TAX POLICY AND ENTRY INTO ENTREPRENEURSHIP

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Abstract

While recent research has emphasized the desirability of studying effects of changes in marginal tax rates on taxable income, broadly defined, there has been comparatively little analysis of effects of marginal tax rate changes on entrepreneurial entry. This margin is likely to be important both because of the likely greater elasticity of entrepreneurial decisions with respect to tax changes (relative to decisions about hours worked) and because of recent research linking entrepreneurship, mobility, and household wealth accumulation. Previous work focuses on how marginal tax rates affect work incentives, incentives to take compensation in taxable forms, and reporting incentives. In addition, both the level and the progressivity of tax rates can affect decisions about risky activities. The tax system offers insurance for taking risk because taxes depend on outcomes; however, asymmetric taxes on different outcomes, such as progressive rates, may discourage risk taking. Using the Panel Study of Income Dynamics for 1979-1993, we incorporate both of these effects of the tax system in empirical estimations of the probability that people enter self employment. While the level of the marginal tax rate does not affect entry into self employment in a consistent manner across specifications, we find robust results that progressive marginal tax rates discourage entry into self-employment and into business ownership. Our estimates of the effects of the convexity of the tax schedule on entrepreneurial entry are rather large. For example, we estimate that the Omnibus Budget Reconciliation Act of 1993, which raised the top marginal tax rate, lowered the probability of entry into self employment for upper-middle-income households by as much as 20 percent. Our estimated effects are robust to controlling for differences in family structure, spousal income, and measures of transitory income.

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I. Introduction

In surveying the literature on taxes and portfolio choice, Poterba (2001) observes that risk-taking has received considerably less research attention than the level of saving, despite the prominent role of risk in many investments. One reason for the lack of empirical research on taxes and risk-taking is that theoretical predictions are often ambiguous with regards to how taxes should affect risky investments (see Domar and Musgrave, 1944, for a seminal contribution; Sandmo, 1985, and Poterba, 2001, summarize this body of research). While a tax on a risky investment lowers its expected return, it also reduces the variance of the returns which offers a form of insurance. To further complicate empirical work, with nonlinear tax schedules, risk taking depends on the entire tax schedule rather than merely the marginal tax rate.

In this paper, we study the effects of the tax system on one particular risky investment – the decision to enter entrepreneurship. Given recent research on the significance of business ownership in explaining aggregate wealth accumulation and its distribution (see, *e.g.*, Gentry and Hubbard, 2000; and Quadrini, 1999), understanding how taxes affect this decision may have important implications for overall savings and growth. Previous research (see Gordon, 1998; or Bruce, 2000) on taxes and entrepreneurship emphasizes how differences in the tax rate and the tax base between entrepreneurship and working for someone, suggesting that higher tax rates on employment may increase the attractiveness of self employment. However, research by Carroll, Holtz-Eakin, Rider, and Rosen (2000a, 2000b, and 2001) concludes that the theoretical effect of the tax rate on entrepreneurial activity is ambiguous given the myriad of interactions between the entrepreneur's own time and other inputs; empirically, these authors find that lower marginal tax

rates increase sole proprietors' income, investment, and propensity to hire workers.

In addition to the ambiguous effect of the level of tax rates on entrepreneurial decisions, the discrete nature of starting a business and the risk associated with new firms suggest that non-linearities in the tax system may play a prominent role in the entry decision. With progressive tax rates or if the tax system provides imperfect loss offsets, the government claims a larger share of the payoffs for successful entrepreneurs than it claims from less successful entrepreneurs. This asymmetric treatment of success can discourage entry into risky business ownership and is central to our empirical analysis. We examine whether the nonlinearities in the tax system discourage potential entrants from taking risks.

Outside the context of tax policy, nonlinearities in rewards play a major role in incentive contracting models (see, *e.g.*, Holmstrom and Milgrom, 1987; and the survey in Prendergast, 1999). In these models, principals offer managers (agents) a nonlinear compensation schedule to help align the manager's incentives with those of the principal. With an incentive contract, the agent's income increases when outcomes are good; in contrast, an increase in tax progressivity implies the opposite – the return to success is lower than it would be with less progressive taxes. While the theory of such contracts is well developed, empirical tests of these models have been limited (see, *e.g.*, Prendergast, 1999; and Himmelberg and Hubbard, 2000). By analogy, our analysis tests whether behavior responds to the extent to which returns are nonlinear.

Using time-series and cross-sectional variation in tax schedules faced by households in the Panel Study on Income Dynamics (PSID) over the period from 1979 to 1993, our empirical results imply a significant increase in entrepreneurial entry when tax rates are less progressive. For example, we estimate that the Omnibus Budget Reconciliation Act of 1993, which raised the

top marginal tax rate, lowered the probability of entry into self employment for upper-middle-income households by as much as 20 percent. Whether such encouragement is efficient (that is, stimulating the most talented entrepreneurs) is a topic for future research. In contrast, we do not find support for the hypothesis that the level of the tax rate affects entry into self employment.

The paper is organized as follows. Section II reviews previous literature and background issues concerning entrepreneurship, taxation, and the effects of convexity in the tax schedule. Section III provides a simple model of how progressivity affects the incentives for entering entrepreneurship. In section IV, we discuss our empirical strategy for measuring the effects of tax progressivity on entry into entrepreneurship. Section V presents our empirical results based on self employment, including a variety of specifications to check the robustness of our results; section VI presents results defining entry based on owning business assets. We conclude in section VII by discussing the implications of our results and future research directions.

II. Entrepreneurship and Tax Policy: Background

In this section, we discuss important features of entrepreneurship, including the variability of returns which is critical to how taxes may affect entry decisions. We also review previous studies on how taxes affect self employment and entrepreneurs. Finally, we place our work in the context of previous work on how convexity in tax schedules affects behavior as well as other models in which nonlinear payoffs affect incentives.

II.A. Self Employment, Business Ownership, and "Entrepreneurship"

Our focus on "entrepreneurship" raises an important question for empirical work: What does it mean to be an "entrepreneur"? Descriptions of entrepreneurship span a broad spectrum

of activities. One end of this spectrum has businesses with a single worker, or businesses in which the owner hires a few employees. The capital requirements for such businesses, while possibly modest by the standards of corporate-based investment, may be large relative to the resources available to the entrepreneur. At the other end of the entrepreneurial spectrum are businesses that, for reasons related to economies of scale, start with substantial capital requirements (sometimes raised through the backing of venture capitalists) and many employees.

Our theoretical arguments about tax convexity should apply across this spectrum of entrepreneurial ventures. However, we focus on relatively small ventures due to two empirical concerns. First, to have sufficient panel data for empirical work, we use the PSID, so we define entrepreneurship as self employment or, for a subset of years, ownership of business assets. Second, our measure of the relevant tax rate convexity facing a potential entrant depends on his or her current labor earnings; this measure is less relevant for capturing the convexity facing large, venture-capital-backed businesses. Nonetheless, to the extent that some large-scale start-up firms begin as small businesses, our results may shed light on their initial entry decisions.

Across this spectrum of entrepreneurs, one common feature is that entrepreneurship is a risky business. Many small businesses fail while a small number of new businesses do extremely well. Holtz-Eakin, Rosen, and Weathers (2000) find that households entering self employment experience more mobility in the income distribution (both upward and downward) than households that continue working for someone else. Hamilton (2000) documents that the distributions of returns to self employment are skewed. Borjas (1999) reports that the standard deviation of log weekly income is higher among the self employed than among paid employees; however, the gap in variability of income narrowed during the 1980s and 1990s.

Entrepreneurs also face differential mobility in the wealth distribution. Quadrini (1999) shows that, conditional on survival, entrepreneurs have a greater probability of moving up in the wealth distribution. Of course, entrepreneurs that fail are more likely to move down in the wealth distribution. Similarly, Gentry and Hubbard (2000) find that both continuing entrepreneurs and new entrepreneurs experience more mobility in terms of the distribution of wealth, income, and the ratio of wealth to income. Taken together, this evidence suggests that entrepreneurship entails more variable payoffs than continuing to work for someone else, which is an important underlying assumption of our framework.

The social mobility associated with entrepreneurship is a one reason why someone might leave a relatively safe job for the uncertainties of entrepreneurship; many entrants perceive that they will enjoy the upward mobility rather than the downward mobility. Entrepreneurship's role in social mobility has lead researchers to study how demographic differences in self employment relate to differences in economic advancement across demographic groups.[1] Fairlie and Meyer (1996) describe the wide-ranging pattern of self employment across 60 ethnic and racial groups in the United States. Across these groups, Fairlie and Meyer find that groups with high rates of self employment also have high self-employment earnings relative to working for someone else, suggesting that the self-employment decision is related to the relative returns to self employment and to working for someone else.

While risk and return play a role in the decision to become self employed, many other factors also affect this decision. First, limited access to capital constrains some potential entrants

[1]The literature on self employment and demographics also considers the role of discrimination in both labor and capital markets. In addition to Fairlie and Meyer's discussion of this issue, see Hout and Rosen (2000) who consider racial considerations as well as intergenerational linkages in self-employment decisions.

(Gentry and Hubbard, 2000, survey this literature). Second, intergenerational considerations (see Hout and Rosen, 2000) could influence the entry decision through a number of channels, including the transmission of human capital specific to running a business, attitudes towards risk, financial capital, or simply being part of the family business. Third, in analyzing the long-term trends in self employment, Fairlie and Meyer (2000) emphasize the role of technology and scale of production in the rate of self employment. Fourth, as argued by Hamilton (2000), self employment may offer non-pecuniary benefits, such as the value of "being the boss," that result in the observed compensation of the self employed being less than the wages of those who work for someone else. The unobserved value of these benefits complicates measuring the true return to self employment; furthermore, by their nature, these benefits are exempt from taxation.

Many of these factors clearly affect the distribution of returns from self employment. For example, credit-constrained potential entrants may have projects with high expected rates of return. Other factors, such as preferences over control, are not directly related to the distribution of returns; however, in deciding whether to enter entrepreneurship, potential entrants face a trade off between the risk and return issues and other issues.[2]

II.B. Taxes and Self Employment

Despite the public policy interest in self employment and business formation, previous research on whether the tax system affects these decisions is limited. Most previous research on taxes and self employment has focused on the effects of differential taxation between self employment and working for someone else (see, *e.g.*, Long, 1982a; Gordon, 1998; and Bruce,

[2] A separate question is how household characteristics may affect the extent to which someone responds to risk, return, and nonlinearities in rewards. For example, responsiveness to nonlinearities may depend on risk aversion, which might depend on age or family structure; in our sensitivity analysis, we explore whether the responsiveness to convexity varies across groups of households.

2000). While these tax differentials can arise from differences in explicit tax rates (*e.g.*, before 1984, the self-employed faced a lower payroll tax rate than those who worked for others), they are typically created by differences in the tax bases between the two employment options (*e.g.*, before 1987, the self employed could not deduct the cost of "employer-provided" health insurance). In addition to the legislated differences in the tax bases for different employment choices, this literature emphasizes that self employment allows more opportunities to avoid taxes through either misreporting of income or disguising personal consumption as a business expense. Even if both employment options face the same marginal tax rate, the value of these tax base differences increases with the level of the marginal tax rate.

Early empirical research on the time-series relationship between marginal tax rates and self employment (*e.g.*, Long, 1982a; and Blau, 1987) supported the claim that higher tax rates are associated with higher rates of self employment. Studies using household-level data (*e.g.*, Long, 1982b; Moore, 1983; and Schuetze, 2000) report that higher marginal tax rates are associated with higher probabilities of self employment. Bruce (2000) makes two important innovations over these previous studies. First, he focuses on the decision to enter self employment; in a companion paper (Bruce, 2002), he examines the decision to exit self employment. Second, he examines the difference in tax rates between self employment and working for someone else; because he only observes the actual tax rate in one employment choice, he uses household characteristics to estimate the tax rate in the other employment choice by estimating household income if it had chosen the other sector. He finds that an increase in the differential between the marginal tax rate when working for someone else and the marginal tax rate on self employment of "5 percentage points causes a reduction in the average self-

employment transition probability of about 2.4 percentage points." He concludes that taxes affect entry decisions, but these effects are not those arising from workers switching to self employment to avoid high taxes on wages; instead, the effect appears to go the opposite direction – workers who would face higher marginal tax rates in self employment are more likely to switch into self employment.

