Taxes and Entrepreneurial Activity: An Empirical Investigation Using Longitudinal Tax Return Data

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for

under contract number SBAHQ-04-M-0521

Release Date: March 2005

The statements, findings, conclusions, and recommendations found in this study are those of the authors and do not necessarily reflect the views of the Office of Advocacy, the United States Small Business Administration, or the United States Government.

SMALL BUSINESS
RESEARCH SUMMARY

SBA Office of Advocacy

No. 252
March 2005

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under contract no. SBAHQ-04-M-0521 (2005, 51 pages)

Purpose

The decision to start a business or engage in entrepreneurship depends in part on tax incentives. The U.S. income tax is a graduated tax, designed so that people pay an increasing percentage rate as their income rises through various tax brackets. The rate of tax paid on the highest dollars of income is the marginal tax rate.

Currently, the tax code is largely blind to the source of income when one files a personal income tax statement. Historically, however, income from wages and salaries and income from entrepreneurial activities—running a business—were taxed differentially. This study explores the historical differences and subsequent standardization, largely stemming from the Tax Reform Act of 1986, to determine how marginal income tax rates affect an individual's decision to enter, remain in, and exit entrepreneurial activities.

The report uses longitudinal tax return data to measure the responsiveness of individual tax filers to changes in marginal income tax rates with respect to their choices to engage in entrepreneurial activity. Individual choices to engage in wage-and-salary employment, entrepreneurial activity, or a mixture of both, are taken as given by the existence of each type of income as reported in individual income tax filings.

Overall Findings

Marginal tax rates have significant effects on entrepreneurial entry and exit, suggesting that the formation and closure of small enterprises are in part determined by the handling of income from these activities in the tax code. The findings show that the level of entrepreneurial entry, exit, and duration react differently to changes in marginal rates on wage-and-salary and entrepreneurial income. Specifically, lower marginal rates on entrepreneurial income encourage more entrepreneurial entry and lower rates of exit, and lengthen the duration of spells of activity. Similarly, higher marginal rates on wage-and-salary income also increase entrepreneurial activity as more workers switch from wage-and-salary work to starting their own business. Importantly, however, the magnitude of the entry, exit, and duration effect is larger for marginal tax rates on entrepreneurial income than on wage-and-salary income.

Highlights

• **Marginal tax rate reductions have effects on entrepreneurial entry.** A reduction in the marginal tax rate on entrepreneurial income of one percentage point would increase the probability of entry into entrepreneurial activity by 1.42 percentage points for single filers and 2.0 percentage points for married filers. Conversely, reducing the marginal tax rate on wage-and-salary income by one percentage point would decrease the probability of entrepreneurial entry by 0.58 percentage point for single filers and 0.51 percentage point for married filers.

• **Marginal tax rate reductions have effects on entrepreneurial exit.** Individuals' decisions to exit entrepreneurial activity are similarly related to tax rates. A marginal tax rate reduction of one percentage point on entrepreneurial income reduces the probability

This *Small Business Research Summary* (ISSN 1076-8904) summarizes one of a series of research papers prepared under contracts issued by the U.S. Small Business Administration's Office of Advocacy. The opinions and recommendations of the authors of this study do not necessarily reflect official policies of the SBA or other agencies of the U.S. government. For more information, write to the Office of Advocacy at 409 Third Street S.W., Washington, DC 20416, or visit the office's Internet site at *www.sba.gov/advo*.

of exiting entrepreneurial activity by 17.32 percentage points for single filers and by 7.81 percentage points for married filers. Likewise, a reduction of one percentage point in the marginal tax rate on wage-and-salary income would increase the probability of exit from entrepreneurial activity for single and married filers by 9.17 and 3.98 percentage points, respectively.

• **The net effect of across-the-board marginal tax rate reductions is an increase in entrepreneurial entry and a decrease in entrepreneurial exit.** Entry and exit choices are affected by marginal tax rates on both entrepreneurial income and wage-and-salary income, but the magnitude of the effect is larger for entrepreneurial income. The result is that an across-the-board marginal income tax rate reduction of one percentage point would increase the rate of entrepreneurial entry by 0.84 percentage point among single filers and 1.49 percentage points among married filers. The same marginal rate reduction would reduce the likelihood of exit by 8.15 percentage points for single filers and 3.83 percentage points for married filers.

• **Marginal tax rate changes have effects on the duration of entrepreneurship.** In addition to affecting entrepreneurial entry and exit, changes in marginal tax rates affect the duration of entrepreneurship. A one percentage point reduction in the marginal tax rate on entrepreneurial income would increase the duration of entrepreneurial activity by 32.5 percent for single filers and 44.8 percent for married filers, while a one percentage point increase in the wage-and-salary marginal income tax rate would prolong the duration of entrepreneurship by 16.1 percent for single filers and 12.7 percent for married filers. The median entrepreneurial period in the sample was between three and four years; thus a marginal tax rate difference that increases duration by one-third corresponds to an increase of one year or more in the duration of entrepreneurship.

• **Effects of marginal tax rate increases are the opposite of reductions.** Effects of marginal tax rates are symmetric, and therefore increases by one percentage point will have the opposite effects from those described above for tax rate decreases.

Scope and Methodology

The researchers used a panel data file drawn from the University of Michigan Tax Research Database. This file was compiled by the Office of Tax Policy Research at the University of Michigan from public-use tax return data from the Internal Revenue Service (IRS) Statistics of Income (SOI) Division. The panel spans the years 1979-1990 to encompass exogenous tax policy changes that took place during the 1980s. These changes had the effect of largely standardizing the marginal tax rates on income from various sources, allowing the researchers to identify the effects of rate changes on entrepreneurship. In order to normalize the data, tax rates were estimated using the TAXSIM model developed by the National Bureau of Economic Research. The estimates of marginal tax rate effects use an instrumental variable (IV) regression model to control for detected tax rate endogeneity. Appendix Table 1 provides a complete detailed list of variables included in the modeling.

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Executive Summary

We make use of a 12-year panel of U.S. federal individual income tax returns to examine the effects of federal income and payroll taxes and state income taxes on entrepreneurial activity. Entrepreneurs are vital to the economy, providing much of the energy behind job creation and overall economic growth. Our focus in this report is on the effects of tax rates on individual transitions into or out of some form of entrepreneurial activity. Economic theory suggests that taxes can have ambiguous effects on these decisions, which leaves the determination of overall effects to empirical analysis. We begin by discussing the tax treatment of entrepreneurs relative to wage workers. After briefly summarizing the growing literature in this area, we turn to a detailed empirical analysis of entrepreneurial exit and entry.

We make a number of contributions to the literature. First, we recognize the difficulty in quantifying "entrepreneurship," and consider a variety of measures that can be gleaned from tax records. Second, we employ a discrete-choice transition analysis framework, which allows us to focus on decisions to enter and remain in an entrepreneurial venture. We extend this in our analysis of entrepreneurial survival by using more advanced duration analysis techniques. Third, we examine these decisions at the tax-filer level, controlling for the relative tax treatment of entrepreneurial income and wage-and-salary income. Finally, we follow the recent literature by controlling for the endogeneity of individual-level tax rates.

Our panel of tax returns spans the period from 1979 to 1990 and includes a number of important changes in the relative tax treatment of entrepreneurs. While overall tax rates were reduced during this period, some tax advantages enjoyed by many entrepreneurs such as favorable payroll tax treatment were gradually eroded. We use this exogenous variation in tax rules to more cleanly identify the effects of tax rates on entrepreneurship in our empirical analysis. Another important advantage of using tax records is that we are able to calculate more accurate tax rates than earlier studies, most of which have relied on survey data with self-reported income and entrepreneurship status.

We find convincing evidence that tax rates have important effects on entrepreneurial entry and survival. Increases in marginal tax rates on wage income increase the probability of entrepreneurial entry and survival, while increases in tax rates on entrepreneurial income have the opposite effects. Our results suggest that the leveling of the tax playing field that took place during the 1980s, where tax rates on entrepreneurs were increased relative to those on wage workers, may have resulted in lower rates of entrepreneurial entry and survival than might otherwise have been observed. We also find that the effects of entrepreneurship tax rates are much larger than those for wage tax rates. This suggests that the recent policy of across-the-board tax cuts, which has resulted in equal-rate tax cuts on wage and entrepreneurship incomes, could increase rates of small business start-up and survival.

1. Introduction

Entrepreneurs are vital to the economy, providing much of the energy behind job creation and overall economic growth. Researchers have long been interested in the process by which one becomes an entrepreneur. Many factors can affect these decisions, including lifestyle, potential earnings and available resources. Relative tax burdens are another potential decision factor. Our focus in this study is on the effects of federal and state income and payroll taxes on transitions into or out of entrepreneurial activity.

Entrepreneurship as a concept cannot actually be 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 take an innovative approach by 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, our use of the terms "entrepreneur," "entrepreneurship," and "entrepreneurial activity" refer to this more limited but measurable concept rather than more general notions of entrepreneurship.

Relative tax treatments affect entrepreneurship decisions in various ways, two examples of which were noted by Goode (1949). First, many expenses related to the entrepreneurial venture are deductible in calculating taxable income. Further, business deductions for goods such as automobiles and computer equipment are likely to have consumption benefits outside of business use. Alternatively, the inability of certain entrepreneurs—namely the self-employed—to deduct expenses on services (such as health insurance prior to 1987), generally paid out of pre-tax dollars for wage-and-salary workers, might either deter entrepreneurial entry or expedite exit. 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,[1] leading to lower levels of entrepreneurship.

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, the necessity of self-reported entrepreneurial income can reduce the effective tax burden of entrepreneurs relative to wage-and-salary workers 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 be prompted to seek professional assistance with their taxes, thereby increasing the likelihood that they learn about legal ways to reduce their tax burden. Finally, entrepreneurs who are prone to breaking the law might attempt to engage in tax evasion by willfully misreporting income or expenses or simply failing to file a tax return. While we certainly do not want to characterize all

[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).

entrepreneurs as tax evaders, we must acknowledge the greater potential for tax evasion in cases of self-reported income.

Given the examples outlined above, it is clear that tax policies can potentially affect entrepreneurial entry and survival. This highlights a key motivation for studying the potential effects of tax policies on entrepreneurship, the familiar concept of economic distortion. Specifically, if the tax code results in either more or less entrepreneurial activity than would otherwise exist, it is said that the economy has been distorted away from its most efficient outcome. Such distortions reduce economic efficiency, as economic inputs (e.g., land, labor, capital, and entrepreneurship) are allocated toward less productive uses. Alternatively, if it can be shown that entrepreneurs are not sensitive to taxes in their decisions to start or maintain small businesses, then tax reform measures can be designed to foster greater overall equity and simplicity without the fear of driving entrepreneurs out of business. Either result can be important in instructing the design of tax policies which will maximize the potential for small business development and growth.

Economic theory suggests that taxes can have ambiguous effects on entrepreneurship (Bruce 2000 and 2002, Cullen and Gordon 2002). On one hand, a higher tax rate translates into lower net-of-tax returns from an entrepreneurial venture and thus reduces the likelihood that a potential entrepreneur will start a new business. On the other hand, higher tax rates reduce the inherent riskiness of a new enterprise by reducing the maximum net-of-tax losses and returns (Domar and Musgrave 1944). This implicit insurance aspect of the tax code can increase the likelihood of a small business start-up. The overall effect of taxes on entrepreneurship is, in the end, an empirical question.

Given this theoretical ambiguity, it is perhaps not surprising that the related 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 policymakers might be better positioned to design and defend effective, efficient, and equitable tax rules.

Research on the effects of tax policy on entrepreneurial activity has flourished in recent years due in part to the availability of vast longitudinal databases containing multiple years of information for large samples of current and potential entrepreneurs. The ability to track individuals over time, especially when the time period includes a major federal tax reform, has resulted in dramatic increases in the quality of this body of research. It is the intent of this research to extend the growing literature by examining the effects of federal income and payroll taxes and state income taxes on entrepreneurial entry and survival.

Our research makes use of a rich panel of individual tax return data to contribute toward this overarching mission. We begin by examining the effects of marginal and average tax rates on transitions into entrepreneurial activity. We then investigate the effects of taxes on entrepreneurial survival using state-of-the-art multivariate econometric techniques, described in detail below. We build upon earlier research by considering a number of indicators of

entrepreneurial activity as noted above and controlling for the likely endogeneity of individual tax rates in entrepreneurial decisions.

This research report is organized as follows. Section 2 presents the motivation for our work, including a brief history of the relative tax treatment of entrepreneurs under the U.S. federal individual tax system. Prior studies of the taxation of entrepreneurs are reviewed in Section 3. Section 4 describes the data and Section 5 explains the empirical methods which are used in this research. Results for the entry analysis are presented and discussed in Section 6 and exit results are presented in Section 7. Section 8 concludes with a summary and suggestions for future research.

2. U.S. Tax Policy Toward Entrepreneurs

Since its inception, the U.S. tax system has treated income from wage-and-salary employment and entrepreneurship (mainly sole proprietorships) differently. This distinction has been necessary due to the lack of a third party—the firm—in the tax collection process for many entrepreneurs. While wage-and-salary workers have income and payroll taxes withheld by their employers, entrepreneurs must remit their own taxes. Marginal federal individual income tax rates are, at least after tax preferences, blind to the source of income (i.e., a separate system of statutory marginal rates does not exist for income from sole proprietorships or other entrepreneurial ventures).

