NBER WORKING PAPER SERIES

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Jonathan Gruber

James M. Poterba

Working Paper No. 4435

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
August 1993

We are grateful to Gary Englehardt, Martin Feldstein, Austan Goolsbee, Brigitte Madrian, Tom McGuire, Joseph Newhouse, Doug Staiger, John Shoven, Glenn Sueyoshi, Richard Zeckhauser, and seminar participants at Boston University, Dartmouth, Harvard, and the NBER for helpful discussions, to Todd Sinai and Aaron Yellowitz for expert assistance with the TAXSIM and SIPP tabulations, respectively, and to the National Science Foundation and the James Phillips Fund for research support. This paper is part of NBER's research programs in Aging, Health Care and Public Economics. Any opinions expressed are those of the authors and not those of the National Bureau of Economic Research.

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ABSTRACT

The Tax Reform Act of 1986 introduced a new tax subsidy for health insurance purchases by self-employed persons. This paper analyzes the changing patterns of insurance demand before and after this reform to generate new estimates of how the after-tax price of insurance affects the discrete choice of whether to buy insurance. We employ both traditional regression models for insurance demand, in which after-tax price of insurance is an explanatory variable, as well as nonparametric tests that compare changes in insurance purchases by self-employed individuals with the coincident changes for other groups. Our analysis suggests that a one percent increase in the cost of insurance coverage reduces the probability that a self-employed household will be insured by as much as 1.8 percentage points.

Jonathan Gruber
National Bureau of Economic Research
1050 Massachusetts Avenue
Cambridge, MA 02138

James M. Poterba
Department of Economics
Room E52-350
Massachusetts Institute of Technology
50 Memorial Drive
Cambridge, MA 02139
and NBER

The value of employer-provided health insurance benefits is not included in an individual's taxable income. This is one of the most costly federal tax expenditures, accounting for an estimated revenue loss of nearly $50 billion in 1993. Furthermore, the tax wedge between insurance and other forms of compensation, which may induce "overinsurance," is often viewed as contributing to high and rising medical expenditures in the United States. As a result, several current reform proposals call for capping the dollar value of health insurance benefits that can be excluded from taxation. A directly opposite set of recent proposals calls for extending the tax incentive for health insurance to reduce the high number of individuals who do not have health insurance.[1]

The effect of these proposals on the number of insured individuals depends critically on the price elasticity of demand for health insurance. If this elasticity is small, then limiting the tax expenditure on health insurance may raise substantial amounts of revenue but not have much effect on the extent of health insurance coverage, and proposals to expand insurance tax credits will have small effects in reducing the number of uninsured individuals.[2] If the elasticity is large, however, tax subsidies will have sizeable effects on coverage, while capping the employer deduction will raise less revenue.

Because it is difficult to find econometrically useful sources of variation in insurance prices, there is little convincing empirical evidence on the price elasticity of demand for health insurance. Variation either through time or in a cross-section of households or firms reflects differences in the

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[1]Pauly (1986) discusses the "overinsurance" hypothesis. Butler and Haislmaier (1989) provide one proposal for expanded tax incentives.

[2]Feldstein (1973) and Feldstein and Friedman (1977) are the seminal contributions to the literature on the efficiency cost of not taxing employer-provided health insurance. Phelps (1992) summarizes subsequent work on this issue.

demand for health care as well as in the costs of providing this care.[3] There are few shocks to the supply side of the health insurance market that are not potentially correlated with shocks to insurance demand and that can therefore identify the insurance demand curve.

Tax changes provide a potentially exogenous source of variation in the after-tax relative price of health insurance, since taxes drive a wedge between the after-tax value of wage income and the value of health insurance. Two types of studies have tried to exploit tax changes to identify the price elasticity of demand for insurance. The first type, exemplified by Long and Scott (1982), Vroman and Anderson (1984), and Turner (1987), examines how coverage changes as tax rates change over time. For example, the fact that health insurance coverage has fallen in the 1980s, as individual marginal tax rates have fallen, is taken as evidence that taxes affect the decision to insure. This correlation may be spurious, however, because other factors that affect the extent of health insurance coverage may have been changing as well. A large shift from industrial employment to service sector employment during the 1980s, rising real health care costs, and the widening income distribution may also have affected the demand for health insurance coverage.

Another approach to estimating the effect of taxes on coverage is to analyze a single cross-section of individuals or firms, and to ask whether those with higher tax-related subsidies to insurance purchase are more likely to be covered by health insurance or to spend more on insurance coverage. Studies of this second type include Taylor and Wilensky (1983), Woodbury (1983), Holmer (1984), and Sloan and Adameche (1986). These studies face three important problems. First, differences in tax rates in a cross-section arise in part from differences in the underlying

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[3]For example, the price variation used by Phelps (1973) comes from differences in firm size, which may be correlated with insurance demand due to the nature of workers who choose firms of different sizes. The price variation used by Leibowitz and Chernew (1992) and Marquis and Long (1993) comes from regional differences, which may be correlated with differences in insurance demand.

behavior of individuals or firms, such as labor supply, family structure, or the nature of the workforce, and it is difficult to tell whether differences in observed insurance coverage are due to taxes or to these behavioral differences. Second, there is a basic problem in measuring the appropriate marginal tax rate for the wage-fringe decision at a firm. Since the workers at a single firm typically face a range of different marginal tax rates, the wage-fringe choice is a standard collective choice problem. It is impossible to escape arbitrary assumptions, such as imposition of a "median worker" rule, in measuring the change in the marginal tax rate that determines the wage-fringe mix at a firm.[4] Finally, we shall argue below that these studies mis-specify the after-tax price of health insurance by measuring the opportunity cost of health insurance relative to labor income. Measuring the cost of insurance relative to out-of-pocket medical expenditures, which is actually the price of insurance, yields quite different results on the nature of tax incentives.

One notable line of research that avoids the problems with cross-section or time-series variation in after-tax insurance prices is the "experimental" approach, used for example by Marquis and Phelps (1987) and Thorpe et al. (1992). Marquis and Phelps use evidence from the RAND Health Insurance Experiment, which asked people about their preferences for supplementary insurance at different prices, to estimate a price elasticity of demand for supplementary insurance of -0.6. Thorpe et al. estimated an elasticity in the range of -0.07 to -0.33 for small businesses who were offered a generous subsidy to the price of health insurance. It is not clear, however, whether such experimental evidence generalizes to evaluating the design of broad-based tax policies towards

[4]Woodbury and Hammermesh (1992) surmount some of these problems by focusing on fringe benefit expenditures around the Tax Reform Act of 1986 for a panel of colleges. They cannot disentangle the income and price effects of the effects of a tax reform, however, and their methodology does not solve the problem of measurement error in the average campus tax rate.

health insurance.[5]

In this paper, we exploit a new source of tax-induced variation in the effective price of health insurance: the 1986 change in the tax treatment of insurance purchases by self-employed individuals. Prior to the Tax Reform Act of 1986 (TRA86), self-employed individuals who did not itemize their income tax deductions paid for their health insurance with after-tax dollars. After TRA86, self-employed individuals could claim a tax deduction equal to 25% of their health insurance costs. For an individual facing a federal tax rate of 28%, this change represented a non-trivial decline in the after-tax price of health insurance.

We examine the effects of the tax-induced price change on the demand for health insurance by self-employed workers. Our methodology avoids many of the confounding factors described above. First, by comparing the change in coverage for the self-employed to that of the employed, we can control for other changes in the economy that may have affected health insurance coverage. In particular, we note that, contrary to popular wisdom, the tax incentives for the purchase of health insurance by the employed remained unchanged around TRA86, so that they become a natural candidate to pick up other economy-wide trends. Second, by comparing similar self-employed individuals both before and after the tax reform, we can control for other sources of demand variation that may be correlated with income or self-employment status. Finally, by looking at the self-employed, we avoid the problem of identifying the "marginal" employee; a self-employed person

[5]Marquis and Phelps (1987) note that it is not clear how applicable evidence from the demand for supplemental insurance is for evaluating the demand for existing health insurance plans. Thorpe et al. (1992) note a number of potential problems with their experiment as well, such as a lack of information about the availability of the subsidy and the limited time for which it was offered. For a broader discussion of the applicability of the evidence from small scale experiments to broader policy changes, see Burtless and Orr (1985).

is the firm's only employee.[4]

We use the Current Population Survey (CPS), a nationally representative survey of over 50,000 households that collects information each March on individuals' insurance status in the previous year. Because the CPS does not include data on insurance expenditures, our analysis focuses on the price-sensitivity of the discrete decision to purchase insurance. This is precisely the parameter that is central for evaluating proposals to use expanded tax incentives to increase insurance coverage among currently uninsured individuals.

Our study is divided into six sections. The first provides a detailed description of how the tax code affects the incentive to purchase insurance, with particular attention to the 1986 change in the after-tax price of health insurance for both the employed and self-employed. Section two outlines our modelling framework. The third section describes our data and discusses the insurance demand of the self-employed. In section four, we construct a measure of the after-tax price of health insurance, and report estimates of probit models of insurance demand for self-employed as well as employed workers. These models parallel those that have been used in previous work on the effect of taxes on fringe benefit demand, and our results confirm previous findings that changes in the after-tax price of insurance significantly affect insurance purchase decisions.

