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"Success Taxes," Entrepreneurial Entry, and Innovation

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Executive Summary

Interest in the role of entrepreneurial entry in innovation raises the question about the extent to which tax policy encourages or discourages entry. We find that, while the level of the marginal tax rate has a negative effect on entrepreneurial entry, the progressivity of the tax also discourages entrepreneurship, and significantly so for some groups of households. These effects are traceable principally to the "upside," or "success," convexity of the household tax schedule.

Prospective entrants from a priori innovative industries and occupations are no less affected by the considerations we examine than are other prospective entrants. In terms of destination-based industry and occupation measures of innovative entrepreneurs, we find mixed evidence on whether innovative entrepreneurs differ from the general population. The results for entrepreneurs moving to innovative industries suggest that they may be unaffected by tax convexity, but the possible endogeneity of this measure of innovative entrepreneurs confounds interpreting this specification. Using education as a measure of potential for innovation, we find that tax convexity discourages entry into self-employment for people of all educational backgrounds. Overall, we find little evidence that the tax effects are focused simply on the employment changes of less-skilled or less-promising potential entrants.

I. Introduction

Public policy interest in entrepreneurs reflects several considerations, from the role of entrepreneurs in innovative activity to the significance of entrepreneurship in wealth accumulation (Gentry and Hubbard 2004a), to the relationship between entrepreneurship and income and wealth mobility (Quadrini 1999). Entrepreneurship can take many forms, ranging from small mom-and-pop operations to larger firms backed by venture capital. Naturally, some entrepreneurial enterprises are more innovative than others; for example, some entrepreneurs open restaurants that closely follow existing business models, while other entrepreneurs develop new computer software. Despite the wide range of entrepreneurial activities and their varied contributions to innovation, entrepreneurship is typically a risky business.[1]

The risk entailed in entrepreneurship amplifies public policy concerns about whether the government can (or should) foster innovation and entrepreneurship. In addition to specific policies toward entrepreneurship, the tax system can potentially have positive and negative effects on entrepreneurship. Some tax policies, such as accelerated capital recovery for small businesses, target entrepreneurs, but other tax effects may arise from general tax policy choices, such as the choice of the shape of the tax rate schedule. Given the riskiness of entrepreneurship, the shape of the tax schedule may play an especially important role in affecting entrepreneurial decisions because, with a progressive income, successful ventures may face a higher tax rate than unsuccessful ventures face.

In our previous work (Gentry and Hubbard 2003), we focus on the effect of the progressivity of the income tax schedule on the entry decisions of risk-averse potential entrepreneurs. On one hand, when greater tax progressivity can offer insurance through the tax system against uninsured idiosyncratic risk, entry may be enhanced (see, for example, Kanbur 1981). On the other hand, the "success tax" feature of a progressive tax combined with imperfect loss offsets can reduce the likelihood of entry. As we discuss more fully below, our focus on the progressivity of the tax system departs from earlier research on taxation and entrepreneurship that mainly focuses on how the level of taxation affects entrepreneurial activity.

In our previous (2003) study, using data from the Panel Study of Income Dynamics (PSID), we estimated the effects of tax progressivity (while controlling for the level of taxation) in empirical estimations of the probability of entry into self-employment.[2] We found robust results that progressive marginal tax rates discourage entry into self-employment and business ownership. Those effects are large. The Omnibus Budget Reconciliation Act of 1993, which raised the top marginal individual income tax rate, was estimated to have reduced the probability of entry into self-employment for upper-middle-income households by as much as 20 percent. Those estimated effects were robust to controlling for differences in family structure, spousal income, and measures of transitory income.

An open question in this research is, Do the estimated negative effects of tax progressivity on entrepreneurship translate into negative effects on innovation? That is, we do not know whether the tax system discourages entry by potential entrepreneurs who are especially innovative by more or less than it discourages entry by potential entrepreneurs who want to pursue projects that are not terribly innovative or risky. It is possible that risk and innovation are positively correlated, so that entrepreneurs with more innovative projects are more concerned with the success tax from progressive tax rates compared to entrepreneurs who undertake safer, less innovative projects. It is also possible, however, that tax factors play less of a role for innovative entrepreneurs because of the relative importance of other factors dominating the entry decision.

We do not have a direct measure on how innovative are particular entrants into entrepreneurship. As an indirect test of whether the tax system discourages particularly innovative types of entrepreneurship, we examine whether our estimated effects vary by characteristics of the potential entrepreneur that might plausibly be correlated with how innovative his or her project may be. As characteristics that might be correlated with how innovative the potential entrepreneur is, we focus on the potential entrepreneur's education, industry, and occupation. Our underlying assumption is that better-educated entrepreneurs are more likely to be innovative than are less-educated potential entrepreneurs. In terms of industry and occupation, we assume that more technical industries and occupations (as opposed to, say, service industries and occupations) are more innovative forms of entrepreneurship. We use industry and occupation in two ways to proxy for how innovative the entrepreneur is. First, we use the potential entrepreneur's industry and occupation at the time of the decision as measures of his or her predetermined characteristics; we call this the "origin" basis for defining innovation as a characteristic. Second, we identify innovative entrepreneurs based on their "destination" industry and occupation; that is, we test whether entry into self-employment in innovative industries or occupations is differentially sensitive to tax incentives.

