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Essays in Retirement and Public Economics

A dissertation submitted in partial satisfaction of the requirements for the degree
Doctor of Philosophy

in

Economics

by

Boris Chunhei Wong

Committee in Charge:

Professor Roger Gordon, Chair
Professor Julie Cullen
Professor Gordon Dahl
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2017
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Chair

University of California, San Diego

2017
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ABSTRACT OF THE DISSERTATION

Essays in Retirement and Public Economics

by

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Doctor of Philosophy in Economics

University of California, San Diego, 2017

Professor Roger Gordon, Chair

This dissertation studies empirical questions in public economics and labor economics, with a heavy emphasis on pension and retirement saving. The first chapter assesses the role of liquidity constraints on retirement saving. The second chapter evaluates the impact of pension reform on formal sector labor supply. Finally, the third chapter appraises the revenue and distributional effects of a potential tax reform that can diminish distortions and disincentives to saving.
Introduction

The following is a more detailed introduction to each chapter.

In Chapter 1, I show that liquidity constraints can help to explain low contribution rates to Individual Retirement Accounts (IRAs). The existing literature has tried to explain the low rates by self-control problems or financial illiteracy. While these factors can explain why some people never contribute, they cannot satisfactorily justify why many individuals contribute in some years but not in other years. Using panel data to follow the same households over time and exploiting changes in liquidity constraint within the same households, I find that households are 3.1 percentage points less likely to contribute when liquidity constrained, which is sizable relative to a baseline contribution rate of 17.2 percent.

In Chapter 2, I examine the effect of the 2008 reform on formal sector labor supply. The reform changed the formulas for how pension payments are calculated, such that one subgroup of the population faced a new significant disincentive to contribute to individual accounts while another subgroup faced a significant drop in disincentive. Since workers can avoid the mandatory contribution (10 percent of their wages) to their individual personal accounts by shifting to self-employment or the informal sector, the pension reform may affect formal sector labor supply. Using panel survey data and administrative social security data, I implement a difference-in-differences design to measure the formal sector labor supply responses for these two
affected subgroups. For individuals who should expect to face the new disincentive of a 29.4 percent implicit marginal tax rate, I show that they are 3 percentage points less likely to be in formal sector employment after the reform. For young people and individuals close to retirement, the formal sector labor supply response are especially strong, a decrease of 6.5 percentage points and 5.5 percentage points respectively. The other subgroup that faces a drastic drop from a 100 percent implicit marginal tax rate to 29.4 percent is 8.1 percentage points more likely to be in formal sector employment after the reform.

Finally, in Chapter 3, we evaluate the merits of a new tax regime with the personal income tax base requiring registered accounts for all savings. The new tax base requires all forms of income to first enter a registered account. Similar to the tax treatment of many current pension plans, 401(k)s, and traditional IRAs, the income entering the registered accounts is not taxed initially. The income can be invested within the registered account tax-deferred. Individuals pay taxes only when they withdraw funds from their registered accounts to finance their consumption. We use the Consumer Expenditure Survey to estimate how much tax revenue would change if we replace the current labor income tax, capital income tax, and corporate tax with the proposed progressive consumption tax through use of registered accounts. We also assess the level of the tax rates needed to sustain a revenue-neutral reform and evaluate the distributional effects on different subgroups of the population from this tax reform proposal.
Chapter 1

Liquidity Constraint and Contributions to Individual Retirement Accounts

Abstract

This paper investigates the effect of liquidity constraint on the contributions to individual retirement accounts (IRAs). It finds strong evidence that households that are liquidity constrained are less likely to contribute to IRAs. Using the Panel Study of Income Dynamics data set to follow the same households over time from 2003 to 2011, this paper finds that during periods when a household is liquidity constrained, the household is on average 3.1% less likely to contribute to an IRA account compared to when that same household is not liquidity constrained. With the baseline contribution rate of only 17.2%, liquidity constraint has a significant impact on whether households decide to contribute to IRAs in any given year.

1.1 Introduction

The United States has many different tax-qualified retirement vehicles for individuals to save for retirement. Two types of vehicles are most prominent: 401(k)s and Individual Retirement Accounts (IRAs). The traditional 401(k) plans, introduced
by Congress in 1978, and the traditional IRA, established by the Tax Reform Act of 1986, are tax-deferred accounts. A tax-deferred account generally allows tax-deductible contributions. Distributions and capital gains are tax-deferred until withdrawals and are then taxed at the ordinary income tax rate. Early withdrawal from either of this qualified retirement plan is subject to an additional tax of 10% for early distribution before the age 59 ½.

In the more recent years, Congress enacts variations to the traditional 401(k) plan and IRA. The Roth account, such as a Roth IRA established by the Taxpayer Relief Act of 1997 and a Roth 401(k) enacted as a provision of the Economic Growth and Tax Relief Reconciliation Act of 2001, is another type of tax-qualified retirement vehicles. In contrast to a tax-deferred account, contributions to a Roth account are not tax-deductible, but withdrawals are tax-free.

This paper investigates the effect of liquidity constraint on the contributions to Individual Retirement Accounts. A simple life cycle model predicts that the contribution limit to Individual Retirement Accounts should always bind: even if the desired savings of individual are less than the contribution limit, the theory predicts individuals should borrow or shift assets to reach the contribution limit. However, the empirical evidence shows very different results. Many individuals do not contribute to tax-advantaged savings account (Gravelle, 1991). Even among those who contribute, many do not contribute fully as the theory predicts (Burman, Cordes, and Ozanne, 1990; Gale and Scholz, 1994). A possible explanation to this phenomenon in the data is that some individuals face liquidity constraint that restrains their abilities to borrow
and contribute to Individual Retirement Accounts. This paper studies the puzzle that many qualified individuals fail to contribute to IRAs up to the statutory limit, and examines whether liquidity constraint can be one reason to explain the very low contribution rates to IRAs.

The rest of this paper proceeds as follows: Section 2 provides a brief overview on the literature. Section 3 describes the theoretical prediction. Section 4 presents the empirical evidence that motivates the topic of this paper. Section 5 explains the data. Section 6 discusses the methodology. Section 7 presents the result and Section 8 concludes.

1.2 Literature

In the existing literature on tax-advantaged savings accounts, the dominant branch of the literature focuses on the questions on the effectiveness of these programs to induce new savings. Johnson (1985), Feenberg and Skinner (1989), Poterba, Venti, and Wise (1994, 1995), and Chetty et al (2012) all study how much less individuals would save without these programs and whether these programs actually promote new saving or do they merely displace other types of saving. The results are somewhat mixed as each additional dollar of tax-advantaged savings increases total saving by as little as 1 cent (Chetty et al, 2012) or up to 32 cents (Johnson, 1985).

Regardless of whether contributions to tax-advantaged savings accounts are new savings, the significant tax incentive should prompt individuals to contribute, even if they are merely displacing other types of saving. However, some studies have
pointed out that many individuals do not contribute to tax-advantaged savings account (Gravelle, 1991), and even among those who contribute, many do not contribute fully as the theory predicts (Burman, Cordes, and Ozanne, 1990; Gale and Scholz, 1994). The current literature that studies the potential reasons of this low contribution rate to tax-advantaged savings account focuses on self-control and financial literacy. Thaler and Shefrin (1981), Laibson, et al. (1998), and Diamond and köszegi (2003) analyze the effect of self-control, present bias, and hyperbolic discounting on savings. Lusardi and Mitchell (2009), Lusardi and Mitchell (2011), and Van Rooij, Lusardi, and Alessie (2012) find evidence of widespread financial illiteracy, and as a result, affect people from making contributions to tax-advantaged savings account.

While self-control and financial literacy are likely parts of the reasons that explain the low contribution rates to Individual Retirement Accounts, they cannot resolve the considerable divergence between the theory and the empirical evidence on the contribution to IRAs. Figure 1.1 plots the percentage of households that has at least one IRA account or private annuity (blue line) and the percentage of households that has made at least one contribution to an IRA account or private annuity in the last two years (green line). Self-control and financial literacy may be able to explain why only around thirty percent of the household have IRA accounts. However, they cannot explain the significant gap between the blue line and the green line, which shows that even among households that have IRA accounts, many households contribute in some years, but not in other years. Another interesting observation from this figure is that the contribution rate drops more significantly during the years of 2007 to 2009, a
period when more households are likely to become suddenly liquidity constrained because of the Great Recession. This project contributes to the literature by empirical investigating whether liquidity constraint, which prevents individuals from borrowing to finance their contributions to tax-advantaged savings accounts, is one reason that explains the low contribution rates to the Individual Retirement Accounts.

1.3 Theoretical Predictions

1.3.1 General framework

The theory predicts that every individual should contribute to Individual Retirement Accounts up to the eligible contribution amount every year. Consider a multi-period life-cycle model similar to that outlined in Bernheim (2002). Individuals in this model live for $T+1$ periods and they earn wages $w_t$ for each period that they work. They derive utility from consumptions $c_t$, and want to maximize their lifetime utility using an intertemporally separable utility function:

$$\max \sum_{t=0}^{T} u_t(c_t) \rho^t$$  \hspace{1cm} (1)

where $\rho < 1$ represents the pure rate of time preference.

When there is no liquidity constraint, individuals can freely change their intertemporal allocation of resources by borrowing or lending, and subject to only a life-time budget constraint. In each period $t$ that the individuals work, they receive wage $w_t$ and consume $c_t$. For each period $t < T$, individuals have to choose how much
to consume $c_t$, and the amount of saving or borrowing is given by $w_t - c_t$, where $w_t - c_t > 0$ implies saving and $w_t - c_t < 0$ implies borrowing in period $t$.

Let the pretax interest rate in period $t$ be at a rate $i_t$, and let the effective capital income tax rate\(^1\) be $m_t$ in period $t$. Let $A_t$ denote the net asset holdings at the beginning of period $t$. Then we can define the amount of asset holdings over time as follows:

$$A_{t+1} = [A_t + w_t - c_t](1 + \beta_t)$$ \hspace{1cm} (2)

where $\beta_t$ is a weighted average of the after tax interest rate and the pretax interest rate, with weights equal to the fraction of saving within tax-advantaged saving accounts (such as IRAs) and outside them at that date. Let $\lambda_t$ be the fraction of saving within tax-advantaged saving accounts in period $t$. Then,

$$\beta_t = \lambda_t i_t + (1 - \lambda_t)(1 - m_t)i_t$$ \hspace{1cm} (3)

Individuals have to satisfy the lifetime budget constraint such that they die with non-negative asset holdings. Given their utility functions and that individuals know they would live up to period $T$, they would want to have zero asset holding at the end of period $T$. Formally, we require

$$A_{T+1} = \sum_{t=0}^{T} (w_t - c_t)(1 + \beta_t)^{T-t} = 0$$ \hspace{1cm} (4)

---

\(^1\) The effective capital income tax rate $m_t$ is a weighted tax rate of the long-term capital gains tax rate and the short-term capital gains tax rate, with weights depends on the proportion of assets that would incur the long-term or short term capital gains tax. $m_t$ is also adjusted for the potential tax deferral if capital gains are not realized and taxed in period $t$. 
Since $\frac{\partial \bar{R}_t}{\partial \lambda_t} = m_t i_t$, individuals would always gain from increasing the fraction of saving within IRAs whenever $m_t > 0$ and $i_t > 0$, as long as it is feasible at that period. Therefore, the contribution limit to IRAs should certainly be binding in years where $m_t > 0$ and $i_t > 0$. Even if $m_t = 0$ (which may occur for individuals with very low income in year $t$) such that one is indifferent to contributing, one should still contribute in year $t$ if one expects that $m_{t'} > 0$ for some $t' > t$. In other words, one would like to relax the contribution limit constraint in a future year $t'$ by contributing in an earlier year $t$.

1.3.2 Traditional and Roth IRAs

In the United States, the government offers tax-advantaged savings accounts that reduce the capital tax burden on saving up to some fixed amount, which is determined by the contribution limits and possibly the adjusted gross income of the individuals. For the simple multi-period life-cycle model outlined above, saving within a tax-advantaged savings account is equivalent with any other saving. However, the return of saving within a tax-advantaged savings account is strictly higher.

In a tax-deferred account such as a traditional IRA or a traditional 401(k), contribution is typically tax-deductible. The tax-deductibility of contribution allows an initial after-tax dollar of saving to be worth $1 / (1 - \tau)$, in which $\tau$ represents the marginal tax rate on ordinary income at the time of contribution (e.g. at the beginning of year 1). Let $\tau'$ be the marginal tax rate on ordinary income at the time of withdrawal (e.g. at the end of year $T$). Since withdrawal is taxed at the ordinary income tax rate,
the after-tax value of an equivalent after-tax dollar of saving within a traditional IRA for T years would thus yield

$$\left(1 - \tau\right)\left\{\frac{1}{1 - \tau} \prod_{t=1}^{T}(1 + i_t)\right\}$$

(5)

where the term $\left\{\frac{1}{1 - \tau}\right\}$ is the tax-deductible contribution and the term in

$\left\{\prod_{t=1}^{T}(1 + i_t)\right\}$ is the pre-tax value of the investment in period T.

In a Roth account such as a Roth IRA or Roth 401(k), contributions are not tax deductible, but distributions and withdrawals are tax-exempt. The after-tax value of an equivalent after-tax dollar of saving within a Roth account for T years would yield

$$\prod_{t=1}^{T}(1 + i_t)$$

(6)

Saving outside of a tax-advantaged savings account, however, does not enjoy any deduction during the contribution phase. Furthermore, all realized returns are subject to taxation.

The after-tax value of an equivalent after-tax dollar of saving outside of a tax-advantaged savings account for T years would yield

$$\prod_{t=1}^{T}[1 + i_t(1 - m_t)]$$

(7)

Even if we assume the entire return of savings is capital gain, and it is deferred from realization until year T, the after-tax value of an equivalent after-tax dollar of saving outside of a tax-advantaged savings account for T years would be
which is still strictly less than that of saving within a tax-advantaged savings account, for \( m_T > 0 \). In fact, if the ordinary income tax rate is lower when one retires, \( \tau' < \tau \), then a traditional IRA yields a higher rate of return than either a Roth IRA or regular saving. If the ordinary income tax rate is higher when one retires, \( \tau' > \tau \), then a Roth IRA yields a higher rate of return than either a traditional IRA or regular saving. Finally, if the ordinary income tax rate remains the same, \( \tau' = \tau \), then both traditional and Roth IRA have the same rate of return and they dominate regular savings. A thorough review of the value of tax-advantaged savings account over taxable account is well beyond the scope of this paper, but interested readers can find citations and summaries on this topic in Wong (2012).

Saving within a tax-advantaged savings account generates strictly higher return. Given that savings within tax-advantaged savings accounts are perfect substitute with other savings in the simple life-cycle model, the theory clearly predicts that the contribution limit to tax-advantaged savings accounts should always bind. Even if the desired consumption \( c_t \) in any given period \( t \) is high such that \( w_t - c_t \) does not reach the contribution limit, individuals should borrow or shift other assets. Borrowing or shifting other assets does not violate the lifetime budget constraint \( A_{T+1} = 0 \) in the model. In conclusion, a simple life cycle model predicts that the contribution limit to tax-advantaged savings account should always bind, a result that is clearly violated in the empirical evidence.
1.4 Empirical Evidence

The empirical evidence on contribution to IRA shows significant deviation from the prediction of the theory. Gravelle (1991) found that there had been significant sums of saving contributed to IRA in the 1980s: $28 billion was contributed in 1982 and about $38 billion was contributed by 1985 and 1986. However, there had never been more than 16 percent of tax filers who contributed to IRAs in those years. This is in contrary to the theory, which predicts every eligible individual should contribute to IRAs.

Even among those who contributed to IRAs, not all of them contributed up to the contribution limit as predicted in the theory. Burman, Cordes, and Ozanne (1990) found that only 75 percent of contributions were made by household at the limit in 1983. Gale and Scholz (1994) demonstrated that only 30 percent of IRA contributors contribute at the limit for each of the three years, implying that 70 percent of contributors fall short of the limit at least once over a three-year period.

One possible explanation for the divergence between the theoretical predictions of the simple multi-period life-cycle model and the empirical evidence is the assumption of perfect substitutes of different saving in the model. It is evident that IRA saving is not perfect substitute to non-IRA saving because early withdrawals before age 59 ½ from traditional IRA is subjected to a 10 percent penalty. However, this argument still cannot be reconciled with the data. The penalty only applies for early withdrawals, which implies individuals who do not contribute at the limit must
have anticipated needs of the saving before age 59 ½. If the anticipated needs are sufficiently far into the future, individuals are better off by saving in traditional IRAs and paying the 10% early withdrawal penalties. If the anticipated needs are near into the future, individuals are still better off by saving in Roth IRAs, in which contributions can be withdrawn penalty-free at any time. Furthermore, there are many exceptions for some penalty-free early withdrawals from traditional and Roth IRA, such as un-reimbursed medical expenses, medical insurance expenses when unemployed, disability, higher-education expenses, and home purchases. Therefore, the imperfect substitutability between IRA saving and non-IRA saving cannot satisfactorily explain the empirical evidence.