Section five explores this finding in more detail with a variety of non-parametric models. We compare the changes in insurance demand over the 1985-1989 period between employed and self-employed individuals, as well as the changes in insurance coverage of high- and low-income self-employed and employed groups. In nearly all cases, these comparisons support the earlier finding

[4]Some of the self-employed are likely to work in group settings, or participate in professional associations that offer group coverage. Among the single self-employed for whom we argue that tax reform should have the most pronounced effect, 40% of those with insurance have group health insurance coverage. For these individuals, identifying the marginal worker who decides to purchase insurance is again problematic.

that tax-induced reductions in the price of insurance raises the demand for insurance. Moreover, our central estimates imply a substantially higher demand elasticity than does the standard demand model. A brief concluding section summarizes and interprets our findings, and suggests several directions for future work.

I. Tax Incentives and the Relative Price of Insurance

The tax system subsidizes expenditures on health care in several ways, thereby complicating the analysis of the tax incentive for insurance purchase. Individuals with employer-provided health insurance are not required to include the value of this insurance in their taxable income. Until 1986, the self-employed did not receive any comparable tax benefit if they purchased insurance. Taxpayers who claim itemized deductions can also deduct the portion of their expenditures on medical care and directly-purchased health insurance which exceed a certain fraction of their income from their taxable income. Thus, the tax deductibility of employer-provided health insurance premia does not in itself imply that the tax system subsidies insurance purchases because the alternative to insurance, direct payment of medical expenses, is also a deductible expense. A tax system which allowed deductions for both health insurance premia and medical expenses would provide no net subsidy to health insurance, although it would provide a substantial subsidy to health care expenditures.

To model the tax incentive for insurance purchase, we assume that an individual faces random medical costs M with an expected value that we normalize to unity, and that these costs are independent of whether the individual is insured.[7] The individual chooses between purchasing

[7]We also assume that the hypothetical insurance policy exhibits a zero copayment rate, in effect requiring that the price elasticity of demand for medical care is zero. In principle, one could increase the cost of insurance by a "moral hazard premium", but doing so requires drawing a judgement on the valuation of that extra medical care. The basic inferences that we draw here are robust to such a model.

insurance which costs $(1+\lambda)$, where λ is the policy's load factor, and paying for medical costs out-of-pocket. If the tax code treats insurance premia and medical expenditures symmetrically, then the cost of insurance relative to the direct outlays on medical care is $q_{ins} = 1 + \lambda$. This is the benchmark case against which we evaluate the after-tax price of insurance in more complex cases.

I.1 Employed Taxpayers

We begin by analyzing the incentives for insurance purchase by an employed taxpayer who can purchase health insurance through his employer. Our exposition builds on the analysis by Phelps (1992). There are three ways for this taxpayer to pay for medical care: with employer-provided insurance, with insurance purchased on own account, or with "self-insurance". We view this individual as the marginal worker who decides whether his employer will offer insurance, and assume for simplicity that both employer-provided and directly-purchased insurance policies have no deductible and a zero coinsurance rate. We focus on the average cost of insurance, and the average cost of self-insurance, rather than the marginal cost of an additional dollar of insurance expenditure because the data we analyze apply to the discrete choice of whether or not to purchase insurance.[8] We denote marginal tax rate on earned income by τ, the employer share of the payroll tax by τ_{ss}, and the loading factor on employer-provided health insurance by λ_g; we assume that payroll taxes are borne in full by labor.

We first contrast the attractiveness of employer-provided group insurance and individually-purchased insurance to the employed person. When the employer purchases insurance at a cost of $(1+\lambda_g)$, the employee's wage is reduced by $(1+\lambda_g)/(1+\tau_{ss})$. The employer is indifferent between purchasing one dollar of benefits or paying wages of $1/(1+\tau_{ss})$, since each dollar of wages requires

[8] The marginal incentives to purchase additional insurance, for example by selecting a more comprehensive employer-provided policy, could also be analyzed in a framework like the one we develop, although the marginal incentives generally differ from the average incentives.

a payroll tax payment as well. The employee's after-tax wage therefore falls by $[(1-\tau-\tau_{w})/(1+\tau_{w})]*(1+\lambda_{g})$. This expression measures the after-tax cost of insurance in terms of foregone wage income.

The after-tax cost of directly-purchased insurance to the same individual depends on his itemization status. If his income and other deductions imply that he would not itemize even if he purchased an individual health insurance policy, then the after-tax cost of such a policy is $(1+\lambda_{i})$, where λ_{i} is the loading factor on individual insurance; generally, $\lambda_{i}>\lambda_{g}$. The relative price of employer-provided vs. directly-purchased insurance policy is therefore $[(1-\tau-\tau_{w})/(1+\tau_{w})]*[(1+\lambda_{g})/(1+\lambda_{i})]$. If the taxpayer would itemize if he bought an insurance policy, the after-tax cost is $(1-\beta\tau)(1+\lambda_{i})$, where $\beta = [(1+\lambda_{i}) - F]/(1+\lambda_{i})$ is the tax-deductible share of insurance costs. The parameter F denotes the "floor" amount of spending on health costs that the taxpayer must incur before medical expenses become deductible. In this case, the relative price of the two types of insurance becomes:

(1) $$[(1-\tau-\tau_{w})/(1+\tau_{w})]*[1+\lambda_{g})/(1+\lambda_{i})*(1-\beta\tau)]$$

Employer-provided insurance therefore strictly dominates insurance purchased on own account for both itemizing and non-itemizing taxpayers, due to the higher loading factors on individual policies, the full deductibility of employer-provided insurance expenditures relative to the partial deductibility of own insurance expenditures, and the deductibility of employer-provided health insurance from the payroll tax as well as the income tax.

If the employed taxpayer does not buy insurance at all, his expected after-tax medical costs are $(1-\alpha\tau)$, where α indicates the expected fraction of medical expenses that will be deducted from taxable income.[9] The after-tax price of employer-provided insurance relative to direct medical outlays is now

$$(2) \qquad q_{ins}' = [(1+\lambda_g)(1-\tau-\tau_{ss})]/[(1+\tau_{ss})(1-\alpha\tau)].$$

Insurance load factors raise the price of insurance relative to self-insurance, in part offsetting the tax incentive to purchase insurance. The greater the fraction of medical expenses that a taxpayer expects to be able to deduct, the higher the relative price of insurance.

We define the tax-induced distortion in the relative price of insurance as the percentage change in the price of insurance as a result of the tax code:

$$(3) \qquad \theta = (q_{ins}' - q_{ins})/q_{ins} = (1-\tau-\tau_{ss})/[(1+\tau_{ss})(1-\alpha\tau)] - 1$$

where $q_{ins} = 1 + \lambda_g$. To illustrate the magnitude of this distortion, consider a non-itemizing taxpayer who faces a federal marginal tax rate of 28%, a state tax rate of 5% (so $\tau = .33$), $\tau_{ss} = .0765$, and assume that if the taxpayer does not itemize, a quarter of medical expenses will ultimately be deductible from taxable income. In this case, $\theta = .601$, so the tax code effectively reduces the price of insurance by forty percent.

For the employed taxpayer, the Tax Reform Act of 1986 had two countervailing effects on the after-tax price of insurance. First, it lowered marginal tax rates substantially; the top rate on earned income dropped from 50% to 28% (Hausman and Poterba (1987)). Second, it made it more difficult to claim medical deductions, raising the non-deductible level of medical expenses from 5% to 7.5% of AGI and increasing the standard deduction, the amount that a taxpayer can deduct from

[9] Formally, $1-\alpha\tau = E\{M-\tau * I * (M-F)\}$, where I denotes an indicator variable for whether the taxpayer itemizes medical expenses, M is medical expenses, and F is again the floor below which medical expenses are not deductible.

taxable income if they decide not to itemize, from \$3760 to \$5000.[10] As a result, the percent of tax returns claiming itemized medical deductions fell from 10.3% before TRA86, to 4.5% after the reform.[11] These changes effectively reduced α, so that the net effect of TRA86 on the price of insuring, relative to self-insuring, depends on the particular circumstances of the employer taxpayer.

I.2 Self-Employed Taxpayers

Now consider a self-employed taxpayer, and for simplicity assume that he would not have claimed itemized deductions even if he purchased health insurance before, or after, the Tax Reform Act of 1986. Assume also that this taxpayer buys insurance in the individual market. Before TRA86, the cost of insurance was $(1+\lambda_i)$, since the premiums could not be deducted from income taxes. After TRA86, the cost was $(1-.25\tau)*(1+\lambda_i)$, since one quarter of the premium could be deducted. For this taxpayer the expected cost of medical self-insurance is $(1-\alpha\tau)$, as above. The relative price of insurance before TRA86 is therefore $q_{ins}' = (1+\lambda_i)/(1-\alpha\tau)$, while after TRA86, $q_{ins}' = (1-.25\tau)(1+\lambda_i)/(1-\alpha\tau)$. The tax distortion in the effective price of insurance therefore changed from $\theta = \alpha\tau/(1-\alpha\tau)$ before TRA86, to $\theta = (\alpha - .25)\tau/(1-\alpha\tau)$ afterward. For taxpayers who could expect to itemize less than one quarter of medical costs if they self-insured, TRA86 reducted the after-tax price of health insurance.

