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An Analysis of the Effect of Tax Policy on Health Insurance Purchases by Risk Group

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Abstract

There is an extensive body of literature dealing with the welfare loss associated with generous levels of health insurance as a function of the tax subsidy. The theoretical discussion in this study considers the effect of the tax subsidy on pooling within plans, and suggests the hypotheses that the tax subsidy will have a disproportionately positive effect on the likelihood that a high-risk worker will be eligible for and participate in employment-based coverage, while the effect of the tax subsidy on plan generosity will be greatest for low-risk employees. If coverage of high-risk individuals enhances social welfare, this result may offset, at least in part, the welfare loss associated with generous plans. Data from the 1987 National Medical Expenditure Survey are used to test these hypotheses. The results provide evidence that the subsidy works to expand risk pools in the employment-based health insurance market.

Introduction

The exemption of health insurance benefits from state and federal income tax and from payroll tax represents a substantial tax expenditure to the federal and state governments. The Congressional Budget Office (CBO) estimated the federal subsidy to be $74 billion in 1994. Sheils and Hogan (1999) estimate the subsidy to be $111 billion by the federal government and an additional 13.6 billion by the states in 1998. The level and distribution of this tax expenditure and its effect on the health insurance market are the subject of much debate.

Analysis of a change in the tax subsidy requires a clear understanding of potential consumer response to the pre- and posttax price of coverage. A change in tax policy would result in a change in the real price of coverage within employment groups. Any response to changes in insurance premiums must be considered within the context of risk pooling in the employment-based insurance market. The demand for insurance coverage depends, in part, upon the perceived risk of incurring an insured loss. Thus a change in price is likely to affect the level of pooling in employment-based coverage.

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Monheit, Nichols, and Selden (1995) analyzed the distribution of net health insurance benefits in the employment-based market using the 1987 National Medical Expenditure Survey (NMES) data. They demonstrated that without the tax subsidy, substantial negative net benefits could be anticipated by most workers. However, the tax subsidy narrows the loss experienced and thus may promote participation in the employment-based health insurance market by those who would otherwise anticipate net losses from participation. Their study provides some evidence that the tax subsidy affects the extent of risk pooling in the employment-based system. Likewise, Royalty (2000) evaluated the effect of state tax rates on group health insurance to show that the tax subsidy expands worker eligibility for coverage.

This study contributes to the existing literature and the policy debate by considering the effect of the tax subsidy within the context of the selection problem in the insurance market. The following section provides the theoretical background through a review of risk pooling in insurance markets and within employment-based markets. This is followed by a discussion of the welfare effects of pooling and the effect of the tax subsidy on the level of pooling. The theoretical discussion is followed by a presentation of empirical work that provides evidence of the effect of the tax subsidy on risk pools, a discussion of the results obtained, and the implications of this study for policy with respect to the tax subsidy.

THEORETICAL BACKGROUND

Pooling in Insurance Markets

Many authors have addressed the problem of the effect of asymmetric information on insurance markets. Akerloff (1970) showed the potential for asymmetric information to eliminate a potential risk market. Rothschild and Stiglitz (1976) consider the application of the problem of asymmetric information to insurance markets. The Rothschild Stiglitz (RS) work demonstrates that in the absence of other market imperfections, the only sustainable equilibrium is one in which individuals with differing risk profiles purchase separate contracts, each priced consistently with the risk of the purchaser.

If there is any sustainable pooling, it must be achieved because the initial assumptions about market behavior are inaccurate. For example, the Wilson reactive equilibrium (Wilson, 1977) relies on assumptions that insurers have dynamic expectations about competitors' behavior that inhibit them from offering plans to break a pool. If entry into or exit from the market is costly, a firm may be able to offer a pooled plan without the risk that a competitor will draw off the best risks in the class. If scale economies are associated with insurance contracts such that some minimal group size is required to offer a contract at nonnegative profits, then some pooling will be sustainable. Administrative costs that include some portion of fixed costs act to create economies of scale over some number of enrollees. Newhouse (1996) applied the RS model to the health insurance market to demonstrate that in the presence of large contracting costs, pooled plans exist, and such plans increase optimal coverage levels for low-risk enrollees, while decreasing coverage levels for high-risk enrollees.

Employment-Based Coverage and Risk Pooling

The link between employment and health insurance creates a situation in which either employees with similar risk profiles select employment based on health insurance

offerings and thus create homogenous risk pools, or employees with different risk profiles select employment based on other criteria such as wages, job characteristics, and other fringe benefits and then form heterogenous pools under a single plan or group of plans. Monheit and Vistnes (1999) demonstrate some evidence of sorting of single workers based on their stated perception of their need for coverage. However, demand for coverage is related to human capital variables such as income and education (Grossman, 1972) and thus, evidence of sorting based on preferences for coverage is difficult to isolate from sorting based on job skills. As the heterogeneity of human capital required at a specific firm increases, heterogeneity with respect to demand for coverage should also increase. Therefore, the likelihood of a homogenous risk pool should decrease as firm size and thus variations in human capital increase, or as the complexity of the production process increases. In all but the smallest firms, labor-force heterogeneity implies at least some variation in the risk pool. Risks within these plans are pooled to the extent that wages do not fully adjust for individual risk-profiles.

Compensating Differentials. Economists have assumed that employees bear the cost of the insurance through reduced wages in the long run, but the distribution of the premium among employees depends upon the relative compensating differential each receives. The observed positive correlation between wages and health benefits has obscured compensating differentials, although Miller (1995) demonstrates the presence of a negative-wage impact of health insurance when controlling for differences in productivity. If compensating differentials vary substantially with health risk, then the employment-based market may not pool risks at all, or at least not any better than the individual market.

There is some evidence of wage adjustments that vary with anticipated health expenditures. Gruber (1994) found that mandated pregnancy coverage reduced wages primarily for those in the child-bearing years and thus likely to benefit from that coverage. Pauly, Percy, and Herring (1999) indicate that data from the 1987 National Medical Expenditure Survey (NMES) can be used to demonstrate that compensation for those with employer-sponsored coverage does not increase with tenure to the same extent that it does for those without coverage. However, there are institutional and regulatory limitations on an employer's ability to adjust wages to reflect the true cost of insuring each employee. Individuals hired to perform similar functions within a corporation are compensated with wages that are similar, although some adjustment for competencies may be provided. Unions ensure that all members obtain wages that are based on negotiated pay scales and are not individually adjusted.