Another possible explanation is that high income individuals may not contribute because there is an income limit such that anyone with a high enough adjusted gross income is not permitted to make a contribution to a Roth IRA, and can only make a nondeductible traditional IRA contribution (similar to a traditional IRA contribution except the person cannot take a tax-deduction for the contribution). However, a person who made a nondeductible traditional IRA contribution can still enjoy tax-deferral, which is a significant tax incentive given that she/he has high adjusted gross income. Furthermore, there is a provision in the tax code, commonly referred as the Backdoor IRA, that allowed high income individuals who are over the income limit to enjoy almost the same tax benefit of Roth IRAs as if they were below the income limit: Since there is no income limit on contributing to a nondeductible traditional IRA nor on converting a traditional IRA to a Roth IRA, high income
individuals who are over the income limit can simply and legally contribute to a nondeductible traditional IRA and almost immediately (may need a few business days for the paperwork) convert it into a Roth IRA. If one has no other traditional IRA account, no tax or penalty has to be paid for this conversion except for the possible capital gains incurred during the period between the contributions to the nondeductible traditional IRA and the conversion (which is supposed to be very small unless one makes a huge fortune from his/her investment during the few business days needed to complete the paperwork of conversion). As a result, the income limit should not effectively prevent high-income individuals from enjoying the significant IRAs tax benefits or contributing to IRAs. Therefore, the income limit of IRAs contribution does not seem likely to explain the empirical evidence of very low IRAs contribution rates in the United States.

A further possible explanation to explain the empirical evidence is to introduce liquidity constraint. The simple multi-period life-cycle model only requires individuals to satisfy the lifetime budget constraint $A_{T+1} = 0$, which always allow individuals to borrow in order to contribute at the contribution limits. The credit market in the real world, however, is likely to have much more stringent borrowing constraints, especially for low-income individuals and young adults who have yet to acquire well-paid jobs with stable job histories. Empirical observations in the demographics of IRA contributors display consistent results to this possible explanation. Venti and Wise (1991) found that among households with income less than $20,000 and with head of household between the ages of 25 and 34, only 4 percent of them contributed to IRAs.
in 1985. In contrast, among those households with the same income profile but with head of household between the ages of 55 and 64, 18 percent of them contributed to IRAs in 1985. Contribution rates were also higher among households with higher income, conditional on age. Among those with ages of 55 and 64, the contribution rate was 50 percent among those with income between $20,000 and $40,000 (up from 18 percent compared to those with income less than $20,000), and 70 percent among those with income over $40,000. These empirical observations prompts a need to investigate empirically whether liquidity constraint can be the reason that the theoretical predictions fail to match the empirical results.

1.5 Data

This paper uses the Panel Study of Income Dynamics (PSID) data set, a nationally study of socioeconomics and health over lifetimes and across generations. I use the most recent five waves of data in 2003, 2005, 2007, 2009, and 2011. While there are two earlier waves of data that contain information on IRAs contribution, the survey questions were very different from these five waves. Each wave of PSID data contains a nationally representative sample of over 22,000 individuals living in about 8,900 families in the United States.

This paper defines a household to have made a contribution to an IRA if anyone in the household has contributed to an IRA in the last two years. Using this definition for contribution, about 14.5% of the households has made a contribution. A
A household is defined to be liquidity constraint if the liquid asset\(^2\) of the household is less than the household one month’s income. Using this definition for contribution, about 46.2% of the households is considered to be liquidity constrained. An alternative definition of liquidity constraint is such that a household is defined to be liquidity constraint if the total net wealth of the household is less than the household one month’s income. Using this definition for contribution, about 20.4% of the households is considered to be liquidity constrained. Note that total net wealth of the household includes the value of IRA accounts. Therefore, this definition would mitigate a potential reverse causation problem. If the value of IRA accounts were not included in the definition to total net wealth, those households that have contributed in the past would have less net wealth outside the IRAs, which would make them more likely to be considered liquidity constrained.

Table 1.1 provides selected summary statistics on contributions to IRAs, liquidity constraints, and other financial and demographic variables from the PSID panel data. Across the most recent five waves of PSID data, there are 12,284 unique households and 34,816 observations in which a unit of observation is a household surveyed in a given year. On average, this sample has information on the same household in about three distinct points of time.

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\(^2\) Liquid asset is defined as the aggregate market value of all checking or savings accounts, money market funds, certificates of deposit, government savings bonds, treasury bills, shares of stock in publicly held corporations, mutual funds, or investment trusts, bond funds, and cash value in a life insurance policy, not including assets held in employer-based pensions or IRAs.
1.6 Methodology

The estimating equation is

\[ Y_{it} = \alpha + \beta \text{Constrained}_{it} + X_{it}\Omega + \delta_i + \lambda_t + \eta_{it} \]

where \( i \) denotes the household and \( t \) denotes the year. \( Y_{it} \) is an indicator variable of whether a household \( i \) in year \( t \) made at least one contribution to an IRA account in the last two years (i.e. between \( t-2 \) and \( t \)). \( \text{Constrained}_{it} \) is an indicator variable of whether a household \( i \) in year \( t \) is liquidity constrained for the last year. \( X_{it} \) is a set of demographic and economic characteristics. \( \delta_i \) and \( \lambda_t \) are household and year fixed effects respectively.

The identification of this estimating equation is coming from the variation in the changes of the liquidity constraint status of the same households over time. Since the sampling time period is 2003 to 2011, it covers the Great Recession in which some households that are not liquidity constrained before the financial crisis suddenly becomes liquidity constrained.

1.7 Results

1.7.1 Baseline results

To be eligible to contribute to an IRA, an individual must have positive amount of income from wages or salaries. As a result, this paper only focuses on those households who are eligible to contribute (by dropping about 27\% of the households that had no income from wages or salaries). This procedure guarantees that every household in the remaining sample must be eligible to contribute to an IRA.
Table 1.2 presents the baseline estimates of the effect of liquidity constraint on making contributions to IRA accounts. The set of controls include whether the households already have IRA accounts, the head of household’s age, race, marital status, education level, and the household’s income.

Specification (1) does not use any household or time fixed effect. The coefficient of liquidity constraint is negative and statistically significant at the 1% level. On average, households that are liquidity constraint are 9.2% less likely to make at least one contribution in a two year periods. However, we may worry that there are possibly fixed households characteristics, such as financial education, that are biasing the results. Therefore, specification (2) adds household fixed effect. The coefficient of liquidity constraint is still negative and statistically significant at the 1% level, but now on average, households that are liquidity constraint are 3.1% less likely to make at least one contribution in a two year periods. Specification (3) and specification (4) add time trend and year fixed effects respectively, and the coefficients of liquidity constraint remain stable. Finally, specification (5) add in more demographic and employment controls, including the gender of the head of the household, the composition of the family structure (number of adults and number of children in the households), the employment status of the head of the household, and the living condition of the household (whether the household owns the home or whether it rents). The coefficient of liquidity constraint stays about the same: on average, households that are liquidity constraint are 3.1% less likely to make at least one contribution in a two year periods. Table 1.3 presents the estimates using the alternative definition of
liquidity constraint – net wealth less than one month’s income – and the results are similar.

1.7.2 Robustness

Between the year 2003 and 2011, the contribution limit is $5000 per year for each individual. Yet, not every individual may be allowed under law to contribute up to $5000 because one is not legally allowed to contribute more than one’s labor income. In other words, someone who only earns $1000 of wages or salaries can only contribute up to $1000, regardless of whether he/she is not liquidity constrained and would like to borrow $4000 to contribute. Table 1.4 is the same as table 1.2 except it drops households that cannot legally contribute at the maximum limit of $5000. The coefficients of liquidity constraint are again consistent with those in table 1.2.

The marginal tax rate significantly determines the benefit of contribution to IRAs. For example, households those owe little or no income tax in any given year would have much smaller IRAs tax benefits compared to households in the top marginal tax bracket. After all, tax avoidance should be of interest only for households those owe taxes. Given that tax rate is sufficiently non-linear compared to the control variable in income, it is of interest to compute the marginal tax rates for each household.

Using the NBER TAXSIM program, I calculate the federal and state tax liabilities as well as the marginal tax rate for each household in each year. As expected, households those have higher marginal tax rates are more likely to
contribute to IRAs (figure 1.2). However, the marginal tax rate does not seem to affect IRA contribution after conditional on income (table 1.5), and the coefficients on the liquidity constraint variable remain the same.

In addition to the marginal tax rate, there are other potential factors that may affect IRA contribution. For example, workers who were covered by a qualified employment-based retirement plan were restricted from contributing to an IRA when it was first introduced, though that restriction was lifted in 1981 by the Economic Recovery Tax Act. If people have outdated beliefs in the eligibility of IRA contributions, those with employment-based retirement plan would systematically less likely to contribute.

For traditional IRA, there is an income limit such that households with income above the limit would face a phase-out of the traditional IRA tax deduction, thus reducing the attraction to contributing to traditional IRA. On the other hand, those households above the income limit in the current year would face high marginal tax rate in the current year, and thus the tax-deferral benefits are large.

For the Roth IRA, there is an income limit such that households with income above the limit would face a phase-out of eligibility to contribution. However in practice, high income households above the income limit can mostly circumvent the restriction by making a nondeductible traditional IRA contribution and immediately converting a traditional IRA to a Roth IRA.

Table 1.6 attempts to control for these three potential factors that may affect IRA contribution. The effects of these three factors are small and not statistically
significant, especially when household fixed effect is included. The effect of liquidity constraint on IRA contribution remains the same and is robust to these three factors.

1.7.3 Other measure of liquidity constraint

The two measures of liquidity constraint, liquid asset less than one month’s income and net wealth less than one month’s income, are imperfect proxies of liquidity constraint. As discussed by Jappelli, Pischke, and Souleles (1998), there are drawbacks to defining liquidity constraint status by splitting the sample on the basis of wealth and income. First, there is not necessarily a monotonic relationship between wealth and liquidity constraint. Households those have no or negative net wealth may possibly be taking out their optimal, unconstrained amount of debt. Second, income and wealth information in survey data is likely to have measurement errors. As a result, households those are classified as liquidity constrained are likely to be contaminated by the presence of unconstrained households, and vice versa. Because these errors would reduce the power of the statistical tests and move the coefficients closer to zero, the true effect of liquidity constraint on IRA contribution is potentially even higher than the results shown earlier.

Unfortunately, the Panel Study of Income Dynamics data set does not have any direct measure of liquidity constraint. The Survey of Consumer Finance (SCF), however, has better information to directly measure liquidity constraint status. Using the SCF, I define a household to be “turned down for loan” if it gave an affirmative answer to the following question: "In the past few years has a particular lender or
creditor turned down any request you (or your husband/wife) made for credit or have you been unable to get as much credit as you applied for?” I also define households to be “turned down for loan” for those “discouraged borrowers,” that is, households who reported an affirmative answer to the question: "Was there any time in the past few years that you (or your husband/wife) thought of applying for credit at a particular place but changed your mind because you thought you might be turned down?"

Finally, the group of liquidity constrained households who reapplied for loans and received the desired amount is not considered to be “turned down for loan”. Using this definition of “turned down for loan” to proxy for liquidity constraint, 26.22% of households in the 2010 Survey of Consumer Finance are considered to be liquidity constrained.

Though the SCF has better information to measure liquidity constraint status, it regrettably does not have IRA contribution information. Therefore, the empirical strategy is to impute the likelihood of liquidity constraint status in the PSID sample using the information in the SCF. Both the PSID and SCF contain many demographics, education, income, and employment variables that are consistent across the two data sets, and many of these variables can be used to predict whether the households are likely to be “turned down for loan.” Columns 1 and 2 in table 1.7 show the sample means of these variables. The means in the two data sets are fairly similar. This is comforting since we would want the two samples to originate from the same population. Column 3 compares the sample means for households those are “turned down for loan.” Households those are “turned down for loan” typically are younger,
are not married, are black, have many children, have lower education status, earn lower income, and are not homeowners.

Table 1.8 shows the estimates to predict liquidity constraint status using the SCF. Many of the demographics, education, income, and employment variables are highly statistically significant in predicting whether a household is “turned down for loan,” and the F-stat is at a comfortably high level of 289. The coefficients in this estimation are then used to generate predicted probabilities of “turned down for loan” in the PSID sample.

Among the top quartile of households that has the highest predicted probability of being liquidity constrained, the IRA contribution rate is 2.8%. The next two quartiles have IRA contribution rates of 6.6% and 13.8% respectively. The lowest quartile of households, which has the lowest predicted probability of being liquidity constrained, has an IRA contribution rate of 32.9%.

1.8 Conclusion

Contribution rates to Individual Retirement Accounts are very low, despite the economic theory’s prediction that people should contribute up to the statutory limit as long as they are eligible. Current literature has tried to explain the low contribution rates as a result of self-control or financial illiteracy. While self-control or financial illiteracy can explain why some people never contribute, they cannot satisfactorily justify why many individuals contribute in some years but not in other years. Using panel data to follow the same households over time and exploiting the changes in
liquidity constraint status over time within the same households, this paper finds evidence that liquidity constraint can be one factor that explains the low contribution rates to IRAs. Under the baseline specification, households those are liquidity constrained (proxied by liquid asset less than one month’s income) are about 3.1% less likely to contribute than households those are not liquidity constrained, out of a baseline contribution rate of 17.2%.

Further research may reevaluate the welfare benefits of IRA accounts. Under the theory in the existing literature that every individual contributes the maximum eligible amounts, IRA accounts should have high welfare benefits because even those who are very poor (and thus have high marginal utility to the retirement income from IRA accounts) would contribute as much as possible and enjoy the tax benefits. Yet, findings in this study shows that liquidity constrained individuals are very unlikely to make contributions, and those who are liquidity constrained also tend to be the very poor. Thus the actual welfare benefits of IRA accounts may be very different from what is predicted in the theory.

Acknowledgement: Chapter 1, in full, is currently being prepared for submission for publication of the material. Wong, Boris. The dissertation author was the sole author of this material.
Figure 1.1: IRA account and contribution rate from 2003 to 2011 using the PSID

Note: Data are from the most recent five waves of PSID (2003, 2005, 2007, 2009, and 2011). Observations are adjusted by the sample weights to obtain a nationally representative sample. The blue line plots the percentage of household who reported having at least one IRA account or private annuity. The green line plots the percentage of household who reported making at least one contribution to an IRA account or private annuity in the last two years. The PSID does not separate out IRA account and private annuity account. Yet after cross-referencing with the Survey of Consumer Financial data set, very small fraction of the population would have private annuity but not IRA.
Figure 1.2: IRA contribution rate by marginal tax rate

Note: Marginal tax rate equals to the sum of the marginal federal tax rate and the marginal state tax rate. The 0th to 25th percentiles include households with marginal tax rate less than 17.51%. The 25th to 50th percentiles include households with marginal tax rate between 17.51% and 21.85%. The 50th to 75th percentiles include households with marginal tax rate between 21.85% and 30.87%. The 75th to 100th percentiles include households with marginal tax rate more than 30.87%. 

