CREDITS AND DEDUCTIONS:
AN EXPERIMENTAL TEST OF THE RELATIVE STREGNTH OF ECONOMIC INCENTIVES

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Abstract: Does the type of tax incentive matter in terms of encouraging behavior? Social policies often use tax incentives to encourage behavior, but little research has been on how the structure or type of tax incentive might influence behavior. Using experimental methods, we test the effects of incentives structured as tax deductions and credits with respect to the policy problem of how best to encourage people to purchase annuities at retirement. We hypothesize that tax credits may be more effective than tax deductions at increasing the rate at which individuals would engage in socially desirable behavior because credits appear to have immediate value. Adult subjects played a financial decision making game in which they were offered different incentives to purchase annuities. We found that incentives in the form of tax credits not only encouraged more annuity purchases relative to actuarially equivalent deductions but also relative to deductions that were greater in value than the credit-based tax incentives.

Introduction

Social policy in the United States has undergone an important transformation in recent decades as policymakers have increasingly employed the tax code to promote a broad range of social goals and policy objectives (Howard 1997; Howard 2007). This form of social policy is comprised of provisions within the tax code that provide credits, deductions, or exclusions that serve as incentives for behaviors thought to be socially desirable. Unlike social policies such as Head Start, Medicare, or Temporary Assistance for Needy Families that are provided through direct expenditures, these "tax expenditures" represent foregone revenue resulting from those reductions in the tax liability of qualifying households. Tax expenditures provide an economic incentive to engage in the behaviors they subsidize by allowing the household to reduce their tax burden and increase their after-tax income.

Among the largest of the tax expenditures in the tax code are the mortgage interest deduction, the Earned Income Tax Credit (EITC), and the exclusion of income contributed to individual pension plans. These provisions are designed to subsidize and thereby encourage, respectively, home ownership, work (among low-income persons), and retirement savings. These tax-based incentives are significant: According to the Joint Committee on Taxation (2010), the revenue losses from individual households in 2010 due to these provisions within the tax code were $91 billion, $56 billion, and $105 billion, respectively.

Our research question is whether the structure of the tax incentive matters for inducing the desired behavior. Currently, most research has been devoted to establishing whether these programs are effective at encouraging the behaviors they subsidize, and the results from the empirical work in this field are decidedly mixed. Little work has been done to explore how different types of tax expenditures cause different policy outcomes.

Using experimental methods and a sample of adults in a metropolitan community, we explore these issues with respect to the policy problem of how best to encourage people to purchase annuities when they retire. Many Americans have the choice of taking retirement plan distributions in the form of a lump sum or an annuity. Individuals exercising the lump-sum distribution option must make certain that they do not under- or over-consume their lump sum. Under-consumption can lead to an unnecessarily low standard of living in retirement while over-consumption can deplete resources. Avoiding these risks is difficult because of the uncertainty as to how long one will live, limited self-control, and bounded rationality (Benartzi and Thaler 2007). While we might expect individuals to hedge against these vulnerabilities through annuitization, most choose a lump sum form of distribution and very few choose to purchase an annuity at retirement (General Accounting Office 2011). Are some types of tax subsidies better at encouraging annuitization than others?

We study whether tax credits may be more effective than tax deductions at increasing the rate at which individuals would engage in socially desirable behavior. Contrary to economic theory, experimental evidence indicates that individuals respond differently to alternative, yet economically equivalent, incentives. This understanding will help establish how lawmakers can best apply the limited resources available to them in order to achieve specific policy aims.

Tax Expenditures, Social Policy, and Behavioral Models

Policy makers often use tax credits, deductions, and exclusions to achieve policy goals, and as an introduction we first compare the three largest: the Earned Income Tax Credit (EITC), the mortgage interest rate deduction (MID), and exclusions for pension plan contributions (EPC). The EITC provided $55 billion to 25.7 million working families with low-income in 2009 (Joint Committee on Taxation 2010). This provision within the tax code is currently the largest source

of cash-assistance for the working poor and is the nation's primary antipoverty program (Gitterman 2010). Research has demonstrated that this program has been successful at increasing workforce participation among single mothers and reducing US poverty rates among the working poor (Eissa and Liebman 1996; Meyer and Rosenbaum 2001; Sherman 2009; Ben-Shalom, Moffit, and Scholz 2011; Hotz and Scholz 2006).

The MID provided more than 34 million households with more than $91 billion worth of tax benefits in 2009 (Joint Committee on Taxation 2010). This subsidy is intended to promote homeownership, which is thought to be associated with a number of positive externalities and socially beneficial outcomes. Despite being larger in terms of total benefit than the EITC, the empirical evidence indicates that this subsidy has had little to no effect on the rates of homeownership within the US. Glaeser and Shapiro (2004) estimate that a one percent increase in the subsidy rate is associated with only a .0009 percent increase in the rate of homeownership. In other words, the subsidy is going to people who would have engaged in the desired behavior even in the absence of the subsidy.

The federal government also allows for deductions and exclusions for income contributed to defined contribution plans and individual retirement accounts. The EPC is intended to incentivize retirement savings and thereby improve financial security in retirement for those covered under qualifying plans. According to estimates from the Joint Committee on Taxation (2010), US workers were able to save $69 billion in tax liabilities through contributions to their pension plan in 2010. Contributions to these plans are typically tax deferred, meaning that individuals are allowed to exclude them from their taxable income throughout their working lives, but must eventually pay taxes on them and any investment earnings when they withdraw them. Here again, the empirical evidence indicates that the incentives embedded within the tax

code fail to encourage new retirement savings (Engen, Gale, and Scholz 1996; Gale and Scholz 1994).

In summary, social policies administered through the tax code have had mixed success. The existing literature analyzing the effects of tax expenditures has tended to focus, primarily, on whether a particular tax policy has an effect on individual behavior. By contrast, this analysis will attempt to understand why one form of tax expenditures may be more effective than another at encouraging behavior.

