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INCOME TAXES AND ENTREPRENEURS'
USE OF LABOR

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ABSTRACT

This paper investigates the effect of entrepreneurs' personal income tax situations on their use of labor. We analyze the income tax returns of a large number of sole proprietors before and after the Tax Reform Act of 1986 and determine how the substantial reductions in marginal tax rates associated with that law affected their decisions to hire labor and the size of their wage bills. We find that individual income taxes exert a statistically and quantitatively significant influence on the probability that an entrepreneur hires workers. Raising the entrepreneur's "tax price" (one minus the marginal tax rate) by 10 percent raises the mean probability of hiring workers by about 12 percent. Further, conditional on hiring employees, taxes also influence the total wage payments to those workers. The elasticity of the median wage bill with respect to the tax price is about 0.37.

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"It is not forgotten that a considerable number of persons mingle their own labor with capital—that is, they labor with their own hands and also buy or hire others to labor for them..."

Abraham Lincoln
(Annual Message to Congress, December 3, 1861)

1. INTRODUCTION

One reason for the public fascination with entrepreneurial enterprises is their putative ability to "create" jobs. But there is little research on the factors that determine entrepreneurs' hiring decisions.¹ In particular, not much is known about the effect of an entrepreneur's personal income tax situation on his or her hiring decisions. A popular belief is that tax increases inhibit entrepreneurs from hiring labor. For example, after taxes were increased in 1993, the *Wall Street Journal* [1994] quoted an entrepreneur who planned

to reduce his labor force of 40 people to pay his firm's increased taxes... "...we will find ways to reduce labor costs. We may have to cut some people and give overtime to others to do their work."

If income taxes do indeed inhibit entrepreneurial enterprises from hiring workers, there are important implications for the sectoral allocation of labor and the distribution of earnings. The purpose of this paper is to investigate the effect of entrepreneurs' taxes on their use of labor. We analyze the income tax returns of a large group of sole proprietors before and after the Tax Reform Act of 1986 (TRA86) and determine how the substantial reductions in marginal tax rates associated with that law affected their decisions to hire labor and the sizes of their wage bills.

Section 2 provides a framework for the analysis. We address the question of why, on *a priori* grounds, one might expect a sole proprietor's personal tax situation to affect his or her use of labor. Section 3 describes the data used in our analyses and contains a preliminary investigation of the issues using simple cross tabulations. Section 4 presents a multivariate

analysis. To anticipate the conclusions, we find that individual income taxes exert a substantial influence on the probability that an entrepreneur hires workers. For example, raising the entrepreneur's "tax price" (one minus the marginal tax rate) by 10 percent raises the mean probability of hiring workers by about 12 percent—an elasticity of 1.2. Moreover, given that an entrepreneur chooses to employ workers, lower taxes also raise the total wage payments made to those workers. A 10 percent increase in the tax price would increase the median wage bills of entrepreneurs by 3 to 4 percent. Section 5 concludes with a summary and suggestions for future research.

2. CONCEPTUAL FRAMEWORK

Consider a sole proprietor who is deciding whether or not to hire some workers.² Why should his personal income tax situation affect this decision? The answer is not entirely obvious. After all, the *entrepreneur's* marginal tax rate has no effect on the relative prices of labor and capital because business expenses are deductible.³ However, this argument ignores the implications of the fact that entrepreneurs supply their own labor to their firms. When a tax is levied on the entrepreneur, the conventional theory of labor-leisure choice suggests that, in general, his work effort will change. To the extent that entrepreneurial labor is related in production to hired labor, the latter's optimal quantity changes as well. In this section, we develop a model that formalizes this insight.⁴

Consider an entrepreneur whose utility (U) depends positively upon his consumption (c) and negatively upon his labor supply (e). We assume the convenient functional form

$$U = \frac{c^{1-\gamma_c}}{1-\gamma_c} - \frac{e^{1-\gamma_e}}{1-\gamma_e}, \quad (2.1)$$

where γ_c and γ_e are both strictly greater than zero. The individual can operate his enterprise in one of two regimes. In the first, he hires labor as an input. Assuming a Cobb-Douglas production technology,⁵ his before-tax profits are

$$\pi = A_o e^\alpha \ell^{1-\alpha} - w\ell,$$

where ℓ is the quantity of hired labor, w is the wage rate, A_o and α are production function parameters, and the price of output is normalized to 1.

The profit-maximizing choice of hired labor (conditional on e) is

$$\ell^* = e \left[\frac{(1-\alpha)A_o}{w} \right]^{\frac{1}{\alpha}},$$

and it is associated with profits of

$$\pi = e \alpha A_o^{1/\alpha} (1-\alpha)^{\frac{1-\alpha}{\alpha}} w^{\frac{\alpha-1}{\alpha}} \equiv e \bar{\pi}.$$

The entrepreneur chooses e to maximize his utility, taking into account the fact that his consumption is generated by the after-tax profits of the enterprise: $c = (1-\tau)\pi$, where τ is the applicable tax rate. The optimizing choices of entrepreneurial labor and consumption are, respectively,

$$e_h = [(1-\tau)\bar{\pi}]^{\frac{1-\gamma_e}{\gamma_e-\gamma_c}}$$

and

$$c_h = [(1-\tau)\bar{\pi}]^{\frac{1-\gamma_e}{\gamma_e-\gamma_c}},$$

where the h subscripts remind us that these are outcomes in the regime in which labor is hired.

To conclude this portion of the framework, we assume that there are fixed monitoring and organizational costs associated with hiring labor, μ , where μ is measured in terms of utility.⁶

Then by substituting e_h and c_h into equation (2.1), we find that the maximal level of utility conditional on hiring labor, V_h , is

$$V_h = \frac{c_h^{1-\gamma_c}}{1-\gamma_c} - \frac{e_h^{1-\gamma_e}}{1-\gamma_e} - \mu .$$

We next consider the alternative regime, in which the entrepreneur hires no labor. In this case, he has access to an entirely different technology that uses only his own input, and his consumption is

$$c = (1 - \tau) B_o e^\beta ,$$

where B_o and β are parameters. Maximizing utility subject to this constraint yields

$$e_n = \left[\beta \left[(1 - \tau) B_o \right]^{1-\gamma_e} \right]^{1/z} ,$$

where $z \equiv (1 - \gamma_e) - \beta(1 - \gamma_c)$ and the subscript n indicates that this is the optimum given that no labor is hired. The maximal utility associated with this regime is found by substituting e_n and the associated value of consumption into equation (2.1), and we denote it by V_n .

The decision whether or not to hire labor depends on whether $(V_h - V_n) > 0$. Given a distribution of the variable μ in the population, this leads to a conventional discrete choice model in which the probability of hiring labor depends on observable variables relating to the individual's tastes and to the production technology.

The key comparative statics question from our standpoint is how $(V_h - V_n)$ changes when the entrepreneur's "tax price" $(1-\tau)$ increases. $\partial(V_h - V_n) / \partial(1 - \tau)$ is a very messy expression which is indeterminate in sign. A simpler expression is obtained when $\beta=1$, i.e., the technology in the regime with no hired labor also exhibits constant returns to scale.

