Taxes and entrepreneurial risk-taking: Theory and evidence for the U.S.

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Abstract

How does the tax law affect individual incentives to engage in entrepreneurial risk taking? We first show theoretically that taxes can affect incentives due to differences in tax rates on business vs. wage income, due to differences in the marginal tax rates faced on losses vs. profits through a progressive rate structure and through the option to incorporate, and due to risk sharing with the government. We then provide empirical evidence using U.S. individual tax return data that each of these aspects of the tax law have clear effects on individual behavior, and together have had large effects on the amount of entrepreneurial risk taking.

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Entrepreneurial activity is commonly viewed to be a key ingredient generating economic growth. New firms try out not only new products and new technologies, but also new internal forms of organization or even merely a new location. When new approaches succeed, other firms can imitate, leading to improvements generally in productivity. Given such spillovers, market incentives alone can generate too little entrepreneurial activity, leading to potential efficiency gains from subsidizing such activity through the tax system. The objective of this paper is to assess to what degree the U.S. tax system in fact affects the amount of entrepreneurial activity, both theoretically and empirically. The stylized view we adopt in this paper is that entrepreneurial

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activity consists primarily of start-up firms pursuing highly risky projects, generating externalities through publicly observable outcomes for these projects.

There are a variety of possible mechanisms through which the tax system can affect an individual’s incentives to undertake risky projects. One mechanism, originally described in Domar and Musgrave (1944), is the risk sharing with the government resulting from random tax payments. If adverse selection in financial markets makes risk sharing with outside investors difficult, then the tax system provides an alternative means to share risk that is free from these adverse selection problems. With more risk sharing available, an entrepreneur’s risk premium will be lower, and risk taking should be greater.

In a far more recent paper, Gentry and Hubbard (2004) emphasize a different effect of the tax system on risk taking that arises even if investors are risk neutral. If the marginal tax rate under the personal income tax is an increasing function of taxable income, then entrepreneurs are able to save little in taxes on any losses they incur but can owe substantial taxes on any profits. Facing a progressive tax system, a risk-neutral investor will require a higher pretax expected return on a project as risk increases, to offset the resulting increase in expected tax payments, so that risk taking is discouraged.

An important omission from this last argument is the option firms have to avoid high personal tax rates by incorporating. This option is valuable to the extent that personal income is taxed at a higher rate than corporate income. In recent years in the U.S., the corporate tax rate for a small firm can be as low as 15%, which is below the marginal personal (plus payroll) tax rate faced by nearly all individuals with positive taxable income. As a result, when and if the firm generates profits, for tax purposes many entrepreneurs will want to incorporate so that these profits are taxed at the lower corporate tax rate. In contrast, given the no-loss-offset restrictions under the corporate tax, a firm with losses will typically prefer to be noncorporate, so that these losses can be deducted from other personal income. This option to choose the organizational form ex post based on the outcome reduces the effective tax rate on profits without affecting the tax rate on losses, thereby encouraging more risk taking. The higher are personal relative to corporate tax rates, the larger is the encouragement to risk taking arising from this option.

Another mechanism through which taxes can generate extra risk taking is by encouraging more self-employment per se, given that self-employment income is inherently risky. Taxes can encourage self-employment by treating self-employment income more favorably than wage income.

Section 1 derives an expression for the effects of taxes on entrepreneurial risk taking that contains each of the above effects.

Both corporate and personal tax schedules in the U.S. have varied substantially over time, and the changes have differed substantially by income bracket, enabling us to proceed to test empirically for the effects of tax incentives on the amount of entrepreneurial risk taking. We construct explicit measures of these tax incentives and examine how they have affected the amount of entrepreneurial risk taking, using Statistics of Income tax return data over the time period 1964–1993. While time trends in tax incentives correspond closely to time trends in entrepreneurial activity, in the estimation we use a difference-in-differences specification, allowing for arbitrary changes over time in nontax factors affecting entrepreneurial activity, and

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1 For an early recognition of this point, see Feldstein and Slemrod (1980). Gordon (1998) emphasizes the potential resulting subsidy to risk taking.