While there is little literature on this issue, research suggests that individuals may respond differently to similar incentives depending on how the incentives are structured (Gale 2011). According to economic theory, individuals should be indifferent between two options with equal expected values, but individual economic behavior frequently deviates from the expectations of these models. In a field experiment comparing the relative strength of offering a credit (cash rebate) or economically equivalent matching contributions, Saez (2009) found that the matching contributions were more effective at increasing enrollment in and contributions to an individual retirement account (IRA). The credit and match were set at rates such that the out-of-pocket costs associated with any contributions were identical for individuals in each group. Those offered a match were more likely to enroll in an IRA by roughly 4 percentage points and contributed $153 more to their accounts after enrolling. In a related study, Davis and Millner (2006) compared the effect of matches and credits as price-reduction strategies on consumer decisions. In this study, the researchers offered participants either a rebate or a matching incentive to purchase chocolate bars. Those participants that were offered a matching incentive purchased significantly more candy bars than those offered an economically equivalent rebate.

A recent study by Goldman Sachs (2010) found that the first-time homebuyer's tax credit had a significant impact on home sales in 2008 and 2009. This temporary tax credit provided those purchasing their first home with a refundable tax credit of up to $8,000 and is estimated to have increased home values by 5 percent and to have led to 400,000 additional home purchases in 2009 (Goldman Sachs 2010). Matched contributions and matching rates also appear to have a significant effect on participation in and contributions to individual retirement accounts (Duflo, Gale, Liebman, Orszag, and Saez 2006). However, the size of the effect of the Saver's Tax Credit, a non-refundable tax credit that reduces the tax liability up to 50 percent of contributions to a defined contribution plan of qualifying households, appears to be small (Duflo. Orszag, Gale, Saez, and Liebman 2007).

These studies suggest that credits are more effective in inducing the desired behavior than deductions or exclusions. There are a number of reasons to doubt that equal incentives would produce equivalent responses. First, compliance costs of specific incentives may cause different outcomes. Deductions and exclusions such as the MID and EPC may have a higher compliance cost than tax credits like the EITC (Bertrand, Mullainathan, and Shafir 2006). The complexity of the tax code may prevent individuals from being able to incorporate any expected benefit from specific subsidies into their economic decisions. A recent article in the USA Today, based on information from tax professionals about the difference between the marginal and effective tax rate, incorrectly claimed that workers receiving a pay raise may actually end up with less take-home pay after being "bump[ed] into the next tax bracket." [1] Further, a study by Fuiji and Hawley (1988) found that a large portion of the population could not guess or correctly identify their marginal tax rate. This also provides a reasonable explanation for why wage earners and those with positive taxable income do not bunch into kink points at the various income tax

[1] The article was written by Gregory Connelly (2011) and the USA Today has since issued a correction.

brackets (Saez 2010; Chetty and Saez 2009). This finding is true over time as well, even when

the increase in the marginal rates have been large and stable (Saez 2010). Survey results indicate

that workers are aware of the existence of the EITC but are not knowledgeable with respect to

the structure of the EITC (Phillips 2001; Romich and Weisner 2002; Smeeding, Phillips, and

O'Conner 2000; Maag 2005). This might explain why wage earners fail to bunch around the kink

points at the phase-in and phase-out ranges of the EITC benefit schedule (Saez 2010; Chetty and

Saez 2009).

The differing behavioral responses to the different tax subsidies may also be a function of

household type. Deductions and exclusions reduce the amount of income that falls under an

individual's marginal rate of taxation and, therefore, provide a larger benefit to higher income

households that, typically, face higher marginal rates. As a result, these provisions provide little

benefit to the vast majority of income earners.[2] Moreover, a household can only claim benefits

like the mortgage interest deduction if they itemize their deductions on their income tax returns,

and only a small minority of taxpayers itemize their deductions (Prante 2007). In 2009, 69

percent of all the benefits from the MID went to the 20 percent of US households making more

than $100,000 (Joint Committee on Taxation 2010). Higher income households may be

predisposed to the types of behavior the government is attempting to encourage through these

types of tax expenditures, and these programs are functioning more as an unexpected reward for

high-income households than as an incentive for these behaviors for those at lower points along

the income distribution.

In addition, responses to these tax subsidies may vary due to psychological biases such as

those explained by prospect theory (Kahneman and Tversky 1979). One of the central tenets of

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[2] In 2009, 80 percent of tax payers faced a marginal rate of taxation of 15 percent, the rate applied to income below $67,900 for a married couple filing jointly (Tax Policy Center 2011).

this theory is that individuals tend to prefer a benefit that is certain over a larger benefit that is

not certain. This tendency is referred to as the "certainty effect" and helps explain why

individuals tend to heavily discount future benefits (Laibson 1997). Indeed, research has shown

that when given the choice between a larger benefit paid out over time and a smaller lump sum

benefit, individuals tend to prefer the lump sum (Pleeter and Warner 2001; Loewenstein and

Prelec 1992). Researchers have defined this type of impatience as hyperbolic discounting

(Laibson 1997).

The evidence establishing the certainty effect and hyperbolic discounting implies that

deductions and exclusions may be less effective at incentivizing the behavior due to the

uncertainty they engender. For example, an individual must incorporate the probability that

he/she will make enough in the future to justify itemizing their deductions, accurately forecast

future rate of taxation they may face, and accurately forecast the value of any other deductions

they intend to claim in the future. Individuals also would need to know the value of any other

deductions because the value of any one deduction is equivalent to its share of all deductions

multiplied by the average tax rate on all of the deducted income. This is true because all

deductions are not factored in any particular order. These calculations introduce variation and

uncertainty into expected present value of tax deductions, a problem that is not shared by tax

credits that reduce a tax bill dollar-for-dollar and that may even be refundable, meaning that the

household is paid the residual amount of the credit after their tax liability has been reduced to $0.

In contrast, the ability to structure benefits from a credit as an immediate windfall speaks

to the certainty effect. For example, the first-time home buyer tax credit may have been more

effective than the MID because it provided homebuyers with a one-time, fixed windfall rather

than a stream of uncertain benefits issued over time. In a natural experiment involving

substantial sums of money, Warner and Pleeter (2001) demonstrate the value that individuals place a large premium on the present gains. They illustrate the behavioral tendency towards hyperbolic discounting and show that individuals overwhelming prefer a smaller yet immediate gain to a larger gain paid out over time.

Why Annuities

This study uses the decision to purchase an annuity as the context in which to analyze whether and how individuals respond differently to equivalent economic incentives. The incentives in this study are designed to replicate existing tax expenditure policies but because the results are derived from a game-based computer simulation, this study is limited in what it can say about the effect that these incentives might have on actual annuitization behavior.

