ENTREPRENEURS, INCOME TAXES, AND INVESTMENT

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ABSTRACT

This paper investigates the effect of entrepreneurs' personal income tax situations on their capital investment decisions. We examine the income tax returns of a sample of sole proprietors before and after the Tax Reform Act of 1986 and determine how the substantial reductions in marginal tax rates for the relatively affluent associated with that law affected their decisions to invest in physical capital. We find that individual income taxes exert a statistically and quantitatively significant influence on investment decisions. In our sample, a 5 percentage point increase in marginal tax rates would reduce the proportion of entrepreneurs who make new capital investments by 10.4 percent, and decrease mean investment expenditures by 9.9 percent.

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1. INTRODUCTION

Some of America's richest people are entrepreneurs.[1] Much of the public policy interest in these individuals has surrounded their putative roles as "creators" of jobs and new products. More specifically, it has been argued that tax policy should encourage entrepreneurs to invest in their businesses. Such arguments influenced the Omnibus Budget Reconciliation Act of 1993, which contained a number of provisions favoring investment in small businesses, including a 50 percent exclusion of long-term capital gains from certain small business investments. At the same time, there are concerns that the high marginal tax rates embodied in that law have discouraged investment by entrepreneurs. As one business economist opined after high-end personal income tax rates were raised in 1993, "It means their cash flows will not grow as fast, and they will not have as much to plow back into their business" (*Wall Street Journal* [1994]).

Does tax policy affect the investment decisions of small businesses? Interestingly, most of the voluminous literature on taxes and investments focuses on aggregate business investment, or investment undertaken by large firms of the type represented (say) in the Compustat data base.[2] Engen and Skinner [1996] point out there has been little systematic investigation of whether the tax system adversely affects entrepreneurial investment behavior. This is a significant omission given that entrepreneurial enterprises account for at least 10 percent of the economy's non-residential fixed investment.[3]

The purpose of this paper is to analyze entrepreneurs' investment behavior and how it is affected by their tax situations. 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 whether and how much they invested in their enterprises.

Section 2 presents the framework for our analysis, which is based on a conventional user cost of capital model. Section 3 describes the data and contains a preliminary investigation of the issues using simple tabulations. Section 4 presents a multivariate analysis of the decision to invest and also considers the impact on the quantity of investment spending. Our results indicate that taxes exert a statistically and quantitatively significant influence on the probability that an entrepreneur invests. For example, a 5 percentage point rise in marginal tax rates would reduce the proportion of entrepreneurs who make new capital investments by 10.4 percent. Further, such a tax increase would lower mean capital outlays by 9.9 percent. Section 5 concludes with a summary and suggestions for future research.

2. WHY TAXES MIGHT MATTER

Consider an entrepreneur organized as a sole-proprietor who is considering a marginal investment in his enterprise.[4] There are two possible ways in which the individual's personal income tax situation can affect this decision. First, taxes affect the demand for investment through their impact on the user cost of capital. Following Cummins, Hassett, and Hubbard's [1994] exposition of the neoclassical investment model, the investment of entrepreneur i during year t, I_{it}, is

$$I_{it} = E_{it-1}(\gamma c_{it}) + \varepsilon_{it}, \tag{1}$$

where E_{it-1} is the expectations operator given information available at time t-1, c_{it} is the user cost of capital, γ is a parameter, and ε_{it} is a white-noise error. The user cost, in turn, is

$$c_{it} = \frac{r_t - \pi_t + d}{1 - \tau_{it}}(1 - k_t - a_{it}\tau_{it}z_t) \tag{2}$$

where r is the nominal after-tax discount rate, π is the (constant) inflation rate, d is the exponential rate of economic depreciation, k is the rate of investment tax credit, τ is the entrepreneur's personal income marginal tax rate, a is the percentage of basis entitled to statutory depreciation allowances, and z is the present value of depreciation allowances per dollar of marginal investment.[5] (See Appendix B for a detailed discussion of the construction of the user cost.) Clearly, changes in the personal tax rate τ alter the user cost and may thereby influence investment decisions. The magnitude of the effect depends on the elasticity of investment with respect to the user cost. This discussion presumes an interior solution for the desired amount of investment. As will become apparent below, many entrepreneurs are at a corner solution involving zero investment. If so, equation (1) is best interpreted as determining the latent index of desired investment.

The other channel through which the entrepreneur's tax rate might affect his investment decision relates to liquidity constraints.[6] 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 demand for capital. The user cost and liquidity constraint stories are not mutually exclusive, and we will investigate both.

To make equation (1) operational we need to establish a link between expected and observed user costs. Cummins, Hassett, and Hubbard [1994] show that if a change in user costs generated by a tax reform is expected to last indefinitely, then the change in expected user costs can be represented by the actual change. Our identifying variation in user costs is generated by the Tax Reform Act of 1986, so we make this strong and useful assumption below.

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 over 62,100 tax returns for taxpayers present in both years.[7] These files contain detailed information on taxpayers' income and deductions taken from their Form 1040. Of those taxpayers with complete information on their Schedule C, we exclude those taxpayers who filed more than one tax return for any year, those who changed filing status between 1985 and 1988, those who reported income on a fiscal year basis, and those who reported farm or rental income.[8] We include only people between 25 and 55 years of age in order to avoid complications that would arise because of entry into the labor market by the young and impending retirement by the old. 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. Figures A1 and A2 (Appendix A) provide information on the sample distributions of Adjusted Gross Incomes and marginal tax rates, respectively.

Sole-proprietors do not report annual investment on their Schedule C. However, they do report depreciation deductions. Moreover, using the detailed information regarding the computation of these deductions reported on Form 4562 it is possible to identify which of these deductions are associated with capital purchased during the tax year under consideration.[9] Thus, we can determine whether the entrepreneur made any investment during the year and the associated expenditure. (To compute expenditures, we simply add up the amounts listed on Form 4562 indicating the cost or basis of investments made during the current year.) Detailed

summary information on the types of investment expenditures undertaken by sole proprietors is contained in Tables A1 and A2.[10]

Our basic sample consists of individuals who filed a Schedule C in both 1985 and 1988. In principle, this might engender 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 investment decisions to include individuals who exited from entrepreneurship between 1985 and 1988, no important differences emerge.

An important implicit assumption in this discussion is that we can equate sole-proprietors with "entrepreneurs." Is this sensible? In the non-statistical 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.[11]

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 incomes 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 portion of Schedule C filers, about 16 percent.[12] 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. Finally, we note that even if all sole proprietors are entrepreneurs, it is clearly not true that all entrepreneurs are sole proprietors. Analysis of the behavior of entrepreneurs who are organized in other forms of business is beyond the scope of this paper.

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 made capital purchases. Panel (a) of the table exhibits a 3x3 matrix comparing combinations of filing status and investment decisions in 1985 (rows) with corresponding measures for 1988 (columns). Consider, for example, the center entry. It indicates that 1,705 observations are sole-proprietors who did not make any investment in either 1985 or 1988. The second entry in this cell indicates that these observations constitute 57.3 percent of the entrepreneurs who did not have capital outlays in 1985. In contrast, 459 or 15.4 percent moved from zero to positive investment, and 812 or 27.3 percent exited from sole-proprietorship entirely.

For the matrix as a whole, a couple of observations stand out. First, those who made an investment in 1985 are more likely to stop acquiring physical assets than to leave sole-

proprietorship (40.6 percent versus 12.3 percent). Second, those without investment in 1985 are more likely to cease operations than add capital (27.3 percent versus 15.4 percent).

As already noted, we focus mostly on 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. Within this sample, 79 percent of the individuals who made no investment in 1985 also made no investment in 1988, and 54 percent of those who invested in 1985 also did so in 1988. Thus, there appears to be substantial persistence in the propensity to invest, a feature of the data that influences the design of our statistical analysis below. Another critical implication of the data in panel (b) is that only a relatively small proportion—about a third—of the sole-proprietors make any capital investments. This is consistent with earlier findings using different data which suggest that most small enterprises have no capital at all (see Meyer [1990]).

