditure over the past eighty years can be explained by a median voter approach.

Breyer and Craig (1997) discuss four models of public choice for public pensions: benevolent dictator, direct democracy with majority rule, horizontal redistribution, and rational family. Their common paradigm is that participants in the political decision process vote to maximize their utility from lifetime consumption. As in Congleton and Shughart (1990), they also assume each individual lives for three periods as child, worker, and pensioner, respectively, which consists of a three-period overlapping generation model. One of their findings, based on the empirical results done with the OECD countries for the years 1960, 1970, 1980, and 1990, is that the social security benefit level

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<sup>37</sup> The size of government is analyzed in Meltzer and Richard (1981), instead of the size of social security.

<sup>38</sup> If the situation is that two candidates compete with each other, they all adopt the median voter's position as their platform at the Nash equilibrium, assuming that voters preferences are single peaked and the public program is one-dimensional.

shown as a fraction of GDP increases with higher median voter's age, more income heterogeneity, and greater similarity in family size.<sup>39</sup>

### 2.3 Political Economy of Interest Groups and Social Security

Along series of papers have argued that interest groups have increased the size of government programs and their growth rates (Mueller and Murrell 1986; Shughart and Tollison 1986; Davidson and Ekelund Jr 1997; Ekelund Jr. and Tollison 2001). Such studies have developed special interest group models of political decision making (Becker and Mulligan 1998; Mulligan and Sala-i-Martin 1999b; and Profeta 2000). Special interest groups have an incentive to divert the supply of public policies away from the median voter's preference. Such models imply that the larger the proportion of the elderly is, the greater the influence on the determination of the social security benefit level by their voting power.

Several papers stress the political influence of the elderly as a special interest group. According to the interest group theory of Olson (1965), a group of retired elderly can be organized with relative ease as an interest group. In this regard, Olson's interest group theory implies the concentrated benefits of the social security program for the elderly with dispersed costs to many working generations. From the perspective of the young working generation, increasing retirement benefit level is not the only thing that makes them worse off. They would pay more social security tax, but the increased benefit

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<sup>39</sup>  $P_t = \tau_t M_t$ , where  $P_t$  is the payment to each pensioner in period  $t$ ,  $\tau_t$  is the per capita contribution of workers to the unfunded pension system, and  $M_t$  is population path. Therefore the positive effect of the median voter's age implies an increase either in the payment or in the per capita contribution, holding population path constant.

could be better for their future consumption because they would receive more benefit. A group that illustrates Olson's theory is, for example, the American Association of Retired Persons (AARP) whose members seem to have a homogeneous interest and thus are likely to agree to the rent seeking activity that influences the social security benefit determination with concentrated votes for those politicians in favor of higher social security benefits because such politicians would want political support from this special interest group.<sup>40</sup> Similarly, this implication stems from the interest group theory in which special interest groups with votes may attempt to affect the political determination of social security in the U.S. as done by Weaver (1982). Sjoblom (1985) argues that, although the number of the individual beneficiaries is much smaller than the number of the individual contributors who pay the social security taxes while working, the former gains more from an expansion in benefit than the latter pays. Tabellini (2000) uses an overlapping-generations model to explain the size of social security associated with the proportion of elderly people in the population. Accordingly the retired elderly population has better incentive to get involved in the determination process of social security benefit level.

In a similar vein, social security bureaucrats as an inside interest group have an interest in the growth of social security. As social security expenditure grows, they have

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<sup>40</sup> Wikipedia introduces AARP as follows:

*"AARP, formerly the American Association of Retired Persons, is a United States-based non-governmental organization and interest group. According to its mission statement,[1] it is "a nonprofit, nonpartisan membership organization for people age 50 and over ... dedicated to enhancing quality of life for all as we age," which "provides a wide range of unique benefits, special products, and services for our members." AARP operates as a non-profit advocate for its members and as one of the most powerful lobbying groups in the United States, and it also sells insurance, investment funds and other financial products. AARP claims over 38 million members,[2] making it one of the largest membership organizations for people age 50 and over in the United States."* <http://en.wikipedia.org/wiki/AARP>

more resources to increase their discretionary power and more non-pecuniary on-the-job benefits. Unfortunately, no social security literature including such an insider's view has appeared except for Congleton and Shughart (1990).

## **2.4 Combined Models of Social Security**

The estimates in Congleton and Shughart (1990) suggest that both median voter interests and interest groups may both simultaneously affect public spending levels. Their combined model from their median voter model and special interest group models includes most of determinants of the size of the social security system. Congleton and Shughart's (1990) estimates imply that the median voter model outperforms the pure special interest group model, using the data sets of the U.S. social security program for the period from 1946 to 1982, but that a combined model is superior to either pure form model.

Galasso and Profeta (2002) explain the main determinants of the size of the social security system around the world, including the size of the U.S. social security benefit, citing the following literature: Lindert (1996); Perotti (1996); Breyer and Craig (1997); and Mulligan and Sala-i-Martin (1999b). They identify financial performance of the system, income factors, and demographics as main determinants. Growth rate of economy, real interest rate, inflation, and deadweight cost, as financial performance factors, are considered. Gini coefficient, mean to median income ratio, and skewness of the income distribution and average income of country are included in income factors. Finally, for demographic factors, the proportion of elderly people in the population is taken into account. They report that the proportion of elderly is positively related to the

size of social security measured as the share of social security expenditure of GDP, or of total government spending. However, the positive relation between the social security benefit and the elderly is not significant when the benefit level per retired person is the dependent variable (Galasso and Profeta 2002; Breyer and Craig 1997; and Mulligan and Sala-i-Martin 1999b).

## **2.5 Conclusions and Relevance for the Dissertation**

The economics literature regarding social security levels has been examined in this chapter. Macroeconomic variables, such as economic growth and investment, are affected by the optimal social security that reflects individual choices.

Political economy explanation differs from purely economic models because an individual chooses in economic activities as a consumer while she/he makes political choices in elections as a voter. From the perspective of median voter's model, the growth of social security is a consequence of changes in the median voter's constraints. From the perspective of interest group theories, because of voters' rational ignorance, they are vulnerable to biased political information that is distorted by special interest groups. In this line of research, special interest groups have several ways to influence the determination of social security benefit level, and thus some researchers have attempted to demonstrate it theoretically and empirically. In practice, however, it is possible that the median voter's preference and special interest groups' political influence jointly determine social security benefit levels, as argued in Congleton and Shughart (1990).

Interestingly, most of the aforementioned social security literature commonly uses an overlapping generation (OLG) model as a tool for analyzing the optimal level of social

security benefit levels (Browning 1975; Feldstein 1985). Nishimura and Zhang (1992), Nishimura and Zhang (1993) and Zhang (1995) use two-period OLG models. Congleton and Shughart (1990), Breyer and Craig (1997), and Tabellini (2000) employ three-period OLG in their models.

My review of the literature on social security benefit levels suggests that Congleton and Shughart (1990) provide the most complete public choice model of social security. As a result, it is both reasonable and desirable to use their methodology as the basis of a new study.

In chapters 3 and 4 I first follow their methodology as closely as possible, but attempt to improve upon it by applying both updated and extended data sets. A variety of different econometric techniques are also applied because time series techniques have advanced since Congleton and Shughart (1990). Chapters 5 and 6 extended the empirical analyses using extended data, interval prediction, and post sample forecasts of social security benefit levels. Chapter 7 analyzes legislation effects on social security from legislation adopted in 1983, (the reforms of the the Greenspan Commission).

### **3. Three Public Choice Models of Social Security Demand**

As described in the previous chapter, Congleton and Shughart (1990) provide the most complete models in the social security literature. Their models include demographics, altruism with overlapping generation model, financial performance of the system, income, majority voting rule, and factors of special interest group models. In this chapter, I develop revised versions of their models of the electoral demand for social security, special interest group model, and combined model. Throughout my analysis, I assume that individuals make rational choices.<sup>41</sup>

#### **3.1 A Median Voter with Interdependent Lifetime Utility Function**

Median voter theory implies that the size of a government program is mainly affected by the median voter's preference and constraints if the country adopts majority voting rule as its political decision method (Congleton 2003; Downs 1957; Black 1948). Based on this theory, government expenditure maximizes the median voter's utility given his/her constraints.<sup>42</sup> To apply this theory to social security, I reapply the interdependent lifetime

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<sup>41</sup> Although some economics literature has attempted to explain the growth of social security benefits in many industrialized countries, there seems to be few obvious models that can practically explain the growth from the perspective of rational choice with a reliable empirical data set (Tabellini 2000; Breyer and Craig 1997; Boadway and Wildasin 1989).

<sup>42</sup> Hillman (2003) explains public spending with median voter model.

utility function used in Congleton and Shugart (1990),<sup>43</sup> since it provides a useful tool for analyzing demand for social security benefits funded by working populations.

It is assumed that a voter maximizes the following interdependent lifetime utility function given her/his constraints. The median voter is assumed to be altruistic, she/he is interested not only in her/his own consumption, but also that of the adjacent generations: parents and children.

$$(1) \max U = \int_0^{D_2} u(C_1, C_2, C_3, t) dt$$

$$(2) C_1 = G_1 + S_1 \text{ and } C_3 = G_3$$

To maximize her/his lifetime utility the median voter chooses consumption ( $C_2$ ) and gifts to parents ( $G_1$ ) and child ( $G_2$ ), private pension and social security benefit levels,<sup>44</sup> subject to the following lifetime budget constraint,<sup>45</sup>

$$(3) \int_0^{R_2} (1-\tau)(Y_2)e^{-rt} dt + \int_0^{R_2} e^{-rt} dt \int_{R_2}^{D_2} (A_2 + S_2)e^{-rt} dt \\ = \int_0^{R_2} (C_2 + G_1 + G_3)e^{-rt} dt + \int_0^{R_2} e^{-rt} dt \int_{R_2}^{D_2} (C_2)e^{-rt} dt$$

The symbols used above are:  $U$  is the interdependent lifetime utility function of the median voter; subscripts denote generation, for example, the median voter is a member of generation 2; her/his parents are members of generation 1; her/his children are members of generation 1;  $C_i$  ( $i=1,2,3$ ) is the consumption level of typical members of  $i$ th

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<sup>43</sup> Congleton and Shugart (1990) mentioned that this function is similar to those used by Turner (1984) and Barro (1974; 1979). However, their utility function is different from those because they took into account both timing and duration of consumption and income flows.

<sup>44</sup> Private pension is the remainder of the median voter's choices of consumption and gifts. Current social security benefit level is given, but future social security benefit level is assumed to be determined in the process of the median voter's utility maximization.

<sup>45</sup> The median voter is assumed to choose lifetime rates of personal consumption and transfers to members of the adjacent generations, and social security benefit levels.



generation;  $R_2$  is the retirement time;  $\tau$  is a proportional tax rate on labor income;  $Y_2$  is real labor income;  $r$  is real interest rate;  $A_2$  is real private pension income received as deferred compensation for pre-retirement labor;  $S_2$  is the median voter's anticipated social security retirement income;  $D_2$  is the time that the median voter dies.

The median budget constraint indicates that the median voter is limited to spend the present value of her/his future income in left-hand side of equation (3): labor income, social security benefit and private pension income. The consumption for generation 3 (e.g. children) totally depends on the gift ( $G_3$ ) from generation 2 at the time of the decision, and the consumption for generation 1 (e.g. parents) is partly contingent on the gift ( $G_1$ ) because they receive social security benefits as well as private pension incomes. These gifts reflect generation 2's altruism.<sup>46</sup>

The median voter has to pay social security tax based on labor income, which is used to finance social security benefits. Thus, the government budget constraint for social security

$$(4) \quad N_1 S_1 = \tau(1-s)N_2 \overline{Y_2}$$

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<sup>46</sup>An overlapping generation model with altruism in Tabellini (2000) uses indirect utility function as follows.

$$H_t = \max \left[ \frac{\gamma}{1+n} H_t^k + U(c_t^k) + E_t H_{t+1}^k \right]$$
, where  $\gamma$  indicates the degree of kid's altruism, which is greater than zero and less than one,  $n$  is the rate of population growth,  $H_t^k$  is the indirect utility function of the period  $t$  parent in the  $i$ th household,  $U(\cdot)$  is a well-behaved utility function,  $c_t^k$  is consumption of the  $i$ th kid in period  $t$ , and  $E_t$  is the expectations operator.

where,  $N_1$  is the number of social security retirement beneficiaries;  $S_1$  is the current benefit level;  $s$  is administrative overhead;  $N_2$  is the number of current workers who pay taxes;  $\bar{Y}_2$  is the average income level of members of generation 2.

It is assumed that for each generation the utility increases as consumption level increases but the marginal utility decreases with it.

$$(5) \quad \frac{\partial U_i}{\partial C_i} > 0, \quad \frac{\partial^2 U_i}{\partial C_i^2} < 0.$$

The cross partial of consumption and time, which is the intertemporal effect, is assumed to be less than zero, as usually assumed about time discount rates.

$$(6) \quad \frac{\partial^2 U_i}{\partial C_i \partial t} < 0.$$

The characteristic of a pay-as-you-go pension system implies that the source of social security benefit for generation 1 (current retirees) is financed by the tax collected from generation 2 (current young working people) as presented in equation (4). This equation can be rewritten with respect to tax rate,  $\tau$  :

$$(7) \quad \tau = \frac{N_1 S_1}{(1-s)N_2 \bar{Y}_2}.$$

Let  $\frac{(1-s)N_2 \bar{Y}_2}{N_1}$  be  $B$ , the effective tax base per elderly person, then equation (5) can be

rewritten as

$$(8) \quad \tau = \frac{S_1}{B}.$$

This equation implies that social security benefit increases with the effective tax base per elderly person or social security tax, or both. Substituting for  $\tau$  in equation (3) yields:

$$(9) \quad \int_0^{R_2} (Y_2 e^{-rt} - \frac{S_1}{B} Y_2 e^{-rt}) dt + \frac{1}{r} (1 - e^{-rR_2}) \int_{R_2}^{D_2} (A_2 + S_2) e^{-rt} dt \\ = \int_0^{R_2} (C_2 + G_1 + G_3) e^{-rt} dt + \frac{1}{r} (1 - e^{-rR_2}) \int_{R_2}^{D_2} (C_2) e^{-rt} dt$$

It is reasonable to assume that median and average labor income increases at the long-term growth rate of the economy,  $g$ .<sup>47</sup> By letting  $Y, A, S$  be initial values of wage, private pension income, and social security benefit, respectively, which are constant, equation (9) can be rewritten as<sup>48</sup>

$$(10) \quad \int_0^{R_2} (Y e^{(g-r)t} - \frac{S_1}{B} Y e^{(g-r)t}) dt + \frac{1}{r} (1 - e^{-rR_2}) \int_{R_2}^{D_2} (A e^{(g-r)t} + S e^{(g-r)t}) dt \\ = \int_0^{R_2} (C_2 + G_1 + G_3) e^{-rt} dt + \frac{1}{r} (1 - e^{-rR_2}) \int_{R_2}^{D_2} (C_2) e^{-rt} dt \quad .$$

The following Lagrangian function can be characterized using equation (1) and (10).<sup>49</sup>

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<sup>47</sup> Congleton and Shughart (1990)'s explanation is "We elect not to close the model for a variety of reasons. First, there is no consensus on the timing or magnitude of impact that the social security program has had on long-term growth. See, for example, Barro (1974) and Feldstein (1974). Moreover, it has long been emphasized in the public choice literature that voters have relatively little incentive to invest their energies in complete information or careful calculations if information and computation are costly and the voting population is relatively large. Any single voter's effect on the outcome is trivial before the election takes place. As a consequence, voters have little incentive to find precise answers to complex problems. This is not to say that voters are unsophisticated, but rather that a careful consideration of the anticipated net benefits of analyzing models of various degrees of complexity probably leads them to use partial equilibrium models."

<sup>48</sup>  $Y, A$ , and  $S$  are assumed to be constant regardless time, but grow with growth rate;

$Y_2 = Y e^{gt}, A_2 = A e^{gt}, S_2 = S e^{gt}$

<sup>49</sup> As the initial value,  $S_1 = S$

$$\begin{aligned}
L = & \int_0^{D_2} u(G_1 + S_1, C_2, G_3, t) dt \\
(11) \quad & - \lambda \left[ \int_0^{R_2} (C_2 + G_1 + G_3) e^{-rt} dt + \frac{1}{r} (1 - e^{-rR_2}) \int_{R_2}^{D_2} (C_2) e^{-rt} dt \right. \\
& \left. - \int_0^{R_2} (Y e^{(g-r)t} - \frac{S}{B} Y e^{(g-r)t}) dt - \frac{1}{r} (1 - e^{-rR_2}) \int_{R_2}^{D_2} (A e^{(g-r)t} + S e^{(g-r)t}) dt \right]
\end{aligned}$$

Differentiating this equation with respect to the median voter's choices ( $C_2, S, G_1, G_3$ , and  $A$ ) generates the following first order conditions.<sup>50</sup> With the median voter's personal budget constraint, these conditions describe the characteristics of the median voter's utility maximizing allocation of lifetime wealth.

$$(12) \quad \int_0^{R_2} \left( \frac{\partial U}{\partial C_1} \frac{\partial C_1}{\partial S} \right) dt = -\lambda \left[ \int_{R_2}^{D_2} \frac{Y}{B} e^{(g-r)t} dt + \frac{1}{r} (1 - e^{-rR_2}) \int_{R_2}^{D_2} e^{(g-r)t} dt \right] \text{ for } S,$$

$$(13) \quad \int_0^{D_2} \frac{\partial U}{\partial C_2} dt = \lambda \left[ (1 - e^{-rR_2}) \frac{1}{r} + (1 - e^{-rR_2}) \frac{1}{r} (e^{-rD_2} - e^{-rR_2}) \right] \text{ for } C_2,$$

$$(14) \quad \int_0^{D_2} \frac{\partial U}{\partial C_1} \frac{\partial C_1}{\partial G_1} dt = \lambda (1 - e^{-rR_2}) \frac{1}{r} \text{ for } G_1,$$

$$(15) \quad \int_0^{D_2} \frac{\partial U}{\partial C_3} \frac{\partial C_3}{\partial G_3} dt = \lambda (1 - e^{-rR_2}) \frac{1}{r} \text{ for } G_3,$$

$$(16) \quad \int_0^{D_2} \frac{\partial U}{\partial A_2} dt = \lambda \left[ (1 - e^{-rR_2}) \frac{1}{r} (e^{(g-r)D_2} - e^{(g-r)R_2}) - (1 - e^{-rR_2}) (e^{gt} - e^{2gt}) \frac{1}{r} \right] \text{ for } A$$

where  $A$  is the Lagrangian multiplier.

Equation (12) shows the first order condition of the median voter's preferred level of social security benefit that equates the discounted present values of altruistic consumption benefit to the first generation with the present value of increased personal retirement income plus the discounted present value of the marginal tax cost of the social

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<sup>50</sup>  $\int_0^{D_2} e^{-rt} dt = \frac{-1}{r} [e^{-rt}]_0^{D_2} = (1 - e^{-rD_2}) \frac{1}{r}$

security program. Similarly, equations (13) through (16) indicate the first order conditions of the median voter's choice of consumption, gifts to adjacent generations, and private pension, respectively. If the utility function is strictly concave and the constraint is convex, the values of the median voter's choices are unique.

The implicit function theorem implies that the median voter's preferred levels of social security benefit, consumption, gifts, and private pension, can be characterized as functions of the exogenous variables. In particular, the preferred level of social security benefit for the median voter,  $S^*$ , can be written as a function of the exogenous variables, affecting the median voter's constraint from equations (12) through (16).

$$(17) \quad S^* = m(Y, A, R_2, D_2, B, r, g).^{51}$$

The median voter's preferred social security benefit is affected by the median voter's labor income ( $Y$ ), private pension income ( $A$ ), remaining work life ( $R_2$ ), remaining life of median voter ( $D_2$ ), effective tax base per social security benefit recipient ( $B$ ), real interest rate ( $r$ ), and long term growth rate ( $g$ ).

The effects of these variables on the benefit level can be specified, (e.g. signs of their partial derivatives) if only the direct effects of such variables and positive wealth effects are assumed.<sup>52</sup> An example of these wealth effects implies that an increase in the median voter's labor income, holding all other things constant, increases the social security benefit level through an increase in the lifetime budget constraint in the left hand

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<sup>51</sup>  $S^*$  is the initial value, which is the current social security benefit level.

<sup>52</sup> It is because as is the case in most consumer choice models, the indirect effects through interaction terms hinders the determination of signs of partial derivatives of  $S^*$ .

side of equation (12). For example, an increase in income, in that case, will induce the median voter to increase her/his consumption in both the pre-retirement period and retirement period. More pre-retirement income has to be transferred to the retirement period for more consumption, all else being equal, which leads to a higher demand of the median voter for social security benefits;  $\frac{\partial S^*}{\partial Y} > 0$ . An expected longer life and the effective tax base per retirement beneficiary have similar effects, so  $\frac{\partial S^*}{\partial D_2} > 0$  and  $\frac{S^*}{B} > 0$ .

In these cases, the median voter will prefer higher social security benefit levels if any of these variable increase. Note that in order for the effective tax base per retirement beneficiary to be increased average income increases, the number of working people increases, the number of the beneficiary decreases, or the program overhead decreases. These changes ultimately increase the tax base per the beneficiary, which reduces the cost of the social security program to the median voter and thus leads to higher benefit levels. An increase in the long term growth rate has an effect similar to a wage increase. It shifts the median voter's budget constraint out, and thus makes future social security benefit higher while making the present value of lifetime income larger;  $\frac{\partial S^*}{\partial g} > 0$ . Conversely a higher level of private pension income increases personal wealth in retirement period, and thus it makes the social security benefit less necessary;  $\frac{\partial S^*}{\partial A} < 0$ . An increase in real interest rate is also likely to lead to lower social security benefit;  $\frac{\partial S^*}{\partial r} < 0$ . Because it decreases the present value of future income and thus induces more consumption in pre-

retirement period, it therefore makes social security program less attractive as a source of retirement income. The effect of remaining work life of the median voter is, however, ambiguous. Longer remaining work life enables the expectation of more personal wealth with more contribution, but it implies a longer tax period, which decreases the net present discounted value of benefits.

### **3.2 Special Interest Groups**

An alternative to the election driven model of social security benefit levels is the interest group model of public policy.

