Do Tax Cuts Promote Entrepreneurial Longevity?

Abstract *- We use a 12–year panel of tax return data to assess whether or not taxes affect the duration of entrepreneurial activities. Our study is the first to examine the effects of tax rates on exit decisions using duration–analysis techniques. We find convincing evidence that cutting marginal tax rates faced by wage–and–salary workers can reduce the duration of entrepreneurial activities, while cutting marginal tax rates faced by entrepreneurs can lengthen entrepreneurial spells. The relative magnitudes of these effects suggest that an across–the–board tax cut would increase entrepreneurial longevity.*

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INTRODUCTION

Entrepreneurs are thought to play a vital role in the economy, providing much of the energy behind job creation, technological advancement and overall economic growth. Given the importance of entrepreneurship, researchers have long been interested in the factors that affect decisions to participate in an entrepreneurial activity. Recent research has turned to the influence of individual tax rates on entrepreneurial decisions. From a policy perspective it is important to understand whether the tax code creates economic distortions (causing resources to be devoted to less–productive activities) and if these distortions exist, how the tax code can be used as a policy tool to alter levels of entrepreneurial activity in the economy.

Entrepreneurship as a concept cannot actually be directly measured; nearly every individual has some element of the entrepreneurial spirit within. Like all earlier studies, then, we must resort to a measurable proxy for entrepreneurship. Most studies have examined individual responses on surveys to questions regarding self–employment activity. We follow the more recent literature in using federal individual income tax return data to identify entrepreneurs by the presence of one or more forms of entrepreneurial income, such as income from a sole proprietorship, partnership, or small business corporation, as described in more detail below. Henceforth, the use of the terms "entrepreneur," "entrepreneurship," and "entrepreneurial activity" refers to this potentially more limited but measurable concept rather than more general notions of entrepreneurship.

In our analysis, we consider an entrepreneur who faces the decision of whether or not to remain in business in the next time period. The entrepreneur compares the net benefits from participating in entrepreneurship with those of becoming a wage–and–salary worker. As taxes affect take–home income, our entrepreneur must consider his or her tax rates in each of the two possible states of the world (entrepreneur or wage–and–salary worker). These rates are likely to differ due to differences in pre–tax income and available tax preferences.

Goode (1949) noted two examples of how relative tax treatments can affect entrepreneurship decisions. First, many expenses related to the entrepreneurial venture are deductible in calculating taxable income, and business deductions for goods such as automobiles and computer equipment are likely to have consumption benefits outside of business use. Alternatively, the inability of many entrepreneurs to deduct certain expenses (such as health insurance costs for the self–employed prior to 1987), generally paid out of pre–tax dollars for wage–and–salary workers, might expedite exit from an entrepreneurial activity. Entrepreneurs might also be affected by other aspects of the tax system. For instance, the costs of complying with the tax code are likely to be relatively higher for entrepreneurs who run small businesses, leading to lower levels of entrepreneurship.[1]

Second, the taxation of many forms of entrepreneurial income depends upon voluntary compliance, while most wage–and–salary tax payments are withheld by employers. This allows relative tax burdens to vary even when entrepreneurs and wage–and–salary workers face the same tax rates. Given the complexity of the tax code and the significant compliance burden on entrepreneurs and small businesses noted above, self–reporting can reduce entrepreneurs' relative tax burdens in three ways. First, entrepreneurs might not be aware of their actual tax burden and might mistakenly underreport their income or neglect to report certain information. Second, they might seek professional assistance with their taxes and thereby learn more about legal ways to reduce their tax burden.[2] Finally, some entrepreneurs might engage in tax evasion by willfully misreporting income or expenses or simply failing to file a tax return.

If the tax code results in either more or less entrepreneurial activity than would otherwise exist, the overall excess burden of the tax system increases. Alternatively, if it can be shown that entrepreneurs are not sensitive to taxes in their decisions to remain in business, then tax reform measures can be designed to achieve goals such as greater overall equity or simplicity without the fear of altering entrepreneurial decisions. The recent empirical literature has not yielded a consensus regarding the effects of tax rates on entrepreneurship. Many studies have found that higher tax rates lead to higher rates of entrepreneurial activity, while a number of more recent studies have called this general finding into question. More research on this topic is needed, such that policy makers might be better positioned to design and defend effective, efficient, and equitable tax rules.

We capitalize on the length of our panel dataset by using hazard modeling techniques to examine entrepreneurial

[1] Crain and Hopkins (2001) estimate that tax compliance costs per employee in small businesses range from 1.8 times greater than large firms in the service industry to 4.5 times greater than large firms in the manufacturing industry. Also see Hopkins (1995).

[2] Our data indicate that entrepreneurs are indeed more likely to use the services of a paid tax preparer. Between 68 percent and 76 percent of entrepreneurs used paid preparers between 1982 and 1988, while only 37 percent to 45 percent of non–entrepreneurs used a paid preparer. All differences are statistically significant at the one percent level.

survival. This is a key innovation over the existing analyses of entrepreneurial exit as we are able to examine the exit decision in the context of the entire entrepreneurial spell instead of a single discrete choice framework. Building upon earlier research, we consider a number of indicators of entrepreneurial activity and control for the likely endogeneity of individual tax rates in entrepreneurial decisions.[3]

We find convincing evidence that marginal tax rates have significant impacts on entrepreneurial decisions. Our results show that increases in expected entrepreneurship tax rates shorten spells of entrepreneurial activity, while increases in wage–sector tax rates lengthen the duration of an entrepreneurial activity. The effects from changes in the entrepreneurial marginal tax rate are larger than those from the marginal tax rate on wages, suggesting that an across–the–board tax cut would increase levels of entrepreneurship through enhanced survival and lower probabilities of exit.

The paper is organized as follows. Following a brief discussion of the history of relative tax treatment of entrepreneurs in the U.S. in the next section, we review prior studies of the taxation of entrepreneurs in the third section. We describe our data in the fourth section and our empirical methods in the fifth section. Results are discussed in the sixth section, while the seventh section concludes with a summary and suggestions for future research.

U.S. TAX POLICY TOWARD ENTREPRENEURS

The U.S. income and payroll tax systems have treated income from wage–and–salary employment and entrepreneurship (mainly sole–proprietorship) differently since their inceptions. Wage–and–salary workers have income and payroll taxes withheld by their employers, while entrepreneurs play the roles of employer and employee and, thus, remit their own taxes. Withholding for these individuals often takes the form of quarterly payments of estimated taxes. Despite this fundamental difference in tax collection, marginal federal individual income tax rates are, at least after tax preferences, blind to the source of income; a separate system of statutory marginal rates does not exist for income from sole proprietorships or other entrepreneurial ventures. This has generally not been the case for payroll taxes, however.

Wage–and–salary income has been subject to the payroll tax since it was implemented in 1937 to fund the Social Security and Medicare systems. The only form of entrepreneurial income that is explicitly subject to payroll taxation, and this only since 1951, is self–employment income. Between 1951 and 1984, the statutory payroll tax rate on self–employment income was less than the combined employer–employee payroll tax rate on wage–and–salary income. An effort to equalize the treatment of wage–and–salary and self–employment income began in 1984, with the statutory self–employment payroll tax rate set equal to the combined employer–employee rate. While tax credits were used to phase in the change from 1984 to 1990, this represented a dramatic change in the relative tax treatment of self–employment income.[4]

Coupled with these changes in the payroll tax system during the 1980s was

[3] Of course, in order to understand the effects of tax rates on overall levels of entrepreneurship in the economy, one must also consider entry decisions as in Gurley–Calvez and Bruce (2007).

[4] In a further effort to equalize the treatment of wage–and–salary and self–employment income, as of 1990 the self–employment payroll tax applies to only 92.35 percent of self–employment earnings, and half of the self–employment taxes due may be deducted in the computation of adjusted gross income (AGI). The gross, pre–credit, statutory social security tax rates for wage–and–salary (employer plus employee contribution) and self–employment have been identical since 1984. See Bruce (2002) for additional details.

a significant, although perhaps less dramatic, change in relative income tax treatment. In addition to reducing tax rates and broadening the base, the major federal tax reforms of 1981 and 1986 involved several changes in the tax treatment of business expenses.[5] While tax rate changes affected both wage workers and entrepreneurs similarly, relative definitions of taxable income changed during this time. For example, while the Economic Recovery Tax Act of 1981 brought such benefits as accelerated depreciation allowances and an investment tax credit, which reduced taxable income for entrepreneurs, these and other similar provisions were either scaled back or eliminated by subsequent legislation including the Tax Reform Act of 1986 (TRA86). Further, TRA86 brought substantial base–broadening measures such as reductions in the deductibility of expenses for meals and entertainment. Provisions regarding the business use of one's home were liberalized, while certain fringe benefits (often paid for in wage–and–salary jobs out of pre–tax dollars) are still not deductible in self–employment. Further, before 1987, the self–employed could not deduct health insurance costs on their income tax returns. The tax treatment of health insurance costs is still not equalized for wage workers and entrepreneurs, as the self–employed cannot deduct these costs in calculating their payroll tax liability. Yet another feature of the income tax code that involves differential taxation of entrepreneurs is the ever–changing system of rules governing the depreciation of capital investments.