Income from wage-and-salary employment has been subject to a payroll tax since 1937, its proceeds serving as the primary funding for the Social Security and Medicare systems. Generally, a percentage of a worker's earnings (up to some maximum taxable amount) is withheld, and that percentage is matched by the employer. The only form of entrepreneurial income that is explicitly subject to payroll taxation is self-employment income, which was not subject to a payroll tax until 1951. From 1951 through the early 1960s, the statutory payroll tax rate on self-employment income was one and one-half times the employee's rate on wage-and-salary income. From the early 1960s through 1984, however, self-employment income was subject to a tax that was less than 1.5 times the wage-and-salary rate.

Beginning in 1984, in an effort to equalize the treatment of wage-and-salary and self-employment income, the statutory self-employment payroll tax rate was set equal to two times the wage-and-salary rate. Essentially, self-employed individuals were made liable for payroll taxes equal to the employer plus employee shares for wage-and-salary individuals. While tax credits were used to phase in the change from 1984 to 1990, this series of events represents a dramatic change in the relative tax treatment of self-employment income, a key source of income for many entrepreneurs.[2]

[2] 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 income have been identical since 1984.

Coupled with these changes in the payroll tax system during the 1980s was a significant, although perhaps less dramatic, change in relative income tax treatment. For both wage workers and entrepreneurs, tax rates were reduced and the tax base was broadened as a result of major federal tax reforms in 1981 and 1986. Toward this general end, a number of limitations on deductible business expenses were passed.[3] Other 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. Conversely, more liberal provisions relating to the business use of one's home made entrepreneurial activity more attractive during this time.

Despite some small gains, it is apparent that the payroll and income tax changes during the 1980s rendered entrepreneurship significantly less tax-advantaged relative to wage-and-salary employment. Indeed, the overall theme of the 1980s tax changes and most notably the Tax Reform Act of 1986 was to level the playing field for various types of taxpayers. 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.

3. Prior Studies of the Taxation of Entrepreneurs

Theoretical models have 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). Results of the theoretical literature are ambiguous, and have not been resolved by the inconsistent empirical findings.[4]

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 higher relative rate reduces the returns to the entrepreneurial venture relative to wage-and-salary work, decreasing the likelihood of a small business startup. Conversely, if loss offsets are allowed, an increase in the relative tax rate compresses the entrepreneurship income distribution and reduces the risk of entrepreneurial ventures. This implicit insurance leads to an expected increase in entrepreneurial entry.

The absence of a third party to report income or expenses on behalf of many entrepreneurs might increase the likelihood that entrepreneurs either unknowingly misreport their

[3] 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. 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.

[4] See Schuetze and Bruce (2004) for a more detailed summary of the literature on taxes and self-employment.

taxable income (due to tax complexity) or engage either in legal tax avoidance or illegal tax evasion. Theoretical models of behavior that account for evasion opportunities also yield ambiguous results. Intuitively, an increase in income tax rates might lead to an increase in entrepreneurship as the returns to evasion activities are higher. However, Watson (1985) argues that the net effect is ambiguous: as more people take advantage of evasion opportunities by switching to self-employment, the wages in the sector where evasion is possible fall, making entrepreneurship less appealing. The scant empirical research on tax evasion among entrepreneurs has been somewhat inconclusive.[5]

Both of the theoretical approaches discussed above produce ambiguous results, and the lack of consensus in the theory highlights the importance of empirical work on the topic. It is perhaps unsurprising that despite a growing empirical literature on the economic effects of taxes on entrepreneurship, little consensus has arisen. Most of the empirical studies were restricted by their use of cross-section or time-series data rather than panel data, and most used aggregate tax information—such as statewide average tax rates—to avoid issues of tax rate endogeneity.[6] A number of more recent studies have used panel data and have relied on exogenous changes in tax rules to deal with the potential endogeneity of individual tax rates.

Time-series studies have focused on national-level tax policies, mainly in the U.S. and the U.K. Early studies, some of which have relied on time series econometric techniques that have since been found to be problematic, generally conclude that higher federal tax rates cause higher rates of self-employment.[7] 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. More recent time series studies used more sophisticated time series econometric tools, typically involving some consideration of cointegration (i.e., the case where two or more series exhibit a common trend but might not necessarily be closely linked).[8]

Somewhat surprisingly, the general positive relationship between tax rates and self-employment rates continued to hold even after cointegration is addressed. Parker (1996) found that higher marginal tax rates increased self-employment rates, and Robson (1998) found a positive relationship between self-employment and the average tax rate. Robson and Wren (1998) provided a model that predicted (and regressions confirmed) that higher marginal tax rates reduced self-employment rates while higher average tax rates increased self-employment.[9]

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[5] 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.

[6] An individual's marginal tax rate can be endogenous to the entrepreneurship decision if, for example, the tax rate is a function of whether or not one is self-employed.

[7] Specifically, they typically involve the use of ordinary least squares regression analysis, with simple corrections for the common problem of autocorrelation (i.e., where observations in the time series data are related in some way over time). See, for example, Long (1982a) and Blau (1987).

[8] In time series data on tax rates and self-employment rates, one often observes that both series have trended generally downward, especially in the U.S., in recent decades. Both rates were quite high in the mid-1900s but have gradually fallen over time. This relationship may or may not involve some form of causation, but only more modern econometric techniques can fully address this.

[9] Robson and Wren (1998) examined data for 15 OECD countries for the years 1978, 1981, 1985, 1989, and 1992.

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.

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 enter or remain in an entrepreneurial activity. The finding that higher tax rates lead to more self-employment as measured by aggregate time series, while interesting, has not been confirmed by the most recent time series studies.[10] A better understanding of this relationship is only possible through the analysis of cross-section or panel data.

While the initial evidence from early cross-section studies generally supported the time-series results,[11] more recent cross-sectional research casts doubt on the importance of tax policy in the self-employment decision. Parker (2003) found no evidence that the decision to be self-employed is sensitive to taxes or opportunities for evasion, pointing to earlier studies' omission of relative incomes between self-employment and wage employment as a reason for their finding of significant tax effects.

The most significant shortcoming of these cross-sectional studies, all of which have used individual tax information, is that potential tax rate (and relative income) endogeneity was not addressed. Also, with the exception of Parker (2003) who eventually dismissed the issue, 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. While a number of time series and cross-section studies have considered self-employment entry and exit, none considered taxes. 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. Panel data studies and those relying on repeated cross-sections have been able to focus on individual decisions about self-employment (Bruce 2000 and 2002, Carroll, Holtz-Eakin, Rider, and Rosen 2001, Cullen and Gordon 2002, Gentry and Hubbard 2000, Moore 2003, and Schuetze 2000). Results have been less conclusive than those from earlier time-series and cross-section studies. Indeed, some of the more recent studies have indicated that higher tax rates on self-employment income might either increase or decrease self-employment rates. The key to understanding this is recalling that a higher tax rate reduces not only the expected return from entrepreneurial activity, but may also reduce the risk of the entrepreneurial venture.

Schuetze (2000) avoided the pitfalls of tax rate endogeneity by using asynchronous variation in the aggregate "tax climate" across tax jurisdictions (states and provinces) in the United States and Canada – two countries that are similar in terms of overall institutional

[10] See Fairlie and Meyer (1998), Briscoe, Dainty, and Millett (2000), and Bruce and Mohsin (2003).
[11] See Long (1982a). Long (1982b), or Moore (1983)

structure but which differ substantially in their income tax policies and self-employment outcomes. Using repeated cross-sections for the two countries covering the period 1983 through 1994, he found that increases in average income tax rates had large and positive effects on the rate of male self-employment.

Bruce (2000 and 2002) used U.S. data from the Panel Study of Income Dynamics to show that the differential tax treatment of the self-employed has statistically significant, although somewhat counter-intuitive effects on the probabilities of entering and exiting self-employment. Both of these studies involved the use of exogenous changes in tax rules to generate instrumental variables for addressing the possible endogeneity of individual-specific tax rates. Results showed that decreasing an individual's expected marginal tax rate on self-employment income (holding the wage tax rate constant) actually reduced the probability of entry, while a similar decrease in the average self-employment income tax rate increased this probability. Similarly, higher tax rates on self-employment income were found to reduce the probability of exit. These results are at least partially explained by the fact that changes in differential tax treatment, while having the primary effect of altering net returns to labor, also affect the incentives to capture relevant tax preferences (or to evade or avoid taxation altogether).

Cullen and Gordon (2002) echoed the general finding from the earlier literature that cutting personal tax rates can reduce the extent of entrepreneurial activity. They attributed this not only to the standard Domar and Musgrave (1944) risk-sharing argument within the personal income tax system, described above, but also to similar arguments regarding relative tax rates on corporate and individual income. While their study made use of repeated cross sections of U.S. tax return data from 1964 through 1993, their focus was on a much more limited definition of entrepreneurship than those found in most other analyses.[12] They also used aggregate (averaged) tax measures to avoid concerns of tax rate endogeneity.

Two recent papers have called the conventional wisdom into question. Gentry and Hubbard (2000) used the same data as Bruce (2000) but focused instead on tax progressivity. They found that the probability of entry into self-employment increased as tax rates became less progressive, indicating that progressive rate schedules serve as something of a tax on success in self-employment. Moore (2003) used repeated cross section data from the Surveys of Consumer Finances, which spanned key federal tax reforms in the U.S. This strategy permitted the use of a difference-in-differences technique to account for tax rate endogeneity. Moore found a negative relationship between tax rates and self-employment, but coefficients were either statistically insignificant or sensitive to model specification.

Leaving the question of how taxes affect the level of entrepreneurial activity aside for the moment, a number of innovative and interesting panel data studies have examined the effects of certain tax policies on the activities of existing entrepreneurs. Carroll, Holtz-Eakin, Rider, and Rosen (2000a, 2000b, and 2001) used a panel of taxpayer data to examine the effect of taxes on the growth of small firms' receipts and on decisions by existing entrepreneurs to hire additional workers or to make capital investments. Relying on exogenous variation provided by the Tax

[12] Cullen and Gordon (2002) focus on entrepreneurship as indicated by the presence of a noncorporate loss from a proprietorship, partnership, or subchapter S corporation that was larger than 10 percent of reported wage-and-salary income. They further restricted the analysis to tax returns filed by single individuals.

Reform Act of 1986, they suggested that the self-employed were indeed cognizant of their own personal tax situations. Specifically, marginal tax rate increases reduced overall firm growth (as measured by receipts), mean investment expenditures, and the probability of hiring employees.

Power and Rider (2002) examined a panel of sole proprietors in their investigation of the use of tax-based savings incentives among entrepreneurs. Their estimate of the tax price elasticity of contributions to these plans was about –2.0, suggesting again that entrepreneurs are highly sensitive to changes in their tax rates. Finally, Barbour, Bruce, and Holtz-Eakin (2002) used a panel of individual taxpayer data from 1979 to 1990 to investigate charitable giving among entrepreneurs. Results indicated that single taxpayers who filed a Schedule C and itemized their deductions were more likely to report charitable contributions than those without a Schedule C, but this result held only at lower marginal income tax rates. These filers were also less sensitive to changes in marginal tax rates than those who did not file a Schedule C.

Our research builds upon the earlier 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.[13] Second, we examine the importance of taxes at the individual level using tax return data. Third, our use of a 12-year panel of tax returns allows us to focus on the effects of tax rates on transitions into and out of entrepreneurial activity. Finally, we consider the likely endogeneity of individual-level tax rates, making use of exogenous variation in tax rules to construct valid instrumental variables.

We begin by exploring the determinants of entrepreneurial entry in a discrete choice framework. We then treat entrepreneurial exit in a similar fashion, before exploring entrepreneurial survival in a duration analysis framework. A number of studies have examined entrepreneurial survival empirically in a multivariate context (e.g., Bates 1990, Holtz-Eakin, Joulfaian, and Rosen 1994a, and Taylor 1999), but only Bruce (2002) has considered the effects of taxes on entrepreneurial endurance. The current study is believed to be the first to consider the effects of taxes on entrepreneurial survival using duration analysis techniques.

4. Description of Data

The data for this research are drawn from the University of Michigan Tax Research Database. In constructing this panel data file, the Office of Tax Policy Research (OTPR) at the University of Michigan acquired the public-use tax return data released by the Internal Revenue Service (IRS) Statistics of Income (SOI) Division and converted them to user-friendly format. The 1979-1990 panel is constructed from annual IRS-SOI Individual Tax Model Files, which contain up to 200 pieces of information for between 80,000 and 250,000 personal income tax

[13] 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. The omission of wage income for entrepreneurial households filing joint returns is potentially more serious. An average of 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.

returns in each year. Within each Individual Model File is a subset of returns that were randomly selected to be part of a panel of taxpayers whose returns would be drawn year after year. In total, the panel includes data from over 200,000 tax returns. Approximately 6,000 filers are present in the panel for all 12 years.

While the time period of the OTPR tax panel could be perceived to be a bit outdated, this data file is the best publicly available longitudinal tax return data set. It also directly overlaps the time period of data used in the most similar prior study (Bruce 2000), allowing for important comparisons to be made. Furthermore, it encompasses a number of significant tax policy changes, providing the necessary exogenous variation for identification purposes. Examining entrepreneurial sensitivity to changes in tax policy during this window will be instructive for analysis of more current and future policies.

Our panel of tax return data allows precise definitions of entrepreneurship based on filing status (e.g., presence of a Schedule C) and reported sources of entrepreneurial income instead of self-reported survey responses. 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.

