TAX POLICY AND ENTREPRENEURIAL ENTRY

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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 since 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 1978-1993, 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 about 20 percent.

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I. Introduction

Many commonly used general equilibrium models of tax policy evaluation abstract from decisions about entrepreneurship, such as entrepreneurial entry, saving and investment, and change of business scale. Given the emphasis in 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), such omissions are likely to be significant. In addition, decisions by entrepreneurs may account for much of the substantial responsiveness of households' taxable income to changes in marginal tax rates.

We focus on the effects of tax rates and, in particular, income tax progressivity on the decision to become an "entrepreneur." 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. For a risk-neutral individual, this asymmetric treatment of success can discourage entry into risky business ownership. In contrast, if income from entrepreneurship and income from working for someone else face the same proportional tax rate (and the tax system provides refunds for losses), then the tax system will not affect the entry decision for a risk-neutral individual even when self employment entails more variable returns than working for someone else. In principle, if potential entrepreneurs are sufficiently risk-averse, progressive taxation could encourage business entry by offering some insurance against bad outcomes. As has been emphasized by previous research (see Gordon, 1998; or Bruce, 1999a), differences in the tax rate or tax base between entrepreneurship and working for someone else can also affect entrepreneurial decisions.

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, we find substantial evidence that progressive taxation discourages entrepreneurship. We do not find support for the hypothesis that the level of the tax rate affects entry into self employment. Our empirical results imply a significant increase in entrepreneurial entry when tax rates are less progressive; whether such encouragement is efficient (that is, stimulating the most talented entrepreneurs) is a topic for future research. 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 class households by about 20 percent.

The paper is organized as follows. Section II reviews previous literature and background issues concerning self employment, 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 our empirical results using the 1984 and 1989 wealth supplements of the PSID to define entrepreneurial entry based on owning business assets. We conclude in section VI by discussing the implications of our results and future research directions.

II. Tax Policy and Entrepreneurship: Background

In this section, we discuss previous hypotheses regarding how taxes affect entrepreneurial decisions and the associated empirical work. Our basic premise departs from much of this

previous research by focusing on the variability of returns earned by entrepreneurs and the effects of progressive taxation on these returns. Therefore, we also review previous work on: (1) the relative variability of income of entrepreneurs and non-entrepreneurs; and (2) how convexity in the tax schedule affects behavior.

II.A. 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 across self employment and working for someone else (see, *e.g.*, Long, 1982a, Gordon, 1998; and Bruce, 1999a). 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. However, more recent research by Fairlie and Meyer (1999), using data from 1910 to 1990, provides little evidence for this claim. In explaining

the difference between their results and the previous results, Fairlie and Meyer point to the experience of the 1980s, in which average marginal tax rates fell but self-employment rates rose.

Studies using household-level data (*e.g.*, Long, 1982b, Moore, 1983; and Schuetze, 1998) report that higher marginal tax rates are associated with higher probabilities of self employment. Bruce (1999a) makes two important innovations over these previous studies. First, he focuses on the decision to enter self employment; in a companion paper (Bruce, 1999b), 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.

A second area of research on taxation and self employment examines the decisions of ongoing entrepreneurs regarding investment and hiring of outside workers. In two forthcoming papers, Carroll, Holtz-Eakin, Rider, and Rosen examine the effects of the tax reforms of the 1980s on investment and hiring decisions of small businesses. They find that the tax reforms had statistically significant effects on both of these decisions. Thus, along these margins,

entrepreneurs appear to respond to tax incentives.

A third 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. Two complications limit the application of the risk-bearing models to analysis of U.S. tax policy. First, researchers have been concerned generally with optimal taxation, which can depend importantly on heterogeneity in ability or attitudes toward risk. Second, the actual tax system is unlikely to offer full loss offsets for entrepreneurs. While these models make theoretical points about progressivity and entrepreneurial decisions, they have not been tested empirically.[1]

II.B. The Variability of Returns to Self Employment

The focus of existing research on tax policy and entrepreneurial selection is either the level of the tax rate or the difference in the tax rate across employment choices. While we control for such channels in our empirical work, we emphasize a different effect of the tax system on entry into entrepreneurship. Instead of focusing on the level of tax rates, our main interest is the convexity in the tax schedule. Our general assumption is that the returns to entrepreneurship vary

[1] 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 (2000) show that the U.S. tax reforms of the 1980s reduced the degree to which the tax system stabilized fluctuations in consumption.

more than the returns to working for someone else and investing in financial markets. This assumption follows from the simple observation that many small businesses fail while a small number of new businesses do extremely well.

Several previous studies document that entrepreneurship (or self employment) is a risky business. 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 (1998) documents that the distributions of returns to self employment are skewed.[2] 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. In considering entering self employment, the asymmetry in tax rates across different outcomes could discourage workers from choosing more variable employment choices.[3]

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

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[2] Instead of focusing on the variability of returns to self employment relative to working for someone else, Hamilton focuses on the difference in mean returns (conditional on individual characteristics). He finds that the median returns to self employment are lower than for working for someone else suggesting that self employment provides non-pecuniary rewards.

[3] The distinction between self employment and working for someone else is a discrete example of how behavioral choices can affect the variability of income. To a lesser degree, all occupational choices can affect the variability of income. One problem with studying occupational choices more generally is that it may be costly to change occupations later in life.

the ratio of wealth to income. Taken together, this evidence suggests that entrepreneurship entails more variable payoffs than continuing to work for someone else.

II.C. The Behavioral Effects of Convexity of the Tax System

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 (1995) 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. The link between these studies and our work is that they emphasize the behavioral consequences of tax policy when uncertain returns to investments (either saving or entrepreneurship) facing a convex tax schedule.[4]

III. Tax Policy and Entrepreneurial Selection

The convexity of the income tax schedule can have significant effects on the entry decisions of potential entrepreneurs. To the extent that entrepreneurship is a discrete choice, average tax rates on entrepreneurial activity can affect entrepreneurial selection, as a potential entrant compares after-tax returns to work and entrepreneurship. Moreover, to the extent that

[4] Our model of the effects of non-linearities 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 non-linear budget constraint. In addition to these traditional labor supply effects, our point is that when the "wage rate" is uncertain, a non-linear tax system can affect employment choices even for a given number of hours.

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. Exploring such a channel requires a definition of "entrepreneurship;" we have elsewhere (Gentry and Hubbard, 2000) defined entrepreneurship as combining individual-specific ability with an upfront investment to generate an uncertain return (and we explore effects of the tax system on this concept of entrepreneurship later in the paper).