In this case,

$$\frac{\partial(V_h - V_n)}{\partial(1 - \tau)} = \frac{[(1 - \tau)\bar{\pi}]^{\frac{(1 - \gamma_e)(1 - \gamma_o)}{(\gamma_e - \gamma_o)}} - [(1 - \tau)B_o]^{\frac{(1 - \gamma_e)(1 - \gamma_o)}{(\gamma_e - \gamma_o)}}}{(1 - \tau)}.$$

The sign of this expression depends upon the sign of

$$\frac{(1 - \gamma_e)(1 - \gamma_o)}{\gamma_e - \gamma_o} \quad (2.2)$$

and the relationship between $\bar{\pi}$ and B_o . If expression (2.2) is positive and $\bar{\pi} > B_o$, then raising the tax price will increase the probability of hiring labor. But if expression (2.2) is negative, then the opposite is true.

In our empirical work, we will also be interested in the effects of changing taxes upon the entrepreneur's wage bill ($w\ell$), conditional on hiring labor. It is straightforward to show that

$$\frac{\partial \ln(w\ell)}{\partial(1 - \tau)} = \frac{1 - \gamma_e}{\gamma_e - \gamma_o},$$

which again is indeterminate.

A second reason that the entrepreneur's tax rate might affect his hiring decision relates to liquidity constraints. An increase in taxes reduces the entrepreneur's cash flow. To the extent that liquidity constraints are present, this leads to a reduction in the scale of operation of the enterprise, and hence a reduction in the demand for inputs.⁷ In the *Wall Street Journal* article cited above, a Paine Webber economist offered exactly this explanation for why increased personal income taxes adversely affect small firms: "It means their cash flows will not grow as fast, and they will not have as much to plow back into their business."

These two stories are not mutually exclusive and our data are not ideally suited to discriminating between them. The key point is that it is at least possible that changes in the entrepreneur's tax situation may affect his hiring decisions. Our general strategy is to determine whether such tax effects are actually present by estimating reduced form equations in which changes in hiring decisions are related to changes in the entrepreneur's income tax rate, *ceteris paribus*.

3. DATA

3.1 Description

Our data are drawn from the Statistics of Income Individual Tax files for 1985 and 1988, a panel consisting of 62,159 tax returns for taxpayers present in both years. These files contain detailed information on taxpayers' income and deductions taken from their Form 1040. We excluded from our sample those with duplicate (and likely erroneous) returns in either year, those who changed filing status between 1985 and 1988, and those who reported income on a fiscal year basis.

We include only individuals between 25 and 55 years of age in order to avoid complications that would arise because of younger sole proprietors' labor market entry decisions and older sole proprietors' impending retirements. We also eliminate taxpayers who had negative marginal tax rates or who were subject to the alternative minimum tax (AMT). The tax situations of the former group are complicated by the interaction of the Earned Income Tax Credit with the ordinary income tax, while the members of the latter group are in effect subject to an entirely separate tax base and rate schedule.⁸ All of these exclusions left us with a group of 27,734 tax returns.

Our basic sample consists of individuals who filed a Schedule C in both 1985 and 1988, of whom there are 6,078. In principle, results drawn from such a sample might be subject to selectivity bias—sole proprietors who survive until 1988 may not be a random sample of the 1985 group. However, as noted below, when we expand our analysis of hiring decisions to include individuals who ceased filing a Schedule C between 1985 and 1988, no important differences emerge.

Our sole proprietors have much higher incomes than taxpayers as a whole, a finding that is consistent with earlier research. In 1985, the mean Adjusted Gross Income (AGI) in our sample of sole proprietors was \$402,588, while the mean for all taxpayers was \$24,219. Also consistent with previous research (see, for example, Hamilton [1995]) is the tremendous amount of income variation among sole proprietors—the standard deviation of AGI was \$1,369,364. The distribution of sole proprietors' incomes is also very skewed; median AGI was only \$93,319. Not surprisingly, the key components of AGI exhibited qualitatively similar patterns. Mean wages and salaries on the returns were \$127,889 (s.d. = \$517,589), with a median of \$25,686. Mean capital income (the sum of interest and dividends) was \$46,846 (s.d. = \$275,774), with a median of \$2,855. In our context, it is particularly interesting to note the dispersion in net schedule C income—the mean in our sample was \$156,611 (s.d. = \$511,008), but the median only \$14,286. The mean of other income (net of adjustments) was \$71,242 (s.d. = \$1,003,875). This category includes capital gains/losses, alimony received, taxable unemployment compensation, and so forth.

Sole proprietors do not report the number of workers they employ on their Schedule C. However, they do report their wage bill. Whether the wage bill is positive or zero tells us whether the entrepreneur has hired any labor. Our main focus, therefore, is on changes in the

dichotomous decision about whether or not to hire labor. Changes in the wage bill itself are hard to interpret because one does not know if they are dominated by changes in wage rates rather than labor demand. Nevertheless, expenditures on labor inputs are of independent interest, so we also analyze how the wage bill changes in response to tax rate changes. As we will see below, most sole proprietors hire no labor at all. The mean 1985 wage bill in our sample was \$33,417, but the median was zero.

An important implicit assumption in this discussion is that we can identify sole-proprietors as “entrepreneurs.” Is this sensible? In the nonstatistical literature on this topic, entrepreneurs are typically identified by their daring, risk-taking, animal spirits, and so forth. However, statistical work forces us to settle for more prosaic, observable criteria for classifying someone as an entrepreneur. With tax return data, the most sensible proxy for “entrepreneurship” is the presence of a Schedule C in the return.⁹

It has been suggested that the presence of Schedule C is more indicative of tax-sheltering activity than entrepreneurial activity. For example, some economists may report their consulting income and honoraria on Schedule C solely in order to be eligible for certain deductions. However, data from the 1985 *Statistics of Income* suggest that such personal service activities are undertaken by only a small proportion of Schedule C filers, about 16 percent.¹⁰ And surely at least some of these activities reflect classical entrepreneurial behavior.

One might be tempted to implement an algorithm for identifying which Schedule C filers are “serious” entrepreneurs. For example, one could require that business income be above some threshold level. But many start-up enterprises have low or even zero receipts. Another possibility is that the ratio of Schedule C income to earned income be above some threshold. But as already suggested, “serious” entrepreneurs can have low incomes from their enterprises.

Further complications result from using annual data. A serious entrepreneur who starts his or her business late in the year is likely to resemble a full-year, but non-serious, entrepreneur.

We conclude that trying to weed out ersatz entrepreneurs from the population of Schedule C filers is not likely to be terribly fruitful. Nevertheless, below we experiment a bit with alternative thresholds for business revenues as criteria for being classified as an entrepreneur, and find that they have no serious impact on our substantive results.

3.2 A Preliminary Look at the Data

Table 1 provides some information on the number of sole proprietorships in 1985 and 1988, and the extent to which they employed labor. Panel (a) of the table exhibits a 3x3 matrix comparing combinations of filing status and hiring decisions in 1985 (rows) with corresponding measures for 1988 (columns). Consider, for example, the center entry. It indicates that 3,632 observations are sole proprietors who did not hire anybody in either 1985 or 1988. The second entry in this cell indicates that these observations constitute 67.9 percent of the entrepreneurs who did not hire anybody in 1985. In contrast, 375 or 7.0 percent moved from having no labor to having a positive wage bill, while 1,345 or 25.1 percent exited from sole proprietorship entirely.

For the matrix as a whole, three observations stand out. First, only 2,550 of the 27,334 returns—about 9.3 percent—had a positive wage bill in 1985, in large part because only 7,602 (or 27.8 percent) were sole proprietors at all. Second, there is substantial persistence in hiring decisions. Of those without any workers in 1985, 67.9 percent also had none in 1988. Similarly, 71.9 percent of those who had employees in 1985 continued to have some in 1988. Lastly, those with workers in 1985 are more likely to stay in business but stop hiring workers than to leave self-employment altogether (20.1 percent versus 8.0 percent). However, those sole proprietors

without workers are more likely to end the sole-proprietorship than add employees (25.1 percent versus 7.0 percent).