To preview our results, we find some evidence that our estimated effects of tax progressivity discouraging entry into entrepreneurship vary with our proxies for how innovative the potential entrepreneur is. In most cases, the sensitivity to the tax parameters does not vary systematically with our industry and occupation measures of how innovative the entrepreneur is. We found one notable exception: while the benchmark estimated effect of tax convexity is negative, entrepreneurs who enter into innovative industries are essentially unaffected by convexity of the tax system. We also find that the estimated effects suggest that the negative effect of tax progressivity is larger (in absolute value) for people with more than a college degree, but these estimated effects are not statistically different from the estimated effects for other education groups. Overall, however, the results suggest that potential entrepreneurs in innovative industries and occupations are less likely to enter self-employment than are potential entrepreneurs in other industries and occupations, though these differences are only marginally statistically significant. One explanation for these negative effects is that the activities that we define as innovative tend to be undertaken in relatively large organizations.

One overall lesson from our results is that the shape of the tax schedule can have substantial effects on whether individuals undertake risky investments. The interactions with measures of innovative occupations and industries do not reveal that these large effects are either more or less likely in such activities. This possible distortion from nonlinear tax schedules is not commonly included in discussions of designing tax schedules; the size of our estimated effects and the importance of entrepreneurship in the economy suggests that this omission may be important. If the estimated responsiveness to nonlinearities in tax schedules by individuals carries over to corporate investment, then loss-offset rules and other features of the corporate tax system that create nonlinearities may generate larger distortions in investment than previous estimates suggest.

This paper is organized as follows. Section II briefly surveys previous empirical work on the effects of taxation on entrepreneurship. Section III describes our basic empirical specification of the link between progressivity and entry and describes the data. We present empirical results in Section IV. Section V concludes.

II. Taxation and Entrepreneurship

Tax policy can affect entrepreneurship and innovation through various channels. Broadly speaking, these channels can be categorized as the effects of general tax policies (such as a change in marginal tax rates) and targeted tax policies (such as a tax credit for research). In assessing how general tax policies affect entrepreneurship, the critical question is, Why would the tax policy have a differential effect on entrepreneurship relative to other economic activity (e.g., other occupation or investment choices)? For targeted tax policies, the policy design question is, Can the policy encourage the desired behavior without providing subsidies to projects that would have taken place without the targeted policy?

One common hypothesis regarding the differential effects of tax rates on self-employment (one measure of entrepreneurship) and working for someone else is that higher tax rates encourage self-employment because it provides tax-sheltering opportunities.[3] These tax-sheltering opportunities include both tax evasion (i.e., it is relatively easy to underreport self-employment income) and tax avoidance (e.g., legal opportunities to deduct business-related consumption from one's taxable income).[4] The value of these tax-sheltering opportunities increases with the tax rate, which leads to the hypothesis that higher tax rates increase the level of self-employment in the economy. Previous empirical tests of this hypothesis have yielded mixed results, but the bulk of the evidence suggests a positive relationship between tax rates and self-employment.[5]

The tax-sheltering hypothesis provides one channel for general tax policies to affect the decision to be an entrepreneur. In a series of papers, Carroll, Holtz-Eakin, Rider, and Rosen (2000a, 2000b, and 2001) examine a separate line of inquiry regarding the role of tax rates and entrepreneurship. Their goal has been to assess whether taxes affect the ongoing decisions of entrepreneurs. They examine the effects of the tax reforms of the 1980s on the investment and hiring decisions of small businesses and on small-business income growth. These reforms, which reduced marginal tax rates, could differentially affect small-business investment and hiring for several reasons. First, the tax rate reductions for noncorporate businesses were larger than the tax rate reductions for corporate businesses. Second, if the production functions for small businesses include complementarities between the owner's effort and the use of other factors (i.e., capital or hired workers), then any tax effects on the labor supply of existing entrepreneurs can affect their purchase of other factors. Carroll, Holtz-Eakin, Rider, and Rosen find that higher tax rates reduce investment, hiring, and small-business income growth.

A third channel for general tax policies to affect entrepreneurship arises because entrepreneurship is riskier than other occupational choices and because innovative investments are riskier than other possible investments. Thus, tax policies that affect the returns from taking risks can have consequences for entrepreneurship. Because the returns from entrepreneurship are relatively risky, the level of the marginal tax rate is unlikely to capture the complete effect of tax policy on entrepreneurship (see Cullen and Gordon 2002, and Gentry and Hubbard 2003).[6] To understand this concept, consider the example of a proportional tax on entry by a risk-neutral individual. Because a prospective entrant would pay the same rate of tax on earnings from work for a firm and earnings from self-employment, selection into entrepreneurship would be independent of tax considerations.[7] When investment is risky, the tax effects may depend on the overall shape of the tax schedule, which is not captured by a local measure of the marginal tax rate. Thus, nonlinearities in the tax system can affect decisions. Our previous research emphasizes this point, as do the results we present below.