There are two types of interest groups that tend to lobby for increases in social security benefit levels. One group consists of those individuals who currently receive or are about to receive social security retirement benefits. The population of over 60 year olds in the U.S. is now more than 50 million,<sup>53</sup> and thus their strategic voting, if any, is able to have a significant effect. Active candidates may choose their positions partly because they anticipate that interest groups will provide them, given their policy choice, with resources that increase their net votes (Mueller, 2003). From this perspective, organized retired persons are likely to be important sources of support, not only in terms of campaign funds and volunteers, but also in terms of votes for higher social security benefits, insofar as the group votes as a block.<sup>54</sup> Relatively homogenous people, such as elderly people, are likely to be more easily organized to politically influence based upon their common interests (Olson 1965). These kinds of special interest groups seek to

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<sup>53</sup> The U.S. Statistical Abstract 2007.

<sup>54</sup> The largest number of retirement recipients of social security is largely dependent on the benefit as their income.

exercise leverage in their pursuit of wealth (Peltzman 1986). The number of retired older persons and their wealth are plausible factors for explaining the effectiveness of such groups.

There may also be “inside” interest groups. The literature on the political economy of bureaucracy stimulated by Niskanen (1975) argues that bureaucrats have incentives to increase their discretionary power, for instance, through budget maximization (Weingast and Moran 1983; Bender, Taylor, and van Gaalen, 1985; Weingast and Marshall, 1988). Larger budgets may generate more pecuniary and nonpecuniary benefits for bureaucrats, such as salary, ease of making changes, chance of promotion, staff support, and office facilities. Furthermore, more available resources help bureaucrats to advance their agency’s mission, e.g. the output of the bureau. As a result, budget-maximizing incentives of bureaucrats can increase systematic growth of government budget as long as they are successful in lobbying.

Accordingly, both social security bureaucrats as an inside interest group and benefit recipients as an outside interest group may affect the social security benefit levels.

$$(18) \quad S = f(N_1, A, sE)$$

where  $sE$  is administrative expense of the social security administration. More recipients imply more votes for their goals. It is likely that the social security retirement benefit level increases with the number of OASI recipients and with their income from private

pensions;  $\frac{\partial S^*}{\partial N_1} > 0$  and  $\frac{\partial S^*}{\partial A} > 0$ . Since all social security recipients become better off as

the social security benefits increase, it is very likely that they are potentially supportive of



more generous benefit levels. Denzau and Munger (1986) indicate that voters make voting choices to obtain their most preferred outcomes and organized interest groups offer campaign contributions to improve their own wealth. More wealth means more resources to attain their policy purposes. As discussed in Becker (1983), expenditure of money on campaign contributions are one of the main ways that interest groups exert political pressure. Congleton (1986) implies that voters' wealth increases their ability to contribute to interest groups that support a particular electoral outcome. Grossman and Helpman (1996) suggest that special interest groups may have an electoral motive for their campaign giving. It is also probable that the benefit level increases as the administrative expense of OASI rises;  $\frac{\partial S^*}{\partial sE} > 0$ . With more administrative expenditures, the bureaucrats associated with social security have more discretion to affect the social security level they prefer.<sup>55</sup>

### 3.3 Combined Model and Hypotheses

The three components of the special interest group model in equation (18) may act in opposition to the effect of the changes in the median voter's demand. Congleton and Shughart (1990) imply that political effects of the median voter's policy preference may counteract political effects of the special interest groups. In Denzau and Munger (1986) legislators seek both campaign contributions and votes from special interest groups to obtain reelection using a constraint that requires not losing the majority of voters' votes

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<sup>55</sup> According to the model of Niskanen (1975), bureaucrats are likely to maximize the budget of the project for the public sector, which positively affects their utility as a function of power, money income, security, perquisite of office and patronage. Bureaucrats produce the public goods more than at the efficient level (MR=MC) in order to maximize the budget.

based on the median voter's preference. Explaining political outcomes in such cases require a model that includes the effects of both a median voter and special interest groups. The following Figure 1 depicts the tradeoff that politicians face in such a combined model.<sup>56</sup>

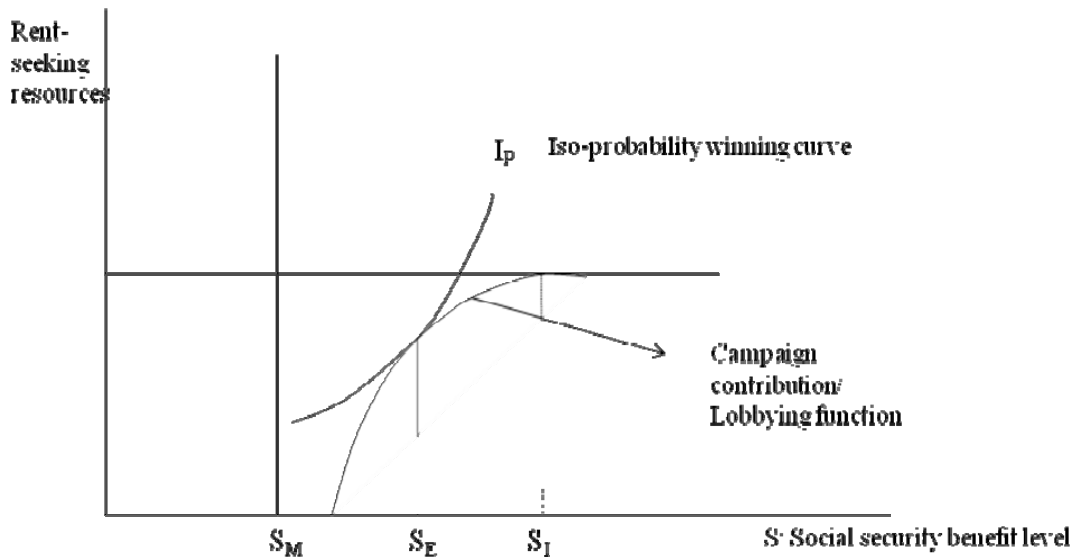


Figure 1 Social Security Benefit Level and Campaign Contribution

In Figure 1  $S_M$  represents the median voter's preferred benefit level,  $S_I$  denotes the highest benefit level that special interest groups pursue, and  $S_E$  indicates the actual benefit level determined by candidates for Congress, who are rationally self-interested politicians, who pursue both votes and campaign resources in elections.  $I_p$  represents the iso-probability winning curve for the policy maker. Candidates will adopt platforms equal to the median voter's preference, only if the iso-probability winning curve is vertical. In

<sup>56</sup> Figures in Congleton (1986) provide a foundation to illustrate Figure 1.

contrast, if the iso-probability winning curve is horizontal, candidates will adopt platforms to please interest groups in order to maximize campaign contributions. In such cases campaign support funding for the policy maker from special interest groups such as AARP, will lead to higher level of the social security benefits. In intermediate cases, the policy maker will adopt platforms in between these extremes ( $S_M$  and  $S_I$ ), because they are concerned that they would lose vote supports from the electorate. The more important campaign resources are the closer the platform will be to interest groups ideal  $S_I$ .

The combined model provides a foundation to test whether the policy maker has simply responded to the demand of the median voter for social security benefit or whether it has been captured by the special interest groups. The following equation can be used to empirically test the relative explanatory power of median voter and special interest group explanations of social security benefit levels.

$$(19) \quad S = W_M * m(Y, A, R_2, D_2, B, r, g) + W_S * f(N_1, A, sE),$$

where  $W_M$  is the weight for the constraints faced by the median voter and  $W_S$  is the weight for political influence of special interest groups. The equation consists of two groups of components: the factors that affect the constraints of demand of the median voter for social security benefit and the factors that are composed of special interest groups' political influence.

Estimates of linear forms of equation (19) allow several hypotheses to be tested. With the previous explanation on the effect of independent variables, the signs of independent variables can be predicted as follows.

$$(20) \quad S_t = \beta_0 + \beta_1 Y_t + \beta_2 A_t + \beta_3 R_{2t} + \beta_4 D_{2t} + \beta_5 B_t \\ + \beta_6 r_t + \beta_7 g_t + \beta_8 t + \beta_9 N_{1t} + \beta_{10} E_t + \varepsilon_t$$

In sum, three hypotheses are to be tested as follows.

*Hypothesis 1: the growth of social security (average real retirement benefit) in the U.S. from 1946 to 2004 is mainly associated with changes in median voter's constraints.*

In this case, the parameter estimates associated with the median voter model may be significant;  $\beta_1$ ,  $\beta_4$ ,  $\beta_5$ , and  $\beta_7$ , are expected to be positive while  $\beta_6$  anticipated to be negative.

*Hypothesis 2: the growth of social security (average real retirement benefit) in the U.S. from 1946 to 2004 is mainly associated with political influence of special interest groups.* In this case, the parameter estimates associated with the special interest group model may be significant;  $\beta_2$ ,  $\beta_9$ , and  $\beta_{10}$  are expected to be positive.

*Hypothesis 3: the growth of social security (average real retirement benefit) in the U.S. from 1946 to 2004 is mainly associated with both.* In this case, the parameter estimates associated with the combined model may be significant.  $\beta_1$ ,  $\beta_4$ ,  $\beta_5$ ,  $\beta_6$ ,  $\beta_7$ , and  $\beta_{10}$  are expected to be positive while  $\beta_6$  is anticipated to be negative.

*Hypothesis 4: the growth of social security (average real retirement benefit) in the U.S. from 1946 to 2004 is neither associated with changes in median voter's constraints, nor associated with political influence of special interest groups.* In this case, none of the parameter estimates may be significant and the signs of the coefficient estimates may be opposite to those of the median voter and special interest group model.

## 4. Data and Estimation

### 4.1 Data Characteristics

To estimate the political influence of the median voter and special interest groups on the increased retirement benefits, a data set for the period from 1946 to 2004 was used. Most data are available from published sources and relevant websites. I endeavored to find data as recent as possible: some data are available up to 2008, but others are not available that recently. The descriptive statistics of these data are shown in Table 1.<sup>57</sup> Most data are in inflation adjusted dollars. Real social security retirement benefits ( $S$ ), real median income ( $Y$ ), effective tax base per OASI recipient ( $B$ ), and real Social Security Administration Expenditure ( $E$ ), were deflated using the all-item CPI (1967=100). Average private retirement income ( $A$ ) is represented as the average annual retirement benefit (dollars/annuitant) from private pensions and profit sharing plans reported in the Historical Statistics of the United States, and Historical Tables of Private Pension Plan Bulletin, deflated with the CPI. A proxy for real interest rate ( $r$ ) is calculated as the yield on AAA corporate bonds minus a centered five-year moving average of the inflation rate for the all-item CPI. The economy's long-term growth-rate ( $g$ ) is the centered five-year moving average of the growth rate of real GDP.<sup>58</sup> The effective tax base per OASI

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<sup>57</sup> All variables are annual data. However, in regression, data for “Average Real OASI Benefit” are used in monthly because Congleton and Shughart (1990) used the data that way.

<sup>58</sup> Real GNP was used in Congleton and Shughart (1990).

recipient ( $B$ ), is calculated as  $\frac{(1-s)N_2\bar{Y}_2}{N_1}$ , where total wages and salary ( $N_2\bar{Y}$ ), were

taken from the Economic Report of the President. The percentage overhead ( $s$ ) is the ratio of net administrative expenses to contributions and reimbursements from the general revenues of the Social Security Administration. The number of OASI recipients represents the number of elderly persons benefiting from the social security retirement program ( $N_1$ ).  $N_2$  is the number of workers reporting taxable earnings.  $E$  is real administrative expenses.

Table 1. Data Characteristics: Social Security (1946-2006)

Series	Mean	Standard Deviation	Minimum	Maximum
Real Median Income	3395.788	426.148	2540.616	4171.384
Average Real Private Pension	1460.167	345.310	699.043	2155.424
Remaining Work Life of Median Voter	18.762	1.640	13.5	21.5
Remaining Life of Median Voter	26.272	3.366	18.2	32.3
Real Interest Rate	2.725	2.694	-4.406	8.891
Long Term Growth Rate of RGNP	2.847	3.847	-7.898	14.46
Effective Tax Base per OASI Recipient	48230.04	45392.36	26,079.67	265,237.8
Average Real OASI Benefit	1393.284	489.06	421.92	2025.456
Number of OASI Recipients	16,324,727	9,268,248	702,000	30,455,298
Administrative Expense of OASDI (mil)	361.810	155.338	68.376	585.647

## 4.2 Identifying the Median Voter

Literally, the median voter is the voter whose ideal point is the median of all the persons casting votes in an election. To isolate the median voter, I estimated the participation rate of specific age group from the years 1946 to 1962 using data for the years 1964 to 2004. Following the estimation method in Congleton and Shugart (1990), the estimated participation rate equation for age groups is shown below:<sup>59</sup>

$$(21) P_{it} = a + bP_t + ct ,$$

where  $P_{it}$  is the participation rate of the  $i^{\text{th}}$  age group in time  $t$ ,  $P_t$  is the average participation rate<sup>60</sup> of the population as a whole in national elections during that time period, and  $t$  is time variable.

The median voter's age was estimated with voter's participation rate and the number of voters who actually voted by age group in each election in Table 2. Whereas data for the annual estimates of the population by each age group are available for all the years of interest (1946-2006), data for voter participation rate by age group is not available for the years prior to 1964. The U.S. Census Bureau provides total voting-age population and percent voting in each age group from 1964 to 2006.<sup>61</sup> The four age group categories used in this paper are age groups of 18 to 24 years, 25 to 44 years, 45 to 64 years, and 65 years and over. For non-election years, values for median voter age are calculated by averaging adjacent election year's values.

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<sup>59</sup> The estimation of participation rates for age groups from 1946 to 1962 is found in Table A3 in the Appendix.

<sup>60</sup> Participation rates for presidential and congressional elections were estimated.

<sup>61</sup> <http://www.census.gov/population/socdemo/voting/tabA-1.xls>

Table 2 Estimates of Participation Rates for Age Groups: 1946-1962

Voting Age Group	The Estimated Participation Rate Equation for Age Groups: $P_{it} = a + bP_t + ct$	$R^2$
18-24	$P_{1824} = -41.849 + 1.342P + 0.026t$ (6.283) ** (0.067) ** (0.044)	0.965
25-44	$P_{2544} = .978 + 1.108P - 0.121t$ (2.825) (0.030) ** (0.020) **	0.991
45-64	$P_{4564} = 23.032 + 0.792P - 0.019t$ (2.815) ** (0.030) ** (0.020)	0.981
Over 65	$P_{65+} = 1.744 + 0.609P + 0.334t$ (4.339) (0.046) ** (0.031) **	0.965

Note: \* significant at the 0.05 level; \*\* significant at the 0.01 level.

※ The equation in each age group is estimated for the period from 1946 to 2006.

Given the estimated median voter's age, the remaining work years of the median voter ( $R_2$ ) is calculated by subtracting the median voter's age from the normal retirement age of 65 years. Similarly, the average life expectancy of the population class nearest the median voter's age is represented as the remaining life of the median voter ( $D_2$ ). The median voter's income data are proxied by the median income from the U.S. Census Bureau in this paper.<sup>62</sup>

One of the main data sources for the historical data is “the Historical Statistics of the United States, Colonial Times to 1970.” “Statistical Abstract Data of U.S. Census Bureau” provides the recent data of interest. In between both data sources, adjustments and changes of classifications seem to have been taken place. For example, average private retirement income represented as the average annual retirement benefit from

<sup>62</sup> The median voter's income in Congleton and Shughart (1990) was proxied by the median annual earnings of workers. To compare how much replicated estimates are different I also use the data set for the period from 1946 to 1982 used in Congleton and Shughart (1990). More details are in Table 4 and Table 5 in the Appendix.



“private pension and deferred profit-sharing plans” reported in “the Historical Statistics of the United States, Colonial Times to 1970” is no longer available in “the Statistical Abstract of U.S. Census Bureau.” The later data of interest, estimated with somewhat different criteria, are provided in “Private Pension Plan Bulletin” published by the Pension and Welfare Benefits Administration of U.S. Department of Labor.<sup>63</sup>

According to Runkle (1998), the difference between the initial data estimated and the final data estimated occurs as more information becomes available and the definitions and classifications of data change. For example, revisions in estimates of real output growth and inflation have historically been large over time. Accordingly, it is possible that data are not the same as that used in Congleton and Shughart (1990) although from same data sources. I found, for example, some data differed, because of data revision, throughout various year of the Statistical Abstract of the United States. All equations estimated in Table 1, except as noted, use the revised data.

My first step is to replicate the Congleton – Shughart study. To minimize the data revision and maintain data consistency I have used the same years of data sources and the same methods for estimating data sets as found in Congleton and Shughart (1990). For instance, the all-item CPI (1967=100) applies to converting the nominal term of variables

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<sup>63</sup> As shown in Table A2, there are small differences between the median voter age in Congleton and Shughart (1990) and in this paper. For example, the estimated median voter age in this paper seems older than that in Congleton and Shughart (1990). The major reason for the difference of the average median voter’s estimated age stems from the number of age groups used in both papers. The six age groups were used to estimate the median voter’s age for each year in Congleton and Shughart (1990), whereas four age groups are used in this paper because of lack of data on the six groups used previously. Thus, such differences of the median voter’s age cause the difference of the remaining life of the median voter between in both papers.

to the real term for the entire period 1946 to 2006. It was used for the period from 1946 to 1982 in Congleton and Shughart (1990).

Figure 2 shows that the average real social security benefits have been steadily increasing for the period from 1947 to 2005 whereas the level of the effective tax base fell for the first fifteen years and since then it has been relatively steady.

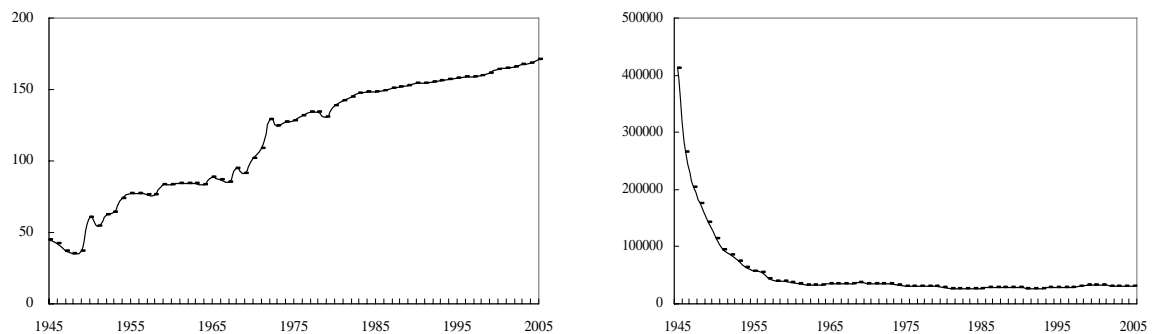


Figure 2

(a) Average Monthly Real Social Security Benefits  
1940-2005 (1976 dollars)

(b) Effective Real Tax Base per Recipient 1940-  
2005 (1976 dollars)

Source: Data are from the Annual Statistical Supplement to the Social Security Bulletin

The average monthly real social security retirement benefit per recipient was 41.97 dollars in 1946 and had increased to 171.286 dollars in 2005, while the effective real tax base per recipient was 265,237 dollars in 1946 and had decreased to 26,079 dollars in 1983, but after then it steadily increased to 32,708 dollars, and stayed near that level in 2007. This interesting finding implies that the social security benefit level is determined not only by economic reasons, but also by other reasons, such as political demand. Obviously, the effective real tax base per recipient in recent years fell because of

economic recession, but the social security retirement benefit was not decreased, which again causes concern about the imbalance between the social security tax payments and the social security benefit payments.

### **4.3 Estimation Methods**

Congleton and Shugart (1990) used OLS estimation and AR(1) and/or AR(2) in the case where an estimation model had autocorrelation of residuals. In my study, I first, used the same linear time series technique employed in Congleton and Shugart (1990) to estimate equation (19) over the same period from 1946 to 1982.<sup>64</sup> In addition to OLS, I also applied Robust Standard Error, Feasible Generalized Least Squares (FGLS), and Median Regression.<sup>65</sup> To address problems common with time series data, I checked whether variables of interest had unit roots.<sup>66</sup> In cases where this was so, I tested cointegrating relationship between independent variables and the dependent variable in the three models. Finally, I used Dynamic Ordinary Least Squares (DOLS) as a time series analysis technique.<sup>67</sup>

In the previous study, heteroscedasticity<sup>68</sup> of the error term was not reported since the OLS estimation assumes homoskedasticity of the error terms. This current study used

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<sup>64</sup> Congleton and Shugart (1990) used OLS with a time variable over the period 1946 to 1982. They used AR(1) and AR(2) to deal with the low value of Durbin-Watson statistics for the special interest group model.

<sup>65</sup> These relax the assumption of error term that OLS holds.

<sup>66</sup> Unit root is the short expression of unit autoregressive root. It means that a time series data has a stochastic trend. For more details see Stock and Watson (2003) p. 460.

<sup>67</sup> In this study, the regression results using first difference form and vector error correction model are, respectively, not useful as much as DOLS.

<sup>68</sup> When using some statistical techniques, such as ordinary least squares (OLS), a number of assumptions are typically made. One of these is that the error term has a constant variance. This will be true if the observations of the error term are assumed to be drawn from identical distributions. Heteroscedasticity is a violation of this assumption (Greene 1993. p. 358).

the same OLS estimation and adjusts the heteroskedasticity as well. I report the test statistics with robust standard error.<sup>69</sup> Also, I found autocorrelation problems in some regression results.<sup>70</sup> The problems occur especially when regressing time series data. Prais-Winsten regression with Cochrane-Orcutt transformation<sup>71</sup> was used to resolve the problems.<sup>72</sup> These techniques transform the errors to be homoskedastic, and thus provide slightly more efficient results. This correction by Prais-Winsten iterates estimator to convergence and increases the values of F-statistics, when compared to the result regressed by OLS. Finally, median regression is used in order to be compared with other regression results. Median regression minimizes sums of absolute residuals which mitigate other problems with error term such as outliers (Koenker and Hallock, 2001).

#### **4.4 Replication of the Congleton-Shughart Estimates for “Average Monthly OASI Benefits”**

##### **4.4.1 Estimates of Median Voter Model**

Table 3 reports estimates and test statistics for the median voter model. Average monthly real OASI benefits per recipient is the dependent variable, as defined by the social security data set of the U.S. from 1946 to 1982 in Table 3. In terms of equation (19) what

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<sup>69</sup> If the error terms display heteroscedasticity, F statistics are no longer F distributed. Thus the F test would be invalid.