Cutler and Madrian (1998) found evidence that rising health insurance costs increase hours worked by those with coverage relative to those without insurance by up to 3 percent. Similarly, Lettau and Buchmueller (1999) find evidence that health insurance is a quasi-fixed cost, meaning that the cost per hour worked is greater for part-time employees than for full-time employees. Gavin (1994) models productivity as a positive function of health insurance. These results imply that the premium incidence might not fall entirely on employees and suggest that employers are not indifferent to the composition of total compensation, as they would be, if wages to the individual worker fully adjusted for the cost of coverage.

Intertemporal Risk Pooling. Even if wages adjusted fully for risk status at the time an individual seeks employment, there is an intertemporal protection through employment-based coverage that is not present in the individual market. Premiums for an individual worker are not adjusted on an annual basis to reflect excessive health care utilization in the previous year. Workers are protected against the effect of a change in risk status on premiums to a greater degree than purchasers in the individual market.[1]

Despite the difficulties associated with identifying the level of pooling within employment groups, it is reasonable to accept that at a minimum, group coverage pools risks over a greater range than does individually purchased coverage because:

- labor requirements for all but the smallest of firms are heterogenous,
- evidence for fully adjusted compensating differentials has not been forthcoming, and
- employment-based coverage provides for intertemporal risk pooling.

Welfare Effects of Pooling

Even if employment-based coverage expands risk pools and the tax subsidy expands pools within the employment-based market, the welfare effect of that expansion remains open to debate. In comparing a full-information equilibrium in which each risk type purchases coverage priced according to risk with an equilibrium in which risks are pooled, the pooled equilibrium implies a wealth transfer from low- to high-risk individuals. This wealth transfer represents a welfare loss, so the pooled plan can only be welfare enhancing if there are other effects of separating plans.

The positive welfare effects of risk pooling arise in part from the assumption that health care is a public good and that some level of subsidization of consumption is therefore efficient. In the case of some preventive care and the treatment of communicable diseases, a direct positive externality arises from individuals obtaining treatment and thereby reducing the risk of transmitting disease to others. In addition, treatment and research go hand in hand, and technological advances depend upon some individuals obtaining care for which the marginal benefit to them may be small or negative.[2]

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[1] This is true unless the link between employment and coverage reduces labor mobility to such a degree that employees experience an offsetting wage reduction. Estimates of the size of the reduction of labor mobility attributable to this link vary substantially. Madrian (1994) and Gruber and Madrian (1994) find evidence of significant job-lock effects, Kapur (1997) obtained small and statistically insignificant estimates of job-lock from the same data set. Monheit and Cooper (1994) suggest that the proportion of workers affected and the magnitude of welfare loss have been overestimated, as do Gilleskie and Lutz (1999). Spaulding (1997) demonstrated that the clustering of benefits may lead to difficulty in estimating the specific effects of health insurance on job-mobility, especially since those most likely to be higher risk (and hence face difficulty in obtaining individual coverage) are also more likely to face reduced mobility because of pension benefits. Moran (1997) highlights the problem of properly identifying the direction of causality associated with estimating reduced labor mobility as a function of health insurance benefits.

[2] For example, life expectancy among elderly heart attack victims increased 13 percent between 1984 and 1991 (Cutler et al., 1998). This enhanced life expectancy is a result of refinements in treatment and outcomes research over a long period. The research generated by that care enhances life expectancy for those who will experience heart attack in the future.

Individuals who do not obtain timely medical care impose a burden on society through decreased productivity. The costs of worker illness on productivity are borne by the remaining labor force, if total output is maintained, or by the firm owners if productivity is reduced. In either case the cost of illness is not entirely borne by the worker, and subsidization of therapeutic interventions to improve health can be welfare enhancing, especially subsidization of health care by those most likely to be burdened by the illness.

In the current health care market, for almost any wealth, some level of care can be purchased with insurance that will be greater than that could be purchased without insurance. Traditional economic analysis implies that the difference between these two levels of care is attributable to moral hazard, and entirely welfare reducing. Nyman (1999) argues that care purchased because of the income effect of insurance is not welfare reducing. It is precisely the ability to purchase that difference, or some part of it, that individuals wish to achieve through insurance. The uncertainty associated with outcome of health care services implies limited ability to borrow against future earnings to finance high-cost care. Therefore, insurance facilitates access to care that would otherwise be unaffordable.

The benefits of pooling extend beyond the health services market into the insurance market. The loss of intertemporal pooling in the individual market is akin to a missing market for insurance. Therefore, employment-based coverage provides an additional level of coverage—that is, coverage against a change in risk-status over time. This additional coverage may be Pareto improving over the full information state, and at a minimum, there is no evidence that the full information separating equilibrium is superior to the pooled plan (Cutler and Zeckhauser, 1999).[3]

A separating equilibrium implies partial coverage or no coverage for some high-risk individuals for whom policies are unaffordable. This lack of coverage reduces social welfare if these individuals receive subsidized care in the health services market. Pooling to enhance affordability is welfare enhancing if the welfare loss from cross-subsidization within health plans is less than the sum of the inefficiencies generated through:

- public expenditures made to provide care for the uninsured and underinsured,
- cost-shifting at the point of delivery to compensate for the uninsured and underinsured who obtain care, but do not pay the full cost for that care, and
- under provision of care to the uninsured and underinsured.

Although none of these arguments can prove that risk pooling is welfare enhancing, because each relies on trading one efficiency loss for another, it is at least possible that risk pooling is not harmful to social welfare. Given equity concerns and the extensive public policy devoted to the problems of the uninsured, it would be

[3] The alternative to the pooled or partially pooled plans available through the work force may not be the full information separating equilibrium but a separating equilibrium with asymmetric information. If suppliers of coverage are unable to observe risk characteristics of those purchasing coverage, then low-risk individuals will only purchase partial coverage. Therefore, the potential welfare effects of pooled coverage include the gains from additional coverage purchased by low-risk individuals.

important for public policy makers to at least consider the potential for the tax subsidy of employment-based coverage to enhance not just the generosity of coverage (and thus moral hazard losses), but also the distribution of coverage.

Effect of the Tax Subsidy on Pooling

The tax exemption afforded health insurance benefits affect each worker differently, depending upon the level of coverage offered as part of the total compensation package, family income and thus individual marginal tax rate (MTR), and the totality of all taxes exempted (payroll, federal, and state income tax). Therefore, the extent of the subsidy is variable between workers with the same coverage, between workers with different coverage but the same family income, and workers with the same coverage and family income but residing in different states with different MTRs.