Imperfect loss-offset provisions provide another example of how relatively risky projects face a higher tax burden than relatively safe projects face. Rather than focusing on the riskiness of occupational choices, the analysis of loss-offset provisions usually focuses on corporate investment.[8] For corporations, reporting negative taxable income does not necessarily generate a tax refund. Instead, corporations benefit from losses in one year by applying a set of tax-loss carryback and carryforward rules; these rules specify a limited time period over which corporations can essentially average their income. These rules create another form of "success tax" in the tax code, whereby successful firms face a higher tax rate than unsuccessful firms face. In the extreme, if a corporation has negative taxable income in a year but does not have sufficient positive income during the carryback or carryforward period, then it faces a tax rate of zero on the losses; however, had the corporation been successful, it might face the top corporate tax rate of 35 percent. Altshuler and Auerbach (1990) and Graham (1996) discuss how these loss-offset rules can affect corporate investment and financing decisions.[9]

Capital gains taxation provides a final channel through which general tax policy can affect entrepreneurship. If entrepreneurial activity inherently generates more of its income as capital gains relative to other employment or investment choices, then lower capital gains tax rates may increase entrepreneurial activity.[10] These capital gains tax effects are often discussed in the context of the taxation of venture capital. Poterba (1989) has stressed that the ability of entrepreneurs to shift some 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 startup firms.[11]

By definition, these effects of general tax policies on entrepreneurship are not the main objectives of the tax policy process. Presumably, general tax policies are set based on broad policy goals, and the effects on entrepreneurship are only part of the overall effects of tax policy. Nonetheless, given the importance of entrepreneurship to the overall economy, the effects on entrepreneurship could be an important part of the overall effects of tax policy, especially if the effects on entrepreneurship are large.

In contrast to the effects of general tax policies on entrepreneurship, specific tax policies can be targeted at small businesses and innovation. Such targeted tax policies include: (1) tax credits for research and development,[12] (2) favorable depreciation rules for the capital expenditures of small businesses, (3) reduced capital gains taxes after the initial public offerings of qualified small-business stock,[13] and (4) preferential exemptions for business assets under the estate tax. The goals of these policies are aimed at promoting specific aspects of entrepreneurship or solving problems associated with taxing small businesses. For small businesses, Slemrod (2003) argues that these tax preferences may offset the high tax compliance costs relative to business size that small businesses face.

III. Description of Tests and Data

In a perfect world, tests of the effects of tax policy on entrepreneurship would use household-level panel data, with information on employment, entrepreneurial status and capital, and measures of the shape of the tax schedule over both households and time. The hurdle for measuring the relevant shape of the income tax schedule is high because the measure of progressivity depends both on provisions of the tax code and the ex ante distribution of outcomes in entrepreneurship. While the former is common across households, households have access to quite different entrepreneurial opportunities. To link the potential tax policy effects to innovation, we need a measure of how innovative the different entrepreneurial opportunities are.

We use data from the PSID, relying on self-employment of the head of the household as an indicator of entrepreneurship.[14] Self-employment is one of many potential measures of entrepreneurship. Our choice of looking at self-employment—rather than some measure of business ownership or investment—is that our empirical methodology is based on household characteristics and we need panel data on a large sample of households.[15] A possible criticism of studying self-employment is that it does not necessarily capture innovative activity that might be concentrated in a small number of entrepreneurial firms. Our methodology cannot be adapted easily to concentrate on small corporations, but at a general level, our framework tests whether decision makers respond to nonlinearities in the tax system. An open question is, Can the responsiveness that we estimate for individuals entering into self-employment be generalized to comment on how executives in somewhat larger firms respond to nonlinearities in the tax schedule?

Our data cover the period 1979–1993. We start in 1979 because our source for variation in state tax rates begins in the late 1970s; our data end in 1993 because it is the last year of final release data from the PSID. We include in the sample heads of households between the ages of eighteen and sixty who are in the workforce in consecutive years. We pool in the sample single men and women and married heads of households; to avoid issues of the endogeneity of labor-force participation, we excluded married women. Because entry is the object of our attention, our sample is based on working for someone else (without any self-employment) in the first of the consecutive years for each observation. Entry, then, is represented by the household reporting self-employment income in year $t+1$. On average for our sample, 3.1 percent of households enter self-employment each year, with the remainder continuing to work for someone else.

To model entry into entrepreneurship, we estimate a probit model for the choice of each household head i at time $t+1$:

$$ENTRY_{i,t+1} = f(e_i, x_t, z_t, \gamma_t, TAX_{it})$$

where e represents educational attainment, x is an individual's earnings potential as an employee, z captures demographic differences across households, TAX includes an individual's marginal tax rate and a measure of the convexity of the tax schedule faced by the individual as an entrepreneurial entrant (described below), and γ reflects time-specific macroeconomic factors.

More specifically, we represent educational status with indicator variables for less than high school education, some college, college, and some postcollege education.[16] As basic controls for the opportunity cost of entry, we include the level and square labor earnings of the head of the household in year t.[17] We also include as a proxy for wealth (reflecting the effects of access to capital on entry) interest and dividend income.[18] Finally, we control for the level and square of the spouse's labor earnings in year t (assigning values of zero for single households).