2 For example, effective payroll tax rates have differed for wage vs. self-employment income. A number of past papers have examined the effects of such differential tax rates on self-employment rates, including Bruce (2000), Schuetze (2000), and Fairlie and Meyer (1999).
arbitrary differences in propensities for entrepreneurial activity across ability groups. Section 2 describes our estimation strategy in more detail, Section 3 summarizes the data, while results are reported in Section 4. Section 5 explores the forecasted sensitivity of entrepreneurial activity to tax policy, while Section 6 provides a brief set of conclusions.

1. Theory

The main objective in developing the theory is to assess the impact of taxes on the amount of risk taking in small firms. Risk taking depends not only on the riskiness of any given business (the standard deviation per dollar of expected income), but also on the average scale of each business, and the number of individuals engaged in business activity. In addition, the chosen scale of the business will depend on how much of the entrepreneur’s own time is allocated to the business, how many other people she hires and how much capital she invests in the firm. Our model is designed to capture how taxes affect each of these decisions.

Assume that a particular individual starts with available hours of $H$ and available assets of $A$. This individual can divide her time between a salaried position, paying $w$ per hour before tax (where the skill level $w$ varies by individual), and an entrepreneurial project. Let $H_e$ denote the time spent as an employee, and $H_p$ the time spent on the entrepreneurial project, where $H_e + H_p = H$.

If this individual works $H_p$ hours in self-employed activities, we assume that the resulting pretax income $\pi(\tilde{\epsilon})$ equals

$$\pi(\tilde{\epsilon}) = f(awH_p, L, K; s)(1 + s\tilde{\epsilon}) - w_mL,$$

where $a$ is an entrepreneurial ability parameter (varying by individual), $L$ equals the number of workers hired at market wage $w_m$, $K$ is the amount of own and borrowed funds invested in the firm, and $\tilde{\epsilon}$ is distributed $N(0,1)$. Here, $s$ denotes the standard deviation of the random variable, which enters the production function directly to capture the higher expected profits on more risky projects available in equilibrium in the market.

In addition to income from entrepreneurial activity and salaried employment, the individual receives income $r(A - K)$ on any assets not invested in the firm, where $r$ is the market interest rate. In addition, let $Y$ denote any other income, e.g. spouse’s income. Total pre-tax income, denoted by $\tilde{I}$, therefore equals

$$\tilde{I} = Y + wH_e + r(A - K) + \pi(\tilde{\epsilon}).$$

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3 We chose not to model the choice of overall savings or labor effort, focusing instead on how differences in tax treatment affect the division of these factors between entrepreneurial and non-entrepreneurial activities.

4 We assume that the function $f(.)$ has constant returns to scale in its first three arguments.

5 We make the implicit assumption here that workers do not share in the firm’s risk, being insured by the entrepreneur. This can arise not only due to differences in the relative costs of risk bearing for workers vs. the entrepreneur, but also due to lemons problems, arising when workers fear that pessimistic entrepreneurs will offer equity compensation more readily.

6 Technically, we assume that the individual rather than the firm borrows. (If instead firms borrow, the effects on the analysis are minor, leading to first-order conditions below of the form of Eq. (3) vs. Eq. (2)). One further assumption is that the individual cannot sell equity in her firm to outside (venture capital) investors, due to lemons problems. (Data from the Panel Study of Entrepreneurial Dynamics (PSED) show that only 3% of start-ups were seeking any venture capital funding).

7 For simplicity, we ignore here the possibility of bankruptcy, and the resulting risk sharing with outside creditors. As with risk sharing through the tax system, risk sharing through the bankruptcy law could in principle make entrepreneurship more attractive. For evidence on this, see White and Fan (2003), who find that self-employment is more common in U.S. states that have more generous bankruptcy provisions.
How does the tax law affect individual incentives? For simplicity, we assume that \( \bar{I} \) also measures taxable income, so ignore any differences between economic income and taxable income. Let \( T_p(\cdot) \) represent the personal income tax schedule applying to that part of \( \bar{I} \) reported under the personal tax, while \( \tau(\cdot) \) represents the corporate tax schedule (including any personal taxes owed on dividend or capital gains income) for income instead reported under the corporate tax. Wage income and income from financial assets are always subject to personal income taxes. We assume that income from self-employment can be divided flexibly between the corporate and the personal tax schedules, so that the individual can classify any amount \( C \) of business income as corporate, as long as \( 0 \leq C \leq \pi(\tilde{e}) \) if the firm has profits, and \( \pi(\tilde{e}) \leq C \leq 0 \) if the firm has losses.