The recent history of tax policy changes has likely involved a net reduction in the tax advantages from entrepreneurial activity relative to wage–and–salary employment. Other policy changes, such as the income ceiling for payroll tax contributions provide more sources of exogenous policy change. These changes in the federal tax code—along with substantial variation at the state and individual levels—provide ample variation that can be used in analyzing individual sensitivity to tax policies among potential entrepreneurs.[6]

PRIOR STUDIES OF THE TAXATION OF ENTREPRENEURS

Schuetze and Bruce (2004) provide an exhaustive review of the recent literature on small business taxation. We highlight a few key themes here and refer readers to their paper for more details. The available models have generally focused on two different dimensions of the tax system, namely the effects of tax policies on the relative risk of the entrepreneurial sector through loss offsets (Bruce, 2000 and 2002; Cullen and Gordon, 2002) and the opportunities for and benefits of evasion (Watson, 1985; Kesselman, 1989). Both of these approaches have produced ambiguous results, but interestingly, recent work combining the two approaches produces unambiguous results for the effects of tax rates on tax reporting behavior (Gurley, 2005).

In models of relative risk, wage–and–salary employment provides a certain income, whereas entrepreneurship involves an uncertain return. An increase in the relative tax rate faced by entrepreneurs has two potential effects. First, the relative return to entrepreneurial activity falls, thereby decreasing one's likelihood of remaining in an entrepreneurial activity. Conversely, if loss offsets are

[5] An exhaustive discussion of the changes in relative tax treatment during the 1980s is beyond the scope of this paper; interested readers should consult Steuerle (2004) and the references therein for an excellent first–person account of the many tax changes implemented during this time.

[6] Indeed, variation in state rates can be extreme in the cross section since several states do not impose a tax on individual income.

allowed, an increase in the relative tax rate compresses the post–tax distribution of entrepreneurial income and, thus, reduces the risk of entrepreneurial ventures. This implicit insurance (Domar and Musgrave, 1944) leads to an expected increase in entrepreneurial activity. The net effect is ambiguous and depends on individual preferences over risk and return.

The second strand of theoretical literature focuses on the absence of a third party to report income or expenses on behalf of many entrepreneurs, which might increase the likelihood that entrepreneurs either unknowingly misreport their taxable income (due to tax complexity) or engage either in legal tax avoidance or illegal tax evasion.[7] Theoretical models of behavior that account for evasion opportunities also yield ambiguous effects of taxation on the extent of evasion activities and depend crucially on risk attitudes (see Watson (1985) and Kesselman (1989)).

Gurley (2005) combines these two approaches into a model that allows for a relatively risky entrepreneurial sector and opportunities for evasion. The probability of reporting entrepreneurial income on a filer's tax return (e.g., filing a Schedule C) increases with the marginal tax rate on wage–and–salary income and decreases with the marginal tax rate on entrepreneurial income. Given the results of this model, the tax reforms of the 1980s, which increased relative tax rates on entrepreneurial income, would be expected to reduce entrepreneurial activity reported in tax data. Although this model provides clear testable hypotheses for our empirical work, the implications are less clear for other proxies of entrepreneurship, such as survey responses.

A growing empirical literature has tried to resolve the theoretical ambiguities. Until recent years, the vast majority of the empirical work in this area has focused on self–reported self–employment status or aggregated self–employment rates as measurable indicators of entrepreneurial activity. Most time series studies conclude that higher federal tax rates lead to higher rates of self–employment (see, for example, Long (1982a), Blau (1987), Parker (1996), and Robson and Wren (1999)). The explanation for this result usually rests on the assumption that high tax rates drive workers out of paid employment, or wage jobs, into entrepreneurial ventures where they can more easily avoid or evade taxes.

Robson and Wren (1999) were among the first to cast doubt upon this theme, concluding that higher marginal tax rates reduced self–employment rates, while higher average tax rates increased self–employment. This divergence was attributed to the positive (negative) relationship between average (marginal) tax rates and optimal effort and evasion. Higher marginal tax rates reduce the return to effort, thereby leading to reduced self–employment even though the rate of evasion may increase. Fairlie and Meyer (2000), Briscoe, Dainty, and Millett (2000), and Bruce and Mohsin (2006) also call the positive relationship between tax rates and self–employment rates into question.

While time series studies of self–employment have clearly dominated the empirical literature on taxes and entrepreneurship, they are not able to address individual–level decisions to remain in an entrepreneurial activity. A better understanding of this relationship is only possible through the analysis of cross–section or panel data. The initial evidence from early cross–section studies generally sup-

[7] For example, Joulfaian and Rider (1998) found a positive relationship between marginal tax rates and evasion among the self–employed. Slemrod, Blumenthal, and Christian (2001) showed evidence that suggested that Schedule C filers were more likely to engage in tax evasion, but the amount of tax revenue at stake was likely to be small.

ported the time–series results (see Long (1982a), Long (1982b), or Moore (1983)), but more recent cross–sectional research casts doubt on the importance of tax policy in the self–employment decision (Parker, 2003).

The most significant shortcoming of these cross–sectional studies, all of which have used individual tax information, is that potential tax rate endogeneity was not addressed. Also, time series and cross–section studies had not yet considered the relative tax treatment of wage employment and self–employment. To the extent that tax policies treat each type of employment differently, the resulting tax wedge could have important consequences for self–employment rates. Further, most studies have focused on the (cross–sectional) probability of being self–employed rather than the equally interesting start–up and shut–down processes. A few more recent studies have used panel data to investigate these broad questions.

The availability of richly detailed longitudinal data at the individual level has been a boon to empirical research on taxes and self–employment, and has allowed researchers to address the critical issues of tax rate endogeneity and relative tax rates in an individual–level transition framework. Results have been less conclusive than those from earlier time–series and cross–section studies (see Carroll, Holtz–Eakin, Rider, and Rosen (2000a, 2000b, and 2001), Bruce (2000 and 2002), Schuetze (2000), Cullen and Gordon (2002), Gentry and Hubbard (2000), Moore (2003), and Wu (2005)). Interestingly, most studies find that taxes influence entrepreneurial behavior, but the direction of effect varies from study to study.

Our research builds upon the earlier empirical literature in a number of important ways. First, following the general methodology of Bruce (2000 and 2002), we consider separately the tax treatment of income from wage–and–salary employment and entrepreneurial activity. Our analysis also provides an innovation over previous work by recognizing that most entrepreneurial households have both entrepreneurship and wage income.[8] Second, we examine the importance of taxes at the individual level using tax return data. Third, the use of a 12–year panel of tax returns allows us to focus on the effects of tax rates on the duration of entrepreneurial activity spells. While a few studies have examined entrepreneurial survival empirically in a multivariate context (e.g., Bates (1990), Holtz–Eakin, Joulfaian, and Rosen (1994a), and Taylor (1999)), only Taylor (1999) has used duration analysis techniques and only Bruce (2002) has considered the effects of taxes on entrepreneurial endurance. We combine the estimation framework of Taylor (1999) with Bruce's (2002) treatment of taxes.

DATA

Our data are drawn from the public–use panel of individual tax returns assembled from IRS Individual Model Files by the Office of Tax Policy Research (OTPR) at the University of Michigan. The 1979–1990 panel contains up to 200 pieces of information from over 200,000 tax returns, and approximately 6,000 filers are present in the panel for all 12 years.[9] While this time period is somewhat outdated, this data file is the best publicly available longitudinal tax return data set. It also directly overlaps

[8] Bruce (2000 and 2002) and other prior studies treat the self–employed as entirely self–employed and do not consider the impact of simultaneous wage earnings. On average from 1979 to 1990, 53 percent of single, entrepreneurial filers also had wage income ranging from a low of 50 percent in 1979 to a high of nearly 57 percent in 1989. Similarly, about 77 percent of married (including married filing separately) entrepreneurial households had positive wage income ranging from a low of 73 percent in 1979 to a high of nearly 80 percent in 1990.