In recent research, Cullen and Gordon (2002) examine household entrepreneurial activity using tax return data; their model includes the option to incorporate, which is valuable if double taxation of corporate income leads to a lower tax burden than the tax rate for unincorporated enterprises. Their model also includes the effects of nonlinearities in income tax rates. They find that the tax system can have a large effect on entrepreneurship. For example, they "forecast that a shift to a 20% flat tax would virtually triple the self-employment rate" (p. 36).[3]

A second area of research on taxation and entrepreneurship examines the decisions of ongoing entrepreneurs regarding investment and hiring of outside workers. In three recent papers, Carroll, Holtz-Eakin, Rider, and Rosen (2000a, 2000b, and 2001) examine the effects of the tax reforms of the 1980s on investment and hiring decisions of small businesses and on small business income growth. They find that the tax reforms had statistically significant effects on both of these decisions and on the growth of business income. Thus, along these margins, entrepreneurs appear to respond to tax incentives.

A third area of research on taxation and entrepreneurship is on the role of capital gains taxation and venture capital (see, *e.g.*, Poterba, 1989). The ability of entrepreneurs to shift some

[3] They also report that uniformly reducing the marginal tax rate by five percentage points would decrease self employment. Thus it appears that their result for the flat tax depends on making the tax rates flatter rather than lower.

of their labor returns from ordinary income to less-heavily taxed capital gains income encourages entrepreneurial ventures; in addition, the capital gains tax can affect the supply of venture capital to start-up firms. Capital gains taxes are less relevant for our sample of smaller enterprises.[4]

Another channel through which the shape of the income tax schedule may affect entrepreneurial decisions is through its effect on risk-taking by risk-averse potential entrepreneurs. Since Domar and Musgrave (1944), public finance economists have studied ways in which a proportional tax with full loss offset can affect risk taking in a portfolio. Kanbur (1981), Peck (1989), and Boadway, *et al*. (1991) consider the discrete choice of entrepreneurship as well. When greater tax progressivity can offer insurance through the tax system against uninsured idiosyncratic risk, entry may be enhanced. Applying these models of risk-bearing to analysis of U.S. tax policy is complicated by the actual tax system offering less than full loss offsets for entrepreneurs. While these models make theoretical points about progressivity and

[4] Larger-scale entrants may also face convex tax schedules for many reasons. First, both the personal and corporate income taxes are relevant for these businesses. If the firm fails relatively quickly, it may never incorporate so that only the personal tax rate is relevant; however, if the business is successful, the marginal tax rate may be high if the business incorporates and faces both corporate and personal income taxes. The extent to which facing both the corporate and personal income tax raises the tax rate on success depends on the corporate tax rate structure and the amount of tax planning the entrepreneur undertakes; Cullen and Gordon (2002) argue that with sufficient tax planning, the option to incorporate could lower the tax rate on successful ventures relative to unsuccessful ventures. Second, given the loss offset rules for corporations and the graduated tax schedule for corporations with low incomes, the corporate income tax is nonlinear. Third, from the perspective of the firm's founder, tax convexity not only arises from the taxation of business income but also the tax on his or her labor compensation. Finally, while preferential capital gains tax rates may offer the founder an opportunity to sell a business before the income tax is levied on the future income generated by success, how much an outsider will pay for the business may depend on the firm's future expected after-tax cash flows. The higher the tax rate on the future expected business success, the lower the price received by the founder; thus preferential capital gains tax rates offer only partial relief from the convexity of the tax system.

entrepreneurial decisions, they have not been tested empirically.[5]

II.C. The Behavioral Effects of Convex Payoffs and Taxes

Recent research in areas other than entrepreneurship has pointed out that convexities in tax and transfer programs can have strong (and sometimes unintended) behavioral effects. For example, using simulation models, Hubbard, Skinner, and Zeldes (1995) find that non-linearities introduced by asset-based, means-test social insurance programs help explain the low saving of low-income households. Gruber and Yelowitz (1999) find strong empirical evidence of these affects using data on Medicaid eligibility. Feldstein (1995a) and Dick and Edlin (1997) point out that a non-government program – means-tested college financial aid rules – can have substantial effects on household saving behavior. In another example that is related to entrepreneurship, Fan and White (2000) consider the effects of state-level variation in bankruptcy exemptions on the likelihood of being self-employed. The link between these studies and our work is that they emphasize the behavioral consequences of tax policy when uncertain returns to investments face a convex tax schedule.[6]

Our emphasis on the interaction between behavior and nonlinear payoffs is common in the literature on incentive contracting (see, *e.g.*, Holmstrom and Milgrom, 1987; and the survey

[5] The general point that progressive taxation affects the variability of earnings and provides insurance has received empirical attention in other contexts. Progressive taxation may play a role in macroeconomics as an automatic stabilizer by reducing the variability of disposable income and consumption; Kniesner and Ziliak (2002) show that the U.S. tax reforms of the 1980s reduced the degree to which the tax system stabilized fluctuations in consumption.

[6] Our model of the effects of nonlinearities in the tax system departs from the traditional approach to analyzing effects of taxes on labor supply (see Hausman, 1985) that emphasizes how workers choose the number of hours to work when facing a nonlinear budget constraint. In addition to these traditional labor supply effects, our point is that when the "wage rate" is uncertain, a nonlinear tax system can affect employment choices even for a given number of hours.

in Prendergast, 1999) that emphasizes the role of nonlinear compensation schedules in aligning the incentives of principals and agents. One constraint in designing these contracts is that they often shift risk onto the risk-averse manager; from the perspective of the risk-averse manager, reducing the sensitivity of pay to performance offers insurance against these unforeseen bad outcomes. Thus, as with the incentives from the tax system for risk-taking, there can be countervailing incentive and insurance effects.

Despite the well-developed theory on incentive contracts, empirical tests of whether managerial actions respond to nonlinearities in payoffs has been limited (see, *e.g.*, Prendergast, 1999; and Himmelberg and Hubbard, 2000). For the most part, the empirical work has focused on relatively well-paid workers, such as corporate executives; one notable exception is Lazear (2000) who examines the effects of monetary incentives on the effort of automobile glass repairpeople; he finds that monetary incentives enhance worker productivity. By analogy, our empirical analysis can be viewed as using the tax system to identify variation in the nonlinear payoffs to engaging in a risky venture across workers throughout the income distribution.

III. Tax Policy and Entrepreneurial Selection

As emphasized by previous research, to the extent that entrepreneurship is a discrete choice, average tax rates on entrepreneurial activity can affect entry, as a potential entrant compares after-tax returns to work and entrepreneurship. However, to the extent that rewards to entrepreneurship are more variable than rewards to work and loss offsets are imperfect, greater convexity of the tax schedule (as, for example, with an increase in progressivity) can discourage entrepreneurial activity by raising the average tax burden. Consider the following illustrative

example of a risk-neutral individual *i* considering entry into entrepreneurship. For simplicity, we abstract from capital income and assume that he or she receives certain wage income of W_i as an employee.[7] An entrant faces uncertain income. With a probability of π, the entrant is successful and earns income *ES*; with a probability of $(1 - \pi)$, the entrant is unsuccessful and earns income EU_i.

To highlight the effects of a nonlinear income tax, assume that the individual faces a piecewise-linear income tax with three brackets and increasing marginal tax rates across the brackets. The first bracket has a marginal tax rate of t_1 and covers the first B_1 dollars of income. The second bracket has a marginal tax rate of t_2 and covers income between B_1 and B_2 dollars of income. In the third bracket, a marginal tax rate of t_3 applies to income above B_2 dollars. For analyzing the effects of changes in marginal tax rates, the interesting case to analyze is where each of the three possible levels of income fall in a different bracket. This case is characterized by $EU_i < B_1 < W_i < B_2 < ES_i$.

For entrepreneurial selection, the individual compares expected after-tax consumption (income less the tax liability) across entrepreneurship and employment. The risk-neutral individual will choose entrepreneurship when $(1 - \pi)(1 - t_1)EU_i + \pi(1 - t_3)ES_i - (1 - t_2)W_i + \pi[(t_2 - t_1)B_1 + (t_3 - t_2)B_2] - (t_2 - t_1)B_1$ is greater than zero. The first two terms of this expression represent the expected after-tax consumption from entering entrepreneurship assuming that the marginal tax rate in the bracket applies to all income. The third term is the after-tax consumption from being an employee assuming that the marginal tax rate applies to all income.

[7] To include capital income, one could think of W_i capturing the return to investing capital assets in safe assets and the return to entrepreneurship as including the variable return to the portion of the portfolio invested in the entrepreneurial enterprise as well as the returns to safe assets held in the remainder of the portfolio.

The fourth term represents the value of income below the lower-tax- bracket cutoffs being taxed at a rate below t_3 when the entrant is successful. The last term captures the tax savings from the lower bracket when the individual works as an employee.

Examining comparative statics of this expression for the expected gain from entry confirms that the probability of entry increases with either EU_i or ES_i, but decreases with an increase in wage income W_i. Assuming that after-tax consumption is higher for a successful entrepreneur than for an unsuccessful one, the probability of entry increases with the probability of success.

For our purposes, the more important comparative statics involve the tax parameters. The derivative with respect to the lower marginal tax rate t_1 is equal to $(1 - \pi)(B_1 - EU_i)$ which is strictly positive by the assumption that the income with the unsuccessful outcome is less than the first bracket cutoff. Thus entry is more likely when the marginal tax rate in the first bracket is closer to the marginal tax rate in the second tax bracket. This is because an unsuccessful entrant loses the value of earning income taxed at the lower-bracket's tax rate. Intuitively, when t_1 increases, this value is reduced. As the gap between t_1 and t_2 increases holding t_2 constant, entry is more likely.

For an increase in the higher marginal tax rate t_2, the change in the entry decision is ambiguous. The derivative of the entry expression is $(W_i - B_1) - \pi(B_2 - B_1)$. The change in the tax rate for the middle tax bracket does not affect after-tax income for unsuccessful entrants but it lowers the after-tax income of workers by the change in the tax rate times $(W_i - B_1)$ and lowers the after-tax income of successful entrants by the change in the tax rate times $(B_2 - B_1)$. While the first change makes entry more attractive by lowering the returns to working, the second

change makes entry less attractive by lowering the return to being successful. While the second effect is larger than the first, it only happens with a probability π, so the overall effect is ambiguous.

An increase in t_3 has an unambiguous negative effect on the entry decision. The derivative with respect to the entry expression is $\pi(B_2 - ES_i)$ which is negative given the assumption that the successful entrepreneur is in the highest marginal tax bracket. This result arises because the increase in the top tax rate reduces the rewards to successful entry.

The location of the tax brackets can also affect the entry decision. The derivative with respect to the first-bracket cutoff is $(\pi - 1)(t_2 - t_1)$, which is negative if marginal tax rates increase with income. An increase in the lower bracket cutoff makes entry less attractive by increasing the cost of not earning more than B_1 (which the individual earns with certainty as a worker). An increase in the second-bracket cutoff makes entry more attractive since it increases the after-tax rewards for successful entrants by lowering the average tax rate (even if it does not affect the marginal tax rate).

If the marginal tax rate is constant, then the income tax reduces the difference between the expected income as an entrant and as a worker but the income tax cannot change the sign of entry decision for a risk neutral potential entrant. This flat tax rate case is the commonly analyzed analogue to the Domar and Musgrave (1944) analysis of a proportional tax on a risky investment for risk averse potential investors. The Domar and Musgrave result emphasizes the effect of the proportional tax on both the mean and the variance of returns. In addition to reducing the mean return, which makes risk taking less attractive, the proportional tax also reduces the variance which makes risk taking more attractive. The nonlinear income tax will

affect the higher moments of the return distribution as well as the mean and variance so it is difficult to make generalizations about preferences over how the nonlinear income tax affects decisions about risky investments; however, the critical point is that the nonlinearities create an effect that is additional to the reduction in the mean and variance created by a linear income tax.