Consider the following illustrative example of a risk-neutral individual *i* considering entrepreneurial entry at time *t*. If the individual works for a firm, he or she receives a certain wage $w_{it}(e_i, x_{it}, z_{it})$, where *e*, *x*, and *z* refer, respectively, to education, experience, and other household characteristics.[5] Entrepreneurial ability is indexed by θ_i. With an investment of *k*, gross returns from entrepreneurship are given by $q_i k_{it}^a$ if a project is successful, and gross returns are zero if the project is unsuccessful. Letting π_s represent the probability of success and *r* the gross risk-free interest rate, individual *i*'s expected net return from entrepreneurship is given by $p_s\left(q_i k_{it}^a - rk_{it}\right) - \left(1 - p_s\right) rk_{it}$, or $p_s q_i k_{it}^a - rk_{it}$.

For entrepreneurial selection, individual *i* compares expected returns to entrepreneurship and employment, choosing entrepreneurship if $p_s q_i k_{it}^a - rk_{it} > w_{it}\left(e_i, x_{it}, z_{it}\right)$. In this simple discrete choice example, a proportional tax with full loss offset has no effect on entrepreneurial selection. Consider, however, the case of a "success" tax at rate τ_s, which exceeds the tax rate on wages τ for individual *i*, and an imperfect loss offset (in the failure state,

[5] In general, these wages are also uncertain and the effects of taxes on employment modes depend on the relative mean and variability of the returns across employment modes.

the tax rate $\tau_f = \beta\tau_s$, $\beta < 1$). Entrepreneurial entry now occurs if:

$$p_s q_i k_{it}^a - rk_{it} > \left(\frac{1-t}{1-t_s}\right) w_{it} + t_s rk\left[(1-b)(1-p_s)\right].$$

Relative to the no-tax case, the likelihood of entrepreneurial entry is reduced the greater is the gap between τ_s and τ. In addition, the more imperfect the loss offset (*i.e.*, the lower is β), the less likely is entrepreneurial entry.

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. To 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 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. The PSID also has a wealth supplement in 1984 and 1989 that allows us to define entrepreneurship based on business assets; we return to this alternative definition in section VI. For our sample, 3.10 percent of household heads enter self employment each year, with the remainder continuing to work for someone else (our sample conditions on working in both years). Abstracting from tax considerations, we estimate probit models for entry into entrepreneurship (some self-employment activity), *ENTRY*, the head of the household i at time $t + 1$:

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

We approximate educational status with indicator variables for "less 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 head of households labor earnings in year t. 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 in the PSID on an annual basis. For z, we include the head's age *(AGE* and AGE^2*)*; the number of children in the household; and dummy variables for whether the head is nonwhite, female, single, a homeowner, and whether the household lives in a rural area (not resident in a Standard Metropolitan Statistical Area). Finally, we include 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. Thus 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 need a measure of the spread in tax rates across the distribution of possible outcomes.

To get a feel for 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. As entrants, we select households for which the head of household entered self-employment between year t and year $t+1$. Regardless of whether they 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 of

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 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 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 are more different 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 assume that the household will either be "successful" or "unsuccessful" as an entrepreneur. Our basic measure of convexity is the

difference in marginal tax rates in the 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.[6] Because the definition of "success" is arbitrary, we use two measures of the success spread that we label the "less convex"and "more convex" cases. In the "less convex" case, we define "success" as an increase in the household head's labor income corresponding to the 75th percentile of the three-year wage growth distribution for entrants; this is roughly an increase of 50 percent over what it had been in the previous year working for someone else. We define being "unsuccessful" as the head's labor income growth corresponding to 25th percentile of the three-year wage growth distribution for entrants; this is roughly a decline of 25 percent. The "more convex" case is defined in a similar way, but we interpret success and failure as a 100 percent increase and a 50 percent decrease in labor earnings; this distribution of outcomes roughly corresponds to the 10th and 90th percentiles of the three-year wage growth profile for entrants. Because the "less convex" case has a smaller income differential between being successful and unsuccessful, it typically leads to a smaller spread in marginal tax rates.

To construct tax variables, we use the TAXSIM model of the National Bureau of

[6] 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 in hopes of balancing these concerns.

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.[7] To construct the household's predicted marginal tax rate in year $t + 1$, we use household characteristics in year t and project the tax rate using the year $t + 1$ tax code.[8] The TAXSIM model processes the PSID data by incrementing nonwage 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.[9] 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.,* 150 percent of labor income for "success" in the less convex case).

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

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[7] The PSID lacks many of the components of actual tax returns. 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, since many capital gains realizations are transitory phenomenon, excluding realized capital gains probably better captures the incentives to change employment status. We restrict our analysis to observations in the PSID that have these data items.

[8] 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 discuss below, the results are also not sensitive to constructing the tax measures with either the year t or $t + 2$ tax code.

[9] This exclusion restriction extends to the average and marginal tax rates that we create assuming the household is a successful or unsuccessful entrepreneur (defined below). We exclude approximately 185 observations out of slightly more that 55,700 total observations for this reason.

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.[10] 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.[11] 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; the tax rate as self-employed assumes the same spousal income as in the previous year. Our calculation does not account for the imperfect loss offset for returns of capital, as we do not have data on investment by entrants.

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 details on a variety of examples of how the various tax rates and convexity measures (for the "less convex" case) vary by household characteristics over time.

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[10] 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.

[11] 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 range of these brackets increased with income. Thus using a constant percentage variance in outcomes makes the probability of changing marginal tax brackets similar across income groups.

Consider a family with one child that lives in a state without a state income tax; the 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. In our less convex case, the husband would either earn $37,500 or $18,750 in self employment, and the household's marginal tax rate would either rise to 33 percent or fall to 25 percent for a spread in marginal tax rates of 8 percentage points. In 1988, this family faced a marginal tax rate of 15 percent as employees, but a spread of 13 percentage points between successful and unsuccessful entry. Alternatively, consider what happens to this family if 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 5, 0, 2, and 7 percentage points, respectively.

Comparing these two families reveals that convexity need not be positively correlated with the level of the tax rate or with income. Figure 1 provides a histogram of the median convexity measure (from the less convex case) by income groups. Middle income households face the largest amount of convexity, with a median convexity measure of 12.20 percent and 12.36 percent for households in the $30,000 to $40,000 and $40,000 to $50,000 ranges, respectively. Overall, the convexity depends on tax provisions that vary across households within a state, across similar households in different states, and across time. Convexity also depends on the distribution of income within the family.