Some self-employed taxpayers can deduct part of their health insurance cost (β) as an itemized deduction. For these taxpayers, the after-tax cost of purchasing insurance before TRA86 was $(1-\beta\tau)(1+\lambda_i)$. After TRA86, the after-tax cost became $(1-\max(\beta,.25)*\tau)(1+\lambda_i)$, because taxpayers could now only itemize the fraction of their insurance expenditures which were not taken

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[10]The standard deduction is the amount that a taxpayer can deduct from taxable income if they decide not to itemize; that is, it represents the opportunity cost of itemization.

[11]Based on authors calculations using the TAXSIM model, described below.

as part of the general tax subsidy. For these itemizing self-employed taxpayers, the after-tax price of health insurance changed from $q_{ins}' = (1-\beta\tau)(1+\lambda)/(1-\alpha\tau)$ before TRA86, to $q_{ins}' = (1-\max(\beta,.25)^{*}\tau)(1+\lambda)/(1-\alpha\tau)$ afterwards. For self-employed taxpayers with $\beta > .25$ both before and after TRA86, the health insurance deduction for the self-employed did not affect the tax subsidy to insurance. The changes in marginal tax rates and the thresholds for itemizing medical expenses could, however, have changed α and β, and therefore altered the tax incentive for insurance purchase.

I.3 Calculating the After-Tax Price of Health Insurance

Our analysis of both employed and self-employed individuals has assumed that if they have insurance, they will not face any out-of-pocket medical expenses. In fact, most individuals with insurance do face such expenses, although their amount and relationship to the individual's need for care vary widely. To estimate α, the expected fraction of medical expenses that a self-insured person will be able to deduct from his taxes, and β, the expected fraction of insurance costs that will be deductible, we use data on the distribution of expenditures on both health care and privately-purchased insurance from the 1977 National Medical Care Expenditure Survey. We combine this information with data from the Treasury Department's Individual Tax Model, along with the NBER's TAXSIM program, to estimate the expected after-tax price of health insurance. Appendix A describes our algorithm in more detail.

Our estimates demonstrate that the 1986 Tax Reform Act subsidized insurance purchase by self-employed individuals, but had little effect on the incentive for employed persons to purchase insurance. For the self-employed, the average after-tax price of insurance before TRA86 was 1.41 (with a standard deviation of 0.07), while after the reform, this after-tax price declined to 1.33 (.06). For employed individuals, the after-tax price declined trivially, from .922 (.045) to .920 (.045).

Our finding of virtually no change inthe relative price of insurance and self-insurance contrasts with the usual conclusion, presented for example in Woodbury and Hammermesh (1992), that falling marginal tax rates raised the cost of health insurance. TRA86 raised both the after-tax cost of employer-provided health insurance and the cost of self-insuring for medical expenses. While the tax change therefore raised the cost of purchasing health care, with or without insurance, it had little effect on the incentive to finance health care services with insurance. If one were studying how TRA86 affected the total amount of health care purchased, the crucual relative price would be that for health services (a weighted average of the insured and self-insured costs), relative to all other goods. TRA86 raised this relative price. Conditional on choosing to purchase medical care, however, this relative price for the health services aggregate should not affect the choice between insurance and self-insurance.[12] For studying the discrete decision of whether to buy insurance, the relative price of insurance versus self-insurance is central.

2. Modelling the Demand for Insurance

We begin our study of TRA86 and insurance demand by specifying a discrete choice model of individual insurance demand, which follows the previous literature on the demand for fringe benefits (i.e., Marquis and Phelps (1987)). We assume that an individual's underlying demand for health insurance, I_i^*, can be described by a vector of socio-demographic characteristics X_i, income Y_i, and after-tax price of health insurance, P_i:

(4) $$I_i^* = X_i\beta + Y_i\alpha + P_i\gamma + \epsilon_i.$$

In practice, I_i^* is unobservable. What we observe instead is a dummy variable, defined by:

[12]We ignore the possibility that individuals spend nothing on the health services aggregate by receiving uncompensated care.

$I_i = 1$ if $I_i^* > 0$

$I_i = 0$ otherwise

The insurance purchase decision exhibits a random component, and the probability that we will observe insurance coverage is:

$$Prob(I_i = 1) = Prob(I_i^* > 0) = Prob(\epsilon_i > -X_i\beta - Y_i\alpha - P_i\gamma)$$
$$= 1 - F(-X_i\beta - Y_i\alpha - P_i\gamma)$$

where F is the cumulative distribution function for ϵ_i. We assume that ϵ_i follows a normal distribution, and estimate the parameters in (4) by fitting a probit model to a pooled set of Current Population Survey data, including observations from both before and after the Tax Reform Act of 1986.

This probit equation combines many different sources of variation in the price of health insurance. Some of this variation, particularly the cross-sectional differences in after-tax prices between households, is correlated with other household attributes that may affect the demand for health insurance. Omitting these unobserved attributes from the estimating equation could lead to biased estimates of the price elasticity of insurance demand. An example can illustrate this problem. With a progressive tax code, a large number of children in a family lowers the household's marginal tax rate conditional on pre-tax income, since it increases the number of personal exemptions that can be claimed on the federal tax return. However, a large family may also demand more health insurance for other reasons. This source of cross-sectional variation in the after-tax cost of health insurance and the probability of purchasing health insurance could therefore yield an apparently <u>positive</u> relationship between tax price and demand. While one can try to control for such effects, there always remains a danger of spurious correlation.[13]

To move beyond simple warnings about identification, we can describe the three sources of identifying variation in our pooled Current Population Survey data sample:

(i) Cross Section: Employed vs. Self-Employed Workers, Each Year;

(ii) Cross Section: High- vs. Low-Marginal Tax Rate Workers, Each Year;

(iii) Time Series: Before vs. After TRA86

Each source of variation is prone to yield spurious conclusions about the price elasticity of insurance demand in specifications where the tax rate is the only source of variation in the after-tax price of insurance. For example, the cross-sectional differences between employed and self-employed workers could easily be driven by unobserved differences in the tastes for risk of workers who do and do not decide to become self-employed. Cross-sectional differences in marginal tax rates within the employed and self-employed groups are largely the result of differences in income, family status, or other household decisions that may be correlated with taste for insurance. The time series variation alone is potentially confounded by other shifts in insurance demand over this time period.

Combining these different sources of variation offers a more promising identification strategy.[14] For example, while there may be a number of reasons why self-employed persons have a lower insurance coverage rate than employed persons in a cross-section, by examining the change in relative coverage rates across these groups from before to after TRA86, we can hold these other

[13]In the limit, the only way to convincingly control for all such effects would be to fully model the underlying behavioral differences which drive tax rate differences, removing any useful variation from the cross-sectional model. Feenberg (1987) discusses the problems with cross-sectional tax price regressions for the case of charitable giving.

[14]This is the essence of the "difference-in-difference" estimator employed by Angrist (1990a), Card (1991), and Gruber (1992). By using two different degrees of variation, spurious factors correlated with each degree of variation individually can be differenced away.

differences fixed. Similarly, by comparing high marginal tax rate self-employed persons to low-marginal tax rate self-employed persons both before and after the subsidy is in place, we can control for cross-sectional differences in attributes that may be correlated with the tax rate. This is the essence of our second modelling strategy below. Rather than using all of these sources of variation in a cross-sectional probit model, we control for each source of variation individually, and use various combinations to identify the effect of taxes on insurance purchase decisions.

3. Data on Insurance Coverage

Each March, the Current Population Survey (CPS) asks respondents about their health insurance coverage for the previous year. The CPS includes information on employment status, job characteristics, and income in the previous year as well. We combine data from the 1986 and 1987 March CPSs to create a sample of households for the pre-tax reform period, and we combine the respondents in the March 1989 and 1990 CPSs to construct a post-tax reform sample. The pre-TRA sample therefore provides information on insurance coverage in 1985-86, while the post-reform sample applies to 1988-89.

The major advantage of the CPS for our purposes is that it is the largest annual survey that collects information on health insurance status. This large sample size may be important for examining groups, such as the self-employed, which constitute a small fraction of the population. The principal disadvantage of the CPS is that it does not include information on health insurance expenditures, but is limited to data on whether an individual has insurance. Another disadvantage is that the CPS questionnaire was changed in March, 1988, in order to more accurately capture the insurance coverage of dependents. This change implies that we are unable to examine insurance coverage in an individual's own name, since the survey responses are not consistent over time.

Instead, we focus on coverage from private health insurance either in one's own name or in someone else's. This could affect our results if there were changes in insurance coverage from the self-employed's other family members, particularly their spouse, coincident with TRA86. In the results below, we will address this by examining single and married individuals separately. Appendix B discusses this issue in more detail.

Table 1 presents the characteristics of our sample, which is limited to persons aged 25-54, since this is the group which the Census Bureau (1988) notes is the least likely to be affected by the CPS questionaire change. Individuals are classified as self-employed if they report themselves to be self-employed and if they report at least $2000 ($1985) in self-employment income. The latter restriction is used because the health insurance deduction was limited to the amount of self-employment income earned by the individual. Thus, we exclude persons with only occasional self-employment earnings from our sample. Employed persons are those who report themselves to be employed, report no self-employment earnings, and also earn at least $2000.

Relative to the employed, the self-employed are slightly more educated and older (experience is defined as age minus education minus 6), are less likely to be female or black, are roughly equally wealthy, and are less likely to be in sales or manufacturing. There is little change in the characteristics of the employed sample over time. For the self-employed, there is a noticeable increase in the percentage that are female and in average family income, but other characteristics appear similar over this time period. The working uninsured resemble the employed more than the self-employed in terms of demographic characteristics; but in terms of occupational and industrial distribution, they are more similar to the self-employed.