This simple illustration can be extended to account for the common claim that the tax system affects the entry decision through opportunities for entrepreneurs to report less income than equivalent wage earners. These opportunities could take the form of disguised consumption through the business or simply evasion. In our simple formulation, one could add a parameter that reflects the percentage of entrepreneurial income that is reported as taxable income.[8] A reduction in the percentage of income that is reported as taxable income makes entry more attractive by increasing the returns to entry; the value of this tax avoidance increases with the level of the tax rates. While tax avoidance complicates the model, the effects of the nonlinearities in tax rates persist.

The negative effects of progressivity on entrepreneurial entry must be considered in conjunction with the other possible effects of the tax system. If self employment faces a lower tax rate (either for legitimate or illegal reasons) than working for someone else, then the level of tax rates, or the differential between average tax rates between the two options, should enter our selection equation; the lower the tax rate on self employment relative to working for someone else, the higher would be rates of self employment. Furthermore, if potential entrepreneurs value the insurance aspect of income taxation, higher tax rates may increase entry probabilities.[9] To

[8] Alternatively, it is possible that the tax avoidance technology depends on the level of success.

[9] See Kanbur (1981), Peck (1989), and Boadway, *et al.* (1991) for theoretical models of taxes and entrepreneurial entry.

summarize, links between tax policy and entrepreneurial entry because of insurance or tax avoidance predict a positive correlation between increases in income tax progressivity and entrepreneurial entry probabilities, while models emphasizing a link between entrepreneurial talent and selection into entrepreneurship predict a negative correlation between increases in tax progressivity and entrepreneurial entry probabilities. Distinguishing among these explanations requires longitudinal data on households over a period in which there is both time-series and cross-sectional variation in marginal tax rates.

IV. Empirical Specification and Data

To discriminate among potential effects of tax rates on entrepreneurial entry, one would ideally like to have household-level panel data, with information on employment, entrepreneurial status and investment, and sufficient information to estimate measures of income tax convexity across households and time. For a household, the relevant convexity of the income tax depends upon provisions of the tax code and a description of the *ex ante* distribution of entrepreneurial outcomes. While households face a common tax code, they may have access to vastly different entrepreneurial opportunities.

While long panel data are available for U.S. households in the PSID, those data do not record entrepreneurial capital investment. As a result, we principally use self employment of the head of the household as an indicator of entrepreneurship. We use data over the period from 1979-1993.[10] We use both the representative national sample and the national sample of low-

[10] While the PSID starts earlier, we start with 1979 due to availability of state tax code coverage by the NBER TAXSIM model; we end with 1993 because it is the last year for which final-release PSID data are available.

income families; our analysis uses sample weights to avoid overweighting the low-income households. The PSID also has a wealth supplement in 1984, 1989, and 1994 that allows us to define entrepreneurship based on ownership of business assets, which we explore in section VI.

Our sample conditions on being a head of household between the ages of 18 and 60 who is in the workforce in consecutive years with positive income in year *t*. The sample pools single men and women (and single parents) and married heads of households (almost always men); in our sensitivity analysis, we examine whether this pooling matters. We exclude married women to avoid issues of the endogeneity of labor force participation. Because we are interested in entry, our sample conditions on working for someone else (without any self employment) in the first of the consecutive years used to create each observation; we define entry by the head of household reporting some self employment in year *t+1*. For our sample, 3.10 percent of household heads enter self employment each year, with the remainder continuing to work for someone else.

Abstracting from tax considerations, we estimate probit models for entry into entrepreneurship (defined as having some self-employment activity), *ENTRY*, the head of the household *i* at time *t*+1:[11]

$$ENTRY_{i,t+1} = f(e_i, x_{it}, z_{it}, \gamma_t) \quad (1)$$

where e_i represents educational attainment, x_{it} is an individual's earnings potential as an employee, z_{it} captures demographic differences across households, and γ_t reflects time-specific macroeconomic factors. We approximate educational status with indicator variables for "less

[11] One advantage of studying who enters entrepreneurship rather than cross-sectional evidence of who is an entrepreneur is that we use workers' wage income as a measure of earnings potential, which is critical for creating our tax variables.

than high school education," "some college," "college," and "some post-college education" (with the omitted category being a high school education). To control for opportunity cost of working, we include the level and square of the labor earnings of the head of household in year *t*. We control for the level and square of the spouse's labor earnings in year *t*, assigning values of zero to non-married households. Because access to capital may affect the decision to enter self employment, we include dividend and interest income as a proxy for wealth, which is not available on an annual basis in the PSID. For z, we include the number of children in the household and dummy variables for five-year age ranges for the head, whether the head is nonwhite, female, single, a homeowner, whether the household lives in a rural area (not resident in a Standard Metropolitan Statistical Area), and whether the head experienced a marital transition during the year (using separate variables for marriages, divorces, or the death of a spouse). Because previous research (see, *e.g.*, Fairlie and Meyer, 2000) indicates that self employment propensities vary by industry and occupation, we include dummy variables for the worker's occupation and industry (both at the two-digit classification level in the PSID) in year *t*. Finally, we include Census-region-specific year dummy variables to capture trends in entry decisions or the effects of macroeconomic conditions. Table 1 provides summary statistics for the control variables.

Starting from this standard econometric approach to estimating the effects of household demographics on entry into self employment, we face the more complicated task of adding empirical measures of the tax incentives for the entry decision. While the *current tax rate* facing a worker is a relatively easy concept to model, the *convexity* of the tax system that a worker faces is much harder to measure. The model above highlights the importance of the asymmetry

in the variation of tax rates. Neither the average tax rate in self employment nor the variance in tax rates faced over the distribution of outcomes are useful measures of the asymmetry in tax rates faced by potential entrepreneurs. Instead, we require a measure of the spread in tax rates across the distribution of possible outcomes.

To characterize how entering self employment affects a worker's relatively long-term earnings prospects, we examine the distribution of real earnings growth (labor earnings plus business income) of entrants and non-entrants over a three-year period.[12] As entrants, we select households for which the head of household entered self-employment between year *t* and year *t+1*. Regardless of whether these entrants continue as self-employed, we calculate the growth in the real earnings of the head of household between year *t* and year *t+3*. Because we do not condition on business survivorship, we capture both positive and negative experiences in self employment. Table 2 presents statistics that compare the distribution of earnings growth for the entrants and non-entrants in the PSID from 1978 to 1993. The non-entrants are the households that did not enter self employment between year *t* and year *t+1* but were in the workforce in year *t*. The comparison also conditions on household heads having labor income of at least $1,000 in the first year and non-negative labor income in year *t+3*, as well as being between the ages of 18 and 60 in the first year.

Consistent with the previous research on the mobility of entrepreneurs discussed above, entrants into self employment experience more variable wage growth, as measured by the

[12] The choice of focusing on the three-year wage growth is inherently arbitrary. We use these calculations merely to illustrate what changes in income potential entrepreneurs might reasonably expect to face. A short time horizon may suffer from income being low while entrepreneurs start operations; however, longer horizons reduce the amount of available data. We selected three years as an attempt to balance these competing concerns.

standard deviation of the three-year growth rate. On average, the labor income of entrants grows over three times faster than the labor income of non-entrants (33.4 percent to 10.1 percent); however, the median growth rates of non-entrants' wages and entrants' wages are similar (2.7 percent compared to 3.1 percent). Because entrants into self employment can return to working for someone else, it is not surprising that the distribution of wage growth differs more for increases in wages than for decreases in wages. A quarter of entrants experience real wage growth of more than 43.9 percent, and 10 percent of entrants experience wage growth of more than 119 percent. Overall, despite the variability in wage growth among non-entrants, this comparison confirms that entrants into self employment experience more variable wage growth than non-entrants experience.

This observed distribution of wage growth guides our construction of measures of the convexity of the tax schedule facing potential entrepreneurs. To measure the relevant spread in tax rates faced by potential entrepreneurs, we calculate tax rates that an entrepreneur would face at various levels of success. Based on the distribution of wage growth, we form a weighted average of these tax rates for "successful" and "unsuccessful" entrepreneurs. Our basic measure of convexity is the difference in the weighted average of the marginal tax rates in the various successful and unsuccessful states – how does the marginal tax rate change between positive and negative outcomes? For someone facing a constant marginal tax rate over the range of possible outcomes, this measure of convexity is zero. If success or failure changes the household's tax bracket, then the convexity measure is non-zero (and typically positive).

We use the observed wage growth experience of entrants in formulating a spread between the successful and unsuccessful states. To simulate the tax rate faced by a potential entrepreneur

under different levels of success, we compute tax rates after replacing the head's labor income with business income that is a multiple of the head's current labor income. We consider four possible "successful" outcomes by entrants; labor income increases by 25, 50, 100, or 200 percent. The distribution of wage growth indicates that these outcomes are not equally likely so we assign probabilities of 0.4, 0.4, 0.15, and 0.05, respectively, to the four cases. Similarly, we consider four possible "unsuccessful" outcomes for entrants; labor income falls by 10, 25, 50, or 75 percent. We assign probability weights of 0.5, 0.3, 0.15, and 0.05, respectively, to these outcomes. As a robustness check, we also estimate specifications that rely on single-point definitions of being successful or unsuccessful. For example, we define success as an increase in labor income of 50 percent and being unsuccessful as a 25 percent decline in labor income.

To construct tax variables, we use the TAXSIM model of the National Bureau of Economic Research (see Feenberg and Coutts, 1993). From the PSID, we use household characteristics on family size, family structure, age, labor earnings, dividends, interest received, income from other sources (*e.g.*, rental income), and state for residence.[13] To construct the household's predicted future marginal tax rate, we use household characteristics in year t and project the tax rate using the year $t + 1$ tax code;[14] to capture the effects of future wages

[13] We restrict our analysis to PSID observations that have these data items. Actual tax returns incorporate variables that are not available from the PSID. For example, without interest payments and charitable contributions, we understate the number of households that itemize their deductions; similarly, we do not have information on contributions to tax-advantaged retirement savings. Lastly, we do not have data on realized capital gains; however, because many capital gains realizations are transitory phenomena, excluding realized capital gains probably better captures the incentives to change employment status.

[14] By using the t +1 tax code, we are assuming that households have information about future tax rates. Also, one could argue that the tax effects on the entry decision should depend on the persistence of the tax provisions. As we describe below, the results are also not sensitive to constructing the tax measures with either the year t or $t + 2$ tax code.

exceeding current wages, we allow earnings to grow by five percent in constructing our benchmark tax rate.[15] The decision to enter self employment depends on the longer run consequences rather than just income over a short horizon. We use the near-term tax code for forming tax rates because households probably have a better idea of the near-term tax structure (either explicitly or implicitly through observing the after-tax living standards of households with differing levels of success) than of the actual future tax code when the steady-state outcome will be realized.

The TAXSIM model processes the PSID data by incrementing non-wage income by $100 to calculate federal and state income tax payments and marginal income tax rates; we also construct average tax rates using family income. Because the tax rate schedules can have notches, TAXSIM occasionally produces unrealistic marginal tax rates; we exclude observations for which TAXSIM produces marginal or average tax rates that are below -20 or above 75 percent.[16] To compute our convexity measures, we repeat this process for alternative levels of income by replacing the head of household's labor income with nonwage income (business income) equal to some multiple of the original labor income (*e.g.,* 125, 150, 200, and 300 percent of labor income for the four levels of being successful). Our convexity measure is the difference between the weighted average of the marginal tax rates if the entrant succeeds and the weighted average of the marginal tax rates if the entrant is unsuccessful.

Implicitly, we link the distribution of entrepreneurial potential to opportunity cost as

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[15] We obtain similar results is the benchmark tax rate assumes no wage growth or ten percent wage growth.