Another source of added precision over survey data is the detailed nature and accuracy of tax-related information. In addition to filing status and entrepreneurship variables, the data include detailed information on income from all sources including wages and salaries, sole proprietorships (and other forms of entrepreneurship), dividends, and transfers. The drawback of using tax return data—lack of detailed demographic information—is discussed in greater detail below along with variables that are likely to provide at least a rough proxy for the missing information.

One of the most important advantages of using tax return data is that they provide a number of categories of entrepreneurial activity at the individual level. 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. We also explore two increasingly broader definitions of entrepreneurship. Measure 2 adds to Measure 1 those with income from partnerships or subchapter S corporations. 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. Our measures mirror some of those explored by Bruce and Holtz-Eakin (2001). It should be noted that our data pertain to individual entrepreneurs and not to their entrepreneurial businesses or enterprises.

Entrepreneurship rates for the three measures over the time period are presented in Figures 1 through 3.[14] Figure 1 indicates that entrepreneurship rates generally rose over the time

[14] These 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

period of our analysis, with most of the growth occurring before 1987, and remained roughly stable from 1987 until the end of the time period. Given that the data are at the household (tax filer) level, dividing the sample by marital status seems necessary on at least two grounds.[15] 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 these 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.

Figures 2 and 3 add credibility to the argument that single and married filers behave differently. Entrepreneurship rates for married filers (Figure 3) exhibited a remarkably stable upward trend for all three measures. Rates among single filers (Figure 2) were much less stable with periods of relatively rapid increases and decreases. However, the pattern appears to be mainly driven by Schedule C filers and is quite similar across measures. Given the observable differences, all further analysis is conducted separately for single and married filers.

Interestingly, none of the trends exhibited increased volatility around key tax policy changes. Despite a leveling of the payroll tax playing field in 1984, the marginal income tax rate reduction in 1986, and the general scaling-back of tax preferences throughout this time period, the general increase in entrepreneurial activity appears to have been uninterrupted.

Entrepreneurship rates are a function of both entry rates and exit rates. We define entry as having no entrepreneurial activity (e.g., Schedule C) on one year's tax return but having some entrepreneurial activity on the next year's return. Similarly, exit is defined 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). The overall increase in entrepreneurial activity over the time period could be driven either by an increase in the rate of entry or a decrease in exit rates, or some combination of both effects. Indeed, entry rates (Figures 4 through 6) and exit rates (Figures 7 through 9) indicate that the broadly stable increase in entrepreneurship rates masks significant variations in entry and exit rates.

Entry rates generally rose over the course of the 1980s and seem to have reacted to the increased relative payroll taxation of sole proprietors enacted in 1984—all series show a slight decrease in entry around this time. Nonetheless, the general upward trend is consistent with the overall increase in entrepreneurship shown in Figure 1. In comparison to Figure 1, however, entry rates are "noisier" and display more year-to-year fluctuation. Entry rates for the single or unmarried filers (Figure 5) are particularly volatile.

(entrepreneurs).

[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.

The same characteristic (noise) is exhibited by exit rates, as shown in Figures 7 through 9. However, exit rates have some features that are quite different from those of overall entrepreneurship rates and entrepreneurial entry rates. First, exit rates for single returns are *higher* than for joint returns (the opposite is true for both entry rates and the overall rate of entrepreneurship). Second, in this instance the measure of entrepreneurial activity is more important. Exit rates often move in different directions for different measures of entrepreneurship. For single filers, the broadest measure is least volatile, while the opposite generally holds for married filers.

Interestingly, exit rates do not display an upward spike around the key payroll tax reform of the mid-1980s. This lack of a response is perhaps partially responsible for the more stable increase in overall activity as shown in Figure 1. Regardless of the measure of entrepreneurship, entry rates increased and exit rates decreased over time for married returns, leading to an overall increase in entrepreneurship. This is perhaps a result of the general increase in self-employment among women, and married women in particular (Devine 1994, Bruce 1999). Results for single filers are more sensitive to measurement issues, as the exit rate rises by a smaller amount when the broader measure is used. Overall entrepreneurship rates and entry rates rise by similar amounts over time for single filers regardless of the measure.

The results presented above suggest a simple story: entrepreneurship was on the rise during the 1980s, driven both by increased entry of new entrepreneurs and enhanced survival of those already in business (although the evidence is a bit less clear-cut on the latter point). Explanations for this vary. While popular discussion focuses on an increased "taste" or proclivity for entrepreneurship, econometric research has focused on the degree to which a variety of constraints such as taxes, access to capital, health insurance, or discrimination have determined rates of entrepreneurship over time, across space, or among races.[16]

5. Empirical Methodology

We begin by estimating discrete choice models to examine the effects of taxes on a tax filer's entrepreneurial entry decision. The methodology involves estimating an equation of the following form:

$$D_{i,t+1} = \beta' X_{i,t} + \gamma T_{i,t+1} + \mu_i + \upsilon_{i,t+1} \qquad (1)$$

where $D_{i,t+1}$ is a binary variable that takes a value of 1 if an individual transitions from not having entrepreneurial activity at time *t* to having entrepreneurial activity at time *t + 1* (and zero if the household remains nonentrepreneurial in both *t* and *t + 1*). $X_{i,t}$ is a vector containing a constant and a set of exogenous control variables defined as of time *t*. Potential post-transition tax rates are calculated separately for each individual, discussed in greater detail below, and

[16]For example, see Evans and Jovanovic (1989), Evans and Leighton (1989), Holtz-Eakin, Joulfaian, and Rosen (1994a and 1994b), Blanchflower and Oswald (1998), Dunn and Holtz-Eakin (2000), and Bruce, Holtz-Eakin and Quinn (2000) on the role of capital market constraints; Holtz-Eakin, Penrod, and Rosen (1996) or Bruce, Holtz-Eakin, and Quinn (2000) on the effects of health insurance; and Meyer (1990), Blanchflower, Levine, and Zimmerman (1998), and Fairlie and Meyer (2000) on the effects of race.

included in $T_{i,t+1}$. The error term in this equation includes an individual-specific time-invariant random effect (μ_i) to capture unobserved individual heterogeneity, and an independently and identically distributed residual component ($\upsilon_{i,t+1}$) with zero mean and finite variance. A convenient empirical specification for the above equation is a random effects probit, as in Bruce (2000 and 2002).[17]

Estimating Tax Rates

The effects of taxes on entry are assessed by calculating the tax rates faced by an individual in each of the two outcomes: entrepreneurship and wage employment. Of course, we only observe one of these outcomes and must therefore estimate hypothetical tax rates for the alternative outcome. To do so, we must first predict income for the alternative outcome. For example, for a tax filer who enters entrepreneurship, we can easily measure their entrepreneurship tax rate by examining their actual post-transition income, etc. We must estimate their hypothetical wage-sector tax rate—the tax rate that they would have faced if they had not entered entrepreneurial activity. For those who do not enter entrepreneurship, we must estimate their hypothetical entrepreneurial income.

We improve upon earlier research by recognizing that many 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. We would have a similar situation if we only estimated entrepreneurial income for nonentrepreneurs. In terms of estimation, this requires us to predict wage-and-salary income as well as entrepreneurial income for those who do not transition into entrepreneurship. Recall that entrepreneurship in our study is defined by the presence of entrepreneurial income, regardless of whether or not the filer also reports wage-and-salary income.

Our strategy for predicting income is to run ordinary least squares (OLS) regressions of observed income for a given sector by year and filing status on a constant, nonlabor 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 regressions are estimated separately by year and filing status (single and married), and are repeated for each of our three measures of entrepreneurship. Estimated parameters from each regression are used to predict incomes for tax filers in the alternative sector. Rather than present the regression results for all of these models, we provide plots of average actual and predicted incomes for the first entrepreneurship measure (Schedule C) in Figures 10 through 15.[18]

The figures suggest that, on average, our income predictions are quite reasonable. The predicted incomes for those unobserved in a particular sector track the incomes of those observed in that sector fairly closely. One would not expect the values to correspond perfectly as there are likely to be systematic differences between those households who self-select into

[17] Most of the existing empirical literature follows the custom of limiting the sample to male heads of household who are of prime working age (25-54). Due to the lack of demographic information, it is not possible to limit our sample in such a fashion. However, separate analyses are conducted for married and single households. In the case of a single filer, the household self-employment decision is equivalent to the individual decision.

[18] Full results from the income-prediction regressions are available upon request from the authors.

entrepreneurship and those who do not. Adding credence to this observation, the actual and predicted values tell a consistent story about the earnings potential of the wage-and-salary and entrepreneurial filers; entrepreneurial filers are almost universally expected to have higher incomes.

In Figure 10, the predicted hypothetical wage earnings for single, entrepreneurial filers are higher than the actual wage earnings observed for those without entrepreneurial income. Predicted wage and entrepreneurial incomes for single filers in the wage sector were lower than the actual values among entrepreneurial filers (Figures 11 and 12). These patterns were nearly identical for married filers (Figures 13 through 15) suggesting that households with the highest earning potential are self-selecting in entrepreneurship. In light of the similarities between actual and predicted incomes and the consistency of differences, we are confident that our income predictions result in accurate estimates of the relevant tax rates.

With the income estimates in hand, we then estimate tax rates by running a set of 17 variables from the tax returns through the National Bureau of Economic Research's TAXSIM model.[19] 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.[20]

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.

State income tax rates are also calculated by the TAXSIM model and are included in our analysis. Following the most recent literature, we also include estimates of individual payroll tax rates.[21] Federal and state income taxes are combined with payroll taxes to arrive at a single tax rate for each outcome. Separate analyses are conducted using marginal and average tax rates as

[19] TAXSIM can be thought of as a virtual tax form or calculator which 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).

[20] 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 our tax return data.

[21] 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 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.

the previous literature suggests that responses vary with different tax rate measures.[22]

Table 1 presents some preliminary evidence that tax rates might play an important role in entrepreneurial transitions. This table shows mean values of marginal tax rates (MTRs) and average tax rates (ATRs) for both sectors, broken down by filing status and whether or not the filer entered entrepreneurship (as indicated by the presence of a Schedule C, our Measure 1). Among single filers, those who did not enter enjoyed lower tax rates in the wage sector than they would have faced in entrepreneurship. Those who did enter enjoyed much lower tax rates in entrepreneurship than they would have faced in the wage sector. The same story generally holds for married filers, although those who did not enter entrepreneurship had slightly higher MTRs in the wage sector.

The story is somewhat similar when looking at entrepreneurial exit, as shown in the bottom half of Table 1. Among single filers, entrepreneurial tax rates were only lower than wage tax rates for those who did not exit, and then only for MTRs. Single filers who exited would have had higher tax rates on average if they had remained in entrepreneurship. Married filers who did not exit entrepreneurship enjoyed lower tax rates in entrepreneurial activity. Those who exited would have had a lower MTR but a higher ATR on average if they had remained in entrepreneurship.

Additional Independent Variables

Our 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. 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 including 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

[22] Average tax rates are calculated as ratios of tax payments to adjusted gross income.

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.[23]

Summary statistics for the nontax variables are shown in Table 2.[24] Note that entry rates are larger and exit rates smaller on average the more inclusive the entrepreneurship measure. Roughly one in ten filers claims an age 65 exemption. Filers are fairly evenly distributed across the West, Midwest, and Northeast regions (South is the omitted reference category). Between roughly one-tenth and 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 our measure of the balance due indicate sufficient variation for our estimation purposes, with the entry samples receiving refunds on average (negative balance due) and the exit samples owing money on average.

Are Tax Rates Endogenous?

An issue only recently addressed in the literature is that of the potential endogeneity of the calculated tax rates. In other words, whether or not an individual moves from wage-and-salary employment to entrepreneurship might have some effect on his or her calculated tax rates. Endogeneity is addressed here using the instrumental variable approach applied by Bruce (2000 and 2002). This approach requires an additional set of tax rates from the TAXSIM 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 time $t + 1$ income and time t tax rules. These are our best approximations of the tax rates that would have existed had the tax rules remained constant. Our 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. 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.[25]

6. Econometric Analysis of Entrepreneurial Entry

Table 3 presents our baseline analysis of entrepreneurial entry, using marginal tax rates and our first measure of entrepreneurial activity (Schedule C). Positive coefficients indicate that an increase in that variable, all else in the model held constant, is associated with an increased probability of entrepreneurial entry. Two sets of results are presented for each filing status, one with actual tax rates (Non-IV) and another with fitted tax rates (IV) from first stage regressions.[26]

[23] Dummy variables indicating the year in which the return was filed (time $t + 1$) are also included to account for year fixed effects.

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

[25] This approach more closely resembles Bruce (2002). Bruce (2000) actually used a tax rate difference, defined as the wage tax rate minus the entrepreneurship (self-employment) tax rate, in his baseline analysis. We explore this approach as a robustness check below.

[26] Our use of random effects probit models makes it difficult to handle endogenous variables. No software is

Beginning with the former, our results support the conventional wisdom. Specifically, increasing the wage-sector MTR is associated with an increase in the probability of entering entrepreneurship (although the effect is only statistically significant for single filers), while increasing the entrepreneurship MTR is associated with a decrease in the probability of entry.

In a series of endogeneity tests, we reject the null of exogeneity for both tax rates, for both single and married filers.[27] Therefore, we now turn to the econometrically more appropriate IV results in Table 3.[28] Interestingly, the same general story regarding the tax effects continues to hold after accounting for endogeneity, although the coefficients are now larger and more uniformly statistically significant. Further, the negative effect from the entrepreneurship tax rate is more than double the size of the positive effect of the wage tax rate.