Given U.S. tax provisions, losses are deductible from other income under the personal tax but corporate losses do not result in any corporate tax refunds. The entrepreneur’s combined personal plus corporate tax liabilities equal \( T_p(\bar{I} - C) + \tau(C) \), for any given \( C \). The entrepreneur will choose \( C \) to minimize this expression, subject to the constraint that \( \text{sign}(C) = \text{sign}(\pi(\tilde{e}) - C) \). It quickly follows that a profitable firm will report nonzero corporate income as long as \( \tau'(0) < T_p'(\bar{I}) \), while a loss-making firm will be entirely noncorporate as long as \( T_p'(\bar{I}) \geq 0 \). This forecast that firms with losses should be noncorporate, so that the losses are immediately tax deductible, and that firms with profits should seriously consider incorporating to take advantage of the low initial corporate tax brackets, mirrors the standard advice provided by tax guides during this time period.

In general, when the individual can divide business but not other income optimally between the corporate and the personal tax schedules, we can express the individual’s tax payments by some function \( T[Y + \omega H_e + r(A - K), \pi(\tilde{e})] \). The individual’s marginal tax rate on nonbusiness income is then denoted by \( T_1 \), while the marginal tax rate on business income is denoted by \( T_2 \).

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8. We abstract from payroll taxes (and any offsetting pension benefits) here, though they are taken into account in the empirical work.

9. There are many ways to accomplish this. One is to set up two firms (one corporate and the other noncorporate), each of the desired scale. A second is to set up a corporation, and then choose the amount of tax deductible wages, royalties, and interest to pay out to the entrepreneur. Third, the firm can be a partnership, with a corporation owning the desired fraction of the shares in the partnership. For simplicity of exposition, we ignore here any real costs/benefits of incorporation, though these are allowed for in the empirical work and included explicitly in the derivations reported in Cullen and Gordon (2002). As a special case considered in the empirical work, the nontax benefits of noncorporate activity could be sufficient that the firm remains entirely noncorporate regardless of relative tax rates.

10. On tax grounds, there are incentives to be more aggressive, e.g. by reporting noncorporate losses and corporate profits, implemented through transfer pricing between a noncorporate and a corporate firm both owned by the entrepreneur. In general, such income shifting generates both real costs, due to changes in cash flow and accounting profits within each firm as in Mintz and Smart (2004), and a greater risk of IRS audit and disallowance when reported income is clearly inconsistent with the economic activity undertaken by each firm. Our assumption that these combined costs are zero as long as the reported income of both firms has the same sign, and then become infinite, is clearly a rough approximation to a more smoothly increasing marginal cost function limiting the extent of income shifting. To the extent that more aggressive income-shifting occurs, we should find a larger effect of the “income-shifting” term, defined below.

11. We ignore the potential benefits from corporate tax-loss carryforwards, on the grounds that the failure rate of new start-ups is very high. In addition, we ignore the possibility of a corporation with tax losses merging with a firm with taxable profits, on the assumption that the real costs of such a merger along with IRS rules disallowing tax benefits from solely tax-motivated mergers make such mergers unlikely.

12. In the simplified version of the model presented here, the forecasts are quite sharp: firms with losses will be noncorporate while profits will be shifted to the corporate sector whenever the entrepreneur would otherwise be pushed into a personal tax bracket above the effective tax rate on corporate income. In the empirical work, a variety of additional complications described below are taken into account.
Given the tax code, the individual chooses the control variables $H_e$, $H_p$, $L$, $K$, and $s$ to maximize expected utility, subject to the constraint that $H_p + H_e = H$. The one decision we assume can be made ex post, once $\tilde{\epsilon}$ is observed, is whether or not income/losses are reported as corporate or noncorporate. All other decisions are made ex ante. For simplicity, assume that utility depends on just the mean and the variance of income, so that the individual maximizes $EU(\tilde{I}_N) = E(\tilde{I}_N) - 0.5(\beta/\omega H) \text{var}(\tilde{I}_N)$, where $\tilde{I}_N = \tilde{I} - T$ equals after-tax income, and $\beta$ is a taste parameter measuring the cost of risk bearing. Let $\bar{T}$ denote the expected value of tax payments. Expected after-tax income equals