As already noted, our basic sample consists of individuals who were sole proprietors in both 1985 and 1988, i.e., those in the lower right hand 2x2 submatrix. Panel (b) of Table 1 replicates these cells, but provides frequencies contingent upon remaining a sole proprietor. In 1985, 34.1 percent of the sole proprietors hired workers. This figure reflects the pattern found among OECD countries, in which most of the self-employed have no employees (see Lindh and Ohlsson [1996]). Between 1985 and 1988, 9.4 percent took on workers, while 21.9 percent ceased having a wage bill.

In Table 2, we divide this set of entrepreneurs into two groups, those with "low" tax rates in 1985 (below 34 percent) and those with "high" tax rates (34 percent and above). People in the upper tax brackets received the largest tax rate reductions under TRA86—the maximum statutory tax rate went from 50 percent to 28 percent.¹¹ Hence, if there is anything to the story about high tax rates discouraging firms from hiring labor, then we would expect those individuals who were initially in the higher brackets to have the largest increase in their propensity to engage labor.¹² The figures in Table 2 are consistent with this story. Of the sole proprietors who had no workers and low tax rates in 1985, 8.4 percent had workers in 1988. For those with high tax rates in 1985, the figure was 10.4 percent. Similarly, 37.4 percent of the low-tax-rate sole proprietors who had labor in 1985 had no wage bill in 1988, while for the high-tax-rate sole proprietors, the figure was only 15.7 percent.¹³

An immediate concern regarding the interpretation of the results in Table 2 is that high-income, "successful" individuals are simply different than those with low incomes and tax rates. In this view, these personal characteristics are the source of the differences in Table 2, not tax

rates *per se*. In order to investigate this possibility, we estimated a similar set of transition matrices over a time period that did not contain a major tax reform, 1989 to 1993.¹⁴ If the key factors determining hiring decisions are the observable or unobservable characteristics of high-income individuals, the pattern in Table 2 should be repeated in these data. Alternatively, if changes in tax rates are driving the results in Table 2, in the 1989 to 1993 transitions there should be no differences between high-income and low-income individuals.

The data support the latter scenario. Among high-income, high-tax sole-proprietors with no workers in 1989, 20 percent had a wage bill 1993. Among low-tax individuals, the analogous percentage was *higher*, 30.4 percent, although the difference was not statistically significant. Similarly, among those high-tax individuals who had workers in 1989, 6 percent did not have workers in 1993 compared with a rate of 4.2 percent among low-tax individuals. Again, although not statistically different, the pattern is directly opposite to that in Table 2.

Note that the fact that the *overall* rate of transitions was higher during the period 1989 to 1993 than during the period 1985 to 1988 is not relevant here. Business cycle conditions in the early 1990s were different from those of the mid-1980s, and one would expect this to affect entrepreneurs' decisions. The key issue is not the magnitude of the transition rates, but the *differences* in the transition rates between high- and low-income individuals. In the 1989 to 1993 transitions, there are no (statistically significant) differences. In short, the comparison between the 1985 to 1988 "reform" data and the 1989 to 1993 "no-reform" data does not give credence to the notion that unobserved differences between high- and low-income sole-proprietors are determining the results in Table 2. That said, other factors might influence an entrepreneur's propensity to hire labor, and some of these could be correlated with marginal tax rates.¹⁵ Hence, while the results in Table 2 are suggestive, we turn now to a multivariate approach.

4. MULTIVARIATE ANALYSES

4.1 The Hiring Decision

Our goal is to estimate the determinants of the probability that a sole proprietor hired any labor in 1988. We showed in Section 2 that this probability depends upon the parameters of the entrepreneur's utility function, the parameters of the relevant production functions, the tax price facing the entrepreneur, and the (unobservable) costs associated with managing hired labor. Further, the data suggest that there is substantial persistence in the decision to hire labor, so it makes sense to condition the 1988 decision on whether the entrepreneur hired labor in 1985. Given these considerations, an appropriate empirical specification posits that the probability of hiring labor is a function of the presence of labor in 1985, the magnitude of the reform-induced change in the tax price, and the entrepreneur's characteristics. Specifically, we assume that the probability that the entrepreneur hires labor in 1988 ($\text{Prob}(\ell_{88} > 0)$) is

$$\begin{aligned} \text{Prob}(\ell_{88} > 0) = & \gamma_0 + \gamma_1 \Delta \ln(\text{TAXPRICE}) + \gamma_2 (\Delta \ln(\text{TAXPRICE}) \times \ell_{85}) \\ & + \gamma_3 \ell_{85} + X_{85} \Omega, \end{aligned} \tag{4.1}$$

where $\Delta \ln(\text{TAXPRICE}) = [\ln(1 - \tau_{88}) - \ln(1 - \tau_{85})]$ and τ_s is the entrepreneur's marginal tax rate in year s ; $\ell_{85} = 1$ if the firm had a positive wage bill in 1985 and is zero otherwise; and X_{85} is a vector of characteristics of the entrepreneur (which reflect differences in utility function parameters) and of the entrepreneur's industry (which reflect differences in production function parameters), and Ω is the associated parameter vector. To estimate the parameters of equation (4.1) requires an assumption regarding the distribution of μ , the fixed costs associated with hiring labor. We assume normality, which yields the conventional probit statistical model.

The interaction term in (4.1) permits us to determine whether taxes affect differently those entrepreneurs who did and did not initially hire labor, a possibility suggested by Table 2. If

$\ell_{85}=0$, the effect of the change in tax price is γ_1 . In contrast, for those entrepreneurs who had employment in 1985 ($L_{85}=1$), the effect of the lower rates in TRA86 is $\gamma_1+\gamma_2$.

An important issue related to equation (4.1) is what variables to include in the X_{85} -vector. Tax returns do not contain as rich a set of personal variables as some other data sets, but several useful controls are available. These variables, along with their means and standard deviations, are included in Table 3. Age is listed because it is related to one's experience in the job market and human capital accumulation; hence, it affects the entrepreneur's production function. Age also may affect the individual's risk aversion and hence, the utility function. Previous research on entrepreneurial decision making suggests that a quadratic term in age is also appropriate.¹⁶ We include marital status and the number of dependents given the possibility that they too may affect the entrepreneur's leisure-consumption preferences.

We include capital income as a measure of the individual's assets, which should affect entrepreneurial decision making in the presence of capital market constraints.¹⁷ However, one should note that tax return data on capital income are quite poor. Our variable is the sum of reported dividends and interest; it omits capital gains and municipal bond interest, *inter alia*.¹⁸ Hence, one must be cautious in interpreting the coefficient on this variable as a test of the liquidity constraint hypothesis. Finally, using the principal business codes reported on Schedule C, we develop a set of dichotomous industry variables. These are intended to take into account industry-specific effects, such as the fact that wage growth, the parameters of the production technology, and profitable opportunities differ across industries.¹⁹

We report statistics for two samples in Table 3. Column (1) contains the statistics for our basic sample, individuals who were sole proprietors in both 1985 and 1988. In column (2) we report the corresponding values for a sample restricted to those sole proprietors who reported

employment in both 1985 and 1988. This latter sample is used in our analysis of changes in the wage bill.