[16] This restriction, which reduces our sample of over 53,000 observations by 239 observations, extends to the tax rates that we create for successful and unsuccessful entrepreneurs (defined below).

measured by current income. The convexity measure assumes that each head of household with a given current labor earnings has the same potential earnings distribution in self employment. That is, other household characteristics do not affect the variance of the outcomes.[17] The variability of the distribution of payoffs is constant in percentage terms across households. As an alternative, one could consider entry into self employment as affecting the level of income by the same amount across households. Unfortunately, this alternative would lead to either very large percentage changes for low-income households or very small percentage changes for high-income households; for example, a loss that might be of reasonable magnitude for an upper-income household might result in negative income (or other unreasonable outcomes) for a moderate-income household.[18] We also assume that other types of income and demographics do not change with the decision to enter self employment. For example, the wife's labor supply does not change upon the husband's entry into self employment.

Our measure of convexity only accounts for differences in marginal income tax rates at the various income levels associated with successful and unsuccessful entry. It excludes the double taxation associated with corporate taxation that might be relevant if successful businesses incorporate and capital gains taxes that might be relevant for entrepreneurs who sell their businesses; for more on these taxes, see our discussion in footnote 4. In addition to the income tax, the estate tax also creates convexity in tax payments; we exclude the estate tax from our

[17] The mobility tables constructed by Holtz-Eakin, Rosen, and Weathers (2000) suggest that self employment has different effects on the income mobility of women and minorities. In our sensitivity analysis, we focus on subgroups of the population to check whether these differences affect our results.

[18] A key part of our convexity measure is whether households change marginal tax rate brackets. In the early years of the sample, the tax code had many different tax brackets but the income range within a bracket increased with income. Thus using a constant percentage variance in outcomes makes the probability of changing marginal tax brackets similar across income groups.

analysis because we could not find a tractable way to include its incentive effects.

Even focusing on income taxes, it is not obvious how to measure the convexity of the tax system. By using marginal tax rates at specific income levels, our measure focuses on the shape of the tax rate schedule over the relevant range of outcomes associated with entry; for example, if a household remains in the same marginal tax bracket regardless of the degree of success in entrepreneurship, our measure of convexity will be zero. As an alternative measure of convexity, we replace our marginal tax rate measures with average tax rate measures. The level of the average tax rate replaces the level of the marginal tax rate; the spread between average tax rates for successful and unsuccessful entry replaces the marginal tax rate measure of convexity. This alternative measure of convexity incorporates features of the tax code that apply to incomes below the income associated with unsuccessful entry;[19] for example, reducing every household's tax liability (irrespective of income or employment status) by $500 would affect average tax rates but not marginal tax rates.[20]

Before presenting results on how convexity affects entry into self employment, some simple examples help illustrate our measure of convexity. These examples also help clarify the sources of econometric identification for the convexity effects. Table 3 provides a variety of examples of how tax rates and the convexity measures vary by household characteristics over time. Consider a family with one child that lives in a state without a state income tax; the

[19] Marginal tax rates below the income level associated with the lowest income that we allow for in the unsuccessful case may be important if the entrepreneur also invests capital without full loss offset.

[20] For most entrants, because employment status is a discrete choice, one could argue that average tax rates are relevant for the entry decision. While the average tax rate captures the discrete nature of the choice, as illustrated by the example in the text, it also depends on features of the tax code that do not vary with the income level or entry choice.

husband earns $25,000 and the wife earns $15,000 as employees. In the 1986 tax code, this family faced a marginal tax rate of 28 percent and our convexity measure based on marginal tax rates for this household is 10.09 percentage points; in 1992, this family's marginal tax rate was 15 percent and their convexity measure was 7.17 percentage points. Alternatively, consider a family in which the husband earns $90,000 and the wife earns $50,000. For the years 1986, 1988, 1992, and 1993, working as employees, this family would face marginal tax rates of 49, 33, 31, and 31 percent, respectively; however, the spread between successful and unsuccessful entry would be 3.06, -0.75, 2.00, and 7.24 percentage points, respectively.

Comparing the various examples in Table 3 reveals that convexity need not be positively correlated with the level of the tax rate or with income. Table 1 includes the basic summary statistics on the tax rate and convexity measures. The mean of the marginal tax rate spread is 9.06 percentage points and the median is 8.92 percentage points. The fifth, 25th, 75th, and 95th percentiles of the distribution of this measure of convexity are 0.71, 5.00, 12.70, and 17.74, respectively.[21] Figure 1 provides a histogram of the median convexity measure by income deciles (computed on an annual basis). Middle-income households face the most convexity; for example, the sixth income decile has a median convexity measure of 11.61 percent. While the figure indicates that convexity varies with income, convexity also varies within each income decile. For example, for the overall sample, the standard deviation of the convexity measure is 5.34 percentage points but within income deciles the standard deviation of the convexity measure ranges from 4.28 to 7.67 percentage points indicating that income is only one of the

[21] The average tax rate measure of convexity has a mean of 6.66 percentage points and a median of 6.72 percentage points. The distribution of this measure of convexity is much tighter, with a fifth to 95th percentile range of 2.37 to 10.73 percentage points.

determinants of convexity.[22] Overall, the convexity depends on tax provisions that vary across households within a state, across similar households in different states, across time, and the distribution of income within the family.

Figures 2 and 3 illustrate the relationships between some key variables for the analysis. Figure 2 is a histogram of entry probabilities into self employment by the marginal tax rate measure of convexity. The numbers along the x-axis are the percentage of the distribution of households that is in each range of the convexity measure. The numbers at the top of each bar are the percentage of households in the range of convexity that entered self employment. For example, of the 12.9 percent of the sample that had a convexity measure of greater than or equal to 6 percent but less than 8 percent, 3.15 percent entered self employment. In contrast, among the 12.5 percent of the sample with a convexity measure of greater than or equal to 10 percent but less than 12 percent, the entry probability is only 2.25 percent.

Figure 3 plots the entry probability of different income groups by income decile. The relationship between entering self employment and income is u-shaped with entry probabilities above three percent for the bottom and top income quintiles but below three percent in the middle three income quintiles. Combining Figures 1 and 3 suggests that both entry and convexity are related to family income, suggesting that it is critical to control for income in measuring the effect of tax convexity on the entry decision. The multivariate analysis of entrepreneurial entry in the next section controls for a variety of determinants of entry, including

[22] To get a sense of the variation within subgroups of the sample, as opposed to variation across groups, consider the percentage of the variation in convexity explained by grouping the data. Income deciles, year and state effects explain 6.5, 12.7, and 2.0 percent, respectively, of the variation in convexity. Simultaneously controlling for these three characteristics explains 21.5 percent of the variation in convexity.

several functional forms for controlling for income differences.

V. Estimated Effects of Tax Rate Convexity on Entry

V.A. Base Case Results

The first column of Table 4 reports estimates of a probit model for entrepreneurial entry in which tax variables are not included. The entries in the columns are estimated marginal effects (and robust standard errors, allowing for a correlation across years for observations from the same household) from probits for entry into self employment. Overall, the results are similar to those of previous entry probits that do not include tax rate variables (*e.g.*, see Holtz-Eakin and Rosen, 1999). After controlling for educational attainment, current labor earnings have a negative effect on the probability of entry; the positive coefficient on the quadratic term does not outweigh the negative coefficient on the linear term until labor earnings of approximately $251,000. Capital income (as a proxy for the wealth of the potential entrants) has a positive effect on the entry probability, as does other property income. Minority and female heads of households are much less likely to enter self employment than white male heads of households. Higher levels of educational attainment are associated with higher entry probabilities.

In the second column of Table 4, we report results adding the marginal tax rate on employment and the measure of tax schedule convexity using marginal tax rates. The estimated coefficient on the marginal tax spread is negative and statistically significant. Thus convexity in the tax system reduces the probability of entrepreneurial entry, all else being equal, consistent with our "success tax" story. The finding is inconsistent with an alternative in which more progressive taxation increases the likelihood of entrepreneurial risk-taking through entry.

Moreover, the estimated effect of the convexity of the tax system on entry is economically important. A five-percentage-point increase in the convexity measure reduces the probability of entry by approximately 0.67 percentage points, a decline of about 21 percent from the average probability of entry of 3.26 percent. While this average change in the entry probability provides a useful benchmark, the predicted change in the entry probability varies with household characteristics. Simulations of actual tax changes provide similar magnitude changes in the entry probability. For example, we can estimate the effects of the Omnibus Budget Reconciliation Act of 1993 for a household in which the husband earns $90,000 and the wife earns $50,000. For this couple, the 1993 tax act increased the progressivity of the tax system without changing their marginal tax rate if they worked as employees. The coefficients in the third column predict that the increase in the spread in marginal tax rates from 2.00 percentage points to 7.24 percentage points between 1992 and 1993 would lower the probability of entering self employment by 32 percent.[23]

The coefficient on the marginal tax rate associated with the head of household having five percent growth in labor earnings is small and negative but is not statistically significant. This negative estimated coefficient is the opposite of the prediction that high tax rates encourage entry into self employment as a method of tax avoidance. In general, the coefficients on the non-tax variables are broadly similar to those in the first column that excludes the tax variables.

In the third column of Table 4, we replace the weighted-average measure of convexity with a simple two-outcome measure in which the tax rate for success assumes that income

[23] The probability falls from 3.52 to 2.60 percent. This comparison assumes that the household owns its home in a non-rural area of Northeastern state with no state income tax, has $2,000 of property income, and has $2,000 of dividend income; the husband works as an engineer in the electrical equipment industry. The calculation uses the year effect for the 1992 to 1993 transition (the last year in our sample).

increases by 50 percent and the tax rate for being unsuccessful assumes that labor income falls by 25 percent. While our method of measuring convexity is necessarily somewhat arbitrary, this alternative measure yields a similar conclusion that more convexity in the tax schedule decreases the probability of entry into self employment. However, the estimated effect is 45 percent smaller than in our base case.[24]

The fourth column of Table 4 reports the results for replacing the marginal tax rate measures of the tax system with average tax rate measures (weighting the tax rates associated with possible outcomes as in the second column). Consistent with the results presented in the two prior columns, the estimated coefficient on the convexity variable is negative and statistically significant. In this specification, the effect of progressivity on entry into self employment is larger than in the previous specifications. However, a given change in marginal tax rates typically has a smaller effect on average tax rate measures of convexity than it has on the marginal tax rate measures; thus the inferences drawn about policy changes are more similar than suggested by merely comparing the estimated coefficients.[25] In contrast to the results using

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[24] In unreported results (available upon request), we examine similar specifications using alternative two outcome measures of convexity that vary the range of uncertainty over which potential entrepreneurs consider possible outcomes. Specifically, we examine cases in which the potential outcomes are the following: (1) an increase in the labor income of the head of household of 25 percent or a decrease of 10 percent; (2) an increase in the labor income of the head of household of 100 percent or a decrease of 50 percent; and (3) an increase in the labor income of the head of household of 200 percent or a decrease of 75 percent. The estimated effects of tax convexity on self employment in these specifications are similar to the estimated effect in the third column of Table 4. Because our base-case measure of convexity combines the information from these various cases, we believe that it more accurately captures the convexity facing a potential entrant than any of these two outcome measures.

[25] For example, a one standard deviation reduction in the marginal tax rate convexity (5.25 percentage points) would increase the average predicted entry probability by 0.70 percentage points (−5.25 multiplied by −0.00134) and a one standard deviation reduction in the average tax rate convexity measure (2.50 percentage points) would increase the average predicted entry probability by 1.24 percentage points (−2.50 multiplied by −0.00497).

the level of the marginal tax rates, the coefficient on the average tax rate is positive and statistically significant at the 90 percent confidence level, consistent with the possibility that higher tax rates increase the attractiveness of self employment.

Convexity can arise either because success increases the household's marginal tax rate or because being unsuccessful lowers the household's marginal tax rate. The specifications in Table 4 restrict the behavioral response to these different sources of convexity to be the same. Because less successful entrepreneurs have the option of returning to work for someone else, one might expect that the behavioral response is not symmetric and that convexity associated with being *successful* has a larger effect than convexity associated with being *unsuccessful*. To examine this possibility, we break our convexity into two parts. "Upside" convexity is the difference between the tax rate when successful and the baseline tax rate (*i.e.*, the tax rate working for someone else); "downside" convexity is the difference between the baseline tax rate and the tax rate when unsuccessful. The sum of these two convexity measures is our overall measure. In the alternative specification, we include these two convexity measures separately.