Variables in z include the number of children in the household, as well as dummy variables for five-year age ranges for the head; whether the head is nonwhite, female, single, a homeowner, and living outside a standard metropolitan statistical area; and whether the head experienced a marital transition during the year (as a result of marriage, divorce, or death of a spouse). For x, we include census-region-specific year dummy variables to capture trends in entry decisions or effects of aggregate conditions. Summary statistics for these non-tax-related control variables are provided in table 4.1.

Tax variables present several challenges. To construct marginal tax rates, we use the TAXSIM model of the National Bureau of Economic Research (see Feenberg and Coutts 1993). For the household's predicted future marginal tax rate, we use household characteristics in year t, and we project the tax rate using the year $t + 1$ tax code.[19]

The other tax variable central to analysis is the measure of the convexity of the tax schedule confronting prospective entrepreneurs. Following our earlier work (Gentry and Hubbard 2003), we use the observed distribution of three-year real-wage growth for entrants into self-employment to capture the range of successful and unsuccessful outcomes for entrants. Based on these outcomes, we calculate the marginal tax rates that an entrepreneur would face at various levels of success. Using the observed distribution, we form weighted averages of these marginal tax rates for successful and unsuccessful entrepreneurial outcomes. This measure of convexity has a value of zero if the marginal tax rate is constant over the range of potential outcomes. Nonzero values occur when entrepreneurial success or failure changes the household's marginal tax rate. In taking this approach, we are relating the distribution of potential entrepreneurial success to opportunity cost measured by current income. We assume that the variability of the distribution of rewards to entrepreneurial activity is constant in percentage terms across households.[20]

Specifically, guided by the three-year real-wage growth experience of entrants, we consider four possible successful outcomes by entrants, in which labor income increases by 25 percent (with probability 0.4), 50 percent (with probability 0.4), 100 percent (with probability 0.15), or

Table 4.1
Summary statistics[a]

	Mean	Standard deviation	Minimum	Maximum
Marginal tax rate (percentage)	28.29	11.04	−18.85	69.45
Marginal tax rate convexity measure (percentage)	8.98	5.25	−15.09	49.34
Average tax rate (percentage)	16.22	7.50	−19.83	61.51
Average tax rate convexity measure (percentage)	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 (years)	36.07	10.24	18	60
Minority (nonwhite = 1)	0.15	0.35	0	1
Female head	0.23	0.42	0	1
Married (single = 1)	0.40	0.49	0	1
Number of children	0.92	1.15	0	9
Homeowner (yes = 1)	0.60	0.49	0	1
Rural (yes = 1)	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

[a] 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 eighteen and sixty 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.

Source: Authors' calculations based on data from the Panel Study of Income Dynamics (PSID).

200 percent (with probability 0.05). Similarly, we consider four possible unsuccessful outcomes for entrants, in which labor income falls by 10 percent (with probability 0.5), 25 percent (with probability 0.3), 50 percent (with probability 0.15), and 75 percent (with probability 0.05).[21] Our basic convexity measure is the difference between the weighted average of the marginal tax rates if the entrant is successful and the weighted average of the marginal tax rates if the entrant is unsuccessful.

In principle, convexity need not be positively correlated with the level of the marginal tax rate or with income. Indeed, convexity depends on tax provisions that vary across households within a state, across similar households in different states, and over time. As we discuss in our (2003) paper, the most important source of variation in tax convexity is the household's location on the tax schedule, which is determined by sources of income other than the head of household's labor income (e.g., spousal income).[22]

Our (2003) paper showed that the relationship between entry and household income is U-shaped, with higher entry probabilities for the lowest and highest income groups than for middle-income households. This pattern implies that one must control carefully for household income so that non-tax-related variation in entry probabilities across income groups is not assigned to tax considerations alone.

To link these tax effects to innovation, we interact the tax variables with measures of whether a potential entrepreneur is innovative. As proxies for innovative entrepreneurs, we use information on what industry or occupation the potential entrepreneur is working in when deciding whether to become self-employed. Our choices of innovative industries and occupations are somewhat arbitrary, of course, but we lacked data on our research and development (R&D) intensity or other proxies that could be matched to industry or occupational categories in PSID. Our definition of innovative industries includes the following: machinery (including electrical), transportation equipment, scientific instruments, chemicals and allied products, petroleum and coal, rubber and plastics, commercial research, development and testing labs, and computer programming services. These industries account for 13.8 percent of the observations in our sample. Overall, workers in these industries are less likely to enter self-employment. The entry rate among workers in these industries is 2.02 percent, compared with an entry rate of 3.47 percent for workers in other industries.

Our definition of innovative occupations includes computer specialists, engineers, life and physical scientists, operations and systems researchers, science teachers at the college and university level, and engineering and science technicians. The occupations account for 7.8 percent of our sample. As with our innovative industries, the entry rate is lower for these occupations than for other occupations (2.16 percent compared to 3.38 percent).