Table 1.1: Selected summary statistics (12284 households)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Obs</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contribution</td>
<td>34813</td>
<td>0.145</td>
<td>0.352</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Liquid asset less than 1 month's income</td>
<td>34813</td>
<td>0.462</td>
<td>0.499</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Net wealth less than 1 month's income</td>
<td>34813</td>
<td>0.204</td>
<td>0.403</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Have IRA account</td>
<td>30198</td>
<td>0.349</td>
<td>0.477</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Age</td>
<td>34813</td>
<td>50.1</td>
<td>16.8</td>
<td>16</td>
<td>98</td>
</tr>
<tr>
<td>Married</td>
<td>34813</td>
<td>0.499</td>
<td>0.500</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Divorced</td>
<td>34813</td>
<td>0.166</td>
<td>0.372</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Black</td>
<td>34813</td>
<td>0.143</td>
<td>0.350</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Male Head</td>
<td>34813</td>
<td>0.708</td>
<td>0.455</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>No High School diploma</td>
<td>34813</td>
<td>0.089</td>
<td>0.284</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>High School graduate</td>
<td>34813</td>
<td>0.365</td>
<td>0.481</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Some College</td>
<td>34813</td>
<td>0.230</td>
<td>0.421</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Four or more years in college</td>
<td>34813</td>
<td>0.169</td>
<td>0.375</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Post Graduate</td>
<td>34813</td>
<td>0.111</td>
<td>0.314</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Income</td>
<td>34813</td>
<td>70,888</td>
<td>104,689</td>
<td>0</td>
<td>6,317,099</td>
</tr>
<tr>
<td>Net Wealth</td>
<td>34813</td>
<td>342,428</td>
<td>1,555,773</td>
<td>-2.7E+06</td>
<td>1.00E+08</td>
</tr>
<tr>
<td>Head Employed</td>
<td>34813</td>
<td>0.684</td>
<td>0.465</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Home owner</td>
<td>34813</td>
<td>0.651</td>
<td>0.477</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>
Table 1.2: Baseline estimates

<table>
<thead>
<tr>
<th>Contribution to IRA</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liquid asset less than 1 month's income</td>
<td>-0.092</td>
<td>-0.031</td>
<td>-0.031</td>
<td>-0.031</td>
<td>-0.031</td>
</tr>
<tr>
<td>Have IRA account</td>
<td>0.246</td>
<td>0.007</td>
<td>0.007</td>
<td>0.007</td>
<td>0.007</td>
</tr>
<tr>
<td>Income (log)</td>
<td>0.043</td>
<td>0.036</td>
<td>0.036</td>
<td>0.036</td>
<td>0.039</td>
</tr>
<tr>
<td>Age</td>
<td>0.008</td>
<td>0.008</td>
<td>0.019</td>
<td>0.019</td>
<td>0.020</td>
</tr>
<tr>
<td>Age Squared/100</td>
<td>-0.009</td>
<td>-0.013</td>
<td>-0.013</td>
<td>-0.013</td>
<td>-0.015</td>
</tr>
</tbody>
</table>

Household Fixed Effect: X X X X X
Time Trend: X
Year Fixed Effect: X X
More Demographic and Employment controls: X
Observations: 25602 25602 25602 25602 25602
Households: 7125 7125 7125 7125 7125

* significant at 10%, ** significant at 5%, ***significant at 1%
Table 1.3: Baseline estimates – alternative definition of liquidity constraint

<table>
<thead>
<tr>
<th>Contribution to IRA</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net Wealth less than 1 month's income</td>
<td>-0.052</td>
<td>-0.034</td>
<td>-0.034</td>
<td>-0.033</td>
<td>-0.036</td>
</tr>
<tr>
<td>Have IRA account</td>
<td>0.262</td>
<td>0.007</td>
<td>0.007</td>
<td>0.007</td>
<td>0.007</td>
</tr>
<tr>
<td>Income (log)</td>
<td>0.045</td>
<td>0.034</td>
<td>0.034</td>
<td>0.034</td>
<td>0.037</td>
</tr>
<tr>
<td>Age</td>
<td>0.007</td>
<td>0.008</td>
<td>0.019</td>
<td>0.019</td>
<td>0.021</td>
</tr>
<tr>
<td>Age Squared/100</td>
<td>-0.007</td>
<td>-0.014</td>
<td>-0.014</td>
<td>-0.014</td>
<td>-0.015</td>
</tr>
<tr>
<td>Household Fixed Effect</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Time Trend</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year Fixed Effect</td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>More Demographic and Employment controls</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>25602</td>
<td>25602</td>
<td>25602</td>
<td>25602</td>
<td>25602</td>
</tr>
<tr>
<td>Households</td>
<td>7125</td>
<td>7125</td>
<td>7125</td>
<td>7125</td>
<td>7125</td>
</tr>
</tbody>
</table>

* significant at 10%, ** significant at 5%, ***significant at 1%
## Table 1.4: Samples who can contribute the maximum amount

<table>
<thead>
<tr>
<th>Contribution to IRA</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liquid asset less than 1 month's income</td>
<td>-0.092 (0.006)***</td>
<td>-0.031 (0.008)***</td>
<td>-0.031 (0.008)***</td>
<td>-0.031 (0.008)***</td>
<td>-0.031 (0.008)***</td>
</tr>
<tr>
<td>Have IRA account</td>
<td>0.250 (0.008)***</td>
<td>0.003 (0.011)</td>
<td>0.003 (0.011)</td>
<td>0.003 (0.011)</td>
<td>0.002 (0.011)</td>
</tr>
<tr>
<td>Income (log)</td>
<td>0.049 (0.004)***</td>
<td>0.041 (0.008)***</td>
<td>0.041 (0.008)***</td>
<td>0.04 (0.008)***</td>
<td>0.044 (0.008)***</td>
</tr>
<tr>
<td>Age</td>
<td>0.006 (0.001)***</td>
<td>0.008 (0.004)*</td>
<td>0.016 (0.012)</td>
<td>0.016 (0.012)</td>
<td>0.018 (0.012)</td>
</tr>
<tr>
<td>Age Squared/100</td>
<td>-0.006 (0.001)***</td>
<td>-0.014 (0.005)***</td>
<td>-0.014 (0.005)***</td>
<td>-0.014 (0.005)***</td>
<td>-0.015 (0.005)***</td>
</tr>
<tr>
<td>Household Fixed Effect</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Time Trend</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year Fixed Effect</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>More Demographic and Employment controls</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>24597</td>
<td>24597</td>
<td>24597</td>
<td>24597</td>
<td>24597</td>
</tr>
<tr>
<td>Households</td>
<td>6895</td>
<td>6895</td>
<td>6895</td>
<td>6895</td>
<td>6895</td>
</tr>
</tbody>
</table>

* significant at 10%, ** significant at 5%, ***significant at 1%
### Table 1.5: Marginal tax rate from Taxsim

<table>
<thead>
<tr>
<th>Contribution to IRA</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liquid asset less than 1 month's income</td>
<td>-0.092</td>
<td>-0.031</td>
<td>-0.031</td>
<td>-0.031</td>
<td>-0.031</td>
</tr>
<tr>
<td></td>
<td>(0.006)***</td>
<td>(0.008)***</td>
<td>(0.008)***</td>
<td>(0.008)***</td>
<td>(0.008)***</td>
</tr>
<tr>
<td>Marginal tax rate (%)</td>
<td>0.0001</td>
<td>-0.0003</td>
<td>-0.0003</td>
<td>-0.0003</td>
<td>-0.0003</td>
</tr>
<tr>
<td></td>
<td>(0.0002)</td>
<td>(0.0002)</td>
<td>(0.0002)</td>
<td>(0.0002)</td>
<td>(0.0002)</td>
</tr>
<tr>
<td>Have IRA account</td>
<td>0.246</td>
<td>0.007</td>
<td>0.007</td>
<td>0.007</td>
<td>0.007</td>
</tr>
<tr>
<td></td>
<td>(0.008)***</td>
<td>(0.011)</td>
<td>(0.011)</td>
<td>(0.011)</td>
<td>(0.011)</td>
</tr>
<tr>
<td>Income (log)</td>
<td>0.041</td>
<td>0.039</td>
<td>0.039</td>
<td>0.039</td>
<td>0.042</td>
</tr>
<tr>
<td></td>
<td>(0.005)***</td>
<td>(0.008)***</td>
<td>(0.008)***</td>
<td>(0.008)***</td>
<td>(0.008)***</td>
</tr>
</tbody>
</table>

- Household Fixed Effect          | X         | X         | X         | X         |          |
- Time Trend                      | X         |           |           |           |          |
- Year Fixed Effect               |           | X         | X         |           |          |
- More Demographic and            |           |           |           | X         |          |
  Employment controls             |           |           |           |           |          |
- Observations                    | 25602     | 25602     | 25602     | 25602     | 25602     |
- Households                      | 7125      | 7125      | 7125      | 7125      | 7125      |

* * significant at 10%, ** significant at 5%, ***significant at 1%
Table 1.6: Robustness Check

<table>
<thead>
<tr>
<th>Contribution to IRA</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liquid asset less than 1 month's income</td>
<td>-0.090</td>
<td>-0.031</td>
<td>-0.031</td>
<td>-0.031</td>
<td>-0.031</td>
</tr>
<tr>
<td>Pension</td>
<td>-0.012</td>
<td>-0.009</td>
<td>-0.009</td>
<td>-0.010</td>
<td>-0.006</td>
</tr>
<tr>
<td>Traditional IRA deduction phase-out</td>
<td>0.037</td>
<td>0.012</td>
<td>0.012</td>
<td>0.013</td>
<td>0.012</td>
</tr>
<tr>
<td>Roth IRA contribution phase-out</td>
<td>-0.019</td>
<td>-0.002</td>
<td>-0.002</td>
<td>-0.003</td>
<td>-0.004</td>
</tr>
<tr>
<td>Marginal tax rate (%)</td>
<td>0.0001</td>
<td>-0.0003</td>
<td>-0.0003</td>
<td>-0.0003</td>
<td>-0.0003</td>
</tr>
<tr>
<td>Household Fixed Effect</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Time Trend</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year Fixed Effect</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>More Demographic and Employment controls</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>25602</td>
<td>25602</td>
<td>25602</td>
<td>25602</td>
<td>25602</td>
</tr>
<tr>
<td>Households</td>
<td>7125</td>
<td>7125</td>
<td>7125</td>
<td>7125</td>
<td>7125</td>
</tr>
</tbody>
</table>

* significant at 10%, ** significant at 5%, *** significant at 1%

**Pension** is an indicator variable that equals 1 if the head of household participates in a pension or retirement plan through his/her present job, or through his/her union.

**Traditional IRA deduction phase-out** is an indicator variable that equals 1 if the household has an adjusted gross income high enough such that the deduction tax benefit of Traditional IRA is phasing out or has phased out.

**Roth IRA contribution phase-out** is an indicator variable that equals 1 if the household has an adjusted gross income high enough such that the eligible Roth IRA contribution amount is phasing out or has phased out.
Table 1.7: Sample Means

<table>
<thead>
<tr>
<th></th>
<th>PSID</th>
<th>SCF Full Sample</th>
<th>SCF Turned Down for Loan</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Variables</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Demographics</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age of Head</td>
<td>51.2</td>
<td>50.5</td>
<td>43.5</td>
</tr>
<tr>
<td>Married</td>
<td>0.456</td>
<td>0.503</td>
<td>0.409</td>
</tr>
<tr>
<td>Divorced</td>
<td>0.176</td>
<td>0.141</td>
<td>0.182</td>
</tr>
<tr>
<td>Black</td>
<td>0.150</td>
<td>0.138</td>
<td>0.221</td>
</tr>
<tr>
<td>Male Head</td>
<td>0.680</td>
<td>0.729</td>
<td>0.680</td>
</tr>
<tr>
<td>One Adult</td>
<td>0.430</td>
<td>0.379</td>
<td>0.411</td>
</tr>
<tr>
<td>Two Adults</td>
<td>0.466</td>
<td>0.518</td>
<td>0.474</td>
</tr>
<tr>
<td>Three or more Adults</td>
<td>0.104</td>
<td>0.103</td>
<td>0.114</td>
</tr>
<tr>
<td>No Child</td>
<td>0.723</td>
<td>0.647</td>
<td>0.528</td>
</tr>
<tr>
<td>One Child</td>
<td>0.118</td>
<td>0.146</td>
<td>0.183</td>
</tr>
<tr>
<td>Two Children</td>
<td>0.104</td>
<td>0.123</td>
<td>0.163</td>
</tr>
<tr>
<td>Three or more Children</td>
<td>0.055</td>
<td>0.084</td>
<td>0.127</td>
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<tr>
<td><strong>Schooling</strong></td>
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<td></td>
</tr>
<tr>
<td>Less than High School</td>
<td>0.088</td>
<td>0.120</td>
<td>0.135</td>
</tr>
<tr>
<td>High school graduate</td>
<td>0.361</td>
<td>0.322</td>
<td>0.362</td>
</tr>
<tr>
<td>Some College</td>
<td>0.234</td>
<td>0.238</td>
<td>0.280</td>
</tr>
<tr>
<td>Four or more years in college</td>
<td>0.173</td>
<td>0.189</td>
<td>0.156</td>
</tr>
<tr>
<td>Post Graduate</td>
<td>0.108</td>
<td>0.115</td>
<td>0.056</td>
</tr>
<tr>
<td><strong>Income and Employment</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Income</td>
<td>69,466</td>
<td>76,056</td>
<td>48,703</td>
</tr>
<tr>
<td>Head Employed</td>
<td>0.625</td>
<td>0.636</td>
<td>0.694</td>
</tr>
<tr>
<td>Homeowner</td>
<td>0.604</td>
<td>0.601</td>
<td>0.434</td>
</tr>
<tr>
<td>Number of observations</td>
<td>8,907</td>
<td>32,410</td>
<td>7,983</td>
</tr>
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Table 1.8: Estimates to predict liquidity constraint status using the SCF

<table>
<thead>
<tr>
<th></th>
<th>Turned Down for Loan</th>
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<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Coefficient</td>
<td>Standard Error</td>
<td></td>
</tr>
<tr>
<td>Have IRA account</td>
<td>-0.111***</td>
<td>0.006</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>0.006***</td>
<td>0.001</td>
<td></td>
</tr>
<tr>
<td>Age Squared</td>
<td>-0.000***</td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td>Male Head</td>
<td>-0.027***</td>
<td>0.008</td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>-0.056***</td>
<td>0.010</td>
<td></td>
</tr>
<tr>
<td>Divorced</td>
<td>0.054***</td>
<td>0.009</td>
<td></td>
</tr>
<tr>
<td>Two Adults</td>
<td>0.067***</td>
<td>0.010</td>
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<tr>
<td>Three or more Adults</td>
<td>0.113***</td>
<td>0.013</td>
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</tr>
<tr>
<td>One Child</td>
<td>0.031***</td>
<td>0.008</td>
<td></td>
</tr>
<tr>
<td>Two Children</td>
<td>0.072***</td>
<td>0.009</td>
<td></td>
</tr>
<tr>
<td>Three or more Children</td>
<td>0.098***</td>
<td>0.011</td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>0.100***</td>
<td>0.009</td>
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<tr>
<td>High school graduate</td>
<td>0.019**</td>
<td>0.009</td>
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<td>Some College</td>
<td>0.030***</td>
<td>0.009</td>
<td></td>
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<tr>
<td>Four or more years in college</td>
<td>-0.006</td>
<td>0.010</td>
<td></td>
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<tr>
<td>Post Graduate</td>
<td>-0.028***</td>
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<tr>
<td>Log Income</td>
<td>0.240***</td>
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<tr>
<td>Log Income Squared</td>
<td>-0.013***</td>
<td>0.001</td>
<td></td>
</tr>
<tr>
<td>Head Employed</td>
<td>-0.009</td>
<td>0.007</td>
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</tr>
<tr>
<td>Homeowner</td>
<td>-0.091***</td>
<td>0.006</td>
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</tr>
<tr>
<td>Constant</td>
<td>0.852***</td>
<td>0.171</td>
<td></td>
</tr>
</tbody>
</table>

F-stat | 289.43
R-squared | 0.136
Observations | 31970
References


Chapter 2

Formal Sector Labor Supply Responses to the 2008 Chilean Pension System Reform

Abstract

Chile initiated a significant pension reform in 2008 that introduced a new disincentive to pension contribution for one subgroup of the population and drastically reduced simultaneously the disincentive to pension contribution for another subgroup. Since workers were allowed to avoid contributions by shifting to self-employment or the informal sector, there were concerns about how the reform might affect the formal sector labor supply. Using panel survey data and administrative social security data, I implemented a difference-in-differences design to measure the formal sector labor supply responses for the two affected subgroups. For individuals who should expect to face the new disincentive of a 29.4 percent implicit marginal tax rate, I showed that they were 3 percentage points less likely to be in formal sector employment after the reform. As for young people and individuals close to retirement, the formal sector labor supply responses were especially strong – decreases of 6.5 percentage points and
5.5 percentage points respectively. The other subgroup that faced a drastic drop from a 100 percent implicit marginal tax rate to 29.4 percent was 8.1 percentage points more likely to be in formal sector employment after the reform.

2.1 Introduction

Systematic research on labor supply responses to pension reform is useful for policy evaluation in the retirement arena. Chile’s pension system provides an interesting arena for research because its pioneering privatized system is considered by some to be a possible prototype of pension reform in the United States and elsewhere (Arenas de Mesa 2005; Arenas de Mesa et al. 2006; and Barr and Diamond, 2008). Since 1981, Chile’s formal sector workers have been required to contribute 10 percent of their wages to individual personal accounts that are managed by private sector pension fund providers called Administradoras de Fondos de Pensiones (AFPs). Workers have the freedom to choose the AFPs and the specific investment choices offered by the AFPs, and they have to preserve the funds within their individual personal accounts until their retirement ages.

Although these individual personal accounts and AFPs system work well in many respects, criticisms of its weak social safety net for those ineligible for the minimum guaranteed pension and low contribution rates outside the formal sector (Berstein et al. 2006; Gill et al. 2005; Kritzer et al. 2011) led to a major pension reform in 2008. The 2008 pension reform enriched the public pension benefits of many citizens. While the reform eliminated some perverse incentives to pension
contribution for a small subgroup of the population, it introduced a new disincentive to pension contribution for a different and much larger subgroup. This subgroup faced a jump in the implicit marginal tax rate on pension contributions from 0 percent to approximately 30 percent, giving this group an increased incentive to leave the formal sector and evade the tax. The former subgroup faced a drop in their implicit marginal tax rate from 100 percent to approximately 30 percent, which gave this group an increased incentive to work in the formal sector after the 2008 reform. Lastly, a sizable group of the population has remained unaffected by the pension reform. The uncovered sector of self-employed and informal jobs, which covers over 35 percent of the labor market in Chile, has no mandatory pension contribution. Thus, these changes in the incentives to pension contributions may significantly affect the formal sector labor supply. Exploiting the pension reform’s differential impact on the relative attractiveness of the formal sector jobs and the uncovered sector jobs for different subgroups of the population, this paper evaluates the shift in the labor market between the formal sector and the uncovered sector.

This study contributes to the literature in several ways. In economics, an extensive literature evaluates how policy changes affect the labor supply (Gruber 1996; Elissa and Hoynes 2006; Ardington, Case, and Hosegood 2009; Mastrobuoni 2009). In contrast to the existing literature, which focuses mainly on the extensive margin of entering or exiting the labor force and the intensive margin of the number of hours worked, I examine the shift between formal sector jobs and uncovered sector jobs. Moreover, this study adds to the literature on Chile’s pioneering privatized
pension system. Whereas many existing studies examine aggregate and macroeconomic information to study the pension system in Chile, this paper examines new household survey data that are linked to Social Security records. My findings are most related to those of Behrman et al. (2011), who find that the 2008 reform produced modest gains in household annual income and expenditures on basic consumption for poor targeted households, and Attanasio, Meghir, and Otero (2011), who find that the 2008 pension reform increased pension wealth at retirement and slightly lowered aggregate formal labor market participation. However, neither of these studies examines the separate formal sector labor responses that occur in subgroups that experience different changes in incentives. My paper looks at how two subgroups of the population that have opposite incentives make the choice between the formal sector and the uncovered sector: one group faces a new disincentive to work in the formal sector subsequent to the 2008 reform while the other faces a significant drop in disincentive to work in the formal sector.