Table 5 presents the estimates of key coefficients for specifications that separate upside and downside convexity that correspond to the second through fourth columns of Table 4. The estimated coefficients on both the upside and downside convexity measures are negative and statistically significant. On average, the estimated coefficients are roughly equal to the estimated coefficient on the single measure of convexity. For our base-case measure of convexity, the magnitude of the estimated "upside" convexity effect -- that is, the "success tax" effect we emphasize here -- is more than double the estimated effect of "downside" convexity.

V.B. Sensitivity Analysis

In addition to comparing different measures of convexity, several other statistical questions merit further investigation. This sensitivity analysis not only addresses whether the results are robust to alternative statistical assumptions, it also helps determine whether particular sources of variation in our convexity measure drive our results.

V.B.1. Choice of Sample

In Table 4, we analyze the decision of the head of household to enter self employment, but we pool data from different family structures. Because different family structures face different tax rate schedules (single, head of household, or married), the variation in the tax variables could be related to family structure. If the dichotomous variables for female-headed households and marital status do not capture fully the effects of family structure on entry decisions, the tax variables may capture more complicated relations between family structure and entry rather than the effects of the tax system on behavior. For example, one reason that family structure or minority status affects the entry probability is that these households may perceive a different distribution of returns to self employment than male-headed, non-minority households do.[26] Because our measure of convexity thus far assumes that all households perceive the same distributions of opportunities (relative to the opportunity cost of working for someone else), any differences in the perception of potential returns may affect our results.

To explore whether the coefficients on the tax rate variables are sensitive to pooling different family structures or demographic groups, we report in Table 6 results for entry probits focusing on samples of male heads of households and married men, both including and

[26] Despite claims that the returns to entrepreneurship differ by demographic groups, a comparison of the income growth rates in Table 2 with similar statistics that exclude women and minorities suggests that the differences are too small relative to the coarseness of our weighting scheme to affect how we construct our convexity measure.

excluding minorities. The estimated models are comparable to the model in the second column of Table 4. The first column of Table 6 presents the results for male headed households and the second column has results for white male headed households. The third and fourth columns report the results for all married men and married white men, respectively. The results are quite consistent across the four columns. The estimated coefficients on the convexity measure are roughly 60 percent larger in absolute value than the estimated coefficient we report in the second column of Table 4. Relative to female household heads, men appear more sensitive to the tax disincentive for entry into self employment; among men, excluding minorities has little effect on the estimated convexity effect. Our primary results, however, are not driven by a correlation between the convexity measure and these demographics.

To explore further whether the effects of convexity are concentrated among specific groups in the population, we interact the tax variables with household characteristics. Table 7 reports the coefficient estimates for the tax variables of various interactions. Each panel represents a separate regression that is similar to the second column of Table 4 except for the interaction terms along with direct effects of the household characteristics (if they are not already included in the earlier specification). Panel A reports results from interacting the tax variables with dummy variables for a household's income quintile. As illustrated by Figure 1, convexity varies with income which raises the concern that the estimated convexity effects reflect nonlinearities in how income affects entry; the specification in Panel A of Table 7 uses variation within income quintiles to identify the tax effects. The estimated coefficients do not reveal a systematic relation between convexity and income levels (although the effect is somewhat larger for households in the fourth highest income quintile). Thus the estimated convexity effects are

not concentrated, for example, in low income households for which one might expect a series of transitory spells in different jobs and employment modes.

Panel B of Table 7 reports the results of interacting the tax convexity measure with five levels of educational attainment. Education might be correlated with responsiveness to tax convexity, especially if the motives for entering self employment vary by education groups. For example, entrants with low skills or education may be "pushed" into self employment by a spell of unemployment but high-skill entrants may enter based on the hope of creating wealth. The negative effect of convexity is similar across the first four education groups but is almost twice as large for households with some post-college education relative to other groups, suggesting that highly-educated people are the most sensitive to tax convexity.

Age and family structure may affect risk aversion which might affect the sensitivity to nonlinearities in rewards. Panel C of Table 7 has the results of interacting the tax variables with three dummy variables for the age of the head of household (for whether the head is less than 35 years old, between 34 and 51 years old, and over 50 years old) since risk aversion could possibly vary with age. The estimated tax effects are similar across age groups. Among married households, we interact the tax variables with five dummy variables for the number of children in the household (no children, one child, two children, three children, and four or more children). As reported in Panel D of Table 7, we find no systematic differences across groups in the sensitivity to tax convexity.

V.B.2. Controlling for Earnings

A common concern in estimating the effects of income tax rates on household behavior is that income tax rates are correlated with income so that it is difficult to separate tax rate effects

from other nonlinearities in income effects. While this statistical problem is a concern for interpreting the level of the tax rate in our specifications, the convexity variable potentially suffers much less from this problem because convexity is not a simple nonlinear function of income. Nevertheless, one might be concerned that the functional form of the earnings control affects the estimated coefficients on both tax rate variables.

In Table 8, we report results for several alternative functional forms for controlling for the household's labor earnings. Results presented in the first column have only a linear term in labor earnings; the second column allows for a cubic function of labor earnings; the third column uses a logarithmic specification in labor earnings; and the fourth column adds dummy variables for income quintiles to the specification reported in the second column of Table 4. Across these four specifications, the estimated coefficient on the level of the tax rate is much more sensitive to the control for earnings than is the coefficient on the convexity variable. In the first column, the estimated coefficient on the level of the tax rate is negative and statistically significant at the 90 percent confidence level, but this estimated coefficient is positive and statistically significant in the second and third columns. Thus the "tax price" effects of the tax schedule on entry into self employment are sensitive to controlling for nonlinearities in earnings.

In contrast to the rather fragile estimates on the level of the tax rate, the estimated coefficient on the convexity measure is consistently negative and statistically significant; it is, however, about one-third smaller in magnitude in the specifications with the cubic earnings or the logarithm of earnings. These results, along with the previously reported results that interact the tax variables with income quintiles, suggest that the convexity effects that we find are not

artifacts of simple nonlinearities in controlling for income.[27]

A general feature of our convexity measure based on marginal tax rates is that it will be zero for households that have very low income (as the spread in income is small and unlikely to induce a change in the marginal tax bracket) or very high incomes (as they are in the highest marginal tax bracket for all reasonable perturbations of income).[28] In addition, relative to middle-income families, low-income households may be more likely to enter self employment because the opportunity cost of working for someone else is low, and high-income households may be more likely to enter self employment if their income relaxes borrowing constraints that discourage self employment. These alternative reasons for entering self employment could combine with the observed low convexity measures for low and high income households and could explain the observed correlation between convexity and entry. To examine this possibility, we exclude households with incomes below $10,000 or above $200,000 from the specifications. Alternatively, we exclude households whose head has labor income less than

[27] To check whether higher-order polynomials in earnings further diminish the estimated effects of convexity, adding fourth-order earnings terms has a relatively small effect on the estimates compared to the cubic specification. Focusing on married men yields similar results to including all households in terms of the sensitivity of estimated tax effects with respect to varying the functional form of the earnings controls. Finally, the general pattern of upside and downside convexity effects reported in Table 5 persists for all variations of earnings controls. These results are available upon request from the authors.

[28] In part, this feature of our convexity measure is an artifact of defining opportunities as percentage changes in income instead of absolute changes in income. Using absolute dollar values as the perturbations in income would inherently involve using many negative income outcomes for low income households and a small variance in incomes across outcomes for high income households. As an alternative to recalculating our convexity measure based on absolute dollar changes, dropping households with high or low income provides some comfort that basing convexity on percentage changes in income does not drive the results. Furthermore, using percentage changes in income seems less troubling within an income group, so the result in Table 7 that the sensitivity to convexity is similar across income quintiles also provides reassurance that basing our convexity measure on percentage changes is not critical to our results.

$10,000. Neither of these alternative specifications changes the substance of the results.[29]

V.B.3. Spatial and Time-Series Variation in Tax Variables

One source of econometric identification for our estimates is the variation in state tax codes. This variation is potentially correlated with other unmeasured state-level characteristics that influence entry decisions. To investigate whether such correlations affect our results, we estimate entry probits with state fixed effects. For the sample of all households, the estimated marginal effect of convexity is -0.00130 (with a standard error of 0.000209), quite similar to the estimate reported in the second column of Table 4 without state fixed effects. Because state fixed effects do not change the estimated coefficient on the convexity measure, it is unlikely that a correlation between state tax policy and other state characteristics explains our findings.

Including state fixed effects reduces our reliance on interstate variation in convexity that is persistent over time; however, the time-series variation in overall state-level convexity is a source of econometric variation. To further remove time-varying state-level characteristics (including the annual difference in state-level convexity), we include state fixed effects interacted with year effects, essentially identifying the model off of the features of the Federal tax system and cross-sectional changes over time in state-level convexity.[30] Even controlling for

[29] If we exclude low- and high-income households, the estimated coefficient on convexity is −0.00151 (with a standard error of 0.000240); if we exclude households in which the head earns less than $10,000, it is -0.00110 (with a standard error of 0.000225). More generally, as shown in Figure 2, roughly 1.9 percent of the sample has negative measures of convexity, which may arise from relatively unusual elements in the tax code (such as phase-outs of tax provisions). Because these observations also have relatively high rates of entry into self employment, they may unduly influence our results. Eliminating these 1,089 observations slightly reduces the observed effect of convexity with an estimated coefficient of -0.00119.

[30] This specification estimates 561 parameter estimates, while the overall sample size is 53,151 and only roughly 1,650 of these observations enter self employment. Given the number of parameters relative to the number of entrants, caution is warranted in interpreting the results.

state-specific year effects, the estimated marginal effect of convexity is -0.000994 (with a standard error of 0.000156). These specifications suggest that state-level variation in tax policy is not central to identifying the convexity effects; instead, variation across households in their location on the federal tax schedule, their composition of income, and variation in the tax code across years seems critical to our econometric strategy.[31]

In Table 9, we examine whether the relationship between taxes and entry into self employment is stable over time. Because some of the variation in the tax rate variables comes from changes in the tax code over time, the estimated coefficients could be influenced by this time-series variation to the extent that the year fixed effects do not completely control for aggregate changes in entry probabilities. Furthermore, one might expect that the tax variables would be relatively more important shortly after tax reforms that change the amount of convexity in the tax system.

In Table 9, we allow the relationship among entry, the various income variables (earnings, capital and property income), and the tax variables to vary by year. The coefficients on the other demographic variables are constrained to stay constant over time. The "year" in the table reflects the beginning of the period from the perspective of the transition into self employment. The estimated coefficient on the level of the marginal tax rate is not stable over time. In the early years of the sample, it tends to be positive (and not statistically significant) but

[31] As another test of the relative importance of sources of variation, we separate the tax rate variables into federal and state tax components. The estimated coefficients for the federal tax measures are similar to the estimates from using the combined tax rate but the estimates on the state-level tax measures are statistically indistinguishable from zero. For example, for our base case specification the estimated coefficient on convexity from the federal tax code is -0.00153 (with a standard error of 0.000236) but the estimated coefficient for state-level convexity is 0.0000712 (with a standard error of 0.000511).

in the later years, it is typically negative (though of only marginal statistical significance). In contrast, the estimated annual coefficients on the convexity of the tax system are consistently negative and are statistically significant at the 90 percent confidence level in nine of the fifteen years. This table suggests that the results in the pooled data are not merely reflecting time-series variation in the tax incentives to enter self employment; instead, the cross-sectional variation in tax incentives is also important for identifying the tax effects.[32]

The tax measures in Table 4 use household characteristics from year t and tax provisions for year $t + 1$. On the one hand, this convention requires households to predict the future tax rates. On the other hand, the tax rate in years beyond year $t + 1$ are also relevant for entry decisions, especially since entry may entail low income in the short run even for a venture that is successful in the long run. The critical question is how much foresight seems reasonable to assume that potential entrants have in making decisions. Our base case assumes that potential entrants base their decisions on the tax code in the upcoming year. If households cannot predict the future tax system, then it might make more sense to use tax provisions for the year t to predict entry from year t to year $t + 1$. In some instances, potential entrants may have enough foresight to incorporate the year $t + 2$ tax code in their decisions. Of course, when the tax code is stable over time, these timing differences are moot. To explore whether our results are sensitive to the timing of the construction of the tax variables, we replace the tax variables with variables based on using either the year t or year $t + 2$ tax codes. The results are not sensitive to

[32] In similar specifications that replace the marginal tax rate measures with the average tax rate measures (equivalent to those in the fourth column of Table 4), the estimated annual coefficient on the convexity measure is negative for all years and statistically significant at the 95 percent confidence level in twelve of the fifteen years. Specifications that focus on married men yield similar results to those that use all households. These results further confirm the importance of cross-sectional variation in tax incentives for our econometric identification.

this change. Using the year t tax code, the estimated coefficient on convexity is −0.00147 (with a standard error of 0.000215); using the year $t + 2$ tax code, the estimated coefficient on convexity is −0.00125 (with a standard error of 0.000193). That the results do no vary with the timing of the tax variables suggests that entry decisions depend on the persistent variation in tax incentives.