[9] Note that amended returns filed in later years are reassigned to the appropriate tax year.

the time period of data used in the most similar prior study (Bruce, 2002), allowing for important comparisons to be made.[10] Perhaps most importantly, it includes detailed and accurate tax information and encompasses a number of significant tax policy changes, providing the necessary exogenous variation for identification purposes.

A main challenge in any study of entrepreneurial activity is finding a suitable proxy for entrepreneurship, a concept that cannot actually be directly measured; nearly every individual has some element of the entrepreneurial spirit within. Most previous research has relied on survey responses to questions about whether a person works for themselves or someone else. A smaller number of recent studies have made use of tax return information (see, for example, Holtz–Eakin, Joulfaian, and Rosen (1994a, 1994b), Carroll, Holtz–Eakin, Rider, and Rosen (2000b), and Bruce and Holtz–Eakin (2001)). The principal advantage to a tax–related definition is precision, as it is not subject to the possible interpretation and self–reporting biases of survey data.[11] Further, we are able to consider multiple measures of entrepreneurship in testing the robustness of our results. Following the previous literature, we begin with the most straightforward definition of entrepreneurship: sole proprietorships (as evidenced by the presence of a Schedule C). We refer to this as Measure 1.[12] We also explore two increasingly broader definitions of entrepreneurship, drawn from Bruce and Holtz–Eakin (2001).[13] Measure 2 adds to Measure 1 those with income from partnerships or subchapter S corporations.[14] Finally, Measure 3 adds to Measure 2 those filers with rental or royalty income. Survey data typically capture the first three of these as "self–employed," but researchers often omit those in the latter categories (rent and royalty income) as "partially" entrepreneurial. It should be noted that the data pertain to individual entrepreneurs and not to their entrepreneurial businesses or enterprises.

Given that the data are at the tax filer level, dividing the sample by marital status seems necessary on at least two grounds.[15]

[10] In terms of the generalizability of our results, NBER data reveal that average marginal federal income tax rates have remained fairly stable since 1960 (http://www.nber.org/~taxsim/ally/). It is interesting to note that the year–to–year change in the average marginal tax rate has rarely exceeded two percentage points, with recent exceptions being a four–percentage–point drop between 1986 and 1987 and a 2.5–percentage–point drop between 2002 and 2003. Typical year–to–year fluctuations are much smaller. This suggests that our results might be viewed as upper bounds of what might happen in the current tax environment.

[11] This is a valuable contribution as biases in survey responses could be particularly large for self–reported entrepreneurship status. Blanchflower and Oswald (1998) found that a majority of individuals report a desire to be self–employed, but a small number actually achieve this goal. A desire on the part of respondents to be entrepreneurs coupled with differing definitions of what activities qualify as entrepreneurial diminish the precision of survey classifications.

[12] To be sure, tax measures of entrepreneurship suffer from their own limitations. For one, not all Schedule C filers are entrepreneurial and not all entrepreneurs file a Schedule C. Also, our use of individual tax return data precludes a consideration of incorporated entrepreneurial ventures that appear in corporate tax return data. We are also not able to determine whether some wage earnings might actually be entrepreneurial income derived from C Corporations. Relative to the existing literature, however, our measures have important advantages over such things as self–reported self–employment status.

[13] These measures are identical to those reported in Bruce and Holtz–Eakin (2001) with the exception of the broadest measure in which missing values in rent and royalty income fields are coded as zeros (not entrepreneurs) instead of ones (entrepreneurs).

[14] Partnership, subchapter S corporation, and rent and royalty income are determined from entries on Schedule E. Other income (or losses) reported on Schedule E, including income from estates and trusts, is not used to classify filers as entrepreneurial.

[15] Returns are compressed into two categories—married (joint), including those whose filing status is married or married filing separately, and single, including returns filed as unmarried (single), head of household or widowed.

First, for single filers, the data represent individual as well as household–level decisions. Examining single filer entrepreneurship behavior yields results more closely comparable to a number of earlier studies, which focused on self–employment activity using individual survey data. In addition, single filers are likely to be younger on average with larger variations in income. This might make single households more willing to undertake the risk of entrepreneurship. Willingness to undertake risk might also be greater for single filers as they are likely to have fewer dependents. Conversely, lack of credit history might make single filers more likely to be liquidity–constrained, decreasing the probability of entry and increasing the likelihood of exit for those who do become entrepreneurs.

Analogously, dual–earner married households might be more willing to take on the added risk of entrepreneurship if one spouse has a relatively steady source of income. The decision to remain in an entrepreneurial activity might also be influenced by the role of spousal income in determining household–level marginal tax rates. Married households might also be less likely to remain in a relatively risky entrepreneurial venture as they have more dependents on average, and might have more financial obligations such as mortgage and car payments.[16]

We define entrepreneurial exit as having entrepreneurial activity in one year but not the next. We should note that exit in no way implies failure, as many small businesses are successful at closure (Headd, 2003).[17] Exit rates based on the tax return data are shown in Figures 1 through 3 and exhibit some interesting features. First, exit rates for single returns are higher than for joint returns. Second, trends are sensitive to measurement issues, particularly for single filers. Interestingly, exit rates do not display a dramatic upward spike around the key payroll tax reform of the mid–1980s.

EMPIRICAL METHODOLOGY

Survival Analysis

Since spells of entrepreneurial activity are typically short (a median length of three to four years in our data), we are able to observe many entire episodes of entrepreneurship from start to finish. We are, thus, able to follow Taylor (1999) in applying duration analysis techniques, which enable us to estimate the probability of exit from an entrepreneurial activity given that exit has not yet occurred. This represents an important advantage over discrete–choice approaches that are not able to fully account for the conditional nature of recurring entrepreneurial longevity decisions.

Denoting T as a filer's length of time in entrepreneurship in years and t as the current time, the probability that this filer exits entrepreneurship this period given that he has not yet exited is $P(t \leq T \leq t + \Delta \mid T \geq t)$, where Δ represents a small increment of time. The limit of $[P(t \leq T \leq t + \Delta \mid T \geq t)] / \Delta$ as Δ goes to zero is the hazard rate. T is assumed to have a continuous probability distribution function, $f(t)$, and

[16] It should be noted that, for married households, we are unable to distinguish which spouse is (or whether both spouses are) entrepreneurial. If one spouse exits entrepreneurship as the other enters, then an observed spell of entrepreneurship actually represents two separate ventures.

[17] It is possible that entrepreneurs in our data are progressing from Schedule C filers to partnership, S Corporation, or C Corporation returns. Our broader Measure 2 captures most of these as continuing entrepreneurial activity, but we are unable to account for incorporations that move taxpayers from the individual income tax to the corporate income tax. Interestingly, the scant empirical evidence suggests that presumably theoretically optimal progressions through these organizational—form categories are not the norm in the actual data (Bruce and Holtz–Eakin, 2001).