In Table 2, we divide our entrepreneurs into two groups, those with "lower" tax rates in 1985 (below 34 percent) and those with "higher" rates (34 percent and above). Relatively affluent people in the upper tax brackets received the largest tax rate reductions under TRA86. Hence, if there is anything to the story about higher tax rates discouraging entrepreneurs from investing, then we would expect those individuals who were initially in the higher brackets to have the largest increase in their propensity to make capital outlays. The figures in Table 2 appear to be consistent with this story. Of the sole-proprietors who had no investment and lower tax rates in 1985, 18.7 percent made capital purchases in 1988. For those with higher tax rates in 1985, the figure was 23.9 percent. Similarly, 55.7 percent of the lower-tax-rate sole-proprietors who had capital expenditures in 1985 had no investment in 1988, while for the higher-tax-rate sole-proprietors, the figure was only 41.0 percent.[13]

Of course, our theory suggests that investment decisions depend on the user cost of capital, of which marginal tax rates are only one component. Indeed, as documented in Appendix B, the tax reform affected not only marginal tax rates, but also depreciation allowances and the investment tax credits (the variables z and k in equation (2)). It turns out, however, that in our data changes in the user cost are primarily driven by changes in tax rates—the correlation between changes in the two variables is 0.99. That said, the user cost framework is more desirable in principle because it allows one to estimate how the change in any relevant tax parameter affects investment. An additional limitation of the simple tabulations in Table 2 is that variables other than marginal tax rates (or user costs) might influence an entrepreneur's propensity to invest, and some of these could be correlated with marginal tax rates. Hence, while the preliminary calculations in Table 2 are suggestive, we turn now to a multivariate approach in which the focus is on changes in the user cost of capital.

4. MULTIVARIATE ANALYSES

4.1 The Investment Decision

Investment functions are typically estimated using aggregate data or data from established corporations. Hence, it can be taken for granted that each observation is associated with at least *some* investment. However, as Table 2 demonstrates, most sole-proprietors make no investments in physical capital, so understanding the dichotomous decision, to invest or not to invest, is itself of considerable importance. Hence, our first goal is to estimate the determinants of the probability that a sole-proprietor made any investment in 1988 (Prob ($I_{88} > 0$))

What are the determinants of this probability? In light of the strong persistence in the propensity to invest evident from Table 2, one variable that belongs is an indicator for whether

there was investment in 1985. Conditional on the 1985 investment decision, the discussion of the previous section suggests that the 1988 decision will be influenced by changes in the user cost of capital between the two years. Finally, and unlike the case in conventional analyses of investment using corporate data, it makes sense to include some demographic and economic information about the individual who is actually making the decision.[14] (For example, even conditional on past investment, an individual's decision might depend on his or her stage in the life cycle.) All of this suggests that the probability that the entrepreneur acquires some capital in 1988 can be written as

$$\text{Prob}\,(I_{88} > 0) = \alpha_0 + \alpha_1\,(\%\Delta c) + \alpha_2\,(\%\Delta c \times I_{85}) + \alpha_3\, I_{85} + X\beta\,, \tag{3}$$

where $\%\Delta c = [\ln(c_{88}) - \ln(c_{85})]$ and c_s is the entrepreneur's user cost in year s (as defined in equation (2)); $I_{85} = 1$ if the firm had positive capital outlays in 1985 and is zero otherwise; and X is a vector of personal and economic characteristics of the entrepreneur for which β is the associated parameter vector. The interaction term permits us to determine whether taxes affect differently those entrepreneurs who did and did not initially purchase capital, a possibility suggested by Table 2. If $I_{85} = 0$, the effect of the change in user cost is given by α_1. In contrast, for those entrepreneurs who had investment in 1985 ($I_{85} = 1$), the effect is $\alpha_1 + \alpha_2$. To estimate the parameters of equation (3) requires that we make some assumption about the error term associated with the investment decision. We assume normality, which yields the conventional probit statistical model.

The specification of equation (3) gives rise to several questions. First, what personal and economic characteristics are to be included in the X-vector? Tax returns do not contain as rich a set of personal variables as some other data sets, but some useful controls are available. These variables, along with their means and standard deviations, are listed in Table 3. Age is included

because it is related to one's experience in the job market, human capital accumulation and, hence, the structure of the business; previous research on entrepreneurial decision making suggests that a quadratic term is also appropriate.[15] Marital status and the number of dependents may be related to attitudes towards risk.

We include capital income in 1985 as a measure of the individual's assets, which should affect entrepreneurial decision making in the presence of capital market constraints.[16] However, one should note that tax return data on capital income are quite limited. Our variable is the sum of reported dividends and interest; it omits capital gains and municipal bond interest, *inter alia*.[17] 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 the fact that the capital-intensity of the production technology differs across industries. Further, as suggested by Shleifer and Vishny [1992], investment opportunities within industries tend to move together, suggesting that a firm's industrial classification is a useful proxy for its investment opportunities.

The second major issue associated with equation (3) is the potential endogeneity of the user cost variable. Marginal tax rates, of course, vary with taxable income. As capital investment goes up, taxable income and the marginal tax rate decline, as does the user cost of capital, *ceteris paribus*. This may induce a positive relationship between $\%\Delta c$ and the probability of investing that has nothing to do with economic behavior, a problem ubiquitous in investigating the behavioral effects of taxation (see Feenberg [1987]). A remedy is to estimate the equation using instrumental variables, which requires that we find a variable that is correlated with $\%\Delta c$ 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.[18] To do so, we begin by computing each individual's marginal tax rate and user cost of capital using the data and tax law for 1985. 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 rate and the synthetic 1988 tax rate computed in this fashion is due entirely to modifications of the tax code. We then use this synthetic marginal tax rate together with 1988 values of the interest rate and the economic depreciation parameter to compute a synthetic user cost for 1988.[19] Our instrumental variable is the percentage change between the synthetic 1988 user cost and the actual 1985 value. (Similarly, the instrumental variable for I_{85} x $\%\Delta c$ is I_{85} times the synthetic percentage change in the user cost.) Essentially, this procedure removes the endogenous component of tax rate movements from $\%\Delta c$, leaving only the part due to the exogenous change in the tax law associated with TRA86.[20] Prior to estimating our probit model with these instrumental variables, we can use them to implement the test suggested by Rivers and Vuong [1988] to assess whether the potential endogeneity of $\%\Delta c$ is in fact a significant problem.[21]

Basic Results. To begin, we present in column (1) of Table 4 a simple specification that includes on the right hand side only $\%\Delta c$, an indicator variable for whether the firm made any investment in 1985 (I_{85}), and the interaction of the two. In effect, this represents a more structured variant of the comparisons presented in Table 2 that exploits all changes in the user cost. Not surprisingly, the coefficient on I_{85} is positive and highly significant—those entrepreneurs who invested in 1985 are more likely to have done so three years later. Given the discussion surrounding Table 2, it is equally unsurprising that the coefficient on $\%\Delta c$ is also highly significant and has the expected, negative sign. The greater the percentage increase in a

sole-proprietor's user cost of capital between 1985 and 1988, the lower the probability that he or she undertook capital outlays in 1988. Finally, the negative sign on the interaction term suggests that increases in the user cost are even more important for firms that already had some capital outlays.

In column (2) we augment the specification to include our other control variables. The coefficients on both $\%\Delta c$ and the interaction of $\%\Delta c$ with I_{85} remain negative and statistically significant. They are essentially identical to their counterparts in column (1). Thus, the apparent importance of taxes (embodied in the user cost) found in column (1) is not an artifact of any correlations between $\%\Delta c$ and other variables. Turning to these other variables, the effect of *AGE* is initially positive, but subsequently declines (the quadratic term 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.[22] The effect of *AGE* is positive until the age of 29, and after that is negative. Our other demographic variables, marital status and number of dependents, do not have a statistically significant impact. The coefficients on the industry dichotomous variables suggest that entrepreneurs engaged in the service sector are more likely to have undertaken investment than their counterparts in other sectors.[23]

As stressed earlier, the negative coefficient on $\%\Delta c$ 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. The chi-square test statistic associated with the hypothesis that the coefficients of the relevant residuals are both zero is 13.2, which easily rejects at any conventional level of significance. Thus, we re-estimated both of our equations using instrumental variables. These results are reported in columns (3) and (4) of Table 4. The results in these columns are essentially the same as their

counterparts in columns (1) and (2). In particular, the coefficient on $\%\Delta c$ in column (4) is still negative (-1.86, with a standard error of 0.536), as is the coefficient on the interaction term (-1.88 with a standard error of 0.722).