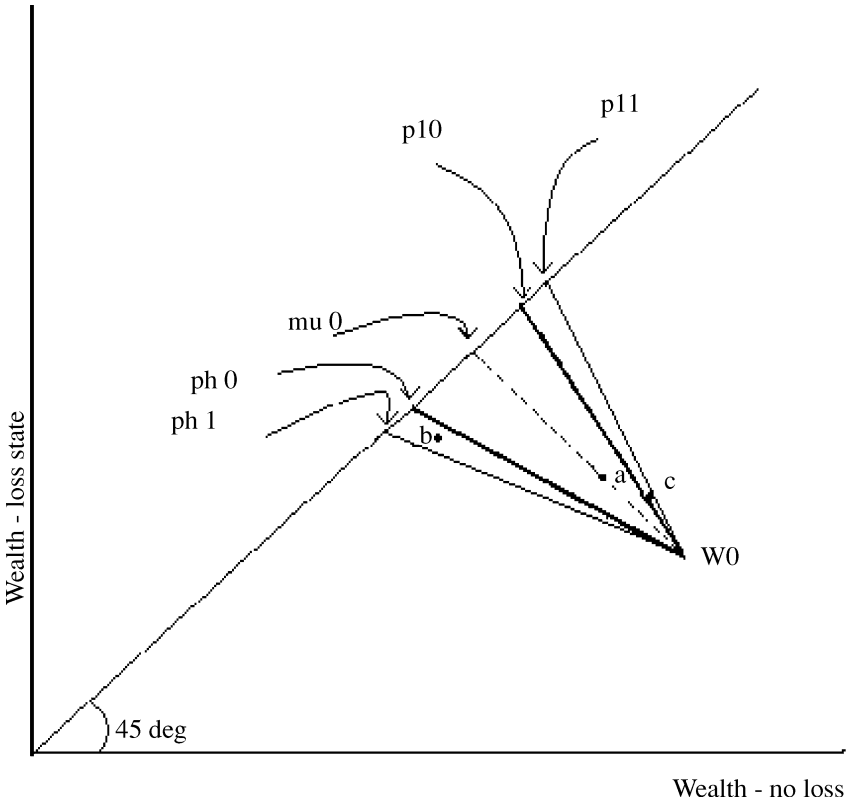
If firms were homogenous with respect to demand for coverage and with respect to worker wages, then the tax subsidy for health insurance would simply increase the quantity of coverage purchased within each group, but would not affect the risk composition of the group. Assuming the sorting based on risk classification was based on the level of coverage offered following the RS model for self selection, then a tax subsidy would prompt high-risk groups to offer even more generous coverage, but generosity would still be decreasing with risk groups. However, if employment groups create a potential for expanded risk pooling, then the subsidy might change the risk-composition of the group as well as the generosity of coverage.[4]

Selden (1999) demonstrated in a theoretical model the potential for linear subsidies for health insurance premiums to act as a compromise between excessive consumption caused by generous coverage and adverse selection. In the absence of the ability of the government to observe risk type, tax subsidies that increase with the generosity of coverage are similar to risk-adjusted premium subsidies. Therefore, capped subsidies may have the potential to be second-best Pareto efficient in a market in which adverse selection is problematic, risk is not easily observable, and plans vary along many dimensions. The figures below demonstrate the differential effect of the subsidy on price and quantity for high- and low-risk individuals, building upon the figures presented by Selden.

In the unsubsidized market, some level of pooling is possible, such as depicted in Figure 1. Suppose three plans (a, b, and c) are offered to individuals with risk between

[4] Evidence of risk-based behavior in the individual market is mixed. According to the pure RS model, in the absence of risk-adjusted premiums, high-risk individuals should have full or close to full coverage but low risks should have less generous coverage. Brown and Doerpinghaus (1994) found that in the individual market for Medigap insurance, coverage generosity was unrelated to self-reported measures of health status. On the other hand, Cartwright, Hu, and Huang (1992) found those in poor health status who obtained coverage tended to purchase more generous policies, consistent with the RS model. Similarly, Browne (1992) found evidence that low-risk individuals purchase less generous insurance in the individual market than they do in the group market. Clearly additional research is necessary to clarify the conflict between these results. However, the results from Browne (1992) may be more applicable to the nonelderly population, simply because of the nature of the leverage involved in using Medigap coverage to increase the existing value of Medicare coverage.

FIGURE 1
Partially Pooled Equilibrium Without Subsidy

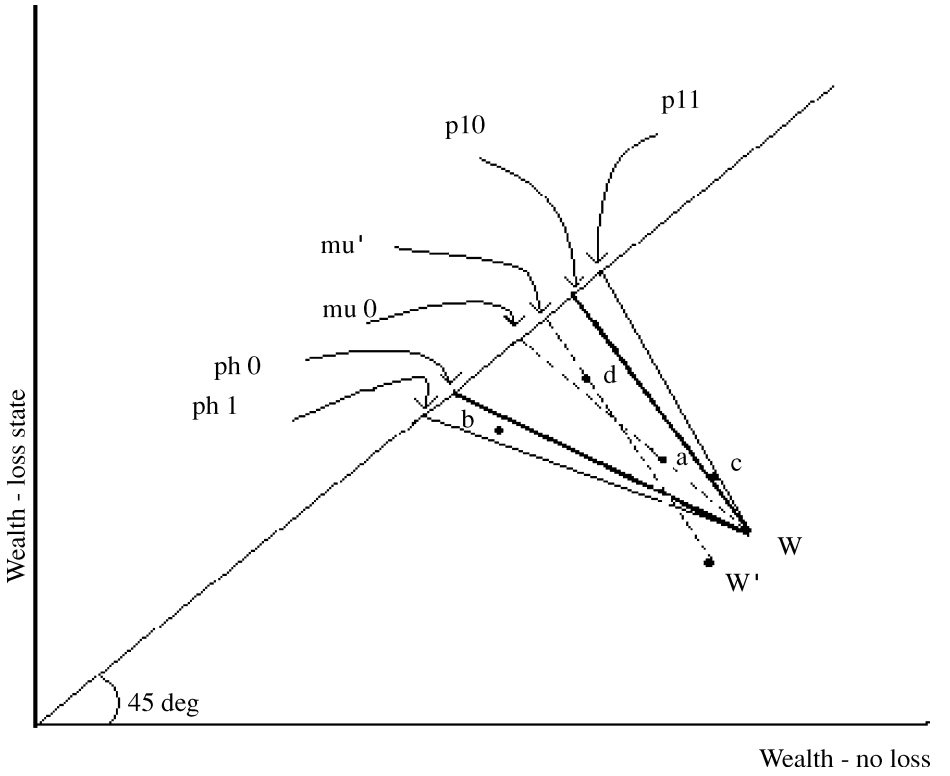


ph_1 and pl_1. The point a represents the presubsidized pooled equilibrium for those with risk between ph_0 and pl_0, given by the bold lines. For those with risks outside the potential pooling range, bounded by ph_0 and pl_0, the points b and c represent the plan choice. The classic RS analysis suggests that point a must represent the most generous coverage available within the unsubsidized pool (given market imperfections such as returns to scale and administrative costs), because if coverage were any more generous, higher risk individuals would be attracted into the pool. This would raise the cost of coverage, reducing the slope of the line (mu_0), which would in turn make the lower coverage option c more attractive to the lowest risks in the pool.[5]