Table 2 presents background information on the incidence of insurance coverage for both employed and self-employed workers before and after TRA86.[15] The sample is disaggregated by marital status, to provide some information on the potential confounding effects of spousal coverage, and by tax filing unit income. Tax filing units are defined in the CPS as heads of families, spouses, and any dependents who are younger than 19 or are students. Table 2 illustrates four important phenomena. First, the rate of private insurance coverage among self-employed persons is quite low; it averages 69.4% before TRA86, and is only 50% for single self-employed persons. This suggests the potential for a large response to government tax subsidies of health insurance for this group. Second, the probability of insurance coverage for all groups rises sharply with income. Coverage rates at the top income level are at least twice, and often more than three times, those at the bottom income level. Third, the rate of insurance coverage for employed persons is higher than that of self-employed persons at all except the lowest income levels. Fourth, coverage rises more rapidly with income for employed persons than for self-employed persons. This set of facts is consistent with the presence of a tax subsidy to the employed that becomes more valuable as incomes (and tax rates) rise.

Table 3 presents data from tax returns on the take-up of the health insurance deduction for self-employed workers in 1988. We use two criteria to define self employed individuals in the tax return data. The first is Schedule C income in excess of $2000, which parallels our basic definition of self-employed in the CPS data. Our second criterion strengthens this definition, by requiring that individuals have more than $2000 of self-employment income and no wage income. We estimate that 6.1% of taxpayers are self-employed by our first definition, compared with 2.2% by our second

[15]In results not reported, we examined two alternative definitions of self-employment: self-reported self-employment; and self-reported self-employment with more than $2000 in self-employment income and no wage income. The results are very similar to those that emerge from the definition of self-employment used in constructing Table 3.

definition.[16] The data is also disaggregated between joint and other filers, and by income groups within these categories.

Table 3 shows that low-income tax filers who are self-employed have a relatively low probability of claiming the health insurance deduction. For the stricter definition of self-employment, only 7% of taxpayers with incomes below $10,000 claimed the deduction. The probability of claiming the deduction rises with taxpayer income, but never exceeds 60%. The positive correlation between take-up rates and household taxable income may in part reflect the progressivity of the tax code, which makes the value of a .25*τ discount larger for higher income households.

Since tax returns do not contain any information on whether the taxpayer has insurance coverage other than the self-employed deduction, the data in Table 3 must be interpreted in conjunction with the previous information on individual coverage rates. The share of the population with insurance after TRA86 provides an upper bound on the fraction of self-employed individuals who should claim the tax deduction. Furthermore, since some self-employed workers are covered by policies that they do not purchase directly, not all insured self-employed workers are eligible for the deduction. The take-rate therefore seems in line with that for other tax subsidies. For example, the take-up rate for the child care tax credit in the first year after its introduction was only 19.4% (see Robins (1992)), and has never exceeded 50% of families with working mothers.

The fact that takeup of this subsidy is less than 100% implies that the estimates of behavioral responses we derive from comparing insurance coverage changes among the self-employed to those

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[16]We also excluded any household with a member over 65, and any household that reported a health insurance deduction of more than $5000. The figure for the first definition of self-employment is comparable to the fraction in the CPS data; for the second definition, the figure is much lower, which most likely reflects the restriction that no household member can earn wage income in the tax data, while only the individual is restricted from earning wage income under the CPS definition.

among the employed will be a combination of price effects and takeup effects. This can be illustrated with an example. Consider a subsidy of 5% of the price of health insurance that is offered to everyone, which raises insurance coverage by 5%. Further assume that only 50% of the population is aware of the presence of the subsidy. In this case, the "subsidy elasticity" is minus one, but the true price elasticity is minus two, since there was really a 10% coverage increase among the population at risk.

We could in principle adjust our estimated subsidy effects by take-up propensities to obtain price elasticities. However, doing so would require information on what the take-up rate was among the population at risk, rather than that among the population as a whole. In the absence of such take-up data, we can point out the direction of the likely bias to our results, which we will do below. Our results are appropriate, however, for evaluating future tax subsidy programs similar to this one, since take-up will remain a relevant concern.

4. Estimates of Insurance Demand Equations

Table 4 presents estimates of probit models such as specification (4) above. The models relate insurance coverage to income and the after-tax price of insurance. Each equation controls for a detailed set of individual and job characteristics: potential experience; education; indicator variables for gender, marital status, and non-white; controls for part time (< 35 hours/week of work), less than half-time (< 18 hours/week), and part-year (< 26 weeks of work in the preceding year); the log of tax unit income; self-employment status; four year dummies; and 15 major industry dummies.

The first column presents the estimates from a regression which excludes the tax cost variable. Column two shows the marginal effects of each coefficient.[17] The results are broadly consistent with prior studies of insurance coverage. Insurance coverage rises with experience, education, and marriage, is higher among white than non-white workers, and is higher for full time than less-than-full time workers. Higher income families are much more likely to have insurance coverage, and the self-employed are much less likely to be covered. These last two findings may be the result of the tax subsidy to employer provided health insurance, which becomes more valuable as income rises and is either non-existent (before TRA86) or less valuable (after TRA86) for the self-employed.

The after-tax price of insurance is included in the equation reported in column (3). Since the majority of the control variables do not change when the tax price is added to the regression, the full set of marginal probabilities is not presented here. The tax price has a highly significant coefficient, suggesting that higher after-tax prices reduce insurance coverage. We interpret our coefficient estimates by calculating the derivative of the probability of insurance coverage with respect to the after-tax price of insurance. The implied derivative in the third column of Table 4 is approximately -0.3. A more natural parameter is the semi-elasticity of insurance coverage with respect to the after-tax price of insurance, ie. the number of percentage points that the insured fraction of the population would changege by if the after-tax price of insurance rose by one percent. To compute this semi-elasticity we multiply the estimated derivative by 0.96, which is approximately the average after-tax price of insurance in our data. This yields a semi-elasticity of -0.252.

[17]The marginal probabilities are calculated as follows. For indicator variables, we predict the probability of coverage both if the dummy were equal to one, and again equal to zero, for the entire sample, and take the average of the differences in these predictions across individuals. For continuous variables, we predict the probability at the current level of the variable, and again at the current level plus one standard deviation, and take the average of the differences in the predictions across individuals.

This fairly low value is similar to that found in studies of the quantity of insurance purchased by individuals, for example Taylor and Wilensky (1983), and Holmer (1984), but lies below many of the findings using firm-level data, for example Phelps (1973), Woodbury (1983), and Woodbury and Hammermesh (1992). It is interesting to note that the coefficient on the self-employed dummy is now positive and significant, suggesting that the self-employed are over-insured relative to their after-tax price of insurance.

One potential problem with this specification is that the tax cost may simply be capturing a second-order income effect, since the tax price itself depends on income in a nonlinear way. We attempted to control for this by replacing the log of family income with 101 indicator variables for households in each $1000 income bracket. The estimated coefficinets for both the entire sample and the self-employed only fell slightly, but remained sizeable and significant. This is perhaps unsurprising, given that the full set of dummies explains only 2.5% more of the variation in the tax price than the log of tax filing unit income.

While measuring tax price using the individual's tax rate may be appropriate for the self-employed, it is more problematic for employed persons, since insurance coverage for this group partly reflects the demands of a collection of workers at a firm, not just the individual worker we observe in the CPS. We therefore construct an alternative measure of P_i for employed workers as the average value of the after-tax price for workers in their industry and occupation cell.[18] The results in column four replace the tax price for employed workers with this "grouped" tax price. The estimated derivative of coverage with respect to the price of insurance approximately doubles and the implied semi-elasticity is now -0.425.

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[18]More specifically, we create 150 detailed industry (50) by broad occupation class (3) cells, and assign each individual the average tax price for their cell; if the cell has less than 30 observations, we use the tax price for the entire industry.

This rise in the price effect may be the result of a reduction in the error with which the relevant marginal tax price for the employed is measured. Measurement error in the tax price can arise either the collective choice problem discussed above, or from errors induced by our imputation of the individual's tax rate. If this measurement error averages to zero in a broad industry/occupation group, then the grouped regressions will be free of such error. Angrist (1990b) develops this argument in the context of labor supply.

5. Nonparametric Results on Insurance Demand

Our estimates of insurance demand equations suggest that the after tax price of insurance affects the probability that a household will purchase insurance. Yet they do not provide any direct evidence on how households responded to the Tax Reform Act of 1986. The empirical tests in this section focus more narrowly on particular sources of variation in the after-tax price of health insurance.

5.1 Employed vs. Self-Employed Workers, Pre- and Post-TRA86

The first source of variation that can be used to identify the price elasticity is the change in insurance coverage among self-employed persons, relative to employed persons, over the period when TRA86 took effect. We noted above that the tax price for self-employed workers fell, while that for employed workers was unchanged, around TRA86. We would therefore expect an increase in the insurance coverage rate of self-employed as opposed to employed workers coincident with the tax reform.