These definitions of innovative potential assume that a worker's industry or occupation in year t reflects the chance that he or she will undertake an innovative activity conditional on entering self-employment. The entry decision could, however, involve a change in either industry or occupation, and this change could be into something more or less innovative than the entrant's previous industry and occupation. As an alternative measure of innovative industry or occupation, we use the individual's industry or occupation in year $t+1$. For entrants into self-employment, this measure will capture the industry or occupation in which they are self-employed. For innovative industries, we use the same definitions as above. For innovative occupations, however, we exclude college and university science teachers as innovative destinations for the self-employed.[23] We refer to these proxies for innovative industries and occupations as destination-based because they reflect the industry or occupation into which an entrant moves; in contrast, we refer to the proxies based on year t variables as origin-based because they capture the field in which the potential entrant starts.

The destination-based proxies for innovative industries and occupations have an important statistical disadvantage relative to the origin-based measures because they are endogenous. For example, if the tax system discourages entry into particular industries or occupations, then the data will have fewer such observations and we will not identify the people who were discouraged from entering. Given this endogeneity, the results using the destination-based measures should be interpreted with caution.

As we discuss below, we also allow the estimated effects of the tax system to vary with the individual's level of education. In these specifications, we interpret the level of education as a proxy for the probability that the new entrepreneur will undertake an innovative activity.

IV. Empirical Results

We report our basic results in table 4.2. The first column of results of table 4.2 (Base case) presents estimates of a probit model for entrepreneurial entry in which the nontax and tax variables described in Sec-

Table 4.2
Effects of tax rates and tax convexity on entry decisions[a]

		Definition of *innovative* based on occupation		Definition of *innovative* based on industry	
	Base case	Origin	Destination	Origin	Destination
Tax rate	−0.000314* (0.000147)	−0.000320* (0.000146)	−0.000333* (0.000145)	−0.000309* (0.000146)	−0.000346* (0.000134)
Tax convexity	−0.00173† (0.000240)	−0.00170† (0.000237)	−0.00168† (0.00024)	−0.00171† (0.000241)	−0.00169† (0.000230)
Tax rate,* innovative		0.000416 (0.000527)	0.000782 (0.000530)	0.000121 (0.000333)	0.00134† (0.000368)
Tax convexity,* innovative		0.000325 (0.000933)	0.000160 (0.000936)	0.000248 (0.000652)	0.00175† (0.000666)
Dummy variable for *innovative*		−0.0217 (0.00777)	−0.0259* (0.00486)	−0.0158 (0.00718)	−0.0380† (0.00311)
Pseudo-R^2	0.0779	0.0804	0.0811	0.0807	0.0884

[a] The sample has 53,151 observations. The reported coefficients are the marginal effects from a probit regression. An asterisk (*) denotes coefficient estimates that are statistically different from zero at the 95 percent confidence level, and a dagger (†) denotes coefficient estimates that are statistically different from zero at the 99 percent confidence level. The last four columns reflect different definitions of *innovative*—by industry or occupation—using year t or year $t+1$ data. Robust standard errors are in parentheses. The regressions also include the following covariates: labor earnings and labor earnings squared for the head of household; labor earnings and labor earnings squared for the spouse (or zero for unmarried individuals); dividend and interest income; other property income; dummy variables for five-year age ranges; number of children; dummy variables for race, female-headed households, single, became married during the year, became divorced during the year, spouse passed away during the year, homeownership, lived outside a standard metropolitan statistical area (SMSA), less than a high school education, some college education, college graduate, and post-college education; and census-region-year effects.

tion III are included as explanatory variables, but interactions with the measures of being innovative are not included. We report estimated marginal effects, accompanied by robust standard errors that allow for intertemporal correlation for observations from the same household. These base case results are consistent with our earlier work (Gentry and Hubbard 2003). For the tax variables, the estimated effect at the level of the marginal tax rate on the probability of entry is negative (−0.000314) and statistically different from zero at the 95 percent confidence level.[24] Note that the sign of the estimated coefficient is *not* consistent with the argument that high tax rates stimulate entry to take advantage of tax-avoidance possibilities. The estimated coefficient on the marginal tax *spread*, however, is negative (−0.00173) and statistically significantly different from zero at the 99 percent level. Consistent with the "success tax" prediction and inconsistent with the insurance prediction, convexity of the tax schedule decreases the likelihood of entrepreneurial entry, all else being equal.[25]

As a way of interpreting this estimated coefficient, consider a five-percentage-point reduction in convexity (which is roughly a one standard-deviation reduction in the convexity measure). This reduction would increase the entry probability by 0.86 percentage points; given a baseline entry probability of 3.2 percent, this reduction in convexity would increase the entry rate by about 25 percent. Hence, the estimated effect of tax convexity is economically significant.

In the second through fifth columns of table 4.2, we investigate how the estimated tax effects vary across noninnovative and innovative potential entrants. The second and third columns of table 4.2 report results for potential entrants from innovative occupations or moving to innovative occupations, respectively. The fourth and fifth columns of table 4.2 report results with *innovative* defined based on industry on an origin and on a destination basis, respectively. Across all of the specifications, the baseline coefficient estimates for the level and convexity of the tax system are similar to those reported in the first column. The interaction terms are not statistically significant in three of the four columns; these results suggest that innovative potential entrants are not affected by the tax incentives differentially than are other potential entrants.