$$E(\tilde{I}_N) = Y + \omega H_e + r(A-K) + E\pi(\tilde{\epsilon}) - \bar{T}.$$ 

The variance of after-tax income equals $E[(\tilde{I}_N - E(\tilde{I}_N))^2] = E[(s f \tilde{\epsilon} - T + \bar{T})^2]$. The resulting first-order condition for $H_e$ implies:

$$w(1-T_1) \geq a\omega f_H \left[ (1-T_2^e) - sE(\tilde{\epsilon} T_2) - \beta \text{cov} \left( \frac{\tilde{I}_N}{\omega H}, s\tilde{\epsilon}(1-T_2) \right) \right],$$

where

$$T_1^e = ET_1 - \beta \text{cov}(T_1, \tilde{I}_N / \omega H)$$

and

$$T_2^e = ET_2 - \beta \text{cov}(T_2, \tilde{I}_N / \omega H)$$

measure the certainty-equivalent cost of paying the random amounts $T_1$ or $T_2$. As always, this certainty equivalent equals the expected value minus the required risk premium.

13 After having changed organizational form once, a given firm cannot again change its form for five years. This restriction is nonbinding, however, if the key uncertainty is simply whether and when the firm becomes profitable. Regardless, even given the law, some additional flexibility remains, e.g. corporations can vary tax deductible payouts or income can be shifted between affiliated noncorporate and corporate firms. See Gordon and Slemrod (2000) for evidence on the sensitivity of where income is reported to relative tax rates.

14 While such a mean-variance utility function is very convenient mathematically, together with our assumption of normally distributed risk it generates the implausible implication of constant absolute risk aversion. By assuming that the weight on the risk term is inversely proportional to income, however, we replicate the first-order conditions implied by constant relative risk aversion in a continuous-time-stochastic-process setting without taxes. (This derivation is available in the online version.) With this assumption, our expressions below for the effects of taxes on the probability of entrepreneurship vary across individuals and over time only due to effects of the tax law, not due to differences in ability levels per se. Any direct effects of ability on entrepreneurship are captured instead by other controls.

15 We make the simplifying assumption that the random return to each entrepreneurial project is statistically independent from that on other projects, so that there is no extra term in $\tilde{I}_N$ capturing the individual’s share of the risk in aggregate tax revenue.

16 We assume a continuous choice here for the allocation of time between salaried employment and self-employment, rather than a 0–1 choice. This was done in part to simplify the exposition, though we should note that within our estimation sample 57% of the individuals reporting self-employment income also report wage income.

17 While we assume that total hours are fixed, so that more time in self-employment means less time as a salaried employee, in fact the first-order condition would be unchanged if more time in self-employment instead means less leisure as long as the opportunity cost of leisure is the after-tax wage rate.
The left-hand side of Eq. (1) measures the net-of-tax income from working an extra hour as an employee while the right-hand side measures the certainty-equivalent net-of-tax income from an extra hour spent as an entrepreneur. If the individual chooses not to engage in any entrepreneurial activity, e.g. due to low entrepreneurial ability \( a \), then the inequality in Eq. (1) will be strict. In general, this equation forecasts that all observationally equivalent individuals with unobservable entrepreneurial ability above some level \( a^* \) will engage in at least some entrepreneurial activity. The higher the value of the expression inside the brackets, capturing the effects of the tax law, the lower the value of \( a^* \) at which an individual is just indifferent to engaging in entrepreneurial activity, and so the higher the probability that an individual with wage \( w \) (and other observed attributes) will be an entrepreneur.

To understand the role of taxes in this equation, we rewrite this equation to isolate all tax terms within one expression:

\[
\frac{w - z w f H}{1 + T_1 - T_2} - \frac{E(\tilde{\epsilon} T_2)}{1 - T_1} - \beta \text{cov} \left( \frac{\tilde{I}_N}{wH}, \tilde{\epsilon} (1-T_1-1) \right). \tag{1a}
\]

The term in brackets on the right-hand side of this equation captures a variety of effects of the tax law on behavior. Each of these effects, in isolation, has been recognized to some degree in the past, though paying attention to only one (some) of these terms provides a misleading summary of the overall effects of the tax law on behavior.

To understand the many different roles of the tax law, note to begin with that the third tax term is nonzero only if the individual is risk averse \( (\beta > 0) \), the second term is nonzero only if the firm is risky \( (s > 0) \), while the first tax term is present regardless.