<sup>70</sup> Autocorrelation is the correlation of a series with its own lagged values (Stock and Watson 2003, p. 434). There are several approaches to resolving problems of autocorrelation: Lagged Dependent Variables, Differencing the Dependent variable, GLS, ARIMA, etc.

<sup>71</sup> It is a regression technique of Feasible Generalized Least Squares, which is similar to Generalized Least Squares except that it uses an estimated variance-covariance matrix since the true matrix is not known (Greene 1993 p. 431).

<sup>72</sup> According to Kormendi (1983) fixing autocorrelation problems also resolves the issue of nonstationary time series data used in regression, which causes spuriously significant coefficients. Stock and Watson (2003) notes that stationarity means the distribution of the time series variables does not change over time.

$W_M = 1$  and  $W_S = 0$  indicates is the case in which OASI benefit fluctuations increased by changes in the median voter's constraints: median voter model. The Student's T-statistics of the parameter estimates are shown in parenthesis beneath each coefficient except for the third and the fourth column of the right-hand panel, which reports robust T-statistics. The first column of the right-hand panel presents the estimates from the data set used in Congleton and Shughart (1990). Estimates using the revised new data set are displayed in the second column, and estimates from the OLS results with robustness are shown in the third one. Linear forms were also estimated using the Prais-Winsten regression with Cochrane-Orcutt transformation. Estimates from Prais-Winsten AR(1) are reported in the fourth column, and estimates from median regression are shown in the last column. All five estimates remain as close as possible to the specifications and definitions in constructing the regression variables to replicate the original Congleton and Shughart (1990) paper.<sup>73</sup>

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<sup>73</sup> The estimates in Congleton and Shughart (1990) are in Table A4 in the Appendix.

Table 3. Average Monthly OASI Benefits by Median Voter Model for the Period from 1946 to 1982: (1967 Dollars)

Period Estimation	Median Voter Model				
	1946-82(S) OLS	1946-82(R) OLS	1946-82 Robust S.E.	1946-82 Prais-Winsten	1946-82 Median Regression
Intercept	-254.841 (-4.92)***	-110.229 (-2.96)***	-110.229 (-2.81)***	-65.350 (-2.61)**	-84.377 (-4.03)***
Real Median Earnings	0.082 (6.83)***	0.031 (3.96)***	0.031 (4.16)***	0.021 (4.19)***	0.027 (6.02)***
Average Real Private Pension	-0.088 (-4.34)***	-0.0009 (-0.12)	-0.0009 (-0.16)	-0.001 (-0.28)	-0.011 (-0.40)
Remaining Work Life of Median Voter	-8.356 (-1.83)	-13.663 (-4.30)***	-13.663 (-6.14)***	-10.201 (-5.22)***	-12.880 (-7.62)***
Median Life Expectancy	12.883 (3.43)**	15.639 (5.15)***	15.639 (7.14)***	11.924 (10.44)***	14.473 (8.83)***
Real Interest Rate	0.741 (1.35)	0.652 (0.73)	0.652 (0.89)	0.211 (0.28)	0.624 (1.33)
Long Term Growth Rate	-2.989 (-4.4)***	-1.866 (-2.15)**	-1.866 (-1.98)*	-1.734 (-1.77)*	-2.250 (-4.49)***
Effective Tax Base per Beneficiary Time	0.0001 (1.72)	0.00001 (0.28)	0.00001 (0.39)	-0.00004 (-0.64)	-0.00002 (-0.58)
	-0.895 (-1.4)	-0.833 (-1.12)	-0.833 (-1.47)		-0.575 (-1.52)
R <sup>2</sup>	0.987	0.977	0.977	0.965	0.873 <sup>a</sup>
Durbin-Watson	1.67	1.70	1.70	1.92***	
F-statistic	269.91***	146.26***	450.48***	3244.47***	
Standard Error	4.16	5.57	5.57	5.45	

Note: T-statistics are reported in parentheses. Those followed by \*\*\* are statistically significant at the .01 level, \*\* at the .05 and \* at the .01 level. All entries are rounded to the nearest decimal.

(S): Estimates from the original data set used in Congleton and Shughart (1990)

(R): Estimates from replicated data set.

a: Pseudo R<sup>2</sup>

The estimates in the third column are results by the OLS with robust standard error.

The signs of the coefficients are the same, but their T-statistics and F-statistics are different from those in the first column. The values of Durbin-Watson statistics in the first three columns may imply autocorrelation that can either inflate or deflate the

standard errors,<sup>74</sup> which makes a relationship significant when it is actually not, or it hides a statistically significant relationship. In the first column, the OLS results assume that the errors are homoskedastic and serially uncorrelated. The estimates in the fourth column showing Prais-Winsten regression are the results treated with adjusted autocorrelation, Cochrane-Orcutt transformation and robust standard error. The Prais-Winsten and iterated Cochrane-Orcutt estimators presented here are special cases of GLS estimation. In general, FGLS estimation involves transforming the error matrix so that the errors are homoskedastic and serially uncorrelated, then estimating the coefficients of the transformed regression model by OLS (Stock and Watson 2003).

The FGLS estimates are very similar to those reported by the OLS. The Durbin-Watson statistics were much improved and the F-statistics are much larger. It may be useful to compare estimates obtained by OLS with those by median (quantile) regressions because median regressions relative to OLS are less sensitive to outliers. Interestingly, the estimate of effective tax base per elderly has a negative sign, which was implied in Figure 2. However, its value is extremely low, and thus not a significant effect on the social security benefit levels.

Overall, the replicated estimates are very similar to the estimates reported in Congleton and Shughart (1990): the signs of the coefficients,  $R^2$  and Standard Errors. One difference between the two results is that the T-statistics of average real private

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<sup>74</sup> Positive autocorrelation causes inflation of the errors whereas negative autocorrelation does deflates the errors (Stock and Watson 2003, p. 436)

pension became statistically insignificant whereas remaining work life of median voter” became a more statistically significant variable.

#### 4.4.2 Estimates of the Special Interest Group Model

Estimates of the special interest group model for the period 1946 to 1982 are shown in Table 4. The same estimate techniques were used.

Table 4. Average Monthly OASI Benefits by Special Interest Group Model for the Period from 1946 to 1982: (1967 Dollars)

Period Estimation	Special Interest Group Model				
	1946-82(S) OLS	1946-82(R) OLS	1946-82 Robust S.E.	1946-82 Prais-Winsten	1946-82 Median Regression
Intercept	80.906 (4.36)***	52.472 (5.21)***	52.472 (4.51)***	39.029 (4.89)**	58.952 (2.43)**
Average Real Private Pension	-0.033 (-2.06)*	-0.011 (-1.21)	-0.011 (-1.08)	0.002 (0.45)	-0.017 (-0.77)
Number of Retired Workers	4.56E-06 (5.48)***	4.62e-06 (5.50)***	4.62e-06 (5.40)***	3.94e-06 (3.99)***	4.76e-06 (2.53)**
Net Administrative Expenses	0.0401 (1.18)	0.020 (0.71)	0.020 (0.70)	0.031 (0.91)	0.021 (0.33)
R <sup>2</sup>	0.938	0.937	0.937	0.781	0.743 <sup>a</sup>
Durbin-Watson	0.50***	0.67***	0.67***	1.90***	
F-statistic	167.08***	163.58***	210.94***	458.01***	
Standard Error	8.40	8.42	8.42	6.11	

Note: T-statistics are reported in parentheses. Those followed by \*\*\* are statistically significant at the .01 level, \*\* at the .05 and \* at the .01 level. All entries are rounded to the nearest decimal.

(S): Estimates from the original data set used in Congleton and Shughart (1990)

(R): Estimates from replicated data set.

a: Pseudo R<sup>2</sup>

As compared with the estimates in Congleton and Shughart (1990), the replicated estimates are very similar results except that the T-statistics of average real private pension become insignificant. The sign is negative, which is not the anticipated sign and thus departs from the special interest group theory. The statistical insignificance of



average real private pension seems to stem from the different data source for the later period. However, the Prais-Winsten regression corrected that sign although it is not statistically significant at a conventional level. Also, the low values of Durbin-Watson statistics and the F-statistics are much improved in the Prais-Winsten regression. Other than these findings, the estimates from OLS with Robust Standard Error, Prais-Winsten regression, and Median regression are not different from the replicated ones. One thing to compare with the results from the median voter model is that standard errors reported in the special interest group model are higher and the Durbin-Watson statistics are lower.<sup>75</sup> These differences between the two models suggest that the median voter model explains the variation in OASI benefits somewhat better than the special interest group model.

#### 4.4.3 Estimates of the Combined Model

Table 5 presents estimates of the combined model using the same estimation strategy. The combined model allows both median voter's constraints and special interest group influence to affect social security retirement benefits. That is  $W_M = W_S = 1$  in equation (19).

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<sup>75</sup> Durbin-Watson statistics in the first through third columns of the right hand panel in Table 3 indicate positive autocorrelation problems. However, they are solved with Prais-Winsten and Cochrane-Orcutt regression resulting in no autocorrelation. Congleton and Shughart (1990) report autocorrelation problems in the estimation of special interest group model, and they correct them using AR(1) and AR(2).

Table 5. Average Monthly OASI Benefits by Combined Model for the Period from 1946 to 1982: (1967 Dollars)

Period Estimation	Combined Model				
	1946-82(S) OLS	1946-82(R) OLS	1946-82 Robust S.E.	1946-82 Prais-Winsten	1946-82 Median Regression
Intercept	-296.186 (-4.91)***	-100.603 (-2.32)**	-100.603 (-2.17)**	-71.288 (-2.36)**	-139.126 (-6.24)***
Real Median Earnings	0.088 (6.87)***	0.027 (2.64)**	0.027 (2.58)**	0.020 (2.69)**	0.041 (7.55)***
Average Real Private Pension	-0.08 (4.25)***	-0.001 (-0.13)	-0.001 (-0.21)	-0.0007 (-0.14)	-0.0004 (-0.13)
Remaining Work Life of Median Voter	-7.184 (-1.46)	-13.542 (-3.83)***	-13.542 (-4.87)***	-11.632 (-5.23)***	-16.277 (-9.26)***
Median Life Expectancy	13.293 (3.43)***	15.516 (4.42)***	15.516 (5.12)***	13.453 (7.37)***	18.162 (10.22)***
Real Interest Rate	1.04 (1.72)	0.952 (0.93)	0.952 (1.16)	0.547 (0.67)	0.794 (1.59)
Long Term Growth Rate	-3.191 (-4.58)***	-1.774 (-1.95)*	-1.774 (-1.76)*	-1.835 (-1.80)*	-2.201 (-4.76)***
Effective Tax Base per Beneficiary Time	0.00008 (1.14)	0.00002 (0.37)	0.00002 (0.53)	-0.00003 (-0.50)	0.00002 (0.69)
	-3.906 (-1.79)	-1.041 (-0.42)	-1.041 (-0.46)	-1.041 (-0.42)	-2.881 (-2.26)**
Number of Retired Workers	4.06E-06 (1.39)	-1.31e-07 (-0.04)	-1.31e-07 (-0.04)	-1.22e-06 (-1.32)	3.10e-06 (1.85)*
Net Administrative Expenses	0.007 (0.33)	0.025 (0.82)	0.025 (0.78)	0.027 (0.88)	-0.026 (-1.87)*
R <sup>2</sup>	0.988	0.969	0.969	0.971	0.875 <sup>a</sup>
Durbin-Watson	1.89	1.74	1.74	1.93	
F-statistic	216.93***	111.64***	430.67***	3126.31***	
Standard Error	4.14	5.69	5.69	5.56	

Note: T-statistics are reported in parentheses. Those followed by \*\*\* are statistically significant at the .01 level, \*\* at the .05 and \* at the .01 level. All entries are rounded to the nearest decimal.

(S): Estimates from the original data set used in Congleton and Shughart (1990)

(R): Estimates from replicated data set.

a: Pseudo R<sup>2</sup>

The results are similar to the previous replicated results, and largely consistent with Congleton and Shughart (1990). As in Congleton and Shughart (1990), the median voter model of social security benefit levels outperforms the special interest group model.

None of the explanatory variables in the special interest group model are statistically significant in the combined model estimates.

#### 4.4.4 Overview of Replication Results

The results in Table 3, Table 4, and Table 5 largely support the median voter model. The variables focused on explain most of the increase in the retirement benefit for the period from 1946 to 1982, and the coefficient estimates for the median voter model are statistically significant. In contrast, explanatory variables in the special interest group model are statistically insignificant in the combined model. Furthermore, the magnitudes of the explanatory variables in the special interest group model are too small to have meaningful effect on OASI benefit levels.

### **4.5 Regression Results for “Average Monthly OASI plus Medicare Benefits”**

As explained in Chapter 1, a major new program called Medicare was added in 1966 to the social security program. Under the Medicare program all persons aged 65 and over become entitled to receive medical benefits. Medicare is essentially a “free” insurance policy<sup>76</sup> received by retired persons and so can be thought of as an expansion of OASI benefits. Medicare is also based on the same labor income tax base of OASI.<sup>77</sup> The Social Security Administration is responsible for the Medicare program as well.

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<sup>76</sup> Medicare is an in-kind increase in social security benefits.

<sup>77</sup> For Medicare’s Hospital Insurance (HI) program, a tax rate of 1.45% is imposed on employee income.

Medicare spending has been growing steadily in both absolute terms and as a percentage of the federal budget.<sup>78</sup> Total Medicare spending was \$2.7 billion dollars or 1.8% of all federal spending in 1967, but had reached \$71.6 billion (1967 dollars), or 16% in 2008.<sup>79</sup> Average monthly real Medicare benefit per beneficiary was 31 dollar in 1967, but increased to 178 dollars in 2006. Thus, it is meaningful to add Medicare to OASI for analyzing the three public choice models.<sup>80</sup>

Average monthly real OASI benefits plus average monthly real Medicare benefits per beneficiary is used as a dependent variable. The same estimate strategy is employed.

#### 4.5.1 Estimates of Median Voter Model

Regression results for a median voter model of average monthly real OASI benefits plus average monthly real Medicare reimbursements per beneficiary” as a dependent variable are shown in Table 6. Since Medicare benefits began in the middle of 1966, a dummy variable was inserted after 1967 to get reasonable regression results. The first column of Table 6 shows estimates using the data set of Congleton and Shughart (1990), the second column provides estimates with the replicated data set, and the other columns present estimates from OLS with robust standard error, Prais-Winsten regression, and median regression, respectively.

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<sup>78</sup> According to "Medicare's Financial Condition: Beyond Actuarial Balance," American Academy of Actuaries, March 2008, the Medicare Hospital Insurance Trust Fund will become insolvent by 2019.

<sup>79</sup> Economic Report of the President, 2009.

<sup>80</sup> However, it should be somewhat different in terms of special interest groups. Many experts argue that the critical increase in Medicare has been associated with medical costs. It is very likely that medical doctors and insurance companies may have an incentive to do rent-seeking activities regarding Medicare. In addition to these interest groups, high-tech companies related to medical equipment seems to be another factor in increasing medical costs. Considering this circumstance, I applied the three public choice models for only Medicare growth since 1966 in a separate study. The results imply that political influence of special interest groups seems to be greater for Medicare than for OASI benefit levels.

Table 6. Average Monthly Medicare and OASI Benefits by Median Voter Model for the Period from 1946 to 1982: (1967 Dollars)

Period Estimation	Median Voter Model				
	1946-82(S) OLS	1946-82(R) OLS	1946-82 Robust S.E.	1946-82 Prais-Winsten	1946-82 Median Regression
Intercept	-344.81 (-6.37)***	-174.682 (-3.65)***	-174.682 (-3.27)***	-149.504 (-2.79)**	-189.201 (-6.77)***
Real Median Earnings	0.092 (7.17)***	0.038 (3.33)***	0.038 (2.95)***	0.032 (2.74)***	0.042 (5.89)***
Average Real Private Pension	-0.1008 (-4.65)***	-0.007 (-0.55)	-0.007 (-0.88)	-0.008 (-0.88)	-0.004 (-0.94)
Remaining Work Life of Median Voter	-3.205 (-0.64)	-19.771 (-4.74)***	-19.771 (-5.96)***	-17.082 (-6.37)***	-20.826 (-8.85)***
Median Life Expectancy	11.545 (2.85)***	23.017 (5.72)***	23.017 (6.52)***	19.952 (8.27)***	23.866 (10.76)***
Real Interest Rate	1.222 (1.33)	-1.224 (-0.74)	-1.224 (-0.86)	-0.999 (-0.60)	-0.336 (-0.36)
Long Term Growth Rate	-3.358 (-4.73)***	-2.836 (-2.57)**	-2.836 (-2.03)*	-2.581 (-1.84)*	-3.075 (-4.47)***
Effective Tax Base per Beneficiary	0.0001 (2.36)**	0.0001 (0.76)	0.0001 (1.02)	0.00009 (0.64)	0.00008 (1.75)*
Time	-0.28 (-0.40)	-0.952 (-0.96)	-0.952 (-1.04)	-0.903 (-0.94)	-1.351 (-2.38)**
Dummy	32.816 (8.60)***	24.633 (3.61)***	24.633 (3.65)***	21.347 (2.20)***	28.159 (7.23)***
R <sup>2</sup>	0.995	0.986	0.986	0.982	0.907 <sup>a</sup>
Durbin-Watson	1.90***	1.92***	1.92***	1.94***	
F-statistic	597.83***	205.26***	320.20***	1363.71***	
Standard Error	4.30	7.02	7.02	7.07	

Note: T-statistics are reported in parentheses. Those followed by \*\*\* are statistically significant at the .01 level, \*\* at the .05 and \* at the .01 level. All entries are rounded to the nearest decimal.

(S): Estimates from the original data set used in Congleton and Shughart (1990)

(R): Estimates from replicated data set.

a: Pseudo R<sup>2</sup>

The sign of the dummy variable is positive and statistically significant in each estimate, which implies that the average monthly Medicare plus OASI benefits was increased by Medicare. The replication result is almost the same in the case of average monthly OASI benefits in Table 3. Adding a medical dummy variable leaves key parameter estimates essentially unchanged. However, one of the interesting differences is

that the Durbin-Watson statistics are good enough not to have suffered from autocorrelation problems.

#### 4.5.2 Estimates of Special Interest Group Model

Table 7 presents the estimates of average monthly Medicare and OASI benefits using the special interest group model. The OLS estimates from the replicated data set are very close to the estimates in the previous study; however, the Durbin-Watson statistics are very low, implying that this is associated with autocorrelation problems. Since dummy variables are positive and statistically significant, it can be said that the Medicare plus OASI benefit growth seems positively related to the political activities of the special interest groups.

Table 7. Average Monthly Medicare and OASI Benefits by Special Interest Group Model for the Period from 1946 to 1982: (1967 Dollars)

Special Interest Group Model					
Period Estimation	1946-82(S) OLS	1946-82(R) OLS	1946-82 Robust S.E.	1946-82 Prais- Winsten	1946-82 Median Regression
Intercept	118.988 (5.50)***	70.561 (3.02)***	70.561 (1.91)***	21.189 (1.15)	129.437 (4.22)***
Average Real Private Pension	-0.071 (-3.87)***	-0.036 (-1.75)*	-0.036 (-1.07)*	0.001 (0.08)	-0.089 (-3.27)***
Number of Retired Workers	5.87E-06 (5.47)***	4.38e-06 (2.88)***	4.38e-06 (1.85)*	5.63e-06 (4.07)***	4.28e-06 (1.99)*
Net Administrative Expenses Dummy	0.06 (1.50) 40.289 (6.32)***	0.083 (1.52) 31.207 (3.08)**	0.083 (0.88) 31.207 (2.55)**	0.085 (3.06)*** 11.224 (1.13)	0.096 (1.25) 40.037 (3.25)***
R <sup>2</sup>	0.976	0.945	0.945	0.819	0.840 <sup>a</sup>
Durbin-Watson	0.69***	0.56***	0.56***	1.45	
F-statistic	298.63***	129.68***	208.85***	265.27***	
Standard Error	9.043	12.963	12.963	7.36	

Note: T-statistics are reported in parentheses. Those followed by \*\*\* are statistically significant at the .01 level, \*\* at the .05 and \* at the .01 level. All entries are rounded to the nearest decimal.

(S): Estimates from the original data set used in Congleton and Shughart (1990)

(R): Estimates from replicated data set.

a: Pseudo R<sup>2</sup>

#### 4.5.3 Estimates of Combined Model

Table 8 shows the estimates of average monthly Medicare and OASI benefits by the combined model. The results from the OLS provide a number of significant explanatory variables and significant Durbin-Watson statistics. Medicare dummy variable is positive and statistically significant in OLS, implying that the introduction of Medicare in 1966 affected the growth of average real social security benefit levels. Surprisingly, no coefficient estimates from the median regression are statistically significant. However, the signs of the explanatory variables are the same as in the other estimates. Interestingly, unlike the estimates in the combined model for the OASI benefit, the political influence

of the special interest groups became effective on the Medicare plus OASI benefit. My conjecture is that more interest groups including insurance companies, pharmaceutical companies, medical doctors, etc have had increased interest regarding Medicare growth.