There are many reasons why self-employed individuals may have lower insurance rates than employed persons, one of which is the lack of a tax subsidy for health insurance before 1986. By taking the difference in insurance coverage rates for this group over time, however, we can control for any time invariant factors in their insurance demand. Furthermore, we can compare this time difference to the change in insurance coverage among employed individuals, to control for time series trends in economy-wide insurance demand, including the income effects of TRA86. Under the assumption that there are no non-tax shocks to only one of these groups, the result is a "differences-in-differences" estimate that can be labelled the effect of the taxes on insurance demand.[19]

Table 5 presents summary statistics on insurance demand for these groups, without controlling for any other factors. Each cell contains the private insurance coverage rate among the group labelled on the axes, and the standard errors are shown in parentheses. The first row of Table 5 shows that insurance coverage for the self-employed rose by 4% between 1985-6 and 1988-9. At the same time, coverage was falling significantly for the employed, despite a lack of change in their tax incentives. This suggests that other economy-wide trends were leading to lower demand for insurance over this time period. Using the experience of the employed as a control for these trends, we find a net rise in the coverage of the self-employed of 6.8% during the TRA86 enactment period. This pattern is consistent with TRA86 encouraging insurance purchase by the self-employed relative to the employed.

One potential problem with this identification strategy, however, is that the composition of these two groups may have been changing over time as well. Devine (1992) reports that there was a large rise in self-employment rates beginning around 1986, and in our data the self-employment

[19]Our analysis will focus on the absolute change in the difference between the insurance coverage rates for self-employed and employed workers. One could imagine alternative ways to measure the change in coverage, however, such as the difference in the percentage change in the coverage (or non-coverage) ratio. Our conclusion, that the tax subsidy to insurance purchase by the self-employed increased coverage among this group relative to other groups, is robust to alternative methods of measurement.

rate rises by 7% from before to after the tax reform.[20] If the new self-employed individuals were systematically more likely to be insured, then our finding could simply be an artifact of this compositional change. However, even if this new group of self-employed were as likely to be insured as the average employed worker, a compositional shift of this magnitude can explain only about 10% of the relative shift in insurance rates we see over this period.[21] Furthermore, in terms of the observable characteristics that affect insurance demand, the pool of self-employed in the CPS data after the Tax Reform Act is quite similar to the group we observe before the Act.[22]

Nevertheless, to help control for the possibility that the differences in insurance probabilities reported in Table 5 are due to changes in the characteristics of the self-employed or employed groups between 1985-6 and 1988-9, we also estimate probit ANOCOVA models that control for these characteristics. We begin with an equation of the form:

(5) $I_i^* = X_i\beta + Y_i\alpha + SELF_i{*}\delta_1 + POST86_i{*}\delta_2 + SELF_i{*}POST86_i{*}\delta_3 + \epsilon_i.$

$SELF_i$ is set equal to one if the worker is self-employed, and is zero otherwise. $POST86_i$ is set to one for years after 1986, and is zero previously. In this framework, the fixed effects, $POST86_i$ and $SELF_i$, control for the general time series trend in insurance coverage and the secular demand effect of being self-employed, respectively. The interaction, $POST86_i{*}SELF_i$, captures the change in demand for the self-employed, relative to the employed, after TRA86. In this case, the estimate of

[20] There are a host of explanations for this increase, such as the presence of the tax subsidy itself, or the fall in the top individual marginal tax rate to a level below the corporate rate, which may have been the cause of the large shift into S-corporation status seen after TRA86 (Poterba, 1992).

[21] Of course, larger gross flows, if the individuals leaving self-employment are more likely to be uninsured, could strengthen this effect. Nevertheless, these flows would have to be quite large to explain our finding.

[22] This conclusion is derived by using the coefficients on the observable characteristics in our insurance dmeand equation to predict the expected level of demand in the self-employed population both before and after TRA86. The predicted rates are virtually identical across the two time periods.

δ_3 indicates whether the insurance coverage rate for self-employed workers changed more after 1986 than did the coverage rate for employed workers. Even if there were no relative changes in group characteristics, controlling for individual covariates can reduce the sampling variance of the differences-in-differences estimator.

The top panel of Table 6 presents the results of estimating equation (5), and includes results for the entire data sample as well as for single and married individuals separately. Because the coefficients on the socio-demographic variables and income are similar to those in Table 4, we focus our attention on the estimates of δ_3. We present the probit coefficients and their associated standard error, the marginal effect of the interaction on the probability of insurance coverage, d Pr[I = 1]/d ($SELF_i$*$POST86_t$), and the implied estimate of the derivative of demand with respect to the tax price. The derivatives are calculated by using the probit marginal effects from this regression in the numerator, and the difference-in-difference of the average tax cost for each cell in the denominator. To convert these figures to semi-elasticities, multiply by 1.37, the average after-tax price of health insurance for self-employed individuals in our sample.[23]

The results in the first panel of Table 6 confirm the conclusions from in Table 5. The difference-in-difference estimate of the effect of the tax subsidy is sizable and statistically significant. The magnitude is about two-thirds of the estimate from Table 6 and it implies a price derivative of -0.5, and a semi-elasticity of -0.685. This finding is similar to the result from the probit equations in Table 4, for the case when the after-tax price for employed individuals was measured using group average marginal tax rates. The second and third columns of Table 6 present ANOCOVA estimates for single and married workers separately. We distinguish these groups because the TRA86

[23]We use the after-tax price for the self-employed only, rather than that for the entire sample, since we view the self-employed as providing information about the behavioral response to after-tax price changes, and the employed as controls for other economy-wide factors.

experiment is much weaker for the married group, who may be covered by their spouse's health insurance, and thus may not be responding to the incentives put in place by the law change.[24] While the estimated price elasticity is large and statistically significant for both groups, it is approximately 40% larger for single persons, which is consistent with this interpretation.[25]

5.2 High-Income vs. Low-Income Self-Employed Workers, Pre- and Post-TRA86

A second component of insurance price variation is due to different marginal tax rates within the self-employed group. The post-1986 deduction should be more valuable to higher income self-employed individuals than to lower income self-employed individuals, since the marginal tax rate for the former group is higher. We test the effect of TRA86 on different groups of self-employed workers by estimating another differences-in-differences probit model, this time for self-employed workers only. The basic specification is:

(6) $I_i^* = X_i\beta + Y_i\alpha + RICH_i*\delta_1 + POST86_i*\delta_2 + RICH_i*POST86_i*\delta_3 + \epsilon_i$.

RICH is set equal to one for individuals with over $50,000 in real family income, and zero for individuals with less than $20,000 in real family income.[26] The estimated coefficient on the RICH*POST86 interaction term, δ_3, now tests whether insurance coverage rose more among the

[24] TRA86 includes a provision disqualifying self-employed individuals who are eligible for insurance coverage through a spouse from taking advantage of the tax subsidy. "Eligible" is not defined, however, and it is not clear whether this aspect of the rule is enforced. The average tax prices for the married and single samples differ only marginally relative to the estimated derivatives, so that it is reasonable to use the constant multiplier of 1.37 to derive the semi-elasticities.

[25] Recall that our estimated responses are combinations of price and take-up effects. The direction of bias in the estimated price effect is unambiguously nonpositive. So long as take-up is less than 100% by the marginal self-employed individuals, the overall response to the subsidy will understate the price effect.

[26] Individuals with family income between $20,000 and $50,000 are excluded from our estimates. Our estimates are similar if we simply split the sample at $50,000, and the results below are not very sensitive to the cutoffs used.

high-income self-employed than their lower-income counterparts. Once again, this framework allows us to control for both time series trends in demand among the self-employed, and for fixed characteristics of high and low income self-employed which may affect their demand. To the extent that the earlier finding of a relative rise in coverage for the self-employed is an artifact of a change in the market for insurance by employment status, then this model provides an independent test of the effect of the role of taxes on demand.

The second panel of Table 6 presents the results of estimating equation (6). We again find a statistically significant effect of the tax subsidy, and the implied price derivative of demand, -0.37, is similar to that of the previous case. It is much larger for single self-employed workers, and smaller for the married self-employed.

The larger magnitude of the estimated price effect for the single self-employed in this specification than in the first differences-in-differences specification may be a function of the take-up rate discussed earlier. As we noted above, the resulting bias to the price effect estimate from our first differences-in-differences model was downward. When comparing rich to poor self-employed, the direction of the bias is theoretically ambiguous. It seems likely, however, that awareness of the availability of tax subsidies of this nature rises with income. In this case, there will be an upward bias to the estimated price effect in the second differences-in-differences estimation. The true price effect lies somewhere in between the two estimates.

5.3 High vs.Low Income Employed vs.High vs.Low Income Self-Employed Pre/Post-TRA86

The previous difference-in-difference regression makes an identifying assumption that non-tax related insurance demand changes by income class are not correlated with tax changes by income class. This may be an untenable assumption given the nearly linear relationship between tax changes and income in an era when several researchers have documented changing opportunities between the rich and poor (Katz and Murphy, 1992). A natural test for whether non-tax related insurance demand changes by income class pose a problem is to compare our difference-in-difference estimates for the self-employed to similar estimates for the employed. We estimate that TRA86 should have had little impact on the health insurance demand of the the high-income employed relative to the low-income employed, since the decline in marginal tax rates at the top of the income scale is compensated for by the fall in the tax subsidy to self-insuring for that group. Therefore, if we were to find a relative rise for wealthy employed workers as well, it would suggest that factors other than the TRA86, such as an economy-wide shock to insurance demand at high incomes, might explain our findings for the self-employed group.