This first term indicates that entrepreneurial activity is encouraged to the degree that \( T_2 e > T_1 e \). This term largely captures the benefits from being able to shift business but not wage income from the personal to the corporate tax schedule, so we will refer to it as the “income-shifting” effect. While Gordon and Slemrod (2000) investigate the extent of “income shifting” between the corporate and personal tax bases in response to differences in relative tax rates, the effect of this tax difference on entrepreneurial activity has not been examined in the past.

The numerator in the second term, \( E(\tilde{\epsilon} T_2) \), measures the expected tax payments on the random return \( \tilde{\epsilon} \). To the extent this term is positive (negative), taxes discourage (encourage) risk taking, even if the individual is risk neutral. For that reason, we refer to it as the “risk-subsidy” term. Note first that under a proportional tax, this term equals zero: risk taking in that case has no effect on expected taxes. If income instead is subject to a strictly progressive personal tax, and we ignore the option to incorporate, then this term is necessarily positive, implying a tax penalty on risk taking.\(^{18}\) Conversely, if losses instead are deductible subject to a high personal tax rate while profits are taxed at a lower corporate tax rate, then expected tax payments on \( \tilde{\epsilon} \) are negative. In this case, taxes fall as the firm undertakes more risk, providing a tax subsidy to risk taking.

The last term captures the effects of taxes on the required risk premium, due to sharing of risk with the government. We then refer to it as the “risk-sharing” term. The higher are the marginal

\(^{18}\) This possibility was the focus in Gentry and Hubbard (2004), where they test for the effects of various measures of the convexity of the rate structure under the personal income tax schedule on the propensity to be self-employed, ignoring though any effects of the payroll tax, the corporate tax, and some potentially important complications under the personal tax (e.g. the EITC and net operating loss carrybacks/carryforwards).
tax rates on business income, the less risk the entrepreneur bears net of tax, and so the easier it is to undertake a riskier project. This effect was first noted by Domar and Musgrave (1944). For example, under a proportional tax at rate $t$, the tax system would allow entrepreneurs to diversify $t$ percent of their risks with the rest of the population, to that extent lowering the net costs of risk bearing. This term generalizes the Domar–Musgrave expression by capturing the effects of a nonlinear tax.

On net, we find that higher personal tax rates should lead entrepreneurial time to increase, given the resulting change in the denominator in all three terms in Eq. (1), given the increase in $T_1^e - T_2^e$ in the numerator of the first term (since corporate income largely escapes the increased tax rate), given the lower value of $E(\tilde{\epsilon}T_2)$ (as losses are subject to higher personal tax rates but profits often remain subject to an unchanged corporate rate), and given the increased risk sharing with the government captured by the numerator of the last term. Higher corporate tax rates, in contrast, reduce the benefits from income shifting and reduce the risk subsidy, but also reduce the costs of risk bearing; the net effect depends on the relative sizes of these offsetting changes.

The decisions on $K$ and $L$ both affect the scale of the firm, so the amount of overall risk taking. Assuming that $H_p > 0$, so that the individual spends some time as an entrepreneur, the optimal choice for $K$ satisfies

$$r = f_K \left[ 1 + \frac{T_1^e - T_2^e}{1-T_1^e} - s \frac{E(\tilde{\epsilon}T_2)}{1-T_1^e} - \beta \text{cov} \left( \frac{\tilde{I}_N}{wH}, s \tilde{\epsilon} \left( \frac{1-T_2}{1-T_1^e} \right) \right) \right].$$

(2)

Here, taxes affect investment incentives in exactly the same way they affect the allocation of time to the firm.

The first-order condition for the optimal number of employees, $L$, differs in structure from that for $K$ and $H_e$ simply because labor costs are deductible business expenses rather than foregone personal income, so that differences between $T_1$ and $T_2$ no longer enter:

$$w_m \leq f_L \left[ 1 - s \frac{E(\tilde{\epsilon}T_2)}{1-T_2^e} - \beta \text{cov} \left( \frac{\tilde{I}_N}{wH}, s \tilde{\epsilon} \left( \frac{1-T_2}{1-T_2^e} \right) \right) \right].$$

(3)

Since hiring workers does not provide any income-shifting benefit, we find that the tax subsidy term for $K$ is proportionately larger than that for $L$, by the ratio $(1-T_2^e)/(1-T_1^e) \geq 1$. Taxes therefore should increase the capital/labor ratio of an entrepreneurial firm, and more so the larger the size of this “income-shifting” tax term.