I find that people who should expect to face the 30 percent jump in the implicit marginal tax rate are about three percentage points less likely to be engaged in formal sector employment after the reform. This result is particularly strong among individuals who are aware of the changes introduced by the 2008 reform, and this provides evidence that people actively switch away from the formal sector to evade the jump in implicit marginal tax rate. Those who should expect to face a drop in the implicit marginal tax rate from 100 percent to 30 percent are about eight percentage points more likely to be in the formal sector employment after the reform, although
this figure cannot be precisely estimated because of the small number of individuals encountering this incentive. Furthermore, I find very different results across different age groups. The formal sector labor supply responses are the strongest among the young, for whom the cost of switching between the formal sector and the uncovered sector is low and who have many remaining working years to benefit from the switch. This effect is also slightly stronger among people who are close to retirement age, whereas among those aged 40 and 54, who are in the prime working years, there is no effect.

The rest of this paper proceeds as follows. Section II provides a brief overview of the Chilean pension system and its 2008 reform. Section III describes the data. Section IV provides the methodology and presents the results, and Section V concludes.

2.2 Background

2.2.1 Before the 2008 Pension Reform

In 1981, Chile replaced its traditional pay-as-you-go system with a fully funded individual personal account system run by private sector pension funds. Since 1981, formal labor market workers are required to contribute 10 percent of their wages to a personal retirement account plus 2 to 3 percent of their wages for administrative fees and disability and survivors’ insurance. Upon retirement, workers must convert their accumulations into an annuity or set up programmed withdrawals; most retirees
select the annuity options. Men and women can start receiving pensions and stop contributing at age 65 and 60, respectively.

While the individual personal account system had much strength, there were a number of problems that necessitated another major pension reform in 2008. First, many individuals did not participate in the system or they contributed infrequently because only formal sector workers were required to contribute. Therefore, many workers who spent some or most years in self-employment or in the informal sector gained inadequate pensions. Second, the government guaranteed an old-age minimum pension to all workers who contributed for 20 years or more. Unfortunately, the old-age minimum pension guarantee offered no benefit to most workers since many of them could never accumulate 20 years of contributions. Furthermore, it discouraged low-wage workers from working because once they met the 20 years eligibility further contributions only displaced the government benefits. In other words, those workers faced a 100 percent implicit marginal tax rate on their pension contributions. Third, the means-tested benefits for non-contributors, called Pension Asistencia (PASIS) and funded from general revenue, provided meager benefits (about 12 percent of the average wage). The budget constraint of the program also led to waiting lists that caused some eligible persons to not receive benefits. Moreover, workers who had made small irregular contributions had to exhaust their personal account to become eligible for PASIS, implying a 100 percent implicit tax rate on their pension contributions.
2.2.2 After the 2008 Pension Reform

These problems with the individual personal account system led to the 2008 Chilean pension reform, which introduced the dual means test. On the one hand, eligibility for the public benefit was limited to individuals in households deemed to be among the poorest 60 percent of the population, as measured by the poverty score “Ficha de Proteccion Social.” The actual implementation, however, was divided into stages: only the poorest 40 percent would be entitled to public benefit in 2008; the program would expand to the poorest 45 percent in 2009, to 50 percent in 2010, and, finally, to 60 percent in 2012. On the other hand, higher payouts from the individual personal account led to lower amounts of public benefits. For pension non-contributors, the 2008 pension reform replaced the Pension Asistencial (PASIS), which was a benefit paid to low-income individuals who were either disabled or over the age of 65 and did not qualify for any other type of pension, with Pension Basica Solidaria (PBS). The PBS benefit (approximately $125 per month) is about 55 percent greater than PASIS, which is paid to all residents over age 65 who have no pension and live in households in the bottom three-fifth of the population. The PBS almost doubled the benefit coverage of pension non-contributors, thus causing many non-contributors to suddenly be eligible for benefits. As for pension contributors, the 2008 pension reform replaced the old-age minimum pension guarantee, which guaranteed a monthly pension payout of about $160 to individuals who had at least 20 years of pension contributions, with the Aporte Previsional Solidario (APS), which was a new pension supplement that went to individuals in the bottom three-fifths of households.
whose self-funded pensions fell below $425 a month, regardless of the number of years of contributions.

2.2.3 Summary of major changes included in the 2008 Pension Reform

2.2.3.1 Graphical Summary

Figure 2.1 plots the relationship between the total monthly pension (including individual accounts and public benefits) and the monthly pension that is supported only by the individual accounts. As mandated by the 2008 pension reform, people who receive higher payouts from the individual accounts receive lower amounts of public benefits. For example, pension non-contributors would receive $125 per month ($0 from the individual account and $125 from PBS). The APS supplement for pension contributors has the following benefit formula:

\[
\text{APS benefit} = 125 - 0.294 \times \text{Monthly pension payment from the individual accounts}
\]

Accordingly, the APS benefit phases out as the monthly pension payment from the individual account increases. As the latter reaches around $425, the APS benefit completely phases out and the total monthly pension simply equates to the monthly pension supported by the individual accounts.

Consider a graphical representation similar to Figure 1 of Joubert (2015). Figure 2.2 plots the relationship between the monthly pension and the number of years of pension contribution. The two black lines plot the monthly pension payment
supported by only the individual accounts (ignoring the public benefits) for high-wage and low-wage individuals. Both lines have positive slopes because the monthly pension amount should increase as the number of years of pension contribution rises. Since high-wage individuals make larger pension contributions per year, they should have higher pension amounts than low-wage individuals for any given positive number of years of contribution. Thus, the high-wage line is more steeply sloped than the low-wage line.

The yellow dot and line in Figure 2.2 represent public benefits offered prior to the 2008 pension reform. The yellow dot denotes PASIS, which is a $80 public benefit given to retirees who have no individual accounts; the budget constraint of the PASIS program necessitated that not all eligible retirees could receive the benefit. The yellow line indicates the minimum pension guarantee, which is a public benefit of approximately $160 given to retirees who have worked in the formal sector and have been making pension contributions for at least twenty years. The minimum pension guarantee generates a strong and sharp incentive effect on the formal sector labor supply around the twenty-year threshold for low-wage individuals. High-wage individuals are not affected by the minimum pension guarantee because when they reach the twenty-year threshold their pension benefits are already higher than the $160 minimum pension guarantee benefit. As for low-wage individuals, there is a strong incentive to work in the formal sector when the number of years of contribution is just short of twenty because once they reach the twenty-year threshold they can earn a significant jump of retirement benefits. In contrast, there is a huge disincentive (a 100
percent implicit marginal tax rate) for individuals to work in the formal sector immediately after they satisfy the 20-year requirement: when they work in the formal sector they must make the mandatory pension contributions even though their contributions cannot increase their pension payments. This disincentive is only eliminated after the low wage line moves above the minimum pension guarantee level, which may require many to work beyond thirty years in the formal sector. As noted below, this group of individuals, who faced the 100 percent implicit marginal tax rate on pension contribution prior to the reform, became eight percentage points more likely to work in the formal sector after the 2008 pension reform, when the minimum pension guarantee was eliminated.

The green lines in Figure 2.2 represent public benefits offered after the 2008 pension reform. People who have no pension receive a PBS of about $125 per month. As the number of years of pension contribution increases, the total pension increases, too, although the benefits offered by the pension supplement (the vertical difference between the green line and the black line) phase out at a 29.4 percent rate. This continues until the monthly pension amount exceeds $425. As noted below, I find that this group, which, because of the 2008 pension reform, faces the new 29.4 percent implicit marginal tax rate on pension contributions, is three percentage points less likely to work in the formal sector after the reform.
2.2.3.2 Table Summary

Table 2.1 illustrates the 2008 pension reform changes to the implicit marginal tax rate to one additional dollar of monthly pension payout from the individual accounts of different subgroups of the population. For pension non-contributors, the implicit marginal tax rate for PASIS before the 2008 reform could be 0 percent or 100 percent because of the budget constraint of the program. Those who received PASIS faced a 100 percent implicit marginal tax rate because to receive a PASIS benefit they had to first exhaust their personal account. In contrast, those who did not receive PASIS because of the budget constraint of the program faced a 0 percent implicit marginal tax rate. As for a pension non-contributor after the 2008 reform, the marginal effect of a pension contribution was losing the PBS but gaining the pension supplement (APS) instead. Using the APS benefit formula provided in equation (1), the implicit marginal tax rate is calculated to be 29.4 percent (Figure 2.1).

Prior to the 2008 pension reform, pension contributors who received a monthly pension payout from the individual accounts of between $0 and the minimum pension guarantee were not eligible for PASIS and, thus, they faced a 0 percent marginal implicit tax rate for PASIS. The marginal implicit tax rate for the minimum pension guarantee depended on the number of years of pension contributions. It was close to zero for those who had a few years of contribution and it was negative for those who had close to 20 years of contribution (because they would face a discrete jump of pension payment once they reached the 20-year threshold). The rate was 100 percent for those who had more than 20 years (because further contributions only displaced
the government benefit). Following the 2008 pension reform, this subgroup of pension contributors all faced the 29.4 percent implicit marginal tax rate from the pension supplement phase-out.

Prior to the 2008 pension reform, pension contributors who received a monthly pension payout from the individual accounts above the minimum pension guarantee faced a 0 percent implicit marginal tax rate because they did not benefit from either PASIS or the minimum pension guarantee. Following the reform, those who received less than $425 in the monthly pension payout from the individual accounts still faced the 29.4 percent implicit marginal tax rate from the pension supplement (APS), whereas those above the $425 threshold were not eligible for APS benefits. Finally, according to the dual means test, households in the top two quintiles always have a 0 percent marginal implicit tax rate for every additional dollar of monthly pension payout from individual accounts because by law they are not eligible for public benefits PBS or APS.

The 2008 Chilean pension reform changes caused by the imposition of the implicit marginal tax rate on pension contribution can be broadly classified into three categories. First, individuals in the top two-fifths of households who have earned the average wage or more face an implicit marginal tax rate on pension contribution of zero both before and after the reform: before 2008, they had a pension above the minimum pension guarantee; after 2008, they fail to meet the means test for public benefit. Second, non-contributors who received PASIS and low-earning contributors who had more than 20 years of pension contribution and who were receiving the
minimum pension guarantee would have faced an implicit marginal tax rate on their pension contribution of 100 percent before 2008; after 2008 the rate was 29.4 percent. Third, non-contributors in the bottom three-fifths of households who did not receive PASIS as well as contributors who did not qualify for the minimum pension guarantee faced an implicit marginal tax rate on pension contribution of 0 percent before 2008 and 29.4 percent after 2008.

Given the prevalence of self-employment and informality in Chile’s labor market, the sharp changes in the implicit marginal tax rate on pension contribution created by the 2008 reform might encourage some subgroups of the population to become workers in the self-employed or uncovered sector, and these workers are not required to make pension contributions. More specifically, the group of individuals who in 2008 faced a 0 percent to 29.4 percent increase in their implicit marginal tax rate is expected to be more likely than other groups to exit the formal sector labor force after 2008. In contrast, another group of individuals experienced a huge reduction in the implicit marginal tax rate of their pension contributions, from 100 to 29.4 percent. It is likely that following the 2008 reform this group has worked more in the formal sector than other groups. This paper tests these behavioral responses empirically through analyses of data from the Chilean Social Protection Surveys, which is the largest panel household survey in Chile, and administrative Social Security record.
2.3 Data

2.3.1 Panel Survey Data

To analyze the near-term formal sector labor supply responses to the 2008 pension reform, this paper uses the Social Protection Survey (Encuesta de Protección Social, EPS). The largest longitudinal panel survey in Chile, the Social Protection Survey is a sample of about 16,000 respondents spread across all regions of the country. It has four survey waves (2002, 2004, 2006, 2009) plus a forthcoming fifth (2012) wave. The Microdata Center of the Universidad de Chile collected the data under the guidance of a University of Pennsylvania research team. This paper focuses on the 2009 wave of the survey, which contains a detailed work history for the period that runs from the beginning of 2006 to the end of 2009.

Table 2.2 presents the summary statistics for demographics, work, income, and other factors. The average age of the respondents is 50 years and 49 percent of them are male. In terms of educational attainment, 45 percent have no secondary school diploma, 26 percent are secondary school graduates, and the rest have an education attainment above secondary school. Approximately 69 percent of the respondents are affiliated with the personal account system. The poverty score “Ficha de Proteccion Social” (FPS) is a measure that determines the eligibility of public benefits after the 2008 pension reform. Only about 16 percent of the sample reports contain poverty score. About one in four has heard about the changes that were instituted in the 2008 Chilean pension reform. At the beginning of 2006, about 65 percent of the sample was working; 65 percent of that group worked in the formal
sector and, thus, contributed to personal accounts. In 2009, the percentages were 3 percent and 2 percent lower, respectively. The monthly median net income was 200,000 pesos, which based on 2009 exchange rate, converted to about US dollars 370. The monthly median total expenditures were 170,000 pesos, which converted to about US dollars 315.

2.3.2 Administrative Data

I was able to link 65 percent of the Social Protection Survey observations with administrative data from the pension system’s regulatory agency. The administrative data include information such as the individual account provider, the affiliation start date with the individual account provider, the account balance by type of investment funds, and the monthly taxable income history. Table 2.3 presents the relevant summary statistics of the administrative data. When workers make pension contributions, they can choose the private individual account provider and they can choose among five funds (Funds A-E) that vary in terms of their weights in equity investments. Table 2.4 summarizes the differences across the five funds: Fund A has the highest proportion in equity investment whereas fund E mainly invests in fixed income instruments. In addition to individual account balances by investment funds, the administrative data also allowed me to tabulate the number of years of pension contributions to the individual accounts. The average number of years of contribution is nine years, with the maximum at 28 years.
2.4 Estimates of Labor Supply Responses

2.4.1 Treatment Group I

For large sectors of the population the pension supplement (APS) introduced by the 2008 Chilean pension reform created a new disincentive to work in the formal sector because of the implicit marginal tax rate of 29.4 percent from the pension supplement phase-out. APS beneficiaries would receive only 70.6 cents worth of incremental total benefits from each dollar of contribution to their individual accounts. In this section I estimate the labor supply responses from the APS disincentive to work in the formal sector.

Unlike many studies of labor supply responses to policy changes and new public programs, this paper does not directly evaluate the differences in the labor supply responses of a typical treatment group (people who because of the pension reform experienced a jump of the implicit marginal tax rate from 0 percent to 29.4 percent) or a typical control group (people who faced a constant implicit marginal tax rate of 0 percent both before and after the reform). This is because like researchers, Chilean workers themselves do not know with certainty whether they will receive the APS benefits and thus incur the implicit marginal tax rate of 29.4 percent at retirement. The APS benefit, if eligible, is determined at retirement age, whereas the labor supply responses that this paper evaluates all occurred shortly after the 2008 pension reform. In other words, this paper studies the impact of the expectation, rather than the actual realization, of facing the 29.4 percent implicit marginal tax rate in the future on the current labor supply after the 2008 reform.
Treatment group I consists of people who would reasonably expect that the 2008 pension reform would change their implicit marginal tax rate from 0 percent to 29.4 percent upon retirement. The control group is defined as people who would reasonably expect that the 2008 pension reform would not affect their implicit marginal tax rate – that it would be 0 percent both before and after the 2008 reform.

For Chileans to face a jump in the implicit marginal tax rate from 0 percent to 29.4 percent because of the reform four requirements must be met. First, they must have individual personal accounts because they cannot get APS otherwise. Second, they must have worked fewer than twenty years in the formal sector; that is, they are not affected by the separate changes of incentive from the minimum pension guarantee. Third, the monthly pension payout from the individual personal accounts must be below the $425 level, at which point the pension supplement completely phases out. Fourth, they must meet the means test for public benefit, which is defined as the poorest 60 percent of the population measured by the poverty score “Ficha de Proteccion Social.” With regards to the first requirement, this paper restricts the analysis to those who have individual personal accounts. This restriction allows me to bypass the problem of the uncertainty of receiving PASIS before the 2008 pension reform. The second requirement restricts the treatment group to those who have less than twenty years of pension contribution. The third requirement is insignificant because practically every individual personal account in the poorest 60 percent of the population is below the $425 phase-out limit. Thus, virtually all individuals who have individual personal accounts in the poorest 60 percent of the population and who have
fewer than twenty years of pension contributions are subject to this new disincentive to work in the formal sector. This disincentive forces them to forfeit the value of 29.4 percent of their pension contribution.

Table 2.5 explicitly lists the pension benefits for treatment group I both before and after the 2008 reform. For this group the relative attractiveness of working in either the formal sector or the uncovered sector shifts after the reform towards the uncovered sector. After the reform, working in the formal sector loses its appeal because of the loss of the minimum pension guarantee benefit and the phase-out of the 29.4 percent pension supplement benefit for additional pension contributions.