Results presented in Table 2 suggest that coverage rates rise by income class for the employed as well as the self-employed. There was a large rise in the insurance coverage of the high-income employed relative to their poorer counterparts. And regressions similar to (5) for the employed yield significant positive estimates of δ_3. For the employed, this finding appears to be driven by a drop in insurance coverage at the bottom of the distribution, rather than a rise at the top of the distribution, as for the self-employed.

To assess the implications of this finding for our results, we can move to a "differences-in-differences-in-differences" framework, as in Gruber (1992), where the change for the employed by income class is viewed as a control for economy-wide trends in demand by wealthy and poor persons. One can ask whether the difference in the rate of coverage growth between high-income and low-income self-employed was larger than that for employed persons. We do so by estimating the following probit model for the entire employed and self-employed sample:

$$(7) \quad I_i^* = X_i\beta + Y_i\alpha + RICH_i*\delta_1 + POST86_i*\delta_2 + RICH_i*POST86_i*\delta_3 + SELF_i*\delta_4 + RICH_i*SELF_i*\delta_5 + SELF_i*POST86_i*\delta_6 + RICH_i*POST86_i*SELF_i*\delta_7 + \epsilon_i.$$

As in the earlier specifications, the fixed effects control for the secular effects on demand of being self-employed or rich, and for general time series trends in demand. The second level interactions control for changes in the demand for insurance among the rich relative to the poor, changes in demand for the self-employed relative to the employed, and differences in demand among the rich self-employed relative to the poor self-employed. All that remains to identify the effect of the subsidy is the effect on the rich (relative to the poor) self-employed (relative to the employed) after TRA86 (relative to before TRA86).

The bottom panel of Table 6 reports estimates of equation (7). Overall, the price derivative estimates are reduced by about 50%. For the entire sample, the estimate of δ_7 is negative but only significant at the 10% level; the implied semi-elasticity is -0.334. When this model is estimated on the sample of single persons, however, the results are statistically significant and the point estimate is negative, with an implied price derivative of insurance purchase of about -1.3 and a semi-elastiicty of -1.78. For the sub-sample of married persons, the group that we view as yielding a weaker "experiment" because of the presence of spousal coverage, the estimated effect is negative but statistically insignificantly different from zero.

These results suggest that, for the full sample of workers, the economy-wide trend towards increased insurance coverage for higher income classes may weaken the second of our differences-in-differences tests used above. However, for single workers, the group for whom our experiment is more well defined, there remains strong evidence of a response to the tax subsidy, even when this economy-wide trend is controlled for.

6. Conclusions

The Tax Reform Act of 1986 is that it extended a partial income tax deduction for health insurance costs to self-employed workers, bringing them closer to the tax treatment afforded to employer-provided health insurance. We compare the change in health insurance coverage for the self-employed with that of employed workers and find strong support for a negative price elasticity of demand for insurance coverage. Our central estimate suggests that a one percent increase in the cost of insurance coverage reduces the probability that a self-employed household will be insured by 1.8 percent. This price elasticity is much larger for single workers than for those who are married. This may reflect the crisper "experiment" that TRA86 provides for single workers, since some married self-employed workers may have taken advantage of spousal coverage both before and after TRA86. While the precise estimates of the elasticity are somewhat dependent on other aspects of the econometric specification, the general direction of our findings, a rise in the insurance coverage rate among self-employed relative to employed workers, is very robust to our choice of specification.

One potential limitation of our analysis is our relatively small set of control variables for characteristics of the employed and self-employed that might affect their demand for health insurance. Provided the distributions of the unobserved characteristics of these groups remain constant over time, the simple presence of unobservables should not contaminate our findings. If the TRA86 tax subsidy to health insurance for the self employed induced some previously employed workers with high health insurance demand to become self employed, or if other aspects of TRA86 or coincident shocks altered the characteristics of the self-employed in a systematic way, this could affect our results. We have not found any evidence that suggests important contaminating factors of this type.

A second limitation of our analysis is our focus on the discrete decision of whether or not to purchase insurance, rather than the quantity of insurance to purchase. This focus, which was dictated by our data set, implies that our estimates may be more relevant for the design of tax subsidies to increase coverage among the uninsured than for the evaluation of limits on the tax deductibility of employer-provided health insurance. Our results are not directly applicable to the question of how the level of insurance demand amongst currently insured individuals will change if the tax code allows partial deductibility of health insurance outlays.

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Table 1: Characteristics of the Sample					
	Employed pre-TRA86	Employed post-TRA86	Self-Emp pre-TRA86	Self-Emp post-TRA86	Working Unins pre-TRA86
Experience	17.9	18.1	20.1	20.3	18.2
Education	13.1	13.1	13.3	13.4	11.7
Female	49.1	49.2	25.8	30.1	41.2
Married	69.2	68.0	78.8	76.2	49.4
Non-White	13.5	13.4	6.1	6.3	18.0
Working	100	100	100	100	100
<35 hours	14.4	13.6	15.5	16.5	20.5
<26 weeks	11.0	9.6	5.1	4.9	19.2
Family Income	35839	36856	37852	39837	27641
Management, Technician	29.5	30.7	31.8	31.1	14.1
Sales, Services	39.8	39.1	30.0	31.1	41.0
Manual	30.7	30.2	38.6	37.8	44.8
Ag, Mining, Construction	8.7	8.4	30.3	30.4	22.0
Manufacturing	21.5	20.8	3.7	3.8	12.9
Trade & Services	69.8	70.8	66.1	65.8	65.1

Notes: Figures are for 25-54-year old sample for the CPS. Figures are percentages, except for family income which is in 1985 dollars.

Table 2: Insurance Coverage, Self-Employment Status, and Income

	Pre-TRA86					
	All		Single		Married	
Income	SE	Empl	SE	Empl	SE	Empl
0 - 5K	30.0	36.0	23.7	35.4	39.7	38.9
5 - 10K	38.3	51.7	38.8	53.5	38.0	46.3
10 - 20K	55.4	80.0	48.0	83.7	59.0	74.8
20 - 30K	71.9	92.4	57.4	94.3	75.0	91.4
30 - 50K	81.3	96.5	68.7	95.6	82.9	96.6
50K+	88.1	97.9	73.5	96.2	89.4	98.0
Overall	69.4	87.9	50.0	80.1	74.7	91.4
	Post-TRA86					
	All		Single		Married	
Income	SE	Empl	SE	Empl	SE	Empl
0 - 5K	33.5	30.9	29.9	30.0	42.9	35.3
5 - 10K	39.1	45.5	38.0	47.7	40.8	38.1
10 - 20K	57.2	74.3	50.7	79.8	61.0	66.0
20 - 30K	73.6	88.9	59.2	92.0	77.7	87.2
30 - 50K	84.3	95.2	68.8	94.5	86.5	95.3
50K+	91.6	97.2	87.0	93.9	92.1	97.4
Overall	73.3	84.9	53.4	76.3	79.5	88.9

Notes: SE denotes self-employed. Figures are average percent privately insurance for the cell labelled on the axes. Means tabulated from the March 1986, 1987, 1989, and 1990 CPS. Pre-TRA86 is calendar years 1985 and 1986; post-TRA86 is calendar years 1988 and 1989. Self-employed defined as self-reported, with at least $2000 in self-employment income. Employed is non self-reported self-employed, no self-employment income, and at least $2000 in wage and salary income.

Table 3: Takeup of the Health Insurance Deduction by the Self-Employed, 1989						
	All		Non-Joint Filers		Joint Filers	
	Takeup (%)	Mean if Takeup	Takeup (%)	Mean if Takeup	Takeup (%)	Mean if Takeup
Tax Returns with Schedule C income > $2000						
0 - 5K	6.44	365	5.24	247	10.3	557
5- 10K	12.6	352	15.1	294	8.80	500
10 - 20K	20.7	447	20.2	307	21.0	536
20 - 30K	23.1	443	27.1	362	21.9	474
30 - 50K	22.1	533	27.9	329	21.0	587
50 - 100K	23.1	588	33.6	384	21.9	623
100K +	25.0	679	30.7	500	24.4	704
Overall	20.31	491	19.6	313	20.6	572
Tax Returns with Schedule C Income > $2000 and No Wage Income						
0 - 5K	6.69	346	5.06	259	10.7	505
5- 10K	14.3	364	17.1	311	10.2	498
10 - 20K	26.7	459	25.6	331	27.7	586
20 - 30K	38.0	505	38.4	383	37.6	595
30 - 50K	44.4	579	38.4	329	48.3	712
50 - 100K	54.5	651	44.0	422	58.3	714
100K +	52.3	751	46.5	554	53.9	798
Overall	28.7	475	23.2	325	34.3	619

Notes: Takeup is the rate of health insurance deduction utilization for taxpayers in each cell. Mean is the average value of the health insurance deduction, conditional on takeup. Top half of the Table uses the standard self-employment definition (self-reported and SE income > 2K); bottom half also restricts the sample to those with no wage and salary income. Data from NBER TAXSIM calculator.