(4)

Without taxes, the trade-off simply involves comparing the higher expected return on the left-hand side of the equation with the cost of bearing the extra risk on the right-hand side. Taxes

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19 In the only existing empirical evidence for this effect that we have found, Sinn (1996) and Bird (2001) find that countries with higher tax rates have more variable incomes.

20 Carroll et al. (2000) provide empirical evidence that entrepreneurs have fewer employees when they face a higher tax rate. Our model suggests that the higher tax rate may be inducing firms to substitute capital, or own effort, for labor.
reduce these costs of risk bearing for two reasons: the “risk-subsidy” effect and the “risk-sharing” effect. Both terms are equal to those appearing in Eq. (3).

Together, these first-order conditions show that the sum of the second and third terms in Eq. (1a) enters into all relevant first-order conditions. In contrast, the income-shifting term affects some decisions, but not others. We therefore focus on the role of the income-shifting term separately from the combined role of the other two tax terms in the empirical work.

The three tax terms each capture quite distinct aspects of the tax code. The first “income-shifting” term primarily measures the extent to which taxes can be saved through incorporation, so depends on possible differences between marginal tax rates on business vs. nonbusiness income. The second “risk-subsidy” term depends on the progressivity/regressivity of the effective tax schedule on business income over the entire range of possible outcomes. The third “risk-sharing” term depends on the overall level of marginal tax rates, with higher rates providing more risk sharing with the rest of the economy.

One omission from the above model is any real costs/benefits of operating in corporate vs. noncorporate form. In the empirical work below, we test for the presence of possible nontax costs/benefits of operating as a corporation. Since our only observed measure of the scale of the firm is reported net earnings/losses, we assumed that the gain is some percent (denoted by $\theta$) of the absolute value of net earnings, on the assumption that a larger value of either sign suggests a larger firm. If $\theta \ll 0$, then even very profitable firms would choose to be noncorporate. By estimating $\theta$, we allow the data to judge the degree to which firms in fact anticipate incorporating when profits are high enough.

Another omission from the above model is tax evasion. Small businesses should find it relatively easy to underreport their taxable receipts, e.g. by selling output for cash and not registering the sale, while still reporting all deductible expenses in full. While making self-employment per se more attractive, tax evasion can also imply that the self-employed undertake less risky projects, since the entrepreneur bears more of the resulting risk. The net effect of tax evasion on entrepreneurial risk taking is unclear.

Given our limited data, with information on net income but not reported sales revenue and expenses, we are not in a position to conduct a serious test for the presence of tax evasion. We do attempt one simple test, allowing for a proportional underreporting of positive income and a proportional overreporting of losses.

2. Estimation strategy

2.1. Data

Our empirical tests make use of a series of cross-sectional samples of personal income tax returns made available by the U.S. Statistics of Income for twenty-two years between 1964 and

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21 The denominators differ, though, across equations. We use $T_1^e$ in the denominator, as in Eqs. (1a) and (2), in the baseline results reported below, and try using $T_2^e$ in a sensitivity test.

22 The value of $\theta$ presumably varies by industry, by size of firm, and by access to outside equity financing, e.g. venture-capital funding. For example, Jensen and Meckling (1976) suggest that a noncorporate form is preferred when borrowing is the main source of outside financing, while the corporate form is preferred when equity is the main source. Some types of service firms, e.g. law firms, accounting partnerships, and medical practices, tend to remain noncorporate even when highly profitable, while there are very few large noncorporate firms. We do not observe the industry or the size of a firm, however, so can only estimate a common $\theta$ for all firms.
The strength of this data set is that it is large, spans several major tax reforms, and contains very accurate information about the personal income tax incentives each household faces. However, it contains very little nontax information about these individuals to use as controls. For example, we do not know the sex, race, education, or age of members of the sample, other than if they are age 65 or older. For joint filers, we do not know whether both members of the couple work, or who is self-employed. These limitations shape the structure of the empirical analysis described below.