This measure of convexity only accounts for differences in marginal tax rates at the specific income levels associated with successful and unsuccessful entry. It ignores convexity associated with changes in the marginal tax rate between these two income levels (which is

relevant when the distribution of outcomes is continuous). It also does not account for convexity associated with lower marginal tax rates for income levels below the income associated with unsuccessful entry. The shape of the tax schedule below this income level may be important if the entrepreneur also invests capital without full loss offset. 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 marginal tax rate on being an employee; the spread between average tax rates for successful and unsuccessful entry replaces the marginal tax rate measure of convexity. While the average tax rate measure of convexity captures some features of the tax code that the marginal tax rate measure ignores, one weakness of this measure is that it varies for a household that remains in the same marginal tax bracket regardless of employment status or degree of success in entrepreneurship.

Table 1 includes the basic summary statistics on the tax rate and convexity measures. For the less convex case, the mean of the marginal tax rate spread is 8.93 percentage points and the median is 9.2 percentage points. The fifth, 25^{th}, 75^{th}, and 95^{th} percentiles of the distribution of this measure of convexity are 0, 3.28, 13, and 20, respectively. The average tax rate measure of convexity in the less convex case has a mean of 6.52 percentage points and a median of 6.59 percentage points. The distribution of this measure of convexity is much tighter, with a fifth to 95^{th} percentile range of 2.18 to 10.67 percentage points.

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 spread measure of convexity (from the less convex case). 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 11.6 percent of the sample that had a convexity measure of greater than 2 percent but less than or equal to 5 percent, 3.49 percent of households entered self employment. However, among the almost one-third of the sample with a convexity measure of greater than 10 percent but less than or equal to 15 percent, the entry probability is only 2.13 percent. The highest entry probabilities are highest for households that either face zero convexity or negative convexity (a relatively small number of households). The entry probability falls as the convexity measure increases up to convexity measures of over 15 percent, after which it increases slightly.

The regression analysis in the next section provides a multivariate analysis of entry into self employment since the tax convexity measure could be correlated with other determinants of entry. For example, while Figure 1 shows that convexity is correlated with income, Figure 3 plots the entry probability of different income groups by the level of income. The relationship between entering self employment and income is u-shaped with the lowest entry probability occurring for households with the $30,000 to $40,000 of income suggesting that it is important to control for income in measuring the effect of tax convexity on the decision to enter self employment.

V. Estimated Effects of Tax Rate Convexity on Entry

V.A. Base Case Results

The first column of Table 4 reports estimates of an entry probit without including the tax variables in the regression. 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. The sample includes households for which the head works for someone else in year *t* and is not out of the labor force in year *t+1*. We define entry by the household's reporting some self employment activity in year *t + 1*. The sample only includes those households whose head is between age 18 and 60 and whose labor income is positive in year *t*.

Overall, the results are similar to 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 $191,000. Capital income (as a proxy for the wealth of the potential entrants) has a positive effect on the entry probability. 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 less convex 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 0.61 percentage points, a decline of about 20 percent from the average

probability of entry of 3.10 percent. 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 percentage points to 7 percentage points between 1992 and 1993 would lower the probability of entering self employment by 20 percent.[12]

The coefficient on the marginal tax rate associated with the household continuing to have the same labor earnings as before contemplating entry is negative but of only marginal statistical significance. 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. Most of the coefficients on the non-tax variables are similar to those in the first column that excludes the tax variables; the exceptions to this general pattern are the shape of the earnings-entry profile that becomes more shallow and some of the year effects change across specifications. Below, we examine whether the coefficients on the tax rate variables depend on functional form of the earnings controls and whether they change over time.

In the third column of Table 4, we replace the less convex measure of progressivity with the more convex measure (created by assuming success increases labor earnings by 100 percent and being unsuccessful decreases labor earnings by 50 percent). While our method of measuring

[12] The probability falls from 3.21 to 2.59 percent. This comparison assumes that the household owns its home in a non-rural area of a state with no state income tax and has $2,000 of dividend income. The calculation uses the year effect for the 1992 to 1993 transition (the last year in our sample).

convexity is necessarily somewhat arbitrary, the results across these two assumptions of the uncertainty facing potential entrepreneurs does not affect the main result: more convexity in the tax schedule decreases the probability of entry into self employment. The estimated coefficient on the level of the marginal tax rate is still negative but no longer statistically different from zero.

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 (using the smaller spread in potential outcomes). Consistent with the results presented in the two prior columns, the estimated coefficient on the convexity variable is negative and statistically significant. However, in this specification, the effect of progressivity on entry into self employment is larger than in the previous specifications. In contrast to the results using the level of the marginal tax rates, the coefficient on the average tax rate is positive and statistically significant, consistent with the possibility that higher tax rates increase the attractiveness of self employment. The inclusion of the average tax rate measures changes the relationship between earnings and entry into self employment, suggesting that the correlation between the average tax rate measures and earnings affects the estimated coefficients.

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. Since less successful entrepreneurs have the option of returning to work for someone else, one might expect that the behavioral response is not symmetric. 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 the key coefficients form the specifications that are equivalent 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 the specifications with the convexity measure based on marginal tax rates, however, the magnitude of the estimated "upside" convexity effect -- that is, the "success tax" effect -- is about twice as large as the estimated effect of "downside" convexity. This difference is statistically significant at the 99 percent confidence level.

V.B. Sensitivity Analysis

Our base specification has several underlying assumptions that merit further investigation. In addition to comparing different measures of convexity, we are concerned with several other statistical questions. First, are the results sensitive to pooling heads of household from different family structures and demographic groups? Second, does the choice of functional form for controlling for earnings affect the coefficients on the tax rate variables? Also, we have not controlled for spousal income in our probits. Third, the various tax reforms over the sample period create some of the variation in our tax rate variables, which raises two issues. Are the tax variable coefficients stable over time or are the effects stronger around tax reforms when the tax incentives change for some households? Fourth, are the results driven by a correlation between the convexity measure and transitory income shocks that influence entry into self employment?

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. Because our measure of convexity 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 samples of male heads of households, married men, white male heads of households, and married white men. The tax rate variables are for the less convex marginal tax rate case (comparable to 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 coefficient on the convexity measure is roughly 30 to 75 percent larger in absolute value than the coefficient

reported in the second column of Table 4. Relative to female household heads or minorities, white men appear more sensitive to the tax disincentive for entry into self employment. Our primary results, however, are not driven by a correlation between the convexity measure and these demographics.