Americans get their retirement income primarily from three sources: Social Security, private retirement plans, and personal savings and earnings. While Social Security is generally effective as an anti-poverty program for the elderly, it is less significant in terms of income for middle and upper income Americans (General Accounting Office 2011).

In the private pension system, defined contribution plans are the predominant pension plan. These plans consist of 401(k) plans, employee stock ownership plans, as well as profit sharing plans. These plans are essentially tax-advantaged savings accounts into which employers and employees contribute a specified dollar amount, a share of the participant's salary, which are often coupled with employer-provided matching contributions. Assets within these plans are typically held in securities, company stock, mutual funds, or equity funds. The distribution options within these plans include taking the accumulated benefits as a "lump-sum", receiving installment payments, annuitizing their assets, or rolling them over into an Individual Retirement Account (IRA). Lump-sum distributions are one-time withdrawal of all the assets

and are ubiquitous in these plans (U.S. Department of Labor 2007; Hewitt Associates 2009).

Installment payments are periodic withdrawals and approximately half of these plans provide this option and a small minority (15 percent) offer some form of an annuity (Hewitt Associates 2009). A survey of 401(k) plan participants found that only 6 percent of those offered an annuity settled on this method of distribution.

In 1975, 33 million working Americans were covered by defined benefit pension plans while only 11.5 million participated in defined contribution retirement plans. By 2007, 42 million Americans were covered by defined benefit plans but 81.5 million were participating in defined contribution plans (U.S. Department of Labor 2012: Table E5). The changing nature and composition of the U.S. private pension system means that more retirees will rely on defined contribution rather than defined benefit plans than in the past. The result of this transition is that most workers with a private pension will no longer be able to rely on the specific monthly income traditionally provided through defined benefit plans; they will instead, need to manage a stock of wealth.

Moreover, the lump-sum option is also becoming increasingly available in defined benefit plans. Traditionally, these plans would provide a lifetime annuity but 60 percent of all defined benefit plans now allow workers to opt for a lump-sum withdrawal of their accumulated retirement assets. Where this alternative is available, it is taken by an overwhelming majority of plan participants. A recent study found that vast majority of those eligible to receive a lump-sum through their traditional defined benefit plan (73 percent) and cash balance plan (83 percent) chose this form dispensation over an annuity (Mottola and Utkus 2007). Evidence from a nationally representative sample of older Americans, either near or in retirement, reveals that

only a small fraction (4 percent) of individuals annuitize their assets in retirement (Johnson, Burman, and Kobes 2004).

The shift towards lump-sum distributions likely will hurt retirees' economic well-being (Butrica and Mermin 2006). Individuals exercising the lump-sum distribution option must make certain that they do not under- or over-consume their stock of wealth. Under-consumption can lead to an unnecessarily low standard of living in retirement while over-consumption can led to the depletion of resources. The extent of these risks depends on the allocation of funds by the individual – a task made more difficult by uncertainty as to how long one will live, limited self-control, bounded intelligence, and bounded rationality (Benartzi and Thaler 2007). Under these considerable circumstances, one might expect individuals to hedge against these vulnerabilities and insure against any longevity risk through annuitization.

According to the standard life-cycle model, individuals would realize significant welfare gains were they to annuitize some, or all of their retirement savings (Yaari 1965; Mitchell 2001; Dushi and Webb 2004; Davidoff, Brown, and Diamond 2005). Despite the theoretical and estimable gains that economic theory and literature suggest might flow from such a decision, very few individuals elect to annuitize their assets (Investment Company Institute 2011; Mottola and Utkus 2007). For this reason, it is the type of economic behavior that policymakers may have an interest in subsidizing. In fact, legislation was introduced before Congress in 2009 that would have modified the tax code and established a new tax expenditure that would have allowed individuals to exclude 50 percent of any income from an annuity contract.[3]

This study expects to find that a credit is a more powerful incentive for encouraging annuitization than an actuarially equivalent deduction.

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[3] See H.R. 2748, The Retirement Security Needs Lifetime Pay Act of 2009.

Hypothesis 1: Participants will be more likely to select an annuity when receiving a credit versus a deduction with an equal expected value.

But how strong is the immediate windfall effect of the credit? Actuarially equivalent incentives may not capture the full effects of how the incentives are structured. To test the underlying theory even more, we also expect that people are more likely to select an annuity when offered a credit as compared to a deduction that is worth substantially more than the credit.

Hypothesis 2: Participants will be more likely to select an annuity when receiving a credit even when the expected value of the deduction exceeds that of the credit.

Data and Methods

Using an experimental design, this analysis will test whether the effect of a tax benefit is a function of how the incentives are structured. A growing number of researchers have used games to simulate the annuitization decision within an experimental setting to study various dimensions of the annuitization decision as well as various behavioral biases. Two such studies were conducted recently by Agnew, Anderson, Gerlach, and Szykman (2008) and Gazzale and Walker (2009). Agnew et al. (2008) found that the annuitization decision is sensitive to positive and negative framing. Gazzale and Walker (2009) found that individuals were more likely to purchase an annuity when their benefits were specified as a stream of payments rather than a lump-sum prior to playing the game, implying that individuals anchor themselves to a specific way of thinking about their benefits and are more likely to annuitize because an annuity reinforces their original conceptualization of their benefits. They also found evidence indicating that the annuization decision is negatively affected by the sequential nature of the risk associated with survival (survival to period 15 requires survival to period 14, which requires survival to period 13, and so forth) to which the stream of benefits from an annuity are linked. This study

borrows the relevant game design of these previous studies in an effort to determine whether individual behavior deviates from the expectations of common economic models and whether policy might be better designed to exploit these tendencies.

Our game simulates one of the many economic decisions confronting those entering retirement: whether to insure against the risk of outliving their assets (longevity risk) by purchasing an annuity with a portion of the account balance each player was given at the start of the game. Individuals were randomly assigned to receive incentives modeled after the type of tax expenditures typically used to subsidize socially desirable economic behavior: tax credits and tax deductions. The purpose of the incentives was to encourage annuitization within the game but the research aim is to study whether and how rates of annuitization vary between individuals assigned to the different treatment groups, when the value of the incentives are equal.

The rates of annuitization are compared between three mutually exclusive treatment groups to determine whether those offered a tax credit were more likely to annuitize than those offered the tax deduction. The three treatment groups were Credit, Equal Deduction, or Larger Deduction. Other than the type of incentive offered, the game was identical across treatments. We used the larger deduction treatment to see if the credit would still be more attractive despite the financial benefit of the larger deduction. A control group of participants were offered the annuity but without any tax incentive.