V.B.4. Income Dynamics, Entry, and Convexity

Dynamic factors, such as shocks to income or previous self-employment experience, might affect entry into self employment. For example, workers who experience sudden declines in wages (*e.g.*, a reduction in hours or a layoff for part of the year) may decide that self employment has become more attractive; workers that experience transitory increases in wages may use the transitory income to start a business. Given that our convexity measure uses the household's current income, it may not reflect the long run prospects of households that experience transitory income shocks. Also, as we discussed above, transitory shocks may also systematically lead to lower convexity measures because convexity is lower for higher- and lower-income families. Previous self-employment experience may raise awareness of opportunities or reflect workers with less attachment to their current job.

To reduce the effect on our findings of households that are experiencing transitory income shocks, we control for the effects of transitory wage growth in three ways. First, we include variables for the growth in labor earnings between year t - 1 and year t.[33] Because large changes in labor income in either direction may be correlated with entry, we include separate

[33] To impose this restriction, the head of household must be a head of household in the previous year (*i.e.*, year t - 1), must participate in the labor market (without any self employment) in the previous year and have positive labor income. This restriction eliminates approximately 14 percent of our sample.

variables for negative and positive wage growth. Second, we eliminate households for which the head of household experienced more than a 30 percent increase or 15 percent decrease in labor earnings during the most recent year.[34] Third, we compute our tax measures asa the average value of the tax measure for the current and lagged observation for the household (using the year $t + 1$ tax code relative to the transition year).

The first column of Table 10 reports the results that include the wage growth variables.[35] Households with either larger positive or negative wage growth in the previous year are more likely to enter self employment and the coefficient on the negative wage growth is very precisely estimated. Including these variables reduces the magnitude of the estimated coefficients on convexity by about one third though the coefficients are still very precisely estimated and economically important. As we report in the second column of Table 10, eliminating households with a recent history of a large change in labor earnings reduces the magnitude of the estimated coefficients on convexity by about 50 percent, relative to our base cases. The third column replaces the tax variables with the average value of the current and lagged tax variables. The estimated coefficient on the convexity variable is about 25 percent smaller than in our base case. Overall, these results suggest that a portion of the convexity effect is related to transitory shocks in income that affect both measured convexity and unobserved non-tax determinants of entry into self employment.

Previous experience in self employment could predict future entry for a variety of

[34] Because wage income tends to increase, we allow for larger increases than decreases in creating this restriction.

[35] Table 10 reports the results using all households. Restricting the sample to married men leads to similar conclusions; these results are available upon request.

reasons, such as reflecting a taste for benefits provided by self employment. The fourth column of Table 10 presents results that include a dummy variable which is equal to one if the head of household reported being self employed in any of the previous five years (and zero otherwise). While this variable is an important, positive predictor of entry, the inclusion of this information only slightly reduces the estimated effect of convexity on entry (with a coefficient of -0.00120).

Previous self-employment experience could also affect someone's responsiveness to tax incentives by increasing awareness of differences in taxation of different types or levels of income. The fifth column of Table 10 reports the results from including interactions between previous self employment experience and the tax variables. The interactions with both the level of the tax rate and the convexity of taxes are statistically significant at the 95 percent confidence level. The level of the tax rate is positively related to entry by people with self-employment experience, consistent with experience teaching some of the benefits of possible tax avoidance. With regards to tax convexity, people with previous self-employment experience are more sensitive to convexity than people without previous experience; that is, convexity discourage re-entry into self employment by more than it discourages entry by inexperienced entrants.

Overall, we draw two conclusions from the sensitivity analysis in Tables 6 through 10. First, the result that convexity in the tax schedule discourages entry into self employment appears quite robust to a variety of alternative specifications. We take this as strong evidence of potential entrepreneurs responding to the "success tax" imposed by progressive taxation. However, the point estimate of the responsiveness to convexity varies across specifications. For example, controlling for transitory income shocks or allowing for higher order earnings controls yields lower point estimates but the point estimates are somewhat larger when we focus on men.

Second, the coefficient on the level of the tax rate varies considerably across specifications and does not always have the same sign or statistical significance as in the base specification. Thus the data do not provide strong evidence on the effect of the *level* of taxes on the decision to enter self employment. However, because we are conditioning on working either as an employee or for one's self in both periods, we are abstracting from margins along which higher marginal tax rates (in levels) would affect conventional labor supply decisions.

VI. Identifying Entrepreneurship with Business Ownership

Thus far, we have defined "entrepreneurship" as "self employment." Alternatively, "entrepreneurship" may involve the starting of a business with an investment of funds as well as time, which suggests a definition more centered on "business ownership." Focusing on a financial commitment to the business may also reduce concerns that the self employed include households that are "pushed" into temporary self employment by a spell of unemployment.

Defining entrepreneurship as owning business assets requires data on asset ownership, which are available for three years in the PSID – 1984, 1989, and 1994. We consider two definitions of business ownership: (1) the ownership of any business assets by the household; and (2) the ownership of business assets above a *de minimis* level of $5,000. Because the opportunity to enter now involves a longer time period, we use tax rate variables for the year t + 2 tax code from the perspective of the beginning of the data. Business ownership is measured at the household level as opposed to the individual level. As a consequence, because changes in family structure over the five-year period between the business ownership observations could drive entry, we exclude households that got married or divorced or in which one spouse died.

We present results from probits for entry into business ownership in Table 11. We include the same basic covariates we examined for entry into self employment with one exception – we can now include net worth. Due to the much smaller sample size, we do not include industry and occupation controls. The estimated effect of convexity in the tax rate is negative and statistically significant at the 95 percent confidence level in all four specifications. The magnitude of the estimated effect of convexity on entry into business ownership is slightly larger than the magnitude of the estimated effect on entry into self employment (but it is less precisely estimated).

While we only have three observations of business ownership, the results presented in Table 11 confirm the basic pattern found in Tables 4 - 10. Convexity in the household's marginal tax rate is negatively associated with the likelihood of entry into entrepreneurship. Moreover, this estimated effect is economically important for substantial changes in convexity of the tax schedule faced by a household.

VII. Conclusions and Directions for Future Research

While recent research (see, *e.g.*, Feldstein, 1995b, and Gruber and Saez, 2000) has emphasized the desirability of studying effects of changes in marginal tax rates on taxable income, broadly defined, there has been comparatively little analysis of effects of marginal tax rate changes on entrepreneurial entry. This margin is likely to be important for examination both because of the likely greater elasticity of entrepreneurial decisions with respect to tax changes (relative to decisions about hours worked) and because of recent research linking entrepreneurship, mobility, and household wealth accumulation.

Our investigation of the effects of marginal tax rates on entrepreneurial entry using data from the PSID yields two broad conclusions. First, we find little support for the hypothesis that the level of the tax rate *per se* importantly affects entry into entrepreneurship (as opposed to labor supply generally). Second, we find substantial evidence that the convexity of the tax schedule in progressive taxation discourages entrepreneurship, and significantly so for some groups of households. This second effect is robust to controlling for different potential effects of "upside" ("success") and "downside" ("failure") convexity in the household's tax schedule; differences in family structure; possible contaminating effects of transitory income changes; and the use of a "business ownership" (instead of "self employment") definition of entrepreneurship.

Three extensions related to how tax policy may affect entrepreneurship are particularly noteworthy. The first is to explore the effects of tax policy on the entry decision of larger-scale entrepreneurial ventures, especially because such ventures typically involve considerable risk and potentially face substantial convexity in their taxation. The second is to integrate tax policy effects on entrepreneurial decisions in more general models of saving and investment. The third is to examine more precisely the efficiency consequences of tax effects on entrepreneurial entry. That is, to what extent do progressive marginal tax rates discourage entry by entrepreneurs with the most promising business projects?

Beyond the issue of tax policy and entrepreneurship, the results are also consistent with a convex tax schedule discouraging risk-taking behavior and, more broadly, behavior responding to nonlinear incentives, as emphasized by the theory on incentive contracting. Another direction for future research is to examine whether convexity in the tax system sheds light on other areas in which nonlinear payoffs might affect behavior, such as job search intensity or work effort.

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Table 1: Summary Statistics				
	Mean	Standard Deviation	Min	Max
Marginal tax rate	28.29	11.04	-18.85	69.45
Marginal tax rate convexity measure	8.98	5.25	-15.09	49.34
Average tax rate	16.22	7.50	-19.83	61.51
Average tax rate convexity measure	7.03	2.50	-17.18	21.47
Head's labor earnings	26,249	19,807	30	550,000
Spouse's labor earnings	5,882	10,099	0	240,000
Dividend and interest income	768.17	2,951.49	0	145,000
Other property income	633.79	4,352.49	-111,000	250,000
Age	36.07	10.24	18	60
Minority (non-white = 1)	0.15	0.35	0	1
Female head	0.23	0.42	0	1
Married (single = 1)	0.40	0.49	0	9
Number of kids	0.92	1.15	0	1
Homeowner	0.60	0.49	0	1
Rural	0.39	0.49	0	1
Less than high school	0.15	0.36	0	1
High school	0.38	0.48	0	1
Some college	0.21	0.41	0	1
College	0.18	0.39	0	1
Some post-college education	0.080	0.27	0	1

Source: Authors' calculations based on data from the PSID. Our sample pools data from 1978 to 1993. The number of observations is 53,151. The sample includes households for which the head works for someone else in year t and is not out of the labor force in $t + 1$. We include only those households whose age is between 18 and 60 and whose labor income is positive in t. We drop all observations with average or marginal tax rates larger than 75 percent or smaller than -20 percent. We also drop observations with average or marginal tax rates for the successful or the unsuccessful case larger than 75 percent or smaller than –20 percent. The sample is weighted to reflect oversampling of low-income households.

Table 2: Wage Growth and Self Employment		
	Real Wage Growth over Three Years (%)	
	Entrants from Year *t* to Year *t+1*	Non-entrants from Year *t* to Year *t+1*
Mean	33.4	10.1
Standard Deviation	172.3	84.5
5th percentile	-85.4	-78.1
10th percentile	-64.8	-46.6
25th percentile	-32.5	-15.1
Median	3.14	2.65
75th percentile	43.9	22.7
90th percentile	119.3	57.1
95th percentile	234.0	95.2
Number of observations	1,156	36,189

Source: Authors' calculations based on data from the PSID, 1978-1993.