Implications. We turn now to the quantitative significance of our results. To begin, we use the instrumental variable results (column (4) of Table 4) to simulate the effect of a change in the user cost on the probability of purchasing capital. Specifically, we consider a 10 percent rise in the user cost. To begin, we evaluate all the right hand variables at their actual values. We then use the coefficients in column (4) to find the predicted probability of investing for each observation in the sample. Next, we raise the value of $\%\Delta c$ by 0.1 for every observation and re-compute the probabilities leaving all other variables at their initial values. These calculations suggest that the increase in the user cost lowers the mean probability of undertaking investment from 0.335 to 0.251, a decline of 0.084 or 25 percent.

An alternative approach to assessing the quantitative significance of our results is to focus directly on tax rates. To do so, we again begin by evaluating each of the right-side variables at their actual values and computing the predicted probability of investment for each observation. Next, we raise the 1988 marginal tax rate of each individual in the sample by five percentage points, compute the implied user cost for 1988, and calculate the resulting value of $\%\Delta c$. Using this value of $\%\Delta c$ and the actual values of the other right-side variables, we recompute the implied probability of investment. In this instance, the mean probability of investment falls from 0.335 to 0.300, a decline of 0.035 or 10.4 percent. Using either metric, the estimates imply a substantial response of investment decisions to tax rates.

Alternative Specifications. We now discuss a number of exercises that we conducted in order to assess the robustness of our results.

Statistical Model. One possible problem with our results is that they are a consequence of the assumptions underlying the statistical model. 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 probability model the conditions are 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. Specifically, using the linear probability model, the estimated coefficients on $\%\Delta c$ and $\%\Delta c \times I_{85}$ in both the parsimonious and fully-specified models (analogous to columns (1) and (2) of Table 4, respectively) are negative and statistically significant. As before, we can reject the null hypothesis of exogeneity of the user-cost variables, leading us to estimate the linear probability model using two-stage least squares. The resulting estimates for the coefficients of the user cost, -0.554 (s.e.=0.169), and the interaction term, -0.901 (s.e.=0.238), provide nearly precisely the same qualitative *and* quantitative message regarding the impact of user costs and tax policy on the probability of investment. Specifically, the estimated coefficients imply that an increase of 0.1 in $\%\Delta c$ would reduce the mean probability of investment by 0.089, or 27 percent.

Control Variables. As noted earlier, tax-based data provide relatively few candidates for controls. However, we subjected our equation to a variety of checks to determine whether the estimated relationship is sensitive to the 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. To the extent that they are attributable to the entrepreneur, they may be an indicator of the opportunity cost of time that is spent in sole-proprietorship activity. If so, they are also likely to be endogenous to business decisions generally, the primary reason for not including earnings in the baseline specification. In any event, the estimated coefficient of the earnings variable was positive, but insignificant, and its inclusion had essentially no impact on the character of the results.

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.) *Ceteris paribus*, the changes in after-tax income induced by such "tax-base effects" might alter the propensity to invest either by influencing the entrepreneur's own labor supply or by changing the cash flow of a liquidity constrained venture.[24] To investigate this possibility, we augmented the specification in Table 4 with the change in after-tax income between 1985 and 1988. Of course, this variable may be endogenous for the same reasons as our tax price variable. Hence, we constructed an instrument analogous to that used for our tax price variable (by computing 1988 after-tax income using the 1985 income data and 1988 tax structure). We find that augmenting the equation with this variable does not appreciably alter our other estimates. In the analogue to column (2) of Table 4, the coefficient of the user cost variable is -1.32 (s.e.=0.419) and that of the interaction variable is -1.47 (s.e.=0.587). Somewhat surprisingly, the coefficient on change in after-tax income itself is negative. We do not regard this finding as serious evidence against the hypothesis that liquidity constraints affect the decisions of small firms. Taxable income, after all, poorly measures the total financial 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 the independent effect of liquidity constraints.

Another possible problem with our canonical specification is that it ignores possible state-based differences in investment incentives. For example, states differ considerably in their tax and regulatory environments. 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 $\%\Delta c$ remains negative (-1.54) and statistically significant (s.e.=0.434), as does that on $\%\Delta c \times I_{85}$ (-1.30, s.e.=0.596).

Sample. 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 [1997] or Plesko [1994]. 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 jointly estimate the probability of survival as an entrepreneur with the probability of having investment, conditional upon survival. However, this model requires very strong identification assumptions (see van Praag and van Ophem [1994]) 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 a sole-proprietor *and* purchased capital." This exercise allows us to see if ignoring nonrandom entry and exit changes the character of our results. We

find that the coefficients on the user cost variable and the interaction of user cost and lagged investment are still negative and significant. For example, in the specification corresponding to column (4) of Table 4, the coefficient of $\%\Delta c$ is -2.09 (s.e. = 0.509) and the coefficient on the interaction term -2.04 (s.e. = 0.681).

Another issue in constructing the sample is the possibility that the process determining investment differs between those who already have a history of investment and those who do not. That is, it may not be desirable to pool observations for which I_{85}=1 with those for which I_{85}=0. To see if our pooling of the data was driving the results, we estimated separate probits for those who had investment in 1985 and those who did not. This yielded results similar to those reported in Table 4; $\%\Delta c$ significantly affects the probability of investment in both cases. For those with I_{85} = 1, the estimate is -3.59 (s.e. = 0.564), while for those with I_{85} = 0, the result was -2.04 (s.e. = 0.556).

Last among the sample issues is that, as discussed earlier, 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 $1000 of gross business receipts and repeated our analysis using this smaller (2,556 observations), more select sample. The basic tenor of our results is unchanged; both $\%\Delta c$ and the interaction variable continue to be negative (-1.21 and -1.40, respectively) and statistically significant (s.e.=0.444 and s.e.=0.615, respectively). As further checks, we raised the minimum threshold to $5,000 of business receipts, and then to $10,000. In each case, the estimated coefficients remain negative and jointly significant.

Equipment versus Structures. Our canonical specification determines the probability that an entrepreneur makes any kind of investment. However, one might wish to distinguish between investment in structures and equipment. Indeed, TRA86 had different provisions for

each type of investment. For structures, depreciation allowances were made less generous, while for equipment the major innovation was elimination of the investment tax credit. In short, both the underlying demands and the magnitudes of price changes might have differed across the two types of investment.

We therefore estimated separate probits for equipment and structures. For equipment, the estimated coefficient for $\%\Delta c$ in the instrumental variables probit is -3.57 (s.e.=1.11), and the coefficient on $\%\Delta c \times I_{85}$ is -3.43 (s.e.=1.47). For structures, the corresponding coefficients are -3.73 (s.e.=0.443) and 1.94 (s.e.=1.53). Thus, increases in the user cost reduce the propensity to invest both in equipment and structures. (While the point estimate for the interaction term in the structures model is positive, it is estimated somewhat imprecisely, and the combined effect of both coefficients indicates a negative impact of the user cost on structures investment even when I_{85}=1.)

In summary, our finding of an inverse relationship between tax rates and entrepreneurs' propensity to invest is quite robust. It emerges in the face of a variety of alterations to our assumptions regarding the specification and estimation of the model.

4.2 Investment Expenditures

As noted above, the supporting information associated with tax returns enables us to compute the dollar value of investment outlays in each year, thereby permitting a parallel analysis of the quantity of investment expenditure in 1988, E_{88}. The mean value of E_{88} was \$1,699.[25] Recall from Table 3, however, that only 33.5 percent of the firms had positive investment outlays in 1988. The large number of zeros affects both the interpretation of the mean—among those with positive spending, the mean outlay was \$5,070 (with a standard deviation of \$15,933)—and our econometric strategy.

To begin, we estimate an ordinary least squares regression (OLS) in which the dependent variable is E_{88} and the right-side variables are the same as in the probit equations discussed above, except that we replace the indicator variable for investment expenditures in 1985, I_{85}, with the value of investment expenditures in 1985, E_{85}. We restrict the analysis to those 3,480 observations that included a Schedule C in both 1985 and 1988 because it is not possible to impute the appropriate level of investment expenditure for those that exited from sole-proprietorship status.