The participants made their decisions related to their account before the game began, and once made these decisions would be binding throughout the game. They were binding because we wanted to make sure that the annuitization decision was affected only by the incentive offered and not by the changes in the account balance due to, say, market losses. They began the game with $20,000 in their account that they were to "live off" throughout the game. They were

then told that their compensation for participating would be determined by the balance in their account when they exit the game. Individuals received $2 for exiting the game with a negative balance, $5 for exiting the game with a positive balance but below starting amount, and $10 for exiting the game with more than their the starting balance, which was equal to the initial $20,000 less the cost of the annuity if purchased. The game would take place over multiple periods, and in each period, $3,000 would be deducted from their accounts as a cost of living expense.

Parameters determining survival were determined randomly. After each period, the computer generated a random number between 1 and 18. Individuals with a value larger than the specified number survived to the next period. The value necessary to survive increased with each period, so the likelihood of survival declined over time. For example, an individual needed a value of four or higher to survive to the second stage and then a value of five or higher to survive to the third stage, a value of six in order to survive to the fourth stage, and so forth. Individuals were able to see the conditional probabilities of their survival to a given period in a life table provided to them at the beginning of the game. The game would end if they ran out of money in their account or if they failed to "survive" to the next period.

Participants could invest their funds in three different investment options at the start of the game. They had the option of (1) investing some or all of their money in a fictional stock market, (2) purchasing an annuity to help offset their $3,000 per-period costs of living expenses, or (3) leaving their money in their account balance. The cost of the annuity was $13,110 and the amount of the per-period annuity payment was $2,000 applied to the account balance. Returns in the stock market would be due entirely to chance and any remaining amount they chose not to invest from their account balance would not gain or lose value except for the automatic deduction of the cost of living.

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Individuals assigned to the Credit group would receive a one-time credit of $3,277 applied towards their account balance if they purchased an annuity. Participants assigned to the Credit group saw the following message on the computer screen: "As a part of a new program, however, you will receive a credit of $3,277 that will be immediately added to your savings account should you decide to purchase the annuity."

Those that were assigned to the Equal Deduction group would see their cost of living reduced by $500 to $2,500 in each period if they purchased an annuity (Equation 1). The message for the Equal Deduction group was the following: "As a part of a new program, however, you will be able to reduce your cost of living by $500 in each period should you decide to purchase the annuity." Those that were assigned to the Larger Deduction group were told that their cost of living would be reduced by $875 in each period if they purchased the annuity (Equation 2). The expected value of the deduction is given by the following equation:

$$EV(Equal\ Deduction) = \sum_{t=1}^{t}(p_t * \$500) = \$3,277 = Credit \qquad\qquad \text{Eq. 1}$$

$$EV(Larger\ Deduction) = \sum_{t=1}^{t}(p_t * \$875) = \$4,855 > Credit \qquad\qquad \text{Eq. 2}$$

where p is equal to the conditional probability of surviving to time period t.

The deduction is intended to reduce the per-period "cost of living" of the participant just as tax deductions reduce the annual costs associated with the behaviors they subsidize. The values of the equivalent and larger deductions were set to equal roughly $\frac{1}{6}$ and $\frac{2}{7}$, respectively, of the per-period cost of living. These values are, admittedly, arbitrary but are an unavoidable simplification in a game simulation.[4] The total value of the deduction for the game was set to equal that of the credit after being weighted by the survival probabilities.

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[4] The value was selected primarily because it was the mid-point for acceptable range of possible values. The value had to be less than $1,000 and more than $0. This restriction ensures that individuals that purchase an annuity will still lose money from their account over time (Cost of Living = 3000 – 2000 – 500 = 500). This was to ensure that the project remained within the budget by not paying out too much too often to the participants.

Once they have made their annuitization and investment decisions, nothing more is required of the participant as the game proceeds automatically from period to period until the individual either runs out of money or they fail to survive to the next period. After the participants finished playing the game, they filled out a brief survey that collected demographic information and other data relevant to this study. Individuals are asked about their gender, age, race, marital status, employment status, education, and household size. They were also asked to provide information with respect to their primary pension plan and a question intended to elicit their level of risk aversion. The risk aversion question was a modified version of the same measure taken from the Health and Retirement Study: "Suppose that you are the only income earner in the family. Your doctor recommends that you move because of allergies, and you have to choose between two possible jobs. The first would guarantee your current total family income for life. The second is possibly better paying, but the income is also less certain. There is a 50-50 chance the second job would double your total lifetime income and a 50-50 chance that it would cut it by a third. Which job would you take - the first job or the second job?" After the individual finished filling out the survey information, they had concluded the study and they were given their compensation.

Participants consisted of 301 individuals from a jury pool in a large metropolitan court system in North Carolina. The jury pool consists of randomly selected county residents who were either licensed drivers, registered voters, or both. County residents excluded from jury duty included those individuals who were less than 18 years old, who served as a juror in the previous two years, who did not speak English, who were felons who did not have their citizenship restored, and those who were not physically or medically competent. Individuals called for jury duty in the months between August 2011 and April 2012 were solicited to participate in this

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game as they waited in the jury lounge. Participants played the game on computers set up in the jury lounge.

Estimation Methods

This analysis relies on two types of analysis: a two sample t-test and ordinary least-squares regression (OLS). The outcome in each of these analyses is a dichotomous variable indicating whether or not individuals made the decision to annuitize. The variables of interest are the dichotomous variables indicating whether the individual was assigned to the group offered a credit or an economically equivalent deduction and the dichotomous variable indicating whether the individual offered a credit or the group offered an economically larger deduction. We also compare each of these groups to a control group that was offered no incentive to purchase an annuity.