For single filers, the estimated tax rate coefficients indicate that cutting the wage MTR by one percentage point, holding the entrepreneurship MTR and everything else in the model constant, would decrease the probability of entrepreneurial entry by 0.58 percentage points. Similarly, the results indicate that cutting the entrepreneurship MTR by one percentage point while holding the wage MTR and all else constant would increase the probability of entrepreneurial entry by 1.42 percentage points. The corresponding magnitudes for married filers are 0.51 and 2.00, respectively.

Given that marginal tax rates are generally blind to the source of income under current law, it is perhaps more relevant to consider the effects of across-the-board tax cuts of equal rates. According to our empirical results, cutting both the wage MTR and entrepreneurship MTR simultaneously by one percentage point would have the combined effect of increasing the probability of entrepreneurial entry by 0.84 percentage points (-0.58 plus 1.42) among single filers and 1.49 percentage points (-0.51 plus 2.00) among married filers. These effects are quite large when compared to the average entry rates of 1.6 percent for single filers and 4.2 percent for married filers.

The remaining control variables are also largely statistically significant. Married filers with an age 65 exemption are less likely to enter entrepreneurship, despite the finding in earlier research that entrepreneurial activity is not uncommon among those in or near retirement (Bruce, Holtz-Eakin, and Quinn 2000). Region of residence also has an important effect, although results are not consistent across filing status. Missing region has a large and positive effect on

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currently available that can easily estimate an instrumental variables probit with random effects. Consequently, we simply insert fitted values in the second-stage random effects probits. In order to obtain more appropriate standard errors, we bootstrap the random effects probit 50 times. Our initial intent was to estimate bootstrapped standard errors for all results shown in the paper, but the bootstrapping procedure proved to be extremely costly in terms of computing time. We found in the baseline entry analysis that, while standard errors increased as a result of the bootstrapping procedure, patterns of significance for our tax variables were unchanged. We are therefore confident that our central conclusions would continue to hold if bootstrapped standard errors were calculated for all remaining models.

[27] We assess the potential endogeneity of these tax rates by performing the test suggested by Rivers and Vuong (1988). This test involves inserting the potentially endogenous variable along with the estimated residual vector from the proposed first-stage instrumental variables regression into the transition probit. A significant coefficient on the residual indicates that endogeneity is a serious problem.

[28] Results from first-stage instrumenting equations are provided in Appendix Table 2. Note that our instrumental variables are statistically significant in all first-stage regressions.

entry for married filers, likely due to the fact that those with missing state identifiers have AGI over $200,000.

The presence of a mortgage interest deduction is associated with a lower probability of entry, and the effect is larger for singles. Although we certainly do not have conclusive evidence, this finding may reveal that those with mortgage debt have reduced ability to borrow the necessary funds for a new entrepreneurial venture. Additional children away from home increase entry probabilities for both filing status groups. Finally, and perhaps most interestingly, those with a balance due on their tax returns were more likely to enter. While the magnitudes of these effects are indeed quite small, this suggests that our balance due indicator might be serving well as a proxy for risk-taking behavior.

Robustness Checks – Entrepreneurial Entry

A frequent criticism in the related literature is that the chosen measure of entrepreneurship—typically self-employment—is either not broad enough or not narrow enough. Fortunately, our tax return data provide numerous measures of entrepreneurial activity which can be used for econometric analysis. In Table 4, we present alternative models of entrepreneurial entry that are identical to the baseline model in Table 3 but use more inclusive measures of entrepreneurship. The top half of Table 4 explores entry into Measure 2 (which includes filers with a Schedule C plus those with partnership or small business corporation income), while the bottom half of the Table examines Measure 3 (which adds those with rental or royalty income to Measure 2).

As with the baseline analysis, we present two sets of results for each measure and for each filing status group—one that uses potentially endogenous tax rates (Non-IV) and one that uses fitted values from first-stage instrumental variables regressions (IV). Also as in the baseline analysis, our endogeneity tests indicate that the latter results are more appropriate, so we focus our discussion here on the IV results. Interestingly, the results from this exercise are very similar to those in the baseline model, suggesting that our general conclusions are robust to alternative measures of entrepreneurship. This echoes the general theme from Bruce and Holtz-Eakin (2001). Most of the remaining findings in Table 4 are also similar to our baseline results in Table 3. One interesting difference is that filers with an age 65 exemption are actually more likely to enter Measure 2 entrepreneurship.

Our next robustness check considers average tax rates (ATRs) rather than marginal tax rates (MTRs). The ATR is defined here as the ratio of the filer's tax liability to his or her adjusted gross income. While MTRs measure the tax on the next dollar of income earned, ATRs more accurately portray the overall tax burden as a share of the filer's income. Each tax rate measures something different. The MTR captures effects of taxes on entrepreneurship decisions at the margin, while the ATR captures the effects of taxes on entrepreneurship in an "all or nothing" sense. Table 5 presents results for all three measures of entrepreneurship, where each random effects probit uses the IV approach, the more appropriate method as indicated by endogeneity tests. The first notable result in Table 5 is that the results are not nearly as consistent across specifications as were our MTR results in Tables 3 and 4. Magnitudes of many of the coefficients are often implausibly large and many of the signs change from one

specification to the next, suggesting a very high degree of sensitivity of the model to the use of ATRs. Given this, we are much more confident in the baseline MTR results above.

Table 6 presents results for a series of additional robustness checks, with baseline results provided for purposes of comparison. All of these checks included 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 of these checks replaces our entrepreneurship MTR, which was taken with respect to the primary earner's income as described above, with an entrepreneurship MTR taken with respect to the filer's "other" income. As expected, this has little to no effect on our baseline results; coefficients are nearly identical.

The second and third checks in Table 6 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 conclusion remains unchanged.

Our final robustness check in Table 6 is intended to foster more direct comparison with Bruce (2000), the most similar of the previous studies in this area. Rather than enter the tax rates separately as in our baseline model, this check enters the tax rates as a single "tax rate differential" variable defined as the wage MTR minus the entrepreneurship MTR. Bruce (2000) estimated a positive coefficient on this tax rate differential in a model without endogeneity controls, but the sign changed to negative when an instrumental variables approach was taken. We do not observe this sign change, as our instrumental variables approach yields a positive coefficient for both single and married filers. Nonetheless, this positive sign is consistent with our baseline findings using separate tax rates.[29]

To summarize, we find convincing evidence that marginal tax rates have important effects on entrepreneurial entry decisions. Increases in wage-sector MTRs are found to increase the probability of entry, while increases in entrepreneurship MTRs are found to decrease the probability of entry. These central conclusions are robust to a number of alternative specifications. Our results suggest that the leveling of the payroll tax playing field that took place during the 1980s, where tax rates on entrepreneurs were increased relative to those on wage-and-salary workers, might have resulted in lower rates of entrepreneurial entry than might have otherwise been observed. On the other hand, the across-the-board marginal tax rate cuts might have resulted in more entry.

7. Econometric Analysis of Entrepreneurial Exit

We now turn to an analysis of entrepreneurial exit, beginning with a similar discrete choice framework and then focusing on a more appropriate duration analysis approach. The discrete choice approach is more closely comparable to previous research, but is somewhat

[29] Note that this positive sign implies that increases in the wage MTR will increase the probability of entry, while increases in the entrepreneurship MTR will reduce the probability of entry, all else equal.

limited in that only two-year transitions are considered. Given our rather long panel of tax return data, along with the general notion that most entrepreneurial ventures do not last more than a few years, we are able to employ the more advanced duration techniques to get a better sense of the effects of tax rates not only on the *probability* of entrepreneurial exit, but also on the *timing* of exit.

Discrete Choice Analysis of Entrepreneurial Exit

Results from our baseline model of entrepreneurial exit, which simply replaces our entry indicator with a similarly defined indicator of exit, are shown in Table 7. Note that this specification is based on Measure 1 (Schedule C) entrepreneurship. As with our entry analysis, results are shown for models without endogeneity controls (Non-IV) and models with such controls (IV). For both single and married filers, tests indicate a potentially serious endogeneity problem; we will therefore focus our discussion on the more appropriate IV results.

Again, we find that tax rates affect entrepreneurial exit in a manner that is consistent with conventional wisdom. 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. The estimated tax rate coefficients 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.

Our empirical estimates indicate that cutting both the wage and entrepreneurship MTRs simultaneously by one percentage point each would reduce the likelihood of entrepreneurial exit by 8.15 percentage points (17.32 minus 9.17) for single filers and 3.83 percentage points (7.81 minus 3.98) for married filers. These results suggest that the leveling of the playing field during the 1980s might have resulted in more entrepreneurial exit than might have been observed otherwise. The larger magnitudes of these effects relative to those from our analysis of entrepreneurial entry reveal the greater fragility of entrepreneurial activity vis-à-vis wage employment.

We find some interesting effects from the remaining control variables in Table 7. First, only single filers with age 65 exemptions are less likely to exit. Region of residence again plays an important role, suggesting that regional economic factors can be important. Married filers with missing region (i.e., with AGI above $200,000) are much less likely to exit, unsurprisingly. Having a mortgage interest deduction increases one's likelihood of exit, and by a larger amount for singles than for married filers. Finally, having more dependent children generally reduces the probability of exit, but only for single filers.

Robustness Checks – Entrepreneurial Exit

Our central conclusions regarding the effects of marginal tax rates on entrepreneurial exit

are robust to the choice of entrepreneurship definition, as shown in Table 8. While coefficient magnitudes fluctuate somewhat with more inclusive definitions of entrepreneurial activity, the signs and significance levels remain unchanged. Regarding the nontax variables, the only significant departure from the baseline results is that married filers with age 65 exemptions, who are more likely to exit Measure 1 and Measure 2 entrepreneurship, are actually less likely to exit Measure 3 entrepreneurship.

Table 9 presents a series of models using ATRs instead of MTRs. Interestingly, these results are much more precise than the similar models of entrepreneurial entry in Table 5. Note that our tests only revealed endogeneity for entrepreneurship tax rates. Endogeneity was not found to be a problem for single filers with Measure 1. With this, we present non-IV results for single, Measure 1, and partial IV results (with instrumenting only for the entrepreneurship tax rate) for the remaining five models in Table 9. The effects of the entrepreneurship ATR are positive and statistically significant in all six models, corroborating our baseline MTR results. Wage ATRs exhibit much smaller effects, suggesting that entrepreneurial endurance is more a function of tax rates in the entrepreneurial sector than tax rates in the wage sector.

Results for our remaining robustness checks (similar to those for entrepreneurial entry in Table 6) are provided in Table 10. As with entry, all of these results are similar to our baseline exit findings in Table 7. Tax rates have similar effects regardless of how we enter them in the analysis, and regardless of the sample definition.

To summarize the results of our discrete choice analysis of entrepreneurial exit, we find convincing evidence that tax rates matter. Specifically, increases in tax rates on entrepreneurs are found to increase the likelihood of exit, all else equal. Increases in wage-sector tax rates reduce the probability of exit, but these effects are quite small and in some cases approach zero. Taken together, our findings suggest that policies aimed at reducing the relative tax burden on small businesses might lead to increased entrepreneurial endurance. Additionally, equal cuts in both tax rates (wage and entrepreneur) could also result in lower rates of entrepreneurial exit.

Duration Analysis of Entrepreneurial Exit

We now expand on our relatively simplistic discrete choice framework by estimating duration models which examine *spells* in entrepreneurship. This allows us to estimate the effects of a similar set of covariates on entrepreneurial survival or endurance. Specifically, such an approach allows us to assess the determinants of the probability of leaving entrepreneurship (for whatever reason, be it failure, incorporation, or something else entirely), given that the individual has not yet exited.[30]

[30] The possibility remains that our set of covariates might not account for some of the factors that might influence reentry. We attempted to augment our baseline approach by allowing for unobserved heterogeneity, but these models were unable to converge in most cases. When we were able to get results, our 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 nonexiting spells in our data are right-censored at the end of our analysis period. Our estimation method controls for this, as described in detail by Cleves, Gould, and Gutierrez (2002).

Rather than treat each annual decision as a separate but econometrically linked process as in the discrete choice approach, duration models examine the entire spell of entrepreneurial activity at once. Furthermore, in more sophisticated variants of these models, the covariates are permitted to vary over time during the spell. Of the prior studies of entrepreneurial endurance, only Taylor (1999) used hazard models, but he did not examine the effects of taxes.

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 can be expressed as $P(t \leq T \leq t + \Delta \mid T \geq t)$, 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 known as the *hazard rate*. It is typically assumed that T has a continuous probability distribution function, given by $f(t)$, where the associated cumulative distribution function is $F(t) = \int_0^t f(s)ds = P(T \leq t)$.