The results are shown in the first column of Table 5. The coefficient on $\%\Delta c$ is negative (-17.4, with a standard error of 2.44), while the coefficient on the interaction variable $\%\Delta c$ x E_{85} is positive, (6.48 with a standard error of 0.142). Thus, the impact of changes in the user-cost becomes smaller as the amount of investment in 1985 get larger. In keeping with the pattern established in Table 4, the lagged value of investment expenditures has a positive and statistically significant coefficient. Also consistent with our analysis of the dichotomous decision, only AGE (which along with its square is jointly significant) among the demographic variables influences the magnitude of investment spending. In contrast to the earlier findings, however, of the industry indicator variables only *FINANCE* is statistically significant in determining the quantity of investment.

A potentially serious technical problem arises with OLS because of the large number of zeros among the observations for the dependent variable. Hence, it is appropriate to employ the Tobit estimator, the results of which are shown in the second column of Table 5. Clearly, accounting for the distribution of the zeros has a substantial impact on the estimates. The coefficient on the user cost is now -54.4, while that of the interaction variable is 7.13. Both are statistically significant. Thus, moving to the Tobit model strengthens our main qualitative

result—increases in the user cost of capital decrease entrepreneurs' expected investment expenditures.

As before, it is important to account for the potential endogeneity of the user cost. Implementing the Rivers-Vuong test in the Tobit context yields a test statistic of 280.2 (distributed as a chi-square with two degrees of freedom), an overwhelming rejection of the null hypothesis of exogeneity. Thus, we turn in the third column to a two-stage Tobit (2STOBIT) estimator that employs our instrumental variable for the change in the user cost. The 2STOBIT estimate of the coefficient on $\%\Delta c$ is -67.0 and highly statistically significant. As before, the coefficient on the interaction variable has the opposite sign, 8.24, and is statistically significant.

In sum, the results in Table 5 complement our analysis of the dichotomous decision, showing that changes in the user cost and, thus, changes in tax rates have a statistically significant impact on entrepreneurs' investment expenditures. But how large is the impact? In the presence of the interaction term, the answer clearly depends upon the distribution of 1985 investment expenditures in the sample. Indeed, given that the coefficient on the interaction term is positive, there is a possibility that the response to an increase in the user cost will be positive. However, this is unlikely. With a coefficient on $\%\Delta c$ of -64.0 and a coefficient on E_{85} x $\%\Delta c$ of 8.24, the net impact becomes positive only when 1985 investment expenditure exceeds $8,131. However, mean expenditures in 1985 were only $1,536 ($4,064 among those with positive expenditures).

In any case, it is clear that to gain a feel for the quantitative implications of our sample, we need to conduct some simulations. We begin by evaluating each of the right-side variables at their actual values and computing the predicted value of E_{88} for each observation in the data. Then, we raise the value of $\%\Delta c$ by 0.1 (10 percentage points) and re-compute the predicted E_{88}.

We find that, evaluated at the means, the implied elasticity of investment expenditure with respect to the user cost is -1.78. This is quite a bit higher than the elasticity estimates based on corporate data which, according to Engen and Skinner [1996], range from -0.25 to -1.0. We conjecture that small businesses of the type in our sample are more likely to be liquidity constrained than corporations and the user cost may be picking up some of this effect.[26]

As before, it is useful to provide a more direct measure of the impact of changes in tax rates. Following our previous strategy, we first compute the predicted value of investment using the actual values of the right-side variables. Next, we increase the 1988 marginal tax rate of each individual member of the sample by five percentage points, compute the implied user cost, and the corresponding value of $\%\Delta c$. Using the implied value, along with the actual values of the remaining variables, we calculate the new predicted value of investment for each observation. We find that a five percentage point increase in marginal tax rates leads to a 9.9 percent decline in the mean predicted value. In short, our estimates imply that changes in the user cost of capital induced by increases in marginal tax rates have a substantial impact on entrepreneurs' investment spending.

5. CONCLUSION

Policymakers have long been concerned with tax policy toward high-income individuals, the health of small businesses, and the impact of tax policy on investment. But little is known about the intersection of these concerns, how the taxes levied on the owners of such enterprises influence their investment decisions. In this paper, we have focused on how sole-proprietors' investments are affected by their personal income tax situations. Do high income tax rates discourage entrepreneurs from making capital outlays? On the basis of tax return data for sole-

proprietors from before and after the Tax Reform Act of 1986, we conclude that the answer is yes. When a sole-proprietor's marginal tax rate goes up, the probability that he or she buys capital assets goes down, as does the expected amount of investment expenditures. Further, the magnitudes of the estimated responses are quite substantial. Our response to the question posed by the title of this volume is that these particular Atlases do indeed shrug.

Notes

1. Quadrini's [1996] tabulations of data from the 1984 Panel Study of Income Dynamics indicate that the average wealth of entrepreneurs was $240,249 compared to $71,481 for workers.

2. Chirinko [1993] provides an extensive survey of this literature.

3. For purposes of this calculation, we think of entrepreneurial enterprises as consisting of sole-proprietorships plus some partnerships, *S* corporations, and small *C* corporations. We are only able to calculate the sole-proprietors' investment outlays, which thus serve as a lower bound for the total. From the Statistics of Income 1993 individual sample, we added up the investments recorded by sole proprietors on Form 4562 (Depreciation and Amortization), and arrived at a figure of $63.3 billion. This is 10.6 percent of nonresidential fixed investment in 1993, which was $598.8 billion, according to the *Survey of Current Business* (November/December) [1995]. Note, however, that the definition of income in the National Income and Product Accounts is not quite the same as the tax definition. A reconciliation is contained in the *Survey of Current Business*.

4. See Mitchell and Cowling [1996] for a careful theoretical analysis of the demand for inputs by an entrepreneurial firm.

5. As Atkinson and Stiglitz [1980, p. 136] note, there is some ambiguity associated with selecting the appropriate discount rate because the investor's perceived opportunity cost of funds is not observed. Our specification of equation (2) follows the assumption in Fullerton, Gillette, and Mackie [1987] that the opportunity cost is a tax-exempt investment opportunity.

6. Fazzari, Hubbard, and Peterson [1988] argue that corporate investment decisions are limited by lack of access to capital; Holtz-Eakin, Joulfaian, and Rosen [1994b] document the same phenomenon for sole-proprietorships.

7. The panel is constructed from returns common to the 1985 and 1988 cross-sectional files, that is, the "overlap" between these two files. Matches between the two years are based on the Social Security number of the primary file. Sample stratification is based upon a number of variables, including the presence of a Schedule C, but not upon capital expenditures.

8. The instructions that accompany individual income tax returns state: "Use Schedule C to report income or less from a business you operated or a profession you practiced as a sole proprietor...An activity qualifies as a business if your primary purpose for engaging in the activity is for income or profit and you are involved in the activity with continuity and regularity" [Internal Revenue Service, 1996, p. 105].

9. A number of our sole proprietors were also involved with partnerships and/or *S* corporations. In these cases, we are not able to distinguish between investment done in

the sole proprietorship and investment done in one of the other entities. To the extent that the tax reform affected businesses' choices of organizational form, the inclusion of investment from *S* corporations and partnerships could bias our results. Partnerships are unlikely to be important in this context—*C* corporations converting to pass-through status probably tend not to become partnerships because limited liability is still available if they remain in corporate form as *S* corporations. While switches from *C* to *S* corporations are potentially important, when we excluded returns with any *S* corporation income in either year, it had little effect on our substantive results.

10. Two classes of investment, computers and vehicles ("listed property"), are often used for consumption as well as investment purposes. We therefore exclude them from our measure of investment.

11. This, for example, is the criterion used in the Bureau of the Census' Characteristics of Business Owners survey. See Holmes and Schmitz [1991].

12. This figure includes "business services" (advertising, management consulting, public relations, computer services, etc.) and "accounting and bookkeeping services."

13. In each case, these differences are statistically significant at the 5 percent level.

14. The entrepreneur's investment decision is presumably made jointly with other input decisions, including the owner's supply of labor to the enterprise, which in turn depends on his personal characteristics.

15. 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.

16. See Evans and Jovanovic [1989], Holtz-Eakin, Joulfaian, and Rosen [1994a, 1994b], and van Praag and van Ophem [1994] for evidence on the impact of liquidity constraints on entrepreneurial decision-making.