T-tests are common with randomized designs, but randomization creates only the expectation of equivalence between groups to which participants are assigned. Ordinary least-squares regression is used to control for differences that may exist between the groups across the demographic and control measures collected in the survey portion of the study. Because the outcome is dichotomous, the regression analysis is a linear probability model. A linear probability model with robust standard errors was used as opposed to a non-linear model to ease the comparison of the t-test and regression results.[5]

Descriptive Statistics

The summary statistics in Table 1 highlight some important aspects of the sample of game participants. What stands out most among the characteristics of the participants in this study is that an overwhelming majority of the sample had completed college. The highly educated sample reflects, in part, the population of the metropolitan population from which we

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[5] Robust standard errors were used to account for heteroscedasticity in residuals.

drew our sample. According to the Census Bureau, 47 percent of residents in the county have a bachelor's degree compared with 26 percent of the North Carolina population statewide.[6] Having a college education may also be associated with being a licensed driver or a registered voter, the pre-requisites for jury duty selection in the state. Finally, those that attended college may have been more willing to participate in a study linked with a local university. The relatively large number of college graduates in the study may limit the generalizability of these findings but jury pools are the easiest way to get access to a variety of potential participants. However, the more highly educated are more likely to have access to and participate in defined contribution plans (Engen, Gale, Scholz, Bernheim, and Slemrod 1994; Benjamin 2003). Therefore, the annuitization framework of this analysis may be more relevant to this segment of the population than to the general public. In sum, the benefit of having access to a broad range of individuals randomly sampled from the local population is strongly preferable to sampling undergraduates or employees of a particular firm, practices common among this type of experimental work but there are important differences between the sample and general population.

[Table 1]

A majority of our sample is white, married, over the age of 30, and risk averse. For the most part, the differences across treatment and control groups with respect to these measures are not statistically significant; however, statistical tests of equivalence indicate that we should control for these observables in our regression models estimating the differences in annuitization rate across groups.

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[6] U.S. Census Bureau, State & County Quick Facts, Wake County, North Carolina. Available at http://quickfacts.census.gov/qfd/states/37/37183.html

Results

Figure 1 displays the levels of annuitization for each of the groups in this analysis. Clearly, annuitization was a popular option within the game. The high rates of annuitization across each of the groups stand in stark contrast to the low levels of demand in the actual annuity market in the United States. However, according to data from the American Council of Life Insurers (2011), the amount Americans invest in individual annuity contracts has increased over the past few years, but the current demand is still well below what economic theory would predict (Yaari 1965; Mitchell 2001; Dushi and Webb 2004; Mitchell, Poterba, Warshawsky, and Brown 1999; Davidoff, Brown, and Diamond 2005). While this is an interesting and unexpected finding, the absolute levels of annuitization are not as relevant as are the relative rates of annuitization between the credit, deduction, and control conditions.

[Figure 1 about here]

The results from the pairwise comparisons are displayed in Table 2. Roughly 64 percent of those assigned to the Credit treatment group annuitized their assets compared with a combined 47 percent of those assigned to the two deduction conditions and 51 percent in the control group. Annuitization rates for the Credit group were also higher than those in either of the two types of deduction groups as 50 percent of the Equal Deduction and 43 percent of the Larger Deduction selected an annuity. In other words, being offered a credit increased the likelihood that an individual purchased an annuity by 14 percentage points ($p = .063$) over an actuarially equivalent deduction and 20 percentage points ($p = .031$) over a deduction with a larger expected value. There was no statistically significant difference between the rate of annuitization between those assigned to the two deduction conditions ($p = .512$). Interestingly, the rate of annuitization was higher in the control group than it was in either of the deduction groups, but these differences

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were not statistically significant. The rate of annuitization in the credit group was 13.5 percentage points higher than of the control group and was statistically significant.

[Table 2 about here]

Because individuals were randomly assigned to their respective conditions, we can attribute the differences in the rates of annuitization to the type of incentive each group received. However, randomization provides only the expectation of equivalence across the credit and deduction groups, but it does not guarantee that there will be no measurable differences between the groups, especially in smaller sample sizes like those used in this analysis. According to summary statistics in Table 1 there appear to be some important differences across the treatment and control groups. To control for the effect these differences may have, these measures were included as control variables in a regression analysis comparing the rates of annuitization across the different groups. The results of this analysis are provided in Table 3.

[Table 3 about here]

The coefficients from the regression analysis indicate that the difference in the estimated effect of the credit relative to the deduction remains even after controlling for the observable differences between the two groups. The results from the first column compare the effect of being assigned to the credit condition on the likelihood of annuitization relative to those assigned to the actuarially equivalent deduction condition. The parameter of interest is on the variable Credit & Equal Deduction, a dichotomous variable indicating treatment assignment. The coefficient on this variable, 16.4, indicates that being assigned to the credit condition increases the rate of annuitization by 16.4 percentage points over being assigned to the Equal Deduction condition. This estimate is statistically significant at the .05 level. The second parameter of interest is the variable Credit & Larger Deduction which indicates whether an individual was

assigned to the group offered the Credit condition or the group offered the deduction with an actuarially larger value than the credit. Here again, the statistically significant effect is positive and in the expected direction. Compared to the Larger Deduction group, the rate of annuitization was 21.4 percentage points higher among those assigned to the Credit condition. Finally, when the two groups offered deductions are combined, the rate of annuitization among those offered a credit was 18 percentage points higher and the difference was significant at the .05 level.

The Credit group was the only group to have higher annuitization rates than the control group, but when we add our control variables to the model, this difference is slightly attenuated and is no longer statistically significant. It is possible that the difference in the annuitization rates between these groups is no longer statistically significant because we have inflated our standard errors through the inclusion of irrelevant variables to our regression model. Also, when we use a more parsimonious model—remove all those variables that do not have a significant relationship with annuitization—the difference between the Credit group and the control group remains significant.

Discussion

The findings from this study demonstrated that, contrary to economic theory, individuals respond differently to economically equivalent incentives. This test used incentives designed to resemble tax credits and deductions intended to subsidize socially desirable behavior. The incentive structured to resemble a credit proved a more effective at encouraging a specific type of economic behavior than one designed as a deduction. This fact remained true even when the expected value of the deduction was larger than the credit. The results from this study comport with the stylized facts about the measureable effects of the EITC on labor force participation and the lack of an empirical relationship between the MID and EPC on the economic behaviors they

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are intended to subsidize. However, it is unclear why the difference in the rate of annuitization was larger between the Credit group and the larger deduction group than it was between the credit group and the equal deduction group. One would expect the annuitization rate to be higher among those offered the larger of the two deduction incentives although the observed difference between the two deduction groups is not significant. The variation in the observed differences across the credit and two deduction groups may be attributable to random error in the data.