Table 4: Probit Estimates of Insurance Demand Models

	(1)	(2) Marg Probs for estimates in col (1)	(3)	(4) Grouped
Experience (*10)	0.060 (0.005)	0.100	0.062 (0.005)	0.062 (0.005)
Education	0.067 (0.002)	0.011	0.067 (0.002)	0.065 (0.002)
Female	0.099 (0.009)	0.017	0.101 (0.010)	0.095 (0.009)
Married	-0.014 (0.010)	-0.002	0.024 (0.010)	-0.025 (0.010)
Non-White	-0.171 (0.011)	-0.031	-0.169 (0.011)	-0.169 (0.011)
<35 hours/wk	-0.222 (0.014)	-0.041	-0.213 (0.014)	-0.216 (0.014)
<18 hours/wk	0.063 (0.031)	0.011	0.064 (0.031)	0.062 (0.031)
<26 weeks/yr	-0.314 (0.015)	-0.060	-0.306 (0.015)	-0.313 (0.015)
Log Tax Unit Income	0.801 (0.008)	0.095	0.731 (0.009)	0.797 (0.008)
Self-Employed	-0.526 (0.014)	-0.108	0.116 (0.047)	0.522 (0.071)
After-Tax Price			-1.459 (0.103)	-2.369 (0.158)
Derivative			-0.263	-0.443

Notes: Columns (1), (3) and (4) report estimates of probit equations, and include four year dummies and 15 industry dummies. Numbers in parentheses are standard errors. For column (1), column (2) intepreets the marginal probability derivatives. In other columns, marginal probability derivative for tax price is interpreted in the elasticity row. All regressions have 187,111 observations

Table 5: Illustration of Differences-in-Differences for Price Derviate Estimates
Self-Employed versus Employed

Group/Year	1985-6	1988-9	Time Difference w/in Group
Self-Employed (N=6786,7306)	0.694 (0.006)	0.734 (0.005)	0.040 (0.008)
Employed (N=85685,88562)	0.880 (0.001)	0.853 (0.001)	-0.027 (0.002)
Group Diff at a Point in Time	-0.186 (0.006)	-0.119 (0.005)	
		Difference-in-Difference	0.067 (0.008)

Notes: Numbers in first row of each cell is mean percent privately insured; number in parentheses is standard error on estimate. Sample sizes for each cell presented under row headings. Data tabulated from March CPS.

Table 6: ANOCOVA Models of Insurance Demand			
	All	Single	Married
Diff-in-Diff - Self-Employed versus Employed (δ_3 in equation (5))			
Probit Coefficient	0.236 (0.026)	0.232 (0.050)	0.261 (0.031)
Marginal Probability	0.037	0.049	0.033
Implied Elasticity	-0.500	-0.620	-0.440
Diff-in-Diff - Rich vs. Poor Self-Employed (δ_5 in equation (6))			
Probit Coefficient	0.148 (0.075)	0.538 (0.192)	0.098 (0.085)
Marginal Probability	0.042	0.186	0.025
Implied Elasticity	-0.368	-2.188	-0.216
Diff-in-Diff-in-Diff: Rich vs. Poor Self-Employed vs. Rich vs. Poor Employed (δ_7 in equation (7))			
Probit Coefficient	0.135 (0.082)	0.730 (0.227)	-0.008 (0.094)
Marginal Probability	0.028	0.170	-0.001
Implied Elasticity	-0.248	-1.270	0.008

Notes: Each panel reports probit coefficients and standard errors from regressions such as equations (5), (6), and (7)in the text; marginal probability derivatives, calculated as described in text; and implied elasticities, which are calculated by dividing the marginal probabilities by the appropriate difference-in-difference in tax rates. All regressions include the set of control variables described in Table 4. SE = self-employed.

APPENDIX A: CALCULATING THE AFTER-TAX PRICE OF INSURANCE

This appendix describes our calculation of the after-tax price of insurance coverage for each person in the Current Population Survey. The CPS reports data on individuals, families, and households, but not on <u>tax filing units</u>; these units may be smaller than families, if the family unit includes individuals who are filing their own returns. We used the simple rule that individuals are considered part of a tax filing unit if they are the head of the family, the spouse, or a dependent who is younger than 19 or is enrolled in school. For each of these tax filing units, we extracted data on: filing status (single if not married and no children; joint if married; head of household if unmarried with children); number of dependents; wage and salary income; dividend and interest income; self-employment income; farm income; and other income.

We then computed marginal tax rates for each of our tax filing units using the NBER's TAXSIM calculator. TAXSIM takes as input all of the detailed information that is reported on individual tax returns. The CPS data are missing a number of important items that are reported on tax returns, most notably itemized deductions and capital gains. We therefore used the Treasury Individual Tax Model data file, which contains over 70,000 tax filing units, to impute each tax filing unit's probabilities of itemizing and declaring capital gains, as well as the amounts of deductions and capital gains conditional on having them.

Our imputation algorithm employed Treasury Tax Model data for 1986 and 1988. We applied data for these years to 1985 and 1989 by inflating or deflating monetary amounts using the Consumer Price Index. We imputed information to individuals by assigning each CPS observation to one of 64 classifications: 16 income classifications, by two filing status classifications (single and joint, with head of household in the former), by two self-employment classifications (schedule C income > 0 and schedule C income <=0). In each classification, we assigned individuals the average amount of itemized deductions and capital gains income reported by taxpayers in that classification with non-zero amounts. We also assigned the average probabilities of itemizing deductions and realizing capital gains for each classification. We then imputed four possible tax rates for each tax filing unit, corresponding to: (1) No itemization, no capital gains; (2) Itemization, no capital gains; (3) No itemization, capital gains; and (4) Itemization and capital gains. The tax rate we use in our regressions is a weighted average of these four rates, where the weights are the imputed probabilities of itemizing or declaring capital gains in each classification.

The after-tax price of health insurance must account for the relative tax treatment of health insurance and out-of-pocket expenditures on health care. We compute the average tax price using the following formulas for the self-employed and employed, respectively:

$$P_{SE} = \frac{[(1+\lambda_i)*I/(1+O) + O/(1+O)]*(1-\beta'\tau)}{1 - \alpha\tau}$$

$$P_E = \frac{(G/T)*[(1+\lambda_g)*(1-\tau-\tau_{ss})/(1+\tau_{ss})] + (1-G/T)*[(1+\lambda_g)*I/(1+O) + O/(1+O)]*(1-\gamma\tau)}{1 - \alpha\tau}$$

where λ_i and λ_g are the loading factors on individual and group health insurance, respectively, I is out-of-pocket spending on insurance, O is out-of-pocket spending on health care services, G is employer spending on group health insurance, T is total insurance spending and health care services spending, and β', α, γ are parameters that depend on the tax system and the distribution of health care spending.[27]

The numerator of each price formula reflects the tax adjusted price of purchasing health insurance. A self-employed person pays the individual insurance loading factor on the portion of her health care spending that is on insurance, but no loading factor on out-of-pocket medical expenditures. The average self-employed person can expect that a fraction β' of her expenditures on insurance and health care services will either lie above the threshold for tax itemization, or be subject to the 25% tax subsidy. Thus, the net cost of their medical spending is only $(1-\beta'\tau)$ of the initial dollar outlay.

For the employed person, the calculation is complicated by the fact that the employer's expenditures made on his behalf (G) are fully tax deductible. Thus, for the fraction G/T of health spending, the after-tax price is only $(1-\tau-\tau_w)/(1+\tau_w)$ per dollar of spending. The remainder of his expenditures consist of his expenditures on health insurance and out-of-pocket medical services. We assume that he can purchase insurance at the same group loading factor (λ_g) and that his insurance expenditures are not tax deductible. The average employed person with employer-provided insurance expects that a fraction γ of his own spending on insurance and health services will lie above the itemization threshold.

The denominators of P_{SE} and P_E reflect the cost of self-insuring. There is no loading factor on self-insurance, and the costs of medical care are reduced by α, the fraction of those costs that the taxpayer expects to be able to itemize.

The key parameters for estimating the after-tax price of insurance are λ_i, λ_g, β, γ, and α. The first two parameters can be estimated using data on group and individual insurance premiums and claims experience, from HIAA (1991). The last three parameters represent the fraction of insurance and medical spending which will be expected to be itemized by the self-employed insured, the employed insured, and the self-insured, respectively. We estimate them by assuming that the average person choosing between these categories expects to itemize the same fraction of expenditures as those currently in each category. We then estimate these fractions using information on the distribution of medical and insurance spending from the 1977 National Medical Care Expenditure Survey (NMCES).

We inflate 1977 NMCES data on expenditures to 1986 and 1988 levels using the medical care CPI. We then divide the NMCES into three subsamples of families: those in which both the head and the spouse are uninsured; those in which both the head and spouse have non-employer provided health insurance; and those in which either the head or the spouse has employer-provided health

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[27] α is the same parameter that is used in the text. β' is related to the parameter β used in the text according to: $\beta' = \max(\beta, 0.25)$ for years after TRA86.

insurance.[28] Each group is then further divided into three income categories and four categories of family structure.[29] For each subgroup, we calculate the amount of their spending that can be claimed as an itemized deduction as:

$$DED = \max[I + O - f^*Y - SD^*PI, 0]$$

where f is the fraction of AGI which medical expenditures must exceed in order to be itemized, Y is family income, I is spending on insurance for those who purchase insurance on own accout, O denotes own-spending on medical care, SD is the standard deduction, and PI is the average probability of itemization in the subgroup. The final component of this sum, the expected value of the standard deduction, is an approximation to the loss of the standard deduction in excess of the taxpayer's other itemized deductions.

The fraction of medical spending that is itemized depends on the level of such spending, the AGI floor that such spending must exceed in order to be itemized, and the standard deduction. Tax reforms such as TRA86, which raised the AGI floor from 5% to 7.5% and increased the standard deduction, reduce the share of health care outlays that can be itemized. This affects the after-tax price of health insurance.