To further explore whether the effects of convexity are concentrated among specific groups in the population, we interact the tax variables with household characteristics.[13] To examine whether the relationship in our basic specification is similar at different income levels, we interact the tax variables with five dummy variables for various income ranges. The estimated coefficients do not reveal a systematic relation between convexity and income levels. Thus the 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. Similarly, with interactions between the tax variables and three dummy variables for the agof 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), the estimated tax effects are quite 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). We find some evidence that the negative effects of convexity are larger folr families with no children.[14] One interpretation of this relative difference is that, while the "success tax" story

[13] We run each of the interacted specifications described in the text separately. We do not report the results for space reasons but will provide the results upon request.

[14] The coefficients on the five interactions terms are -0.00260, -0.00163, -0.00150, -0.00151, and -0.00191 from having no children to having four or more children, respectively. The estimated coefficient for families without children is statistically different from the estimates for families with one child, two children, or three children at the 95 percent confidence level; however, we cannot reject the hypothesis that

applies across families with and without children, the effect is weaker for families with children because they place a higher value on the insurance aspects of progressive taxation.

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 perturbations of income). 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 liquidity constraints that discourage self employment. These alternative reasons for entering self employment could combine with the observed zero 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 $10,000. Neither of these alternative specifications changes the substance of the results.[15]

V.B.2 Controlling for Earnings

A common concern in estimating the effects of income tax rates on household behavior is

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it is the same as the estimated coefficient for families with four or more children.

[15] More generally, as shown in Figure 2 roughly 2.8 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 various tax provisions). Because these observations also have relatively high rates of entry into self employment, they may unduly influence our results. Eliminating these 1,594 observations, however, does not change the results. For example, in the specification with all households, the estimated coefficient on convexity without these observations is -0.00126 compared to the -0.00121 reported in Table 4.

that income tax rates are correlated with income so that it is difficult to separate tax rate effects from non-linearities 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 non-linear 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 7 we report results for several alternative functional forms for controlling for the head of household's labor earnings. Results presented in the first column have only a linear term in the head's labor earnings; the second column allows for a cubic function of earnings, and the third column uses a logarithmic specification in the head's labor earnings. Across these three specifications, not surprisingly, the 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, 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 non-linearities in earnings.

In contrast, the coefficient on the convexity measure is consistently negative and statistically significant; it is, however, about 30 percent smaller in magnitude in the specifications with the cubic earnings or the logarithm of earnings. These results suggest that the convexity effects that we find are not artifacts of simple non-linearities in controlling for income.

Focusing more narrowly on married men also allows us to estimate whether including spousal income affects the relationship between entry decisions and the measure of convexity of

the tax schedule. As illustrated by the examples in Table 3, spousal income affects the convexity measure since it affects the household's marginal tax rate under the different possible decisions and outcomes. The fourth column of Table 7 reports the coefficients for entry probits that include a quadratic specification of both the husband's and wife's labor earnings; the fifth column allows for a cubic specification for both the husband and wife's labor earnings. The spousal income variables are statistically significant suggesting that spousal income affects entry decisions. More importantly, for our purposes, the inclusion of these variables does not greatly affect the estimated coefficient of the convexity of the tax schedule.[16]

V.B.3. Time -Series Variation in Tax Rate Effects

In Table 8 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 8, we allow the relationship among entry, the earnings of the head of household, capital income, and the tax variables (constructed in the less convex, marginal tax rate case) to

[16] In specifications that repeat the earnings controls reported in Table 7 but allow for separate measures of upside and downside convexity, the estimated coefficients on both measures of convexity are negative and statistically significant at the 99 percent confidence level. However, in the specifications that allow for a cubic in earnings or the logarithm of earnings, we cannot reject the hypothesis that the effects of upside and downside convexity are symmetric (unlike the results reported in Table 5).

vary by year.[17] 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 (though of weak statistical significance) but in the later years, it is typically negative (though, again, 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 95 percent confidence level in ten of the fourteen years. The largest estimated coefficients on the convexity variable occur for the early 1980s consistent with responses to the changes in progressivity from the 1981 helping to provide econometric identification of the coefficients. 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.[18]

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. 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 $t + 1$. On the other hand, because

[17] In the reported results, the relationship between capital income and entry is assumed to be constant over time. Allowing this relationship to vary over time does not change the results substantially.

[18] 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 and statistically significant at the 99 percent confidence level in every year. 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.

successful spells of self-employment will presumably last longer than one year, the tax rate in future years should also be relevant for entry decisions. Furthermore, because entry decisions might take several years, short-run measures of the tax incentives might not be as important as longer run measures. 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 this change (not reported in a table, but available upon request). 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. Transitory Income, Entry, and Convexity

One dynamic factor that might affect entry into self employment is shocks to income. 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 discussed above, transitory shocks may also systematically lead to lower convexity measures since convexity is lower for higher and lower income families.

To reduce the effect of households that are experiencing transitory income shocks, we control for the effects of transitory wage growth in two ways. First, we include variables for the

growth in labor earnings between year *t-1* and year *t*.[19] Because large changes in labor income in either direction may be correlated with entry, we include separate variables for negative and positive wage growth. Second, 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.[20]

Table 9 reports the results for these specifications for both all households and for married men. The first two columns include the wage growth variables. 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 highly statistically significant. Including these variables reduces the magnitude of the estimated coefficients on convexity by about 40 percent but the estimated coefficients are still highly statistically significant and economically important.[21] As reported in the last two columns of the table, 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. These results suggest that a portion of the convexity effect is related to transitory shocks in income that affect both measured convexity and

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[19] To impose this restriction, the household must be in the sample in the previous year (*i.e.*, year *t-1*), it must participate in the labor market in the previous year and have positive labor income. This restriction eliminates approximately 20 percent of our sample.

[20] Because wage income tends to increase, we allow for larger increases than decreases in creating this restriction. Of the sample of 44,309 observations of various family structures, the wage growth restriction eliminates another 6,945 observations (or about 16 percent of the possible observations).

[21] About half of the reduction in the estimated coefficients on the convexity variables is from reducing the sample size due to requiring more data on labor market participation. For example, with the smaller sample but without the wage growth variables, the estimate of the coefficient for all households changes from -0.00121 to -0.00984. The inclusion of the wage growth variables further reduces the estimated coefficient from -0.00984 to -0.00713.

unobserved non-tax determinants of entry into self employment.