It also remains unclear why the deduction incentive appeared to have no effect on the decision of game participants to annuitize a portion of their assets. The annuitization rates in this group were no larger than those found in the control group.

The types of tax subsidies analyzed in this experiment are important vehicles by which policymakers implement social welfare policies. In fact, spending on tax expenditures has grown at a rate comparable to direct spending programs over the past few decades (Howard 1997). At a point in time when policymakers are looking to trim budget deficits, understanding how these incentives can be structured to maximize their effectiveness and make the most efficient use of public resources is paramount can lead to more efficient policy outcomes.

While this project focuses on the annuities, the behavioral responses to the various incentive structures are relevant to a wider range of activities. The tax code is replete with rules granting favorable and unfavorable tax treatment to specific behaviors that the Congress intends to foster or discourage. If the purpose of tax expenditure subsidies is to increase the rate at which individuals engage in a specified behavior, then the evidence from this analysis would suggest that the focus should shift away from deductions and exclusions and towards refundable tax credits as the results suggest that the government could get a larger behavioral response from a credit than it could with a higher valued, and more expensive, deduction. Opportunities to get

more for less are rare, but with respect to tax expenditures, it appears possible. But the other side of the coin is that credits also have more "upfront" budgetary costs for politicians, which may reduce the appeal of credits.

Future studies looking at this issue may check to determine whether these results are robust under different conditions with respect to both annuitization and other types of economic behavior. For example, would the effect of a credit-based incentive be moderated by whether the credit is refundable or non-refundable? In their review a tax credit designed to encourage retirement saving (the Saver's Credit), Duflo et al. (2006) conclude that complex design combined with non-refundability may explain the limited success of this incentive. Their work establishes that simply providing a credit as opposed to a deduction or exclusion will not ensure the success of the incentive, but that the structure of the credit matters. Future work might also explore how deductions and credits are framed to individuals. For example, in the context of our financial decision making game credits could be framed as reductions in the cost of the annuity or as an increase in the starting; deductions could be reductions in the cost of living or increases in the after-tax income in each period.

Table 1. Variable Means by Group

	Full Sample	Credit Group	Deduction Group (Actuarily Equivalent)	Deduction Group (More Valuable)	Deduction Group	Control Group
Fraction Male	0.51	0.42	0.48	0.56	0.50	0.60
Fraction White	0.74	0.70	0.76	0.79	0.77	0.73
Fraction Married	0.72	0.80	0.70	0.67	0.69	0.69
Under 30 Years Old	0.36	0.28	0.25	0.46	0.31	0.50
College or More	0.75	0.79	0.70	0.74	0.72	0.75
Fraction with Risk Averse	0.69	0.78	0.63	0.78	0.68	0.64
N =	301	89	84	39	123	89

Table 2: Pairwise Comparisons of Annuitization Rates

Pairwise Comparison	Hypothesized Difference in Rates of Annuitzation	Actual Difference	_p_-value
Credit and Control	Avg(Credit) - Avg(Control) > 0	13.5	0.070*
Equal Deduction and Control	Avg(Eq. Deduct) - Avg(Control) > 0	-0.6	0.942
Larger Deduction and Control	Avg(Lrg. Deduct) - Avg(Control) > 0	-7.0	0.471
Deductions (Both) and Control	Avg(Deduct) - Avg(Control) > 0	-2.6	0.711
Credit and Equal Deduction	Avg(Credit) - Avg(Eq. Deduct) > 0	14.0	0.063*
Credit and Larger Deduction	Avg(Credit) - Avg(Lrg. Deduct) > 0	20.5	0.031**
Credit and Deductions (Both)	Avg(Credit) - Avg(Deduct) > 0	16.1	0.020**
Larger Deduction and Equal Deduction	Avg(Lrg. Deduct) - Avg(Eq. Deduct) > 0	6.4	0.512

Table 3: Comparison of Annuitization Rates by Group using OLS (standard errors in parentheses)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Credit (1) & Control (0)	0.110 (0.08)						
Equal Deduction (1) & Control (0)		-0.054 (0.08)					
Large Deduction (1) & Control (0)			-0.133 (0.10)				
Either Deduction (1) & Control (0)				-0.085 (0.07)			
Credit (1) & Equal Deduction(0)					0.164** (0.08)		
Credit (1) & Larger Deduction(0)						0.214** (0.11)	
Credit (1) & Either Deduction(0)							0.180** (0.07)
Male	-0.022 (0.08)	0.085 (0.09)	0.107 (0.10)	0.067 (0.08)	-0.075 (0.08)	-0.161 (0.10)	-0.075 (0.08)
Black	-0.131 (0.12)	-0.045 (0.13)	0.042 (0.15)	-0.019 (0.11)	-0.198* (0.12)	-0.208 (0.13)	-0.169 (0.11)
Other	-0.279** (0.13)	-0.238* (0.13)	-0.223 (0.15)	-0.160 (0.12)	-0.064 (0.14)	0.149 (0.18)	0.005 (0.13)
Married	0.168* (0.10)	0.068 (0.10)	0.058 (0.10)	0.056 (0.09)	0.122 (0.10)	0.080 (0.11)	0.086 (0.09)
Risk Averse	-0.048 (0.09)	0.021 (0.09)	0.083 (0.10)	0.027 (0.08)	-0.106 (0.09)	-0.073 (0.11)	-0.080 (0.08)
Under 30 Years Old	0.055 (0.08)	-0.112 (0.10)	-0.181* (0.10)	-0.162** (0.08)	0.110 (0.09)	0.026 (0.09)	0.002 (0.08)
College	0.005 (0.10)	-0.002 (0.10)	0.089 (0.11)	0.043 (0.09)	0.036 (0.10)	0.127 (0.12)	0.068 (0.09)
Constant	0.473*** (0.16)	0.507*** (0.16)	0.416** (0.18)	0.502*** (0.14)	0.487*** (0.14)	0.421** (0.19)	0.472*** (0.12)
N	156	155	116	191	151	112	187