Although the actual formula from which the FPS score is derived is not public information, it is known that the poverty score “Ficha de Proteccion Social” (FPS) is assigned to families based on actual and imputed potential income, health status, and family composition. In the Social Protection Survey (EPS), about 16 percent of all individuals report their FPS score. To proxy for everyone’s expectation of whether he/she would be classified as the poorest 60 percent at retirement, this paper estimates the predicted FPS score and it ranks predicted FPS scores within different age cohorts. The parameters to generate the predicted FPS scores are estimated from the following regression:

\[ FPS \; score_i = \alpha + \beta Age_i + \gamma Wages_i + \delta Consumption_i + \eta Health_i + \]
\[ \zeta Education_i + \xi Pension\_Account\_Balance_i + \nu_i \]  

(2)

To avoid endogeneity all the independent variables are values that date to before the 2008 pension reform. As expected, people who have a low poverty score
(FPS) tend to have low wages and consumption, perceive their health negatively, and have low levels of education and pension account balances. The coefficients are all statistically significant at the .01 level, with an R-squared of 0.23. For people who have non-missing FPS scores, the correlation between the actual and predicted FPS scores is 0.48. The predicted FPS scores are generated next, using these highly statistically significant parameters. People are proxied to hold the expectation that they will be classified as the poorest 60 percent if their predicted FPS scores are at the lower 60 percent relative to the predicted FPS scores of others of a similar age (no more than two years older or two years younger). Treatment group I consists of these people.

It is possible that upon retirement some people might not be among the poorest 60 percent and, thus, that they would not actually face the 29.4 percent implicit marginal tax rate. But this is not significant because even where it is the case, the 29.4 percent implicit marginal tax rate is realized after retirement, when it is probably too late to affect the labor supply. Thus, I do not assume that all those in the treatment group face the 29.4 percent implicit marginal tax rate upon retirement or that all those not in the treatment group do not. Instead, I assume that people form their decisions by comparing across people of ages similar to their own characteristics known to affect FPS scores, such as income, consumption, health status, and education level.
2.4.2 Baseline Results

As detailed in table 2.5, people in the first treatment group have faced disincentives to work in the formal sector labor force since the 2008 pension reform. To investigate the effect on the formal sector labor supply, I start with the difference-in-differences model with the individual fixed effect:

\[ Y_{it} = \alpha + \lambda Post_{it} + \beta (Treatment_i * Post_{it}) + c_i + \eta_{it} , \]  

where \( Y_{it} \) denotes whether person \( i \) in year \( t \) is in the formal sector labor force. \( Treatment_i \) is defined in three different versions. In version one, \( Treatment_i \) is a dummy variable that takes on value 1 if the predicted FPS score is at the lowest 60%. Even though the means tests of the 2008 pension reform was intended to limit eligibility for the public benefit to the poorest 60 percent of household (as measured by the FPS score), only the poorest 40 percent would be entitled to public benefit in 2008. That would expand to include the poorest 45 percent in 2009, the poorest 50 percent in 2010, and, finally, the poorest 60 percent in 2012. In version two, \( Treatment_i \) is a dummy variable that takes on value 1 if the predicted FPS score is at the lowest 40%. In version three, \( Treatment_i \) is a continuous variable defined in terms of the percentile ranks of the predicted FPS score: If \( Treatment_i \) is close to 1 the individual probably does not meet the means tests and thus is not subject to the new disincentive to the pension contribution. If \( Treatment_i \) is close to zero, the individual probably meets the means tests and thus faces the new disincentive to the pension contribution. \( Post_{it} \) is a dummy variable that takes on value 1 if the year is 2009 (after the reform) and zero if the year is 2006 (before the reform). \( c_i \) is the individual fixed
effect and \( \eta_i \) are the idiosyncratic errors. The estimate \( \beta \) measures the impact of the 2008 pension reform on the formal sector labor supply for people who should expect to face the new disincentive to pension contributions after the 2008 pension reform.

Because my dependent variable is binary (whether or not the individual works in the formal sector), I also included results from a conditional logit model that includes the individual fixed effect. Table 2.6 summarizes the findings.

Columns (1) – (3) present results from a linear difference-in-differences model that has the individual fixed effects; columns (4) – (6) present results from a conditional logit model that has the individual fixed effects. Column (1) shows that, in contrast to those who should not expect to face this new disincentive to pension contribution, people who do expect to face the new disincentive, which would cause their implicit marginal tax rate to jump from 0 percent to 29 percent, are about 2.9 percentage points less likely after the reform to work in the formal sector.

Column (2) uses the second version definition of the treatment group. The formal sector labor supply response under this definition should be stronger than that under the first definition for two reasons. First, in 2008 those who were in the poorest 40 percent could actually realize that their retiree counterparts would be receiving public benefits and would be affected by the new implicit marginal tax rate of 29.4 percent. Second, those were in the poorest 40 percent would hold stronger beliefs than those who were in the poorest 60 percent that they would indeed be below the means test threshold at retirement. The results presented in column (2) do indeed show a slightly stronger effect: after the reform people who should expect to face the new
disincentive to pension contribution are about 3.4 percentage points less likely to work in the formal sector than those who should not expect to face this disincentive.

Column (3) employs the third version definition of the treatment group. When the FPS percentile increases by 10 percent – which implies that individuals are now less likely to meet the means test and thus face the new disincentive to the pension contribution – they become 1.15 percentage points more likely to work in the formal sector after the reform.

Columns (4) – (6) present the logistic analogs of Columns (1) – (3). In addition to the logistic regression coefficients, which are difficult to interpret, I present in columns (4) – (6) the odds ratio. Column (4) shows that after the reform, the odds of being employed in the formal sector are 24 percent greater among those who should not expect to face this disincentive than are the odds among those who expect to face the new disincentive.

### 2.4.3 Robustness Checks

Given the timing of the reform and the fact that Chile was somewhat affected by the recession that occurred in the United States, the primary threat to the validity of the identification strategy is the differential effects of the recession on those classified in the treatment group. For example, if the recession had a larger impact on people in the treatment group (those who had low predicted FPS scores), and if it was more likely to force them to move away from formal sector jobs to uncovered sector jobs, this would lead to biased results.
To ensure that differential effects of the recession were not the main driver of results, I also ran a triple-difference estimation strategy. For the researcher to conclude that individuals were actively leaving the formal sector labor force in order to evade the implicit marginal tax two conditions would have to be met: (i) those in the treatment group must expect to suffer from a jump in the implicit marginal tax rate and (ii) they would need to know about the 2008 pension reform in order to identify the new disincentive to work in the formal sector. The Social Protection Survey asks respondents whether they know about the pension reform, and about 25 percent answered affirmatively.

Table 2.7 reports the results following the triple-difference estimation exercise. The setup of the table is similar to that in table 2.6. Columns (1) – (3) present results from the linear triple-difference model that features the individual fixed effect while columns (4) – (6) present results from a conditional logit model that features the individual fixed effect. Table 2.7 shows that those who know about the changes in the 2008 pension reform are a significant driver of the results in Table 2.6. For example, column (1) shows that in the treated group, those who know about the pension reform are more than five percentage points less likely to work in the formal sector after the reform than are those who are unaware of the pension reform.

Individuals who actively switch away from formal sector employment because of the new disincentive to pension contribution must do so because they expect to be affected by the new disincentive. I assume that people predict their FPS scores (and thus whether they end up in the treated group) on the basis of their age, wages,
consumption level, health status, education level, and pension account balance. But perhaps people arrive at this prediction in a simpler way. For example, perhaps people might predict whether they will be in the treated group on the basis of their current wages and pension account balances only. Table 2.8 presents results for those who predict their FPS scores and thus their eligibility for the new pension benefits on the basis of only their current wages and pension account balances. The results in Table 2.8 are similar to the baseline regression results in Table 2.6. For example, according to column (1) of Table 2.8, people who should expect to face the new disincentive to pension contribution, which entails a jump in the implicit marginal tax rate from 0 percent to 29 percent, are about 4.1 percentage points less likely to work in the formal sector after the reform than are those who should not expect to face the disincentive. In Table 2.6 the difference is 2.9 percentage points.

2.4.4 Heterogeneous Impacts

In this section, I analyze whether formal sector labor supply responses vary across age groups. More specifically, I estimate the baseline specification separately for four age groups: people below age 30, people aged 30 to 39, people aged 40 to 54, and people aged 55 to 59. There are reasons to believe that formal sector labor supply responses can vary significantly across age groups. A person early in his/her career may find that it is less costly to switch from a formal sector job to an uncovered jobs than will a person who is in his/her prime working age. Moreover, compared to those in their prime working years, young workers have longer remaining working years to
benefit from the decision to avoid the new disincentive to pension contribution. Nonetheless, we can expect that people who are close to retirement age will exhibit stronger behavioral responses because, knowing that retirement is imminent, they will pay more attention to pension benefits.

Table 2.9 presents the heterogeneous treatment effects by age groups. The first row reproduces the baseline specification results from Table 2.6, and the next four rows display results for the four age groups. Across the four age groups, the formal sector labor supply responses are strongest among people younger than age 30. In column (1) individuals below age 30 who should expect to face the new disincentive to pension contribution are about 6.5 percentage points (versus 2.9 percentage points for all ages) less likely to work in the formal sector after the reform in comparison than those who should not expect to face the disincentive. In contrast, in the age 40-54 group, there seems to be no difference in the formal sector labor supply response in the cases of those who should and should not expect to face the new disincentive. In the case of people 55-59, who are close to retirement, the effect is again stronger than the baseline specification results, although by not as much as among people younger than 30.

2.4.5 Treatment Group II

The analysis so far has focused on individuals who were facing a new disincentive to pension contribution following the 2008 pension reform: their implicit marginal tax rates on pension contribution increased from 0 percent to 29.4 percent
because after the 2008 reform their pension supplement benefits were phased out at a rate of 29.4 percent. There is, however, another subgroup of the population who faces an even larger change in the relative attractiveness between working in the formal sector and the uncovered sector. I define treatment group II as individuals who face a drop in their implicit marginal tax rate on their pension contribution from 100 percent to 29.4 percent. This treatment group consists of people who have more than 20 years of pension contribution and who have pension amounts that are lower than the minimum pension guarantee level.

Table 2.10 summarizes the pension benefits of treatment group II before and after the 2008 reform. Prior to the reform, these individuals perceived formal sector jobs as unattractive because additional mandatory pension contributions were subjected to a 100 percent implicit tax. As shown in Figure 2.2, in the case low-wage individuals who have just over 20 years of pension contribution, any additional pension contribution would not increase their total pension benefits; they would still get the minimum pension guarantee benefits. After the reform, the elimination of the minimum pension guarantee sharply lowered the 100 percent implicit marginal tax to 29.4 percent.

Given that people in treatment group II who had worked in formal sector jobs were forced prior to the 2008 reform to make pension contribution that generated no increase in pension benefits, we might expect to find a significant bunching at the twenty-year threshold. After all, these individuals could earn a discrete jump in benefits to the minimum pension guarantee level once they reach the twenty-year
threshold, whereas further pension contributions after the twenty-year threshold produced no benefits. Figure 2.3 and Figure 2.4 plot from administrative social security data the distributions of the number of years of pension contributions. As depicted in Figure 2.2, the incentive effect of the minimum pension guarantee on the formal sector labor supply should only affect low-wage individuals who at the 20\textsuperscript{th} year have pension amounts that are lower than the minimum pension guarantee. High-wage individuals who at the 20\textsuperscript{th} year have pension amounts that exceed the minimum pension guarantee should not be affected. Figure 2.3 plots the findings for low-wage individuals, who should have been subjected to the incentive effect of the minimum pension guarantee. As expected, there is bunching at the 20\textsuperscript{th} year and its density is more than twice what is found at the 19\textsuperscript{th} and 21\textsuperscript{st} years. Figure 2.4, which plots the high-wage individuals who should not be subject to the incentive effect of the minimum pension guarantee, shows no bunching at the 20\textsuperscript{th} year.

One limitation observed while studying the treatment group II is that very few people actually belong to it. Figure 2.5 displays the fractions of people in the data who were eligible for the minimum pension guarantee benefit prior to the 2008 pension reform. Less than half of one percent of people was eligible for the minimum pension guarantee benefit. About 85 percent of them did not meet the requirement of twenty years of pension contribution, and about 14 percent had a pension figure already higher than the minimum pension guarantee level. Even if we restricted the sample to only retirees, close to half of the sample did not meet the twenty-year requirement. Another close to half of the sample had a pension already greater than the
minimum pension guarantee level, which indicated that no more than a few percent of the sample received the minimum pension guarantee benefit.

Table 2.11 exhibits the baseline results for treatment group II. Column (1) displays the linear difference-in-differences estimations with individual fixed effects, while column (2) presents the conditional logit estimations with individual fixed effects. The magnitude of the treatment effect, estimated at 8.1 percentage points in column 1, is much stronger than the magnitude in the baseline results for treatment group I, which are illustrated in Table 2.6. In column (2) the conditional logit estimation with individual fixed effects also has a much larger estimated coefficient and odds ratios than does those illustrated in Table 2.6. However, the small number of individuals belonging to treatment group II causes the standard errors to explode, making it impossible to estimate the effects precisely.

In conclusion, the 2008 pension reform eliminated one the most perverse incentives to formal sector jobs by replacing the minimum pension guarantee with the pension supplement. For people in treatment group II this change reduced the implicit marginal tax rate on pension contributions from 100 percent to 29.4 percent. I find evidence that people in treatment group II had relatively higher rates of formal sector employment after the reform, when the disincentive to formal sector employment dropped, but the results cannot be estimated precisely because the number of individuals facing this change of incentives is small.
2.5 Conclusion

The pension reform initiated in 2008 by Chile enriched public pension benefits for many citizens. Although in a small subgroup of the population the reform eliminated certain perverse incentives for pension contribution, it introduced a new disincentive to pension contribution for a separate and much larger subgroup. Since workers can avoid contributions by shifting to self-employment or the informal sector, some wonder whether the pension reform could affect formal sector labor supply.

Using panel survey data and administrative social security data, I have implemented a difference-in-differences design to measure the formal sector labor supply responses for two subgroups of the population that have opposing incentives. The first group faced a new disincentive (a jump in the implicit marginal tax rate on pension contributions from 0 percent to approximately 30 percent) to work in the formal sector because of the 2008 reform. The second group faced a significant drop in disincentive (a decrease in the implicit marginal tax rate on pension contributions from 100 percent to approximately 30 percent), which occurred after the reform, to work in the formal sector.

I find that people who expected to face the 30 percent jump in the implicit marginal tax rate were about three percentage points less likely to engage in formal sector employment after the reform. For those who expected to face a drop in their implicit marginal tax rate from 100 percent to 30 percent, they were about eight percentage points more likely to be in formal sector employment after the reform, although this result could not be precisely estimated because only a small number of
individuals encountered this incentive. I find very different results across age groups. The formal sector labor supply responses were strongest among the young, for whom the costs to switching between the formal sector and the uncovered sector were relatively low; moreover, young workers benefited more from the switch because they had relatively many working years remaining. The effect was relatively strong, too, among people who were close to retirement age. There was no effect among those who were in their prime working years, which I defined as those aged 40 to 54.