17. We have data only for realized capital gains and no data on municipal bond interest. Of course, other conventional data sets also lack information on important components of capital income such as accrued capital gains.

18. We calculate our marginal tax rates using detailed tax calculators developed by the United States Treasury's Office of Tax Analysis, 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. The distribution of marginal tax rates in our sample is shown in Figure A2

19. As noted in Appendix B, computation of the user cost requires weighting across different types of assets. We employ 1985 weights in the computation of the 1988 synthetic user cost so that the instrumental variable cannot be contaminated by endogenous changes in the composition of capital outlays.

20. The identification strategy here is essentially the same as that used by Cummins, Hassett, and Hubbard [1994].

21. 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. 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. The chi-square test statistic (with two degrees of freedom) is 5.21, which is significant at the 5 percent level.

23. 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. See Tables A1 and A2 for details on investment expenditures by industry.

24. TRA86 might also have changed the interest rate, r, in the user cost. To investigate this possibility, we re-estimated the model using the 1985 and 1988 values of Moody's Aaa corporate bond rate when computing $\%\Delta c$. The instrumental variable estimates were basically unchanged, although a bit smaller in absolute value. The coefficient on $\%\Delta c$ was -1.344 (s.e. = 0.337), and on the interaction term -1.096 (s.e. = 0.457).

25. We measure investment in 1985 dollars, using the CPI-U to adjust for changes in the price level.

26. Our investment expenditures elasticity takes into account both the change in the probability of investing (the extensive margin) and the change in expenditures conditional upon investing (the intensive margin). In contrast to our sole proprietors, corporations really make no extensive-margin decision—they more or less always do *some* investment. Our finding that sole proprietors' decisions on the extensive margin are quite sensitive to tax considerations may account for the difference between our results and those from previous studies using corporate data. Note the analogy to the labor supply literature: married women's labor supply is more elastic than that of prime-age males, but most of the difference is due to the responsiveness of married women's participation rates (the extensive margin) to changes in the net wage.

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TABLE 1*

(a)

Sole Proprietors and Investment Decisions

		1988		
		No Schedule C	Schedule C No Investment	Schedule C Investment
1985	No Schedule C	13,252 (0.897)	1,222 (0.083)	304 (0.020)
	Schedule C, No Investment	812 (0.273)	1,705 (0.573)	459 (0.154)
	Schedule C, Investment	185 (0.123)	609 (0.406)	707 (0.471)

(b)

Investment among Sole-Proprietors in 1985 and 1988

		No Investment	Investment
1985	No Investment	1,705 (0.788)	459 (0.212)
	Investment	609 (0.463)	707 (0.537)

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

TABLE 2. INVESTMENT DECISIONS AND TAX RATES*

(a)
Lower Tax Rate in 1985

		1988	
		No Investment	Investment
1985	No Investment	923 (0.813)	213 (0.187)
	Investment	263 (0.557)	209 (0.443)

(b)
Higher Tax Rate in 1985

		1988	
		No Investment	Investment
1985	No Investment	782 (0.761)	246 (0.239)
	Investment	346 (0.410)	498 (0.590)

*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

I_{85} (=1, if investment in 1985)	0.378 (0.485)
I_{88} (=1, if investment in 1988)	0.335 (0.472)
$\%\Delta c$ (log-difference in user-cost)	-0.00695 (0.0785)
AGE (age in years)	40.2 (7.93)
AGE^2 (age squared)	1,679 (648)
CAPINC (interest and dividend income x 10^{-6})	0.0248 (0.156)
MARRIED (=1, if married)	0.914 (0.281)
DEPENDENTS (number of dependents)	0.159 (0.127)
MFG (=1, if manufacturing sector)	0.0250 (0.156)
WHOLESALE (=1, if wholesale sector)	0.0207 (0.142)
RETAIL (=1, if retail sector)	0.0934 (0.291)
FINANCE (=1, if finance sector)	0.0948 (0.293)
SERVICE (=1, if service sector)	0.602 (0.490)
N (number of observations)	3,480

*Table entries are means and, in parentheses, standard deviations. The sample consists of individuals who were sole proprietors in 1985 and 1988.

TABLE 4. PROBIT ANALYSIS OF INVESTMENT DECISIONS*

	(1)	(2)	(3)	(4)
INTERCEPT	-0.795	-1.38	-0.794	-1.27
	(0.0304)	(0.607)	(0.0304)	(0.611)
$\%\Delta c$	-1.26	-1.33	-1.71	-1.86
	(0.400)	(0.419)	(0.500)	(0.536)
$\%\Delta c \times I_{85}$	-1.47	-1.41	-1.96	-1.88
	(0.584)	(0.586)	(0.716)	(0.722)
I_{85}	0.822	0.814	0.800	0.790
	(0.0472)	(0.0474)	(0.0478)	(0.0481)
AGE		3.13		2.81
		(3.07)		(3.09)
AGE^2		-4.58		-4.35
		(3.76)		(3.78)
CAPINC		0.0605		-0.0066
		(0.153)		(0.156)
MARRIED		0.0739		0.0727
		(0.0887)		(0.0892)
DEPENDENTS		-0.354		-0.404
		(0.203)		(0.205)
MFG		0.0754		0.0911
		(0.155)		(0.156)
WHOLESALE		0.159		0.162
		(0.171)		(0.171)
RETAIL		-0.0641		-0.0506
		(0.0979)		(0.0984)
FINANCE		0.0245		0.0149
		(0.0956)		(0.0960)
SERVICE		0.137		0.122
		(0.0650)		(0.0655)
N	3,480	3,480	3,480	3,480

*Figures in parentheses are standard errors. Variables are defined in Table 3. The dependent variable takes a value of 1 if the sole proprietor purchased capital in 1988, and zero otherwise. Columns (3) and (4) show the results when the specifications in columns (1) and (2), respectively, are estimated using instrumental variables

TABLE 5. ANALYSIS OF INVESTMENT EXPENDITURES*

	OLS	TOBIT	TWO-STAGE TOBIT
INTERCEPT	-4.84	-27.7	-22.2
	(4.69)	(10.3)	(9.80)
$\%\Delta c$	-17.4	-54.4	-67.0
	(2.44)	(5.26)	(6.30)
$\%\Delta c \times E_{85}$	6.48	7.13	8.24
	(0.142)	(0.262)	(0.259)
E_{85}	0.888	1.05	1.05
	(0.0160)	(0.0295)	(0.0283)
AGE	37.8	93.0	74.0
	(23.7)	(52.2)	(49.5)
AGE^2	-48.6	-130.0	-108.0
	(29.0)	(63.9)	(60.5)
CAPINC	-0.555	-0.194	-0.856
	(1.18)	(2.45)	(2.32)
MARRIED	-0.832	-0.607	0.633
	(0.686)	(1.49)	(1.41)
DEPENDENTS	1.040	-2.41	-3.24
	(1.57)	(3.39)	(3.23)
MFG	0.868	3.38	3.58
	(1.21)	(2.57)	(2.44)
WHOLESALE	-1.04	-0.355	-0.407
	(1.31)	(2.89)	(2.73)
RETAIL	-0.283	-1.26	-0.868
	(0.733)	(1.66)	(1.57)
FINANCE	-1.74	-2.53	-3.54
	(0.728)	(1.63)	(1.54)
SERVICE	-0.877	0.202	-0.0905
	(0.500)	(1.10)	(1.04)
N	3,480	3,480	3,480

*Figures in parentheses are standard errors. The sample consists of individuals who were sole proprietors in 1985 and 1988. The dependent variable is the value of purchased capital in 1988.

Appendix A

Further Description of the Data

The computations in this paper are based upon confidential Treasury data. This Appendix provides some additional summary information about the sole proprietors who comprise the sample upon which the results in Tables 4 and 5 are based. Figure A1 is a histogram of the distributions of taxpayers by AGI for 1985 and 1988; Figure A2 similarly shows the distribution of taxpayers by marginal tax rate in the two years. (In each case, the observations are weighted so that the histograms reflect the underlying population.) Table A1 displays mean spending on structures and equipment by industry. Table A2 provides a more detailed breakdown of the type of investment expenditures.