* p<.10, ** p<.05, *** p<.01

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Figure 1: Rates of Annuitization by Group
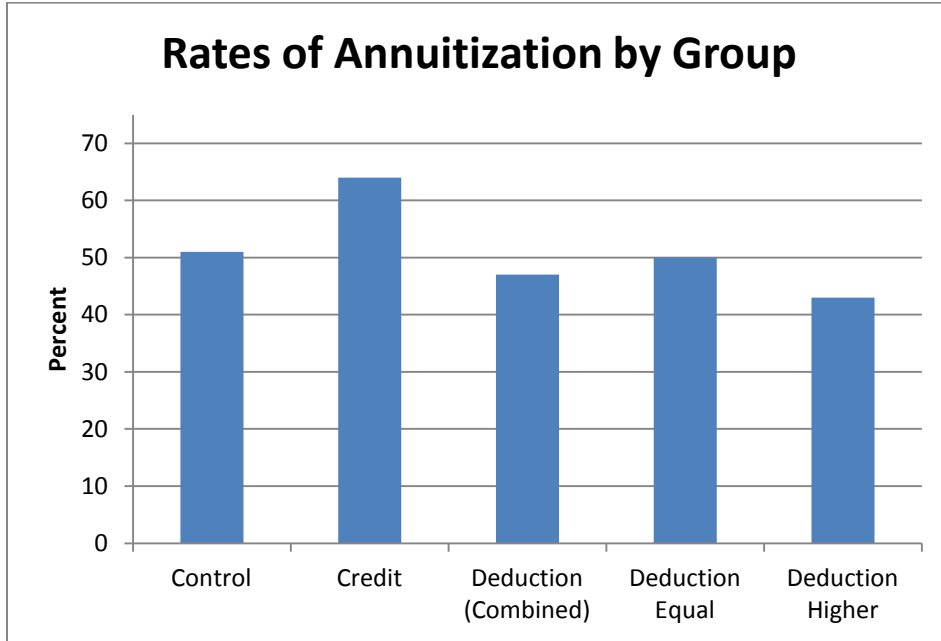
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Appendix

<u>Data Source</u>

The data was obtained from the selections made by participants in a computer-based experiment. Participants consisted of 301 individuals from a jury pool in a large metropolitan court system in North Carolina. The jury pool consists of randomly selected county residents who were either licensed drivers, registered voters, or both. County residents excluded from jury duty included those individuals who were less than 18 years old, who served as a juror in the previous two years, who did not speak English, who were felons who did not have their citizenship restored, and those who were not physically or medically competent. Individuals called for jury duty in the months between August 2011 and April 2012 were solicited to participate in this game as they waited in the jury lounge. Game monitors would make an announcement advertising the game over the jury room audio system to the entire jury pool, and a sign-up sheet would be provided. Participants who signed up were called in order and played the game on laptop computers set up in the jury lounge. Not infrequently, participants would be called for jury duty or dismissed while in the middle of the game. In such cases, no information was collected unless the participant was able to complete the entire game before leaving.

<u>Instructions for Computer-based Annuity Game</u>

The following is the text taken from the computer program that collected the data for this paper. We used the Z-Tree program to develop the game. In brackets, we indicate what the program would do or what the participant would be asked to do or input. In general, participants were recruited from a jury pool lounge at a large, metropolitan court system. Volunteers would sign up following an announcement then proceed to a laptop computer in turn. Monitors would

ensure that hardcopy consent forms were signed and then start the program, making sure that participants knew how to advance through the program.

"Introduction"

Welcome to the Game of Managing Your Money!

In this game you will need to need to manage a pot of money over time.

The higher your account balance when you exit from the game, the higher your compensation will be for playing."

[Next Screen]

"Study Overview"

Basic Information

IRB Study [omitted]

Title of Study: [omitted]

Principal Investigator: [omitted]

[University information omitted]

Email Address: [omitted]

Funding Source and/or Sponsor: [omitted]

Study Contact telephone number: [omitted]

Study Contact email: [omitted]

[Next Screen]

"Consent"

To proceed to the game, you will need to indicate that you consent to participating.

You can do this by signing one of the hardcopy forms.

[Next Screen]

"Overview"

There are 3 parts to this study:

First, there are some introductory screens that provide information about the game and how to play it.   The second phase is when you play the game: You will make some one-time decisions, and then the game will play out automatically. When the game ends, the third phase will be a series of questions about yourself. You can expect to spend about 5-10 minutes total participating in this study.

[Next Screen]

"Rules of the Game"

How to Play the Game

1. You start the game with a "savings" account of $20,000. Your goal is to live off this account and not run out of money before the game ends.

2. In each period, you will need $3,000 to live on.

3. Before the game begins you will have the opportunity to invest your money in three separate investments. The details of these investment options will be explained in next section.

4. The game is played over different periods, and it may end at any time. The likelihood of surviving declines with each additional period of time and is determined by "throwing" dice. The computer will do this for you automatically by generating a random number between 1 and 6, for each face of a normal die. The results of your "throw" will appear on the screen and will determine whether you survive to the next period.

5. If you run out of money, your game will immediately end, and you will receive the lowest compensation for playing the game.

6. The larger your account balance when you exit, the larger your compensation. Therefore, your goal should be to maintain as much of your original account balance as possible throughout the game

7. Payment: You will earn the following amounts for managing your money:

   - $10 if your ending account exceeds your starting balance (less any annuity you buy - see next section)

   - $5 if your ending account is more than 0 but less than your starting balance

   - $2 if you run out of money"

[Next Screen]

"Investment Options"

Investment Options:

You can put your money in 3 places

- Stock market: You can put some or all of your savings account in a stock market account that can earn or lose money in each period. Gains and losses are determined by chance. This

option does not cost you anything but you will not be able to add or remove funds from this account once they have been placed in the market.

- Annuity. The purchase of the annuity will provide you with a $2,000 payment for each period that you survive beginning in first period. This amount will partially offset the $3,000 living expenses that will be deducted from your account in each period. The cost associated with the annuity will be described in the next section.

- Do nothing! Let you money sit in your account, but it will not earn interest or lose money.

[Next Screen – Which option the participant gets depends on which group – treatments or controls – the program has assigned to him or her. There are four possible branches: credit, equal deduction, larger deduction, or control.]

"Annuity Credit"

Your starting savings account balance is $20,000.

If you want to buy the annuity, it will cost you $13,110.

As a part of a new program, however, you will receive a credit of $3,277 that will be immediately added to your savings account should you decide to purchase the annuity.

As a result of this program, your initial account balance would increase from $6,890 to $11,665. ($20,000 - $13,110 + $3,277 = $10,167). If you buy the annuity, your available balance will be equal to $10,167.