Figure 1. Entrepreneurial Exit Rates

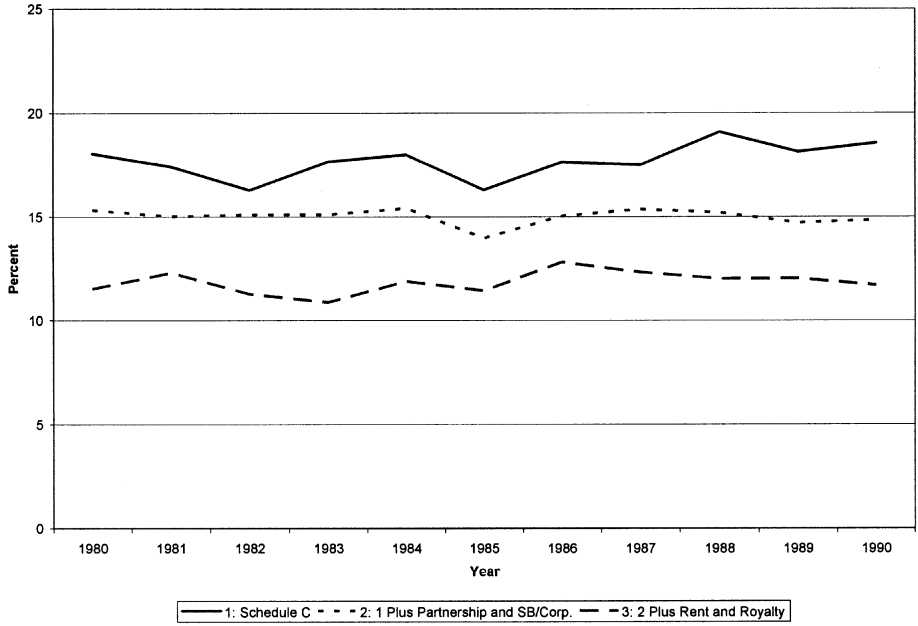
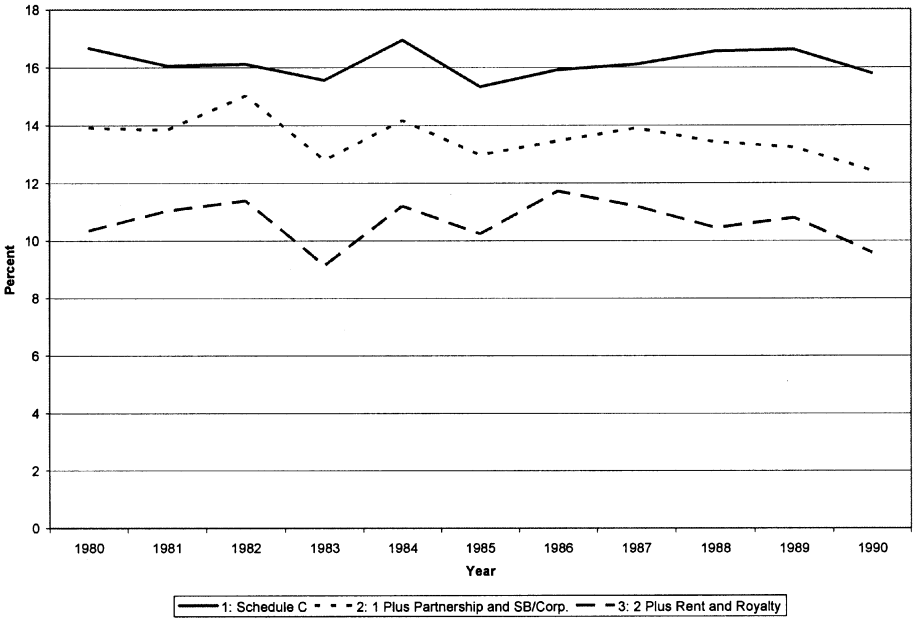


Figure 2. Entrepreneurial Exit Rates for Single Filers

Figure 3. Entrepreneurial Exit Rates for Married Filers



an associated cumulative distribution function of $F(t) = \int_0^t f(s)ds = P(T \leq t)$.

We are interested in the probability that a spell lasts at least as long as some length t, which is given by the survivor function: $S(t) = 1 - F(t) = P(T \geq t)$. The hazard rate $\lambda(t)$, which is the rate at which spells are completed immediately after t given that they have lasted at least until t, is related to the survivor function as follows:

$$[1] \quad \lambda(t) = \lim_{\Delta \to 0} \frac{P(t \leq T \leq t + \Delta | T \geq t)}{\Delta}$$

$$= \lim_{\Delta \to 0} \frac{F(t+\Delta) - F(t)}{\Delta S(t)} = \frac{f(t)}{S(t)}.$$

Empirically, hazard models express the hazard rate as a multiplicative function of a baseline hazard, $\lambda_0(t)$, and an exponential function of a set of covariates:

$$[2] \quad \lambda_i(t) = \lambda_0(t) exp(X_i \beta),$$

where β represents the usual vector of coefficients and X_i is a vector of exogenous control variables defined as of time t in addition to a set of time $t + 1$ tax rates calculated separately for each individual and discussed in greater detail below. Estimation of this type of model requires an assumption about the functional form, if any, of the baseline hazard.

A direct extension of the proportional hazards specification above is the accelerated failure time (AFT) metric, which is more appropriate when hazard rates are thought to be non–monotonic as opposed to the proportional hazards model in which the covariates have a multiplicative effect on the hazard function. In our data, the probability of surviving beyond each time period falls fastest in the early periods (see Table 3), leading us to conclude that the AFT is the more appropriate estimation metric for the current analysis. The AFT metric can be implemented with several distributions, including exponential, weibull, lognormal and log–logistic. Defining $\tau_i = exp(-X_i \beta)t_i$, the log of the failure (or exit) time t can then

be conveniently expressed as a linear function of a set of relevant covariates:

$$[3] \quad ln(t_i) = X_i\beta + ln(\tau_i).$$

The natural log of τ_i represents the acceleration parameter (which can be thought of as an error term) in equation [7], the distribution of which determines the particular model in much the same way as the choice of functional form for the baseline hazard in the proportional hazards metric.[18]

Estimating Tax Rates

The effects of taxes on entrepreneurial survival are assessed by calculating the tax rates faced by an individual in each of the two outcomes: entrepreneurship and wage employment. Our assumption is that part of the decision to continue in an entrepreneurial venture involves a comparison between one's expected tax situation if they remain in business with the tax situation they would face if they left entrepreneurial activity in favor of wage employment. Of course, we only observe one of these outcomes and must, therefore, estimate hypothetical tax rates for the alternative outcome following Bruce (2000 and 2002). For example, for a tax filer who remains in entrepreneurship, we can easily (and accurately) estimate their expected entrepreneurship tax rate by examining their actual *ex post* income, etc. We then estimate their hypothetical wage–sector tax rate—the tax rate that they would have faced if they had not remained in the entrepreneurial activity. Conversely, for those who choose to exit entrepreneurship, we use their actual wage–sector tax information but estimate their hypothetical entrepreneurial sector income accordingly.

Our rationale for taking this approach is quite straightforward. In the ideal scenario, we would have individual–specific expected tax rates that would apply in each of the two possible outcomes. That being impossible, we simply apply a perfect foresight strategy where actual information is used when possible and "best guess" information is used otherwise. Specifically, the "best guess" information is derived from others in the labor market who actually selected that particular sector. In reality, the implications of this strategy for our estimation are not as significant as one might expect, mainly because predicted incomes are used only in the process of generating estimates of marginal tax rates. Given the bracket structure of the income tax, a range of income estimates can yield the same marginal tax rate estimate.

We improve upon earlier research by recognizing that most filers with entrepreneurial income also report wage–and–salary income. Ignoring this wage–and–salary income would provide an inaccurate assessment of that filer's tax situation. In terms of estimation, this requires us to predict only wage–and–salary income for those who remain in entrepreneurship, but both entrepreneurship and wage–and–salary income for those who exit entrepreneurship. Recall that entrepreneurship is defined by the presence of entrepreneurial income, regardless of whether or not the filer also reports wage–and–salary income.

[18] The possibility remains that the set of covariates might not account for some of the factors that might influence reentry. We attempted to augment the baseline approach by allowing for unobserved heterogeneity, but these models were unable to converge in most cases. When we were able to get results, the primary conclusions were unchanged. Given our inability to consistently report results that allow for unobservable heterogeneity, we instead report robust standard errors that allow for more general heterogeneity. It should also be noted that, by definition, entrepreneurship spells never end unless an individual makes an observable exit. Consequently, all non–exiting spells in the data are right–censored at the end of the analysis period. Our estimation method controls for this, as described in detail by Cleves, Gould, and Gutierrez (2002).

We predict income by running ordinary least squares (OLS) regressions of observed income for a given sector by year and filing status on a constant, non–labor income, and a set of household specific control variables including proxies for age and the number of children in the tax filer's household. These year–status–specific regressions are repeated for each of the three measures of entrepreneurship. Estimated parameters from each regression are used to predict incomes for tax filers in the alternative sector.[19] Gurley (2005) provides evidence that, on average, the predicted incomes for those not observed in a particular sector track the actual incomes of those observed in that sector fairly closely, increasing our confidence that the income predictions result in accurate estimates of the relevant tax rates.

We then use the income estimates to estimate tax rates via the National Bureau of Economic Research TAXSIM model.[20] The TAXSIM estimates are calibrated each year based on a large number of tax returns and implicitly include the effects of federal policy changes in the relative treatment of entrepreneurial and wage and salary income discussed above as well as major changes in state income tax policies. We calculate two tax rates for each filer: their actual tax rate depending on their chosen sector, and their hypothetical tax rate in the alternative sector.[21] State income tax rates are also calculated by the TAXSIM model and are included in the analysis. Following the most recent literature, we also include estimates of individual payroll tax rates.[22] Federal and state income taxes are combined with payroll taxes to arrive at a single tax rate for each outcome.