Acknowledgement: Chapter 2, in full, is currently being prepared for submission for publication of the material. Wong, Boris. The dissertation author was the sole author of this material.
Figure 2.1: Public Benefits After the 2008 Pension Reform
Figure 2.2: Public Benefits Before vs. After the 2008 Reform
Figure 2.3: Distribution of Years of Contribution for People Who Can Benefit from the Minimum Pension Guarantee
Figure 2.4: Distribution of Years of Contribution for People Who Cannot Benefit from the Minimum Pension Guarantee
Figure 2.5: Fraction of People Receiving the Minimum Pension Guarantee
Table 2.1: Implicit Marginal Tax Rate to an Additional Dollar of Monthly Pension Payout from the Individual Accounts

<table>
<thead>
<tr>
<th>Monthly Pension payout from the individual accounts ($)</th>
<th>Contribution Years</th>
<th>Pre-2008 All Quintiles</th>
<th>Post-2008 Bottom Three Quintiles</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PASIS</td>
<td>Minimum Pension Guarantee</td>
<td>PBS</td>
</tr>
<tr>
<td>0</td>
<td>0 year</td>
<td>0 or 100%</td>
<td>0</td>
</tr>
<tr>
<td>Between 0 and the Minimum Pension Guarantee</td>
<td>Few Years</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Close to 20 Years</td>
<td>0</td>
<td>Negative</td>
</tr>
<tr>
<td></td>
<td>Over 20 Years</td>
<td>0</td>
<td>100%</td>
</tr>
<tr>
<td>Between the Minimum Pension Guarantee and $425</td>
<td>All Years</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Greater than $425</td>
<td>All Years</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
Table 2.2: Summary Statistics from Social Protection Survey

<table>
<thead>
<tr>
<th>Variable</th>
<th>Obs</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Median</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>14463</td>
<td>50</td>
<td>19</td>
<td>48</td>
<td>108</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>14463</td>
<td>0.49</td>
<td>0.50</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>No Secondary School Diploma</td>
<td>14349</td>
<td>0.45</td>
<td>0.50</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Secondary School Graduate</td>
<td>14349</td>
<td>0.26</td>
<td>0.44</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Affiliate with Personal Account</td>
<td>14463</td>
<td>0.69</td>
<td>0.47</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Poverty Score (FPS)</td>
<td>2286</td>
<td>6742</td>
<td>3783</td>
<td>1000</td>
<td>6500</td>
<td>30000</td>
</tr>
<tr>
<td>Heard About Pension Reform</td>
<td>14463</td>
<td>0.25</td>
<td>0.43</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Work (Year: 2006)</td>
<td>14463</td>
<td>0.60</td>
<td>0.49</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Formal Sector (Year: 2006)</td>
<td>8696</td>
<td>0.65</td>
<td>0.48</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Work (Year: 2009)</td>
<td>14463</td>
<td>0.57</td>
<td>0.49</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Formal Sector (Year: 2009)</td>
<td>8261</td>
<td>0.63</td>
<td>0.48</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Monthly Net Income (pesos)</td>
<td>8702</td>
<td>278009</td>
<td>382383</td>
<td>0</td>
<td>200000</td>
<td>1.5E+07</td>
</tr>
<tr>
<td>Monthly Total Expenditures (pesos)</td>
<td>14337</td>
<td>200079</td>
<td>156480</td>
<td>0</td>
<td>170000</td>
<td>3500000</td>
</tr>
</tbody>
</table>
Table 2.3: Summary Statistics from Administrative Data

<table>
<thead>
<tr>
<th>Variable</th>
<th>Obs</th>
<th>Mean</th>
<th>Dev.</th>
<th>Min</th>
<th>Median</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fund A Balance (pesos)</td>
<td>2584</td>
<td>12.3m</td>
<td>13.8m</td>
<td>0</td>
<td>7.8m</td>
<td>140m</td>
</tr>
<tr>
<td>Fund B Balance (pesos)</td>
<td>7747</td>
<td>4.3m</td>
<td>9.3m</td>
<td>0</td>
<td>1.8m</td>
<td>155m</td>
</tr>
<tr>
<td>Fund C Balance (pesos)</td>
<td>11807</td>
<td>6.1m</td>
<td>10.9m</td>
<td>0</td>
<td>2.5m</td>
<td>221m</td>
</tr>
<tr>
<td>Fund D Balance (pesos)</td>
<td>4797</td>
<td>4.5m</td>
<td>11.7m</td>
<td>0</td>
<td>0.5m</td>
<td>194m</td>
</tr>
<tr>
<td>Fund E Balance (pesos)</td>
<td>472</td>
<td>11.8m</td>
<td>16.3m</td>
<td>0</td>
<td>6.4m</td>
<td>141m</td>
</tr>
<tr>
<td>Years of Contribution</td>
<td>23912</td>
<td>9.24</td>
<td>7.50</td>
<td>0</td>
<td>8</td>
<td>28</td>
</tr>
</tbody>
</table>

m denotes million
Table 2.4: Different Fund Limits on Investment

<table>
<thead>
<tr>
<th>Fund</th>
<th>Limits on investments in equities</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Minimum</td>
<td>Maximum</td>
</tr>
<tr>
<td>Fund A</td>
<td>40</td>
<td>80</td>
</tr>
<tr>
<td>Fund B</td>
<td>25</td>
<td>60</td>
</tr>
<tr>
<td>Fund C</td>
<td>15</td>
<td>40</td>
</tr>
<tr>
<td>Fund D</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>Fund E</td>
<td>Fixed Income</td>
<td>Fixed Income</td>
</tr>
</tbody>
</table>
Table 2.5: Pension Benefits Before and After the 2008 Reform for Treatment Group I

<table>
<thead>
<tr>
<th></th>
<th>Before reform</th>
<th>After reform</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work in formal sector jobs</td>
<td>Minimum pension guarantee benefit of $160 after 20 years</td>
<td>Pension supplement benefit (APS) of $125 – 0.294<em>pension payment from past pension contribution – 0.294</em>pension payment from additional pension contribution</td>
</tr>
<tr>
<td>Work in uncovered sector jobs</td>
<td>Not eligible to either PASIS or the minimum pension guarantee</td>
<td>Pension supplement benefit (APS) of $125 – 0.294*pension payment from past pension contribution</td>
</tr>
</tbody>
</table>
Table 2.6: Baseline Regression Results

<table>
<thead>
<tr>
<th>Treatment X Post</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment Definition</td>
<td>FPS lowest</td>
<td>FPS lowest</td>
<td>FPS</td>
<td>FPS lowest</td>
<td>FPS lowest</td>
<td>FPS</td>
</tr>
<tr>
<td></td>
<td>60%</td>
<td>40%</td>
<td>percentile</td>
<td>60%</td>
<td>40%</td>
<td>percentile</td>
</tr>
<tr>
<td>Regression</td>
<td>Linear</td>
<td>Linear</td>
<td>Linear</td>
<td>Logistic</td>
<td>Logistic</td>
<td>Logistic</td>
</tr>
<tr>
<td>Individual fixed effect</td>
<td>Included</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R-squared</td>
<td>0.84</td>
<td>0.84</td>
<td>0.85</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Odds Ratio</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Treatment X Post)</td>
<td>0.758</td>
<td>0.742</td>
<td>2.575</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Log likelihood</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>5198</td>
<td>5198</td>
<td>5198</td>
<td>5198</td>
<td>5198</td>
<td>5198</td>
</tr>
</tbody>
</table>

Standard errors in parentheses
* p<0.1, ** p<0.05, *** p<0.01
Table 2.7: Formal Sector Labor Force – Differential Effects on Those Who Were Aware of the 2008 Pension Reform

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment X Post X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heard Reform</td>
<td>-0.060</td>
<td>-0.077</td>
<td>0.205</td>
<td>-0.460</td>
<td>-0.560</td>
<td>1.154</td>
</tr>
<tr>
<td></td>
<td>(0.023)**</td>
<td>(0.027)**</td>
<td>(0.081)**</td>
<td>(0.279)*</td>
<td>(0.324)*</td>
<td>(1.132)</td>
</tr>
<tr>
<td>Treatment X Post</td>
<td>-0.015</td>
<td>-0.018</td>
<td>0.077</td>
<td>-0.143</td>
<td>-0.155</td>
<td>0.698</td>
</tr>
<tr>
<td></td>
<td>(0.012)</td>
<td>(0.013)</td>
<td>(0.044)*</td>
<td>(0.150)</td>
<td>(0.162)</td>
<td>(0.629)</td>
</tr>
<tr>
<td>Post</td>
<td>-0.023</td>
<td>-0.026</td>
<td>-0.049</td>
<td>-0.312</td>
<td>-0.349</td>
<td>-0.554</td>
</tr>
<tr>
<td></td>
<td>(0.007)**</td>
<td>(0.006)**</td>
<td>(0.014)**</td>
<td>(0.088)**</td>
<td>(0.080)**</td>
<td>(0.183)**</td>
</tr>
<tr>
<td>Heard Reform X Post</td>
<td>0.006</td>
<td>0.004</td>
<td>-0.101</td>
<td>0.068</td>
<td>0.047</td>
<td>-0.675</td>
</tr>
<tr>
<td></td>
<td>(0.012)</td>
<td>(0.011)</td>
<td>(0.029)**</td>
<td>(0.154)</td>
<td>(0.141)</td>
<td>(0.363)*</td>
</tr>
<tr>
<td>Treatment Definition FPS lowest</td>
<td>FPS</td>
<td>FPS</td>
<td>FPS</td>
<td>FPS</td>
<td>FPS</td>
<td>FPS</td>
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<tr>
<td>Definition</td>
<td>60%</td>
<td>40%</td>
<td>percentile</td>
<td>60%</td>
<td>40%</td>
<td>percentile</td>
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<tr>
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<td>Linear</td>
<td>Linear</td>
<td>Logistic</td>
<td>Logistic</td>
<td>Logistic</td>
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<tr>
<td>Individual fixed effect</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Included</td>
</tr>
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</table>

Standard errors in parentheses
* p<0.1, ** p<0.05, *** p<0.01
### Table 2.8: Robustness Check: Alternative Assumptions on Expectation Formation

<table>
<thead>
<tr>
<th>Robustness Check</th>
<th>Dependent variable: Formal Sector Labor Force</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Treatment X Post</td>
<td>-0.041</td>
</tr>
<tr>
<td></td>
<td>(0.009)***</td>
</tr>
<tr>
<td>Post</td>
<td>-0.023</td>
</tr>
<tr>
<td></td>
<td>(0.006)***</td>
</tr>
<tr>
<td>Treatment</td>
<td>FPS lowest</td>
</tr>
<tr>
<td>Definition</td>
<td>60%</td>
</tr>
<tr>
<td>Regression</td>
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<tr>
<td>Individual fixed effect</td>
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</tr>
<tr>
<td>R-squared</td>
<td>0.84</td>
</tr>
<tr>
<td>Log likelihood</td>
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</tr>
<tr>
<td>Observations</td>
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</table>

Standard errors in parentheses
* p<0.1, ** p<0.05, *** p<0.01
### Table 2.9: Formal Sector Labor Force, by Age

<table>
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<tr>
<th>Heterogeneous Treatment Effects</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dependent variable:</strong> Formal Sector Labor Force</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>All</strong></td>
<td>-0.029</td>
<td>-0.034</td>
<td>0.115</td>
<td>-0.276</td>
<td>-0.299</td>
<td>0.899</td>
</tr>
<tr>
<td></td>
<td>(0.010)**</td>
<td>(0.011)**</td>
<td>(0.035)***</td>
<td>(0.126)**</td>
<td>(0.139)**</td>
<td>(0.501)*</td>
</tr>
<tr>
<td><strong>Age below 30</strong></td>
<td>-0.065</td>
<td>-0.092</td>
<td>0.350</td>
<td>-0.520</td>
<td>-0.613</td>
<td>2.507</td>
</tr>
<tr>
<td></td>
<td>(0.032)**</td>
<td>(0.042)**</td>
<td>(0.151)**</td>
<td>(0.256)**</td>
<td>(0.302)**</td>
<td>(1.255)**</td>
</tr>
<tr>
<td><strong>Age: 30-39</strong></td>
<td>-0.032</td>
<td>-0.054</td>
<td>0.119</td>
<td>-0.212</td>
<td>-0.349</td>
<td>0.388</td>
</tr>
<tr>
<td></td>
<td>(0.018)*</td>
<td>(0.020)***</td>
<td>(0.068)*</td>
<td>(0.212)</td>
<td>(0.231)</td>
<td>(0.841)</td>
</tr>
<tr>
<td><strong>Age: 40-54</strong></td>
<td>-0.004</td>
<td>0.000</td>
<td>0.084</td>
<td>0.006</td>
<td>0.049</td>
<td>0.810</td>
</tr>
<tr>
<td></td>
<td>(0.014)</td>
<td>(0.015)</td>
<td>(0.044)*</td>
<td>(0.204)</td>
<td>(0.230)</td>
<td>(0.760)</td>
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<tr>
<td><strong>Age 55-59</strong></td>
<td>-0.055</td>
<td>-0.049</td>
<td>0.238</td>
<td>-1.392</td>
<td>-1.751</td>
<td>1.963</td>
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<tr>
<td></td>
<td>(0.029)*</td>
<td>(0.032)</td>
<td>(0.113)*</td>
<td>(0.798)*</td>
<td>(1.06)*</td>
<td>(2.73)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Treatment Definition</strong></th>
<th>FPS lowest</th>
<th>FPS lowest</th>
<th>FPS percentile</th>
<th>FPS lowest</th>
<th>FPS lowest</th>
<th>FPS percentile</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Regression</strong></td>
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<td>Linear</td>
<td>Linear Logistic</td>
<td>Logistic</td>
<td>Logistic</td>
<td>Logistic</td>
</tr>
<tr>
<td><strong>Individual fixed effect</strong></td>
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<td>Included</td>
<td>Included</td>
<td>Included</td>
<td>Included</td>
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</table>

Standard errors in parentheses
* p<0.1, ** p<0.05, *** p<0.01
Table 2.10: Pension Benefits Before and After the 2008 Reform for Treatment Group II

<table>
<thead>
<tr>
<th></th>
<th>Before reform</th>
<th>After reform</th>
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<tbody>
<tr>
<td>Work in formal sector jobs</td>
<td>Would receive minimum pension guarantee benefit of $160</td>
<td>Pension supplement benefit (APS) of $125 – 0.294<em>pension payment from past pension contribution – 0.294</em>pension payment from additional pension contribution</td>
</tr>
<tr>
<td></td>
<td>Additional mandatory pension contribution subjects to 100% implicit tax</td>
<td></td>
</tr>
<tr>
<td>Work in uncovered sector jobs</td>
<td>Would receive minimum pension guarantee benefit of $160</td>
<td>Pension supplement benefit (APS) of $125 – 0.294*pension payment from past pension contribution</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
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</table>
**Table 2.11**: Formal Sector Labor Force – Treatment Group II

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment X Post</td>
<td>0.081</td>
<td>1.119</td>
</tr>
<tr>
<td></td>
<td>(0.087)</td>
<td>(1.226)</td>
</tr>
<tr>
<td>Post</td>
<td>-0.033</td>
<td>-0.425</td>
</tr>
<tr>
<td></td>
<td>(0.004)***</td>
<td>(0.057)***</td>
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<tr>
<td>Regression</td>
<td>Linear</td>
<td>Logistic</td>
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<tr>
<td>Individual fixed effect</td>
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<td></td>
</tr>
<tr>
<td>R-squared</td>
<td>0.84</td>
<td></td>
</tr>
<tr>
<td>Odds Ratio (Treatment X Post)</td>
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</tr>
<tr>
<td>Log likelihood</td>
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<td>-873</td>
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<td>Observations</td>
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<td>7796</td>
</tr>
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</table>

Standard errors in parentheses
* p<0.1, ** p<0.05, *** p<0.01
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Chapter 3

Implementing a Progressive Consumption Tax through Use of Registered Accounts

3.1 Introduction

Taxing income from savings is a controversial element of the U.S. tax system. It distorts the saving decision and has high efficiency cost. Individuals can mitigate these taxes by changing their portfolio compositions, altering the timing of the purchases and sales of their investments, and shifting their investments into tax shelters or tax havens. In fact, Judd (1985) and Chamley (1986) showed that in a general equilibrium with infinitely-lived agents, the optimal tax on capital income is zero because of the unlimited growth in tax compounding over time.

Given the high efficiency cost to taxes on income from savings, many tax reform proposals have advocated the elimination of capital income taxes, including Hall and Rabushka’s (1983, 1995) flat tax, Bradford’s (1986) X tax, and Boortz and Linder’s (2005) FairTax. One possible approach is to tax only labor income, with no tax on capital income. While this would eliminate many existing distortions to saving,
it would encourage individuals to shift labor income into the corporate tax base, thus requiring the retention of the corporate tax, which itself creates many distortions such as firms shifting corporate income abroad. Another approach is to focus on taxing consumption directly through sales or value-added taxes. Yet, in practice, neither tax can cover all consumption expenditures, which then distorts the relative prices of goods that are covered and not. Furthermore, it is difficult to implement a sales tax or value-added tax with a progressive tax rate schedule.

In this paper, we evaluate the revenue and distributional effects of shifting from the current tax base under the personal income tax, along with the capital income tax and corporate income tax, to an alternative tax base equal to the household’s consumption expenditures. The proposed tax base can be implemented by having all types of income go through a registered account. Similar to the treatment of many current pension and retirement savings plans, the income entering the registered accounts is not taxed initially. The income can be invested within the registered account tax-deferred, and individuals pay taxes only when they withdraw funds to finance consumption. This tax base treats income coming from corporate vs. non-corporate entities neutrally, so there are no incentives for shifting income and no remaining justification for the corporate tax or capital gains tax—so those taxes can be eliminated. Furthermore, unlike the U.S. retail sales tax and the value-added tax in many European countries, which cover roughly a third and two-thirds of consumption respectively, this proposed tax covers all consumption financed by the withdrawal of funds from registered accounts.
Section 2 describes the design of our proposed tax in more detail. We discuss special considerations that arise for particular types of income, such as insurance payouts, and particular types of consumption, such as housing, health, and education. We also consider the complications that would arise in transitioning from the current tax system.

The following section, Section 3, describes the two approaches we implement to approximate what the tax base would be using the Consumer Expenditure Survey (CEX). The first sums expenditures, while the second relies on a budget constraint approach, where we infer total consumption from income received plus net withdrawals from savings. In comparing the estimated consumption tax base for individuals across these two approaches, we find that the budget constraint approach systematically overstates consumption. This is largely due to the poor quality of the financial asset and liability data, and we show that the gap between the two estimates increases with age prior to retirement age. In light of the relative strengths of the CEX, our preferred tax base estimate is the one derived from reported expenditures.

Section 4 then moves on to evaluate the revenue and distributional implications of the proposed tax reform. We simulate how much tax revenue would change if we replace the current labor income tax, capital income tax, and corporate tax with a progressive consumption tax, where the new consumption tax brackets have the same rate and dollar limits as the existing income tax schedule. We also evaluate the distributional effects on different subgroups of the population. Section 5 offers a brief

---

3 Though BLS has made great strides to improve the quality of pre- and post-tax income data, there is not yet a process in place to address nonresponse for financial assets and liabilities, such as credit card balances and checking and savings deposits (Paulin and Hawk, 2015).
conclusion.