Would you like to purchase the annuity? [participants clicks "YES" or "No"]

You can also put some or all of your money into the stock market. If you have decided to buy an annuity the maximum amount that you may invest is $10,167.

If you did not buy the annuity, the maximum you may put into the stock market is $20,000.

If you would like to invest in the stock market, enter the amount you wish to invest in the space provided. [participants enters dollar amount]

"Annuity Equal Deduction"

Your starting savings account balance is $20,000.

The cost of the annuity is $13,110.

As a part of a new program, however, you will be able to reduce your cost of living by $500 in each period should you decide to purchase the annuity.

As a result of this program, your per-period cost of living would be reduced from $3,000 to $2,500 after purchasing this annuity. ($3,000 - $500 = $2,500)

If you buy the annuity, your available balance will be $6,890.

Would you like to purchase the annuity? [participants clicks "YES" or "No"]

You can also put some or all of your money into the stock market. If you have decided to buy an annuity the maximum amount that you may invest is $6,890.

If you did not buy the annuity, the maximum you may put into the stock market is $20,000.

If you would like to invest in the stock market, enter the amount you wish to invest in the space provided. [participants enters dollar amount]

"Annuity Larger Deduction"

Your starting savings account balance is $20,000.

The cost of the annuity is $13,110.

As a part of a new program, however, you will be able to reduce your cost of living by $874 in each period should you decide to purchase the annuity.

As a result of this program, your per-period cost of living would be reduced from $3,000 to $2,126 after purchasing this annuity. ($3,000 - $874 = $2,126)

If you buy the annuity, your available balance will be $6,890.

Would you like to purchase the annuity? [participants clicks "YES" or "No"]

You can also put some or all of your money into the stock market. If you have decided to buy an annuity the maximum amount that you may invest is $6,890.

If you did not buy the annuity, the maximum you may put into the stock market is $20,000.

If you would like to invest in the stock market, enter the amount you wish to invest in the space provided. [participants enters dollar amount]

"Annuity Control"

Your starting savings account balance is $20,000.

The cost of the annuity is $13,110.

If you buy the annuity, your available balance will be $6,890.

Would you like to purchase the annuity? [participants clicks "YES" or "No"]

You can also put some or all of your money into the stock market. If you have decided to buy an annuity the maximum amount that you may invest is $6,890.

If you did not buy the annuity, the maximum you may put into the stock market is $20,000.

If you would like to invest in the stock market, enter the amount you wish to invest in the space provided. [participants enters dollar amount]

 [Next screen – Once the participant inputs his or her selections, the game runs without further input from the participant. The game progresses through each stage if the participant 'survives' via the random number draw as described above. In each stage, changes to the participant's account are calculated using random 'stock market returns' that range from 0.5 to -0.5, if applicable; the annuity income, if applicable; and the cost of living expense. After each stage, the participant sees a breakdown of the starting balance, market returns if any, annuity income if any, cost of living expense, and ending balance. Then the screen indicates whether the participant 'survives' to the next stage.]

At the end of Period __:

Market Earnings ___

Amount invested in the stock market ___

Amount you received from an annuity ___

Your Cost of Living for the period was ___

Your Ending Balance is ___

Your balance at the beginning of the game was ___

To advance to the next round you, the sum of the "dice" must be greater than ___.

If you survive you will be advancing to the next round, otherwise thank you for playing.

[Eventually, the game ends because the participant did not survive, the participant ran out of money in their account, or they completed the maximum number of 18 stages. When the game ends, the survey begins.]

"Transition"

You have reached the end of the game.

You will now be prompted to answer a few questions about yourself.

[Next Screen]

Finally, we need to ask a couple of questions about you:

Are you male or female? [Participant indicates "Male"/"Female"]

Looking at the ranges of ages below, where does your age fall?

[Participant indicates the applicable age bracket, which are: "18-24"; "25-29"; "30-34"; "35-39"; "40-44"; "45-49"; "50-54"; "55-59"; "60-64"; "65-69"; "70-74"; "75+"]

[Next Screen]

Which of the following best describes your level of education?

[Participant indicates one of the following: "Some High School"; "High School Graduate"; "Some College"; "College Graduate"; "Graduate or Professional Degree"]

[Next Screen]

These questions ask about any retirement plans you currently may be a part of. One question asks about types of plans. These types are:

401(k): You contribute an amount from your paycheck on a pre-tax basis.

- Other defined contribution: An amount is contributed to an account for you.

  Defined benefit: You are promised a benefit that will begin when you retire, and the amount of the benefit is based on different factors such as how long you work and how much you make in salary

Are you currently participating in a pension or retirement plan? [Participant indicates "Yes/No"]

If you are in a retirement or pension plan, what kind of plan is it?

[Participant indicates: "401(k)"; "Defined Benefit Pension"; "Other Type Not Listed"; "Profit Sharing/Other Defined Contribution"; "Don't Know"; "Not Applicable"; "IRA"]

Do you have a second pension plan? If so, what kind?

[Participant indicates: "401(k)"; "Defined Benefit Pension"; "Other Type Not Listed"; "Profit Sharing/Other Defined Contribution"; "Don't Know"; "Not Applicable"; "IRA"]

[Next Screen]

What is your marital status?

[Participant indicates: "Single"; "Married/Partnered/Coupled"; "Divorced"; "Widowed"]

How many persons are in your household currently? [Participant enters a number from 0 to 50]

[Next Screen]

"Risk"

Here is another kind of question. Suppose that you are the only income earner in the family.

Your doctor recommends that you move because of allergies, and you have to choose between

two possible jobs.

The first would guarantee your current total family income for life.

The second is possibly better paying, but the income is also less certain.

There is a 50-50 chance the second job would double your total lifetime income and a 50-50

chance that it would cut it by a third.

Which job would you take - the first job or the second job?

[Participant indicates: "First Job\"; "Second Job"; "Don't Know"]

[Next Screen]

Do you consider yourself to be Hispanic or Latino? ["Yes"/"No"]

Of the following categories, which race do you consider yourself to be?

[Participant indicates: "African-American"; "Asian"; "White"; "Other"]

[Next Screen]

What is your current work status?

[Participant indicates: "Employed Full Time\"; "Part-Time Employed"; "Retired";

"Unemployed"; "Not in the labor force"; "Disabled"; "Other"]

[Next Screen]

"End of questionnaire"

You have finished the question section and are at the end of the study. Thank you!