Overall, we draw two conclusions from the sensitivity analysis in Tables 6 through 9. 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. 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. Defining Entrepreneurship with Business Ownership

The results we have presented thus far use the "self employment" definition for the PSID as a proxy for "entrepreneurship." As we have argued elsewhere (Gentry and Hubbard, 2000), self employment is not an exact measure of entrepreneurship if one means by the latter the starting of a business with an investment of funds as well as time. Thinking of an entrepreneurial venture in this way suggests a definition more centered on "business ownership."

Defining entrepreneurship as owning business assets requires us to use data on asset ownership in the PSID. Over our sample period, these data are available for two years – 1984 and 1989. 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 (following Gentry and Hubbard, 2000).

The business ownership variable in the PSID represents a "household" as opposed to an "individual" decision. As a consequence, analyzing entry into business ownership requires some care to avoid households experiencing significant changes in family structure over the five-year period between the available business ownership observations. Accordingly, we exclude households that got married or divorced between 1984 and 1989 or in which one spouse died. This change yields a sample of 3637 households, including 2389 married households.

We present results from probits for entry into business ownership in Table 10. We include the same basic covariates we examined for entry into self employment with one exception – as we now observe net worth, we replace capital income with non-business net worth. The estimated effect of the tax rate on employment is not positive though imprecisely estimated for married households. Importantly, the estimated effect of convexity in the tax rate is negative (and with one exception – married households in the "owning any business assets" definition of business ownership – precisely estimated). For the "owning at least $5,000 of business assets" definition of business ownership, the estimated coefficients are larger than the estimated coefficients for the "self employment" or "owning any business assets" definition.

While we only have two observations of business ownership, the results presented in Table 10 confirm the basic pattern found in Tables 4 - 9. 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 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. 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.

Two extensions are particularly noteworthy. The first is to integrate tax policy effects on entrepreneurial decisions in more general models of saving and investment. The second 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?

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Table 1: Summary Statistics				
	Mean	Standard Deviation	Min	Max
Average Tax Rate	12.97	8.71	-19.88	61.51
Marginal Tax Rate	26.21	10.58	-19.86	69.45
Marginal Tax Rate Spread – Less Convex Case	8.93	7.02	-25.19	58.63
Marginal Tax Rate Spread – More Convex Case	17.15	9.24	-22.19	59.03
Average Tax Rate Spread – Less Convex Case	6.52	2.59	-35.35	18.18
Average Tax Rate Spread – More Convex Case	12.72	4.73	-33.15	34.44
Head's Labor Earnings	23577.98	17370.47	30	550000
Dividend and Interest Income	497.92	2377.52	0	145000
Age	36.07	10.24	18	60
Minority (non-white = 1)	0.36	0.48	0	1
Female head	0.20	0.41	0	1
Married (single = 1)	0.36	0.48	0	9
Number of kids	1.14	1.24	0	1
Home owner	0.55	0.50	0	1
Rural	0.36	0.48	0	1
Less than h.s.	0.20	0.40	0	1
High school	0.40	0.49	0	1
Some college	0.20	0.40	0	1
College	0.14	0.35	0	1
Some post-college education	0.058	0.23	0	1

The sample pools data from 1978 to 1993. The number of observations is 55738, except for the more convex tax rate spread measures, which are computed with 55699. 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*. The sample only includes those households whose age is between 18 and 60 and whose labor income is positive in *t*. All observations with average or marginal tax rates larger than 75 percent or smaller than -20 percent are dropped. Observations with average or marginal tax rates for the successful or the unsuccessful case larger than 75 percent or smaller than –20 percent are also dropped.

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

The sample pools data from 1978 to 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 &	Marginal tax rate as an employee	Spread in marginal tax rates for success &
Example 1: Husband earns $25,000; wife earns $15,000; one child	1986	15.01	5.97	28.0	8.0
	1988	10.97	4.68	15.0	13.0
	1992	10.14	2.83	15.0	13.0
	1993	9.99	2.68	15.0	13.0
Example 2: Husband earns $40,000; wife earns zero; one child	1986	16.06	9.58	28.0	13.0
	1988	10.97	6.91	15.0	13.0
	1992	10.14	5.54	15.0	13.0
	1993	9.99	5.45	15.0	13.0
Example 3: Husband earns $90,000; wife earns $50,000; one child	1986	33.72	6.09	49.0	5.0
	1988	25.13	3.42	33.0	0.0
	1992	22.86	3.79	31.0	2.0
	1993	22.71	4.71	31.0	7.0
Example 4: Husband earns $200,000; wife earns $75,000; one child	1986	41.56	3.86	50.0	0.0
	1988	27.49	0.26	28.0	0.0
	1992	27.64	1.69	31.0	0.0
	1993	30.14	4.24	40.0	4.0
Example 5: Husband earns $10,000; wife earns $10,000; one child	1986	8.19	2.76	16.0	4.0
	1988	6.94	3.38	15.0	-10.0
	1992	3.81	6.82	28.0	-13.0
	1993	2.97	7.62	28.0	-13.0
Example 6: Single parent earns $30,000; one child	1986	16.00	8.55	28.0	11.0
	1988	10.87	6.46	15.0	13.0
	1992	10.07	4.99	15.0	13.0
	1993	9.90	4.90	15.0	13.0
Example 7: Single individual earns $30,000;	1986	18.35	8.83	30.0	12.0
	1988	15.69	8.06	28.0	13.0
	1992	13.04	6.96	28.0	13.0
	1993	12.78	6.89	28.0	13.0