Table 8. Average Monthly Medicare and OASI Benefits by Combined Model for the Period from 1946 to 1982: (1967 Dollars)

Period Estimation	Combined Model				
	1946-82(S) OLS	1946-82(R) OLS	1946-82 Robust S.E.	1946-82 Prais- Winsten	1946-82 Median Regression
Intercept	-329.962 (-4.79)***	-100.644 (-2.21)**	-100.644 (-1.93)*	-47.865 (-0.86)	-145.826 (-0.13)
Real Median Earnings	0.089 (6.21)***	0.011 (0.85)	0.011 (0.72)	-0.0001 (-0.01)	0.016 (0.05)
Average Real Private Pension	-0.102 (-4.55)***	-0.010 (-0.91)	-0.010 (-1.60)	-0.012 (-2.08)**	-0.010 (-0.06)
Remaining Work Life of Median Voter	-4.387 (-0.80)	-14.548 (-3.57)***	-14.548 (-3.85)***	-10.196 (-2.39)**	-16.709 (-0.17)
Median Life Expectancy	12.044 (2.63)**	16.575 (3.90)***	16.575 (4.08)***	12.109 (2.66)**	19.908 (0.20)
Real Interest Rate	1.334 (1.18)	1.324 (0.81)	1.324 (0.83)	0.050 (0.03)	2.562 (0.07)
Long Term Growth Rate	-3.272 (-4.29)***	-2.219 (-2.34)**	-2.219 (-1.79)**	-2.429 (-1.95)*	-2.956 (-0.13)
Effective Tax Base per Beneficiary Time	0.0001 (2.23)**	0.0002 (2.55)**	0.0002 (2.83)***	0.0001 (1.21)	0.0003 (0.13)
Dummy	0.363 (0.10)	8.414 (2.21)**	8.414 (2.62)**	11.181 (3.31)***	6.100 (0.07)
Number of Retired Workers	32.288 (5.51)***	13.942 (1.73)*	13.942 (2.37)**	6.01 (0.90)	17.569 (0.11)
Net Administrative Expenses	-1.21E-06 (-0.27)	-0.00001 (-2.83)***	-0.00001 (-3.55)***	-0.00002 (-4.19)***	-0.00001 (-0.11)
	0.015 (0.62)	0.085 (2.43)**	0.085 (3.06)**	0.087 (3.27)***	0.085 (0.11)
R <sup>2</sup>	0.995	0.991	0.991	0.992	0.921 <sup>a</sup>
Durbin-Watson	1.97***	1.92***	1.92***	2.15***	
F-statistic	460.27***	238.25***	459.76***	3485.67***	
Standard Error	4.43	5.91	5.91	5.79	

Note: T-statistics are reported in parentheses. Those followed by \*\*\* are statistically significant at the .01 level, \*\* at the .05 and \* at the .01 level. All entries are rounded to the nearest decimal.

(S): Estimates from the original data set used in Congleton and Shughart (1990)

(R): Estimates from replicated data set.

a: Pseudo R2



#### 4.5.4 Conclusion from the Replications of Congleton and Shughart (1990)

I replicated the estimation of U.S. social security growth for the period 1946 to 1982 using the three public choice models developed in Congleton and Shughart (1990). To make the estimation results more efficient, I corrected for heteroskedasticity and autocorrelation. By applying Prais-Winsten regression with Cochrane-Orcutt transformation and robust standard errors, problems associated with autocorrelation and homoskedasticity are resolved. The median voter model of public policy formation implies that any change in the median voter's constraint affects the social security benefit levels. Support for this model is provided by the original estimates and my extended estimates. Support for the special interest group was also found. The political influence of outside special interest group, e.g. retired beneficiaries, appeared to affect the benefit levels. However, the median voter's preferred benefit levels are not always in accordance with special interest groups' interest. Estimates of the combined model for the period 1946 to 1982 in this study support the previous results in Congleton and Shughart (1990) that the median voter model overwhelms the special interest group explanation for the growth of social security benefits. Based on the social security history, it seems obvious that an increase in social security retirement benefits has been directly and/or indirectly associated with an increase in the social security tax rate that the median voter has to bear. But evidently the median voter is willing to pay price to obtain additional benefits. A change in the median voter's budget constraints has affected the benefit level: in particular, median voter's income, her/his remaining work life and life expectancy.

## **5 New Estimates and Improved Methodology: Extended Data set and Time Series Analysis**

In Chapter 4, I replicated the estimates in Congleton and Shugart (1990) and compared them with those estimates from OLS with robust standard error, Prais-Winsten regression, and median regression. Chapter 5 investigates social security benefit levels after 1982. This allows new data to be used in the estimation. In addition, a significant reform occurred in 1983 that needs to be taken account of. The estimates developed in this chapter also take greater account of time series problems, which is one of the key issues for the data set used in this study. In order to address non-stationarity problems, dynamic OLS techniques are applied. Chapter 5 presents a series of stationary tests and estimates of the three public choice models with an extended data set to 2004.

### **5.1 Cointegration Analysis**

In time series analysis regarding causality, endogeneity problems are commonly encountered. Classical econometric theory assumes that observed data come from a stationary process, where means and variances are constant over time. Kmenta (1986) analyzes the basic assumptions for classical normal linear regressions to be “BLUE,” a best linear unbiased estimator. These include normality, zero mean, homoskedasticity,

nonautocorrelation, and nonstochastic explanatory variable.<sup>81</sup> Similarly, Stock and Watson (2003) indicate that in order for OLS to provide appropriate estimates of the regression coefficients, three basic assumptions are necessary. The first least squares assumption is that conditional distribution of  $u_i$  given  $X_i$  has a mean of zero. The second assumption is that  $(X_i, Y_i)$ ,  $i=1, \dots, n$  are independently and identically distributed (i.i.d) across observations. The third assumption is that  $(X_i, u_i)$  have nonzero finite fourth moments. In time series regression, the second assumption is replaced with a more appropriate one with two parts; part (a) is that data are drawn from a stationary distribution, so that the distribution of the data today is the same as its distribution in the past; part (b) of the second assumption is that the random variable becomes independently distributed when the amount of time separating them becomes large. They also denote that if a regressor has a stochastic trend, then the OLS estimator of its coefficient and its OLS T-statistic can have nonstandard (nonnormal) distribution.<sup>82</sup> In sum, time series variables that are not stationary have some undesirable properties that make hypothesis testing using standard techniques unreliable or incorrect and that can cause the forecast to be biased and/or inefficient.<sup>83</sup>

I assumed in the previous analysis that the data of OASI benefit and the other explanation variables were stationary. However, if they are not stationary, then

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<sup>81</sup> For more details, see Kmenta (1986), p.260.

<sup>82</sup> For more details, see Stock and Watson (2003) p.103-107 and p.446-448.

<sup>83</sup> Stock and Watson (2003, p. 447).

confidence interval and forecasts are not reliable. With this in mind, I checked key issues of time series data, such as stationarity, in the data set for the period from 1946 to 2004.

Table 9 presents the results of augmented Dickey-Fuller tests of the hypothesis that the series are integrated for order one without a time trend. A series is integrated of order one if  $X_t$  is stationary in first differences.

Table 9. Results of Augmented Dickey-Fuller Tests for the Series for Order One Without a Time Trend

Series	ADF Statistic
Average Real OASI Benefit (S)	-1.915
Average Real OASI plus Medicare	-1.568
Real Median Income (Y)	-1.241
Average Real Private Pension (A)	-4.157***
Remaining Work Life of Median Voter ( $R_2$ )	-2.234
Remaining Life of Median Voter ( $D_2$ )	-2.882*
Real Interest Rate (r)	-6.673***
Long Term Growth Rate of RGNP (g)	-9.320***
Effective Tax Base per Recipient (B)	-1.854
Number of Retired Workers ( $N_1$ )	-1.997
Net Administrative Expenses (E)	-1.915

Note: Unit root tests are significant at the \*10%, \*\*5%, and \*\*\*10% significance level. Dickey-Fuller at 1% Critical Value is -3.570; 5% Critical Value is -2.924; 10% Critical Value is -2.597.

Three variables (remaining work life of median voter, Long term growth rate of RGNP, and effective tax base per recipient) are statistically significant at 1% level and one variable (real interest rate) at 10% level. Therefore, it can be inferred that these series are integrated of order one, whereas the others are not.

Table 10 shows the results of augmented Dickey-Fuller tests of the hypothesis that the series are integrated for order one with a time trend. In this case, two additional variables (average real private pension, remaining life of median voter) are statistically

significant at 5% level, while one variable (real interest rate) becomes statistically insignificant.

Note that failure to reject the null hypothesis of a unit root using the ADF test does not necessarily mean that the series actually has a unit root. Accordingly, it still can be reasonable to approximate the true autoregressive root as equaling one and therefore to use differences of the series rather than its level.<sup>84</sup>

Table 10. Results of Augmented Dickey-Fuller Tests for the Series for Order One With a Time Trend

Series	ADF Statistic
Average Real OASI Benefit (S)	-1.595
Average Real OASI plus Medicare	-2.626
Real Median Income (Y)	-4.000***
Average Real Private Pension (A)	-4.277***
Remaining Work Life of Median Voter (R <sub>2</sub> )	-3.877**
Remaining Life of Median Voter (D <sub>2</sub> )	-2.834
Real Interest Rate (r)	-6.830***
Long Term Growth Rate of RGNP (g)	-8.799***
Effective Tax Base per Beneficiary (B)	-0.558
Number of Retired Workers (N <sub>1</sub> )	-1.005
Net Administrative Expenses (E)	-1.595

Note: Unit root test are significant at the \*10%, \*\*5%, and \*\*\*10% significance level. Interpolated Dickey-Fuller at 1% Critical Value is -4.135; 5% Critical Value is -3.493; 10% Critical Value is -3.176.

We also test whether there is a cointegrating relationship between the variables. The Engle-Granger Augmented Dickey-Fuller test can be used for that. According to Stock and Watson (2003), one of the ways to check whether two variables are cointegrated is to do a unit root test. For example, if  $Y_t - \theta X_t$  is integrated of order zero, then  $X_t$  and  $Y_t$  are said to be cointegrated. The coefficient,  $\theta$ , is called the cointegrating

<sup>84</sup> Stock and Watson (2003), p. 467.

coefficient. The Engle-Granger Augmented Dickey-Fuller test for cointegration provides a two-step testing procedure for cointegration when  $\theta$  is unknown: the first step is that the cointegration coefficient is estimated by OLS ( $Y_t = \alpha + \theta X_t + z_t$ ), and the next step is to do a Dickey-Fuller t-test (with an intercept but no time trend) for a unit root in the residual form this regression,  $\hat{z}_t$ . I followed this procedure to see if the explanatory variables are cointegrated with the dependent variable (average real social security benefit per recipient,  $S_t$ ).

Table 11 presents the Engle-Granger Augmented Dickey-Fuller test for cointegration between the explanatory variables ( $x'_s$ ) and the dependent variable ( $S$ ) in the median voter model. Since the coefficient of the lag of  $z$  is statistically significant at 5% level, it can be said that they are cointegrated of order one.

Table 11. Engle-Granger Augmented Dickey-Fuller Test for Cointegration Between the Independent Variables ( $x'_s$ ) and the Dependent Variable ( $S$ ) in the Median Voter Model

Number of obs = 58					
		Interpolated Dickey-Fuller			
	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value	
Z(t)	-4.825	-3.569	-2.924	-2.597	
MacKinnon approximate p-value for Z(t) = 0.0000					
D.z	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
L1.	-.599	.1241948	-4.82	0.000	-.847 -0.350
_cons	-.269	.7263586	-0.37	0.712	-1.724 1.1854

Also, Table 12 presents the Engle-Granger Augmented Dickey-Fuller test for cointegration between the explanatory variables ( $x'_s$ ) and the dependent variable ( $S$ ) in

the special interest group model. Since the coefficient of the lag of  $z$  is statistically significant at 5% level, it can be thought of as a cointegrating linear time-independent relation.

Table 12. Engle-Granger Augmented Dickey-Fuller Test for Cointegration Between the Independent Variables ( $x'_s$ ) and the Dependent Variable ( $S$ ) in the Special Interest Group Model

Number of obs = 58					
Interpolated Dickey-Fuller					
	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value	
Z(t)	-3.186	-3.569	-2.924	-2.597	
MacKinnon approximate p-value for Z(t) = 0.0000					
D.z	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
L1.	-0.314	.0986552	-3.19	0.002	-0.511 -0.116
_cons	-0.043	.7090318	-0.06	0.951	-1.463 1.377

Similarly, the Engle-Granger Augmented Dickey-Fuller test for cointegration between the independent variables ( $x'_s$ ) and the dependent variable ( $S$ ) in the combined model is shown in Table 13. It can be inferred that a cointegration relation between the dependent variable ( $S$ ) and the independent variables ( $x'_s$ ) exist since the coefficient of the lag of  $z$  is statistically significant at 1% level. Engle and Granger (1987) indicate that linear combination of non-stationary time series can be stationary even if they have unit roots. If such time series exist, then it can be inferred that the time series are cointegrated and interpreted as long-run equilibrium relationships between the variables.

Table 13. Engle-Granger Augmented Dickey-Fuller Test for Cointegration Between the Independent Variables (  $x'_s$  ) and the Dependent Variable (  $S$  ) in the Combined Model

Number of obs = 58					
			Interpolated Dickey-Fuller		
Test Statistic			1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-4.621		-3.569	-2.924	-2.597
MacKinnon approximate p-value for Z(t) = 0.0000					
D.z	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
L1.	-.560	.1212065	-4.62	0.000	-.802 -0.317
_cons	-.096	.6214837	-0.16	0.877	-1.341 1.148

According to Thorbecke (2008), endogeneity problems can be corrected by the presence of lags and leads of the right-hand side variables.<sup>85</sup> The level of social security benefits can be independent of all other explanatory variables within a given period, but can be influenced by the level of such explanatory variables in the prior period (Kennedy 2008).

Therefore the median voter model can be rewritten as:

$$\begin{aligned}
 (22) \quad S_t = & \beta_0 + \theta_1 Y_t + \theta_2 A_t + \theta_3 R_2 + \theta_4 D_2 + \theta_5 r_t + \theta_6 g_t + \theta_7 B_t + \sum_{k=-K}^K \alpha_k \Delta Y_{t+k} + \sum_{k=-K}^K \delta_k \Delta A_{t+k} \\
 & + \sum_{k=-K}^K \phi_k \Delta R_{2t+k} + \sum_{k=-K}^K \varphi_k \Delta D_{2t+k} + \sum_{k=-K}^K \eta_k \Delta r_{t+k} + \sum_{k=-K}^K \lambda_k \Delta g_{t+k} + \sum_{k=-K}^K \gamma_k \Delta B_{t+k} + u_{1t}
 \end{aligned}$$

Also, the special interest group model can be shown with its leads and lags.

$$(23) \quad S_t = \beta_0 + \theta_2 A_t + \theta_8 N_{1t} + \theta_9 sE_t + \sum_{k=-K}^K \delta_k \Delta A_{t+k} + \sum_{k=-K}^K \sigma_k \Delta N_{1t+k} + \sum_{k=-K}^K \omega_k \Delta sE_{t+k} + u_{2t}$$

Finally, the combined model can be rewritten with its leads and lags:

<sup>85</sup> Endogeneity implies a correlation between the variables and the error term. Endogeneity can arise as a result of autoregression with autocorrelated errors, measurement error, and sample selection errors Kennedy (2008) p.139.



$$\begin{aligned}
(24) \quad S_t = & \beta_0 + \theta_1 Y_t + \theta_2 A_t + \theta_3 R_2 + \theta_4 D_2 + \theta_5 r_t + \theta_6 g_t + \theta_7 B_t + \theta_8 N_{1t} + \theta_9 sE_t \\
& + \sum_{k=-K}^K \alpha_k \Delta Y_{t+k} + \sum_{k=-K}^K \delta_k \Delta A_{t+k} + \sum_{k=-K}^K \phi_k \Delta R_{2t+k} + \sum_{k=-K}^K \varphi_k \Delta D_{2t+k} + \sum_{k=-K}^K \gamma_k \Delta B_{t+k} \\
& + \sum_{k=-K}^K \eta_k \Delta r_{t+k} + \sum_{k=-K}^K \lambda_k \Delta g_{t+k} + \sum_{k=-K}^K \sigma_k \Delta N_{1t+k} + \sum_{k=-K}^K \omega_k \Delta sE_{t+k} + u_{3t}
\end{aligned}$$

## 5.2 Extended Data Set and Dynamic Ordinary Least Square Estimates

As in previous sections, I use the same econometrics techniques with extended data set for the period from 1946 to 2004: OLS, OLS with robust standard error, Median regression, and Prais-Winsten regression. Also, I report dynamic ordinary least square (DOLS) estimates<sup>86</sup> because I confirmed the cointegrating relationships between social security benefit level and the explanatory variables of interest using the Engle-Granger Augmented Dickey-Fuller test. The DOLS include past, present, and future values of the changes in independent variables. More specifically, it indicates the long-run effect on the social security benefit level through a change in the explanatory variables.

The following Table 14 presents the estimates from OLS, OLS with robust standard error, Median regression, Prais-Winsten regression, and dynamic OLS with the extended data set for the median voter model.<sup>87</sup> The estimates from the extended data set seem to explain the growth of OASI benefits from 1946 to 2004. They are very similar to those estimates from both the median voter model and the combined model in previous tables.

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<sup>86</sup> The T-statistic constructed using the DOLS estimator with HAC standard errors has standard normal distribution in large samples (Stock and Watson, 2003 p. 557).

<sup>87</sup> The regression results of the first difference form are not robust since some time series variables have unit roots while some others do not and thus it is not compatible.

Table 14. New Estimates and Dynamic OLS: Average Monthly OASI Benefits by Median Voter Model (1967 Dollars)

Period Estimation	Median Voter Model				
	1946-2004 OLS	1946-2004 Robust S.E.	1946-004 Median Regression	1946-2004 Prais-Winsten	1946-2004 DOLS <sup>b</sup>
Intercept	-66.665 (-2.28)**	-66.665 (-2.18)**	-27.035 (-1.21)	- 11.513 (-0.48)	-148.094 (-3.84)***
Real Median Earnings	0.016 (2.45)**	0.016 (2.13)**	0.011 (2.17)**	0.001 (1.98)*	0.028 (2.65)**
Average Real Private Pension	0.003 (0.60)	0.003 (0.67)	0.004 (1.10)	0.003 (0.72)	-0.006 (-0.41)
Remaining Work Life of Median Voter	-7.224 (-2.75)***	-7.224 (-3.06)***	-6.281 (-3.13)***	-7.909 (-6.02)***	-3.649 (-3.41)***
Median Life Expectancy	10.323 (3.40)***	10.323 (4.33)***	8.558 (4.31)***	9.426 (9.41)***	10.200 (8.59)**
Real Interest Rate	0.056 (0.09)	0.056 (0.09)	0.504 (1.14)	0.154 (0.24)	-0.659 (-0.69)
Long Term Growth Rate	-2.018 (-2.40)**	-2.018 (-2.36)**	-3.043 (-5.05)***	-1.647 (-1.92)*	-3.401 (-1.72)*
Effective Tax Base per Recipient	-0.00008 (-2.02)**	-0.00008 (-1.68)*	-0.0001 (-4.73)***	-0.0002 (-3.42)***	-0.0002 (-0.74)
Time	-0.077 (-0.13)	-0.077 (-0.14)	0.225 (0.50)	- 11.513	
R <sup>2</sup>	0.980	0.980	0.879a	0.953	
Durbin-Watson	1.221	1.221		1.816***	
F-statistic	307.06***	286.84***		2327.22***	545.51***
Standard Error	6.199	6.199		4.986	

a: Pseudo R<sup>2</sup>

b: Heteroskedasticity-and Autocorrelation-consistent (HAC) standard errors are reported in parentheses.

Overall, the estimates are similar to those from the 1946-1982 period.

Microvariables associated with the median voter's preference, such as remaining work life of median voter and median life expectancy, remain significant causes of the growth of OASI benefits. Those coefficients are statistically significant across the regression results and have a stable order of magnitude. The remaining work life of the median voter and the median life expectancy have important choice relevant effects on the median voter's constraints that influence social security benefits. The longer remaining work life

is expected, the less likely to retire earlier, which negatively affects the growth of the social security. However, as the median voter is expected to live longer, she/he is inclined to want higher retirement benefits. Interestingly, effective tax base per beneficiary is negative and statistically significant in all the regression results except for DOLS regression. This variable is analogous to a cost variable. The higher the variable the lower the cost. It seems reasonable that the rate at which the number of retirement beneficiary increases, holding the tax base constant, causes the median voter to pay more tax and thus not want high benefits. Average real private pension fails to explain the increased retirement benefits since it is not statistically significant in all the regression results.

The low values of Durbin-Watson statistics in the results from OLS and OLS with robust standard error are reported. Adjusting the Durbin-Watson statistics with Prais-Winsten regression provides somewhat more accurate estimates of the coefficients for the explanatory variables. The T-statistic, F-statistic and standard error are improved. The result from the DOLS is not different from the result from OLS. In short, the growth of OASI benefits can be explained by changes in median voter's constraints.

The regression results in the special interest group model with extended data set are reported in Table 15. In the case where only special interest groups are included, the signs of number of retired workers and net administrative cost are positive and statistically significant, implying that social security benefits increase with the size of outside interest group and the financial resources of the social security bureaucracy. This result regarding political influence of the elderly is a more precise than the result obtained

when the size of social security is measured as the share of social security expenditure of GDP or as the share of social security and welfare expenditure of GDP, which were done by Tabellini (2000) and Perotti (1996).

This contrasts with the subset of the social security literature as in Tabellini (2000) that predicts that an increase in the proportion of elderly raises the dependency ratio and thus decreases retirement benefit per beneficiary. Dynamic OLS appear to provide more efficient estimates, because both number of retired workers and net administrative cost time series data have a unit root, respectively. Overall, the results suggest that the OLS regression results are not spurious.

Table 15. New Estimates and Dynamic OLS: Average Monthly OASI Benefits by Special Interest Group Model (1967 Dollars)

Period Estimation	Special Interest Group Model				
	1946-2004 OLS	1946-2004 Robust S.E.	1946-004 Median Regression	1946-2004 Prais- Winsten	1946-2004 DOLS <sup>b</sup>
Intercept	46.682 (7.35)***	46.682 (7.01)***	39.431 (6.39)***	42.680 (5.55)***	18.136 (2.05)**
Average Real Private Pension	-0.006 (-1.08)	-0.006 (-1.10)	0.001 (0.22)	0.001 (0.42)	0.005 (0.72)
Number of Retired Workers	4.04e-06 (14.67)***	4.04e-06 (13.81)***	3.58e-06 (13.01)***	3.82e-06 (10.86)***	4.00e-06 (11.62)***
Net Administrative Expenses	0.037 (3.97)***	0.037 (3.63)***	0.050 (5.25)***	0.028 (1.57)	0.021 (2.13)**
R <sup>2</sup>	0.973	0.973	0.864	0.872	
Durbin-Watson	0.627***	0.627***		2.009***	
F-statistic	677.60***	718.48***		4961.78***	197.30***
Standard Error	6.793	6.793		4.812	

a: Pseudo R<sup>2</sup>

b: Heteroskedasticity-and Autocorrelation-consistent (HAC) standard errors are reported in parentheses.

The regression results for the combined model for the period from 1946 to 2004 are reported in Table 16. In the results of OLS and Prais-Winsten many explanatory variables

associated with the median voter remain similar to those of the median voter model. Real administrative expenses related to the special interest group model is statistically significant, which is consistent with a weak form of the Niskanen model, in which “insider” interest groups affect the growth of social security benefit levels. The benefit level was increased by the influence of bureaucratic discretionary power of inside government.