The investment figures are based on Form 4562, which taxpayers use to claim the current year's deduction for depreciation and amortization, *inter alia*. Form 4562 is divided into three parts. Part I of Form 4562 is used to calculate the expensing deduction, in the case of Section 179 property, and the depreciation deduction for assets other than automobiles and other listed property placed in service only during the current tax year. In general, Part I requests that the taxpayer provide the following information: class of property, date placed in service, cost or other basis, recovery period, depreciation method, and deduction. Part II is used to report amortization for the current tax year. Amortizable property includes pollution control facilities, bond premiums, amounts paid for research or experiments, business start-up expenses, qualified forestation and reforestation costs, organizational expenses for a corporation, certain railroad property, construction period interest and taxes on real property, and certain rehabilitation expenses of historic property. Part III is used to report the depreciation dedication for automobiles and other listed property regardless of the tax year such property was placed in

service. Such items include automobiles, property used for amusement or entertainment, and computers or peripheral equipment.

In order to compute total current year investment, we use the cost information reported in Part I of Form 4562 as provided for tax year 1985 and 1988 filings. For the dichotomous choice regressions, the dependent variable was given a value of 1 if the sum of the line items, as provided in Appendix Table A3, in tax year 1988 was positive; and zero otherwise. For the analysis of investment expenditures, total investment is the sum of the line items reported in Table A3. The definitions of equipment and structures are also indicated in the right-hand-side column of the table.

Figure A1

Distribution of Taxpayers by Adjusted Gross Income
(Thousands)

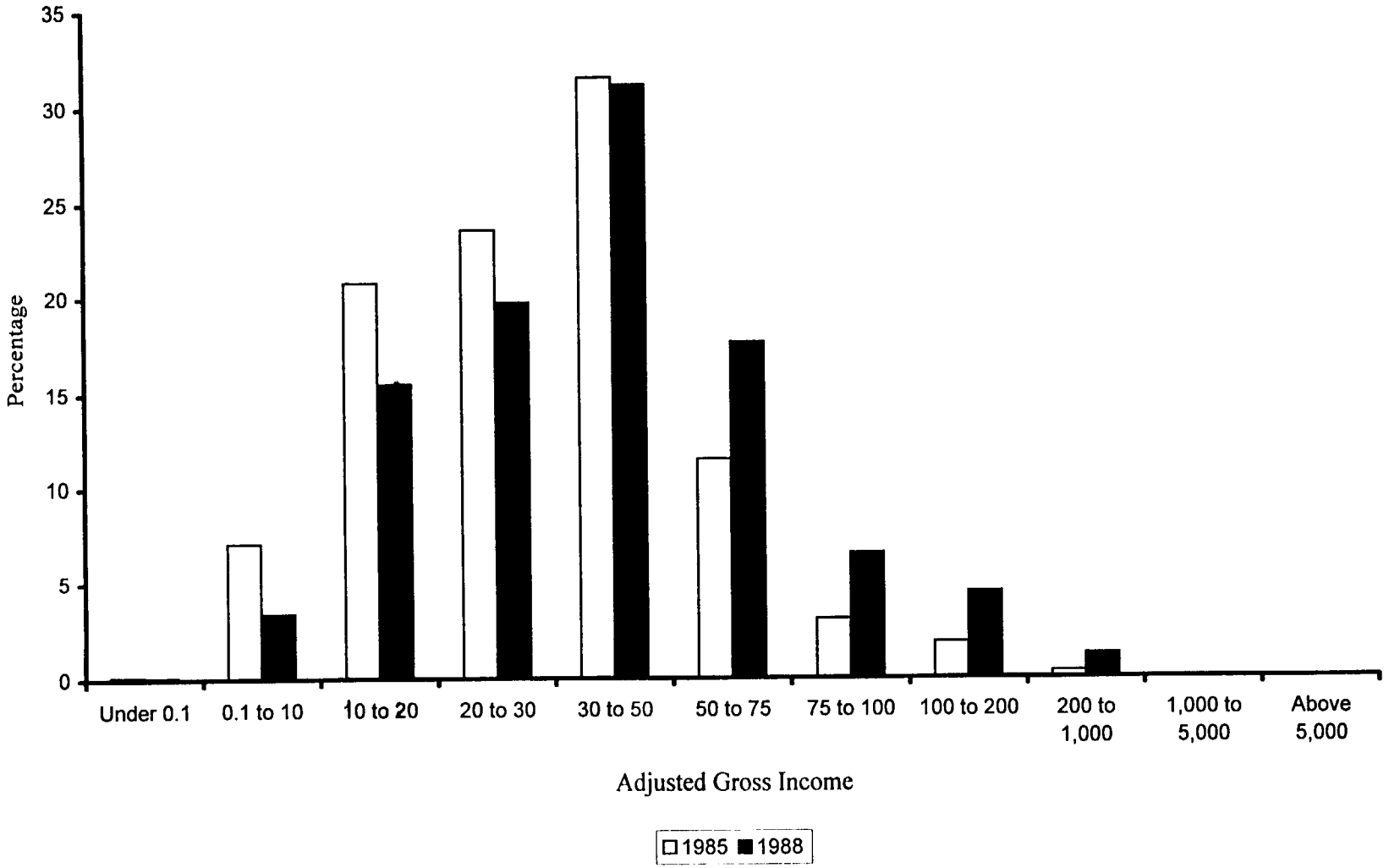

Figure A2

Distribution of Taxpayers by Marginal Tax Rate
(Percentage)