Table A1 presents our estimates of itemization probabilities, which rise rapidly with income. For high income taxpayers, who would most likely itemize in the absence of any medical expenditures, the standard deduction is irrelevant to the decision to itemize medical spending. For those with lower incomes, who would not otherwise be itemizing, medical spending must exceed the AGI floor by a non-trivial amount to justify itemization, given the high level of the standard deduction. We capture this variation with the PI*SD term in the expression above. We do this calculation separately for 1986 and 1988, changing the inflation factors, the itemization floor, and the standard deduction.

Finally, for each subgroup in each year, we estimate total deductible spending and divide this by the total spending in the subgroup. This yields our estimates of β (from the purchasers of non employer-provided health insurance), γ (from the employer-insured), and α (from the uninsured). For 1988, we increase the numerator in the calculation of β by 0.25*total spending, in order to reflect the 25% tax subsidy to the self-employed. The results for each parameter are summarized below (standard deviations in parentheses):

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[28] These groups are used for comparability to the CPS; there is no indicator for self-employment in the NMCES, so we rely on those without employer-provided insurance as a proxy. Families are defined analogously to tax units in the CPS; family members over 19 are split off into their own families.

[29] The three income categories are: for those with either employer-provided or non-employer-provided halth insurance, 0-10,000, 10-50,000, and 50,000+; for those with no insurance, 0-10,000, 10-20,000, and 20,000+. The differences in categorization were constructed to ensure sufficient sample sizes in each cell. The family structure groups were: single; married, no children; 1 or 2 children; 3 or more children.

Parameter	1986	1988
β'	0.152	0.304
	(0.096)	(0.065)
γ	0.089	0.041
	(0.054)	(0.067)
α	0.187	0.100
	(0.116)	(0.102)

These estimates reveal the expected pattern. Both α and γ fall from 1986 to 1988, as both the AGI floor and the standard deduction increase. β' increases, however, as the 25% subsidy more than compensates for these effects for the self-employed. These parameter values are used to calculated the after-tax price of health insurance for each individual in the CPS using our formulae for P_{SE} and P_E.

One key weakness of this approach is that the average individual considering, for example, dropping health insurance and becoming self-insured may look quite different from the current uninsured. Thus, the uninsured may not provide the relevant α for assigning the price of health insurance to an insured individual. We can, however, assess the validity of our methodology by comparing these results to the actual itemization behavior in the population. That is, we can compare our predicted fraction of the distribution of medical spending that is itemized to the actual fraction of spending itemized. We measure the actual fraction itemized as the total dollars itemized by households with no elderly members (from TAXSIM), divided by private spending on health services (from Health Care Financing Administration, 1990). We compute the comparable statistic in our data by measuring the fraction of total spending which is predicted to lie above the itemization threshold, using the methodology described above. The predicted fraction itemized, .048 in 1986 and .023 in 1988, is very similar to the actual fraction in both years (.050 and .026, respectively). This suggests that our methodology has reasonable power in approximating itemization behavior.

Table A1: Inputs to Tax Imputation Algorithm
Averages for entire SOI sample - 1986

Income Category	% Itemizing	Itemization/ Income	% with Cap Gains	Capital Gains/Inc
0-5K	2.60	2.866	4.90	1.974
5-10K	10.72	1.046	4.44	0.627
10-15K	19.75	0.615	6.05	0.404
15-20K	31.06	0.401	7.85	0.321
20-25K	46.77	0.335	8.63	0.226
25-30K	60.47	0.279	8.68	0.177
30-35K	70.88	0.259	9.78	0.174
35-40K	80.59	0.255	11.79	0.155
40-45K	87.13	0.244	13.78	0.135
45-50K	90.00	0.240	14.35	0.126
50-60K	93.79	0.232	17.39	0.125
60-70K	96.36	0.241	21.34	0.143
70-80K	97.78	0.240	28.95	0.143
80-90K	98.39	0.242	28.30	0.151
90-100K	96.72	0.245	32.82	0.173
100K+	98.69	0.260	42.90	0.309

Notes: Data are from the U.S. Treasury Individual Tax Model data file, used in the TAXSIM calculator. The first column reports the percentage itemizing deductions on their tax forms, and the second column reports the average itemized deduction as a percentage of income. The third column reports the percentage reporting capital gains, and the fourth column reports the average capital gains amount as a percentage of income.

APPENDIX B: POTENTIAL PROBLEMS WITH THE CPS DATA

In March, 1988, the Bureau of Labor Statistics changed the format that it used for the series of health insurance questions on the Current Population Survey. Before that date, each household member above 15 years old was asked if he had insurance in his own name, and, if so, who else that insurance covered. For household members without insurance in their own name, insurance coverage was imputed based on the responses of other household members. For example, if the household head reported that his insurance covered his children, then the children were counted as covered; if not, then they were assumed to be uninsured.

After March, 1988, the CPS included a more complete set of questions. Each household member was asked if he was covered by insurance, and, if so, if it was in his own name and who else it covered. Furthermore, household heads were asked explicitly if children were covered from any source of either private insurance or Medicaid. This change meant that individuals who had coverage from outside the household were now recorded as insured. Before 1988, this group would have been counted as uninsured, since they did not have insurance in either their own name or as a dependent of a household member. The result of the survey change was a dramatic rise in the reported rate of insurance coverage. The number of uninsured individuals fell from 37 million to 31 million from March 1987 to March 1988. This makes it impossible to compare overall insurance rates from before and after the survey change.

The problem of intertemporal noncomparability is more acute for some groups than others. In particular, most of the rise in insurance coverage was for children and young adults, who are the most likely to have coverage from outside the household. There was also a significant rise for individuals aged 55-64, since they were previously asked about insurance coverage from a current employer, and subsequently asked about coverage from a current or former employer. Given the prevalence of retiree health insurance, this led to an increase in reported insurance coverage. However, for individuals aged 25-54, the survey change did not have a major effect, and insurance coverage rates were virtually unchanged over this period. We therefore limit our analysis to this group.

It is possible, nevertheless, that there could have been some change in reported insurance status for this age group if some individuals derive coverage from outside of the household. Since the change in the CPS questionnaire occurred at the same time as the tax subsidy to the self-employed, if it differentially affected the responses of employed and self-employed persons, it could affect our results. We have therefore performed two checks of our results to make sure that they are not driven by this definitional change.

First, we have narrowed our CPS sample further, by focusing on 25-54 year old individuals who are heads of households. This group seem even less likely than the overall 25-54 year old population to be covered by insurance from outside of the household. Table B1 reports the basic results for this group, which are very similar to our full-sample findings. The results in the final row, which correspond to the "difference in difference in difference" analysis, are statistically significant for this group. The results are somewhat weaker when, as in the text, we include all 25-54 year olds.

Second, we have used data from the Survey of Income and Program Participation (SIPP) to corrobrorate our results. The SIPP is also a nationally representative survey with a similar format to the CPS. It is a longitudinal file, which begins with a new sample of individuals each year, then reinterviews them every four months for the next 28 to 32 months. The advantage of the SIPP, for our purposes, is that the definition of insurance coverage did not change over this period, so to the extent that the results are similar to those from the CPS, it shows that they are not driven by the definition change. The important disadvantage is that the sample size is only about one-quarter as large as the CPS, which makes it difficult to focus on population sub-groups such as the self-employed.

Table B2 presents the basic difference-in-difference result from the SIPP.[30] We use the data from the fifth wave of the 1984 panel, conducted in January-April, 1985, and the seventh wave of the 1986 panel, conducted in January-April, 1988. Tabulations from the SIPP differ from those from the CPS in that there is no substantial fall in insurance coverage rates for employed individuals. The CPS may be more reliable here, since the bias from the change in the questionaire can only be towards increased coverage. More importantly, the SIPP also shows a sizeable rise in insurance coverage for self-employed persons, so that the estimated net change is similar to that found in the CPS, and is statistically significant. This corroborates our conclusion that the net rise for the self-employed, relative to the employed, was the result of the tax subsidy. Examining changes in insurance coverage by income class is less supportive of our CPS conclusions; the rise in insurance coverage in the SIPP appears to be occuring for the low income self-employed. However, the much smaller sample sizes for income classes within the self-employed makes this finding difficult to interpret.

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[30]We use the insurance coverage questions which relate to current coverage status. The results are similar if questions about the previous four months are used. Individuals are defined as covered by private insurance if they report any insurance coverage, and do not report coverage from Medicare, Medicaid, or other government programs.

Table B1: Basic CPS results - Heads of household						
	Full CPS sample			Heads of HH only		
	Probit Result	Marg Prob	Deriv	Probit Result	Marg Prob	Deriv
DD probit - SE vs. Empl	0.236 (0.026)	0.037	-0.500	0.262 (0.030)	0.041	-0.559
DD probit - Rich vs. Poor SE	0.148 (0.075)	0.042	-0.368	0.227 (0.088)	0.066	-0.574
DDD probit - Rich vs. Poor SE vs. Empl	0.135 (0.082)	0.028	-0.248	0.273 (0.100)	0.058	-0.523

Notes: Coefficients in columns (1) and (4) are from probit regressions such as those presented in Table 5. Marginal probabilities interpret the probit coefficients, and elasticities divide the appropriate change in the tax rate. First three columns repeat results for the full CPS sample, while the second three columns restrict the sample to heads of household.