Based on the less convex measure of success and failure in entrepreneurship. The example assumes that the family lives in a state without a state income tax. The marginal tax rates are calculated 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): Less convex, mar. tax rate	(3): More convex, mar. tax rate	(4): Less convex, ave. tax rate
Tax rate on employment		-0.000166 (0.000109)	-0.0000313 (0.000106)	0.000404 (0.000152)
Convexity in tax rate (spread)		-0.00121 (0.000129)	-0.00133 (0.0000931)	-0.00578 (0.000375)
Head's Labor Earnings	-4.35 (1.02)	-3.01 (1.07)	-2.98 (0.998)	-0.182 (0.973)
Head's Labor Earnings squared	1.14 (0.40)	0.832 (0.363)	0.788 (0.333)	0.152 (0.279)
Dividend and Interest Income	1.10 (0.24)	0.914 (0.223)	0.668 (0.214)	0.344 (0.216)
Age	0.000918 (0.000631)	0.000962 (0.000618)	0.000712 (0.000606)	0.000755 (0.000598)
Age squared	-11.3 (8.05)	-11.9 (7.88)	-8.98 (7.73)	-9.49 (7.60)
Minority	-0.0137 (0.0018)	-0.0137 (0.00172)	-0.0134 (0.00168)	-0.0137 (0.00167)
Female head	-0.0202 (0.00188)	-0.0188 (0.00186)	-0.0164 (0.00190)	-0.0176 (0.00186)
Single (single = 1)	0.00655 (0.00248)	0.00779 (0.00244)	0.00906 (0.00242)	0.0114 (0.00244)
Number of kids	0.00132 (0.000734)	0.00199 (0.00073)	0.00309 (0.000720)	0.00264 (0.000760)
Homeowner	-0.00514 (0.00195)	-0.00503 (0.00190)	-0.00596 (0.00187)	-0.00561 (0.00184)
Rural	0.00143 (0.00172)	0.00106 (0.00167)	0.00101 (0.00163)	0.00124 (0.00160)
Less than h.s.	0.00605 (0.00262)	0.00507 (0.00254)	0.00546 (0.00252)	0.00467 (0.00247)
Some college	0.00962 (0.00259)	0.00975 (0.00255)	0.00913 (0.00248)	0.00888 (0.00244)
College	0.0126 (0.00322)	0.0124 (0.00315)	0.0111 (0.00303)	0.0114 (0.00303)
Some post-college educ.	0.0191 (0.00523)	0.0166 (0.00497)	0.0142 (0.00467)	0.0132 (0.00458)
Number of obs.	55738	55738	55699	55738
Pseudo-R^2	0.023	0.031	0.041	0.050

Estimated models include year effects. 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 coefficients and standard errors for labor earnings are multiplied by 10^7 and for labor earnings squared are multiplied by 10^{12}. The coefficients and standard errors for capital income and for age squared 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.

Table 5: Differential Effects of Upside and Downside Convexity			
	(1): Less convex, mar. tax rate	(2): More convex, mar. tax rate	(3): Less convex, ave. tax rate
Tax rate on employment	-0.000364 (0.000115)	-0.000403 (0.000108)	0.0000420 (0.000178)
"Upside" convexity in tax rate	-0.00171 (0.000159)	-0.00215 (0.000130)	-0.00663 (0.000426)
"Downside" convexity in tax rate	-0.000871 (0.000140)	-0.000984 (0.0000909)	-0.00511 (0.000408)
P-value for test of equality of coefficients for upside and downside convexity	0.000	0.000	0.000
Number of observations	55738	55699	55738
Pseudo-R^2	0.033	0.047	0.051

The regressions 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. See 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	0.0000160 (0.000137)	-0.000188 (0.000182)	-0.0000198 (0.000151)	-0.000168 (0.000195)
Convexity in tax rate (spread)	-0.00163 (0.000155)	-0.00204 (0.000208)	-0.00161 (0.000170)	-0.00214 (0.000222)
Head's Labor Earnings	-3.31 (1.21)	-2.72 (1.40)	-2.05 (1.23)	-1.56 (1.41)
Head's Labor Earnings squared	0.890 (0.391)	0.778 (0.411)	0.653 (0.382)	0.559 (0.407)
Dividend and Interest Income	0.988 (0.255)	1.14 (0.289)	0.858 (0.252)	0.999 (0.285)
Age	0.00139 (0.000765)	0.00210 (0.00103)	0.00123 (0.000864)	0.00204 (0.00115)
Age squared	18.3 (9.82)	27.7 (13.1)	-15.8 (10.9)	-26.6 (14.5)
Minority	-0.0163 (0.00203)		-0.0157 (0.00217)	
Single (single = 1)	0.00900 (0.00295)	0.00761 (0.00385)		
Number of kids	0.00213 (0.000880)	0.00191 (0.00122)	0.00202 (0.000899)	0.00179 (0.00121)
Home owner	-0.00693 (0.00232)	-0.0114 (0.00318)	-0.00910 (0.00258)	-0.0136 (0.00355)
Rural	0.00194 (0.00198)	0.00496 (0.00253)	0.00255 (0.00212)	0.00464 (0.00268)
Less than h.s.	0.00466 (0.00302)	0.00166 (0.00406)	0.00382 (0.00329)	0.00116 (0.60426)
Some college	0.0102 (0.00305)	0.0122 (0.00345)	0.00947 (0.00329)	0.00925 (0.00410)
College	0.0124 (0.00364)	0.0131 (0.00436)	0.0128 (0.00404)	0.0125 (0.00471)
Some post-college educ.	0.0173 (0.00570)	0.0158 (0.00634)	0.0173 (0.00607)	0.0174 (0.00698)
Number of observations	44442	30218	35594	25154
Pseudo-R^2	0.030	0.029	0.032	0.031

Coefficients are marginal effects from probits for entry into self employment. The tax variables are from the less convex case using marginal tax rates. See Table 4 for other notes.

Table 7: Sensitivity to Controlling for Earnings					
	(1)	(2)	(3)	(4)	(5)
Tax rate on employment	-0.000277 (0.000104)	0.000383 (0.000107)	0.000503 (0.000111)	0.000233 (0.000171)	0.000870 (0.000158)
Convexity in tax rate (spread)	-0.00124 (0.000129)	-0.000807 (0.000117)	-0.000892 (0.000123)	-0.00178 (0.000173)	-0.00126 (0.000158)
Head's Labor Earnings	-1.03 (0.781)	-23.8 (2.05)		-2.94 (1.27)	24.9 (2.39)
Head's Labor Earnings squared		28.7 (2.89)		0.803 (0.389)	27.5 (3.03
Head's Labor Earnings cubed		-81.7 (11.2)			-72.9 (10.5)
Log(Head's Labor Earnings)			-0.0186 (0.00160)		
Dividend and Interest Income	0.968 (0.220)	0.674 (0.213)	0.865 (0.221)	0.775 (0.253)	0.534 (0.244)
Spouse's Labor Earnings				-5.79 (1.50)	-1.54 (0.341)
Spouse's Labor Earnings squared				2.90 (1.13)	47.0 (16.4)
Spouse's Labor Earnings cubed					-439.0 (206.0)
Number of obs.	55738	55738	55738	35594	35594
Pseudo-R^2	0.030	0.044	0.041	0.033	0.048

See the notes for Table 4. The estimated coefficients and standard errors for labor earnings are multiplied by 10^7, for labor earnings squared are multiplied by 10^{12}, and those for labor earnings cubed are multiplied by 10^{18}. For dividend and interest income and for age squared, the estimated coefficients and standard errors are multiplied by 10^6. Robust standard errors are in parentheses.