We are interested in the probability that a spell lasts at least as long as some length t, which is given by the *survival (or survivor) function*: $S(t) = 1 - F(t) = P(T \geq t)$. The hazard rate $\lambda(t)$ is the rate at which spells are completed immediately after t given that they have lasted at least until t, is related to the survival function as shown in equation (2).

$$\lambda(t) = \lim_{\Delta \to 0} \frac{P(t \leq T \leq t + \Delta \mid T \geq t)}{\Delta} = \lim_{\Delta \to 0} \frac{F(t + \Delta) - F(t)}{\Delta S(t)} = \frac{f(t)}{S(t)}. \quad (2)$$

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

$$\lambda_i(t) = \lambda_0(t)exp(X_i\beta), \quad (3)$$

where β represents the usual vector of coefficients. Estimation of this type of model involves making a decision 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 the estimation method of choice in the current analysis. Begin by defining τ_i as follows:

$$\tau_i = exp(-X_i\beta)t_i. \quad (4)$$

With some manipulation and rearranging, the log of the failure (or exit) time t can then be conveniently expressed as a linear function of a set of relevant covariates:

$$ln(t_i) = X_i\beta + ln(\tau_i). \quad (5)$$

The natural log of τ_i represents something of an error term in equation (5), 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. We chose the lognormal distribution 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.[31]

To avoid problems due to gaps in the panel of data, we restrict this part of our analysis to filers who were in the panel for all 12 years and did not change filing status (single vs. married). An initial look at entrepreneurship spells among those in our data is provided in Table 11. Note that our 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 beyond each time period (Kaplan and Meier 1958). Note that filers in our 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 12. 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. Note that all MTRs are entered as fitted values from the same first-stage instrumenting regressions as in our discrete choice analysis of exit. Results are largely consistent with the discrete choice findings. Specifically, increases in the wage MTR are associated with increases in the length of time in entrepreneurship (i.e., reductions in the probability of exit), while increases in the entrepreneurship MTR are associated with reductions in the length of time in entrepreneurship (i.e., increases in the probability of exit). The estimated time ratios indicate that a one percentage point increase in the wage MTR would prolong the entrepreneurship spell by 16.1 percent for single filers and 12.7 percent for married filers. A similar increase in the entrepreneurship MTR would reduce the length of the entrepreneurship spell by 32.5 percent for single filers and 44.8 percent for married filers according to these results. While these effects certainly seem large, note that entrepreneurship spells are measured here in years and the median spell length from Table 11 is roughly 3 to 4 years. A one-third reduction in spell length simply indicates that the median entrepreneur would exit about one year earlier in the tax panel.

Most of the remaining covariates are not statistically significant for single filers, presumably due to the small sample size. Results for married filers are largely consistent with our earlier analysis. Those 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.

Robustness Checks – Entrepreneurship Duration Analysis

Table 13 presents results from a series of alternative specifications. When we use un-instrumented MTRs or ATRs of either variety, estimated time ratios for the tax rates are much smaller (closer to one) and largely not statistically significant. This sensitivity to tax rate measures indicates that additional duration modeling of entrepreneurship spells would be a

[31] 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).

useful undertaking. Nonetheless, our rather consistent finding that tax rates are endogenous and our less conclusive evidence from models with average tax rates both lead us to prefer the use of instrumented marginal tax rates in the duration analysis.

8. Conclusions and Suggestions for Future Research

We find convincing evidence that marginal tax rates have important effects on decisions to enter or remain in entrepreneurial activity. Results from discrete-choice models of entrepreneurial entry show that increases in marginal tax rates on wage income increase the probability of entry, while increases in marginal tax rates on entrepreneurship income decrease the probability of entry. In a similar discrete-choice analysis of entrepreneurial exit, we find that increases in entrepreneurship tax rates increase the likelihood of exit, while increases in wage-sector tax rates reduce the probability of exit. Results from duration analysis of entrepreneurial endurance are largely consistent with the discrete-choice findings.

Taken together, our empirical results suggest that policies aimed at reducing the relative tax rates on entrepreneurs might lead to increases in entrepreneurial entry and better chances of survival. Additionally, our results indicate that equal-rate cuts in tax rates on both wage and entrepreneurship incomes could yield similar results. Conversely, equal-rate increases in tax rates on both sources of incomes would most likely result in reduced rates of entrepreneurial entry and increased rates of entrepreneurial exit.

To be sure, while our central conclusions are robust to a number of alternative specifications, our robustness checks reveal a number of important areas for future research. First, our analysis of entry yields different conclusions when we replace marginal tax rates with average tax rates. In this case, we find that higher average tax rates on entrepreneurship income might actually increase the probability of entry. Future analysis should consider the possibility that tax rate increases serve to attract those already prone to tax avoidance or evasion into entrepreneurial activity of one form or another. Second, our duration analysis results are highly sensitive to the choice of tax rate measures used in the model. Future research should continue to investigate the causes of this sensitivity of our baseline findings. A third suggestion for future work would be to 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.

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Figure 1: Entrepreneurship Rates by Category