The dynamic OLS result is not much different compared with those of OLS and Prais-Winsten results. The explanatory variables associated with the median voter age are statistically significant in all the regressions. Long term growth rate being taken care of by stationarity and autocorrelation become statistically insignificant although it is still a negative sign.<sup>88</sup> Real administrative expenses is still positive and statistically significant.

In addition to the regression results for the period 1946 to 1982, it is not clear that the political power of the median voter model outweighs that of the special interest group model. It seems clear that the actual benefit level determined by the Congress,  $S_E$ , in Figure 1, moved away from the median voter’s preferred benefit level,  $S_M$ , after the year 1982.

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<sup>88</sup> Theoretically, growth rate may increase social security benefit level because the benefit is affected by wage rate positively related to growth rate. However, one of the main purposes of the social security program is to financially help those who are in poverty and/or economic risk due to cessation of work activity, which may take place in a period of economic recession. In such periods, it is reasonable to think there will be a greater demand for social security benefits.

Table 16. New Estimates and Dynamic OLS: Average Monthly OASI Benefits by Combined Model (1967 Dollars)

Period Estimation	Combined Model				
	1946-2004 OLS	1946-2004 Robust S.E.	1946-004 Median Regression	1946-2004 Prais- Winsten	1946-2004 DOLS <sup>b</sup>
Intercept	-39.810 (-1.56)	-39.810 (-1.51)	-27.910 (-0.62)	-12.182 (-0.50)	-5.684 (-0.16)
Real Median Earnings	0.013 (2.16)**	0.013 (2.00)**	0.008 (0.78)	0.009 (1.68)**	0.003 (0.48)
Average Real Private Pension	0.002 (0.42)	0.002 (0.65)	0.002 (0.30)	0.001 (0.54)	0.010 (2.07)**
Remaining Work Life of Median Voter	-10.360 (-4.39)***	-10.360 (-4.26)***	-9.435 (-2.23)**	-8.438 (-3.82)***	-8.789 (-3.31)***
Median Life Expectancy	11.639 (5.12)***	11.639 (5.06)***	10.912 (2.72)***	9.406 (4.58)***	10.212 (3.72)***
Real Interest Rate	0.476 (0.88)	0.476 (1.00)	0.141 (0.15)	0.371 (0.75)	0.383 (0.60)
Long Term Growth Rate	-1.441 (-2.06)**	-1.441 (-.87)*	-0.853 (-0.74)	-1.364 (-1.61)	-2.635 (-1.44)
Effective Tax Base per Beneficiary Time	-0.00002 (-0.64)	-0.00002 (-0.86)	-0.00005 (-0.73)	-0.00008 (-2.18)*	-0.0003 (-0.75)
Number of Retired Workers	1.94e-06 (1.07)	1.94e-06 (1.05)	2.10e-06 (0.66)	1.93e-06 (1.01)	-5.23e-07 (-0.38)
Net Administrative Expenses	0.035 (2.65)**	0.035 (3.06)***	0.031 (1.34)	0.030 (2.27)***	0.041 (3.07)***
R <sup>2</sup>	0.987	0.987	0.908	0.975	N/A
Durbin-Watson	1.365	1.365	N/A	1.815	N/A
F-statistic	366.85***	613.97***	N/A	4296.77***	372.21***
Standard Error	5.091	5.091	N/A	4.741	

Note: T-statistics are reported in parentheses. Those followed by \*\*\* are statistically significant at the .01 level, \*\* at the .05 and \* at the .01 level. All entries are rounded to the nearest decimal.

a: Pseudo R<sup>2</sup>

b: Heteroskedasticity-and Autocorrelation-consistent (HAC) standard errors are reported in parentheses.

One point for discussion is regression analysis with non-stationarity of time series data. It is generally agreed that the first difference form can be used to analyze non-stationarity of time series data.<sup>89</sup> I found that regression results using the first difference

<sup>89</sup> Kormendi (1983) describes that the first difference specification yields residuals quite consistent with white noise, and thus generally yields better properties of the residuals.

form are not useful because not all of the time series data used in the regression have unit roots. Because I confirmed that the time series are cointegrated between the explanatory variables and the dependent variable, it is possible to use a vector error correction model (VECM), which includes level variables and first difference variables at the same time in a regression equation. The variables in this regression model are stationary and thus the regression results are not spurious. The results using VECM are, however, not more robust in this paper than the results using DOLS because the first difference variables may not correctly reflect all the information that level variables have.

## 6. Interval Prediction and Post Sample Forecasts

Interval prediction and post sample forecasts can be used to cross check the validation of the three models. There are some differences between the methods. The variances of the forecasts and the predicted values are different. The variance of the forecasts using the regressions is higher than the variance of the predicted values. According to Stock and Watson (2003), the forecast error is the difference between the value of  $Y_t$  that actually occurred and its forecasted value based on  $Y_{t-1}$ , and the error of predicted value is the difference between the value of  $Y_t$  that actually occurred and its predicted value based on  $\hat{Y}_t$ .<sup>90</sup>

However, the forecast is made for some data beyond the data set used to estimate the regression, so the data on the actual value of the forecasted dependent values are not in the sample used to estimate the regression. In other words, forecasts and forecast errors pertain to "out-of-sample" observations, whereas predicted values and residuals pertain to "in-sample" observation.<sup>91</sup> The forecast is not the Prais-Winsten predicted values, and the forecast error is not a P-W residual. The P-W predicted values are calculated for the observations in the sample used to estimate the regression.

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<sup>90</sup> The root mean squared forecast error,  $\sqrt{E[(Y_t - \hat{Y}_{t|t-1})^2]}$  is greater than the root mean squared predicted value error,  $\sqrt{E[(Y_t - \hat{Y}_t)^2]}$ , since  $\hat{Y}_t \geq \hat{Y}_{t|t-1}$ .

<sup>91</sup> Stock and Watson (2003)



## 6.1 Interval Prediction

Prediction is an application of regression analysis. OLS regression of the future value of the dependent variable on the explanatory variables yields a consistent estimate of the linear projection coefficient.<sup>92</sup> It is used to compare the explanatory power of the three political economy models against one another over the growth of social security retirement benefit. Predicted values are estimates from the regressions over the entire data period 1946 to 2004. Since the predicted value is the average value of the dependent variable for a given set of regressors, it is useful to evaluate how well the models explain the dependent variable, other than the forecasts. Unlike point prediction, interval prediction provides the range of predicted values. In Figure 3, the predicted value and their intervals-generated regression for the median voter model with 95% confidence intervals show the median voter model's ability to explain social security benefit levels through time.<sup>93</sup>

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<sup>92</sup> Hamilton (1994), p.76.

<sup>93</sup> Stock and Watson (2003) note that a 95% prediction interval is an interval that contains the future value of the series in 95% of repeated applications.

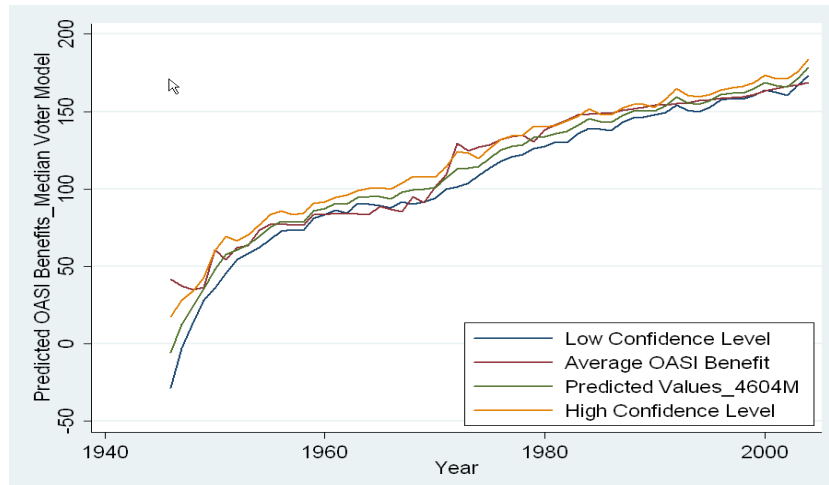


Figure 3 Predicted Values and Intervals for Average Monthly OASI Benefits by Median Voter Model

As illustrated in Figure 3, the green line displays predicted values of average monthly OASI benefits by median voter model; the red line represents the actual average monthly OASI benefits; the orange line shows high confidence level; and the blue line displays low confidence level. The actual benefit line deviates slightly from the confidence intervals during some years in 1960s and in early 1970s, and in 2004.<sup>94</sup> However, on the whole, it seems to fluctuate within the intervals.

<sup>94</sup> Low confidence interval is obtained by calculating predicted values less the product of the value of t-distribution taking account of the degree of freedom and the standard error. Similarly, high confidence interval is obtained by calculating predicted values plus the product of the value of t-distribution and the standard error.

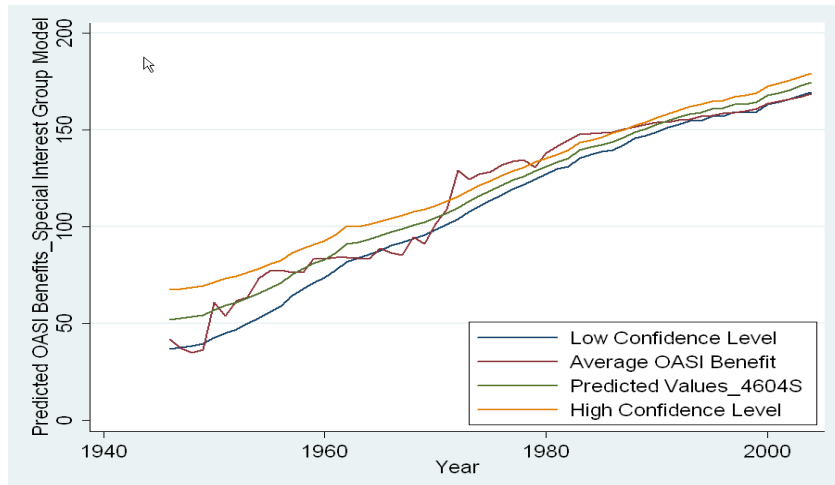


Figure 4 Predicted Values and Intervals for Average Monthly OASI Benefits by Special Interest Group Model

The predicted average monthly OASI benefit by special interest group model is also shown in Figure 4. The actual benefit line frequently deviates, although not far, from the confidence intervals from the mid-1960s to the mid-1980s, and is slightly off in the early 1990s. This implies that the predicted benefits by special interest group seem less explanatory than those by median voter model.

The interval prediction by the combined model is shown in Figure 5. The actual social security benefit line is, on the whole, within the intervals, except for slightly off from the low confidence level in the mid 1960s and one time off from the high confidence level in the early 1970s.

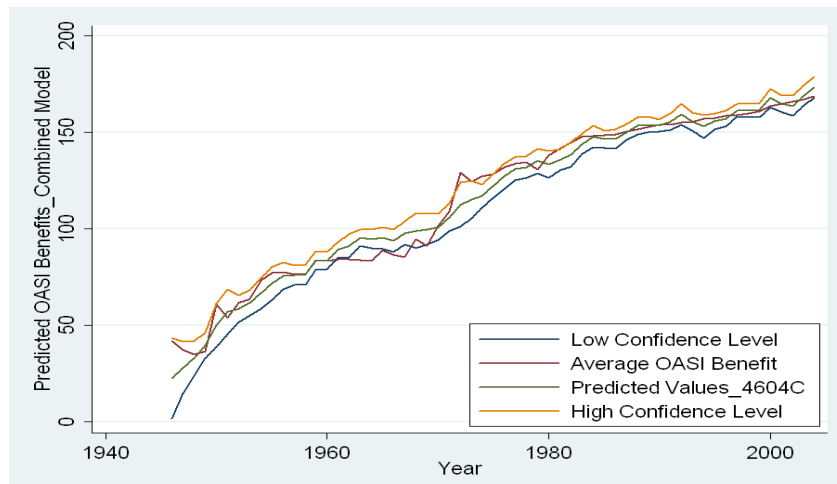


Figure 5 Predicted Values and Intervals for Average Monthly OASI Benefits by the Combined Model

In sum, the prediction line generated by the combined voter model is not much different from the prediction line generated by the median voter model. However, the frequency with which the actual social security benefit line is off from the intervals in the combined model is less than the frequency in the median voter model, which is also much less than in the special interest group model. Thus, the predicted average monthly OASI benefit used by the combined model appears to track the actual benefit levels at 95% credence level for the period from 1946 to 2004.<sup>95</sup>

## 6.2 Post Sample Forecasts

Forecasting is also an application of regression analysis. It infers that the dynamic causal effect on social security retirement benefits of a change in median voter's circumstances and/or special interest group's political influence over time. It is useful to compare the

<sup>95</sup> This result is not different from the comparison done for the average monthly Medicare plus OASI benefit. For more details, please see FigureA1 through Figure A3 in the Appendix.

forecasted values by different models used in the regression. Also, it can provide an inference of which model has better explanatory power of changes in social security benefit level over time. Using the estimates of replication for the period 1946 to 1982,<sup>96</sup> I report forecasts for average monthly OASI benefits for the period 1983 to 2004 in Figure 6. The three models can track the actual benefit levels relatively well over the 1980s; however, the forecasts for the later periods present more upward trends. Currently, the models predict higher benefit levels than actually paid out.

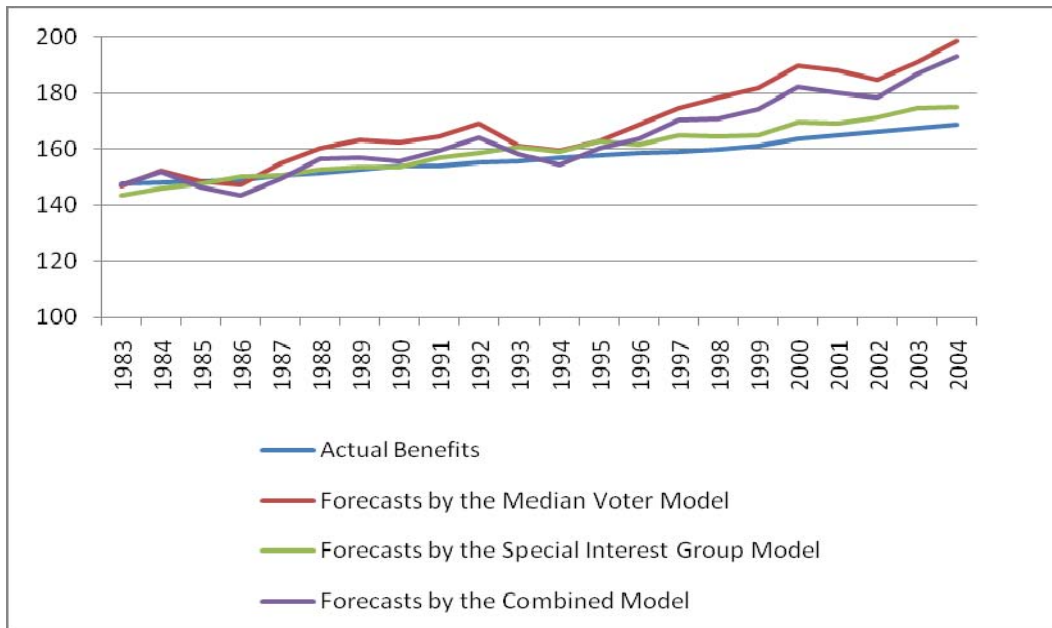


Figure 6 Forecasts for Average Monthly OASI Benefits

<sup>96</sup> It is possible to get the forecasts using the original estimates in Congleton and Shughart (1990). The forecasts, however, are not as good as those using the replicated estimates because the data set is not consistent. The data set for the original estimates are only available up to 1982, and thus different data set of the independent variables for later periods can be used only in a fragmented way.

It is somewhat difficult to visually discern which model tracks out the actual benefit level during the period 1983 to 2004. One characteristic easily distinguished is that the forecasts by the median model after the middle 1990s are relatively off the trend of the observed OASI benefit level.<sup>97</sup> However, it is overly excessive and unreliable to use the estimates for forecasting relatively long periods. Accordingly, if the estimates using more recent years' data set are used to forecast, then they have much more precise forecasts. It is also possible that the program was changed in an important way in the years after 1982. (The Greenspan reforms are analyzed in Chapter 7).

Reliable forecasts for average monthly OASI benefits can be done for the period from 2005 to 2006 by the DOLS regression estimates for the period from 1946 to 2004.<sup>98</sup> Table 17 presents the forecasts of average monthly OASI benefits by using the median voter model, special interest group model, and the combined model, respectively.

Table 17. Forecasts of Average Monthly OASI Benefits

Year	Actual Benefit	Median Voter Model	Special Interest Group Model	Combined Model
2005	171.28	171.12 (-0.09)***	172.46 (0.69)***	173.86 (1.51)**
2006	172.47	175.26 (1.62)**	177.65 (3.00)**	185.29 (7.50)*

Note: Forecast Errors (%) are reported in parentheses. Those followed by \*\*\* are statistically significant at the .001 level, \*\* at the .01 and \* at the .05 level.

<sup>97</sup> The forecasts by the median voter model for the early period are closer to the observed OASI benefit levels than those both by the special interest group model and the combined model.

<sup>98</sup> The forecasted values by the estimates over recent period are more likely to be closer to the actual benefit levels.

There are no large differences between the forecasted values and the observed social security values. The forecasted values are within a five percent error of actual benefits, except for the 2006 value using the combined model. However, the forecasted values using the median voter model are much closer to the observed social security benefits. Therefore, it seems obvious that the forecast using the median voter model works better than the other two models do.

## **7. Legislation Effects on the Growth of Social Security**

### **7.1 Fiscal Sustainability**

The social security benefit level has increased in spite of the fact that the relative size of the working generation has decreased. The demand for higher benefit levels of social security has brought about amendments that have increased the tax rate several times since the beginning of the program. Major features of the Amendments to Social Security Act that occurred in the 1970s created overly generous benefits, which undermined the Trust Funds. A new benefit formula provided a large benefit increase while other changes increased annual program costs. These changes brought about concerns for the sustainability of the social security program. There have been seventeen Social Security Amendments in the United States. Table 18 shows the tax rate changes for OASDI.



Table 18. U.S. Social Security Tax Rate and Average Monthly Benefit Changes (1936 – 2006)

Year	Tax rate (OASDI)		Average monthly real retirement benefits
	Employee+Employer <sup>a</sup>	Self-employed	
1937 - 1949	2.0	-	44.48
1950	3.0	-	63.34
1951 - 1953	3.0	2.25	63.57
1954 - 1956	4.0	3.0	81.77
1960 - 1961	6.0	4.5	88.89
1962	6.25	4.7	92.48
1963 - 1965	7.25	5.4	94.15
1970	8.4	6.3	112.14
1975	9.9	7.0	128.41
1980	10.16	7.05	138.17
1985	11.4	11.4	148.67
1990-2006	12.4 <sup>b</sup>	12.4	154.06

a :Sum of tax rate borne by employee and employer

b:5.3% for the OASI and 0.9% for the DI

Source: Social Security Online (<http://www.ssa.gov>).

The U.S. Social Security tax rate was 1% for each person in 1937, but has increased to 6.2% over the past 60 years. The tax rate for the self-employed was lower than that borne by employee and employer for most of the period, beginning with 2.25% in 1951. However, it has steadily increased and is now the same as that for the sum of employee and employer, 12.4%.<sup>99</sup> Comparing percent increase in the Social Security tax rate to the percent increase in benefit levels shows that taxes have grown faster than average benefit between 1937 and 1962, although not in every sub period. The tax rate increased about 371% while the benefit increased about 240%.<sup>100</sup> From 1962 to 1982, benefits grew faster than taxes; the percent increase in the tax rate was 163% while the

<sup>99</sup> If a tax rate of 1.45% for Medicare's Hospital Insurance (HI) program is included, then the total tax rate is 14.3% each.

<sup>100</sup> The percent increase in the tax rate and the percent increase in the benefit are calculated using Table 18,

percent increase in the benefit was 396%. The difference between the increase in the tax rate and the increase in the benefit was smaller after the 1983 Amendments; the former was 122% while the latter was 192%.

The 1983 Amendments brought comprehensive changes in the U.S. social security program. In the early 1980s, the balance level of Trust Funds (or the social security surplus) had fallen, and the social security program was thought to be in imminent danger of shortage of funds. In other words, the Trust Funds were almost depleted. The Amendments were adopted to correct short term financial problems. They were the last major reforms of social security.

The National Commission on Social Security Reform, the so called “Greenspan Commission,” was organized by President Reagan and the Congress in 1981. It was to make legislative recommendations for “saving” the U.S. social security program. In 1983, amendments, based largely on the Greenspan Commission report, were adopted to improve the short term financing problem in the social security program.

## **7.2 Voting for Social Security Amendments**

Interestingly, the congressional voting rate for the Greenspan proposals of 1983 was quite low, compared to that of other amendments. Part of the reason seems attributable to the political influence of special interest groups. The forecasts in the previous chapter may imply that since the 1980s, the dynamic effect of special interest groups on the growth of social security has been significant because the relative explanatory power of the median

voter model became weaker.<sup>101</sup> Voting rates, nonetheless, may have been affected if not the outcome.

Figure 7 illustrates the congressional voting rate<sup>102</sup> for the amendments of the social security program in the U.S. Since the Social Security Act in 1935 was effected, it has been amended seventeen times. In most of the amendments the congressional voting rates of assent were over 80% and the amendments had super majority support. The voting rate for the 1977 Amendments was only 26.8%. Many members of Congress did not vote.<sup>103</sup> About 50% abstained rather than cast a yes or no vote. The voting rate for the 1983 Amendments, 56%, was the second lowest.<sup>104</sup>

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<sup>101</sup> Table 20 presenting the estimation results for the period 1983 to 2004 in this chapter shows that the estimates of both the inside and outside special interest group explanatory variables are statistically significant whereas only the estimate of the outside interest group variable was statistically significant in Table 4 demonstrating the estimation results for the period 1946 to 1982.

<sup>102</sup> It is based on the vote tallies in the House. The Democrat member votes for the amendments were always larger than those of the Republican member, except for the 1996 Welfare Amendment.

<sup>103</sup> It was the House voting rate, and the Senate voting rate was 54.9%.