The one exception to this pattern is when we define *innovative* based on the occupation for year $t+1$, which is the occupation into which the entrant moves. In this case, the estimated effects of the interactions on the level of the tax rate and the convexity of the tax system are positive. The overall effect of the tax incentives for these groups is the sum of the estimated coefficients with and without the interaction. For example, tax convexity appears to have little overall effect on entry into the innovative occupations based on adding together the estimated coefficient on tax convexity (−0.00169) and the estimated coefficient on the interaction term (0.00175). As mentioned above, the destination-based results should be interpreted with caution because the observed year $t+1$ occupation is endogenous to the entry decision.[26]

Following our (2003) paper, we break our convexity into two parts. The first part is the difference between the average marginal tax rate on successful entrepreneurial outcomes and the benchmark tax rate;

we refer to this part as upside convexity. The second part is the difference between the benchmark tax rate and the average marginal tax rate on unsuccessful outcomes; we refer to this part as downside convexity. Intuitively, the notion of a convex tax system creating a success tax is more related to upside convexity than to downside convexity. To examine whether potential entrepreneurs respond differently to the shape of the tax schedule above versus below their benchmark tax rate, we allow the estimated effects of tax convexity to vary between upside and downside convexity. We also explore whether the effects of upside and downside convexity differ with our proxies for innovative potential entrepreneurs.

Table 4.3 reports the results from decomposing the tax convexity effect into upside and downside convexity. The format of table 4.3 follows that of table 4.2, with the columns containing different definitions of innovative potential entrepreneurs. As in our earlier work (Gentry and Hubbard 2003), the negative estimated effect of upside tax convexity is roughly twice the size of the negative estimated effect of downside convexity, although both estimated effects are statistically different from zero at the 99 percent confidence level. Turning to the interactions with innovative occupations, the estimated coefficients on the interaction terms are small and imprecisely estimated, suggesting that the effects of tax convexity do not differ across our categories of occupations. The same result holds when we define *innovative* using the potential entrepreneur's industry of origin. When we define *innovative* using the destination industry, the estimated coefficients on the interactions roughly offset the estimated effect of the main tax variable; however, this offset appears to be stronger for downside convexity than it is for upside convexity, suggesting that upside convexity may still have a negative effect on entry decisions.

As another a priori measure of how innovative a potential entrepreneur may be, we consider how the estimated tax effects vary by education groups.[27] Education might be correlated with the responsiveness to tax convexity, especially if the motives for entrepreneurial entry vary by education groups. For example, entrants with low skill levels or low educational levels may be pushed into self-employment by a spell of unemployment, while high-skill entrants may enter with the explicit goal of creating wealth. If workers with few skills (as measured by low educational attainment) drive our main results, then one might be tempted to infer that the estimated tax effects are unrelated to innovative entrepreneurship.

Table 4.3
Comparison of upside and downside tax convexity effects on entry decisions[a]

		Definition of *innovative* based on occupation		Definition of *innovative* based on industry	
	Base case	Origin	Destination	Origin	Destination
Tax rate	−0.000494† (0.000155)	−0.000495† (0.000154)	−0.000514† (0.000153)	−0.000488† (0.000154)	−0.000507† (0.000145)
Upside tax convexity	−0.00227† (0.000294)	−0.00223† (0.000294)	−0.00226† (0.000293)	−0.00229† (0.000298)	−0.00218† (0.000284)
Downside tax convexity	−0.00110† (0.000305)	−0.00109† (0.000303)	−0.00102† (0.000304)	−0.00105† (0.000306)	−0.00113† (0.000295)
Tax rate* innovative		0.000351 (0.000581)	0.000955 (0.000553)	0.000194 (0.000356)	0.00123† (0.000363)
Upside tax convexity* innovative		0.000044 (0.00112)	0.000128 (0.00140)	0.000853 (0.000870)	0.00143 (0.000921)
Downside tax convexity* innovative		0.000570 (0.00122)	−0.00104 (0.00130)	−0.000375 (0.000957)	0.00207* (0.000908)
Dummy variable for *innovative*		−0.0207 (0.00878)	−0.0271† (0.00440)	−0.0171 (0.00713)	−0.0372† (0.00305)
Pseudo-R^2	0.0791	0.0816	0.0825	0.0820	0.0895

[a]The sample has 53,151 observations. The reported coefficients are the marginal effects from a probit regression. An asterisk (*) denotes coefficient estimates that are statistically different from zero at the 95 percent confidence level, and a dagger (†) denotes coefficient estimates that are statistically different from zero at the 99 percent confidence level. The last four columns reflect different definitions of *innovative*—by industry or occupation—using year t or year $t + 1$ data. Robust standard errors are in parentheses. The regressions also include the following covariates: labor earnings and labor earnings squared for the head of household; labor earnings and labor earnings squared for the spouse (or zero for unmarried individuals); dividend and interest income; other property income; dummy variables for five-year age ranges; number of children; dummy variables for race, female-headed households, single, became married during the year, became divorced during the year, spouse passed away during the year, homeownership, lived outside a standard metropolitan statistical area (SMSA), less than a high school education, some college education, college graduate, and post-college education; and census-region-year effects.