3.2 Design of the proposed tax

Our proposed tax is a progressive consumption tax. Instead of charging a tax on each purchase of goods and services (similar to the tax treatment of value added and retail sales taxes), the logic of the approach is to determine the amount of funds used to finance consumption expenditure in any given year. The consumption tax base is the withdrawals from registered accounts, in which all income (including labor income, capital income, income from transfer programs, carried interest, and net proceeds from home sales) must first enter the registered accounts. Funds within the registered accounts can be invested tax-deferred in a similar way as traditional 401(k) or traditional IRA plans. Individuals can make withdrawals from their registered accounts any time subject to an annual progressive consumption tax, which has the same rates and limits of the current income tax schedule and the same standard deduction and personal exemption.

The current personal income tax schedule has a variety of other provisions that would be dropped. Since the tax base simply equals net withdrawals from registered accounts, there is no need to distinguish between different sources of the income accruing within these registered accounts, such as capital gains vs. dividends vs. salaries. Since our proposed tax system no longer attempts to tax capital income, we would eliminate all provisions imposing tax on interest, dividends, and capital gains, including the mortgage interest deduction and depreciation provisions for capital
investments.

On the other hand, other aspects of the personal income tax code could be preserved. For example, the earned income tax credit can be kept. Since all income must enter the registered accounts, it should be simple to track the amount of earned income in any given tax year to calculate the EITC in our proposed tax regime.

We also have the potential to retain selected itemized deductions, though these would now be deductions allowed for all. We propose retaining a deduction for charitable contributions, to continue to encourage an activity generating clear externalities, but dropping the other itemized deductions. We choose to eliminate any deductions for state and local tax payments, on the grounds that these taxes finance services that are substitutes for private consumption expenditures. Though we drop the deduction for medical expenditures over 7.5% of AGI, we allow all out-of-pocket medical expenditures to be tax deductible since, as we explain in the next section, we treat these as necessary living expenses.

In addition to the personal income tax, several existing taxes would be eliminated. Since income from corporate and non-corporate sources is treated the same way under this regime, there is no need for the corporate tax as a backstop to the income tax. Thus, we eliminate the corporate tax. We would also eliminate the estate tax. The treatment of bequests would be similar to the current treatment for non-spouse beneficiaries of inherited traditional IRAs. Any remaining funds from a deceased individual’s registered account would be rolled into the heirs’ registered accounts with no tax on receipt of the funds per se. These inherited funds would then
have the same tax treatment to the heirs as their own funds in their registered accounts. The heirs would owe taxes whenever they make withdrawals from their registered accounts subject to their consumption tax schedules.

### 3.2.1 Tax treatment of spending with investment aspects

Some types of spending require special consideration to separate the resources that are consumed from those that are invested. We discuss several of these in this section, starting with housing and education, and moving on to private and social insurance.

Rents for housing are consumption expenditure, and thus should be taxed under the proposed consumption tax with no deduction. The more complicated case is owner-occupied housing. Under a consumption tax, the proper tax base should be the value of housing service provided from the house, which can be represented in a simple way as \((r + d - g)H\), in which \(r\) is the interest rate, \(d\) the rate of depreciation, \(g\) the growth rate of the value of the house \((H)\). Thus, all spending on the house should be taxable, including the down payment, mortgage interest payments, and maintenance, but with a deduction for the net sales proceeds. This proposal would be automatically implemented in our proposed progressive consumption tax through the use of registered accounts. The withdrawals from registered accounts to spend on down payment, mortgage interest, or housing maintenance are taxable, while the net sales proceeds of the house are deposited into the registered accounts. Although the timing of the tax under this implementation may be different from the value of the
housing service each year, they should be equal in present value; instead of taxing the annual service value of the down payment and providing a deduction for the accrued capital gains on housing each year, the down payment is immediately taxable and the net sales proceeds are deductible when received. In principle, it is possible to continue the current provisions favoring owner-occupied housing in our proposed consumption tax, but in this paper we consider taxing all consumption equally.

The appropriate tax treatment of education depends on whether the education spending is consumption (taxable) or an investment (tax deductible). Existing studies on returns of education, including Card (1995), Lemieux and Card (2001), and Zimmerman (2014) have shown that the earnings gain for each year of additional college education is around 10 to 15 percent. If education were valued in part as consumption, then the equilibrium marginal economic return to education should be below a market rate of return. The evidence that rates of return, if anything, are higher than market rates suggests that the consumption value to higher education is minimal. Since education seems to be mostly an investment, our proposed consumption tax would provide a deduction for education expenditures, such as tuition and interest payments on student loans.

What about insurance? We view life insurance as a type of investment. Therefore, premium payments should be deductible while life insurance proceeds should be included in income entering the registered accounts. On the other hand, we do not treat fire and car insurance as investments in a financial asset, since these pay

---

4 Notwithstanding, Jacob, McCall and Stange (Forthcoming) find evidence that students value college spending on amenities (as reflected in spending on student services and auxiliary enterprises).
out only in response to a financial loss. Thus, the premium payments are counted as a form of consumption, but the insurance proceeds are not counted as income and generate a deduction when deposited.

Following convention, we treat medical care as an expense of living, so exclude any spending on health insurance and health care from measured consumption. Any implicit payments for health insurance, such as through employer contributions, would appropriately not be counted in income. Any out-of-pocket payments, such as premiums and co-insurance payments, would be deductible from income, in order to capture funds available for all other forms of consumption. The treatment of Medicare would be to measure earnings net of FICA taxes used to finance Medicare, and then to ignore payouts from the program. For Medicaid, the financing is part of the income tax so does not need separate treatment, and payouts would also be ignored.

What about other social insurance programs, such as Social Security Disability Insurance and Unemployment Insurance? Again, the idea of a consumption tax base is to let consumption be taxable and let investment be tax deductible. Therefore, the contributions to these programs are tax deductible and the benefits received are taxable when withdrawn. For example, in terms of Social Security, both the employer’s and the employee’s shares of the Social Security component of the payroll tax are tax deductible, with the resulting Social Security benefits entirely taxable. One may argue that this proposed consumption tax seems regressive because benefits to the unemployed and the disabled are taxable. However, our proposed consumption tax not
only has a progressive rate schedule, but also maintains the current standard deduction and personal exemption. Thus, in practice, those falling into these categories will only be taxed to the extent they are able to maintain high enough levels of consumption.

### 3.2.2 Transition

A significant complication to any tax reform proposal is the transition rule. A proper transition rule is especially important for people with existing assets. If we treat all existing assets at the time of the tax reform to be within the registered accounts, then we create a windfall tax on all existing assets. This treatment can generate revenue for the government with no efficiency cost (Auerback and Kotlikoff, 1987), ignoring fears of a recurrence in the future that may induce inefficient precautionary behaviors. However, this treatment would create an intergenerational redistribution of the tax burden toward seniors because the elderly and retirees are more likely to have significant assets. Furthermore, such a windfall tax can easily be viewed as “an unjust taking of private property, a violation of individuals’ property rights” (Feldstein, 1976).

What about the opposite extreme that allows a deduction to all existing assets and thus exempting any unrealized capital gains from ever being taxed? This treatment would significantly lower revenue for the government and exacerbate the inequality of the distribution of wealth in the economy.

In this paper, we propose that existing assets at the time of the tax reform be considered within the registered accounts (and thus will incur the consumption tax...
when funds are withdrawn to finance consumption). Nevertheless, we provide a tax deduction equal to the tax basis of the existing assets at the time of the tax reform. This treatment preserves a tax on unrealized capital gains, but avoids the double taxation on the value of the tax basis. Any deductions not taken immediately would grow at the risk-free interest rate, enabling individuals to smooth out their tax base over time instead of incentivizing them to immediately increase consumption when the deduction applies.

3.3 Estimating the consumption tax base

In this section, we describe and compare two approaches to approximate what the tax base would be under the proposed tax plan. Our first approach sums funds used for all nondeductible purchases, and our second exploits the household’s budget constraint, backing out consumption expenditures in a given year from income received plus net withdrawals of savings.

We implement both approaches using the Consumer Expenditure Survey (CEX). The CEX is designed to collect data on expenditures, income and demographic characteristics for a representative sample of the non-institutionalized U.S. population. National probability samples of consumer units (i.e., groups of individuals who live together and share certain expenses) are drawn from the Census of Population. The quarterly interview survey collects detailed data on major and recurring items of expenses (60 to 70 percent of total expenditures), as well as global estimates of frequently purchased items (that capture an additional 20 to 25 percent). Each
consumer unit is interviewed every three months over four consecutive quarters, with 25 percent of the sample entering each quarter to replace those exiting. We use data from the first quarter of 2013, since this is the latest wave that contains the information needed to implement both approaches.

A complication that we face under both approaches is that a consumer unit may contain multiple tax units, and there is no clear way to apportion income or consumption across tax units. Thus, we restrict our analysis to consumer units that closely correspond to tax units. We assume that a consumer unit has only one tax unit if none of the members is classified as an “unrelated person” or “unmarried partner” to the reference person. Our sample restriction excludes 7.2 percent of the weighted sample.

3.3.1 Expenditures approach

For the expenditures approach, we estimate our tax base by deducting nontaxable expenditures from total expenditures. For this exercise, a limitation with the interview survey is that it covers only up to 95 percent of total expenditures, excluding expenditures such as housekeeping supplies, personal care products and nonprescription drugs. Further, by comparing CEX aggregates to personal consumption expenditures from the National Income and Product Accounts, researchers have shown that some categories are significantly underreported.\(^5\) Finally, there is evidence that those at the top of the income distribution are underrepresented.

---

\(^5\) Bee, Meyer and Sullivan (2015) show that reporting is less complete for categories of spending that involve small and irregular purchases, such as clothing, food away from home, and alcohol/tobacco. The interview survey does quite well, though, for the largest components of consumption.
in the sample and that the high-income households included in the sample disproportionately underreport expenditures (Sabelhaus et al., 2015). With these limitations in mind, our approximation is likely to somewhat understate consumption that should be taxable under our approach, and more so at the top.

We calculate the tax base by subtracting those expenses that are deductible under the proposal from total expenditures. From the total, we subtract spending on education, healthcare and health insurance, life and other personal insurance, cash contributions, and public and private pension contributions, including Social Security. The base implicitly includes any sales taxes paid, and explicitly includes property taxes. Since state income taxes are not included in total expenditures in the CEX, we calculate these (using TAXSIM) and add these to the base. Note that any charges to finance consumption, such as credit card fees, are included in the base, and that federal personal income taxes paid are not.

Since we use just the first quarter of 2013, our first pass gives us an estimate of quarterly taxable consumption. This wave includes households interviewed in January, February or March of 2013. These households report expenditures for the three-month period prior to the interview month, so that this period is centered on December of 2012 for our sample. In order to estimate consumption over the prior year, we first obtain average (weighted) quarterly expenditures for each of the four quarterly interviews: 2013 Quarter 1 ($12,413), 2012 Quarter 4 Interview ($12,439), 2012 Quarter 3 Interview ($12,451), and 2012 Quarter 2 Interview ($11,935). We then scale

---

6 The Appendix provides details on the specific variables that are used for both approaches.
7 In addition to charitable contributions, cash contributions include alimony and child support paid to individuals outside the consumer unit.
our quarterly estimate up by the ratio of the sum of these four values divided by the value in the 2013 Quarter 1 Interview, or by 3.97.\footnote{A simple way to adjust would be to multiply by four. The idea of the more complicated approach is to attempt to address seasonality and general increases in prices, though these turn out not to matter much in this case.}

### 3.3.2 Budget constraint approach

For this approach, we rely on the annual income and financial variables collected in the interview surveys. The income variables are collected in the first and fourth interviews only, and cover the twelve months prior to the date of interview. Income data are copied to the middle interviews, with updates for any new consumer unit members who started working since the previous interview. The additional financial information is gathered using the same 12-month recall in the fourth interview. For any given household in our sample, the income data will be from the interview that is administered in the first quarter of 2013, and the financial data will be from the household’s final interview.

The logic behind this approach is to infer consumption from the difference between income and net savings. We start by summing income from all sources. We then deduct federal personal income and payroll taxes paid, which are resources not available for consumption. From this after-tax income measure, we then subtract net savings. Finally, to find taxable consumption, we then subtract deductible expenses. Net savings are contributions to savings less any withdrawals, and any other net savings, including contributions to private and public pensions programs. Other deductible expenses are the same as those under the expenditures approach: education,
healthcare and health insurance, life and other personal insurance, and cash contributions.

### 3.3.3 Comparing the tax base estimates

Table 3.1 summarizes the tax base under the expenditures approach and the budget constraint approach. In theory, the two tax bases should be equal. Yet, as shown in Table 3.1, the mean of the budget constraint tax base ($47,823) is higher than that of the expenditure tax base ($37,828).\(^9\) Because of the poor quality of the financial asset and liability data, the amount of savings is likely to be underreported, which causes the budget constraint approach to consistently overestimate consumption. Figure 3.1 shows that the gap between the two estimates increases with age prior to retirement age. The gap is the largest for people aged 50 to 59, who are in their peak earning years and likely to have the highest amount of new savings. Because of the relative strengths of the CEX, our preferred tax base estimate is the one derived from the expenditures approach.

### 3.4 Revenue and distributional implications

In this section, we estimate the taxes individuals would pay under the proposed scheme, and compare those to the existing tax system. Since the CEX did not first produce income tax estimates until the following wave, we estimate the federal

---

\(^9\) A similar gap exists in the published table of the 2012 Consumption Expenditure Survey between the mean of income after taxes ($63,370) and the mean of average annual expenditures ($51,442), which include contributions to pensions and retirement plans.
personal income tax under the existing tax system ourselves using TAXSIM.

Keeping the same tax rate schedule and maintaining the identical standard
deduction and personal exemption, we again use TAXSIM to estimate the taxes owed
under our two tax bases. The existing tax base, though, measures income gross of any
personal income taxes and gross of the employee share of the payroll tax. In order to
make our two estimates of a consumption tax base comparable to the existing tax base,
we add to each of them the amount that the household paid in federal personal income
taxes and their share of the payroll tax under existing tax law.

Table 3.2 presents weighted estimates of the tax under the three different tax
bases. The table is organized by deciles of our expenditure tax base. Comparing
between the existing tax regime and the expenditures approach, the average tax owed
for all units is about 20 percent lower under the expenditures approach. Taxes are
lower under the expenditure approach for all deciles other than the top decile. In terms
of absolute dollar amounts, those in the ninth decile enjoy the largest decrease in
federal tax liability of approximately $3600 per unit. In terms of percentage, the
lowest decile has the largest drop in federal income tax liability – approximately 82
percent.

Table 3.3 presents weighted estimates of taxes by age. Comparing between the
existing tax regime and the expenditures approach, the mean tax is consistently lower
under the expenditures approach across all age groups. The largest drop, in both
absolute dollar amounts and percentages, occurs for the 40-49 and 50-59 age groups.
This finding suggests plausible improvement in both equity and efficiency grounds for our progressive consumption tax.

In terms of efficiency, people aged 40 to 59 are in their peak earning years. With a progressive rate structure, marginal tax rates of an income tax will be high in these years, and create tax distortions encouraging individuals to shift their work effort away from these high earning years. In contrast, consumption should vary much less over the lifecycle, leading to much weaker distortions to the timing of consumption.

In terms of equity, a consumption tax is a better approach than an income tax if the goal is to shift the tax burden to those who have a lower marginal utility of consumption. A higher tax burden under the income tax for people aged 40 to 59 not only targets those with high lifetime income, but also affects those who are in their peak earning years or have high transitory income in those years. Because of the very heterogeneous values for the marginal utility of income among these individuals, a shift to a progressive consumption tax, which moves the tax burden from those with higher (possibly transitory) income to those with higher consumption, should result in equity gains.

3.5 Conclusion

Taxing income from saving creates a myriad of distortions to the saving decision. A natural way to avoid distortions to saving incentives is to switch from an income tax to a consumption tax, yet it is difficult to design a consumption tax with a
progressive structure. In this paper, we have outlined how to implement a progressive consumption tax through the use of registered accounts.

We propose to shift the current tax base under the personal income tax, along with the capital income tax, corporate income tax and estate tax, to an alternative tax base equal to the household’s consumption expenditures. The proposed tax base can be implemented by having all types of income go through a registered account. Similar to the treatment of many current pension and retirement savings plans, the income entering the registered accounts is not taxed initially. The income can be invested within the registered account tax-deferred, and individuals pay taxes only when they withdraw funds to finance consumption.

We have developed two approaches to measure our consumption tax base – the expenditures approach and the budget constraint approach. We have also use the Consumer Expenditure Survey (CEX) to estimate the taxes individuals would pay under the proposed scheme, and compare those to the existing tax system. Because of the relative strengths of the CEX, we focus our analysis on the expenditure approach. A future extension of the project would be to use a dataset with high-quality financial asset and liability data, such as the Survey of Consumer Finances, where it would be more natural to apply the budget constraint approach.

Our analysis using the CEX shows that the mean federal personal income tax under the expenditures approach is consistently lower than that under the current tax regime, except for the highest 10 percent of households by consumption. Furthermore, we show that the tax burden is particularly lower for people aged 40 to 59. This shift
of the tax burden away from those who are in their peak earning years suggests a plausible improvement in both equity and efficiency grounds for our progressive consumption tax.