2.2. Measurement of “entrepreneurial” risk taking

Our objective is to measure how taxes affect entrepreneurial risk taking in start-up firms, since risk taking is the source of new information that can provide spillover benefits to the rest of the economy. What we can observe is noncorporate business profits or losses reported by proprietorships, partnerships, and subchapter S corporations. In the empirical work reported below, we focus on the presence of business losses (rather than profits) as an indicator of entrepreneurial risk taking. Our reasons for this choice are several:

First, self-employment activity is very heterogeneous, including low-risk firms such as independent contractors and professional groups (law firms, medical groups, and accounting firms) which mostly yield taxable profits, and high-risk firms that are trying out new ideas. Our interest is in the latter firms. Only the high-risk firms are likely to generate ex post losses, so these entrepreneurial firms should dominate the sample of firms with tax losses.

Second, by the theory, business losses should (mostly) show up on the tax return as noncorporate business losses. In contrast, firms often report business profits as corporate profits, eventually yielding personal capital gains or dividends, income sources not necessarily revealing self-employment activity. While an analysis of losses is therefore robust to selection issues, an analysis of profits will be driven by sample selection, making any inference about taxes problematic.

Third, start-up firms almost invariably are noncorporate and commonly have losses, whereas surviving firms should (to justify staying in business) be profitable. By focusing on losses, we focus on start-up activity.

While SOI data exist for 1960, 1962, 1964, and 1966–1993, coverage varied by year. Given our specific data requirements, we were able to make use of data only for 1964, 1966, 1968, 1972–3, 1975, 1977, and 1979–93. We thank the Office of Tax Policy Research at the University of Michigan for making these Individual Master File data series available to us.

We ignore real estate activity and farming, given the very different effective tax treatment of both of these sectors.

Aggregate Statistics of Income figures for 1976 and 1996, for example, show that the fraction of noncorporate firms reporting profits vs. losses varies substantially by industry, ranging from only 10% among medical, legal, and accounting services to 35% in the retail sector and 42% in mining, suggesting that the industrial composition of firms reporting profits is very different than for those reporting losses.

In our data, given tax incentives alone, 88% of those with large business losses will report large noncorporate losses, whereas the equivalent figure for firms with profits is only 42%. A further complication is that income from a business reported on the personal tax schedule can show up as wage or royalty income, income sources again not necessarily revealing self-employment activity.

For example, when corporate tax rates are low, more individuals should choose to engage in entrepreneurial risk taking, but fewer should report any resulting profits as noncorporate profits. Estimated tax effects therefore depend heavily on the choice of controls for sample selection.

According to our calculations using data from the PSED, only 8.2% of start-up firms start as corporations, and 40% have losses in their initial year of operation.
One complication that remains is that reported partnership and subchapter S corporate losses can reflect passive investments as well as self-employment activity. For example, prior to 1986, passive investments in tax shelters generated considerable noncorporate losses. In order to try to screen out passive investments, so that the empirical work focuses more closely on entrepreneurial activity, we chose to classify reported noncorporate losses as “entrepreneurial” only if they are large (in absolute value). Given our limited ability to scale the size of losses by the individual’s potential wage income, we focus simply on whether an individual reports business losses greater than 10% of reported wage income. While our ideal would have been to measure each individual’s extent of entrepreneurial risk taking relative to her earnings ability, a measure that is inherently unobservable, we show in the Appendix that our measure is closely correlated with this ideal measure, though it does respond less to taxes than the ideal measure.

2.3. Sample selection

The key sample restriction, chosen in response to problems we faced in measuring the earnings ability of each individual, was to drop joint filers. The likelihood of self-employment is inevitably a nonlinear function of each individual’s earnings ability. For joint filers, however, we do not know whether one or both members of the couple work, nor who is reporting self-employment income. Therefore, we cannot compare each individual’s self-employment decision with that individual’s earnings ability. Given that the interpretation of the data for single individuals is so much clearer than for joint filers, we chose to limit the empirical work to single individuals.

Single taxpayers comprise 52.2% of the overall sample of tax returns, and 29.6% of tax returns with large business losses. They therefore represent an important subset of the population, and of entrepreneurs.

Single taxpayers do tend to be younger, and as a result tend to face lower tax rates than joint filers. That they face lower personal tax rates certainly can explain their slightly lower propensity to become entrepreneurs. In our forecasts below, we make note of any differential effects of tax reforms on the behavior of those in higher vs. lower tax brackets, since the behavioral responses of those in higher brackets should capture better the responses of married couples.