Table 4.4
Effects of tax rates and tax convexity on entry decisions, by educational attainment[a]

	Less than high school	High school	Some college	College	Post-college work
Tax rate	−0.000091	−0.000495*	−0.000192	−0.000332	−0.000342
	(0.000259)	(0.000199)	(0.000231)	(0.000257)	(0.000429)
Tax convexity	−0.00160†	−0.00175†	−0.00162†	−0.00177†	−0.00261†
	(0.000424)	(0.000341)	(0.000428)	(0.000475)	(0.000878)
Dummy variable for education	−0.00719	NA	0.000131	0.00856	0.0143
	(0.00630)		(0.00803)	(0.0117)	(0.0219)

[a] The sample has 53,151 observations. The pseudo-R^2 is 0.0785. For the education dummy variables, high school education is the omitted category. The reported coefficients are the marginal effects from a probit regression. An asterisk (*) denotes coefficient estimates that are statistically different from zero at the 95 percent confidence level, and a dagger (†) denotes coefficient estimates that are statistically different from zero at the 99 percent confidence level. Robust standard errors are in parentheses. The regressions also include the following covariates: labor earnings and labor earnings squared for the head of household; labor earnings and labor earnings squared for the spouse (or zero for unmarried individuals); dividend and interest income; other property income; dummy variables for five-year age ranges; number of children; dummy variables for race, female-headed households, single, married during the year, divorced during the year, spouse passed away during the year, homeownership, and lived outside a standard metropolitan statistical area (SMSA); and census-region-year effects.

To explore this possibility, we interact the tax effects with five educational attainment groups: (1) less than high school, (2) high school, (3) some college, (4) college, and (5) post-graduate work. Table 4.4 reports the results of these interactions. In the first row of table 4.4, the estimated coefficients on the level of the marginal tax rate across education groups provide an example of the fragility of the estimates of this parameter; the estimated coefficient varies across education groups and is statistically different from zero only for people with a high school education.

In contrast, the estimated effect of tax convexity is consistently negative, of roughly similar magnitude across education groups, and statistically different from zero at the 99 percent confidence level for all five groups. In comparing the estimated effect of tax convexity among the education groups, the largest (in absolute value) estimated effect is for highly educated people, though we cannot reject the hypothesis that the estimated effects are equal across education groups. Overall, it does not appear that the negative estimated effect of tax convexity is concentrated among lower education groups (which one might expect to be less innovative).[28]

V. Conclusion

Interest in the role of entrepreneurial entry in innovation raises the question of the extent to which tax policy encourages or discourages entry. We find that, while the level of the marginal tax rate has a negative effect on entrepreneurial entry, the progressivity of the tax also discourages entrepreneurship, and significantly so for some groups of households. These effects are principally traceable to the upside, or success, convexity of the household tax schedule.

Prospective entrants from a priori innovative industries and occupations are no less affected by the considerations that we examine than are other prospective entrants. In terms of destination-based industry and occupation measures of innovative entrepreneurs, we find mixed evidence on whether innovative entrepreneurs differ from the general population; the results for entrepreneurs moving to innovative entrepreneurs suggest that they may be unaffected by tax convexity, but the possible endogeneity of this measure of innovative entrepreneurs confounds interpreting this specification. Using education as a measure of potential for innovation, we find that tax convexity discourages entry into self-employment for people of all educational backgrounds. Overall, we find little evidence that the tax effects are focused simply on the employment changes of less-skilled or less-promising potential entrants.

Three extensions are promising. The first is to investigate more completely which types of businesses are discouraged by tax policy. Second, the effects of tax policy on innovation may also come through effects on an individual's willingness to pursue education or change jobs or careers (see, e.g., our work in Gentry and Hubbard 2004b). The third is to integrate tax policy effects on entrepreneurial decisions in more general models of savings, investment, and economic growth.

Notes

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1. For evidence that entrepreneurial outcomes are riskier than earnings in employment, see Borjas (1999), Hamilton (2000), and Gentry and Hubbard (2003).

2. We choose this setup (as opposed to examining cross-sectional evidence about who is an entrepreneur) because we use workers' wage income in constructing our proxy for

expected entrepreneurial outcomes. Obviously, self-employment is only one possible definition of entrepreneurship. While other definitions may capture more naturally the notion of innovation, data constraints prevent us from using alternative measures.

3. Cullen and Gordon (2002) embed this hypothesis in a broad model of the effects of taxes on entrepreneurship. The general idea, however, has been common through research on taxes and self-employment.

4. This tax-shelter hypothesis commonly assumes that self-employment provides a tax advantage because the taxpayer reports a smaller tax base due to underreporting income or taking business deductions for expenses that have a personal consumption aspect. However, tax rate differentials between being an employee and being self-employed can also affect the self-employment decision if legislated differences between the two employment choices exist in the tax base. For example, before 1987, the self-employed could not deduct the cost of "employer-provided" health insurance.

5. Bruce (2000) summarizes this literature and estimates how entry decisions into self-employment depend on both the marginal and average tax rates. The time-series studies of taxes and self-employment include Long (1982a) and Blau (1987). Several 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. In our empirical methodology, we control for the level of the marginal tax rate, which should capture some of these tax-sheltering effects of self-employment.