If a tax subsidy is available for employment-based coverage, then wages must fall for all individuals by the tax revenue required to cover the subsidy of benefits. Initial wealth is reduced from W to W′, a loss that applies to both the loss and the no-loss

[5] Given the safety net of publicly financed or charity care, the price of plan b or the minimal benefits available in plan c may induce either the high- or the low-risk individual to self-insure. Evidence that high-risk individuals are more likely to self-insure (forgo coverage in the individual market) may reflect the inverse relationship between wealth and health, and thus the lower cost to means-tested care for high-risk individuals.

FIGURE 2
Pooled Equilibrium With Subsidy



state. As depicted in Figure 2, the subsidization of coverage changes the slope of fair-odds lines for any plan purchased under the subsidy but would leave the slopes of unsubsidized coverage (not shown) unchanged. In addition, the preference for those purchasing coverage is for a higher level of coverage because of the reduction in per-unit cost of coverage. Thus the new plan that is offered will be represented in Figure 2 by point d.

The improved coverage level in the pooled plan will attract high-risk individuals from b (or self insurance) to d, while the lower unit price of coverage within the pool will attract lower risk individuals from the partial coverage of point c (or self insurance). Individuals with risk between ph_1 and pl_1 will participate in the pool. The new pooled equilibrium (d) is preferred by all individuals to the previous equilibrium (a, b, c), and the plan d will represent a stable equilibrium as long as d is the only subsidized plan.[6]

[6] The potential of employers to offer two or more subsidized plans implies the ability to expand the total range of pooled risks by offering a "high" and "low" option. This would theoretically split the risk pool within the labor force. The propensity for employers to minimize the effects of this split through a greater premium subsidy for the high-option is suggested by the low frequency with which employer have adopted a pure managed competition approach to setting employee contributions.

For all individuals who were previously in the pooled plan a, the price of coverage goes down, while the benefits of coverage increase. However, for those added to the pool because of the subsidy, the effect on price and quantity depends upon risk level. For those high-risk individuals who move from b to d, price drops substantially. This substantial drop in price reflects the cumulative effect of the tax subsidy and the pooling subsidy. Benefits of coverage (quantity) will decrease for those who were covered under plan b. For the low-risk individuals who move from c to d the price effect is ambiguous. The tax subsidy decreases the unit cost of coverage but the pooling subsidy increases the cost of coverage. However, the quantity of coverage purchased is substantially higher and positive for those who were covered under plan c.

These results give rise to following two specific hypotheses.

The price effect of the tax subsidy is unambiguously positive for high-risk workers. Therefore, the effect of tax subsidy on the probability of coverage is greater for high-risk workers than for low-risk workers.

The effect of the tax subsidy on the optimal coverage level is unambiguously positive for low-risk workers. Therefore, the quantity of coverage purchased through group coverage will increase more for low-risk workers as a result of the tax subsidy.

EMPIRICAL EVIDENCE

Data

Data for this study are from the 1987 NMES. The NMES is a survey designed to provide nationally representative estimates of consumer health expenditures, along with information about the financing of these expenditures for the civilian, noninstitutionalized population. The household survey is composed of a series of four interviews, conducted over a period of 16 months to obtain information about the entire calendar year of 1987. Data from the household component of the NMES were supplemented by information gathered through a survey of medical providers and the Health Insurance Plan Survey (HIPS).

The HIPS is a follow-up survey designed to verify information on the insurance of persons in the household sample, including premiums paid for and provisions of coverage. The HIPS sample included employers or unions associated with workers over 16 years of age and any sources of private health insurance identified in the household survey. Self-employed individuals without employees were excluded.

Data from the HIPS and NMES were used to estimate the differential effect of the tax subsidy on the propensity of an individual to be offered coverage and to accept that offered coverage. In addition, these data provided information about the extent of coverage such that the effect of the tax subsidy on the quantity of health insurance purchased could be estimated. For each policy held or offered to individual, a constructed variable assigned an actuarial value to the policy that was used as a measure of quantity of insurance.

Self-assessed health status was used to assign risk groups utilizing a four-class scale for health assessment (poor, fair, good, or excellent). Those individuals, for whom all family members had self-reported health status of good or excellent were classified as low-risk, whereas those with at least one family member reporting fair or poor

TABLE 1
Mean Family and Individual Expenditures by Risk Classification

Family Risk Status	Family Expenditures[a] NMES 1987 ($)
Family "low-risk"	2,330
Family "high-risk"	5,289
Individual Risk Status	**Individual Expenditures ($)**
Excellent	656
Good	1,214
Fair	3,100
Poor	8,098

[a]One family in the 1987 NMES data set had expenditures of over 1 million dollars. That outlier was excluded for calculations of the mean expenditures. Inclusion would increase the spread between low- and high-risk families substantially.

health were classified as high risk. If the employee maximizes utility with respect to total family income, then he or she considers total family expenditures on health care in determining demand for health insurance. Total family expenditures are a positive function of the presence of at least one family member in poor or fair health, as demonstrated in Table 1 of mean total health care expenditures by risk group.

There are additional demographic variables, such as age, income, marital status, and education that predict health expenditures and are therefore included in the model.

Tax rates for the NMES data were provided by the Agency for Healthcare Research and Quality (AHRQ). Confidentiality concerns preclude the agency from releasing state identifiers for observations in the sample. Therefore, the analysis file was created and submitted to AHRQ for attachment of two variables: the federal tax rate and a categorical variable for the state tax rate representing the decile in which the observation falls (rather than the absolute state MTR). Both the tax rates were imputed by the AHRQ.

As Table 2 demonstrates, the state MTRs provide the variation in tax rates that is not completely determined by family income. The deciles, mean state MTRs, and the mean income for those within each group is shown in Table 2.