<sup>104</sup> The Senate voting rate was 58%. Interestingly, in most amendments, voting rates of “Yes” in the House were higher than those in the Senate.

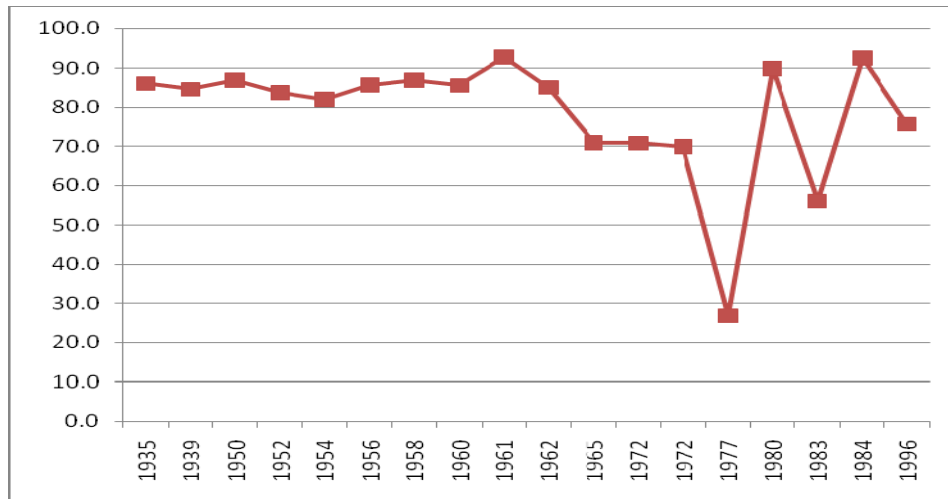


Figure 7 Congressional Voting Rate for the Amendments of Social Security in the U.S.

Source: Data are from Social Security Online (<http://www.ssa.gov/history/law.html>)

It is possible to conjecture that those members of Congress who feared special interest groups felt conflicted regarding voting. The social security program is one of the federal public policies that finances from the diffused cost and provides the concentrated benefit. Thus, it seems rational that members of Congress are less likely to vote for amendments that reduce the benefit for those who have a strong demand for it. The Greenspan amendments were designed to limit various social security benefits.

### 7.3 Major Changes in the 1983 Amendments

In this section, I investigate the effect of the 1983 Amendments on the social security retirement benefits. Many authors claim that these amendments were the most comprehensive changes in recent U.S. social security history (Martin and Weaver, 2005). The most remarkable of the changes is the raising of the eligible age for receiving unreduced retirement benefits, from the current age level of 65 years to 67 years, to be

accomplished in two stages by the year 2027: a phased-in increase in the full retirement age beginning in 2000. Benefits are still available at age 62 or at any other age, but will be reduced. Another significant change is to extend coverage to newly-hired federal workers, which increases social security tax revenue although it also increases future expenditures. The third remarkable change is that the tax rate on self-employment income is increased to the level equal to the combined employee-employer rate. Such changes were intended to improve the balance of Social Security Trust Funds, although some benefits such as for widows, widowers, and divorced, were expanded or/and increased.

Considering all the changes in the 1983 Amendments, the tax revenue brought by both the increase in tax rates and the increase in normal retirement age excelling the sum of expenditure brought by both the expansion in beneficiaries and the increase in non-retirement benefits resulted in improving the balance. Table 19 provides a more detailed overview of the Social Security Amendments of 1983.

**Table 19 Summary of Social Security Amendments of 1983**

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- Makes comprehensive changes in Social Security coverage, financing, and benefit structure. Following are major provisions of the legislation which incorporate the recommendations of the National Commission on Social Security Reform:
- Covers under Social Security the following groups: (1) Federal employees hired on or after January 1, 1984; (2) current employees of the legislative branch not participating in the Civil Service Retirement System on December 31, 1983; and (3) all Members of Congress, the President and the Vice-President, Federal judges, and other executive-level political appointees of the Federal Government, effective January 1, 1984. (See P.L. 98-118 and P.L. 98-369 for a modification of this provision. Also see P.L. 98-168 for a related provision.)
- Covers under Social Security on a mandatory basis all employees of tax-exempt nonprofit organizations as of January 1, 1984. (See P.L. 98-364 for modification of this provision.)
- Prohibits States from terminating Social Security coverage for State and local employees.

- Continues eligibility for Social Security benefits for disabled widow(er)s, disabled surviving divorced spouses, and surviving divorced spouses who remarry after entitlement.
- Increases benefits for disabled widows or widowers who become eligible for benefits before age 60.
- Permits a divorced spouse age 62 or over who has been divorced for at least 2 years to draw spouse's benefits whether or not the former spouse who is eligible for retirement benefits has retired or applied for benefits.
- Provides a different method for computing widows and widowers benefits that will increase benefits for many people whose spouses died before reaching age 62.
- Eliminates virtually all remaining gender-based distinctions.
- Requires the Secretary of HHS, in consultation with the Senate Finance Committee and the House Ways and Means Committee to report on the effects of earnings sharing plans and make recommendations concerning the time periods for implementing earnings sharing proposals.
- Delayed the June 1983 cost-of-living adjustment until December 1983 (January 3, 1984 checks) and provides for future adjustments payable in January rather than July of each year.
- Eliminates windfall Social Security benefits for workers who are first eligible after 1985 for both a pension from non-covered employment and Social Security retirement or disability benefits.
- Provides for cost-of-living increases based on prices or wages--whichever is less--if the trust funds fall below a specified level.
- Advances scheduled increases in Social Security tax rates. Social Security tax rates (which include the Hospital Insurance tax rates) for employers and employees will increase to 7.0 percent in 1984, {1} 7.05 percent in 1985, 7.15 percent in 1986-87, 7.51 percent in 1988-89 and 7.65 percent in 1990 and thereafter.
- Increases tax rates on self-employment income equal to the combined employee-employer rates and provides credits against tax liability to offset part of the increase.
- Accelerates to twice monthly the frequency with which States are required to deposit withheld Social Security contributions.
- Reauthorizes interfund borrowing among the three Social Security trust funds for calendar years 1983 through 1987 with repayment by the end of 1989.
- Provides for crediting the OASDI and HI trust funds at the beginning of each month with revenues to be received during the month and for special reports by the Boards of Trustees in the event the trust fund assets fall below 20 percent of annual expenditures.
- Requires operations of the four Social Security trust funds to be shown as a separate function within the Federal budget for FY 1985-1992 and removes operation of the OASDI and HI trust funds from the unified budget beginning in FY 1993.
- Required the Chairmen of the House Ways and Means Committee and the Senate Finance Committee to appoint a panel to conduct a study concerning the establishment of the Social Security Administration as an independent agency.

- Transfers to the Social Security trust funds from the general fund lump sum payments for: (1) the value of the additional Social Security benefits arising from pre-1957 gratuitous military service wage credits; (2) the amount equivalent to the combined employer-employee Social Security taxes on the gratuitous military service wage credits for the period from 1957-83; (reimburses the trust funds on an annual basis for employer-employee taxes on such wage credits for service after 1983); and (3) the amount of past and future OASDI benefit checks (including interest) that are not presented for payment within 6 months.
- Beginning in 1984, includes up to one-half of Social Security benefits as taxable income for taxpayers whose adjusted gross income, combined with half their benefits and any tax-exempt interest they may have exceeds \$25,000 for a single taxpayer and \$32,000 for married taxpayers filing jointly. Benefits received by married taxpayers filing separately are taxable without regard to other income. Appropriates amounts equal to estimated tax liability to the Social Security trust funds.
- Changes the earnings test for beneficiaries age 65 and over so that \$1 in benefits will be withheld for each \$3 of earnings above the annual exempt amount, beginning in 1990.
- Increases the delayed retirement credit in gradual steps from 3 percent for workers reaching full benefit retirement age (age 65) before 1990, to 8 percent for workers reaching full benefit retirement age after 2008.
- Raises the age of eligibility for unreduced retirement benefits in two stages to 67 by the year 2027. Workers born in 1938 will be the first group affected by the gradual increase. Benefits will still be available at age 62, but with greater reduction.
- Requires the Secretary of HHS to conduct a comprehensive study and analysis of the implications of the changes in retirement age for those individuals affected by the provision for increasing full retirement age who, because they are engaging in physically demanding employment or because they are unable to extend their working careers for health reasons, may not find their work lifetimes are increased as a result of general improvements in longevity.
- Suspends auxiliary or survivors benefits to aliens outside the U.S. for more than 6 consecutive calendar months unless the beneficiary had resided in the U.S. for at least 5 years and, during that period, the relationship of the beneficiary to the worker which is the basis for payment was in existence.
- Extends the current limitation on payment of disability insurance benefits to convicted felons while in prison to include old-age and survivors insurance benefits.
- Requires the establishment of a system under which the States can voluntarily contract with HHS to supply information derived from official death certificates to facilitate comparison with benefit program records in order to prevent payments from being made to deceased persons.
- Requires the issuance of all new and replacement Social Security cards issued after October 30, 1983, on banknote paper.
- The law made other changes in Social Security, Medicare and Supplemental Security Income. For instance, it provided for an increase in SSI benefit rates beginning with July 1983 by \$20 for an

individual and \$30 for a couple. Future automatic SSI cost-of-living increases will be made in January.

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Source: Social Security Online (<http://www.ssa.gov/history/1983amend.html>)

## **7.4 Empirical Analysis of Greenspan Effects on Budget Growth**

The 1983 Social Security Amendments, largely based on the report by the Greenspan Commission, made many significant changes in social security law: social security benefits structure, financing, and coverage. Martin and Weaver (2005) noted that the resulting reform by the 1983 Amendments brought into being large surpluses that helped to generate a large trust fund for the first time. Government debt instruments are accumulated to be used to pay part of future benefits. These reforms made the U.S. social security program a partially funded program.

If cash revenues of the social security program are not enough to pay out the promised benefits, the Trust Funds will exchange its government securities for government revenues from their securities. The Treasury may redeem cash from the social security trust fund bond, or from additional government borrowing from the public.<sup>105</sup> Selling new bonds to the public increases the federal budget and the public debt (Bovbjerg 2005).<sup>106</sup>

It is, thus, of interest to see if the Greenspan Commission had a significant effect on benefits as well as on revenues.

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<sup>105</sup> According to Bovbjerg (2005), the other ways the federal government has to finance cash are decreased spending in the rest of the federal budget, increased revenues, and some combination thereof.

<sup>106</sup> See (Bovbjerg 2005), p.49.



The Greenspan effect ( $G$ ) is represented as a binary variable in the three public choice models. The empirical equation for the median voter model is now:

$$(25) \quad S_t = \beta_0 + \beta_1 G + \beta_2 Y_t + \beta_3 A_t + \beta_4 R_2 + \beta_5 D_2 + \beta_6 r_t + \beta_7 g_t + \beta_8 B_t + u_{1t}$$

The empirical equations using the special interest group model can be rewritten as:

$$(26) \quad S_t = \alpha_0 + \alpha_1 G + \alpha_2 A_t + \alpha_3 N_{1t} + \alpha_4 sE_t + u_{2t}$$

Lastly, the empirical equations using the combined model can be rewritten as:

$$(27) \quad S_t = \delta_0 + \delta_1 G + \delta_2 Y_t + \delta_3 A_t + \delta_4 R_2 + \delta_5 D_2 + \delta_6 r_t + \delta_7 g_t + \delta_8 B_t + \delta_9 N_{1t} + \delta_{10} sE_t + u_{3t}$$

The following Table 20 shows regression results by inserting the Greenspan effect<sup>107</sup> as a binary variable into the three models.

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<sup>107</sup> It comes from the report of the 1983 Greenspan Commission on Social Security Reform.

Table 20. Legislation Effect of the 1983 Amendments on Social Security Retirement Benefits (OASI) in U.S. (1967 Dollars)

Period	Median Voter Model		Interest Group Model		Combined Model	
	1946-2004 OLS(G)	1946-2004 P-W (G)	1946-2004 OLS(G)	1946-2004 P-W (G)	1946-2004 OLS(G)	1946-2004 P-W (G)
Intercept	-75.927 (-2.52)**	3.556 (0.11)	57.782 (7.99)***	47.557 (6.43)***	- 63.081 (-2.28)**	-31.796 (-0.97)
Real Median Earnings	0. 012 (1.78)*	0. 002 (0.31)			0. 020 (2.97)**	0. 015 (1.89)*
Average Real Private Pension	-0.002 (-0.32)	0.002 (0.60)	-0. 012 (-2.03)**	-0. 002 (-0.72)	-0. 0002 (-0.03)	0. 0001 (0.04)
Remaining Work Life of Median Voter	-6.317 (-2.39)**	-4.668 (-1.85)*			-9. 484 (-3.57)**	-7.395 (-2.80)***
Median Life Expectancy	9.559 (3.61)***	6.281 (2.67)***			11.228 (4.32)**	8.333 (3.45)***
Real Interest Rate	0.653 (0.99)	0. 310 (0.46)			0. 159 (0.26)	0. 522 (0. 91)
Long Term Growth Rate	0. 126 (0.50)	0. 261 (0.96)			0. 102 (0.44)	0. 199 (0. 71)
Effective Tax Base per Beneficiary Time	0. 00001 (0.38)	-0.00017 (-2.51)**			-.00001 (-0.28)	-7.31e-06 (-0.27)
	0. 517 (0.84)	1.043 (2.11)**			-3.246 (-2.75)**	-2.844 (-3.12)***
Greenspan Effect	-10.525 (-2.49)**	-6.939 (-2.27)**	-8.387 (-1.93)*	-4.955 (-0.93)	-6.439 (-1.60)	-6.804 (-2.28)**
Number of Retired Workers			4.64e-06 (10.81)***	4.54e-06 (11.68)***	5.36e-06 (3.67)***	5.95e-06 (4.14)***
Net Administrative Expenses			0. 005 (0.87)	0. 0006 (0. 23)	0. 007 (0.93)	0. 004 (0.9 9)
R <sup>2</sup>	0.980	0. 954	0. 970	0. 858	0. 985	0. 958
Durbin Watson	1.18	1.77	0. 64***	1.97***	1.12	1.91***
F-statistic	270.2***	2032.5***	442.8***	1939.6***	274.2***	2482.5***
Standard Error	6.231	5.029	7.265	5.015	5.607	4.836

Note: T-statistics are reported in parentheses. Those followed by \*\*\* are statistically significant at the .01 \*\* at the .05 and \* at the .1 level. All entries are rounded to the nearest decimal.  
(G) indicates the regression with Greenspan effect.

The Greenspan Commission's effect on average social security retirement benefits is negative and significant in the median voter model, the special interest group model, and the combined model. More precisely, the coefficient for the Greenspan effect is negative and statistically significant at 95 percent confidence level except for the OLS estimate of the combined model. For the special interest group model, the coefficient for

the Greenspan effect is negative and statistically significant at 10 percent level in the result of OLS, but not in the Prais-Winsten regression result. The coefficient of Greenspan effect in the combined model is also negative and statistically significant at 95% percent level in the Prais-Winsten regression result, but not in the OLS result. When adding the Greenspan effect into the models, the coefficients for other variables in the three models remain similar. The signs remain the same and the absolute values are not much changed.

These estimates imply that the 1983 Amendments, reflecting legislative recommendations by the Greenspan Commission, reduced social security benefit levels at the same time that it increased the revenues. My interpretation of the Greenspan reforms was that it influenced further adjustments to benefit levels.

### **7.5 Investigating Possible Changes in Coefficients Induced by the Greenspan Reforms**

As shown in Table 19, the 1983 Social Security Amendments affected the growth of the social security retirement benefit level. It is meaningful to compare the regression results for the period from 1946 to 1982 and the ones for the period from 1983 to 2006. The comparison provides an implication on how much the political influence of the special interest groups has changed since the 1983 Amendments. Table 20 provides estimates for the period 1983 to 2006 in the three models.

Table 21. Average Monthly OASI Benefits After the 1983 Amendments (1967 Dollars)

	Median Voter Model		Interest Group Model		Combined Model	
Period	1983-2006 OLS	1983-2006 Robust S.E.	1983-2006 OLS	1983-2006 Robust S.E.	1983- 2006 OLS	1983-2006 Robust S.E.
Intercept	113.708 (27.13)***	113.708 (41.36)***	79.221 (17.14)***	79.221 (24.09)***	113.309 (14.39)**	113.309 (20.78)**
Real Median Earnings	-0.008 (-3.35)***	-0.008 (-3.63)***			-0.007 (-2.74)**	-0.007 (-3.59)**
Average Real Private Pension	-0.0005 (-0.74)	-0.0005 (-1.35)	-0.001 (-0.87)	-0.001 (-0.99)	-0.0002 (-0.23)	-0.0002 (-0.36)
Remaining Work Life of Median Voter	-1.028 (-5.48)***	-1.028 (-4.67)***			-0.922 (-4.22)**	-0.922 (-4.27)**
Median Life Expectancy	0.913 (5.74)***	0.913 (5.32)***			0.802 (3.83)**	0.802 (4.57)**
Real Interest Rate	-0.033 (-0.21)	-0.033 (-0.26)			-0.013 (-0.08)	-0.013 (-0.09)
Long Term Growth Rate	-0.840 (-4.28)***	-0.840 (-5.44)***			-0.890 (-3.72)***	-0.890 (-6.26)***
Effective Tax Base per Beneficiary	0.001 (3.57)***	0.001 (3.74)***			0.0008 (2.60)**	0.0008 (3.90)**
Time	0.867 (14.84)***	0.867 (12.76)***			0.976 (2.91)**	0.976 (2.44)**
Number of Retired Workers			2.80e-06 (32.33)***	2.80e-06 (46.63)***	-2.09e-07 (-0.24)	-2.09e-07 (-0.22)
Net Administrative Expenses			0.016 (3.31)***	0.016 (5.56)***	0.003 (1.00)	0.003 (0.92)
R <sup>2</sup>	0.998	0.998	0.983	0.983	0.997	0.997
Durbin Watson	1.59	1.59	1.29	1.29	1.91	1.91
F-statistic	790.8***	2534.8***	404.5***	725.7***	602.7***	3631.8***
Standard Error	0.449	0.449	1.019	1.019	0.460	0.460

Note: T-statistics are reported in parentheses. Those followed by \*\*\* are statistically significant at the .01 level, \*\* at the .05 and \* at the .1 level. All entries are rounded to the nearest decimal.

Interestingly, the sign of the coefficient of real median earnings became negative although it is a very small value. One possible conjecture is that social security retirement benefit is no longer considered a normal good to a median voter. In recent years, many employees have their own retirement savings plans, such as 401(K), a type of employer-sponsored defined contribution retirement plan. If, along with Individual Retirement Arrangement (IRA) and/or 401(k), the median voter has assets enough to be used for

her/his retirement life, then she/he would not be as interested in the social security retirement benefits. Another possibility may be because the median net benefit from social security fell due to the higher tax.<sup>108</sup> During the first 40 years of the program, the benefits expanded rapidly as shown in Figure 2. The average monthly real benefit increase for that period was about 3.46 times, which was more than 80% of the total increase. Since then it has been very difficult to increase and/or expand benefits without increasing tax rates. Serious financial concern about the Trust Funds may be another factor that. Even though the median voter has been paying social security tax, expecting that she/he will receive benefits when she/he retires in the future, concern about the sustainability of the program due to imbalance problems might have caused the median voter to resist a higher benefit level.<sup>109</sup>

Another interesting change in the estimates is that the coefficient of effective tax base per beneficiary got much larger.<sup>110</sup> As shown in Figure 2, the effective tax base dropped dramatically for the period from the beginning to the middle of 1950s. Then, it steadily decreased until the 1983 Amendments. Since then, it has been increasing at a steady rate. In those times, the relative size of the working generation who pays social security tax became smaller. In 1950, about one in fifty people in the U.S. received social security benefits; however, this has changed to one in about six people in recent years.

The final interesting changes in the estimates are that the effect of the number of retired workers weakened and that during the same period the coefficient of net

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<sup>108</sup> This might have made the median voter's discount rate high for future social security benefits.

<sup>109</sup> Schieber and Shoven (1999) insisted that the surpluses are not likely to be fully saved.

<sup>110</sup> Even the negative sign of "Effective Tax Base per Beneficiary" from OLS in Table 3 became positive.

administrative expenses becomes statistically significant at a conventional level in the special interest group model.,. The former change implies that more beneficiaries bring about more concern over financial burden, which may lead to not favoring an increase of benefit level. On the other hand, the implication of the latter change is that a variety of activities of the Social Security Administration may provide stronger effectiveness on the benefit levels. By providing strategically biased information and advice, the Administration may affect legislators as well as voters.

Based on the estimation above, it seems obvious that the legislative effects on the social security occurred. Adjusting benefits and taxes, the Greenspan Commission solved the short term financial problems by making large surpluses. To confirm the trend of the OASDI Trust Fund,<sup>111</sup> Figure 8 provides OASDI Trust Fund ratios of assets to expenditures for the period from 1940 to 2009. As similarly shown in the case of effective tax base per recipient, the ratio strikingly dropped for the first 30 years of the program.<sup>112</sup> Then, it started to improve after the 1983 Amendments.

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<sup>111</sup> The OASDI Trust Fund is the sum of Trust Fund for OASI and Trust Fund for DI.

<sup>112</sup> According to Martin and Weaver (2005), the decline in the 1940s is due mainly to the natural result of the start-up phase of the new system, when the number beneficiaries increased rapidly.

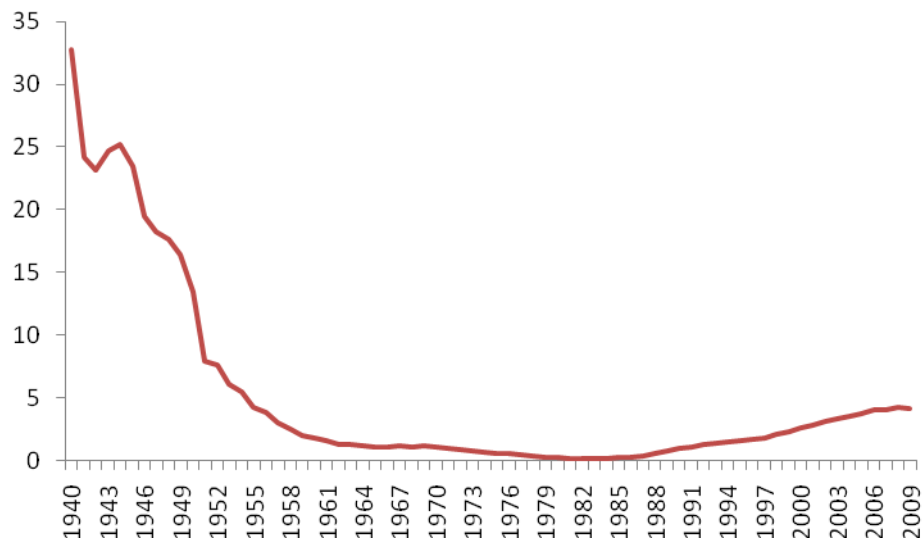


Figure 8 OASDI Trust Fund Ratios of Assets to Current Expenditures from 1940 to 2009  
Source: Data are from the Annual Statistical Supplement to the Social Security Bulletin (SSA 2009, Table 4.A1).