6. In addition to the effects of tax rates, Cullen and Gordon's (2002) model includes the option to incorporate, which is valuable if double taxation of corporate income reduces the tax burden on investment relative to remaining an unincorporated business. The option value of incorporating depends on being able to decide on organizational form after learning about the prospects of the business. This situation creates another form of nonlinearity in the tax system.

7. With a constant marginal tax rate, the income tax cannot change the sign of the entry decision for a risk-neutral potential entrant. This flat-tax case is the commonly analyzed analog to the Domar and Musgrave (1944) analysis of a proportional tax on a risky investment for risk-averse potential investors.

8. Noncorporate firms face similar issues because of progressive tax rates.

9. Our empirical methodology does not account for the effects of these loss-offset rules because we focus on the self-employment decision, which often does not entail forming a C-corporation that would face the corporate tax.

10. Theoretical predictions about the effects of tax rates on risk taking are complicated because the tax system reduces both the mean and the variance of returns. Theoretically, it is possible that a higher tax rate on risky outcomes will increase the amount of risk taking. Domar and Musgrave (1944) wrote the seminal paper on the effects of taxes on risk taking.

11. Our empirical methodology does not incorporate the effects of capital gains taxes because we are focusing on the self-employment decision. It is unlikely than many of the types of self-employed people in our sample engage in activities financed by venture capital. Also, one can view our methodology as capturing the tax on the returns that are taken as personal income (and personal consumption) before the business is sold.

12. Hall and Van Reenen (2000) survey the design of fiscal incentives for research and development (R&D) and the evidence about the effectiveness of these policies. They

conclude that the evidence suggests that a dollar in tax credit stimulates an additional dollar of R&D.

13. Guenther and Willenborg (1999) examine the effects of the reduced tax rate on capital gains on initial public offerings of qualified small-business stock. In 1993, Congress reduced by half the capital gains tax on small-business (defined as having assets of less than $50 million) stock purchased from the corporation by individuals. Guenther and Willenborg find that this policy increased the price that small businesses were able to charge for their stock, which is consistent with the tax break lowering the cost of capital for such businesses.

14. In the data, *self-employment* is defined by the respondent and does not require a specific organizational form. Thus, a self-employed person could work in a business that is organized for legal and tax purposes in either the corporate or noncorporate form.

15. For three years (1984, 1989, and 1994), the PSID includes data on asset holdings, including a category covering business assets. For this smaller sample of years, we can calculate entry into entrepreneurship based on business ownership rather than self-employment. The estimated effects of tax convexity on entry into business ownership are similar to the effects on entry into self-employment (Gentry and Hubbard 2003). Because the sample size in considerably smaller, however, the data do not lend themselves to testing whether the effects are similar across subsets of the population; hence, we define entrepreneurship as self-employment for testing whether the effects are similar across subsets of the population.

16. The omitted category is high school education.

17. In our earlier work (Gentry and Hubbard 2003), we conduct substantial sensitivity analysis on this choice of functional form, with little change in the estimated coefficients of interest.

18. Again, wealth data are not available on an annual basis in the PSID.

19. To capture the effects of wage growth, we allow earnings to grow by 5 percent in constructing our benchmark tax rate.

20. In our earlier work (Gentry and Hubbard 2003), we relax this assumption. Our estimated effects of tax convexity on the probability of entry are not driven much by differences in sex, marital status, or income group.

21. Our (2003) paper presents an analysis of the wage growth distribution and of alternative proxies for the convexity of the tax schedule faced by a prospective entrant.

22. We base this conclusion on the fact that a household's state of residence, its income decile, and the year under consideration do not explain much of the variation in the tax convexity measure.

23. Of course, given the organization of colleges and universities, workers in these occupations are unlikely to be self-employed.

24. While this estimated coefficient is statistically different from zero, sensitivity analysis in our (2003) paper suggests this result is not robust. For example, alternative functional forms for controlling for income or alternative definitions of the sample yield estimated coefficients that change in sign and are typically not statistically different than zero. In contrast, the estimated effects of tax convexity are robust to a wide variety of sensitivity tests.

25. In terms of the (unreported) nontax variables, higher levels of educational attainment are associated with higher entry probabilities. Once we control for education, current labor earnings have a negative effect on the likelihood of entry except for very-high-income households. As a proxy for potential entrants' wealth, capital income positively affects the entry probability. Finally, all else being equal, minority and female heads of household are substantially less likely to enter self-employment than are white male heads of households.

26. To see how the endogeneity problem could affect the estimated coefficients, consider the following extreme example. Suppose that tax convexity reduced the number of entrants into innovative occupations to zero. It would appear in the destination-based entry data that the variation in tax convexity would be unrelated to the entry decision when in fact tax convexity has a large negative effect on entry into these occupations.

27. Separating households by income levels provides another possible categorization that might be related to how innovative a potential entrepreneur is. Our (2003) paper reports results for a specification that allows the tax effects to vary by income quintile (defined on an annual basis). These results do not suggest any strong relationship between income and the responsiveness to tax convexity.

28. We also estimated models in which the education groups interacted with upside and downside convexity separately. The results from this expanded model did not reveal any strong patterns among education and the estimated effects of upside or downside convexity.

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