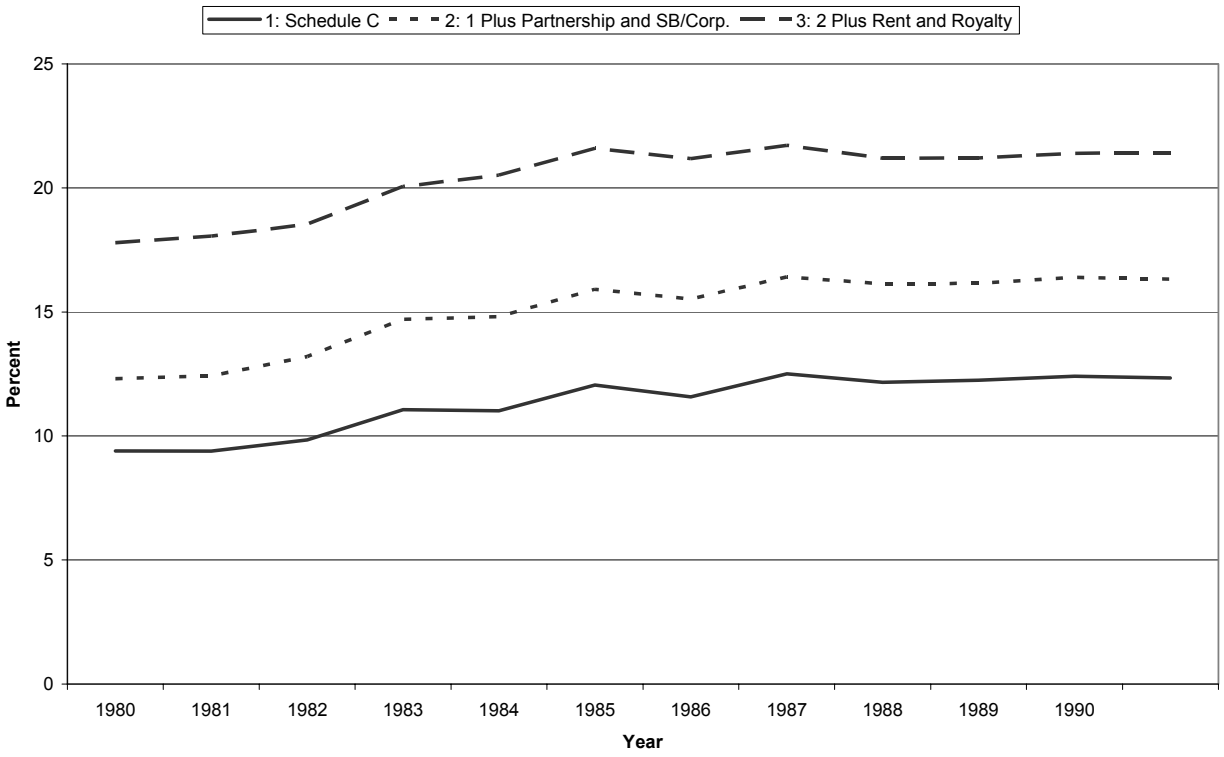

Figure 2: Entrepreneurship Rates among the Unmarried

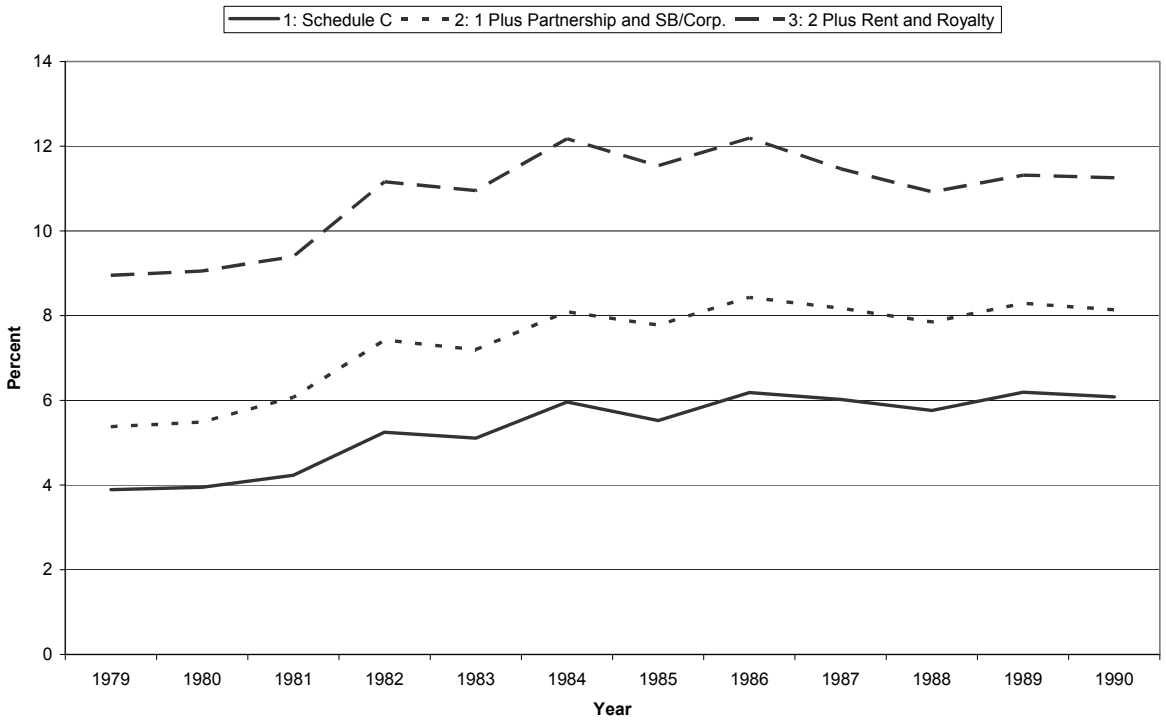

Figure 3: Entrepreneurship Rates among the Married

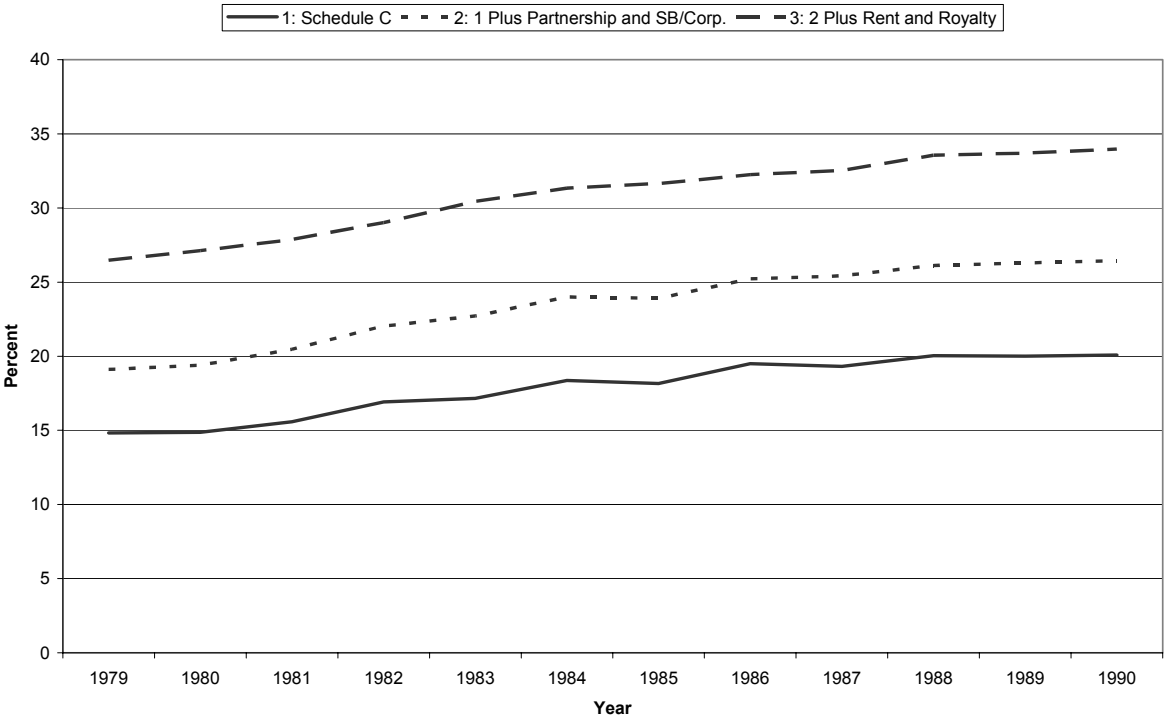

Figure 4: Entrepreneurial Entry

Figure 5: Entrepreneurial Entry among the Unmarried

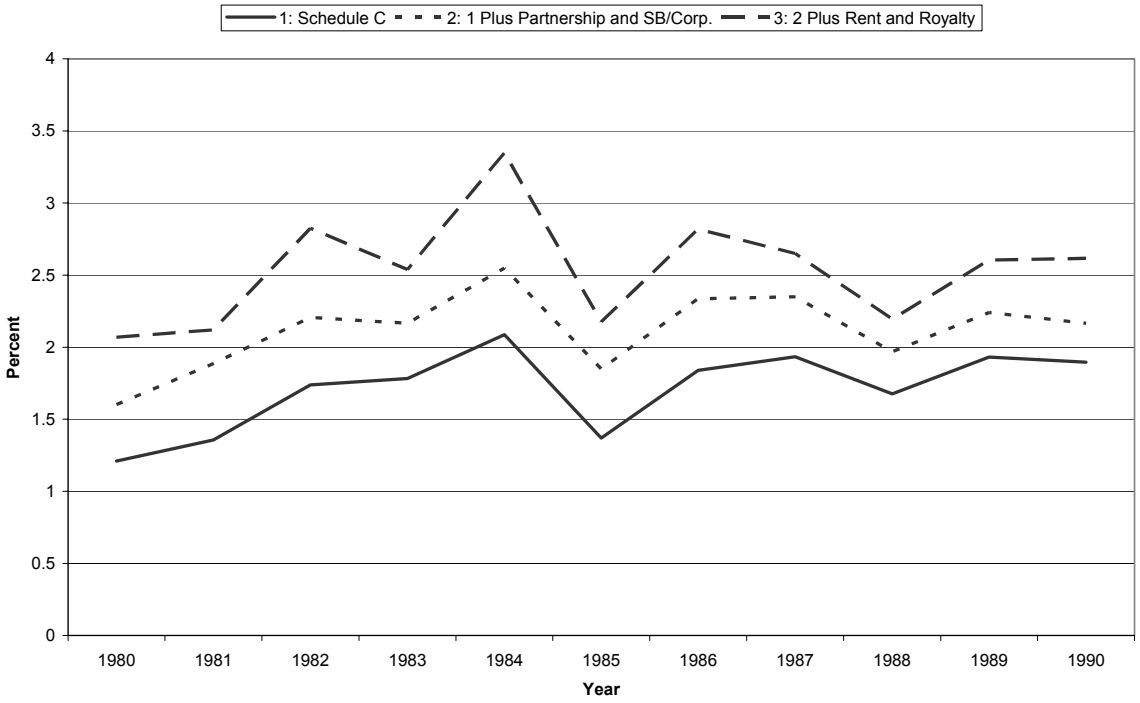

Figure 6: Entrepreneurial Entry among the Married

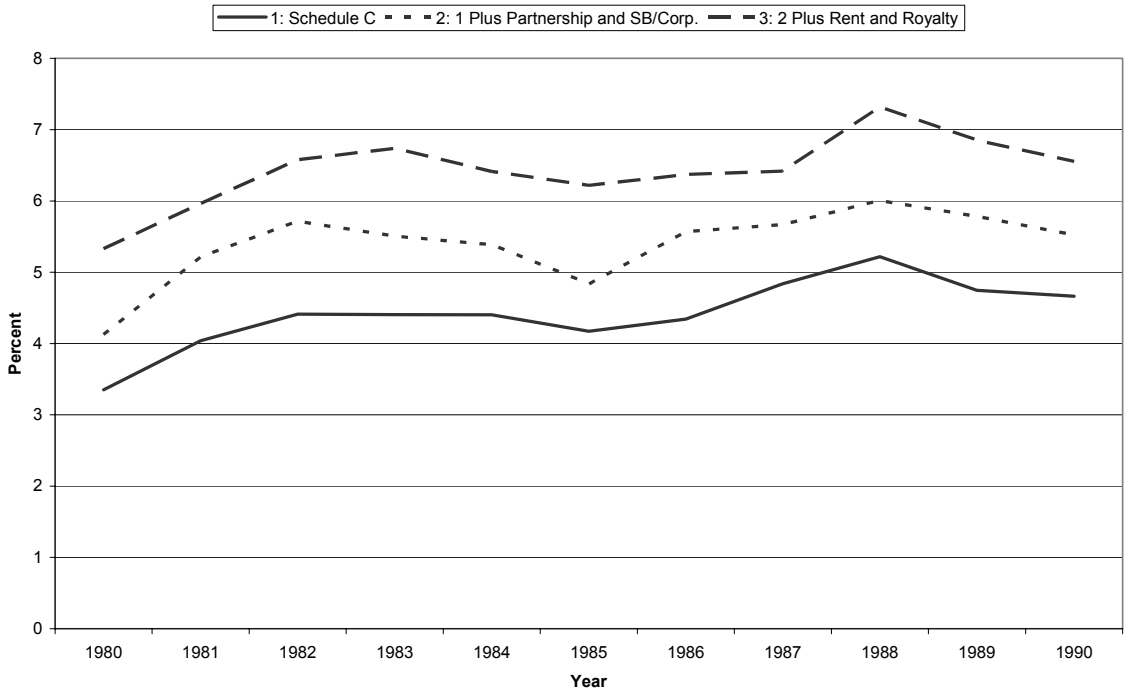

Figure 7: Entrepreneurial Exit

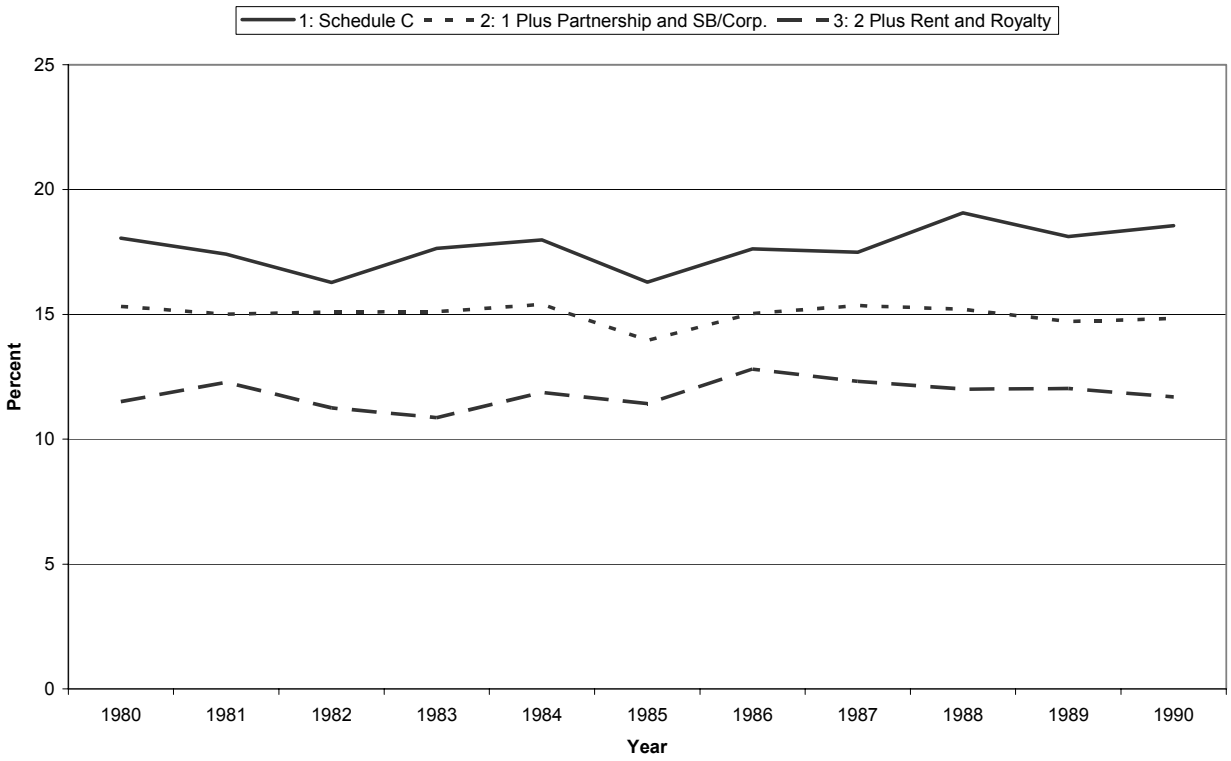

Figure 8: Entrepreneurial Exit among the Unmarried

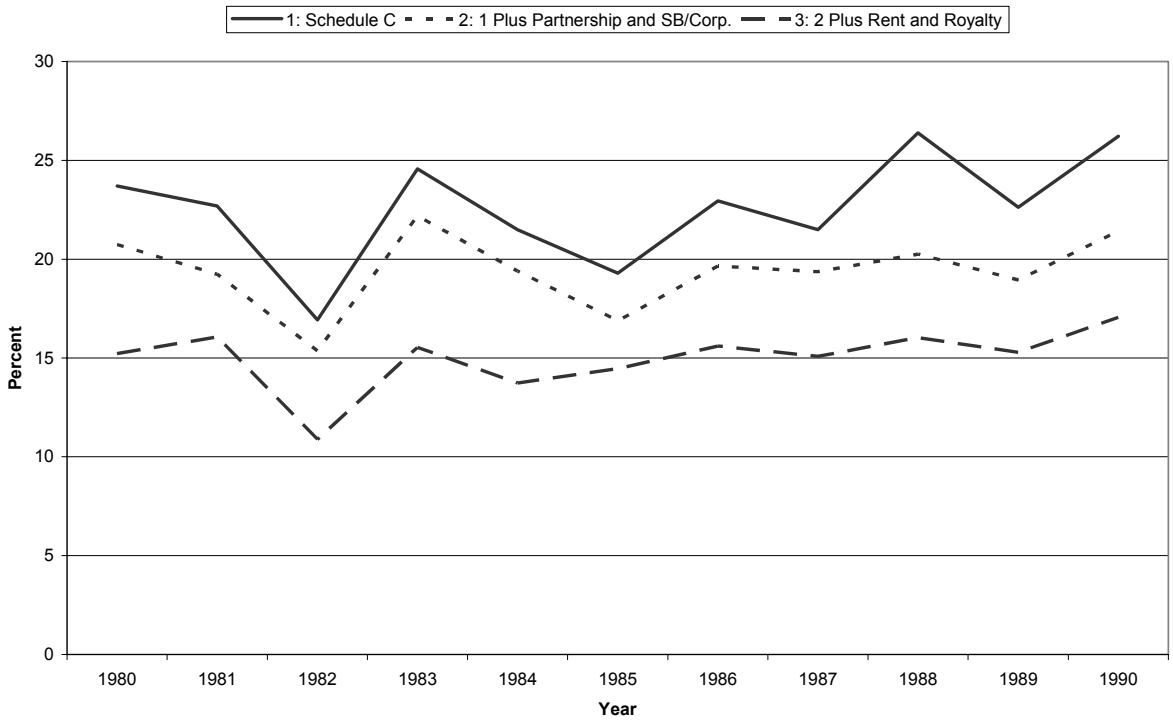

Figure 9: Entrepreneurial Exit among the Married

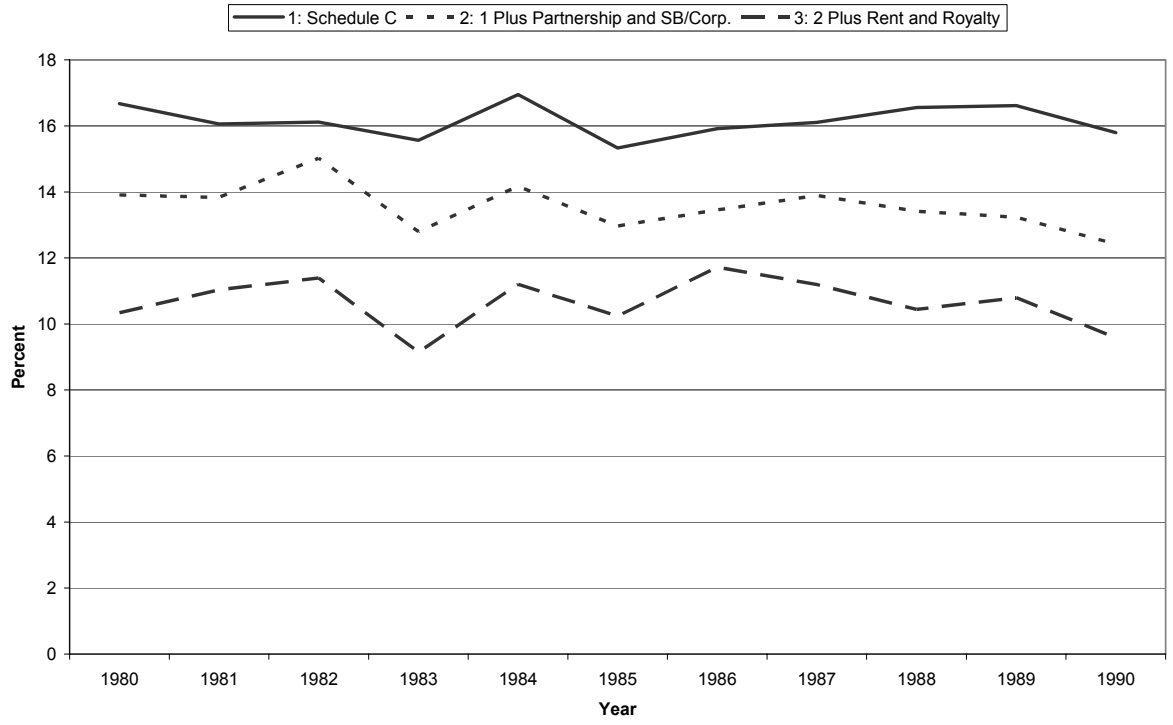

Figure 10: Wages and Predictions for Single Filers

Figure 11: Self-Employment Wages and Predictions for Single Filers

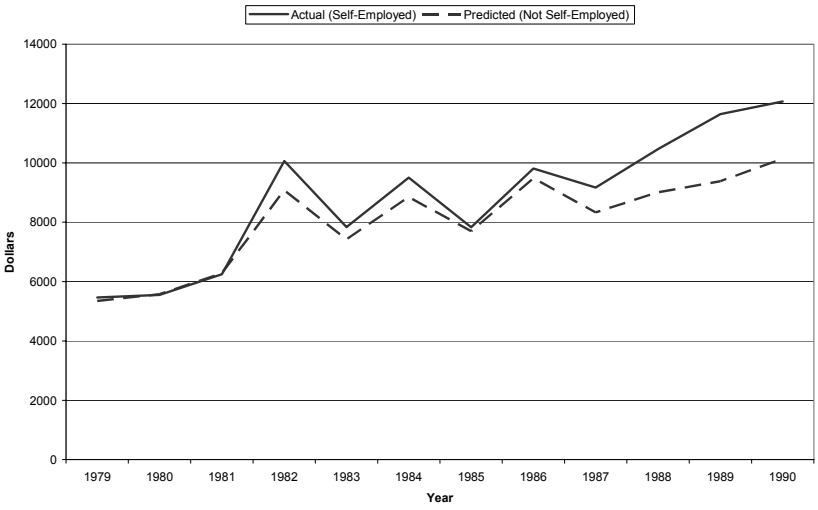

Figure 12: Self-employment Income and Predictions for Single Filers

Figure 13: Wages and Predictions for Married Filers

Figure 14: Self-Employment Wages and Predictions for Married Filers

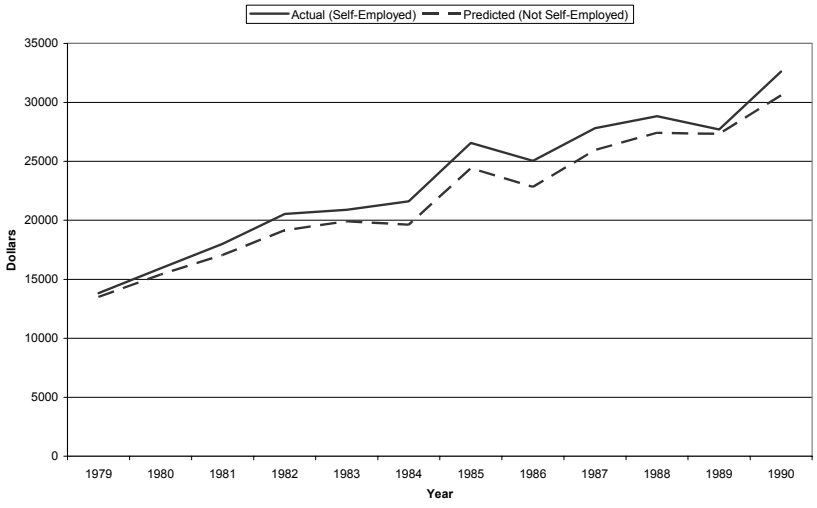

Figure 15: Self-employment Income and Predictions Married Filers

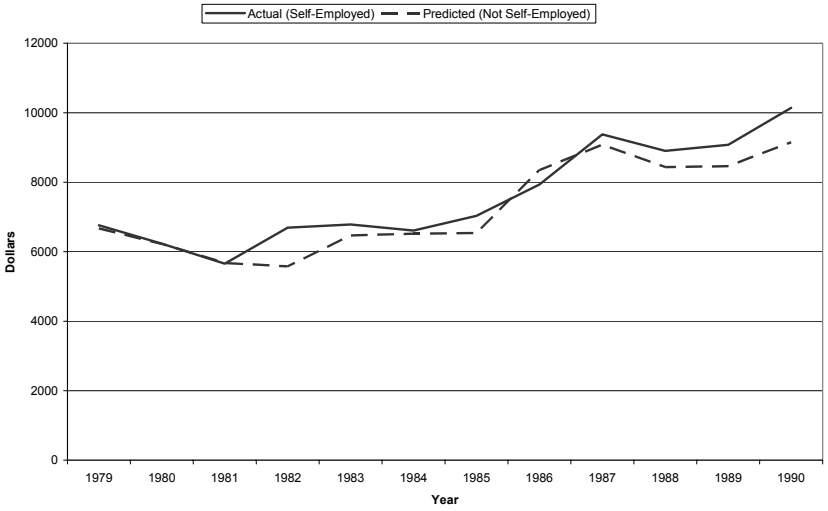

Table 1: Tax Rates by Filing Status and Entrepreneurship Status

		Marginal Tax Rates		Average Tax Rates	
ENTRY		**Did Not Enter**	**Entered**	**Did Not Enter**	**Entered**
Single	**Wage TR**	30.62	33.19	19.06	21.37
	Entrepreneurship TR	32.52	26.72	21.74	18.48
Married	**Wage TR**	36.92	37.82	16.27	18.13
	Entrepreneurship TR	34.99	33.05	17.57	17.65

		Marginal Tax Rates		Average Tax Rates	
EXIT		**Did Not Exit**	**Exited**	**Did Not Exit**	**Exited**
Single	**Wage TR**	31.77	31.89	21.27	20.49
	Entrepreneurship TR	26.55	32.00	21.53	22.74
Married	**Wage TR**	36.83	35.94	17.23	15.77
	Entrepreneurship TR	31.56	33.87	14.67	17.07

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.

Table 2: Summary Statistics for Key Analysis Variables

	Entry				Exit			
	Single		Married		Single		Married	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Entry 1	0.016	0.125	0.042	0.201				
Entry 2	0.020	0.140	0.052	0.222				
Entry 3	0.024	0.153	0.062	0.241				
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	0.097	0.295	0.121	0.326	0.092	0.289	0.090	0.286
West	0.201	0.401	0.187	0.390	0.279	0.448	0.230	0.421
Midwest	0.248	0.432	0.260	0.438	0.223	0.416	0.250	0.433
Northeast	0.234	0.423	0.205	0.404	0.194	0.395	0.169	0.375
Other Region	0.005	0.072	0.007	0.081	0.003	0.050	0.001	0.038
Missing Region	0.001	0.028	0.005	0.073	0.006	0.076	0.010	0.099
Mortgage Interest Ded.	0.094	0.292	0.398	0.490	0.234	0.424	0.503	0.500
Kids Home	0.286	0.746	1.125	1.280	0.325	0.754	1.227	1.258
Kids Away	0.018	0.182	0.023	0.209	0.036	0.251	0.016	0.179
Total Exemptions	1.407	0.931	3.312	1.352	1.546	0.988	3.392	1.286
Balance Due ($100)	-0.313	2.242	-0.349	9.579	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.

Table 3: Baseline Entrepreneurial Entry Analysis

	Single				Married			
	Non-IV		IV		Non-IV		IV	
	Coeff.	**S.E.**	**Coeff.**	**S.E.**	**Coeff.**	**S.E.**	**Coeff.**	**S.E.**
Wage MTR	**0.009**	0.001	**0.203**	0.048	0.002	0.001	**0.123**	0.019
Entrepreneurship MTR	**-0.044**	0.001	**-0.496**	0.098	**-0.015**	0.001	**-0.477**	0.048
Age 65	**-0.567**	0.063	-0.376	0.283	**-0.333**	0.059	**-1.736**	0.279
West	0.037	0.030	**-0.637**	0.180	**0.102**	0.028	**0.563**	0.084
Midwest	-0.028	0.030	-0.026	0.100	-0.010	0.027	**0.628**	0.111
Northeast	0.001	0.031	**0.496**	0.202	**-0.155**	0.031	**0.927**	0.152
Other Region	**-0.904**	0.256	-2.597	4.860	**-1.227**	0.281	-2.504	5.846
Missing Region	-0.049	0.353	1.810	5.760	0.077	0.119	**1.448**	0.303
Mortgage Interest Ded.	**0.069**	0.032	**-1.485**	0.336	**0.199**	0.021	**-0.575**	0.087
Kids Home	**-0.091**	0.033	0.197	0.117	**0.113**	0.027	-0.057	0.046
Kids Away	0.018	0.059	**0.384**	0.129	**0.140**	0.049	**0.280**	0.088
Total Exemptions	**0.057**	0.027	0.038	0.096	**-0.093**	0.024	**0.104**	0.045
Balance Due ($100)	**0.006**	0.003	**0.032**	0.015	0.001	0.001	**0.007**	0.003
Sample Size	91,461		91,461		83,909		83,894	

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). Standard errors for IV models are bootstrapped using 50 iterations of the model. MTR = Marginal Tax Rate.
Bold type indicates statistical significance at the five percent level or better.

Table 4: Entrepreneurial Entry Analysis - Alternative Entrepreneurship Measures

Measure 2	Single				Married			
	Non-IV		IV		Non-IV		IV	
	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