Table 8: Tax Rate, Convexity, and Earnings Coefficients Over Time				
Year: *t* to *t+1* entry	Earnings	Earnings^2	Marginal tax rate	Spread of Marginal Tax Rates
1979	-2.06 (8.98)	11.7 (10.9)	0.000503 (0.000433)	-0.00166 (0.000684)
1980	-18.8 (8.30)	26.1 (9.63)	0.000581 (0.000370)	-0.000621 (0.000621)
1981	-9.96 (7.88)	17.1 (7.99)	0.000161 (0.000376)	-0.00200 (0.000666)
1982	-11.5 (8.03)	16.5 (8.47)	0.000350 (0.000439)	-0.00202 (0.000647)
1983	-6.02 (6.46)	8.75 (5.51)	0.000098 (0.000464)	-0.00288 (0.000734)
1984	-2.37 (5.57)	3.94 (3.64)	-0.000310 (0.00049)	-0.00160 (0.00661)
1985	-9.74 (5.31)	8.84 (3.64)	-0.000087 (0.000418)	-0.00222 (0.000729)
1986	-17.3 (5.28)	9.17 (2.90)	0.000520 (0.000464)	-0.00203 (0.000725
1987	-11.2 (4.15)	5.14 (1.85)	-0.0000518 (0.000378)	-0.000533 (0.000401)
1988	-9.59 (3.67)	4.54 (1.66)	-0.000315 (0.000388)	-0.00127 (0.000401)
1989	-1.31 (2.68)	0.544 (0.753)	-0.000368 (0.000357)	-0.00108 (0.000425)
1990	-2.58 (2.89)	0.625 (0.533)	-0.000572 (0.000424)	-0.000776 (0.000445)
1991	-3.25 (2.39)	0.810 (0.434)	-0.000601 (0.000323)	-0.000242 (0.000291)
1992	-4.70 (2.65)	1.19 (0.532)	-0.0000705 (0.000322)	-0.00132 (0.000308)
Number of obs.	55738			
Pseudo-R^2	0.0426			

The estimated model also includes year effects and demographic variables (not reported). The estimated coefficients are marginal effects from a probit for entry into self employment. Robust standard errors are in parentheses. See the notes for Table 4.

Table 9: Transitory Income and Tax Effects				
	Including Prior Wage Growth		Eliminating Households Experiencing Shocks to Labor Income	
	Full Sample	Married Households	Full Sample	Married Households
Tax rate on employment	0.000153 (0.000096)	0.000390 (0.000136)	-0.0000625 (0.000113)	0.000190 (0.000166)
Convexity in tax rate (spread)	-0.000713 (0.000115)	-0.000992 (0.000149)	-0.000566 (0.000132)	-0.000893 (0.000169)
Positive Wage Growth Rate (0 if wage growth is negative)	0.000415 (0.000182)	0.000419 (0.000244)		
Negative Wage Growth Rate (0 if wage growth is positive)	-0.0646 (0.00403)	-0.0777 (0.00521)		
Number of observations	44309	29214	37364	24290
Pseudo-R^2	0.058	0.064	0.026	0.029

Model estimates also include demographic and earnings variables (not reported). See Table 4 for other notes.

Table 10: 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	0.000858 (0.000415)	0.000532 (0.000766)	0.00102 (0.000360)	0.00102 (0.000680)
Convexity in tax rate (spread)	-0.00151 (0.000611)	-0.00166 (0.00100)	-0.00212 (0.000538)	-0.00350 (0.000906)
Head's Labor Earnings	2.89 (2.83)	6.91 (4.58)	2.44 (2.17)	4.57 (3.59)
Head's Labor Earnings squared	-0.651 (0.639)	-1.35 (1.18)	-0.154 (0.463)	-0.182 (0.762)
Spouse's Labor Earnings		26.4 (14.8)		16.0 (12.6)
Spouse's Labor Earnings Squared		-59.9 (45.7)		-53.5 (39.1)
Non-business net worth	1.11 (0.623)	1.55 (0.871)	0.469 (0.449)	0.692 (0.633)
Number of obs.	3637	2389	3637	2389
Pseudo-R^2	0.082	0.039	0.095	0.051

Model estimates also include demographic variables (not reported). The data are from 1984 and 1989. We exclude households that got married or divorced or in which one spouse died. Coefficients are marginal effects from probits for entry into self employment. The tax variables are from the less convex case using marginal tax rates for year *t+2*. The estimated coefficients and standard errors on labor earnings are multiplied by 10^7; for labor earnings squared, they are multiplied by 10^{12}; and for net worth, they are multiplied by 10^8. See Table 4 for other notes.