A second major issue associated with equation (1) is the potential endogeneity of the tax price variable. Marginal tax rates, of course, vary with taxable income. As the wage bill goes up, taxable income declines, and the marginal tax rate declines, *ceteris paribus*. This may induce a positive relationship between $\Delta \ln(TAXPRICE)$ and the probability of hiring labor that has nothing to do with economic behavior, a problem ubiquitous in investigations of the behavioral effects of taxation (see Feenberg [1987]). As in other settings, a remedy is to estimate the equation using instrumental variables, which requires that we find a variable (or variables) that is correlated with $\Delta \ln(TAXPRICE)$ but is unlikely to be correlated with the error term.

We construct an instrumental variable that takes advantage of the most prominent feature of our data: the exogenous decline in marginal tax rates due to TRA86 itself. To begin, we compute each individual's marginal tax rate using the data and tax law for 1985.²⁰ Next we compute each individual's marginal tax rate using the data for 1985 (inflated to 1988 levels), but employing the tax law for 1988. Clearly, the change between the 1985 and the 1988 tax rates computed in this fashion is due entirely to modifications of the tax code. Essentially, this procedure removes the endogenous component of tax rate movements from $\Delta \ln(TAXPRICE)$, leaving only the part due to the exogenous change in the tax law associated with TRA86.²¹ Prior to estimating our probit model with instrumental variables, we implement the test suggested by Rivers and Vuong [1988] to assess whether the potential endogeneity of $\Delta \ln(TAXPRICE)$ is in fact a significant problem.²²

Basic Results. To begin, we present in column (1) of Table 4 a simple specification that includes on the right hand side only $\Delta \ln(TAXPRICE)$, an indicator variable for whether the firm

employed labor in 1985 (L_{85}), and the interaction of the two. In effect, this represents a more structured version of the comparisons presented in Table 2. Not surprisingly, the coefficient on L_{85} is positive—entrepreneurs who hired labor in 1985 are more likely to have done so three years later. Of more interest from our standpoint is the coefficient on $\Delta \ln(TAXPRICE)$, which is positive, and exceeds its standard error by a factor greater than 2. This mirrors the result that we obtained from the summary statistics in Table 2—the greater the percentage increase in a sole proprietor’s tax price between 1985 and 1988, the greater the probability that he engaged labor in 1988. The positive sign on the interaction term suggests that taxes have an even larger effect on firms that already employ some labor.

In column (2) we augment the specification to include our other control variables. Importantly, the coefficients on both $\Delta \ln(TAXPRICE)$ and the interaction of $\Delta \ln(TAXPRICE)$ with L_{85} remain positive. Each is statistically significant. Hence, the importance of tax effects in column (1) is not an artifact of a correlation between tax rates and other variables. Turning to these other variables, one finds that the effect of AGE is negative. While AGE and AGE^2 are individually insignificant, a joint test reveals that the effect of age as a whole is statistically significant. The other indicators of the individual’s economic and demographic situation do not exert statistically significant impacts, a finding consistent with earlier studies (Holtz-Eakin, Joulfaian, and Rosen [1994a] and von Praag [1994]).^{23,24} However, industry is a statistically significant variable. In particular, entrepreneurs engaged in the retail and service sectors were more likely to have taken on employees than their counterparts in other sectors.²⁵

As stressed earlier, the positive coefficient on $\Delta \ln(TAXPRICE)$ might simply be a reflection of the fact that marginal tax rates increase with taxable income, *ceteris paribus*. To investigate this phenomenon, we implemented the Rivers-Vuong test for endogeneity described

above. Interestingly, the test suggests that we cannot reject the null joint hypothesis that both $\Delta \ln(TAXPRICE)$ and $\Delta \ln(TAXPRICE) \times L_{85}$ are uncorrelated with the error term. More specifically, the chi-square test statistic associated with the hypothesis that the coefficients of the relevant residuals are both zero is 1.73, which does not reject at any conventional level of significance. (The critical value for a chi-square distribution with two degrees of freedom at a five percent level of significance is 5.99.) Thus, endogenous tax rates do not appear to render the results in column (2) invalid. For the sake of completeness, we note that if the equation is nevertheless re-estimated assuming that the tax price is endogenous, the results are essentially the same as those reported in columns (1) and (2). For example, the coefficient on $\Delta \ln(TAXPRICE)$ corresponding to that in column (2) is 0.523 (s.e. = 0.193), while the coefficient on the interaction variable is 1.31 (s.e. = 0.269). Both are quite close to the estimates in column (2).

Alternative Specifications

We subjected our equation to a variety of checks to determine whether the estimated relationship is sensitive to the data or specification. To begin, we included the 1985 value of family wage and salary earnings (they are not reported separately for each spouse). More than one interpretation of this variable is possible. To the extent that earnings are attributable to the entrepreneur's spouse, they may create an income effect for the entrepreneur.²⁶ To the extent that they are attributable to the entrepreneur, they may be an indicator of the cost of time that is spent in sole-proprietorship activity. If so, they are also likely to be endogenous, the primary reason for not including earnings in the baseline specification reported in column (2) of Table 4. In any event, while the estimated coefficient was negative, the inclusion of the earnings variable had essentially no impact on the character of the results. In particular, the coefficient on the tax price variable was 0.593 with an estimated standard error of 0.169.

Another possibility is that the process determining the wage bill differs between those who already have workers and those who do not. To see if our pooling of the data was driving the results, we estimated separately probits for those who hired labor in 1985 ($L_{85}=1$) and those who did not ($L_{85}=0$). This yielded results similar to those reported in Table 4— $\Delta \ln(TAXPRICE)$ significantly affects the probability of having a positive wage bill for both groups. For those with $L_{85} = 1$, the estimate is 1.63 (s.e. = 0.186), while for those with $L_{85} = 0$, the result was 0.516 (s.e. = 0.168).

An important feature of TRA86 is that it embodied changes in the tax base as well as in marginal tax rates. (For example, the itemized deduction for state sales taxes was eliminated.) Thus, the tax reform generated changes in after-tax income; *ceteris paribus* such “tax-base effects” might alter the propensity to hire labor either by influencing the entrepreneurs’ own labor supply or by changing the cash flow of a liquidity constrained venture.

To investigate this possibility, we augmented the specification in Table 4 with the change in after-tax income between 1985 and 1988. The coefficient on this variable is statistically insignificant and its inclusion does not appreciably alter our other estimates. Of course, this variable may be endogenous for the same reasons as our tax price variable. However, instrumenting in a fashion analogous to that used for our tax price variable (i.e., computing 1988 after-tax income using 1985 income data and 1988 tax structure) does not affect the nature of our results. (The point estimates are 0.434 and 1.83 for the tax price and interaction variables, respectively. Each is statistically significant.) We do not regard this finding as serious evidence against the hypothesis that liquidity constraints have an impact on the decisions of small firms. Taxable income, after all, poorly measures the resources available to the entrepreneur. Our data

set allows us to get a good fix on the effects of marginal tax rates, but is not much help in learning about liquidity constraints.

Another possible problem with our canonical specification is that it ignores possible state-based differences in the costs of hiring workers. For example, states differ in their unemployment insurance systems, as well as other labor market policies.²⁷ To control for such differences, we added a set of dichotomous state variables to our basic specification. The inclusion of these controls has little effect as the coefficient on our tax-price variable remains positive (0.506) and statistically significant (s.e. = 0.169).