[19] Full results from the income–prediction regressions are available upon request from the authors.

[20] TAXSIM can be thought of as a virtual tax form or calculator that can take limited information from survey data or other sources and estimate tax rates. Federal tax rates can be estimated for tax years back to 1960, and state tax rates can be estimated for tax years back to 1977. The user supplies as much detail as possible in the required data fields, and all other necessary inputs are estimated using historical data. Variables used in the TAXSIM calculations are outlined in Appendix Table 1. The TAXSIM model is accessible at http://www.nber.org/taxsim. For more details, see Feenberg and Coutts (1993).

[21] For purposes of comparability, we elect to use TAXSIM–calculated tax rates for both outcomes rather than making use of the actual tax rates that are provided (for the chosen outcome only, of course) in the tax return data. Note that the calculated tax rates are inclusive of evasion. We have implicitly assumed that the household's average evasion applies to the next dollar earned. An alternative specification would be to use the full compliance tax rate for the next dollar earned. However, we observe only reported income in the tax return data and cannot assess the level of evasion. In the case that the full compliance tax rate is most appropriate for the analysis, we have underestimated entrepreneurship tax rates and overstated the gap between wage–and–salary and entrepreneurial tax rates. Alternatively, it might be the case that a household decides not to report any portion of the next dollar earned. In this case, the appropriate entrepreneurial marginal tax rate is zero and we have understated the gap between the wage–and–salary tax rate and the entrepreneurial tax rate by overestimating the entrepreneurial marginal tax rate. As an additional note, the TAXSIM model allows marginal tax rates to be calculated with respect to either the primary earner's wage income or other income. This is a potentially important distinction as entrepreneurial income can be included in either or both fields in order to maximize accuracy in rate calculations. Although TAXSIM instructions call for wage and entrepreneurial income to be reported in the wage field, negative values are not permitted. However, simply reporting all entrepreneurial income in the "other income" field would not lead to correct Earned Income Tax Credit (EITC) calculations. In order to appropriately count positive net labor earnings (inclusive of entrepreneurial income) for EITC eligibility, entrepreneurial income is added to wage earnings. If the sum of the two incomes is negative, wage earnings are offset to zero and the remaining negative amount is subtracted from other income.

[22] Note that this includes Federal Insurance Contributions Act (FICA) taxes in the wage–and–salary sector and Self–Employment Contributions Act (SECA) taxes in the entrepreneurial sector. Payroll taxes might be expected to have smaller effects on transition probabilities, primarily because the payment of Social Security and Medicare taxes is associated with clearly defined benefits. It should be noted, however, that the time period in this

Table 1 presents some preliminary evidence that tax rates might play an important role in entrepreneurial exits. Single and married filers who did not exit enjoyed lower marginal tax rates in entrepreneurship than they would have faced in the wage sector. Similarly, single filers who exited would have had higher tax rates on average if they had remained in entrepreneurship. The lone exception to the general theme that filers choose the lower–tax scenario on average is that married filers who exited faced higher marginal tax rates in the wage sector than they would have faced if they had remained in entrepreneurial activity.

TABLE 1
TAX RATES BY FILING STATUS AND ENTREPRENEURSHIP STATUS

		Marginal Tax Rates	
		Did Not Exit	Exited
Single	Wage TR	31.77	31.89
	Entrepreneurship TR	26.55	32.00
Married	Wage TR	36.83	35.94
	Entrepreneurship TR	31.56	33.87

Note: Entries are post–transition means, and all tax rates are inclusive of federal income and payroll and state income taxes.
Entrepreneurship status in this table is defined by the presence of a Schedule C.
TR = Tax Rate. See text for additional details.

Additional Independent Variables

The tax return panel provides more in terms of other control variables than might be immediately apparent. We control for age by including a dummy for the presence of a special exemption for taxpayers or spouses over the age of 65. The number of exemptions claimed for children living at home provides a proxy for household size. We also include the number of children living away from home and the total number of exemptions claimed.

The presence of financial constraints limiting entrepreneurship is an often–cited argument for government intervention. [23] For filers who itemize their deductions, we can identify the presence of a mortgage interest deduction which can be used as a source of information regarding liquidity constraints, as in Bruce and Holtz–Eakin (2001). While those with housing equity might be more likely to have access to sources of loanable funds, it might also be the case that the presence of a mortgage limits the household's ability to obtain financing.

Risk attitudes are also thought to be important in whether or not an individual becomes an entrepreneur. In an attempt to capture a household's risk attitude, we include a measure of the balance due on the tax return. Our motivation for includ-

analysis is characterized by rate increases for the self–employed relative to wage–and–salary workers without equivalent relative benefit increases. In computing payroll tax rates for wage employment, we assume that workers are responsible for both employer and employee contributions. This assumption is in line with the tax incidence literature (Gruber, 1995; Moore, 1983; and Itaya, 1991). In calculating payroll tax rates for joint filers, we estimate the applicable tax rate by dividing income in half and assessing the appropriate tax rate (payroll tax rate or zero if the income is above the payroll tax cap). We correctly assign the payroll tax rate for the majority of joint filing households as they have total income below the payroll cap for a given year (68.77 percent). About 27 percent of joint filing households have total income between the payroll cap and two times the amount of the cap. These households are assigned the statutory payroll tax rate but may actually face a zero rate for the next dollar earned by one filer depending on the distribution on income within the household. Nearly four percent of joint filing households have incomes of more than two times the payroll cap. These households are assigned a zero payroll tax rate but one filer might actually face the statutory rate depending on the distribution of income within the household. Note that for our broader measures of entrepreneurship, our payroll tax rate estimation is an approximation since SECA rules can vary across the various sources of entrepreneurial income.

[23] See Paulson, Townsend, and Karaivanov (2006), Hurst and Lusardi (2004), Dunn and Holtz–Eakin (2000), Holtz–Eakin, Joulfaian, and Rosen (1994a and1994b), and Evans and Jovanovic (1989) for empirical evidence on liquidity constraints.

ing this is that it seems plausible that more risk–averse households should be more likely to over–withhold their taxes, thereby receiving a refund from the IRS. Relatively risk–loving filers might prefer to under–withhold such that the money is available for alternative uses.

Finally, we make use of aggregations of state identifiers in the tax panel to control for region of residence. Locations (such as Guam) outside of the 50 U.S. states and the District of Columbia are represented using an indicator for "other region." Another indicator for "missing region" is also necessary as the state identifiers are omitted for any return with an adjusted gross income of $200,000 or more in order to guarantee confidentiality.[24]

Summary statistics for the non–tax variables are shown in Table 2.[25] Note that exit rates are smaller on average the more inclusive is the entrepreneurship measure. Roughly one in 11 filers claims an age 65 exemption. Filers are fairly evenly distributed across the West, Midwest, and Northeast regions (South is the omitted reference category). Roughly one–quarter of single filers and about half of married filers claimed a mortgage interest deduction. Unsurprisingly, married filers reported more exemptions on average. Results for the measure of the balance due indicate sufficient variation for our estimation purposes, with our sample of existing entrepreneurs owing money on average.

Addressing Endogeneity

An issue only recently addressed in the literature is that of the potential endogeneity of the calculated tax rates. In other words, an individual's decision to leave entrepreneurial activity for wage–and–salary employment likely has some effect on his or her calculated tax rates. Endogeneity is addressed here using the instrumental variable approach applied by Bruce (2002), which requires an additional set of tax rates from the TAX-

TABLE 2
SUMMARY STATISTICS FOR KEY ANALYSIS VARIABLES

	Single		Married	
	Mean	S.D.	Mean	S.D.
Exit 1	0.233	0.423	0.162	0.369
Exit 2	0.197	0.398	0.135	0.342
Exit 3	0.154	0.361	0.106	0.308
Age 65	0.092	0.289	0.090	0.286
West	0.279	0.448	0.230	0.421
Midwest	0.223	0.416	0.250	0.433
Northeast	0.194	0.395	0.169	0.375
Other Region	0.003	0.050	0.001	0.038
Missing Region	0.006	0.076	0.010	0.099
Mortgage Interest Ded.	0.234	0.424	0.503	0.500
Kids Home	0.325	0.754	1.227	1.258
Kids Away	0.036	0.251	0.016	0.179
Total Exemptions	1.546	0.988	3.392	1.286
Balance Due ($100)	0.305	8.056	0.440	10.654

Note: Means and standard deviations (S.D.) for all variables except entry and exit measures are based on estimation samples used for the Measure 1 (Schedule C) models only. See text for additional details.