Wage MTR	**0.009**	0.001	**0.290**	0.020	0.000	0.001	**0.212**	0.014
Entrepreneurship MTR	**-0.047**	0.001	**-0.469**	0.016	**-0.034**	0.001	**-0.668**	0.020
Age 65	**-0.283**	0.051	**0.479**	0.089	**-0.330**	0.055	**0.655**	0.113
West	**0.104**	0.028	**-0.285**	0.040	**0.183**	0.028	**-0.076**	0.032
Midwest	**-0.064**	0.028	**-0.446**	0.037	**0.083**	0.026	**-0.590**	0.043
Northeast	**0.067**	0.029	**0.463**	0.048	0.058	0.030	**0.855**	0.058
Other Region	**-0.830**	0.229	**-2.699**	0.278	**-0.841**	0.192	**-2.202**	0.247
Missing Region	-0.118	0.469	**2.280**	0.490	**0.966**	0.144	**1.875**	0.152
Mortgage Interest Ded.	**0.270**	0.029	**-1.019**	0.070	**0.251**	0.021	**-1.124**	0.050
Kids Home	**-0.114**	0.032	**0.169**	0.051	**0.085**	0.026	**-0.293**	0.032
Kids Away	0.093	0.054	**0.428**	0.054	**0.172**	0.046	**0.551**	0.049
Total Exemptions	**0.053**	0.026	-0.053	0.041	**-0.065**	0.023	**0.447**	0.031
Balance Due ($100)	**0.045**	0.006	**0.058**	0.006	0.003	0.001	**0.044**	0.002
Sample Size	89,490		78,726		89,490		78,726	

Measure 3	Single				Married			
	Non-IV		IV		Non-IV		IV	
	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
Wage MTR	**0.017**	0.001	**0.278**	0.020	0.002	0.001	**0.184**	0.014
Entrepreneurship MTR	**-0.090**	0.002	**-0.366**	0.011	**-0.067**	0.001	**-0.267**	0.006
Age 65	**-0.436**	0.064	-0.055	0.121	**-0.504**	0.056	-0.010	0.122
West	**0.124**	0.037	-0.083	0.047	**0.205**	0.029	**0.215**	0.033
Midwest	-0.066	0.036	**-0.378**	0.046	**0.114**	0.027	-0.038	0.043
Northeast	0.026	0.038	-0.062	0.053	**0.076**	0.030	**0.154**	0.047
Other Region	**-1.259**	0.273	**-1.555**	0.255	**-0.692**	0.194	0.154	0.177
Missing Region	-1.044	0.726	**2.017**	0.745	**0.908**	0.192	**1.807**	0.199
Mortgage Interest Ded.	**0.334**	0.039	**-0.987**	0.077	**0.205**	0.022	**-0.532**	0.044
Kids Home	**-0.141**	0.042	**0.286**	0.060	**0.102**	0.026	**0.204**	0.031
Kids Away	0.073	0.073	**0.278**	0.074	**0.255**	0.048	**0.424**	0.050
Total Exemptions	0.025	0.033	**-0.291**	0.049	**-0.090**	0.024	**-0.188**	0.027
Balance Due ($100)	**0.063**	0.007	**0.049**	0.008	**0.006**	0.002	0.001	0.003
Sample Size	85,842		85,842		71,271		71,271	

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. MTR = Marginal Tax Rate.
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.

Table 5: Entrepreneurial Entry Analysis - Average Tax Rates

	Single					
	Measure 1		Measure 2		Measure 3	
	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
Wage ATR	**0.067**	0.007	**0.155**	0.015	**0.251**	0.018
Entrepreneurship ATR	**3.034**	0.117	**7.791**	0.287	**0.188**	0.019
Age 65	**27.847**	1.065	**76.467**	2.765	**5.319**	0.338
West	**2.314**	0.092	**0.642**	0.037	0.000	0.036
Midwest	**-1.225**	0.054	**1.465**	0.064	**-0.141**	0.036
Northeast	**-6.893**	0.261	**-19.390**	0.707	**-0.728**	0.055
Other Region	**2.594**	0.364	**-1.906**	0.258	**-0.907**	0.254
Missing Region	**-15.933**	0.693	**-29.430**	1.174	**-1.538**	0.706
Mortgage Interest Ded.	**7.963**	0.304	**17.916**	0.658	**0.831**	0.082
Kids Home	**4.454**	0.172	**12.246**	0.443	**0.764**	0.067
Kids Away	**-2.658**	0.118	**-3.813**	0.156	**0.159**	0.071
Total Exemptions	**-1.462**	0.062	**-8.647**	0.313	**-0.475**	0.045
Balance Due ($100)	-0.001	0.004	**0.011**	0.006	**0.047**	0.007
Sample Size	91,381		89,412		85,766	

	Married					
	Measure 1		Measure 2		Measure 3	
	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
Wage ATR	**-0.920**	0.175	**10.052**	2.147	**0.894**	0.099
Entrepreneurship ATR	**1.303**	0.119	**1.063**	0.103	**-48.714**	4.716
Age 65	0.571	1.565	**91.173**	18.117	**-292.454**	29.027
West	**0.085**	0.036	**1.509**	0.300	**-18.976**	1.866
Midwest	-0.171	0.243	**-13.893**	2.730	**39.137**	3.903
Northeast	**-0.962**	0.378	**-20.022**	3.738	**75.119**	7.441
Other Region	**1.204**	0.366	**-10.798**	1.648	**31.896**	3.201
Missing Region	**-5.762**	1.001	**-57.866**	11.151	**268.387**	26.410
Mortgage Interest Ded.	**3.934**	0.473	**-21.023**	4.755	**-53.549**	5.033
Kids Home	**0.377**	0.065	**2.981**	0.589	**17.987**	1.712
Kids Away	**-0.375**	0.084	**-3.053**	0.491	**50.758**	4.916
Total Exemptions	**-0.390**	0.037	**1.131**	0.244	**-23.573**	2.286
Balance Due ($100)	-0.002	0.002	**-0.053**	0.010	**0.392**	0.038
Sample Size	83,965		78,695		71,239	

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. All tax rates are fitted values from first-stage instrumental variables regressions. ATR = Average Tax Rate.
Bold type indicates statistical significance at the five percent level or better.