Table 3 : Examples of Average Tax Rate and Convexity Measures					
	Year	Average tax rate as an employee	Spread in average tax rates for success and failure	Marginal tax rate as an employee	Spread in marginal tax rates for success and failure
Example 1: Husband earns $25,000; wife earns $15,000; one child	1986	15.01	6.14	28.0	10.09
	1988	10.97	4.71	21.5	13.25
	1992	10.14	3.22	15.0	7.17
	1993	9.99	3.19	15.0	7.14
Example 2: Husband earns $40,000; wife earns zero; one child	1986	16.06	9.57	28.0	12.31
	1988	10.97	7.23	21.5	13.93
	1992	10.14	5.69	15.0	14.78
	1993	9.99	5.61	15.0	13.53
Example 3: Husband earns $90,000; wife earns $50,000; one child	1986	33.72	6.06	49.0	3.06
	1988	25.14	3.27	33.0	-0.75
	1992	22.86	3.85	31.0	2.00
	1993	22.71	4.79	31.0	7.24
Example 4: Husband earns $200,000; wife earns $75,000; one child	1986	41.56	4.02	50.0	0.20
	1988	27.49	0.47	28.0	-1.00
	1992	27.64	1.99	31.2	-0.39
	1993	30.14	4.55	40.3	3.17
Example 5: Husband earns $10,000; wife earns $10,000; one child	1986	8.19	2.98	16.0	5.46
	1988	6.94	3.60	15.0	-4.68
	1992	3.81	6.94	27.6	-12.26
	1993	2.97	7.60	28.2	-9.64
Example 6: Single parent earns $30,000; one child	1986	16.00	8.72	28.0	12.00
	1988	10.87	6.74	15.0	14.51
	1992	10.07	5.33	15.0	9.58
	1993	9.90	5.32	15.0	9.63
Example 7: Single individual earns $30,000	1986	18.35	9.00	30.0	12.37
	1988	15.69	7.46	28.0	4.58
	1992	13.04	7.21	28.0	11.68
	1993	12.78	7.13	28.0	13.60

Source: Authors' calculations, as described in the text. The example assumes that the family lives in a state without a state income tax. We calculate the marginal tax rates by adding $100 of non-wage income to the tax return. The average tax rates divide the tax liability by total family income.

Table 4: Marginal Effects from Entry Probits into Self Employment				
	(1)	(2): Marginal tax rate measure of convexity	(3): Convexity measured with two points	(4): Average tax rate measure of convexity
Tax rate on employment		-0.000127 (0.000129)	-0.000146 (0.000130)	0.000474 (0.000228)
Convexity in tax rate (spread)		-0.00134 (0.000209)	-0.000737 (0.000147)	-0.00497 (0.000509)
Head's labor earnings	-3.52 (0.951)	-2.69 (0.982)	-2.75 (1.01)	-1.02 (0.975)
Head's labor earnings squared	0.703 (0.238)	0.500 (0.228)	0.528 (0.236)	0.0600 (0.217)
Spouse's labor earnings	-1.81 (1.28)	-4.07 (1.39)	-2.67 (1.38)	-8.88 (1.51)
Spouse's labor earnings squared	-0.498 (1.53)	1.03 (1.37)	0.00846 (1.51)	3.39 (1.06)
Dividend and interest income	0.825 (0.248)	0.616 (0.247)	0.721 (0.247)	0.199 (0.256)
Other property income	1.96 (0.275)	1.72 (0.262)	1.83 (0.268)	1.27 (0.238)
Minority	-0.00931 (0.00219)	-0.00908 (0.00215)	-0.00923 (0.00217)	-0.00975 (0.00203)
Female head	-0.0186 (0.00235)	-0.0175 (0.00234)	-0.0181 (0.00234)	0.0178 (0.00229)
Single (single = 1)	0.00153 0.00288)	0.00165 (0.00284)	0.00183 (0.00287)	0.00146 (0.00276)
Number of kids	0.00128 (0.000845)	0.00177 (0.000864)	0.00141 (0.000872)	0.00211 (0.000889)
Less than high school	0.00288 (0.00285)	0.00207 (0.00279)	0.00221 (0.00281)	0.00174 (0.00272)
Some college	0.00742 (0.00306)	0.00736 (0.00302)	0.00745 (0.00304)	0.00791 (0.00301)
College	0.00564 (0.00363)	0.00561 (0.00355)	0.00567 (0.00358)	0.00665 (0.00359)
Some post-college education	0.00685 (0.00523)	0.00565 (0.00496)	0.00607 (0.00505)	0.00662 (0.00505)
Number of obs.	53,151	53,151	53,151	53,151
Pseudo-R^2	0.118	0.124	0.122	0.133

Source: Authors' calculations, as described in the text. Estimated models include census region effects by year, age dummies for 5 year age ranges for the head of household, dummy variables for homeowners, marital tranistions, and rural residents (not reported). The sample pools data from 1978 to 1993. We drop observations with average or marginal tax rates larger than 75 percent or smaller than -20 percent. The estimated coefficients and standard errors for labor earnings are multiplied by 10^7 and for labor earnings squared are multiplied by 10^{12}. The estimated coefficients and standard errors for capital income and property income are multiplied by 10^6. The marginal effects are evaluated at the mean values of the variables; for the dichotomous variables, marginal effects are for changes from zero to one. Robust standard errors are in parentheses. The regressions are weighted by sample weights.

Table 5: Differential Effects of "Upside" and "Downside" Convexity			
	(1): Marginal tax rate measure of convexity	(2): Convexity measured with two points	(3): Average tax rate measure of convexity
Tax rate on employment	-0.000270 (0.000138)	-0.000257 (0.000137)	0.000440 (0.000226)
"Upside" convexity in tax rate	-0.00175 (0.000258)	-0.00107 (0.000204)	-0.00603 (0.000993)
"Downside" convexity in tax rate	-0.000867 (0.000266)	-0.000427 (0.000179)	-0.00395 (0.000908)
p-value for test of equality of coefficients for upside and downside convexity	0.006	0.010	0.206
Number of observations	53,151	53,151	53,151
Pseudo-R^2	0.125	0.122	0.133

Source: Authors' calculations, as described in the text. The models also include the other covariates from the specifications in Table 4. The coefficients are marginal effects from probit estimated. Robust standard errors are in parentheses. The regressions are weighted by sample weights. See also the notes for Table 4.

Table 6: Sensitivity to Focusing on Men and Married Men				
	(1): Men	(2):White Men	(3): Married Men	(4): Married White Men
Tax rate on employment	-0.0000060 (0.000162)	-0.0000839 (0.000184)	0.000106 (0.000177)	0.0000665 (0.000196)
Convexity in tax rate (spread)	-0.00216 (0.000266)	-0.00217 (0.000297)	-0.00227 (0.000272)	-0.00233 (0.000302)
Head's labor earnings	-3.21 (1.14)	-3.48 (1.23)	-1.93 (1.10)	-2.09 (1.16)
Head's labor earnings squared	0.564 (0.259)	0.591 (0.277)	0.325 (0.244)	0.325 (0.255)
Spouse's labor earnings	-6.50 (1.63)	-5.57 (1.76)	-7.08 (1.71)	-6.34 (1.82)
Spouse's labor earnings squared	2.39 (1.43)	1.76 (1.55)	2.91 (1.23)	2.34 (1.34)
Dividend and interest income	0.673 (0.290)	0.872 (0.290)	0.540 (0.286)	0.713 (0.278)
Other property income	1.84 (0.285)	1.82 (0.292)	1.46 (0.260)	1.47 (0.271)
Minority	-0.0112 (0.00275)		-0.00887 (0.00306)	
Single (single = 1)	0.000297 (0.00336)	0.000246 (0.00362)		
Number of kids	0.00157 (0.00106)	0.00136 (0.00118)	0.00116 (0.00106)	0.000857 (0.00111)
Less than high school	0.00206 (0.00348)	0.00125 (0.00396)	0.000340 (0.00343)	-0.000617 (0.00380)
Some college	0.00658 (0.00355)	0.00636 (0.00376)	0.00321 (0.00346)	0.00184 (0.00351)
College	0.00423 (0.00417)	0.00461 (0.00449)	0.00215 (0.00423)	0.00159 (0.00445)
Some post-college education	0.00458 (0.00579)	0.00480 (0.00621)	0.00252 (0.00555)	0.00288 (0.00591)
Number of observations	42,300	28,756	33,839	23,939
Pseudo-R^2	0.124	0.123	0.133	0.133

Source: Authors' calculations, as described in the text. The coefficients presented are marginal effects from probits for entry into self employment. The tax variables are from the less convex case using marginal tax rates. The regressions are weighted by sample weights. See also Table 4 for other notes.

Table 7: Tax Variables Interacted with Family Characteristics		
	Marginal tax rate	Convexity in marginal tax rates
Panel A: Income quintiles		
Lowest quintile	-0.000641 (0.000182)	-0.000941 (0.000306)
2nd quintile	-0.000499 (0.000339)	-0.00100 (0.000421)
3rd quintile	0.0000851 (0.00028)	-0.00149 (0.000428)
4th quintile	0.000174 (0.000256)	-0.00205 (0.000391)
Top quintile	0.000638 (0.000239)	-0.00121 (0.000444)
Panel B: Educational attainment		
Less than high school	0.000131 (0.000226)	-0.00120 (0.000372)
High school graduate	-0.000278 (0.000170)	-0.00137 (0.000292)
Some college experience	-0.0000470 (0.000202)	-0.00127 (0.000383)
College graduate	-0.000207 (0.000230)	-0.00126 (0.000426)
Post-college experience	-0.0000562 (0.000385)	-0.00251 (0.000803)
Panel C: Age of head of household		
Less than 35	-0.0000552 (0.000142)	-0.00151 (0.000246)
35 ≤ age ≤ 50	-0.000248 (0.000167)	-0.00109 (0.000301)
Greater than 50	-0.0000790 (0.000242)	-0.00145 (0.000553)
Panel D: Number of children (sample of married men)		
No children	0.000222 (0.000258)	-0.00245 (0.000495)
1 child	0.0000125 (0.000233)	-0.00251 (0.000419)
2 children	0.000143 (0.000238)	-0.00210 (0.000401)
3 children	-0.0000299 (0.000337)	-0.00189 (0.000578)
4 or more children	0.000308 (0.000396)	-0.00235 (0.000882)

Source: Authors' calculations, as described in the text. Each panel is a separate regression. The models also include the other covariates from the specifications in Table 4. The coefficients are marginal effects from probit estimated. Robust standard errors are in parentheses. The regressions are weighted by sample weights. See also the notes for Table 4.

Table 8: Sensitivity to Controlling for Earnings				
	(1)	(2)	(3)	(4)
Tax rate on employment	-0.000215 (0.000121)	0.000376 (0.000136)	0.000407 (0.000136)	-0.0000964 (0.000141)
Convexity in tax rate (spread)	-0.00135 (0.000206)	-0.000886 (0.000203)	-0.000930 (0.000207)	-0.00129 (0.000211)
Head's labor earnings	-1.40 (0.687)	-17.1 (2.20)		-3.57 (1.09)
Head's labor earnings squared		17.7 (2.60)		0.655 (0.244)
Head's labor earnings cubed		-46.7 (8.51)		
Log (Head's labor earnings)			-0.0158 (0.00192)	
Spouse's labor earnings	-3.43 (1.04)	-10.8 (3.15)		-5.08 (1.54)
Spouse's labor earnings squared		32.1 (14.8)		1.45 (1.47)
Spouse's labor earnings cubed		307.0 (185.0)		
Log (Spouse's labor earnings)			-0.00129 (0.000241)	
Dividend and interest income	0.644 (0.242)	0.479 (0.240)	0.548 (0.241)	0.527 (0.248)
Other property income	1.72 (0.261)	1.66 (0.249)	1.71 (0.259)	1.67 (0.259)
Dummy variables for family income deciles	No	No	No	Yes
Number of obs.	53,151	53,151	53,151	53,151
Pseudo-R^2	0.123	0.131	0.132	0.126

Source: Authors' calculations as described in the text. See also the notes for Table 4. We multiplied the estimated coefficients and standard errors for labor earnings by 10^7; we multiplied those for labor earnings squared by 10^{12}; and we multiplied those for labor earnings cubed by 10^{18}. For dividend and interest income and for age squared, we multiplied the estimated coefficients and standard errors by 10^6. Robust standard errors are in parentheses. The regressions are weighted by sample weights.