The confidentiality restrictions on these data preclude identification of many of the state level variables that might impact the market. In order to obtain the state tax variable at all, it was also necessary to strip from the data set other geographic identifiers such as census region and whether or not the individual resided in a metropolitan statistical area. These limitations meant that it was not possible to control for any policy variables or for market-level variations in coverage.

Clearly, it would be preferable to have the actual state tax rate rather than the decile variable. In separate studies, the actual state tax rates were used to estimate the probability of coverage using Current Population Survey (CPS) data (Ketsche and Custer, 2000; Ketsche, 2000). Those data have the following advantages:

TABLE 2
1987 NMES State Tax Rate Decile Ranges

State Tax Rate Decile	Range	Mean Family Income (Thousands)
1	0	33.56
2	0.000001–0.02000	35.33
3	0.020001–0.02500	45.25
4	0.025001–0.03400	37.78
5	0.034001–0.046001	43.72
6	0.046001–0.05000	41.18
7	0.05001–0.057682	42.22
8	0.057683–0.069897	41.20
9	0.069898–0.08500	49.62
10	0.08500–0.11000	61.49

- they permit identification of the state tax rate (imputed) rather than by decile,
- multiple years can be pooled, reflecting periods during which states changed tax structure, thus reducing the likelihood that fixed effects at the state level identify the results, and
- identification of each state permits control for state policy variables (rating regulations) that influence group and individual markets.

However, the distinct disadvantage to those data is that they can only be used to test the distribution of coverage but do not include any measure of the quantity of coverage. The data utilized and the analysis presented here, while subject to the limitations noted because of the confidentiality constraints, are consistent with the studies cited.

Means for some of the key variables are shown in Table 3 for the entire sample and by risk group.

High-risk individuals are less likely to be covered under an employment-based plan, less likely to have coverage in their own name, and more likely to remain uninsured than their low-risk counterparts. The high-risk employees are more likely to work for very small or very large employers and have a substantially lower total family income than workers classified as low-risk.

Health Insurance Plan Survey. The analysis of the second stated hypothesis requires use of the sample selected for the HIPS. HIPS is a follow-up to the household survey and was designed to verify health insurance status provided by the NMES household survey respondents. Data for the HIPS were obtained from employers, insurance providers, and from the Office of Personnel Management for federal employees. Means for some of the key variables for the sample of workers used for analysis of the effect of the tax subsidy on quantities of coverage are shown in Table 4 for the entire sample and by risk group.

The HIPS includes a score variable that reflects the actuarial value of the plan. The Actuarial Research Corporation (ARC), under contract to AHCPR, calculated a "score" (between 0 and 1) for each plan represented on these files. The score indicates the plan's

TABLE 3
Means—Pooled and by Risk Group, 1987 NMES, Working Adults

Variables	Mean—Low Risk	Mean—High Risk	Mean—Pooled
Group health*	0.770	0.715	0.760
Coverage in own name*	0.597	0.536	0.586
Dependent coverage	0.173	0.179	0.174
Uninsured*	0.135	0.185	0.144
1–9 employees*	0.170	0.193	0.174
10–25 employees	0.155	0.156	0.155
25–99 employees	0.220	0.202	0.217
100–499 employees**	0.172	0.190	0.175
Over 500 employees	0.155	0.148	0.154
Federal MTR*	0.184	0.162	0.190
State tax rate decile*	4.68	4.44	4.73
Family income* (in thousands)	43.117	37.543	42.142
N = observations	11,871	2,702	14,573
Weighted population	89,829,852	19,054,799	108,884,651

*Difference between high- and low-risk group significant at the $\alpha = 0.01$ level.
**Difference between high- and low-risk group significant at the $\alpha = 0.05$ level.

TABLE 4
Means—Pooled and by Risk Group, 1987 NMES, HIPS Sample

Variables	Mean—Low Risk	Mean—High Risk	Mean—Pooled
Actuarial value of plan held	0.826	0.825	0.825
1–9 employees	0.132	0.129	0.132
10–25 employees	0.166	0.158	0.165
25–99 employees	0.264	0.242	0.260
100–499 employees*	0.227	0.258	0.232
Over 500 employees	0.211	0.213	0.211
Federal MTR*	0.218	0.191	0.209
State tax rate decile*	5.08	3.17	5.09
Family income* (in ten thousands)	45.13	41.67	44.57
N = observations	4,238	924	5,162
Weighted population	61,525,822	11,700,165	73,225,987

*Difference between high- and low-risk group significant at the $\alpha = 0.01$ level.

actuarial value for a standard population. Actuarial values represent the percent of total covered expenditures paid for by that plan, averaged over the standard population. ARC defined a breakdown of expenditures by service type and calculated mean expenditures per person (all populations) and per family (active population only). The mean expenditures can be multiplied by the actuarial values to create a dollar amount that represents the average benefits paid by each plan.[7] For each observation

[7] Documentation from 1987 National Medical Expenditure Survey: Research Tape 40R: data from the Household Survey, the Health Insurance Plans Survey, the Survey of American Indians and Alaska Natives, and the Institutional Population Component.

included in this sample, the actuarial value for the plan type held (single, family) was used to measure "quantity" of coverage to measure the effect of the tax subsidy on plan generosity.

Estimation and Results

The Effect of the Tax Subsidy on the Probability of Coverage. The effect of the tax subsidy on the distribution of employment-based coverage is difficult to analyze because of the correlation between tax rates and income. However, the wide variation in state income tax policies introduces variation into the tax rates similarly situated individuals face.

The NMES data were used to estimate the impact of the tax subsidy on the probability that a worker has group coverage using the following model:

$$P(\text{Coverage} = 1) = f(\beta_1 \mathbf{X}_1 + \beta_2 \mathbf{X}_2 + \gamma_1 \text{MTR} + \gamma_2 \text{Risk} + \gamma_3(\text{MTR} \times \text{Risk})) + \varepsilon_1.$$

$\mathbf{X}_1$ is a vector of characteristics of an individual's employment characteristics such as firm size, occupation, unionization, and industry that reflect the choices available to a given employee and the demand for coverage of employees similarly situated to the observed individual. All have been shown to be highly determinative of whether employees are offered and whether they participate in coverage. $\mathbf{X}_2$ is a vector of demographic variables (perceived need for coverage, race, age, sex, marital status, family income, and education) that affect utilization of health-care services and hence demand for coverage. Of note were two attitudinal questions included in the survey asking participants whether they believed they were "too healthy to need insurance" and whether they believed "health insurance was not worth the costs." Individuals were classified as believing they "need insurance" and believing that coverage costs too much based on their response to these survey questions.