The estimates so far are based on a sample that includes only individuals who were sole proprietors in both 1985 and 1988. The propensity to exit from Schedule C status is not random. Indeed, TRA86 embodied incentives to alter the organizational form of a business. The main thrust was to make taxation under the individual income tax (sole proprietorship, partnership, subchapter S corporation) more attractive relative to the corporation tax; see Carroll and Joulfaian [1995] or Plesko [1994].²⁸ Hence, TRA86 was more likely to induce “entry” than “exit.” One possible econometric strategy for dealing with this phenomenon would be to estimate a sequential bivariate probit model, which would allow us jointly to estimate the probability of survival as an entrepreneur with the probability of hiring labor, conditional upon survival. However, this model requires very strong identification assumptions (see van Praag and van Ophem [1995]) that cannot be made convincingly in our context. Instead, we simply expand the sample to include all individuals who were sole proprietors in 1985, even if they ceased being so in 1988. The dependent variable in the probit equation in effect becomes “stayed in business *and* employed labor.” This exercise allows us to see if ignoring non-random entry and exit biases our results.²⁹ The results are reported in columns (3) and (4). Again, the

coefficients on the tax price variable and the interaction of the tax price and lagged employment are positive and significant.³⁰

Two possible questions arise in the context of the industry variables. First, is there a difference across industries in the effect of changes in log tax price upon the propensity to hire labor? To address this question, we estimated a specification in which the terms involving the change in the tax price were interacted with the industry variables. We found that, in general, tax price effects did not vary with industry. Only one of the coefficients was statistically significant. (In the service sector, the interaction of ℓ_{85} with the change in the log tax price had a point estimate of 1.54 with a t-statistic of 3.16.) In magnitude, it was slightly larger than the estimate without the interaction (reported in column (2) of Table 4), but the qualitative result was basically the same.

Second, among those individuals who were sole proprietors both years, did many change industries? In our data, about a third of the industry classifications changed. In order to assess the possibility that our results relating to tax price were driven by (say) movements to industries with different labor intensities, we augmented the basic model with a dichotomous variable that took a value of one if the industry changed and zero otherwise. This variable had a coefficient of -0.131 with a standard error of 0.0462. However, while statistically significant, the introduction of the industry-change variable did not materially affect the coefficient on the change in the log tax price—the coefficient was 0.482 (s.e. = 0.167), basically the same as its counterpart in column (2) of Table 4.

We also examined the importance of our statistical assumptions. In the probit model, the two-stage procedure generates consistent estimates only if the error terms in both the first and second stage equations are joint normally distributed, and both equations are correctly specified.

In a linear model the conditions are considerably less stringent—the right hand side variables in the first stage equation have to be uncorrelated with the error term in the second stage equation, but consistent estimates may be obtained even if some variables that belong in the first stage equation are omitted. Therefore, despite the well-known limitations of the linear probability model, it seemed worthwhile to use it to check our estimates.

The linear probability results are very similar to those obtained using the probit. For example, when we estimated the analogue to column (2) of Table 4 using ordinary least squares, the coefficient on the tax price was positive (0.0897) and significant (s.e. = 0.0318).³¹ Implementation of the Wu test for endogeneity indicated that there was no evidence of a correlation between the tax price terms and the error—the chi-squared test with two degrees of freedom was significant at only the 0.594 significance level. Finally, if one nevertheless estimates the equation using two stage least squares, the coefficient on the tax price variable (0.0958) and its standard error (0.0361) are essentially the same as the least squares estimates. In short, while strong assumptions are needed to investigate endogeneity in the probit models, the basic result holds when the analysis is done using the more robust linear probability model: correcting for endogeneity does not change the substantive findings.

The theme emerging from our discussion of Table 4 is that changes in entrepreneurs' tax rates do have a statistically significant impact on their use of hired labor. As discussed earlier, however, one may wish to tighten the criteria for classifying Schedule C filers as entrepreneurs. To do so, we imposed the requirement that sole proprietors reported \$500 of gross business receipts and repeated our statistical analysis using this smaller (5,628 observations), more select sample. The basic tenor of our results is unchanged; both $\Delta \ln(TAXPRICE)$ and the interaction variable continue to be positive (0.480 and 1.23, respectively) and statistically significant

(s.e.=0.173 and s.e.=0.243, respectively). As further checks, we raised the minimum threshold to \$1,000 of business receipts, and then to \$5,000. In each case, the estimated coefficients remain positive and jointly significant.

Implications

We turn now to the quantitative significance of our results. We use the results in column (2) of Table 4 to simulate the effect of a change in tax rates on the probability of an entrepreneur employing labor. Specifically, we consider a decrease in the marginal tax rate inducing a 10 percent rise in the tax price. For example, the top bracket rate embodied in the Omnibus Budget Reconciliation Act of 1993 is 39.6 percent. Reducing this rate to 33.2 percent would generate a 10 percent rise in the tax prices faced by entrepreneurs in this tax bracket. To begin, we evaluate all the right hand variables at their values in 1985, except for $\Delta \ln(TAXPRICE)$, which is set equal to zero (no change in tax rates). We then use the coefficients in column (2) to find the implied probability of hiring labor for each observation in the sample. The next step is to re-compute the probabilities, leaving all variables set at their initial values, except valuing $\Delta \ln(TAXPRICE)$ at 0.10. These calculations suggest that the tax rate reduction increases the mean probability of employing labor from 0.215 to 0.241, or 12.1 percent, implying an elasticity of 1.21. While "large" effects are in the eye of the beholder, it appears that marginal tax rates have a substantial effect on the propensity of entrepreneurs to hire workers.³²

4.2 Changes in the Wage Bill

As noted above, tax returns do not report the number of employees, but do include the size of the wage bill. One could attempt to analyze changes in the number of employees by imputing an average wage rate to each enterprise on the basis of its industry and then dividing

this figure into the wage bill to obtain an estimate of the number of workers. But such an exercise would ultimately be unconvincing, especially given our inability to observe quality differences among employees in different firms. More generally, any such imputation would require a number of untenable assumptions. Instead, our strategy is to analyze the log-difference in the real wage bill itself (in 1985 dollars), $\Delta \ln(WBILL)$, for firms that had positive wage bills in both 1985 and 1988.

Note that to the extent that the wage rate stays fixed, the log-differences of wage bills are the same as log-differences of labor. Alternatively, in a multivariate framework, to the extent that the industry indicator variables pick up all shifts in horizontal firm-specific supply of labor curves, one may interpret coefficients on the other variables as employment effects. These are strong assumptions, so one must be cautious about interpreting the results as telling us anything about the number of workers *per se*. Of course, the wage bill itself is of independent interest because of its relationship to the economy-wide distribution of earnings. In addition, it is an important indicator of the vitality of the enterprise, and of critical importance to understanding the tax revenue implications of changing tax policy.

The mean value of $\Delta \ln(WBILL)$ for these 1,618 firms is 0.245. Following the strategy of Table 2, we may divide this sample on the basis of tax rates in 1985. Doing so indicates that the mean percentage change in the wage bill for those 369 firms with "low" (below 34 percent) marginal tax rates is 0.125. In contrast, the figure for those with high tax rates is 0.265, a difference of 0.14.³³ Thus, just as in our analysis of the presence of a wage bill, there is suggestive evidence of a link between tax rates and the size of the wage bill.