Table 9: Tax Rate, Convexity, and Earnings Coefficients Over Time		
Year: *t* to *t* + 1 entry	Marginal tax rate	Spread of marginal tax rates
1978	0.000232 (0.000539)	-0.00211 (0.00111)
1979	0.000088 (0.000411)	0.000843 (0.000735)
1980	-0.000350 (0.000451)	-0.000252 (0.000802)
1981	0.000955 (0.000565)	-0.001838 (0.000886)
1982	0.000216 (0.000504)	-0.001661 (0.000857)
1983	0.000600 (0.000540)	-0.000125 (0.000931)
1984	-0.000194 (0.000474)	-0.001546 (0.000885)
1985	0.000190 (0.000486)	-0.002286 (0.000717)
1986	-0.000322 (0.000419)	0.000363 (0.000623)
1987	-0.000404 (0.000399)	-0.001994 (0.000544)
1988	-0.000546 (0.000299)	-0.000766 (0.000652)
1989	-0.000655 (0.000387)	-0.001795 (0.000636)
1990	-0.000526 (0.000339)	-0.000232 (0.000485)
1991	-0.000060 (0.000373)	-0.002103 (0.000615)
1992	-0.000724 (0.000319)	-0.001411 (0.000507)

Source: Authors' calculations, as described in the text. The estimated model also includes income, demographic, and census region by year variables (not reported); see Table 4 for a complete list of variables. The estimated coefficients are marginal effects from a probit for entry into self employment. Robust standard errors are in parentheses. The estimated model uses 53,151 observations and has a Pseudo-R^2 of 0.150. The regressions are weighted by sample weights. See also the notes for Table 4.

Table 10: Transitory Income, Self-Employment Experience and Tax Effects					
	Include prior wage growth	Exclude households with income shocks	Use average of two years of tax variables	Include self-employment experience	Include self-employment experience with interaction
Tax rate on employment	0.000200 (0.000113)	0.0000097 (0.000127)	-0.000254 (0.000134)	-0.000137 (0.000115)	-0.000294 (0.000119)
Convexity in tax rate (spread)	-0.000898 (0.000174)	-0.000727 (0.000190)	-0.00113 (0.000222)	-0.00120 (0.000189)	-0.00101 (0.000202)
Positive wage growth rate (0 if wage growth is negative)	0.000327 (0.000149)				
Negative wage growth rate (0 if wage growth is positive)	-0.0533 (0.00471)				
Self-employment experience				0.0614 (0.00592)	0.0367 (0.0116)
Experience*tax rate					0.000587 (0.000161)
Experience*tax convexity					-0.000896 (0.000370)
Number of observations	45,787	36,113	49,761	53,151	53,151
Pseudo-R^2	0.134	0.115	0.122	0.156	0.159

Source: Authors' calculations, as described in the text. Model estimates also include demographic and earnings variables (not reported). See also Table 4 for other notes.

Table 11: Convexity and Business Ownership				
	Entrepreneurship defined by owning business assets		Entrepreneurship defined as owning ≥ $5,000 of business assets	
	Full Sample	Married Households	Full Sample	Married Households
Tax rate on employment	0.000573 (0.000722)	0.00159 (0.00108)	0.00126 (0.000616)	0.00166 (0.000940)
Convexity in tax rate (spread)	-0.00343 (0.00110)	-0.00395 (0.00151)	-0.00175 (0.000864)	-0.00251 (0.00119)
Head's labor earnings	-0.971 (4.63)	-2.39 (6.33)	-3.94 (3.56)	-4.09 (4.96)
Head's labor earnings squared	0.0575 (1.43)	0.457 (1.92)	0.840 (1.13)	0.837 (1.45)
Spouse's labor earnings	-0.239 (9.45)	-9.17 (13.4)	-4.52 (7.30)	-12.4 (10.2)
Spouse's labor earnings squared	16.7 (19.2)	41.7 (25.6)	14.6 (14.2)	29.3 (18.1)
Non-business net worth	1.40 (1.09)	1.49 (1.41)	1.32 (0.796)	1.58 (0.999)
Number of observations	4,816	3,250	5,039	3,436
Pseudo-R^2	0.081	0.047	0.091	0.072

Source: Authors' calculations, as described in the text. Model estimates also include demographic variables (not reported). The data are from 1984, 1989, and 1994. We exclude households that got married or divorced or in which one spouse died. Coefficients are marginal effects from probits for entry into entrepreneurship. The tax variables use marginal tax rates for year *t+2*. We multiplied the estimated coefficients and standard errors on labor earnings by 10^7; we multiplied those for labor earnings squared by 10^{12}; and we multiplied those for net worth by 10^8. See also Table 4 for other notes.

Figure 1: Median Tax Spread vs. Income

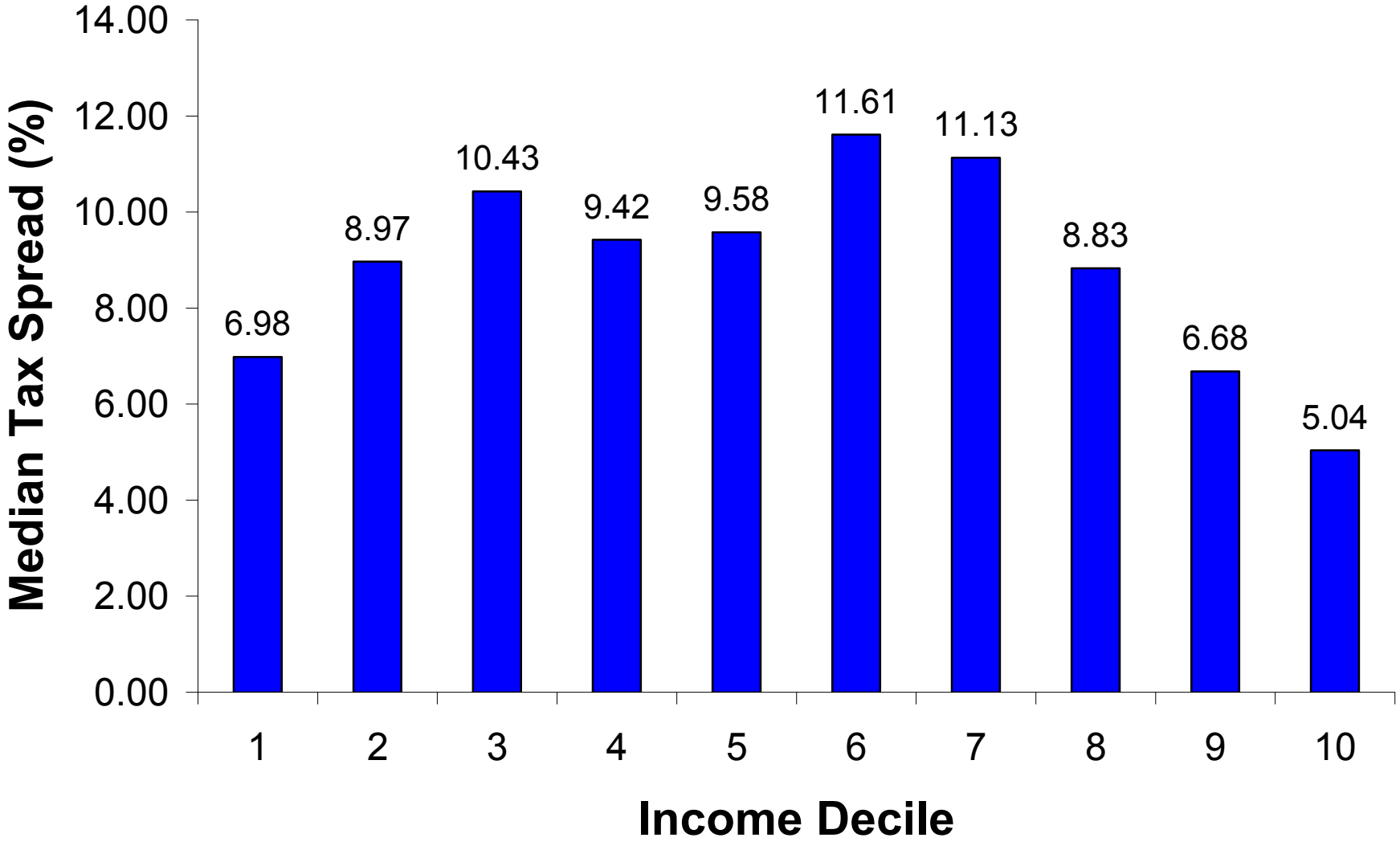

Figure 2: Entry Probability vs. Tax Spread

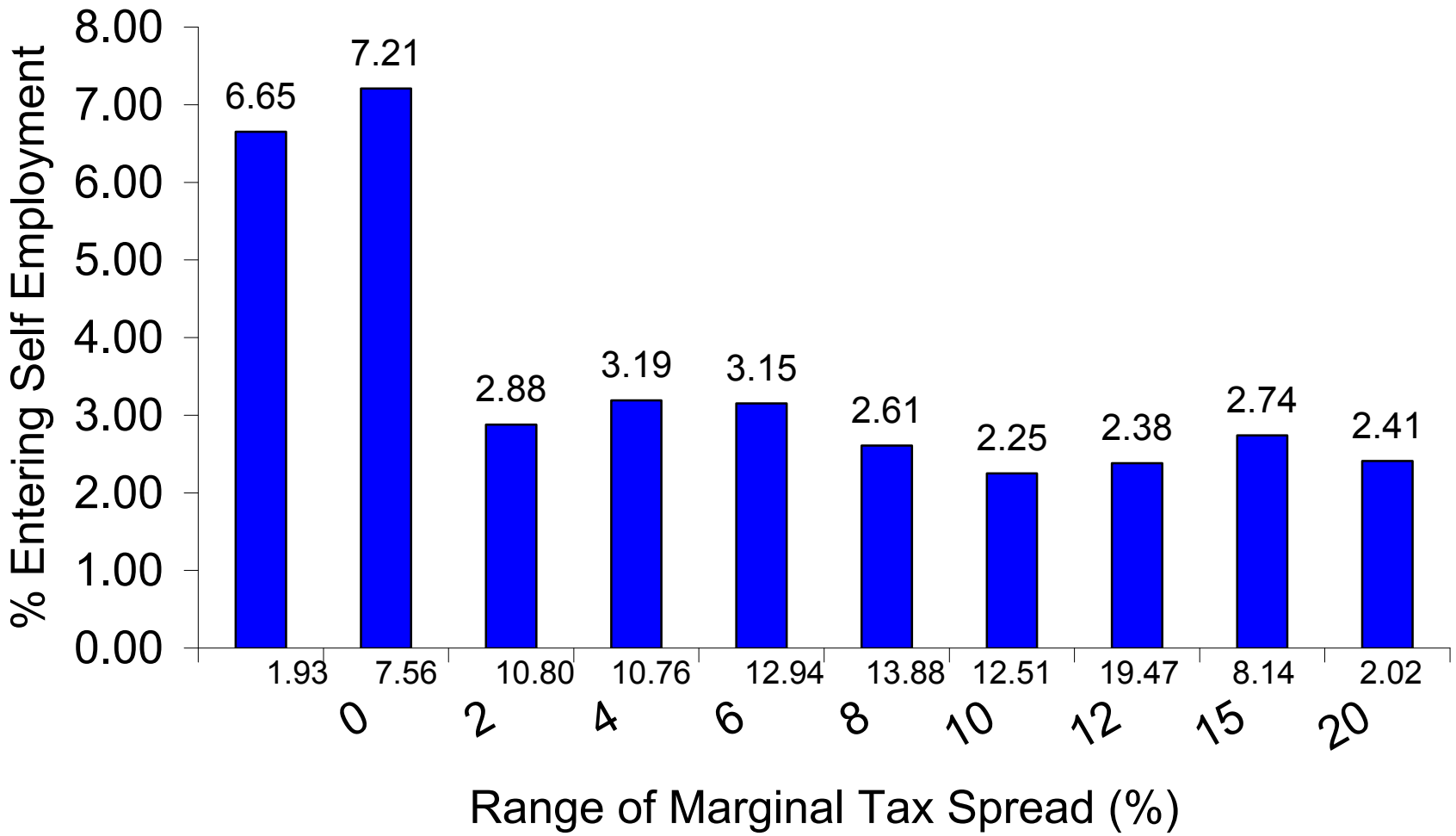

Figure 3: Entry Probability vs. Income