The federal tax rate is included in the regression, as is the state tax decile. The federal MTR is interacted with income because the marginal effect of the tax subsidy might be expected to change with income, and because of the high correlation between income and tax rate. The key variables of interest for this analysis include the MTRs, the risk group, and the interaction between the tax subsidy and risk. The probability that a worker has any coverage (own or as a dependent) can be estimated in a single logistic regression.

This reduced form estimation did not isolate the effect of the tax subsidy on participation and eligibility, and did not control for selection into the labor force. A sample selection model would provide a more general estimate of the effect of the tax subsidy on the probability of having a position with coverage for all adults, workers and nonworkers. However, estimation of such a sample selection model for opting into the workforce is not possible with these data because identification of distinct equations for predicting the decision to work in isolation from eligibility for coverage is not possible. Therefore, results obtained in this study are only applicable to working adults. Similarly, the identification of separate equations for eligibility and participation requires variables with which to identify simultaneously estimated equations. Therefore, the results obtained are the reduced form estimators for the effect of the tax subsidy on a worker's likelihood of having coverage.

TABLE 5
Logistic Regression for the Probability of Any Group Coverage

Number of observations	14,565
Wald χ^2	2,627.14
Prob > χ^2	0
Pseudo-R^2	0.2414
Log-likelihood	−6,441.038

	Estimated Coefficient	Robust Standard Error	$P > \|z\|$
Family income (in thousands)	0.0230	0.0022	0.000
Family income squared	0.0000	0.0000	0.000
Family income × MTR	−0.0376	0.0071	0.000
Employee "needs coverage"	0.4054	0.0621	0.000
Reports coverage "cost too much"	−0.2582	0.0568	0.000
Federal MTR	4.9908	0.3606	0.000
State tax rate decile	1.6834	0.8554	0.049
Risk dummy (high risk)	−0.3266	0.0946	0.001
State tax rate decile × high risk	0.0367	0.0183	0.045

It was not possible to control for the variation in state policy with respect to the small group and individual health insurance markets, since no regional or state identifiers are included in the data set. Although the lack of state identifiers is troublesome, many of the reforms for which control variables would be most important were implemented in the 1990s. These data are from 1987 when state level reforms were less prolific. Full results can be found in Appendix A. Results for the key variables of interest in this study are shown in Table 5.

These results are consistent with the stated hypothesis. Although the high-risk individuals are significantly less likely to have any health insurance coverage, the interaction term between the marginal tax (state tax rate) and the risk dummy demonstrate that the tax has a greater effect on the probability of coverage for the high-risk individuals. If the tax did not affect pooling or if the tax expanded coverage to homogenous pools on the margin, one would expect the interaction term to be zero. If response to the tax subsidy reflected just price elasticity, hypothetically greater elasticity for low-risk individuals would suggest a negative coefficient for the risk–tax interaction term.

The results are not sensitive to whether the interaction term for tax and income or the attitudinal responses are included. An alternative specification including an interaction between risk and income produced a coefficient estimate for the state tax decile that was positive but not significantly different from zero, but the estimated coefficient for the risk–tax rate interaction term remained positive and significant, consistent with the theory that the tax subsidy expands the likelihood of coverage disproportionately for high-risk workers. The estimated effect of the interaction between risk and income was positive and significant, suggesting that the effect of income on the likelihood of coverage is greater for high-risk workers. The model was tested for sensitivity to exclusion of attitudinal variables that could be correlated with risk, and the results were robust to this specification.

Tax rates have been used to calculate the price elasticity for health insurance. Using individual tax rates to calculate such price elasticities is problematic, because the individual measured may not represent the random worker at the firm (Gruber and Lettau, 2000). While, Gruber and Lettau are critical of the use of individual tax rates to measure price elasticity because of the potential for firm heterogeneity to bias that measure, the results obtained through such analysis (−0.63; Royalty, 2000) using the CPS data are only slightly higher than their own measure of the elasticity with respect to offer rates (−0.3 to −0.4).

The logistic model can be used to simulate changes in health insurance coverage that would result from a change in the level of tax subsidization of insurance using the method of recycled predictions. It is difficult to calculate elasticities in this model because the tax rates used are in "deciles" rather than real rates. It is possible to re-estimate the equation using a conversion of the state tax deciles to mean tax rates for each decile and report the change in coverage that is associated with the change in tax subsidy for these imputed tax rates. Of course the change is then calculated over the full tax rate (not just the converted state tax rates). Reduction of the tax subsidy by 10 percent was simulated and the changes as in Table 6 were obtained: While, the estimated elasticity is lower than the estimate from Gruber and Lettau, even a small change in the tax treatment of coverage has the potential to reduce the number of covered workers by almost one million and add to the number of uninsured by over two million when dependents are considered. Furthermore, the effect would be greatest for those families with one or more member in fair or poor health.

The Effect of the Tax Subsidy on the Quantity of Insurance. The second hypothesis is that the quantity of insurance purchased in the employment-based market is an increasing function of the tax subsidy and that the effect of the tax subsidy on quantity is greatest for the low-risk individuals.

$$Q(I) = f(\beta_1 X_1 + \beta_2 X_2 + \gamma_1 MTR + \gamma_2 Risk + \gamma_3 (MTR * Risk)) + \varepsilon$$

If the estimated value for γ_1 is greater than zero and γ_3 is significantly less than zero, the hypothesis is supported. This hypothesis can be tested using data from the NMES linked household and health insurance plan (HIPS) components. The sample consists of the 5,162 observations with coverage in their own name for which a valid actuarial plan value is reported for the main plan obtained from their employer. The sample includes the self-employed if they report holding employment-based coverage.

TABLE 6
Marginal Effect of Tax Subsidy on the Probability of Group Coverage

	Current Tax Subsidy	90% Subsidy	Estimated Elasticity	No. of Workers Losing Coverage
All workers	0.731	0.722	−0.116	968,568
Low-risk workers	0.740	0.732	−0.108	739,497
High-risk workers	0.690	0.679	−0.156	229,489

The dependent variable in this regression is the quantity of insurance as represented by the actuarial value of the plan. The actuarial value of a plan is a score representing the percentage of total covered expenditures paid for by that plan averaged over the standard population. For each observation included in this sample, the actuarial value for the plan type held (single, family) was used to measure "quantity" of coverage to measure the effect of the tax subsidy on plan generosity. If the employee obtains single coverage, the actuarial value of single coverage is used, even if the employee has a family and family coverage is available.