To begin a more careful investigation of the relationship between changes in the wage bill and marginal tax rates, recall from Section 2 that basically the same variables that drive the

decision to hire or not hire labor also influence the wage bill, conditional on hiring labor. We therefore estimate an ordinary least squares regression of the percentage change in the wage bill between 1985 and 1988 on the same right hand side variables as in the probit equations discussed above. We use only the 1,618 observations that had a positive wage bill in each year. The results are reported in column (1) of Table 5. The coefficient on $\Delta \ln(\text{TAXPRICE})$ is positive and exceeds its standard error by more than a factor of three. The point estimate suggests that when the entrepreneur's tax price increases by ten percent, his wage bill increases by about 4.3 percent. Of course, just as in the case of the dichotomous decision discussed earlier, the tax price may be endogenous. Column (2) of Table 5 exhibits the results when the equation is estimated by two stage least squares, employing the same instrumental variables as in our probit analysis. The coefficient on the tax price term remains positive and statistically significant.

A potentially serious technical problem arises because the distribution of changes in the log of the wage bill in our sample has very thick tails. The median log-difference is 0.215; the maximum is 6.3; and the minimum is -5.9. Ten percent of the sample had increases greater than 1.04 and 5 percent had decreases greater than 1.05. Under such conditions, least squares is unlikely to give efficient results. Hence, we compute a least absolute deviations (LAD) estimator. The LAD estimator is preferred when the median is a better measure of central tendency than the mean, which is precisely our situation. Because it is not a member of the class of linear estimators, LAD may be more efficient than OLS in the presence of thick tails. In practice, LAD produces estimates of how each right hand side variable affects the median of $\Delta \ln(\text{WBILL})$ as opposed to its mean. (See Narula and Wellington [1992] for details.)³⁴

The LAD results are exhibited in column (3) of Table 5. The coefficient on $\Delta \ln(\text{TAXPRICE})$ is positive and exceeds its standard error by a factor of over 3.3. The

magnitude (0.318) implies that raising the tax price by 10 percent (e.g., lowering an entrepreneur's marginal tax rate from 39.6 percent to 33.2 percent) would lead to a 3.18 percent increase in the median wage bill.³⁵ In this context, it is important to note that the 3.18 percent figure is probably biased downward. It does not take into account the fact that, as noted in Table 4, lower taxes induce entrepreneurs currently not hiring labor at all to take on employees.

To account for the potential endogeneity of $\Delta \ln(TAXPRICE)$, we estimated the equation using Amemiya's [1982] two-stage least absolute deviations (2SLAD) method.³⁶ The 2SLAD coefficients are shown in column (4) of Table 5. The difference between the two coefficients is 0.051 ($=0.370-0.318$) with a standard error of 0.0501, which does not suggest endogeneity of the tax price. The point estimate on the tax price in column (4) indicates that a 10 percent increase in the tax price would induce a rise in the median wage bill of nearly 5.7 percent.

As noted above, the sample used to generate the estimates in Table 5 includes only entrepreneurs who hired labor in both 1985 and 1988, because one must discard observations with a zero wage bill in order to compute percentage changes. An alternative strategy that allows us to use information from those observations with zero wage bills is to estimate a regression of the level of the wage bill in 1988 on the level in 1985, $\Delta \ln(TAXPRICE)$, and our other conditioning variables.³⁷ When we estimated such a regression by ordinary least squares, we found that the elasticity of the wage bill with respect to the tax price, evaluated at the means, is 0.534. (The complete set of results is available upon request.) Two possible difficulties are associated with this strategy: 1) as before, the terms involving the tax price may be endogenous; and 2) the presence of a substantial number of zeros on the left hand side may render the estimates inconsistent. Each of these may be addressed in a straightforward fashion by the use of instrumental variables and a tobit estimation strategy, respectively. When we re-estimated the

equation with two stage least squares and with tobit, there were no substantial changes in the qualitative nature of the results.

5. CONCLUSION

Policymakers have long been concerned with the “job creation” attributes of small businesses, but not much is known about the hiring decisions of such enterprises. In this paper, we have focused on whether a sole proprietor’s propensity to hire labor is affected by his personal income tax situation. Do high income tax rates discourage entrepreneurs from taking on workers? We examine tax return data for sole-proprietors from before and after the Tax Reform Act of 1986. To the extent that these reflect entrepreneurial behavior, we conclude that the answer is yes—when a sole proprietor’s marginal tax rate goes up, the probability that he or she employs labor goes down. Further, conditional on employing labor, increases in marginal tax rates decrease the rate of growth of such firms’ wage bills. Our data do not allow us to say anything about what kinds of workers are affected by such changes. However, to the extent that the earnings of their workers are affected, it raises the possibility that taxes on high income entrepreneurs may be shifted in part to lower-income employees, leading to counter-intuitive effects on the distribution of after-tax income.

Notes

1. Although not the focus of this paper, a question that has received substantial attention is whether small businesses account for a disproportionate amount of job growth. Recent attention dates to Birch [1981]. See also Armington and Odle [1982] and Davis, Haltiwanger, and Schuh [1993]. Brown, Hamilton, and Medoff [1990] provide a summary of the issues.
2. Throughout this paper we identify sole proprietors as "entrepreneurs," a sensible proxy when using tax data (see Holmes and Schmitz [1991]). However, some individuals who file Schedule C may not be entrepreneurs in the conventional sense of that word. We return below to the issue of identifying "genuine" entrepreneurs.
3. However, to the extent that depreciation allowances are not neutral, tax rate changes may disproportionately affect net wage costs and the user cost of capital.
4. This model bears some similarities to the time-allocation decision of the farmer-entrepreneur in the literature on economic development. See Hamermesh [1993], Chapter 10. For alternative approaches to this problem, see Cowling, Mitchell, and Taylor [1996] and Jefferson [1997].
5. The Cobb-Douglas specification imposes substitutability between ℓ and e . For our purposes, what is key is that ℓ and e are *related* in production; a function that exhibits complementarity would do just as well. Thurston and Libby [1997] investigate the production relationship between hired labor and entrepreneurial labor in physicians' practices, and find non-trivial complementarities and substitutabilities.
6. In a more general model, these costs could depend on the number of workers. For our purposes, all that matters is that there be a fixed component to these costs. Similarly, these costs could enter as a monetary cost of operating in a "hired labor" regime. We enter the costs in the utility function both for tractability and to capture the psychic costs as well.
7. For some evidence that liquidity constraints affect the growth of entrepreneurial enterprises, see Holtz-Eakin, Joulfaian, and Rosen [1994a] and van Praag [1994].
8. We lose 1,345 observations due to the AMT, and 1,768 because of the EITC. We also excluded dependent filers and individuals who changed marital status. This led to the deletion of 1,603 observations.
9. For data sets focused on labor market issues, the key criterion has been whether the individual classifies him or herself as being primarily self-employed. However, the Characteristics of Business Owners data set created by the U.S. Census Bureau also uses a tax-based definition of entrepreneurship. (See Holmes and Schmitz [1991].)
10. This figure includes "business services" (advertising, management consulting, public relations, computer services, etc.) and "accounting and bookkeeping services."