As shown in Figure 8, the ratio in early period of social security indicates that social security asset was 30 times higher than social security expenditures. The asset in 1940 was 2,031 million dollars, while the expenditure was 62 million dollars. The OASI Trust Fund was very robust. The ratio became worse as the social security program was expanded and the number of beneficiaries increased. Through the 1954 Amendments, disabled workers aged 50-64 and disabled adult children became eligible to get benefits. In 1971, the ratio fell below one, and then steadily decreased to 0.129. The adoption of the 1972 Amendments saw the introduction of the Supplemental Security Income (SSI) program for “adult categories” that include aged widows and widowers, a minimum retirement benefit, and more benefits for early retirement at age 62 for men and women. In the same year, automatic Cost-of-Living-Adjustments (COLAs) that adjust social

security benefits by taking into account the annual increase in consumer price index were introduced, and therefore it deteriorated the financial shortage problem of the Social Security Trust Funds. This trend continued until the 1983 Amendments became effective. Since then, the ratio has increased to 4.268 in 2008.<sup>113</sup> As a result, it can be demonstrated that the Greenspan effect greatly improved the balance of the Trust Funds.

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<sup>113</sup> However, the ratio was dropped again in 2009, due to a period of economic recession.



## **8. Summary and Concluding Remarks**

### **8.1 Overview of Contributions**

In this work I explored public choice models with regards to how economics and politics determine the social security growth. Estimates based on the models explain well the observed social security benefit levels. This dissertation makes several contributions to the literature on the political economy of social security: replication of Congleton and Shughart (1990) enhanced by new data sets, new estimates using broader data set and more sophisticated techniques, and analysis of the effects of Greenspan legislation on social security. The latter suggests that useful reforms are possible. I address each contribution, and then discuss policy implications about issues of the social security program in the next section.

The first contribution is that I refined the public choice models of social security demand used in the Congleton and Shughart (1990) and built new data sets applicable to these models. Some typographical errors in the original models were corrected and relevant equations were clarified. Regarding social security benefit levels, the respective incentives of the median voter, special interest groups and a politician were illustrated in the combined model with an incentive for legislators. Also, I collected data to build a new data set to cover the most recent years, significantly expanding the data set to nearly

twice that found in the previous study. Accordingly, replication and new empirical study were prepared.

The second contribution and the main one is that I assembled a new data set and subjected the Congleton and Shughart models to several more refined estimation techniques. While both the median voter and special interest group model explain the growth of the retirement benefit levels for the period from 1946 to 2004, the models have very different hypotheses concerning the relationship between benefit levels and economic and political variables. Such differences enabled me to estimate the relative importance of the various political forces tending to increase social security retirement benefit levels. The statistical results indicate that the median voter model closely tracks the variation in social security retirement benefit levels for the period from 1946 to 2004 at least as much as the special interest group model does. Unlike the results for the period from 1946 to 1982 in Congleton and Shugart (1990), the estimates of the combined model, however, imply that the median voter does not dominate the special interest group model's representation of the politics of benefit levels in all specifications for the entire period. The likelihood-ratio test does allow rejection of the hypothesis  $W_S = 0$ .<sup>114</sup> Overall, the results provide evidence that continuous increase in average real retirement benefits in the U.S. are attributable both to changes in the median voter's circumstances and the special interest groups' political influence.

This result can also be explained in Figure 1. Based on the regression results for the period from 1946 to 1982, the actual social security benefit levels swung between the

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<sup>114</sup> Likelihood-ratio test result for it shows LR  $\chi^2(2) = 17.18$ , Prob >  $\chi^2 = 0.0002$ .

median voter's preferred benefit level ( $S_M$ ) and the half point of and the maximum benefit level that special interest groups pursue ( $S_I$ ). That is, the median voter's interest was, to a large extent, reflected in the determination of the benefit levels. Somewhat differently, for the period from 1983 to 2004, special interest groups' rent-seeking activities evidently were relatively more active. It became clear that actual benefit levels moved away from  $S_E$  to right side, closer to  $S_I$ . It is more interesting to estimate how far its position moved in Figure 1. The distance deviated from  $S_E$  may represent the size of special interest groups' rent-seeking effect on the social security benefit levels. The Greenspan legislation may also have reduced the ability of Congress to revise the program.

A third contribution is that I conducted post-sample forecasts using new estimation results, which provide a useful implication to social security reform, sustainability of the Trust Funds. To help make a proposal for social security reform that solves the insolvency of the Social Security Trust Funds, the public choice models used in this study provide very useful tools and techniques. The reliable results show that forecasted benefits are very close to the actual benefits. Since the Trust Fund for OASI benefits uses more than 85% of the Social Security Trust Funds, forecasting the Trust Fund for OASI benefits roughly explains the projection for Social Security Trust Funds. Thus, the estimated models enable us to forecast how the balance of the Social Security Trust Funds varies in the future, which is a key issue of future reforms of social security programs. In 2008, the Congressional Budget Office (CBO) predicted that the surplus

would exceed \$80 billion<sup>115</sup> in 2009 and 2010, and then rise to around \$90 billion before slowly evaporating by 2020.

Finally, I tested empirically, using the three public choice models, whether the Greenspan legislation in 1983 affected the social security retirement benefit levels. I found empirical evidence that social security retirement benefit levels were negatively affected by the Amendments based on the report of the Greenspan Commission. Since the retirement benefit takes a major part of the Trust Funds, the Greenspan legislation changed the deficit trend of the Trust Funds to the surplus trend.

## **8.2 Concluding Remarks**

The main focus of this dissertation has been in the growth of retirement benefit (OASI) levels since it is historically the longest functioning benefit program, is relatively easy to track historically, and its beneficiaries are very clearly identified statistically. Also OASI is the main part of the social security program, and therefore several implications associated with issues of the social security program are discussed: purpose of the social security program, sustainability of the Social Security Trust Funds, and future of the social security program.

Regarding the purpose of the social security program, the growth of retirement benefits has been affected by the median voter's policy preference and by political influence of special interest groups, as empirically confirmed in the previous chapters.

The social security program in the U.S. in general has the mixed purpose of a pure

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<sup>115</sup> However, the recent recession brought a high unemployment rate, which reduced the surplus. In 2009, the surplus shrank to about 16 billion dollars against the CBO anticipation. This may precipitate the depletion of the funds earlier than estimated.

retirement program and a pure redistribution program (Feldstein and Liebman 2002; Congleton and Shughart 1990; Campbell 1969). Since the future of the median voter is not perfectly foreseeable, savings through social security program helps her/him to live in her/his retirement life, insuring a certain amount of regular income. Also, since it is assumed that the median voter is altruistic, she/he would tolerate redistribution of income through social security, as long as it does not hurt her/his utility. In order to provide substantial retirement income to persons in need, the social security program's schedule of benefits and taxes was partly designed for a redistributive function. The benefit formula replaces a greater fraction of the lifetime earnings of low-income persons than of high-income persons. For example, with the salary replacement rate, low-income persons receive relatively higher benefits than high-income persons (Gruber and Wise 2004; Congleton and Shughart 1990; Stiglitz 1986). In 2005, the rates for high-income persons and low-income persons were 35 percent and 56 percent, respectively (Martin and Weaver 2005).<sup>116</sup> For the period studied, the growth of the social security program clearly helped the elderly who were living in poverty. The poverty rate among the elderly fell from 35.2 percent in 1959 to 10.2 percent in 2005.<sup>117</sup> As a result, the outside interest group for social security (social security retirement recipients), especially a cohort of relatively low-income contributors to social security, seems more interested in the role of redistribution. Legislative history regarding social security indicates that the congressional voting rates for the amendments reducing social security benefits and

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<sup>116</sup> Replacement rate for medium earners retiring at the age of 65 are about 42 percent.

<sup>117</sup> Martin and Weaver (2005), p.10.

raising taxes were quite low, compared to those of other amendments. My conjecture is that vote by members of Congress at that time posed a political burden because such amendments were not good for either the median voter or the outside special interest group. In this respect, the growth of social security has been politically affected.

President Obama's administration determined to provide the retirement beneficiaries with additional lump-sum benefits because their benefit level had shrunk due to the recent economic recession. This is a kind of politically idiosyncratic shock that the public choice models cannot anticipate. Particularly in an economic downturn, when most of the retirement beneficiaries who expect lower benefit levels due to economic recession seem to want additional money, the median voter is also less likely to object to that kind of benevolence, in the sense that she/he is altruistic and does not pay additional tax for it.

Another discussion area regards the sustainability of the Social Security Trust Funds. The U.S. social security is a compulsory public pension system that the federal government sponsored and funded through the social security tax. In 1935 when the U.S. social security program was first introduced, it was a fully funded system. However after the initial period, when there were few beneficiaries, enough funds to pay out benefits were not accumulated due to lack of political support in increasing the social security tax. The accumulation of funds lagged behind schedule, and therefore the social security program turned out to be an unfunded system on a pay-as-you-go basis (Galasso 1999). To maintain a positive balance in Trust Funds, the social security tax has been adjusted seventeen times over the past 60 years. The main motivation of the 1983 Amendments was to stabilize the Social Security Trust Funds by the Greenspan Commission. The

higher tax rates and expanding tax base provided annual fiscal surpluses for the Social Security Trust Funds until this year, 2010. Currently more than 95 percent of jobs are covered under the social security program. Most of the beneficiaries are supported by social security benefits as their main income source. As a result, it is important to keep the Social Security Trust Funds financially stable.

The final area for discussion is associated with the future of social security. Unless the median voter's preference for social security in the next generation is significantly changed, the current program is expected to be continued. However, there are some factors that must not be overlooked. One factor is productivity growth rate associated with economic development. This is significant because productive growth is related to the national average wage index which is used to calculate real benefit levels. If the current economic recession continues, then tax revenues for social security decrease and more people who are around retirement age will likely file for social security benefits. Another factor of importance is dependency ratio. As more baby boomers retire, implying that the size of the outside interest group grows larger, the dependency ratio would not be improved unless the working generation gets large enough to offset the increase in retirement beneficiaries, although holding life expectancy and fertility constant. These factors critically affect the Social Security Trust Funds that are now anticipated to be unsustainable in the future.

My analysis, nonetheless, suggests that reforms are possible, reflected by the seventeen amendments to the original social security reform. The last major reform

reduced benefits and raised taxes. Although the politics may have changed, the political economy of social security implies that changes remain possible.<sup>118</sup>

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<sup>118</sup> The approach developed in this dissertation can also be generalized. This public choice approach can be applied to analyze other public policies, such as the growth of Medicare. It is also possible to analyze the growth of public pension programs in other democratic countries where it is if relevant data set are available.



## Appendix A: Supplemental Tables and Figures

**Table A1 Differences in Data Set and Data Sources**

Data series	Data Source
Average Real OASDI Benefit Average Real OASDI plus Medicare	The Social Security Bulletin
Average Private retirement income	The Historical Statistics of the United States, Colonial times to 1970 (C&S) The Handbook of Pension Statistics (1986) (C&S) The Historical Statistics of the United States, Colonial times to 1970 (K) The Handbook of Pension Statistics (1986) (K) After 1985, the data from the Historical Tables of Private Pension Plan Bulletin, the Department of Labor. (K)
Average life expectancy of the population data from 1939-1941 data from 1949-1970 except for the years, 1953, 1961, and 1970 Additional values	The Vital Statistics of the United States (C&S) The Historical Statistics of the United States, Colonial times to 1970 (C&S) The 1986 Statistical Abstract (C&S) Linear interpolations used to fill in the gaps (C&S) The Historical Statistics of the United States, Colonial times to 1970 (C&S) U.S. National Center for Health Statistics, U.S. Life Tables and Actuarial Tables, 1979-81; Vital Statistics of the United States, annual; and unpublished data (K)
Total wages and salary	The Economic Report of the President
Median voter's income	Proxied by the median annual earnings of workers (1940-1965) available for only five-year intervals. Annual figures are calculated using linear interpolation (C&S) Proxied by median income data from the U.S. Census Bureau (K)
Voter participation rates by six age groups (1946-1962) Data from 1964 to 1982	Estimated by using data from 1964 to 1984 (C&S) Estimated by using data from 1964 to 2004 (K) ? (C&S) Reported Voting and Registration by Race, Hispanic Origin, Sex and Age Groups: November 1964 to 2004 from the U.S. Census Bureau (K)
All-item CPI	The Economic Report of the President (C&S) The Economic Report of the President (K)
Interest rate, the yield on AAA corporate bonds	The Economic Report of the President (C&S) The Economic Report of the President (K)
Age distribution of population	? (C&S) U.S. Census Bureau, Current Population Survey, November 2004 and earlier reports (K)
Growth rate of real GNP	The Economic Report of the President (C&S) The Bureau of Economic Analysis, The Department of Commerce (K)
Number of OASI Recipients	The Social Security Bulletin
Number of workers reporting taxable earnings	The Social Security Bulletin
Administrative Expense	The Social Security Bulletin
Percentage overhead	The Social Security Bulletin (C&S) The Historical Statistics of the United States, Colonial times to 1970 (K)

Note: (C&S) indicates Congleton & Shughart (1990); (K) denote Kim (2010).

Table A2 Data Characteristics by Period

Period for Actual Data	Congleton and Shughart (1990): 1946-1982	Years replicated: 1946-1982	Years extended: 1983-2005
Average Real OASI Benefit	94.255	91.854	157.521
Average Real OASI plus Medicare	112.850	113.827	212.542 <sup>a</sup>
Real Median Income	3,288.311	3,182.176	3,772.569
Average Real Private Pension	1,370.757	1260.234 <sup>b</sup>	1825.465
Remaining Work Life of Median Voter	21.372	19.000 <sup>c</sup>	18.364
Remaining Life of Median Voter	30.723	24.484 <sup>c</sup>	29.243
Real Interest Rate	1.357	1.318	4.969
Long Term Growth Rate of RGNP	2.993	2.974	2.671
Effective Tax Base per OASI Recipient	56,403.050	59,620.654	29,184.694
Number of OASI Recipients	10,233,456.0	10,219,501.6	26,146,177.2
Administrative Expense of OASDI (millions)	305.516	425.083	1,913.609

Note: OASI was replaced with OASDI (Old Age, Survivors and Disability Insurance) since disability provisions were added in 1955.

<sup>a</sup>Indicates data up to 2004 since disability provisions are added in 1955 OASDI benefit.

<sup>b</sup>After 1976, the data is from the Historical Tables of Private Pension Plan Bulletin, the Department of Labor.

<sup>c</sup>Calculated by the estimated participation rate equation using actual data for the period 1964 to 2004, instead of the period 1964 to 1984.

Table A3 Estimation of Participation Rates for Age Groups: 1946-1962

Voting Age Group	The Estimated Participation Rate Equation for Age Groups: $P_{it} = a + bP_t + ct$	$R^2$	Actual Data
18-24	$P_{1824} = -49.349 + 1.324P + 0.146t$	0.981	1964-1982
	(15.266) ** (0.119) ** (0.148)		
	$P_{1824} = -41.849 + 1.342P + 0.026t$	0.965	1964-2004
	(6.283) ** (0.067) ** (0.044)		
25-44	$P_{2544} = -10.770 + 1.120P + 0.031t$	0.995	1964-1982
	(3.647) * (0.028) ** (0.035)		
	$P_{2544} = .978 + 1.108P - 0.121t$	0.991	1964-2004
	(2.825) (0.030) ** (0.020) **		
45-64	$P_{4564} = 13.453 + 0.787P + 0.11t$	0.994	1964-1982
	(2.956) ** (0.023) ** (0.029) **		
	$P_{4564} = 23.032 + 0.792P - 0.019t$	0.981	1964-2004
	(2.815) ** (0.030) ** (0.020)		
Over 65	$P_{65+} = -13.577 + 0.705P + 0.464t$	0.974	1964-1982
	(5.201) ** (0.041) ** (0.050) *		
	$P_{65+} = 1.744 + 0.609P + 0.334t$	0.965	1964-2004
	(4.339) (0.046) ** (0.031) **		

Note: \* significant at the 0.05 level; \*\* significant at the 0.01 level.

※ The first equation in each age group is estimated for the period from 1946 to 2004, while the second equation for the period from 1946 to 1982.

In the original paper, voting age groups are six while in Kim's paper they are four.

Table A4 Average Monthly OASI Benefits 1946 to 1982: (1967 Dollars)

Model	(M)	(S)	(C)
Estimation	OLS	OLS	OLS
Intercept	-238.781	80.906	188.669
Real Median Earnings	0.082 (7.56)***		0.074 (6.69)***
Average Real Private Pension	-0.084 (4.29)***	-0.016 (1.15)	-0.08 (4.14)***
Remaining Work Life of Median Voter	-11.473 (2.43)*		-12.573 (2.61)*
Median Life Expectancy	14.791 (4.17)***		14.619 (4.04)***
Real Interest Rate	0.821 (1.57)		0.873 (1.73)
Long Term Growth Rate	-3.037 (5.052)***		-2.772 (4.60)***
Effective Tax Base per Beneficiary	0.0001 (1.88)*		0.0001 (1.64)
Time	-1.190 (2.22)*		-2.324 (2.446)*
Number of Retired Workers		4.21E-06 (5.78)***	1.93E-06 (1.28)
Net Administrative Expenses		0.0192 (2.42)*	0.001 (0.96)
R <sup>2</sup>	0.988	0.981	0.990
Durbin-Watson	1.85	2.14	1.80
F Statistic	297.13	297.98	251.52
Standard Error	3.96	4.57	3.86

Note: T-statistics are reported in parentheses. Those followed by \*\*\* are statistically significant at the .001 level, \*\* at the .01 and \* at the .05 level.

(M): Estimates from the median voter model in Congleton and Shughart (1990).

(S): Estimates from the special interest group model in Congleton and Shughart (1990).

(R): Estimates from the combined model Congleton and Shughart (1990).

Table A5 Average Monthly Medical and OASI Benefits 1946 to 1982: (1967 Dollars)

Model	(M)	(S)	(C)
Estimation	OLS	OLS	OLS
Intercept	-350.259	57.571	-252.116
Real Median Earnings	0.094 (8.16)***		0.08 (6.94)***
Average Real Private Pension	-0.097 (4.63)***	-0.012 (0.80)	-0.092 (4.83)***
Remaining Work Life of Median Voter	-7.383 (1.37)		-13.625 (2.52)*
Median Life Expectancy	14.755 (3.74)***		17.511 (4.61)***
Real Interest Rate	1.262 (1.42)		1.488 (1.81)
Long Term Growth Rate	-3.535 (5.53)***		-5.042 (5.04)***
Effective Tax Base per Beneficiary	0.0002 (2.50)*		0.0001 (2.37)*
Time	-0.895 (1.46)		2.783 (2.48)*
Medical Dummy Variable	34.478 (9.06)***	41.642 (7.85)***	40.937 (9.83)***
Number of Retired Workers		5.14E-06 (5.06)***	2.40E-06 (1.28)
Net Administrative Expenses		0.0214 (2.70)*	0.022 (2.18)*
R <sup>2</sup>	0.996	0.981	0.990
Durbin-Watson	2.03	2.14	1.80
F Statistic	644.76	297.98	251.52
Standard Error	4.15	4.57	3.86

Note: T-statistics are reported in parentheses. Those followed by \*\*\* are statistically significant at the .001 level, \*\* at the .01 and \* at the .05 level.

(M): Estimates from the median voter model in Congleton and Shughart (1990).

(S): Estimates from the special interest group model in Congleton and Shughart (1990).

(R): Estimates from the combined model Congleton and Shughart (1990).