The regression includes all demographic variables that influence demand for coverage and firm and occupational characteristics from the previous regression. Although the preference for a position with health insurance is largely dependent upon family income, it is likely that average worker wages within the firm is more important in determining quantity of coverage. Therefore, worker hourly wage was included in this estimation, but family income squared was dropped from the regression because of the inclusion of two different measures for income.[8] In addition, the attitudinal questions included in the coverage equation were dropped, because there was little variation in the attitude toward the need for coverage and whether it was worth the costs among those who actually participate in offered coverage. The model was not sensitive to this specification.[9]

An initial linear regression performed in STATA was tested for omitted variables and heteroskedasticity. The omitted variable test utilizing powers of the independent variables to test for poor specification provides no evidence of omitted variable bias ($F(3,4,121) = 0.81$, Prob $> F = 0.49$). The test for heteroskedasticity models the variance of the error as a function of the fitted values and provides evidence of nonconstant variance ($\chi^2(1) = 38.10$, Prob $> \chi^2 = 0.00$). Therefore, the heteroskedastic consistent robust error correction (GLS) was employed.[10] Full results can be found in Appendix B. The results for key variables are listed in Table 7.

Coverage from firms larger than the minimum (less than 10 employees) is associated with increased quantity. However, there is no significant difference between the other firm size coefficients ($F(3,5124) = 0.89$). High-risk individuals with coverage obtain higher quantities of coverage than low risk individuals, consistent with insurance theory that predicts a preference for more generous coverage among high-risk individuals. Surprisingly, the federal tax subsidy does not significantly increase quantity of coverage, although the high degree of collinearity with family income probably accounts for this finding. The results provide support for the hypothesized positive effect of the state tax subsidy on increasing the quantity of coverage obtained, since the

[8] The estimation was tested for sensitivity to this specification of income. Key results did not change when hourly wage was dropped, and income squared was not significant in any specification tested.

[9] An additional alternative specification was tested including an interaction term for risk and income. The estimated coefficient for that term was not significantly different from zero and none of the key results were altered because of its inclusion.

[10] As the dependent variable is limited to a range of 0–1, a Tobit estimation was also performed. Results were substantially the same as those obtained with the standard regression, with the lower limit completely nonbinding and the upper limit only binding on 18 of the 5,162 observations.

TABLE 7
Regression on Actuarial Value of Group Coverage Held (Robust Standard Errors)

Number of observations			5,162
$F(37,5,162)$			9.050
Prob > F			0.000
R^2			0.052
Root MSE			0.103
Variable	Coefficient	Standard Error	$P > \|z\|$
10–25 employees	0.019	0.006	0.002
26–100 employees	0.023	0.006	0.000
101–500 employees	0.026	0.006	0.000
Over 500 employees	0.027	0.006	0.000
Family income	0.004	0.001	0.009
Family income × state tax decile	−0.010	0.004	0.027
Hourly wage	0.001	0.000	0.006
Risk dummy (high risk)	0.016	0.007	0.025
Federal MTR	−0.005	0.026	0.850
State tax rate decile	0.002	0.001	0.003
High risk × state tax rate decile	−0.003	0.001	0.019

effect of the state tax decile is positive and significant. Consistent with the hypothesis, the effect of the tax subsidy on quantity is stronger for low-risk individuals.

CONCLUSIONS

The results obtained provide strong support for the hypothesis that the tax subsidy has the effect of expanding access to coverage among all adults. The analysis suggests that the probability that an individual will have any employment-based coverage, either in his or her own name or as a dependent, is an increasing function of the tax subsidy. The marginal effect of the tax subsidy is greater for high-risk individuals and is decreasing in income. Thus the effect of the tax subsidy on price for the high-risk individuals is not solely determined by the tax rate. Rather, the expansion of risk pools implies that high-risk individuals experience a disproportionate decline in price due to the tax subsidy.

For those individuals who have coverage, the tax subsidy contributes to more generous plans. This result was not surprising and was consistent with a large body of existing literature. However, the unique measure in this study was that the effect of the tax subsidy on quantity is stronger for the low-risk individuals, a result that is consistent with the previous results and the model presented. For those who participate, the plans chosen are relatively more generous because of the subsidy, and in particular, low-risk individuals participate in more generous coverage. This more generous coverage is also more likely to be pooled coverage.

The interpretation of these results based on self-assessed health status as a measure of risk has some limitations. If the absence of health insurance causes a reduction in perceived health, then the model is subject to uncontrolled endogeneity. However, the inclusion of the control variables for attitudes toward insurance should limit the

impact of this potential endongeneity. Certainly there are other variables that correlate with self-perceived health status, such as age, marital status, and education. However, the estimations all included controls for these variables. The extent to which the results were robust to a variety of model specifications supports the interpretation of the results put forth in this article.

The health insurance industry is replete with market imperfections, most notably information asymmetries that give rise to adverse selection in the coverage market and extensive moral hazard in the health services market. This study contributes to delineating the differential effect of the tax subsidy on these twin problems. To the extent the tax subsidy works to hold risk pools together in the employment-based market, it mitigates the adverse selection problem. To the extent it enhances generosity of coverage beyond the optimal, it worsens the moral hazard problem. The support among some policy makers for a reduction in or elimination of the tax subsidy of health insurance rests upon a supposition that reduced levels of coverage, as measured by the generosity of benefits, will minimize welfare loss due to moral hazard. However, there is a potential for such a reduction to also adversely affect employment-based pooling and thus the distribution of coverage. In that case, those who consider themselves to be in fair to poor health might be the most likely to lose group coverage, with its inherent subsidization of premiums. This study provides evidence that the effect of the tax subsidy on quantity of coverage obtained is skewed toward low-risk individuals. The increased utilization of health services attributable to the tax subsidy (i.e., the welfare loss due to "moral hazard") might be broken down into two components:

- increased utilization due to more generous coverage, concentrated in low-risk individuals, and
- increased utilization due to access to coverage, concentrated in high-risk individuals.

Excess utilization that arises because coverage is more generous than optimal might be classified as generally welfare reducing. However, utilization that arises because an individual has access to a health plan at an affordable premium (as opposed to remaining uninsured) cannot be *a priori* classified as welfare reducing. A positive welfare effect of the subsidy arises, not just because individuals benefit by a reduction in risk bearing, but also because some individuals, frequently with greater health care needs, obtain access to care that is necessary and provides a large marginal benefit.