Figure 1: Median Tax Spread vs. Income

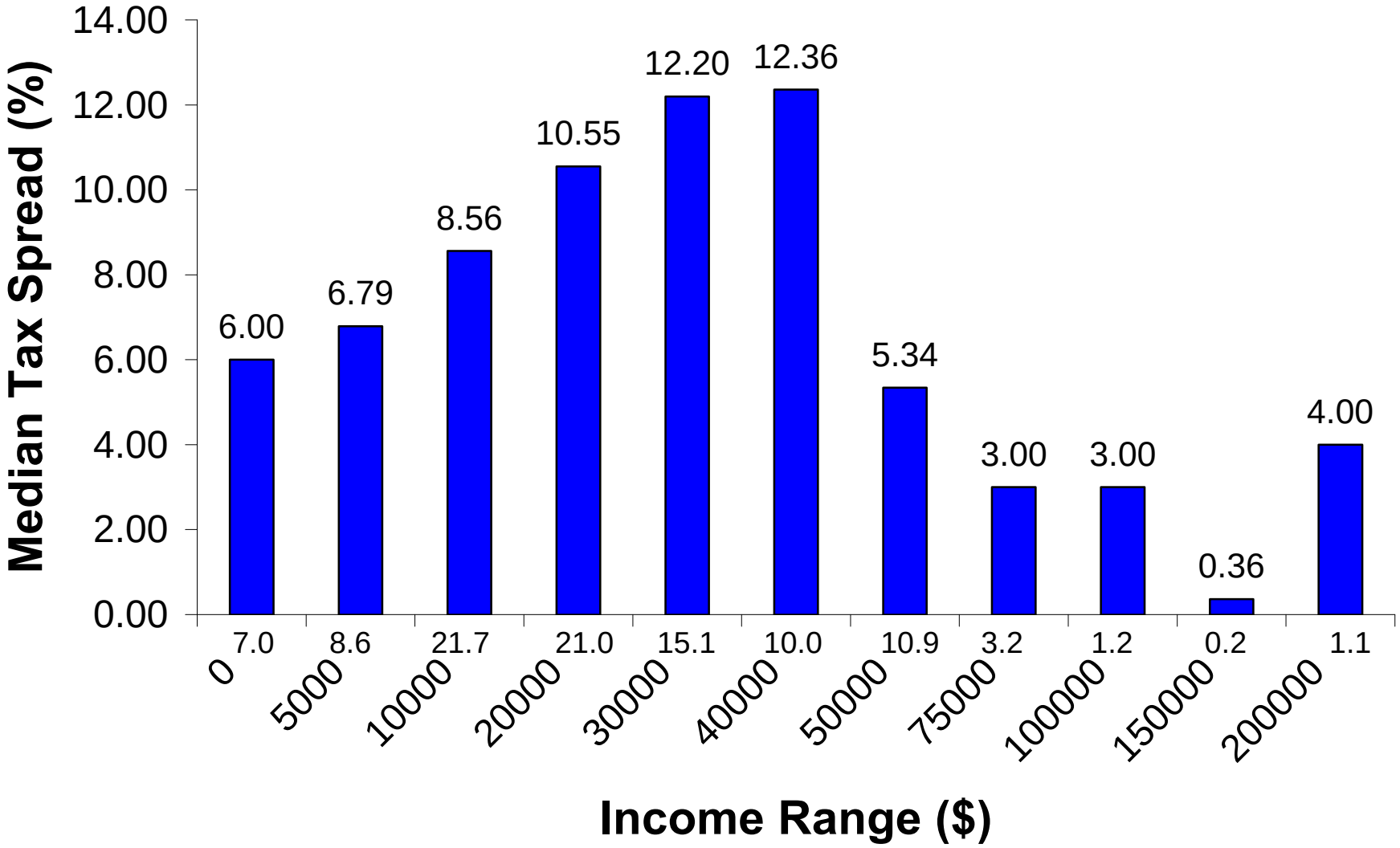

Figure 2: Entry Probability vs. Tax Spread

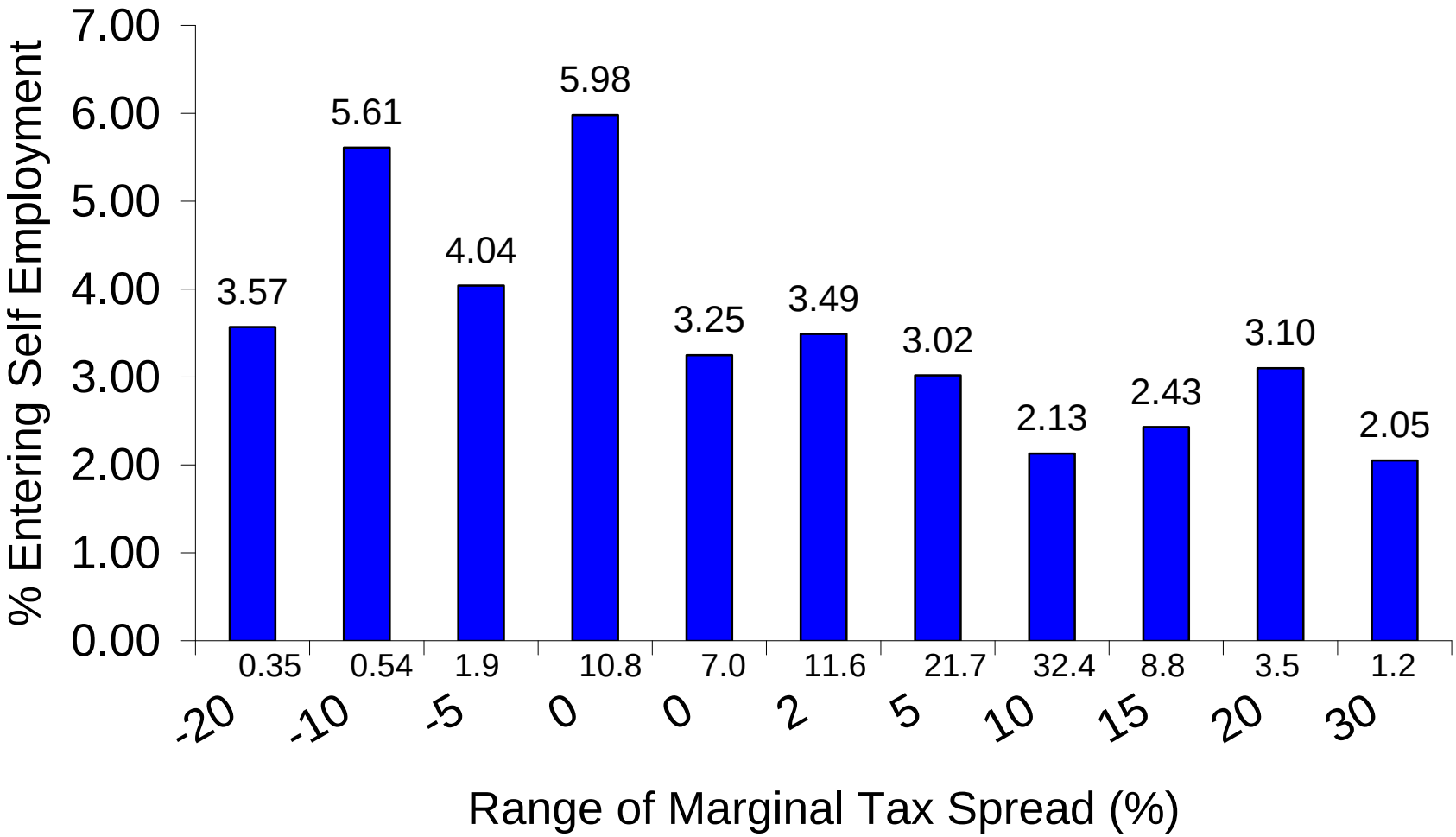

Figure 3: Entry Probability vs. Income