11. Due to the phase-outs of personal exemptions and itemized deductions for high-income individuals, the effective marginal rates were higher than 28 percent for some people.
12. This is similar to the approach taken by Eissa [1995] in her analysis of the impact of TRA86 on the labor supply of married women, and by Feldstein [1993] in his study of TRA86 and its effect on taxable income.
13. In each case, these differences are statistically significant.
14. This is, of course, a period one year longer than the 1985 to 1988 time period in Table 2. The years 1989 and 1993 were the only two years not straddling a major tax reform for which suitable data were available. (The modest changes during the 1989 to 1993 period are unlikely to affect this exercise. In 1990, the 33 percent "bubble" was replaced with a 31 percent rate. There were changes in the high-end rates in 1993, but these were not enacted until late in the calendar year.) To the extent that this tax increase had an impact, it would tend to reduce in relative terms the transition rate of high-income individuals into self-employment. As seen below, we find this pattern in the 1989-1993 data, although it is not statistically significant. In 1988, the maximum statutory tax rate was 28 percent. For purposes of this exercise, "high-tax" individuals were those whose marginal tax rates exceeded 25 percent.
15. As suggested above, business cycle conditions could also affect individuals' responses to changes in the tax system, which is a further reason why this simple comparison across two different time periods must be viewed with caution.
16. Taxpayers' ages are not reported on individual income tax forms. Ages are added to the Individual Tax File through the use of data provided by the Social Security Administration.
17. See Evans and Jovanovic [1989], Holtz-Eakin, Joulfaian, and Rosen [1994a, 1994b], and van Praag and van Ophem [1995] for evidence on the importance of liquidity constraints to entrepreneurial decision-making. To the extent that capital constraints are present, the amount of capital invested in the enterprise may depend on the individual's wealth. Hence, this variable may also be related to the amount of capital invested in the enterprise.
18. Of course, other conventional data sets also lack information on important components of capital income.
19. If we think of the employees as being family relatives, friends, and so on, then the employer and employee might get together and decide what type of relationship would be the most tax advantageous. We do not know the tax situations of the employees. However, we can think of the industry dichotomous variables as also picking up information about the average marginal tax rate of the employees in each industry.
20. We calculate our marginal tax rates using detailed tax calculators developed by the Office of Tax Analysis, U.S. Treasury and tailored for our panel. These calculators account for both the statutory rate schedule and the many implicit tax rates (*e.g.*, the post-TRA86

phase-out of tax benefits associated with the 15 percent tax bracket and the personal exemption) that arise from special features of the tax code.

21. An endogenous component of changes in tax rates of particular interest is that stemming from tax evasion. One possibility is that a cut in tax rates reduces evasion, raises reported taxable income, and as a consequence raises observed marginal tax rates, *ceteris paribus*. Our instrumental variable is constructed to eliminate *any* behavior-based changes in marginal tax rates, including those associated with evasion.
22. Rivers and Vuong's test is a generalization of Wu's [1973] test in a limited dependent variable setting. In the first stage, the potentially endogenous variable is regressed on the instrumental variables. In the second stage, the residuals from the first stage equation are included in the probit model. If the residuals are statistically significant, then one may reject the null hypothesis of exogeneity.
23. While most demographic variables do not seem to be strongly correlated with *changes* in various characteristics of small firms, these variables are correlated with the probability that a given individual is an entrepreneur. See, *e.g.*, Meyer [1990].
24. The possibility remains that some unobserved attribute that is correlated with the change in the tax price is driving our results. In the conventional linear model, one can deal with this possibility by introducing a fixed effect to control for such unobserved heterogeneity, a tactic that is not feasible in the probit setting. However, one can estimate a fixed effects logit model. In our case, this amounts to estimating a conventional logit model using data only on those roughly 25 percent of the entrepreneurs who changed their hiring decisions. Because the focus is on changes, our time-invariant variables drop out of the analysis, leaving us with the percentage change in the tax price and a year effect on the right-hand side. As in Table 4, the coefficient on the tax price variable was positive. While the t-statistic was not as high (only 1.34), this is to be expected given the smaller sample size and the fact that in a differenced specification the residual variance tends to be greater, *ceteris paribus*.
25. The omitted industry category includes transportation, construction, mining, agriculture, and miscellaneous other industries. They are grouped together because, on an individual basis, each accounts for a very small proportion of the observations.
26. The potential for the employee to be a spouse or other relative of the sole proprietor raises the possibility that the employee is being hired so that vacations and other joint expenses can be taken as business expenses. We do not have information on the identity of the employees. It is worth noting, however, that there is not a clear advantage to this kind of activity because the spouse would have to pay the FICA tax. Therefore, the joint expenses would have to be quite sizable in order to make this strategy work. This issue raises the more general possibility that some labor expenses are fraudulent. As noted in footnote 21, since we are looking at *changes* in hiring decisions, the key issue is whether the change in the tax system induced changes in evasion behavior that would render the tax price term endogenous. Our instrumental variables procedure corrects for any such endogeneity.

27. State tax rates also differ, although state dummies may control for this only imperfectly. In particular, for some states the federal tax is deductible from the state tax. If so, the state tax rate is not log-additive and would not coincide with a state dichotomous variable.
28. Under TRA86, the corporate tax rate became higher than the maximum statutory individual rate. This change gave business people an incentive to shift costs--including labor--to corporate entities. This would tend to bias downward our estimate of the tax-induced increase in the probability that an entrepreneur hires labor.
29. In the same spirit, we developed weights based upon the probability of "surviving" in the overall sampling scheme used to construct our data. Our weighted probits are similar in character to those in Table 4. To the extent they differ, the impact of changes in the tax price for the subsample consisting of individuals for whom $L_{85}=0$ is stronger in the unweighted versions.
30. Another sample-based issue is whether our results are highly dependent upon the 1985-88 reform period. As noted earlier, in the context of our discussion of the transition matrices in Table 2, the 1989-93 "no-reform" period is useful for this purpose. Estimating a probit analogous to column (2) of Table 4, we find a small positive (0.0377) but statistically insignificant ($t=1.175$) coefficient for the tax price and a negative coefficient (-0.267, $t = -2.21$) for the interaction term. The point estimates suggest a positive effect of the tax price for all values of ℓ_{89} . However, the effect is imprecisely estimated. This comes as no surprise. As noted earlier, there was no substantial change in tax rates over this period. Hence, there is relatively little variation in the change in the tax price, which makes it difficult to estimate its effect precisely. To the extent that there were changes, they tended to occur late in 1993, so they did not have much time to have an impact. In contrast, the substantial exogenous change in tax rates between 1985 and 1988 allows us to identify the tax price coefficient.
31. Similarly, when the linear probability model is applied to the sample from column (4) of Table 4, it produces estimates that are qualitatively similar to those of the probit model.
32. Notice that one way to evade taxes is to overreport the size, or existence, of a wage bill. If a reduction in tax rate lowers these incentives, our estimate will understate the true response. See also note 21.
33. The difference is statistically significant at the 1 percent level.
34. We thank Bo Honoré for the GAUSS software used to compute our LAD estimates. The standard errors are estimated using bootstrap methods, for which we employ 500 replications. (See Buchinsky [1994] for evidence on the desirability of using bootstrap estimates in a LAD setting.)
35. In general, the median of the difference is not the same as the difference of the medians. It is, however, when the error term is symmetrically distributed, which would be true if the two error terms have the same distribution, so that their difference is symmetric.

36. As with the probit analysis, we would like to have a test to provide some guidance regarding the practical importance of the endogeneity issue. In analogy to a Hausman test for the linear regression model, we compare the coefficient on $\Delta \ln(TAXPRICE)$ computed using 2SLAD with the corresponding coefficient computed using LAD. Because we use bootstrap methods to compute standard errors, we may straightforwardly compute the standard error of the difference between the coefficients on $\Delta \ln(TAXPRICE)$ in the two specifications. Intuitively, one would expect that endogeneity would produce a substantial difference between the LAD and 2SLAD coefficients; hence, we test the null hypothesis that the difference is zero. See Holtz-Eakin [1994] for a discussion.
37. In 1988, the unconditional mean of the wage bill was \$49,694 and the median was zero. Conditional on a positive wage bill, the mean was \$151,553 and the median \$47,240.