[24] Dummy variables indicating the year in which the return was filed (time $t + 1$) are also included to account for time effects. Note that factors affecting entrepreneurship at the macro level (nationally) are accounted for by these time variables. Similarly, factors at the sub–national level that do not vary over time are accounted for by the region dummies.

[25] Additional information on variables used in the analysis can be found in Appendix Table 1.

SIM model. The potentially endogenous tax rates discussed above are calculated using incomes and tax rules as of time t + 1, representing the closest approximation to actual post–transition tax rates.

We calculate a second set of tax rates for each individual using the same time t + 1 income and time t tax rules. These are the best approximations of the tax rates that would have existed had the tax rules remained constant. The instrumental variable is then defined as the difference between the first (using time t + 1 tax rules) and second (using time t tax rules) tax rates, and represents the part of the actual rate that is caused by the change in the tax code only. Note that the TAXSIM calculator, which accounts for an array of tax policies in addition to tax rate changes (some of which vary in the cross section as well as over time), along with our manual payroll tax calculations, effectively provide a large source of the exogenous variation in our instrumental variables.[26] Two instrumental variables are constructed—the difference in the wage–and–salary tax rates and the difference in the entrepreneurship tax rates. These instrumental variables are entered separately into two first–stage panel regressions, one for each potentially endogenous tax rate.[27] In cases where a Rivers–Vuong (1988) test indicates endogeneity, fitted values from these first–stage regressions are used in the subsequent estimation models.[28]

RESULTS

We chose the lognormal distribution for estimating equation [7] based on a comparison of values for the Akaike (1974) Information Criterion for various specifications. However, results were very similar for models with alternative distributions.[29] To avoid problems due to gaps in the panel of data, we restrict the analysis to filers who were in the panel for all 12 years and did not change filing status (single vs. married).[30] An initial look at entrepreneurship spells among those in the data is provided in Table 3. Note that the data restrictions result in a sample of 184 single filers and 1,065 married filers who make a total of 142 and 829 exits, respectively. The Kaplan–Meier Survivor Function provides an estimate, based on the data, of the probability of surviving

[26] For example, TAXSIM separately accounts for wage–and–salary income and "other" income, which includes various forms of entrepreneurial income. Further, our payroll tax calculations explicitly account for the separate tax rate structures that apply to both types of income.

[27] First–stage results are provided in Appendix Table 2.

[28] Given the difficulty of testing for endogeneity in a duration model, we rely on test results from discrete choice models described below. While we are unable to estimate an instrumental variables duration model, we account for the two–stage estimation process by reporting heteroskedasticity–robust standard errors for all specifications.

[29] All survival–time models in this paper were estimated with the Stata (version 8) statistical software, which permits the researcher to consider a multitude of distributional assumptions as well as the usual controls for censored data and unobserved heterogeneity. For additional information on these and other methods, interested readers should consult Cleves, Gould, and Gutierrez (2002), Gutierrez (2002), Greene (2000) or Kiefer (1988). Note that in this estimation method, the analysis focuses on the first "failure," so that if a household has more than one exit from entrepreneurial activity, only the first exit is analyzed. This does not appear to be a significant restriction as the vast majority of households that exit entrepreneurship in the data exit only once (91.35 percent).

[30] Restricting the data to those in all 12 years who have at least one year of entrepreneurial activity (those at risk of exit) leaves 1,818 households. Of these, 28 percent switched marital status at least once and are dropped from the sample, leaving 1,305 households (196 were single and 1,109 were married throughout the 12–year period). The households dropped for switching marital status are most likely to share characteristics with married filers. Five percent of households were married for ten or 11 years of the panel, whereas less than two percent were married for one, two, three, four, or five years.

TABLE 3
ENTREPRENEURIAL SURVIVAL ANALYSIS—PRELIMINARY STATISTICS

Year	At Risk	Exits	Right Censored	Kaplan–Meier Survivor Function
			SINGLE	
			Total Number of Spells = 184	
			Total Number of Exits = 142	
1	184	57	127	69.0%
2	169	21	148	60.5%
3	162	10	152	56.7%
4	148	18	130	49.8%
5	133	10	123	46.1%
6	124	8	116	43.1%
7	107	7	100	40.3%
8	94	7	87	37.3%
9	82	1	81	36.8%
10	65	1	64	36.3%
11	48	2	46	34.8%
			MARRIED	
			Total Number of Spells = 1,065	
			Total Number of Exits = 829	
1	1,065	267	798	74.9%
2	1,024	143	881	64.5%
3	958	77	881	59.3%
4	912	79	833	54.2%
5	856	72	784	49.6%
6	798	45	753	46.8%
7	731	40	691	44.2%
8	662	37	625	41.8%
9	588	29	559	39.7%
10	507	24	483	37.8%
11	420	16	404	36.4%

Note: Entrepreneurship in this table is defined by the presence of a Schedule C (Measure 1).

beyond each time period (Kaplan and Meier, 1958). Note that filers in the data have only about a 50 percent chance of "surviving" beyond their fourth year.

Baseline duration model results, using entrepreneurship Measure 1, are shown in Table 4. Results are expressed as time ratios, where values greater than one suggest that an increase in that particular variable increases the length of the entrepreneurship spell. The results indicate that cuts in tax rates faced by wage workers are associated with decreases in the length of time in entrepreneurship (i.e., increases in the probability of exit), while entrepreneurship tax cuts are associated with increases in the length of time in entrepreneurship (i.e., reductions in the probability of exit).

The estimated time ratios indicate that a one–percentage–point cut in the wage MTR (marginal tax rate) would shorten the entrepreneurship spell by 16.1 percent for single filers and 12.7 percent for married filers. A similar cut in the entrepreneurship MTR would increase the length of the entrepreneurship spell by 32.5 percent for single filers and 44.8 percent for married filers according to these results. The relative magnitudes of these effects suggest that across–the–board cuts on both tax rates, perhaps more relevant in today's policy discussions, would have a net–positive impact on entrepreneurial spell length. Specific magnitudes of such a tax rate cut are difficult to assess in a general equilibrium framework.

While these effects seem large, note that entrepreneurship spells are measured here in years and the median spell length from Table 3 is roughly three to four years. A one–third reduction in spell length simply indicates that the median entrepreneur would exit about one year earlier in the tax panel. Further, the fact that the maximum entrepreneurial spell length is 11

TABLE 4
BASELINE SURVIVAL ANALYSIS

	Single		Married	
	Time Ratio	S.E.	Time Ratio	S.E.
Wage MTR	**1.161**	0.054	**1.127**	0.030
Entrepreneurship MTR	**0.675**	0.127	**0.552**	0.077
Age 65	2.204	1.865	**0.100**	0.070
West	0.593	0.170	**2.260**	0.449
Midwest	0.951	0.260	**2.632**	0.750
Northeast	1.151	0.506	**5.227**	2.255
Other Region	**0.047**	0.037	0.379	0.295
Missing Region	*	*	**3.497**	1.759
Mortgage Interest Ded.	**0.346**	0.172	**0.367**	0.063
Kids Home	1.453	0.842	**0.723**	0.108
Kids Away	1.407	0.785	1.137	0.298
Total Exemptions	0.957	0.544	**1.362**	0.202
Balance Due ($100)	0.921	0.054	**1.015**	0.007
No. of subjects	184		1,065	
No. of exits	142		829	
Time at risk	1,316		8,521	

Notes: Entries are time ratios and robust standard errors from lognormal survival–time models. All models also include a series of indicators for the year of the observation.
All tax rates are fitted values from first–stage instrumental variables regressions.
Entrepreneurship in this table is defined by the presence of a Schedule C (Measure 1).
MTR = Marginal Tax Rate.
*Variable dropped due to insufficient variation.
Bold type indicates statistical significance at the five percent level or better.

years indicates that the smallest feasible percentage change in a spell would be about nine percent (or 1/11). The annual nature of our tax return data necessarily generates larger quantitative effects than might be observed with more frequent data points.[31] With this in mind, we have greater confidence in the signs and relative, rather than absolute, magnitudes of our estimates.