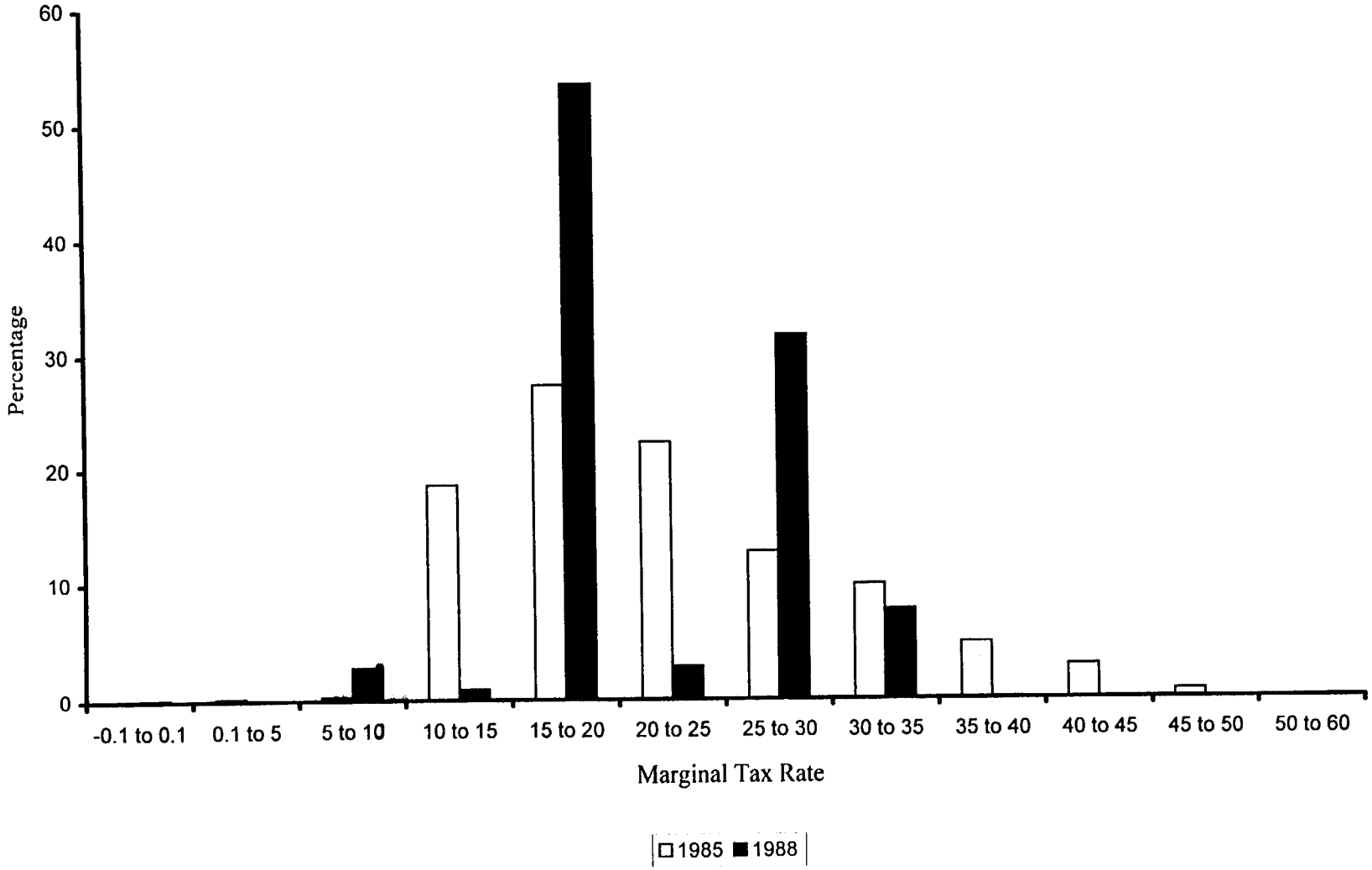

TABLE A1. COMPOSITION OF INVESTMENT*

	All	Agriculture	Mining	Construction	Manufacturing	Transportation	Wholesale Trade	Retail Trade	Finance, Insurance, Real Estate	Services	Other
1985											
Equipment	6,527	4,559	6,956	4,090	7,505	19,634	4,274	6,363	4,461	5,014	5,547
	[1,283]	[23]	[44]	[87]	[37]	[34]	[22]	[98]	[94]	[827]	[16]
Structures	24,193	**	**	16,396	**	**	**	**	9,572	28,011	--
	[126]			[10]					[10]	[80]	[0]
1988											
Equipment	8,108	6,759	18,373	10,530	9,045	36,845	6,288	5,852	7,138	5,709	2,337
	[957]	[17]	[18]	[59]	[27]	[21]	[20]	[65]	[69]	[643]	[15]
Structures	27,874	**	44,634	18,367	26,460	**	**	37,624	46,281	27,172	**
	[496]		[22]	[33]	[12]			[34]	[40]	[324]	
N	3,480	67	102	242	87	91	72	325	330	2,094	61

*The first number in each cell is the conditional weighted mean of expenditure in the associated category. The second number (in brackets) is the number of returns upon which the calculation is based. (The total number of observations in the sample is 3,480.) The sample consists of individuals who were sole proprietors in 1985 and 1988.

**Mean investment is positive, but based on nine or fewer observations. The Treasury's confidentiality rules require that the mean not be published. The last row shows the number of observations. There were nine returns in which no industry was indicated.

TABLE A2. DETAILED COMPOSITION OF INVESTMENT*

	All	Agriculture	Mining	Construction	Manufacturing	Transportation	Wholesale Trade	Retail Trade	Finance, Insurance, Real Estate	Services
1985										
Structures										
ACRS, Low Income Housing	--	-- [0]	-- [0]	-- [0]	-- [0]	-- [0]	-- [0]	-- [0]	-- [0]	**
ACRS, 18-Year Real Property	21,126 [76]	**	**	**	**	**	**	**	**	22,011 [48]
15-Year Real Property	16,969 [16]	-- [0]	**	**	**	-- [0]	-- [0]	**	**	25,846 [10]
Recovery Property Undefined Type	33,458 [40]	-- [0]	**	**	**	-- [0]	**	**	**	40,391 [25]
Equipment										
Section 179	4,109 [647]	**	4,528 [19]	5,987 [37]	2,733 [23]	12,323 [15]	3,105 [12]	3,784 [34]	3,439 [48]	3,417 [442]
ACRS 3-Year	6,773 [223]	**	**	9,074 [35]	**	8,505 [15]	**	7,503 [23]	13,423 [10]	4,339 [118]
ACRS 5-Year	5,536 [812]	3,947 [14]	4,838 [36]	6,321 [50]	8,390 [22]	15,551 [24]	2,252 [14]	5,839 [64]	1,805 [58]	4,399 [521]
ACRS 10-Year	13,879 [22]	-- [0]	**	**	-- [0]	**	-- [0]	**	**	14,846 [14]

TABLE A2. CONTINUED

	All	Agriculture	Mining	Construction	Manufacturing	Transportation	Wholesale Trade	Retail Trade	Finance, Insurance, Real Estate	Services
1988										
Structures										
Residential Rental Property	59,812 [99]	**	**	**	-- [0]	**	**	**	90,772 [12]	57,205 [63]
Non-Residential Rental Property	27,605 [139]	**	**	15,182 [12]	**	**	**	16,494 [14]	**	30,546 [93]
MACRS 20-Year	-- [0]	-- [0]	-- [0]	-- [0]	-- [0]	-- [0]	-- [0]	**	-- [0]	**
MACRS 7-Year	6,696 [337]	**	8,871 [19]	3,997 [16]	27,178 [10]	**	**	4,648 [21]	1,872 [25]	6,430 [227]
MACRS 15-Year	8,247 [21]	-- [0]	-- [0]	**	**	-- [0]	**	**	**	11,479 [16]
Recovery Property Undefined Type	59,166 [10]	-- [0]	-- [0]	-- [0]	**	-- [0]	-- [0]	-- [0]	-- [0]	**
Equipment										
Section 179	5,542 [770]	**	3,477 [13]	6,378 [44]	7,718 [21]	22,372 [13]	5,602 [18]	3,148 [48]	3,433 [54]	4,779 [537]
MACRS 3-Year	8,220 [41]	**	**	**	**	**	**	**	**	3,421 [22]
MACRS 5-Year	8,204 [311]	**	**	10,505 [28]	**	25,847 [14]	**	2,766 [24]	43,755 [23]	4,621 [190]
MACRS 10-Year	28,149 [32]	**	-- [0]	** [0]	-- [0]	-- [0]	**	**	**	21,693 [14]

*The first number in each cell is the conditional weighted mean of expenditure in the associated category. The second number (in brackets) is the number of returns upon which the calculation is based. (The total number of observations in the sample is 3,480.) The sample consists of individuals who were sole proprietors in 1985 and 1988.

**Mean investment is positive, but based on nine or fewer observations. The Treasury's confidentiality rules require that the mean not be published.

TABLE A3. CONSTRUCTION OF INVESTMENT FROM FORM 4562

Line	Column	Description	Category
		Tax Year 1985	
1	(b)	Cost of Section 179 property	equipment
4a	(c)	Cost of 3-year ACRS property	equipment
4b	(c)	Cost of 5-year ACRS property	equipment
4c	(c)	Cost of 10-year ACRS property	equipment
4d	(c)	cost of 15-year ACRS public utility	structure
4e	(c)	Cost of ACRS low-income housing property	structure
4g	(c)	Cost of 18-year real property	structure
4f	(c)	Cost of 15-year real property	structure
SO1 balancing item		Cost of recovery property, undetermined type	structure
		Tax Year 1988	
1	(c)	Cost of Section 179 property	equipment
6a	(c)	Cost of 3-year MACRS property	equipment
6b	(c)	Cost of 5-year MACRS property	equipment
6d	(c)	Cost of 10-year MACRS property	equipment
6g	(c)	Cost of residential rental property	structure
6h	(c)	Cost of non-residential property	structure
6f	(c)	Cost of 20-year MACRS real property	structure
6c	(c)	Cost of 7-year MACRS real property	structure
6e	(c)	Cost of 10-year MACRS real property	structure
SOI balancing item		Cost of recovery property, undetermined type	structure

Appendix B

Computing the User Cost of Capital

We measure investment incentives using the cost of capital approach of Hall and Jorgenson [1967]. Consider a price-taking entrepreneur contemplating a new investment in a world with no uncertainty. Assume that the enterprise has sufficient tax liability to take associated credits and deductions, and that he or she does not resell the asset. Investment receives a tax credit in year t at rate k_t. The rental return increases at the constant inflation rate π, and decreases because of constant exponential depreciation of the asset at rate d. The return is subject to the federal personal income tax of individual i in year t at rate τ_{it}. These net returns are discounted at the nominal after-tax discount rate r. The present value of depreciation allowances per dollar of marginal investment in year t is z_t. The percentage of basis entitled to statutory depreciation in year t is a_t. Assuming debt finance at the margin, in equilibrium the user cost of capital for individual i in year t is

$$\rho_{it} = \frac{r - \pi + d}{1 - \tau_{it}}(1 - k_t - a_t \tau_{it} z_t).$$

The marginal federal individual income tax rates τ_{it} are computed for each observation, using detailed tax calculators developed by the U.S. Treasury's Office of Tax Analysis. These calculators account for both the statutory rate schedule and the many implicit tax rates that arise from special features of the tax code.