Acknowledgement: Chapter 3, in full, is currently being prepared for submission for publication of the material. Wong, Boris; Cullen, Julie; Gordon, Roger. The dissertation author was the primary investigator and author of this material.
Figure 3.1: Ratio by Age Group

Note: The ratio is the difference between the budget constraint tax base and the consumption tax base divided by the consumption tax base. The top and bottom one percent of the ratio are dropped to minimize the influence of outliers. The age group refers to the age of the reference person of the household.
Table 3.1: Summary Statistics

<table>
<thead>
<tr>
<th>Variables</th>
<th>Obs</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expenditure Tax Base</td>
<td>6,311</td>
<td>37,828</td>
<td>31,640</td>
<td>0</td>
<td>433,679</td>
</tr>
<tr>
<td>Total Expenditure</td>
<td>6,311</td>
<td>49,393</td>
<td>42,180</td>
<td>0</td>
<td>745,784</td>
</tr>
<tr>
<td>Deductible Expenditure</td>
<td>6,311</td>
<td>12,612</td>
<td>19,418</td>
<td>-373</td>
<td>612,883</td>
</tr>
<tr>
<td>State Income Tax</td>
<td>6,311</td>
<td>1,047</td>
<td>3,050</td>
<td>-2,835</td>
<td>57,649</td>
</tr>
<tr>
<td>Budget Constraint Tax Base</td>
<td>6,311</td>
<td>47,823</td>
<td>53,005</td>
<td>-544,182</td>
<td>791,170</td>
</tr>
<tr>
<td>Total Income</td>
<td>6,311</td>
<td>66,391</td>
<td>70,355</td>
<td>-249,999</td>
<td>1,060,120</td>
</tr>
<tr>
<td>Net Savings</td>
<td>6,311</td>
<td>4,601</td>
<td>11,511</td>
<td>-177,201</td>
<td>323,123</td>
</tr>
<tr>
<td>Deductible Expenses</td>
<td>6,311</td>
<td>7,422</td>
<td>16,671</td>
<td>-3,335</td>
<td>612,883</td>
</tr>
<tr>
<td>Federal Income and Payroll Tax</td>
<td>6,311</td>
<td>6,544</td>
<td>16,169</td>
<td>0</td>
<td>347,449</td>
</tr>
</tbody>
</table>

Note: Summary statistics are weighted to be nationally representative. The expenditure tax base equals the sum of total expenditure and state income tax minus deductible expenditure. Property taxes are embedded within total expenditure. The budget constraint tax base equals total income minus net savings, deductible expenses, and federal income and payroll tax (only the employee share). Deductible expenditure equals deductible expenses plus pension contributions.
Table 3.2: Deciles of consumption tax base under the expenditures approach: Means of federal tax

<table>
<thead>
<tr>
<th>Number of Units (in thousands)</th>
<th>All units</th>
<th>Lowest decile</th>
<th>Second decile</th>
<th>Third decile</th>
<th>Fourth decile</th>
<th>Fifth decile</th>
<th>Sixth decile</th>
<th>Seventh decile</th>
<th>Eighth decile</th>
<th>Ninth decile</th>
<th>Highest decile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Federal Tax – Existing Tax Regime</td>
<td>116,421</td>
<td>11,655</td>
<td>11,636</td>
<td>11,641</td>
<td>11,638</td>
<td>11,645</td>
<td>11,647</td>
<td>11,644</td>
<td>11,643</td>
<td>11,635</td>
<td>11,639</td>
</tr>
<tr>
<td>Federal Tax – Expenditures Approach</td>
<td>5,062</td>
<td>229</td>
<td>539</td>
<td>1,004</td>
<td>1,616</td>
<td>2,431</td>
<td>3,576</td>
<td>4,388</td>
<td>6,956</td>
<td>11,141</td>
<td>18,751</td>
</tr>
<tr>
<td>Federal Tax – Budget Constraint Approach</td>
<td>4,030</td>
<td>42</td>
<td>283</td>
<td>545</td>
<td>937</td>
<td>1,402</td>
<td>2,043</td>
<td>2,862</td>
<td>4,359</td>
<td>7,530</td>
<td>20,311</td>
</tr>
<tr>
<td>Federal Tax – Budget Constraint Approach</td>
<td>6,478</td>
<td>554</td>
<td>1,146</td>
<td>1,923</td>
<td>2,913</td>
<td>4,008</td>
<td>4,898</td>
<td>6,429</td>
<td>9,494</td>
<td>13,429</td>
<td>19,994</td>
</tr>
</tbody>
</table>

Note: Statistics are weighted to be nationally representative.
Table 3.3: Age of reference person: Means of federal tax

<table>
<thead>
<tr>
<th></th>
<th>All units</th>
<th>Under 30 years</th>
<th>30-39 years</th>
<th>40-49 years</th>
<th>50-59 years</th>
<th>60-69 years</th>
<th>70-79 years</th>
<th>80 years and older</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of Units (in thousands)</strong></td>
<td>116,421</td>
<td>15,290</td>
<td>19,508</td>
<td>21,440</td>
<td>23,247</td>
<td>18,571</td>
<td>10,782</td>
<td>7,583</td>
</tr>
<tr>
<td><strong>Federal Tax – Existing Tax Regime</strong></td>
<td>5,062</td>
<td>2,766</td>
<td>5,438</td>
<td>6,770</td>
<td>7,011</td>
<td>4,826</td>
<td>2,478</td>
<td>2,170</td>
</tr>
<tr>
<td><strong>Federal Tax – Expenditures Approach</strong></td>
<td>4,030</td>
<td>2,603</td>
<td>4,496</td>
<td>4,994</td>
<td>5,170</td>
<td>4,096</td>
<td>2,380</td>
<td>1,681</td>
</tr>
<tr>
<td><strong>Federal Tax – Budget Constraint Approach</strong></td>
<td>6,478</td>
<td>3,311</td>
<td>6,622</td>
<td>8,776</td>
<td>8,614</td>
<td>6,548</td>
<td>3,770</td>
<td>3,119</td>
</tr>
</tbody>
</table>

Note: Statistics are weighted to be nationally representative.
Appendix: Description of key variables and methods

3.A Expenditure approach

In this section, we provide details on the variables used to calculate the tax base under the expenditures approach. In the CEX, expenditures reported over the prior three months are separated into those that fall within the quarter of the interview (suffix CQ) and the quarter prior to the interview (PQ). Below we show the variable names with the “PQ” suffix, and in implementing the approach we add both the “PQ” and “CQ” values.

Total expenditures last quarter, for those amounts collected in the interview survey, are equal to:

\[ \text{TOTEXPPQ} = \]

\[ \text{FOODPQ} + \text{ALCBEVPQ} + \text{HOUSPQ} + \text{APPARPPQ} + \text{TRANSPQ} + \]

\[ \text{HEALTHPQ} + \text{ENTERTPQ} + \text{PERSCAPQ} + \text{READPQ} + \text{EDUCAPQ} + \]

\[ \text{TOBACCPQ} + \text{MISCPQ} + \text{CASHCOPQ} + \text{PERINSPQ} \]

- **FOODPQ**: Total food (includes food at and away from home, nonalcoholic beverages)
- **ALCBEVPQ**: Alcoholic beverages
- **HOUSPQ**: Housing
  - **SHELTPQ**: Shelter
- **OWNDWEPQ**: owned dwellings (includes interest on mortgages and home equity loans, property taxes, insurance, homeowners’ insurance, maintenance and repairs; does not include mortgage principal repayments)
- **RENDWEPQ**: rented dwellings
- **OTHLODPQ**: other lodging (vacation homes, college, hotels, etc.)
  - **UTILPQ**: Utilities, fuels and public services
  - **HOUSOPPQ**: Household operations (domestic services and household expenses)
  - **HOUSEQPQ**: House furnishings and equipment
- **APPARPQ**: Apparel and services
- **TRANSPQ**: Transportation (net outlays for vehicle purchases, vehicle finance charges, gas and oil, maintenance and repairs, insurance, rental, public and other transport)
- **HEALTHPQ**: Health care (health insurance, medical services, prescription drugs, medical supplies)
- **ENTERTPQ**: Entertainment (fees and admissions, equipment and services)
- **PERSCAPQ**: Personal care products and services
- **READPQ**: Reading (subscriptions, books, etc.)
- **EDUCAPQ**: Education (tuition and fees, textbooks, supplies)
- **TOBACCPQ**: Tobacco and smoking supplies
- **MISCPQ**: Miscellaneous expenditures (bank fees, legal fees, accounting fees, union dues, occupational expenses, finances charges other than for mortgages and vehicles)

- **CASHCOPQ**: Cash contributions (cash contributed to persons and organizations outside the CU, including alimony and child support payments, care of students away from home, and charitable contributions)

- **PERINSPQ**: Personal insurance (premiums for life and other insurance, such as disability and personal liability) and pensions (all Social Security and other government and private pension contributions paid by employees and self-employed)

To approximate the tax base, we deduct spending on health, education, cash contributions, personal insurance and pension contributions from this total, and add state income taxes paid under the current system:

\[
\text{Tax base} = \text{TOTEXPPQ} - \text{HEALTHPQ} - \text{EDUCAP} - \text{CASHCOPQ} - \text{PERINSPQ} + \text{state income taxes}
\]

Note that cash contributions include not only charitable contributions but also alimony and child support paid to individuals outside the consumer unit.

### 3.B Budget constraint approach

For this approach, the calculation is:
Taxable consumption = Total income – federal personal income taxes – net savings – deductible expenses

The first component is total income:

Total income = FINCBTXM + LUMPSUMX

FINCBTXM: Amount of CU income before taxes in past 12 months

**Wages and salaries**

FSALARYM: Amount of wage and salary income from all jobs, before deductions for taxes, pensions, union dues, etc., received by all CU members

**Self-employment income**

FSMPFRXM: Total amount of self-employment income or loss, including share of partnership income and farm income

**Social Security, private and government retirement**

FRRETIRM: Amount of Social Security and Railroad Retirement income, prior to deductions for medical insurance and Medicare, received by all CU members

RETSURVM: Amount of income received from retirement, survivor, or disability pensions

**Interest, dividends, rental income, and other property income**

INTRDVXM: Amount of income received from interest and dividends
ROYESTXM: Amount of income received from royalty income or income from estates and trusts

NETRENTM: Amount of income received from net rental income or loss

**Unemployment and workers’ compensation, veterans’ benefits and other regular contributions for support**

OTHREGXM: Amount of income received from any other source such as Veteran’s Administration (VA) payments, unemployment compensation, child support, or alimony

**Public assistance, supplemental security income and Food stamps**

WELFAREM: During the past 12 months, what was the total amount of income from public assistance or welfare, including money received from job training grants such as Job Corps, received by ALL CU members?

FSSIXM: Amount of Supplemental Security Income from all sources received by all CU members

JFS_AMTM: Annual value of food stamps

**Other income**

OTHRINCM: During the past 12 months, what was the total amount of other money income, including money received from cash scholarships and fellowships, stipends not based on
working, or from the care of foster children, received by all CU members?

LUMSUMPX: Total amount received from lump sum payments from estates, trusts, royalties, alimony, prizes, games of chance, or from persons outside the CU

We calculate several components of net savings, where net savings are contributions to savings less withdrawals.

For private and public retirement plans, net savings are simply total contributions:

FINDRETX: Amount of money placed in an individual retirement plan, such as an IRA or Keogh, by all CU members in past 12 months

FPRIPENX: Amount of private pensions deducted from last pay, annualized, for all CU members

FGOVRETX: Amount of government retirement deducted from last pay, annualized for all CU members

FJSSDEDX: Estimated amount of income contributed to Social Security by all CU members in past 12 months

For securities, net savings are amounts purchased less amounts sold:
PURSSECX: During the past 12 months, what was the purchase price including broker fees of any stocks, mutual funds or bonds bought by you (or any members of your CU)?

SELLSECX: During the past 12 months, what was the net amount received from sales of any stocks, mutual funds or bonds after subtracting broker fees by you (or any members of your CU)?

Note that we are assuming that any dividends that are reinvested will show up as purchases. Thus, dividend income is counted as a part of total income, and any amounts reinvested should be canceled. In practice, households are likely to underreport these reinvested amounts, so that net savings through this channel will be quite likely be understated for this reason.

For own businesses and farms, net savings are amounts invested vs. assets withdrawn:

BSINVSTX: During the past 12 months, how much did you (or any members of your CU) invest in your own business or farm?

WDBSASTX: During the past 12 months, what was the value of any assets you (or any members of your CU) withdrew from your own business or farm?

For checking, savings and U.S. savings bonds, we have variables that allow us to measure the change in the net balance. The change in the net balance will capture not only net savings but also interest income. Since interest income is counted as part of
total income, subtracting the change in the net balance is appropriate to deduct from income any interest income that is not withdrawn, so not available for consumption.

COMPBNDX: How much more (less) in U.S. Savings bonds your CU had at the end of the last day of (last month) compare with the amount your CU had on the last day of (last month, one year ago)?

COMPCKGX: How much more (less) in checking accounts your CU had at the end of the last day of (last month) compare with the amount your CU had on the last day of (last month, one year ago)?

COMPSAVX: How much more (less) in savings accounts your CU had at the end of the last day of (last month) compare with the amount your CU had on the last day of (last month, one year ago)?

The deductible expenses are:

HEALTHPQ: Health care expenditure

EDUCAPQ: Education expenditure

CASHCOPQ: Cash contributions

LIFINSPQ: Life insurance premiums

We describe how we calculate federal personal income taxes in the next section.
3.C Estimated tax liabilities

We estimate the baseline tax liability under the existing tax system using TAXSIM, a program developed by the National Bureau of Economic Research (NBER) that can estimate income tax information using various sources of income and household characteristics. TAXSIM requires an input of 22 variables to perform the tax calculation, each of which we calculate using variables available in the CEX.

We assume the tax year to be 2012 for all CUs. For our sample, the survey took place during January, February, or March of 2013. The survey questions ask income information for the past 12 months. We can identify the corresponding state for 87 percent of the sample. We input zero, which stands for “no state tax calculation” in TAXSIM for the remaining 13 percent of the sample.

If the reference person for the household is married, we set the filing status to married filing jointly. If this person is not married and has dependents, we set the filing status to head of household. All others are presumed to be single filers.

We define the number of dependents as the sum of qualified children and qualified relatives. Qualified children are defined as the reference person’s children, adopted children, or grandchildren, who are younger than 19 or younger than 24 and enrolled in college, and who have gross income less than $3800, the amount of personal exemption in the year of 2012. Qualified relatives are defined as members with gross income less than $3800 who are not qualified children or the spouse of the reference person.
We have data on wages and salaries, income from business, dividends, taxable pensions and IRA distributions, social security benefits, unemployment compensation, and other non-taxable transfer income. We enter these in the corresponding inputs to TAXSIM. For the input to other income, we include interest from saving accounts and bonds, fellowships, income from other rental units, income from alimony and child support payments, lump sum payments from estates, trusts, royalties, alimony, prizes, and games of chance. As per the instructions, we subtract contributions to IRA and Keogh, alimony paid, and child support paid. For itemizers, we also include state and local income tax refunds received and property tax refunds received.

TAXSIM also requires inputs on some expenditure items such as rent paid, real estate taxes paid, and childcare expenses. We have expenditure data in these categories for the last three months from the interview survey, and we multiple them by four to estimate the annualized value. On the inputs of itemized deductions, we include personal property taxes for vehicles, mortgage interest, and charitable contributions. For mortgage interest, and charitable contributions, we estimate the annualized values by multiplying the corresponding expenditure in the past three months by four.

One major limitation of using the Consumer Expenditure Survey is that it has insufficient information on short-term and long-term capital gains or losses. The only relevant information available is the net amount received from sales of any stocks, mutual funds or bonds. Information on capital gains is important because they are taxable in the current tax regime, but not taxable until withdrawals from the registered
accounts in our proposed consumption tax. To estimate the short-term and long-term capital gains or losses, we use the SOI Tax Stats – Sales of Capital Assets Reported on Individual Tax Returns from the Internal Revenue Service (IRS). According to our calculations using the statistical table on “Short-Term and Long-Term Capital Gains and Losses, by Asset Type, Tax Year 2012,” the total sales value of any stocks, mutual funds or bonds in 2012 was 2.67 trillion, in which 1.60 trillion was considered short-term and 1.07 trillion was considered long-term. The total amount of taxable short-term and long-term net gain/loss was -522 million and 182 billion respectively. In other words, the proceeds from sales of any stocks, mutual funds or bonds on average consisted of -0.02 percent of short-term capital loss and 6.81 percent of long-term capital gain in 2012. For the inputs for short-term capital gains and long-term capital gains, we assume they equal -0.02 percent and 6.81 percent of the tax unit’s net amount received from sales of any stocks, mutual funds or bonds in the past twelve months.

The procedure to estimate tax liability under our proposed tax scheme is similar to that for estimating the baseline tax liability. We use TAXSIM and keep the inputs of items on household characteristics unchanged. For inputs on various sources of income, we replace them with the expenditure or budget constraint tax base. We add back in the federal personal income taxes and the employee share of the payroll tax paid under current law. Lastly, we eliminate all itemized deductions except for charitable contributions.
References


Jacob, Brian A., McCall, Brian and Kevin Stange. “College as country club: do colleges cater to students’ preferences for consumption?” *Journal of Labor Economics* (Forthcoming).