Therefore, welfare changes achieved by limiting the tax subsidy and reducing generosity of coverage will induce reductions in utilization due to both effects identified. It is clear some of such reductions are welfare enhancing, because individuals will reduce consumption of some care with low marginal benefits. However, some individuals, particularly those with greater risk of requiring services, will lose access to employment-based plans and forego care. To the extent that a reduction in the burden of illness for high-risk individuals contributes to social welfare, and to the extent that some care has positive external welfare effects, limitation of the tax subsidy will have both positive and negative effects on social welfare. It is beyond the scope of this study to attempt to value the positive and negative impacts in order to identify the net gain or loss.

Limitations of the Study

The NMES provides a rich source of information about health insurance coverage. There are some limitations that should be noted when utilizing the NMES data. First and foremost, the data are quite old and some might question the relevance for current policy. However, to the extent that these data provide information about consumer behavior and to the extent that tax policy with respect to health insurance remains as it was in 1987, the conclusions about consumer behavior drawn from these data apply today.

Other limitations of the data set include the confidentiality restrictions on the data that precluded obtaining the best measure of the state tax subsidy. Thus a great deal of the actual variation in state tax policy was unavailable. In addition, state-specific policy variables that are known to influence the market were unavailable, making it impossible to control for fixed effects of the state health policy. Finally, in order to obtain even the limited measure of state tax variation used, it was necessary to strip the data set of any regional identifiers and rural/urban identifiers known to influence both the labor and health services markets.

This study highlights the need for renewed analysis of the welfare loss of excess coverage. Measures of welfare loss of excess coverage from Feldstein (1973) onward have modeled potential reductions in health services purchased under reduced coverage in the aggregate. This study identified the dual effect of reduced levels of insurance coverage that would be encouraged under limited tax deductibility of the premiums. If the reductions in demand for health services due to loss of coverage could be differentiated from the reductions due to less generous coverage, a more appropriate measure of welfare change would be identified. In addition, there has been a dramatic increase in the number of individuals enrolled in plans that rely on supply-side management rather than benefit design to control demand. To the extent that demand in a managed care environment is less responsive to employee cost sharing, reducing the tax subsidy as an indirect method of mitigating the welfare loss of moral hazard may not generate gains as previously estimated.

APPENDIX A

Estimation of the Probability That a Worker Has Any Employment-Based Coverage

Number of observations	14,565
Wald χ^2	2,627.14
Prob > χ^2	0.00
Pseudo R^2	0.24
Log-likelihood	−6,441.04

	Coefficient	Robust Standard Error	$P > \|z\|$
Age 18–24	0.112	0.068	0.100
Age 45–54	0.351	0.090	0.000
Age 55–64	0.525	0.101	0.000
Male	−0.044	0.054	0.411
Single	−0.221	0.077	0.004
Separated, div., or widowed	−0.211	0.077	0.006
Part time worker	−0.442	0.055	0.000
High school graduate	0.221	0.058	0.000
Some college	0.332	0.071	0.000
Four or more years of college	0.370	0.087	0.000
Mining	1.344	0.359	0.000
Construction	0.242	0.152	0.111
Manufacturing	1.040	0.146	0.000
Transportation	1.111	0.163	0.000
Sales	0.476	0.144	0.001
Finance, insurance, real estate	0.867	0.174	0.000
Business, repair	0.372	0.157	0.018
Personal services	0.473	0.167	0.005
Entertainment	0.408	0.216	0.059
Professional services	0.818	0.150	0.000
Public administration	0.443	0.171	0.009
Unknown	0.621	0.169	0.000
White collar worker	0.446	0.064	0.000
Service worker	−0.077	0.077	0.322
10–25 employees	0.795	0.068	0.000
26–100 employees	1.011	0.063	0.000
101–500 employees	1.427	0.077	0.000
Over 500 employees	1.605	0.086	0.000
Union member	0.064	0.017	0.000
Spouse works	0.575	0.069	0.000
Family income (in thousands)	0.023	0.002	0.000
Family income squared	0.000	0.000	0.000
Family income × MTR	−0.038	0.007	0.000
Employee "needs coverage"	0.405	0.062	0.000
Reports cov. "cost too much"	−0.258	0.057	0.000
Federal MTR	4.991	0.361	0.000
State tax decile	1.683	0.855	0.049
Risk dummy (high risk)	−0.327	0.095	0.001
High risk × state tax rate decile	0.037	0.018	0.045
Intercept	−2.579	0.190	0.000

APPENDIX B

Regression of the Actuarial Value of Group Coverage Held

From NMES data	
Number of observations	5,162
$F(37,5,162)$	9.050
Prob > F	0.000
R^2	0.052
Root MSE	0.103

Variable	Coefficient	Standard Error	$P > \|z\|$
Age 18–24	−0.003	0.005	0.603
Age 45–54	0.001	0.004	0.868
Age 55–64	−0.005	0.005	0.299
Male	−0.001	0.003	0.827
Single	0.023	0.004	0.000
Seperated, divorced, or widowed	0.017	0.004	0.000
Part time	0.006	0.005	0.206
Some school	−0.006	0.005	0.186
Some college	0.007	0.004	0.093
College, 4 or more years	−0.001	0.004	0.856
Mining	−0.006	0.023	0.787
Construction	−0.011	0.020	0.592
Manufacturing	−0.006	0.018	0.727
Transportation	−0.013	0.019	0.500
Whole sale or retail trade	−0.019	0.018	0.309
Finance, insurance, real estate	0.008	0.019	0.664
Business, repair	0.013	0.019	0.496
Personal services	−0.006	0.021	0.775
Entertainment	0.039	0.022	0.076
Professional services	0.013	0.018	0.492
Public administration	0.007	0.019	0.722
Don't know	0.009	0.020	0.650
Self employed	0.027	0.012	0.026
White collar	−0.003	0.004	0.515
Service	0.017	0.006	0.006
Union member	0.026	0.003	0.000
10–25 employees	0.019	0.006	0.002
26–100 employees	0.023	0.006	0.000
101–500 employees	0.026	0.006	0.000
Over 500 employees	0.027	0.006	0.000
Family income	0.004	0.001	0.009
Family income × state tax decile	−0.010	0.004	0.027
Hourly wage	0.001	0.000	0.006
Federal MTR	−0.005	0.026	0.850
State tax rate decile	0.002	0.001	0.003
Risk dummy (high risk)	0.016	0.007	0.025
High risk × state tax rate decile	−0.003	0.001	0.019
Intercept	0.775	0.019	0.000

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