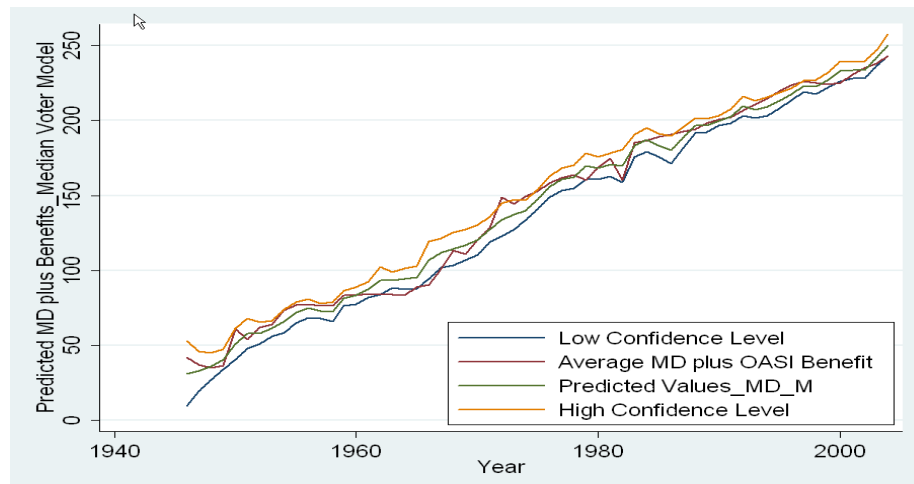


Figure A1 Predicted Values and Intervals for Average Monthly Medicare plus OASI Benefits by the Median Voter Model

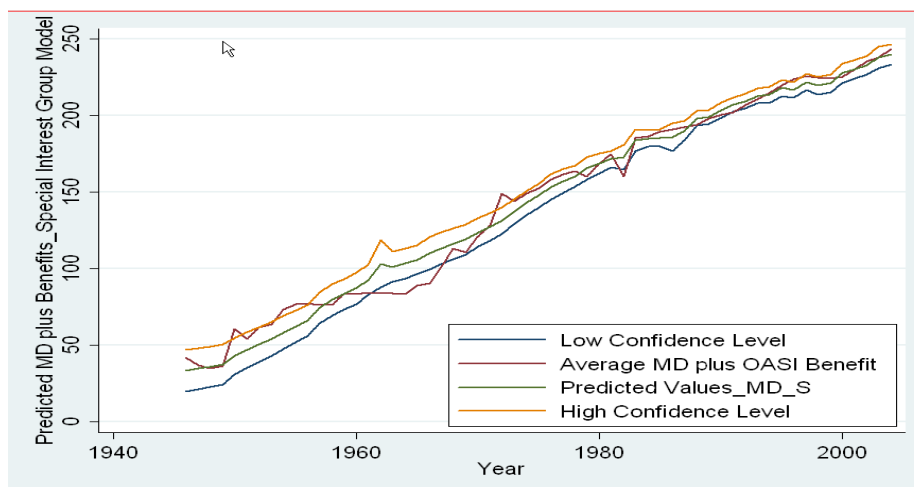


Figure A2 Predicted Values and Intervals for Average Monthly Medicare plus OASI Benefits by the Special Interest Group Model

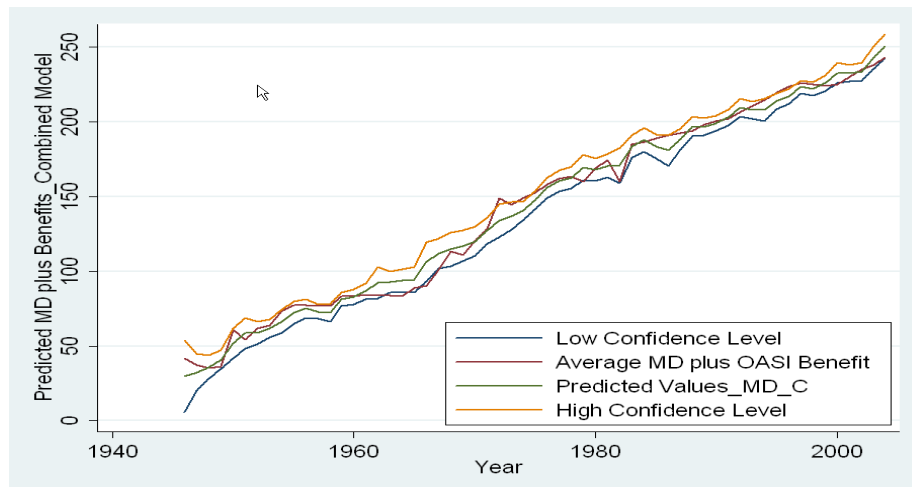


Figure A3 Predicted Values and Intervals for Average Monthly Medicare plus OASI Benefits by the Combined Model

Table B5 Data set for the period 1946 to 2006

Year	Bnft	Md_Os	M_Engs	Pr_Pns	R_W_Lf_MV	M_Lf_Exptncy	I_Rate
1946	41.966	41.966	2892.308	1264.350	16.5	18.2	-4.406
1947	37.220	37.220	2671.151	1143.539	17.5	19.3	-3.784
1948	35.160	35.160	2619.972	1091.265	18.5	20.7	-3.315
1949	36.415	36.415	2540.616	1128.413	18	21	-3.349
1950	60.832	60.832	2733.703	1140.391	17.5	20.7	-0.955
1951	54.165	54.165	2827.763	1071.123	19	22.4	0.689
1952	61.950	61.950	2911.950	1006.289	20.5	24.1	0.495
1953	63.795	63.795	2916.355	1032.043	19	22.8	1.006
1954	73.466	73.466	2850.932	1002.259	17.5	22.1	1.987
1955	77.182	77.182	2897.756	1081.480	18.5	23.1	1.872
1956	77.506	77.506	2991.400	1127.065	19.5	24.2	1.777
1957	76.607	76.607	2901.542	1090.575	18.5	23	2.245
1958	76.617	76.617	2856.813	1064.005	17.5	22.1	1.750
1959	83.368	83.368	2985.109	1109.454	19	23.9	2.436
1960	83.472	83.472	2975.197	1089.394	20.5	25.2	2.956
1961	84.431	84.431	3012.277	1151.131	19.5	24.7	3.199
1962	84.095	84.095	3094.923	699.043	18.5	23.6	3.079
1963	83.839	83.839	3138.495	1238.784	19	24.5	2.985
1964	83.498	83.498	3244.349	1292.576	19.5	24.7	2.756
1965	88.804	88.804	3372.487	1354.497	18.5	23.7	2.493
1966	86.780	94.274	3396.091	1386.077	17.5	22.6	2.536
1967	85.370	116.917	3443.000	1404.692	18.5	24	2.103
1968	94.875	131.556	3612.284	1407.719	19.5	24.7	1.934
1969	91.439	130.529	3640.255	1405.339	18.5	24	2.495
1970	101.548	139.644	3592.433	1340.776	17.5	23.4	3.422
1971	108.961	147.777	3599.340	1360.264	19.5	25.6	2.367
1972	129.290	168.781	3737.430	1437.990	21.5	27.7	1.068
1973	124.718	163.770	3759.579	1386.472	20	26.4	0.654
1974	127.285	171.185	3612.051	1369.989	18.5	25.5	1.490
1975	128.412	176.991	3513.648	1303.169	19.5	27.1	1.119
1976	131.965	184.413	3520.235	1208.425	20.5	28.4	0.432
1977	133.884	189.949	3542.149	1264.547	19.5	27.8	-0.036
1978	134.596	192.520	3486.694	1368.830	18.5	27	-0.202
1979	130.635	189.902	3336.707	1286.269	20	28.9	-0.223
1980	138.169	199.723	3218.801	1396.090	21.5	30.2	2.151
1981	141.703	207.530	3132.159	1572.560	20.5	29.6	5.269
1982	144.587	215.506	3162.574	1912.732	19.5	29	6.290
1983	147.788	222.685	3257.373	1304.223	20.5	30.1	6.531
1984	148.184	225.118	3348.441	1549.181	21.5	31.2	8.891
1985	148.665	229.982	3416.511	1827.306	20	29.7	8.046
1986	148.904	232.799	3515.834	2155.424	18.5	28.2	5.523
1987	150.705	234.589	3555.523	2011.760	20	29.9	5.774



1988	151.566	236.829	3650.861	1634.117	21.5		31.4	5.735
1989	152.707	243.403	3731.753	1810.886	20		30.1	4.822
1990	154.062	247.245	3674.757	1682.239	18.5		28.9	5.010
1991	154.167	250.186	3600.000	1729.863	20		30.5	4.686
1992	155.365	257.862	3545.563	1833.980	21.5		32.3	4.494
1993	155.766	265.893	3565.288	1796.104	19.5		30	4.093
1994	156.982	272.049	3590.766	1775.182	17.5		28.2	5.095
1995	157.722	281.831	3674.699	1714.719	18		28.8	4.864
1996	158.544	288.581	3742.711	1857.551	18.5		29.6	4.922
1997	159.110	292.889	3900.998	1754.361	17		28.5	4.896
1998	159.738	290.082	4086.217	2032.375	15.5		27.2	4.055
1999	161.122	287.082	4125.050	2027.360	16.5		28.2	4.586
2000	163.629	286.846	4171.384	2014.409	17.5		29.5	5.314
2001	164.781	296.004	4135.370	1908.926	15.5		27.7	4.629
2002	166.110	304.355	4105.048	1955.217	13.5		25.8	3.944
2003	167.302	308.577	4113.954	1879.672	15.5		28	3.118
2004	168.788	317.764	4102.863	1905.388	17.5		30.4	2.998
2005	171.277	325.788	4158.120	1754.038	16.5		32.1	2.36
2006	172.470	351.066	4259.772	1845.416	15.5		31.2	2.41

Year	G_Rate	Tax_Base	Time	N_R_Wrks	Net_Expns	Binary	GLE	Union
1946	-0.08	265237.755	1	702000	68.376	0	0	13591000
1947	-1.80	204671.712	2	875000	68.759	0	0	13227000
1948	0.16	174802.809	3	1048000	70.735	0	0	13550000
1949	3.88	142327.589	4	1286000	75.630	0	0	14376000
1950	4.82	112951.734	5	1771000	84.605	0	0	14839000
1951	4.86	94749.406	6	2278000	104.113	0	0	15540000
1952	4.84	86440.578	7	2644000	110.692	0	0	15036000
1953	4.54	75550.567	8	3222000	109.863	0	0	15341000
1954	3.40	63860.613	9	3775000	114.286	0	0	15641000
1955	3.04	57997.980	10	4474000	148.379	0	0	15687000
1956	1.94	53948.077	11	5112000	162.162	0	0	14736000
1957	3.50	44925.605	12	6198000	192.171	0	0	14591000
1958	2.56	39297.598	13	6921000	224.018	0	0	14613000
1959	2.62	38694.591	14	7526000	210.767	0	0	14487000
1960	3.44	37486.541	15	8061000	228.861	0	0	14732000
1961	4.50	34368.064	16	8925000	266.741	0	0	14815000
1962	4.22	33241.749	17	9739000	282.561	0	0	15102000
1963	5.00	32835.994	18	10263000	306.434	0	0	15638000
1964	5.84	33461.115	19	10669000	318.622	0	0	16111000
1965	5.12	33994.363	20	11101000	347.090	0	0	16598000
1966	5.20	34899.969	21	11658000	263.374	1	0	16782000
1967	4.66	35088.561	22	12019000	406.000	1	0	16902000
1968	3.42	35764.494	23	12421000	456.814	1	0	16978000

1969	2.80	36215.438	24	12822000	431.694	1	0	16461000
1970	3.36	34995.077	25	13352145	404.987	1	0	16485000
1971	3.56	34100.502	26	13925444	423.743	1	0	16804000
1972	2.82	34429.229	27	14555475	537.909	1	0	16781000
1973	2.74	34192.776	28	15364044	486.101	1	0	16397000
1974	3.14	32242.737	29	15958492	585.647	1	0	16173000
1975	3.00	30009.709	30	16588174	555.831	1	0	15876000
1976	2.96	30292.104	31	17165415	562.463	1	0	16005000
1977	3.70	30297.762	32	17832484	540.496	1	0	16226000
1978	3.68	30806.204	33	18357985	570.624	1	0	15273000
1979	3.10	30072.407	34	18970172	511.960	1	0	14974000
1980	1.80	28191.705	35	19582625	467.585	1	0	14007000
1981	1.58	27295.657	36	20195362	479.809	1	0	13223000
1982	2.40	26225.411	37	20763742	525.424	1	0	11647000
1983	3.28	26079.673	38	21418860	527.989	1	1	11227000
1984	3.48	26952.233	39	21906651	526.519	1	1	11051000
1985	4.50	27363.563	40	22432103	494.103	1	1	10826000
1986	4.42	27783.534	41	22986678	487.516	1	1	10674000
1987	3.70	28249.642	42	23439839	447.709	1	1	10520000
1988	3.26	28801.066	43	23858226	501.271	1	1	10227000
1989	2.52	28560.662	44	24326604	450.579	1	1	9909000
1990	2.56	28172.610	45	24838100	399.336	1	1	9703000
1991	2.32	27193.383	46	25288719	439.216	1	1	9557000
1992	2.42	27219.080	47	25757727	435.403	1	1	9620000
1993	2.54	27177.648	48	26104305	461.290	1	1	9400000
1994	3.32	27575.701	49	26407756	370.495	1	1	9385000
1995	3.54	28042.991	50	26672806	454.983	1	1	9327000
1996	3.84	28521.320	51	26898072	383.485	1	1	9306000
1997	3.98	29385.827	52	27274572	442.596	1	1	9419000
1998	4.30	30994.345	53	27510535	388.900	1	1	9148000
1999	3.78	32134.519	54	27774677	362.525	1	1	9113000
2000	3.24	32708.380	55	28498945	416.635	1	1	8800000
2001	2.86	32194.074	56	28836774	369.721	1	1	8452000
2002	2.62	31544.219	57	29190137	396.623	1	1	8205000
2003	2.42	31358.939	58	29531611	463.255	1	1	13591000
2004	2.74	31594.526	59	29953081	421.351	1	1	13227000
2005	2.80	32250.343	60	30455298	505.470	1	1	13550000
2006	2.38	32352.503	61	30976000	497.068	1	1	14376000

Note: Bnft = Average Monthly Real OASI Benefit,  
Md\_Os = Average Real Monthly OASI Benefit plus Average Real Monthly Medicare Benefit  
M\_Engs = Real Median Earnings  
Pr\_Pns = Real Private Pension Benefit  
R\_W\_Lf\_MV= Remaining Life of Median Voter  
M\_Lf\_Exptncy = Median Voter's Life Expectancy

I\_Rate = Real Interest Rate  
G\_Rate = Real Growth Rate  
Tax\_Base = Effective Tax Base per OASI Recipient  
N\_R\_Wrks = Number of OASI Recipient  
Net\_Expns = Real Administrative Expenses of Social Security Administration  
GSE = Greenspan Legislation Effect  
Union = Number of Union Workers

## Appendix B: Critical Reviews

### B.1 Dynamic OLS Regression with Time Trend

Currently, many scholars tend to report a time trend when they use dynamic OLS regression. Accordingly, it is worthwhile to report the estimates including time variable in this dissertation. Table B1 provides these regression results for the three public choice models.

Table B1. Dynamic OLS with Time Trend: Average Monthly OASI Benefits (1967 Dollars)

	Median Voter Model	Interest Group Model	Combined Model
Period	1946-2004 DOLS	1946-2004 DOLS	1946-2004 DOLS
Intercept	-133.058 (-2.30)**	15.829 (1.60)	-18.506 (-0.29)
Real Median Earnings	0.026 (1.91)*		-0.024 (-1.71)
Average Real Private Pension	0.009 (0.62)	0.005 (0.67)	0.021 (1.45)
Remaining Work Life of Median Voter	-8.791 (-2.78)**		6.245 (1.10)
Median Life Expectancy	13.938 (4.07)***		-1.618 (-0.29)
Real Interest Rate	-0.816 (-1.04)		-0.623 (-0.29)
Long Term Growth Rate	-3.940 (-2.09)**		0.344 (0.21)
Effective Tax Base per Beneficiary	-0.0002 (-0.94)		0.00003 (0.08)
Time	-1.047 (-1.26)	1.064 (1.23)	6.815 (3.92)***
Number of Retired Workers		1.94e-06 (1.03)	-7.86e-06 (-3.01)***
Net Administrative Expenses		0.031 (2.16)**	0.051 (2.97)***
F-statistic	437.61 ***	173.14***	2960.90 ***

Note: T-statistics are reported in parentheses. Those followed by \*\*\* are statistically significant at the .01 level, \*\* at the .05 and \* at the .1 level. All entries are rounded to the nearest decimal.

The signs of the coefficients in the median voter model including time variable are the same in those signs of the case that does not include time variable. Additionally, absolute values of the coefficients remain similar. Time variable in the median voter model is negative and statistically insignificant at conventional level. F-statistic in this regression result is somewhat lower. Similarly, regression results from the special interest group model including time variable provide analogous results. All of the coefficients have same sign, but the coefficient for the number of retired workers became statistically insignificant. It is very interesting that the estimates including time variable in the combined model are quite different from those not including it. Some explanatory variables for the median voter model became statistically insignificant while number of retired workers in the special interest group model became statistically significant. Additionally, F-statistic became much larger. Therefore, the explanatory power of the special interest group in the combined model turned out to be stronger.

## **B.2 Forecasts with Time Trend and Greenspan Effect**

As an alternative forecasts strategy, I also used the estimates including time trend and Greenspan effect as shown in Table B2.

Table B2. Forecasts of Average Monthly OASI Benefits Considering Time Trend and Greenspan Effect

Year	Actual Benefit	Median Voter Model	Special Interest Group Model	Combined Model
2005	171.28	192.06 (-0.12)	177.31 (0.04)**	185.11 (0.08)*
2006	172.47	197.31 (0.14)	181.57 (0.05)*	187.94 (0.09)*

Forecasts using the median voter model are not better, comparing with the post sample forecasts in Table 17. They are higher than actual benefit both in 2005 and 2006, and forecast errors are higher than those using the median voter model in Table A17. In both the special interest group model and combined model, the forecast errors are higher, respectively. Forecasts using the special interest group model are more accurate than those using combined model, which is different result from that in Table 17, where the forecasts using median voter better fit for actual benefit levels than those using the other two models, respectively. If other time series methods are used rather than DOLS and/or if only recent period data are used, the combined model can provide more accurate forecasts.<sup>119</sup>

### **B.3 Union Workers Instead of Retired Workers as an Interest Group**

Instead of the number of retired workers, it might be possible to use the number of union workers as an explanatory variable for the special interest group model.<sup>120</sup> Union membership for the private sector implies more homogeneous interest among the members. It can be a proxy variable for a special interest group who pursue the same interest. Table B3 presents the new estimates and dynamic OLS estimates using the number of union workers instead of the number of retired workers by special interest group model.

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<sup>119</sup> For the period 1983 to 2004 DOLS cannot be worked in Stata because it is too short a period.

<sup>120</sup> In this analysis, available data for private sector union workers are for the period of 1948 to 2004. The year 1983 is the earliest data for public sector union workers in this respect.

Table B3. New Estimates and Dynamic OLS with the Number of Union Workers:  
Average Monthly OASI Benefits by Special Interest Group Model (1967  
Dollars)

Period Estimation	Special Interest Group Model				
	1948-2004 OLS	1948-2004 Robust S.E.	1948-004 Median Regression	1948-2004 Prais- Winsten	1948-2004 DOLS <sup>b</sup>
Intercept	122.085 (6.14)***	122.085 (7.16)***	108.487 (6.07)***	184.441 (8.25)***	130.662 (4.75)
Average Real Private Pension	0.012 (1.54)	0.012 (2.02)**	0.018 (2.43)**	0.003 (0.98)	0.012 (1.01)
Number of Union Workers	-0.006 (-7.67)***	-0.006 (-9.04)***	-0.005 (-7.03)***	-0.005 (-5.10)***	-0.006 (-5.45)***
Net Administrative Expenses	0.172 (13.35)***	0.172 (13.35)***	0.157 (13.02)***	0.039 (1.93)**	0.153 (9.03)**
R <sup>2</sup>	0.936	0.936	0.777	0.431	
Durbin-Watson	0.876***	0.876***		2.00	
F-statistic	257.71***	239.62***		310.10	104.45***
Standard Error	10.096	10.096		5.49	

a: Pseudo R<sup>2</sup>

b: Heteroskedasticity-and Autocorrelation-consistent (HAC) standard errors are reported in parentheses. .

The growth of average monthly OASI benefits for the period of 1948 to 2004 can be explained by both outside interest group (union workers) and inside interest group (bureaucrats associated with social security). Most regression results are not different from those in Table 15. However, unlike the regression result in Table 15, the sign of the coefficient for the outside interest group is negative, which is an unexpected result. This happens partly because the number of union workers has decreased since 1975.

The regression results for the combined model for the period from 1948 to 2004 using the number of union workers as an outside interest group are reported in Table B4.

Table B4. New Estimates and Dynamic OLS with the Number of Union Workers:  
Average Monthly OASI Benefits (1967 Dollars)

Period Estimation	Combined Model				
	1948-2004 OLS	1948-2004 Robust S.E.	1948-004 Median Regression	1948-2004 Prais- Winsten	1948-2004 DOLS <sup>b</sup>
Intercept	-18.026 (-0.59)	-18.026 (-0.74)	-36.600 (-1.24)	1.769 (0.07)	-215.592 (4.75)
Real Median Earnings	0.007 (1.34)	0.007 (1.24)	0.008 (1.45)	0.004 (0.59)	0.007 (0.66)
Average Real Private Pension	0.003 (0.70)	0.003 (1.19)	0.005 (1.24)	0.002 (0.69)	0.014 (0.86)
Remaining Work Life of Median Voter	-8.907 (-3.97)***	-8.907 (-4.40)***	-8.990 (-4.22)***	-6.444 (-2.88)***	-0.571 (-0.14)
Median Life Expectancy	10.361 (4.74)***	10.361 (5.21)***	10.739 (5.15)***	7.450 (3.22)***	7.594 (2.26)**
Real Interest Rate	0.244 (0.42)	0.244 (0.52)	0.096 (0.16)	0.588 (1.02)	-1.583 (-0.78)
Long Term Growth Rate	-1.422 (-1.79)*	-1.422 (-1.78)*	-0.900 (-1.24)	-1.974 (-2.05)**	1.559 (0.44)
Effective Tax Base per Beneficiary Time	-0.00008 (-1.47)	-0.00008 (-2.32)**	-0.0001 (-1.91)*	-0.00002 (-0.19)	-0.0005 (-1.31)
	-0.243 (-0.43)	-0.243 (-0.48)	-0.203 (-0.39)	0.421 (0.77)	1.964 (1.71)
Number of Union Workers	-0.0002 (-0.29)	-0.0002 (-0.39)	0.0003 (0.48)	0.00005 (0.06)	0.006 (2.11)
Net Administrative Expenses	0.043 (2.96)***	0.043 (3.68)***	0.032 (2.44)**	0.042 (2.90)***	-0.090 (-1.44)***
R <sup>2</sup>	0.985	0.985	0.908 <sup>a</sup>	0.973	
Durbin-Watson	1.42	1.42		1.91	
F-statistic	321.94 ***	664.32***		3842.93***	889.59***
Standard Error	5.078	5.078		4.796	

Note: T-statistics are reported in parentheses. Those followed by \*\*\* are statistically significant at the .01 level, \*\* at the .05 and \* at the .01 level. All entries are rounded to the nearest decimal.

a: Pseudo R<sup>2</sup>

b: Heteroskedasticity-and Autocorrelation-consistent (HAC) standard errors are reported in parentheses.

The signs of the coefficients are all the same as those of the coefficients in Table 16, except for the sign of the number of union workers. The number of union workers has been decreasing during the past 30 years while the number of retired workers has been increasing. This difference brought about the opposite sign.



Overall, replacing retired workers with union workers provides very similar regression results. However, the number of union workers increased prior to 1974, but has been declining steadily since then. The opposite phenomenon has occurred for the number of retired workers, which has been continuously increasing since 1948, the earliest year in this regression analysis. Therefore, it is certain that the group of union workers is homogeneous in terms of their interest. Using it as an outside interest group for OASI benefits does not provide better estimates than using the number of retired workers.

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## CURRICULUM VITAE

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