The values used for the remaining parameters (r, π, a_t, k_t, z_t, and d) are provided in Table B1.[27] The discount rate r and inflation rate π are assumed to be equal to 8 percent and 4 percent, respectively, in both 1985 and 1988, as shown in Table B1. The parameters a_t, k_t, z_t, and d are summary values computed using values from the 35 asset types listed in Table B2,

weighted by their respective shares of the non-corporate capital stock. The capital stocks used to compute the weights are provided in the column labeled CAP in Table B2, and were obtained from the Bureau of Economic Analysis.

In Table B1, the column labeled equipment and structures provides the parameter values used to calculate the aggregate user cost of capital, combining both equipment and structures. Table B1 also provides the parameter values used to compute separate user costs for equipment and structures. In order to compute the parameter values for the user cost of equipment, the capital stock weights for assets 1 through 20 are applied to the corresponding values in Table B2 for a_t, k_t, z_t, and d. In order to compute the user cost of structures, we use the corresponding values for assets 21 through 35.

The percentage of basis entitled to statutory depreciation a_t is 90 percent in 1985, as shown in the top panel of Table B1. This value is obtained by taking the sum of the percentage of basis eligible for statutory depreciation for each asset, weighted by their respective shares of the capital stock. In 1985, the percentage of basis eligible for depreciation is 50 percent for assets eligible for an investment tax credit (ITC), and 100 percent otherwise. The column labeled ITC of Table B2 indicates the ITC rates for the 35 asset types in 1985. The Tax Reform Act of 1986 eliminated the ITC for assets placed in service after 1986. Therefore, the percentage of basis eligible for statutory depreciation in 1988 is 100 percent, as shown in the lower panel of Table B2.

The investment tax credit k_t is assumed to be 0.01978 in 1985, as shown in the upper panel of Table B1. This value is the capital-stock-weighted-average of the statutory investment tax credits in 1985 for the 35 asset types. The investment tax credit k_t is equal to zero in 1988.

We assume a constant value of 0.04703 for economic depreciation d in both 1985 and 1988, as shown in the upper and lower panels, respectively, of Table B1. This rate is computed by taking the sum of the 35 asset depreciation rates, provided in the column labeled HWDEP of Table B2, weighted by their respective shares of the capital stock. The depreciation rates HWDEP are summary measures, computed by Fullerton, Gillette, and Mackie [1981]. They, in turn, use capital-stock-weighted-averages of more disaggregated depreciation rates, obtained from Hulten and Wykoff [1981] and Jorgenson and Sullivan [1981], to calculate the economic depreciation rates for the 35 asset types in Table B2. For a more complete account, see Fullerton, Henderson, and Mackie [1987].

The present value of \$1 of depreciation allowances per dollar of marginal investment in the noncorporate sector, z_t, is 0.63721 in 1985 and 0.50805 in 1988, as shown in Table B1. The variables z_{85} and z_{88} are computed as capital-stock-weighted averages of Z85 and Z88, respectively, for the 35 asset types provided in Table B2. To estimate the present value of depreciation allowances, we classify assets into statutory depreciation categories and calculate Z85 and Z88 using the statutory depreciation rules.

Endnotes to Appendix

B1. A complication that arises in the computation of the user cost relates to the fact that eligible investments below a cap may be expensed, so that $z_t = 1$. However, even for individuals whose current level of eligible investment is below the cap, one cannot know whether the marginal investment would be expensed. To obtain some sense of the potential importance of this issue, we set $z_t = 1$ for individuals whose eligible investments were below the cap and who also had no ineligible investments. With the user cost calculated in this way, the qualitative results reported in Table 4 were basically unchanged, although the magnitudes were somewhat smaller.

TABLE B1. PARAMETER VALUES USED TO COMPUTE THE USER COST OF CAPITAL

	1985			1988		
	1-35	1-20	21-35	1-35	1-20	21-35
Asset Type	Equipment and Structures	Equipment	Structures	Equipment and Structures	Equipment	Structures
a	0.90	0.50	0.99	1.00	1.00	1.00
r	0.08	0.08	0.08	0.08	0.08	0.08
π	0.04	0.04	0.04	0.04	0.04	0.04
d	0.04703	0.15932	0.02142	0.04703	0.15932	0.02142
k	0.01978	0.09840	0.00185	0.00	0.00	0.00
z	0.63721	0.80819	0.59821	0.50805	0.83770	0.43288
MCAP	1.00	0.19	0.81	1.00	0.19	0.81

*Variables are defined in Appendix B.

TABLE B2. PARAMETER VALUES FOR USER COST OF CAPITAL[a]

(by asset type)

Number	Asset Type	HWDEP	ITC	Z85	Z88	CAP
1	Furniture and Fixtures	0.1100	0.10	0.8081920	0.8237391	19,186
2	Fabricated Metal Products	0.0917	0.10	0.8081920	0.8237391	6,090
3	Engines and Turbines	0.0786	0.10	0.8081920	0.8237391	2,167
4	Tractors	0.1633	0.10	0.8081920	0.8721278	38,212
5	Agricultural Machinery	0.0971	0.10	0.8081920	0.8237391	67,654
6	Construction Machinery	0.1722	0.10	0.8081920	0.8237391	26,372
7	Mining and Oil Field Machinery	0.1650	0.10	0.8081920	0.8721278	5,182
8	Metalworking Machinery	0.1225	0.10	0.8081920	0.8237391	3,473
9	Special Industry Machinery	0.1031	0.10	0.8081920	0.8237391	6,779
10	General Industrial Machinery	0.1225	0.10	0.8081920	0.8237391	11,349
11	Office and Computing Machinery	0.2729	0.10	0.8081920	0.8237391	8,432
12	Service Industry Machinery	0.1650	0.10	0.8081920	0.8237391	11,786
13	Electrical Machinery	0.1179	0.10	0.8081920	0.8237391	12,568
14	Trucks, Buses, and Trailers	0.2537	0.10	0.8081920	0.8721278	48,081
15	Autos	0.3333	0.06	0.8081920	0.8721278	12,926
16	Aircraft	0.1833	0.10	0.8081920	0.8721278	4,740
17	Ships and Boats	0.0750	0.10	0.8081920	0.7588973	12,071
18	Railroad Equipment	0.0660	0.10	0.8081920	0.8237391	59
19	Instruments	0.1500	0.10	0.8081920	0.8237391	11,794
20	Other Equipment	0.1500	0.10	0.8081920	0.8237391	13,356
21	Industrial Buildings	0.0361	0.00	0.5846580	0.3728805	27,938
22	Commercial Buildings	0.0247	0.00	0.5846580	0.3728805	341,797
23	Religious Buildings	0.0023	0.00	0.5846580	0.3728805	8,456
24	Educational Buildings	0.0188	0.00	0.5846580	0.3728805	6,423
25	Hospital Buildings	0.0233	0.00	0.5846580	0.3728805	9,226
26	Other Nonfarm Buildings	0.0454	0.00	0.5846580	0.3728805	19,470
27	Railroads	0.0176	0.10	0.5975897	0.5432431	0
28	Telephone and Telegraph	0.0333	0.10	0.5975897	0.5432431	836
29	Electrical Light and Power	0.0300	0.10	0.5975897	0.5432431	19,467
30	Gas Facilities	0.0300	0.10	0.6931839	0.6226086	5,886
31	Other Public Utilities	0.0450	0.10	0.6931839	0.6226086	0
32	Farm Structures	0.0237	0.00	0.5846580	0.5432431	108,048
33	Mining, Shafts, and Wells	0.0563	0.00	0.8612461	0.8475169	66,009
34	Other Nonfarm Facilities	0.0290	0.00	0.5846580	0.3728805	37,502
35	Residential Structures	0.0150	0.00	0.5846580	0.4124012	762,149

[a]Variables are defined in Appendix B.