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TABLE 1*

(a)
Sole Proprietors and Their Hiring Decisions

		1988		
		No Schedule C	Schedule C, No Wage Bill	Schedule C, Wage Bill
1985	No Schedule C	17,486 [0.886]	2,066 [0.105]	180 [0.009]
	Schedule C, No Wage Bill	1,345 [0.251]	3,632 [0.679]	375 [0.070]
	Schedule C, Wage Bill	179 [0.080]	453 [0.201]	1,618 [0.719]

(b)
Employment Among Sole-Proprietorships in
1985 and 1988

		1988	
		No Wage Bill	Wage Bill
1985	No Wage Bill	3,632 [0.906]	375 [0.094]
	Wage Bill	453 [0.219]	1,618 [0.781]

*The first entry in each cell is the number of observations. The entry in square brackets is the number of observations as a fraction of the total number of observations in the corresponding row.

TABLE 2*

HIRING DECISIONS AND TAX RATES

(a)
Low Tax Rate in 1985

		1988	
		No Wage Bill	Wage Bill
1985	No Wage Bill	1,849 [0.916]	168 [0.084]
	Wage Bill	220 [0.374]	369 [0.626]

(b)
High Tax Rate in 1985

		1988	
		No Wage Bill	Wage Bill
1985	No Wage Bill	1,783 [0.896]	207 [0.104]
	Wage Bill	233 [0.157]	1,249 [0.843]

*See note to Table 1. Panel (a) includes all sole proprietors with 1985 marginal tax rates below 34 percent. Panel (b) contains the remainder.

TABLE 3*
SAMPLE STATISTICS

	(1)	(2)
L_{85} (=1, if employment in 1985)	0.341 (0.474)	1.00 n/a
L_{88} (=1, if employment in 1988)	0.328 (0.469)	1.00 n/a
$\Delta \ln(TAXPRICE)$ (log-difference in tax price)	0.174 (0.178)	0.244 (0.166)
AGE (age in years)	41.5 (7.82)	41.9 (7.31)
AGE ² (age squared)	1,784 (650)	1,808 (616)
CAPINC (interest and dividend income $\times 10^{-6}$)	0.0468 (0.256)	0.0430 (0.196)
MARRIED (=1, if married)	0.923 (0.265)	0.950 (0.217)
DEPENDENTS (number of dependents $\times 10^{-1}$)	0.164 (0.132)	0.186 (0.135)
MFG (=1, if manufacturing sector)	0.0224 (0.148)	0.0204 (0.141)
WHOLESALE (=1, if wholesale sector)	0.0220 (0.147)	0.0210 (0.143)
RETAIL (=1, if retail sector)	0.0874 (0.282)	0.0902 (0.287)
FINANCE (=1, if finance sector)	0.111 (0.314)	0.0705 (0.256)
SERVICE (=1, if service sector)	0.584 (0.493)	0.0714 (0.452)
N (number of observations)	6,078	1,618
*Column (1) contains statistics for all the individuals in our sample who were sole proprietors in both 1985 and 1988. Column (2) contains statistics for the subset of those individuals who had employees in both 1985 and 1988. Table entries are means and, in parentheses, standard deviations.		

TABLE 4*

PROBIT ANALYSIS OF EMPLOYMENT DECISIONS

	(1)	(2)	(3)	(4)
INTERCEPT	-1.37 (0.0372)	-1.31 (0.583)	-1.54 (0.0351)	-1.70 (0.541)
$\Delta \ln(\text{TAXPRICE})$	0.335 (0.158)	0.492 (0.167)	0.442 (0.150)	0.538 (0.159)
$\Delta \ln(\text{TAXPRICE}) \times L_{85}$	1.39 (0.234)	1.23 (0.238)	1.49 (0.217)	1.34 (0.221)
L_{85}	1.80 (0.0592)	1.81 (0.060)	1.74 (0.0545)	1.75 (0.0551)
AGE		-0.350 (2.92)		0.505 (2.71)
AGE ²		-0.577 (3.52)		-1.30 (3.27)
CAPINC		0.00439 (0.0796)		0.00836 (0.0751)
MARRIED		-0.0254 (0.0852)		-0.0247 (0.0796)
DEPENDENTS		0.131 (0.174)		0.104 (0.161)
MFG		0.202 (0.147)		0.158 (0.136)
WHOLESALE		0.224 (0.149)		0.126 (0.137)
RETAIL		0.319 (0.0861)		0.209 (0.0786)
FINANCE		-0.0116 (0.0830)		0.0392 (0.0787)
SERVICE		0.226 (0.0596)		0.242 (0.0557)
loglikelihood	-2,280.7	-2,261.0	-2,613.6	-2,597.0
N	6,078	6,078	7,602	7,602

*Figures in parentheses are standard errors. In columns (1) and (2), the sample consists only of individuals who were sole proprietors in 1985 and 1988. The dependent variable takes a value of 1 if the sole proprietor hired labor in 1988, and zero otherwise. In columns (3) and (4), the sample is expanded to include all individuals who were sole proprietors in 1985, regardless of whether they were also sole proprietors in 1988. The dependent variable is "stayed in business and employed labor."

TABLE 5*

ANALYSIS OF PERCENTAGE CHANGES IN WAGE BILL

	(1)	(2)	(3)	(4)
INTERCEPT	2.41 (0.690)	2.43 (0.688)	1.95 (0.534)	1.83 (0.510)
$\Delta \ln(TAXPRICE)$	0.410 (0.134)	0.555 (0.147)	0.318 (0.0954)	0.370 (0.101)
AGE	-9.24 (3.35)	-9.38 (3.34)	-7.38 (2.45)	-7.14 (2.38)
AGE ²	9.13 (3.98)	9.24 (3.97)	7.35 (2.83)	7.13 (2.76)
CAPINC	-0.180 (0.111)	-0.198 (0.111)	-0.112 (0.112)	-0.108 (0.111)
MARRIED	0.0331 (0.100)	0.0369 (0.100)	-0.0680 (0.106)	-0.114 (0.107)
DEPENDENTS	-0.247 (0.168)	-0.267 (0.167)	-0.0463 (0.0583)	-0.00689 (0.0588)
MFG	-0.158 (0.164)	-0.167 (0.163)	-0.0596 (0.0896)	-0.0537 (0.0927)
WHOLESALE	-0.167 (0.162)	-0.175 (0.161)	0.0401 (0.102)	0.0276 (0.108)
RETAIL	-0.0771 (0.101)	-0.0742 (0.101)	-0.0438 (0.0817)	-0.0318 (0.0853)
FINANCE	-0.0627 (0.107)	-0.0684 (0.107)	-0.00329 (0.0924)	0.00238 (0.0934)
SERVICE	-0.0324 (0.0788)	-0.0480 (0.0788)	0.0221 (0.0753)	0.0337 (0.0789)
N	1,618	1,618	1,618	1,618

*Dependent variable is percentage change in the real wage bill between 1985 and 1988. The sample consists of firms that employed labor in both years. Estimates in column (1) are OLS; column (2) 2SLS; column (3) LAD; and column (4) 2SLAD. Standard errors are shown in parentheses. The LAD and 2SLAD standard errors are computed using bootstrap methods with 500 replications.