These results indicate that the leveling of the playing field during the 1980s, where relative tax rates on entrepreneurs increased, might have resulted in more entrepreneurial exit than might have been observed otherwise. Conversely, the broad reduction in tax rates that applied to both wage workers and entrepreneurs probably resulted in lower entrepreneurial exit rates and longer spell lengths. More broadly, to assess the overall effect of taxes on entrepreneurial activity, one must also consider entry decisions. Combined with entry results from Gurley–Calvez and Bruce (2007), the leveling of the playing field likely had a negative effect on total entrepreneurial activity, while the across–the–board reduction in rates likely had a positive effect.

Most of the time ratio coefficients on remaining covariates are not significantly different from 1.0 for single filers, presumably due to the small sample size. Married filers with age 65 exemptions, a mortgage interest deduction, or more dependent children at home have shorter entrepreneurial spells. Those with a missing region (AGI greater than $200,000), more total exemptions, or a larger balance due on their tax return have longer entrepreneurial spells.

[31] It is interesting to note that even the most recent empirical literature on the effects of tax rates on labor supply has found relatively larger behavioral elasticities. For example, Ziliak and Kniesner (1999 and 2005) find larger elasticities of labor supply with respect to tax rates in the context of a life–cycle model and a more complete consideration of intratemporal and intertemporal labor–leisure–consumption decisions than in earlier studies.

Table 5 presents results from a series of alternative specifications intended to gauge the sensitivity of our results to changes in the measurement of entrepreneurial activity. Interestingly, the results in Table 5 for Measures 2 and 3 are highly consistent with the Measure 1 results.

Discrete Choice Analysis of Entrepreneurial Exit

We now turn to a discrete choice analysis of the probability of exit in order to facilitate comparisons to earlier studies that have used similar methods. Specifically, we estimate random effects probits of annual transition decisions, where control variables are defined as in the duration analysis above. This approach mirrors Bruce (2002) as described in greater detail below. Results, presented in Table 6 for Measure 1 and Table 7 for Measures 2 and 3, are similar in spirit to the duration modeling results but not necessarily to the recent studies discussed above.[32] Specifically, reductions in the wage MTR are associated with increases in the probability of exit, while reductions in the entrepreneurship MTR are associated with reductions in the probability of exit, all else equal. Again, the effect of the entrepreneurship tax rate is nearly twice the size of that for the wage tax rate, suggesting that across–the–board tax cuts would reduce exit probabilities.

The estimated tax rate coefficients in Table 6, when translated into marginal effects, indicate that a one–percentage–point cut in the wage MTR (holding the entrepreneurship MTR and all else constant) would increase the probability of exit by 9.17 percentage points for single filers and 3.98 percentage points for married filers. A one–percentage–point cut in the entrepreneurship MTR, holding the wage MTR and all else constant, would reduce the likelihood of exit by 17.32 percentage points for single filers and 7.81 percentage points for married filers. Cutting both the wage and entrepreneurship MTRs simultaneously by one percentage point each would likely reduce the likelihood of entrepreneurial exit, but again the specific magnitudes are difficult to determine. These results are robust to the choice of entrepreneurship definition, as shown in Table 7.

Results for several other robustness checks in the discrete–choice framework are provided in Table 7. All of these

TABLE 5
ENTREPRENEURIAL SURVIVAL ANALYSIS—ALTERNATIVE ENTREPRENEURSHIP MEASURES

		Single		Married	
		Time Ratio	S.E.	Time Ratio	S.E.
Baseline (for comparison)	Wage MTR	**1.161**	0.054	**1.127**	0.030
	Entrepreneurship MTR	**0.675**	0.127	**0.552**	0.077
Measure 2	Wage MTR	**1.231**	0.050	**1.286**	0.029
	Entrepreneurship MTR	**0.542**	0.076	**0.572**	0.051
Measure 3	Wage ATR	**1.253**	0.063	**1.271**	0.034
	Entrepreneurship ATR	**0.740**	0.045	**0.798**	0.023

Notes: Entries are time ratios and robust standard errors from lognormal survival–time models. All models also include a constant and a series of indicators for the year of the observation as well as all other varialbes in Table 4. MTR = Marginal Tax Rate.
All tax rates are fitted values from first–stage instrumental variables regressions.
Entrepreneurship Measure 2 includes filers with income from a Schedule C, Partnership, or Small Business Corporation.
Entrepreneurship Measure 3 includes filers in Measure 2 plus those with rental or royalty income.
Bold type indicates statistical significance at the five percent level or better.

[32] Note that this specification is based on Measure 1 (Schedule C) entrepreneurship.

TABLE 6
DISCRETE CHOICE ANALYSIS OF ENTREPRENEURIAL EXIT

	Single		Married	
	Coeff.	S.E.	Coeff.	S.E.
Wage MTR	**–0.334**	0.025	**–0.193**	0.010
Entrepreneurship MTR	**0.632**	0.073	**0.380**	0.039
Age 65	**–1.158**	0.242	**0.452**	0.226
West	**0.806**	0.120	**–0.343**	0.070
Midwest	–0.087	0.110	**–0.360**	0.091
Northeast	**–0.613**	0.181	**–0.931**	0.129
Other Region	**2.093**	0.671	**0.917**	0.465
Missing Region	**–2.779**	0.520	**–1.223**	0.205
Mortgage Interest Ded.	**2.183**	0.201	**0.869**	0.058
Kids Home	**–0.735**	0.118	0.035	0.053
Kids Away	**–0.777**	0.157	**–0.200**	0.100
Total Exemptions	**0.442**	0.106	–0.069	0.050
Balance Due ($100)	**–0.031**	0.006	**–0.005**	0.002
Sample Size	5,109		17,097	

Notes: Entries are coefficients and standard errors (S.E.) from random effects probits.
All models also include a constant and a series of indicators for the year of the observation.
Entrepreneurship in this table is defined by the presence of a Schedule C (Measure 1).
MTR = Marginal Tax Rate.
Bold type indicates statistical significance at the five percent level or better.

TABLE 7
DISCRETE CHOICE EXIT ANALYSIS—ROBUSTNESS CHECKS

		Single		Married	
		Coeff.	S.E.	Coeff.	S.E.
Baseline (for comparison)	Wage MTR	**–0.334**	0.025	**–0.193**	0.010
	Entrepreneurship MTR	**0.632**	0.073	**0.380**	0.039
Measure 2	Wage MTR	**–0.355**	0.024	**–0.249**	0.012
	Entrepreneurship MTR	**0.750**	0.084	**0.488**	0.047
Measure 3	Wage MTR	**–0.390**	0.023	**–0.264**	0.013
	Entrepreneurship MTR	**0.464**	0.022	**0.306**	0.018
MTR based on "other income"	Wage MTR	**–0.334**	0.025	**–0.193**	0.010
	Entrepreneurship MTR	**0.512**	0.059	**0.338**	0.034
Include only those whose filing status does not change	Wage MTR	**–0.331**	0.026	**–0.197**	0.010
	Entrepreneurship MTR	**0.655**	0.082	**0.383**	0.039
Include only those who are in the panel for the full twelve years	Wage MTR	**–0.189**	0.036	**–0.180**	0.014
	Entrepreneurship MTR	**0.654**	0.170	**0.594**	0.143
MTR Differential	Wage MTR – Entrep. MTR	**–0.231**	0.016	**–0.154**	0.007

Notes: Entries are coefficients and standard errors (S.E.) from random effects probits. All models also include a constant, a series of indicators for the year of the observation, and all control variables in Table 7. All tax rates and differentials are fitted values from first–stage instrumental variables regressions. See text for additional details. MTR = Marginal Tax Rate.
Bold type indicates statistical significance at the five percent level or better.

checks include the full list of control variables in the baseline model, but only the tax rate coefficients and standard errors are shown for convenience and brevity. The first, which was taken with respect to the primary earner's income as described above, replaces the entrepreneurship MTR, which was taken with respect to the filer's "other" income. As expected, this has little to no effect on the baseline results; coefficients are nearly identical.

The next two checks in Table 7 involve different estimation samples. First, we restrict the analysis to filers whose filing status (single or married) does not change during the panel period. Next, we restrict the analysis to those filers who were present in the panel for all 12 years. Neither of these restrictions results in dramatically different results, although coefficient magnitudes change slightly in some cases. Our central conclusions remain unchanged, increasing our confidence in the representativeness of our duration analysis (which was restricted to those whose filing status does not change and who were in the panel for all 12 years).