Table 6: Entrepreneurial Entry Analysis - Robustness Checks

		Single		Married	
		Coeff.	**S.E.**	**Coeff.**	**S.E.**
Baseline (for comparison)	**Wage MTR**	**0.203**	0.016	**0.123**	0.009
	Entrepreneurship MTR	**-0.496**	0.029	**-0.477**	0.017
MTR based on "other income"	**Wage MTR**	**0.203**	0.016	**0.123**	0.009
	Entrepreneurship MTR	**-0.401**	0.023	**-0.427**	0.015
Include only those whose filing status does not change	**Wage MTR**	**0.270**	0.023	**0.122**	0.009
	Entrepreneurship MTR	**-0.589**	0.038	**-0.472**	0.017
Include only those who are in the panel for the full twelve years	**Wage MTR**	**0.166**	0.029	**0.131**	0.015
	Entrepreneurship MTR	**-0.537**	0.095	**-0.511**	0.028
MTR Differential	**Wage MTR - Entrep. MTR**	**0.156**	0.008	**0.178**	0.097

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 3. All tax rates and differentials are fitted values from first-stage instrumental variables regressions. MTR = Marginal Tax Rate. See text for additional details. **Bold type** indicates statistical significance at the five percent level or better.

Table 7: Baseline Entrepreneurial Exit Analysis

	Single				Married			
	Non-IV		IV		Non-IV		IV	
	Coeff.	**S.E.**	**Coeff.**	**S.E.**	**Coeff.**	**S.E.**	**Coeff.**	**S.E.**
Wage MTR	**-0.009**	0.003	**-0.334**	0.074	**-0.008**	0.002	**-0.193**	0.022
Entrepreneurship MTR	**0.039**	0.003	**0.632**	0.228	**0.015**	0.001	**0.380**	0.141
Age 65	**-0.865**	0.163	**-1.158**	0.522	0.076	0.090	0.452	0.686
West	**-0.250**	0.097	**0.806**	0.325	-0.068	0.048	-0.343	0.186
Midwest	-0.195	0.102	-0.087	0.259	-0.052	0.047	-0.360	0.280
Northeast	-0.164	0.104	-0.613	0.465	**-0.283**	0.055	**-0.931**	0.407
Other Region	0.070	0.659	2.093	3.812	0.136	0.438	0.917	2.751
Missing Region	-0.707	0.506	-2.779	3.266	-0.230	0.182	**-1.223**	0.471
Mortgage Interest Ded.	**-0.208**	0.082	**2.183**	0.671	-0.024	0.035	**0.869**	0.169
Kids Home	-0.178	0.101	**-0.735**	0.305	0.007	0.046	0.035	0.113
Kids Away	-0.280	0.148	**-0.777**	0.389	0.019	0.096	-0.200	0.166
Total Exemptions	**0.271**	0.079	0.442	0.273	-0.001	0.043	-0.069	0.114
Balance Due ($100)	0.003	0.004	-0.031	0.022	-0.002	0.002	-0.005	0.006
Sample Size	5,109		5,109		17,099		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). Standard errors for IV models are bootstrapped using 50 iterations of the model. MTR = Marginal Tax Rate.
Bold type indicates statistical significance at the five percent level or better.

Table 8: Entrepreneurial Exit Analysis - Alternative Entrepreneurship Measures

Measure 2	Single				Married			
	Non-IV		IV		Non-IV		IV	
	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
Wage MTR	**-0.006**	0.003	**-0.355**	0.024	**-0.003**	0.001	**-0.249**	0.012
Entrepreneurship MTR	**0.041**	0.003	**0.750**	0.084	**0.022**	0.001	**0.488**	0.047
Age 65	**-0.593**	0.137	**-1.404**	0.214	0.132	0.084	**0.563**	0.248
West	**-0.305**	0.094	**0.218**	0.096	**-0.099**	0.045	**-0.523**	0.081
Midwest	-0.151	0.098	**0.383**	0.100	-0.075	0.044	**-0.426**	0.104
Northeast	-0.178	0.100	**-1.009**	0.207	**-0.302**	0.051	**-1.628**	0.195
Other Region	0.323	0.714	**2.110**	0.707	-0.128	0.391	-0.168	0.405
Missing Region	**-1.639**	0.419	**-3.741**	0.504	**-0.826**	0.147	**-1.347**	0.164
Mortgage Interest Ded.	**-0.314**	0.076	**1.599**	0.152	**-0.174**	0.032	**0.893**	0.061
Kids Home	-0.105	0.099	**-0.312**	0.128	0.036	0.044	0.056	0.052
Kids Away	**-0.373**	0.146	**-0.891**	0.152	0.009	0.090	**-0.289**	0.094
Total Exemptions	**0.223**	0.076	0.186	0.115	-0.026	0.041	**-0.095**	0.048
Balance Due ($100)	**-0.018**	0.006	**-0.067**	0.008	**-0.003**	0.002	**-0.007**	0.002
Sample Size	7,080		7,080		22,379		22,379	

Measure 3	Single				Married			
	Non-IV		IV		Non-IV		IV	
	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
Wage MTR	**-0.022**	0.002	**-0.390**	0.023	**-0.009**	0.001	**-0.264**	0.013
Entrepreneurship MTR	**0.060**	0.003	**0.464**	0.022	**0.040**	0.001	**0.306**	0.018
Age 65	**-0.560**	0.106	**-0.749**	0.177	0.124	0.081	**-0.502**	0.152
West	**-0.234**	0.083	0.100	0.098	**-0.119**	0.046	**-0.165**	0.057
Midwest	-0.039	0.083	**0.467**	0.099	-0.082	0.044	**0.156**	0.062
Northeast	**-0.212**	0.088	-0.013	0.107	**-0.369**	0.052	**-0.568**	0.082
Other Region	-0.072	0.561	**2.275**	0.600	-0.438	0.294	-0.413	0.402
Missing Region	**-1.273**	0.425	**-3.306**	0.473	**-0.999**	0.166	**-1.736**	0.189
Mortgage Interest Ded.	**-0.426**	0.069	**1.463**	0.114	**-0.245**	0.033	**0.789**	0.055
Kids Home	-0.034	0.088	**-0.700**	0.109	0.075	0.044	**-0.135**	0.051
Kids Away	**-0.419**	0.145	**-0.702**	0.155	0.071	0.088	**-0.249**	0.098
Total Exemptions	**0.216**	0.069	**0.749**	0.087	-0.058	0.041	**0.120**	0.048
Balance Due ($100)	-0.004	0.005	**-0.040**	0.006	**-0.004**	0.002	-0.003	0.002
Sample Size	10,729		10,729		29,834		29,834	

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. MTR = Marginal Tax Rate.
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.

Table 9: Entrepreneurial Exit Analysis - Average Tax Rates

	Single					
	Measure 1		Measure 2		Measure 3	
	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
Wage ATR	**-0.008**	0.002	**0.007**	0.003	**0.007**	0.003
Entrepreneurship ATR	**0.019**	0.002	**0.703**	0.079	**0.390**	0.020
Age 65	**-0.808**	0.162	**0.521**	0.170	**1.339**	0.150
West	**-0.257**	0.096	**-0.293**	0.093	**-0.478**	0.098
Midwest	-0.162	0.102	-0.020	0.098	0.007	0.097
Northeast	-0.100	0.104	**-1.630**	0.199	**-0.728**	0.108
Other Region	-0.317	0.659	**1.662**	0.727	**1.513**	0.593
Missing Region	-0.636	0.504	**-2.126**	0.458	**-1.758**	0.472
Mortgage Interest Ded.	**-0.190**	0.082	**0.634**	0.123	**0.299**	0.084
Kids Home	-0.197	0.102	**0.468**	0.119	0.153	0.101
Kids Away	-0.209	0.147	**-0.735**	0.150	**-0.527**	0.159
Total Exemptions	**0.283**	0.079	**-0.443**	0.108	0.039	0.079
Balance Due ($100)	0.005	0.003	**-0.063**	0.008	**-0.029**	0.006
Sample Size	5,104		7,080		10,729	

	Married					
	Measure 1		Measure 2		Measure 3	
	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
Wage ATR	**-0.004**	0.002	**0.003**	0.001	0.002	0.002
Entrepreneurship ATR	**0.373**	0.037	**0.439**	0.042	**0.273**	0.017
Age 65	**1.995**	0.208	**2.323**	0.216	**1.516**	0.119
West	**-0.533**	0.069	**-0.708**	0.075	**-0.390**	0.057
Midwest	**-0.764**	0.087	**-0.924**	0.094	**-0.431**	0.057
Northeast	**-1.376**	0.125	**-2.059**	0.177	**-1.158**	0.079
Other Region	**1.260**	0.459	0.415	0.395	0.180	0.398
Missing Region	**-0.780**	0.200	**-1.240**	0.159	**-1.515**	0.189
Mortgage Interest Ded.	**0.334**	0.048	**0.221**	0.046	0.059	0.040
Kids Home	**0.197**	0.051	**0.219**	0.048	0.045	0.049
Kids Away	-0.130	0.098	**-0.219**	0.092	-0.181	0.096
Total Exemptions	**-0.205**	0.048	**-0.200**	0.045	-0.007	0.045
Balance Due ($100)	**-0.007**	0.002	**-0.010**	0.002	**-0.007**	0.002
Sample Size	17,098		22,379		29,834	

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.
All Entrepreneurship tax rates except those for Single Measure 1 are fitted values from first-stage instrumental variables regressions. See text for additional details. ATR = Average Tax Rate.
Bold type indicates statistical significance at the five percent level or better.

Table 10: Entrepreneurial 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
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 3. 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.

Table 11: Entrepreneurial Survival Analysis - Preliminary Statistics

SINGLE
Total Number of Spells = 184
Total Number of Exits = 142

Year	At Risk	Exits	Right Censored	Kaplan-Meier Survivor Function
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

Year	At Risk	Exits	Right Censored	Kaplan-Meier Survivor Function
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).

Table 12: Baseline Entrepreneurial 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. 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.

Table 13: Entrepreneurial Survival Analysis - Robustness Checks

		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
Non-IV Marginal Tax Rates	**Wage MTR**	0.996	0.009	1.001	0.005
	Entrepreneurship MTR	**0.967**	0.009	0.993	0.004
IV Average Tax Rates	**Wage ATR**	0.852	0.114	*	*
	Entrepreneurship ATR	2.353	1.081	*	*
Non-IV Average Tax Rates	**Wage ATR**	1.010	0.009	1.012	0.006
	Entrepreneurship ATR	0.988	0.008	0.993	0.005

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 3. All tax rates and differentials are fitted values from first-stage instrumental variables regressions. MTR = Marginal Tax Rate. See text for additional details.
* = Model would not converge.
Bold type indicates statistical significance at the five percent level or better.

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 Nontaxable 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

MTR Regressions	Single				Married			
	Wage		Entrepreneurship		Wage		Entrepreneurship	
	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	

ATR Regressions	Single				Married			
	Wage		Entrepreneurship		Wage		Entrepreneurship	
	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
Instrument	**1.017**	0.018	**-0.316**	0.031	**-0.050**	0.021	**-0.202**	0.012
Age 65	**-12.094**	0.161	**-9.105**	0.095	**-8.244**	0.139	**-6.488**	0.119
West	**0.645**	0.122	**-0.749**	0.062	-0.120	0.111	-0.083	0.079
Midwest	**0.402**	0.115	**0.378**	0.059	**1.276**	0.102	**1.002**	0.073
Northeast	**1.583**	0.118	**2.232**	0.060	**1.861**	0.110	**1.901**	0.078
Other Region	**1.697**	0.400	**-1.151**	0.281	0.632	0.374	**-1.478**	0.317
Missing Region	1.737	0.911	**5.258**	0.638	**3.616**	0.334	**7.023**	0.297
Mortgage Interest Ded.	**2.085**	0.112	**-2.582**	0.070	**2.533**	0.062	**-1.058**	0.051
Kids Home	**-2.372**	0.097	**-1.463**	0.064	**-0.255**	0.069	**-0.376**	0.060
Kids Away	**-0.412**	0.179	**0.871**	0.120	0.196	0.139	**0.528**	0.121
Total Exemptions	**0.954**	0.079	**0.501**	0.053	-0.117	0.062	**0.139**	0.054
Balance Due ($100)	**-0.049**	0.009	0.002	0.007	**0.009**	0.002	**0.008**	0.002
Sample Size	96,486		96,570		101,068		101,101	

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; ATR = Average Tax Rate.
Bold type indicates statistical significance at the five percent level or better.