The final robustness check in Table 7 is intended to foster more direct comparison with Bruce (2000), one of the more similar of the previous studies in this area.[33] Rather than enter the tax rates separately as in the baseline model, this check enters the tax rates as a single "tax rate differential" variable defined as the wage MTR minus the entrepreneurship MTR. Again, our results are broadly consistent with our baseline findings using separate tax rates.

CONCLUSIONS AND SUGGESTIONS FOR FUTURE RESEARCH

We find convincing evidence that marginal tax rates have important effects on the decision to remain in an entrepreneurial activity. Specifically, tax rates on entrepreneurial and wage–and–salary income have opposite effects on entrepreneurial decisions. We find that entrepreneurship tax cuts increase the length of entrepreneurial spells, while wage–sector tax cuts shorten entrepreneurial spells. Estimated magnitudes of these effects are such that equal cuts in both tax rates (wage and entrepreneur) would likely result in lower rates of entrepreneurial exit. These central conclusions are robust to a number of alternative specifications.

Interestingly, our results do not align with those from Bruce (2002), who found that greater tax advantages for the self–employed might actually increase exits from self–employment. A number of important differences in data and estimation methods may possibly account for this. First, Bruce (2002) limited the analysis to male heads of household between the ages of 25 and 54, while the current study includes all tax filers regardless of age or gender.[34] Second, and perhaps most obviously, Bruce (2002) adopted a discrete–choice transition framework, while we estimate duration models. Third, while Bruce (2002) included those who worked for both themselves and someone else as self–employed, he ignored non–self–employment income in the calculation of self–employment tax rates. We include both small–business and wage income in our calculation process, as described above. Fourth, the available set of control variables was much richer for Bruce (2002) than for the current study, which is necessarily limited on that dimension by our use of tax return data.[35]

Perhaps most importantly, while Bruce (2002) examined survey data on self–reported self–employment status from the Panel Study of Income Dynamics, we consider reported small business income from federal income tax returns. One important facet of this difference concerns the nature of entrepreneurial activity. Self–reported self–employment status is potentially a significantly different indicator of small business activity than small business income on a tax return. This point actually raises the

[33] Bruce (2002) entered the tax rates separately in his discrete–choice analysis of transitions out of self–employment.

[34] Indeed, we are unable to screen the tax return data by age or gender and are, thus, unable to replicate Bruce's (2002) approach.

[35] Unfortunately, the combination of these important differences makes it virtually impossible to recreate Bruce's (2002) estimation approach within our current tax return data framework.

possibility that the two sets of results might be broadly consistent, to the extent that tax rate increases make more people say they are self–employed, while also resulting in fewer tax filers actually reporting small business income. As with Bruce (2002), this could be an indication of a tax evasion effect driving both sets of results.

In addition to tax evasion (and avoidance), future research should consider the effects of other taxes, namely estate taxes, taxes on corporate income, and the array of taxes at the state and local levels. Despite the voluminous literature on taxes and entrepreneurial activity, very few studies have considered these potentially important taxes. Empirical considerations of other non–rate tax policies such as provisions regarding health insurance deductibility and depreciation rules would also be worthwhile pursuits.

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APPENDIX TABLE 1
VARIABLE DEFINITIONS AND NOTES

Variables Used in Econometric Models	
Age 65	=1 if there is at least one age 65 exemption in a household.
West	=1 if residence in the following states: Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, Wyoming.
Midwest	=1 if residence in the following states: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, Wisconsin.
South	=1 if residence in the following states: Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, West Virginia. (This is the omitted reference category.)
Northeast	=1 if residence in the following states: Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont.
Other Region	=1 for residence classification other than the above, excluding missing residence.
Missing Region	=1 if the state identifier is missing (adjusted gross incomes of $200,000 or more).
Mortgage Interest Ded.	=1 if the household claimed a mortgage interest deduction.
Kids Home	Number of exemptions claimed for children living at home.
Kids Away	Number of exemptions claimed for children living away from home.
Total Exemptions	Total number of exemptions claimed.
Balance Due ($100)	Amount due on the tax return (negative if receiving a refund) divided by 100.
Variables Used to Estimate Tax Rates in TAXSIM	
Tax Year	1979–1990. (Late or amended returns are reassigned to the appropriate tax year.)
State	Indicator for 50 states and DC; other residences treated as missing.
Marital Status	Married (includes widow(er)s and married filing separately), single, or head of household.
Dependent Exemptions	Number of dependent exemptions claimed.
Age Exemptions	Number of age and exemptions other than dependents. (Note: Other exemptions were included in this category as there was not a separate place to enter them and placing them in the dependent exemptions category could potentially distort Earned Income Tax Credit eligibility. However, as TAXSIM only allows a maximum value of "2" in this field, all values greater than "2" were set to the maximum.)
Wage–and–Salary Income of the Taxpayer	Wage–and–salary income for the household. Self–employment earnings are included in the category as long as the sum of wage earnings and self–employment earnings is not less than zero. When this sum is negative, wage–and–salary income is set to zero and the remaining negative amount is added to (subtracted from) other income (see below).
Wage–and–Salary Income of the Spouse	Set to zero for all households (spousal income cannot be distinguished for joint filers).
Dividend Income	Gross dividend income (the gross amount of dividend income is used for 1979–1986 after which there is not a distinction between taxable and total dividend income).
Other Property Income	All income other than wages, self–employment income, dividends, pensions, social security benefits, and unemployment compensation. Can be negative. Self–employment income is included only to the extent that losses are not offset by wage earnings (see "Wage–and–Salary Income of the Taxpayer" for more details).
Taxable Pensions	Taxable portion of reported pension income (addition of amounts reported on Form 1040 and Schedule E for years 1979–1986).
Gross Social Security Income	Gross income from social security benefits.
Other Non–taxable Transfer Income	Not reported in the tax return data; set to zero for all observations.
Rent Paid	Not reported in the tax return data; set to zero for all observations.
Property Taxes Paid	Amount paid in property taxes reported as an itemized deduction on Schedule A.
Itemized Deductions	Deductions other that state income tax and property taxes.
Child Care Expenses	Gross amount of child care expenses or the maximum reportable amount, whichever is greater. For 1979–1980 only the credit amount, not gross expenses, was reported. Gross expenditures were estimated by taking the credit amount times 5. When this estimate exceeded the maximum claimable amount, it was set to the maximum.
Unemployment Compensation	Gross unemployment compensation (the gross amount of unemployment compensation is used for 1979–1986 after which there is not a distinction between taxable and total unemployment compensation).

APPENDIX TABLE 2
FIRST–STAGE INSTRUMENTAL VARIABLES REGRESSION RESULTS

	Single				Married			
	Wage		Entrepreneurship		Wage		Entrepreneurship	
MTR Regressions	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
Instrument	**0.005**	0.000	**0.002**	0.000	**0.006**	0.000	**0.005**	0.000
Age 65	**–2.472**	0.224	**–1.700**	0.110	**–5.658**	0.177	**–4.864**	0.147
West	**1.537**	0.159	**–0.810**	0.076	**1.082**	0.148	**1.278**	0.109
Midwest	**1.140**	0.150	**0.510**	0.072	**2.223**	0.136	**1.942**	0.100
Northeast	**2.043**	0.155	**1.958**	0.074	**2.311**	0.147	**2.952**	0.109
Other Region	**1.478**	0.502	**–3.081**	0.300	**–1.590**	0.455	**–2.556**	0.392
Missing Region	**–3.610**	1.152	**1.821**	0.686	**–2.816**	0.404	**2.030**	0.358
Mortgage=Interest Ded.	**3.058**	0.142	**–2.163**	0.080	**2.599**	0.078	**–0.912**	0.065
Kids=Home	**–2.281**	0.124	**–0.375**	0.070	**–1.026**	0.085	**–0.548**	0.073
Kids Away	–0.366	0.227	**0.601**	0.130	–0.330	0.170	**0.381**	0.147
Total=Exemptions	**1.958**	0.101	**0.810**	0.057	**0.812**	0.076	**0.562**	0.065
Balance Due ($100)	0.005	0.011	**0.057**	0.007	**0.009**	0.003	**0.017**	0.003
Sample=Size	96,571		96,570		100,999		101,097	

Note: Entries are coefficients and standard errors from random effects regressions. All models also include a constant and a series of indicators for the year of the observation. These results are based on Measure 1 (Schedule C).
MTR = Marginal Tax Rate.
Bold type indicates statistical significance at the five percent level or better.