2.4. Measurement of earnings ability

As in the theoretical model, we define an individual’s earnings ability to equal her forecasted earnings if she is not self-employed. This information about earnings if not self-employed is also

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29 Sensitivity tests (available in the online version) show that results are robust to the choice of this fraction. We also report results focusing solely on proprietorships.
30 See the Appendix for other information about sample selection.
31 “Single” here is a shorthand for all nonjoint filers, including married filing separately, head of household, and widow, as well as single.
32 While filing half of the returns, single individuals represent only one-third of the tax-paying population, so that their share of returns with business activity is only slightly below their share of the tax-paying population.
33 In our data, the average marginal personal tax rate of single individuals is 14.6% compared with 20.5% for joint filers.
34 Of course, the behavioral response of married couples could differ, even holding tax incentives constant. For example, single individuals might be more risk averse since they cannot fall back on a spouse’s income to offset business losses, though they also are less likely to need to worry about providing for dependents.
an essential input when calculating each individual’s tax incentives. We then face the inherent problem that this information cannot be observed for the self-employed.

The strategy we adopted was to predict earnings as an employee using variables available on the tax returns that are not directly affected by the decision to become self-employed. Cullen and Gordon (2002) describe the tests we undertook to identify valid predictors and the estimation procedure. Denote the resulting forecast for earnings ability by \( \hat{\lambda}_{it} \).

### 2.5. Empirical specification

The basic objective of the empirical work is to estimate how the tax incentives described in Eqs. (1a) (2) (3) (4) affect the probability that an individual has noncorporate losses exceeding 10% of wage income, controlling for an individual’s earnings ability, other attributes, and time-varying factors. Given the large size of our data set (over two million individual tax returns), we found it convenient to group the data by predicted earnings ability, rather than to estimate a discrete choice model using the individual data.

In particular, we grouped the data each year into six quantiles based on each individual’s value for \( \hat{\lambda}_{it} \). One quantile included all those whose forecasted earnings were in the bottom 70% of the population. The five additional quantiles represented those whose forecasted earnings were in the following percentile ranges in the population: (70,80], (80,90], (90,95], (95,99], and (99,100]. While this grouping implies that we ignore within group variation, little information is lost since forecasted earnings is the main independent variable of importance for each individual.

We then assumed that the probability of having large entrepreneurial losses, holding tax incentives fixed, is a function of one’s percentile rank in the distribution of earnings ability. Assuming that individual propensities follow a conditional logistic distribution, our basic grouped specification is then

\[
\ln \left( \frac{P_{qt}}{1-P_{qt}} \right) = \alpha_1 \tau_{1qt} + \alpha_2 \tau_{2qt} + \delta_q + \mu_t + \tilde{\lambda}_{qt}.
\]

Here, \( P_{qt} \) equals the observed fraction of quantile \( q \) in year \( t \) that has business losses exceeding 10% of wage income, \( \tau_{1qt} \) measures the average value of \( (T_1^e - T_2^e)/(1 - T_1^e) \) among individuals in quantile \( q \) in year \( t \), while \( \tau_{2qt} \) represents the average of the sum of the last two tax terms in Eqs. (1a) and (2). In addition, \( \delta_q \) and \( \mu_t \) represent quantile and time dummies respectively. This specification therefore represents a difference-in-differences estimation procedure, comparing the relative changes in tax incentives over time across different quantiles with the relative changes in the dependent variable.

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35 Specifically, we used a panel data set of individual tax returns, and searched for variables that did not differentially change over a three year period for those who did or did not become self-employed. The resulting variables we chose as predictors were: indicators for each filing status, an indicator for having dependents, ln(number of dependents if nonzero), indicators for whether interest income, dividend income, property tax deductions, or mortgage interest deductions are reported, and the logs of the dollar amount of each of these financial variables, if nonzero. Even though the variables used to forecast earnings ability were chosen because they were not affected by the decision to become self-employed, it is still possible that these variables help forecast the probability of engaging in entrepreneurial activity, even controlling for earnings ability. To test for this, we report sensitivity tests below including these predictor variables as separate controls.

36 This group almost entirely consisted of nonitemizers without income from financial assets, so that only the demographic dummy variables were available to forecast earnings. These individuals therefore had virtually identical expected earnings.

37 See the Appendix for a description of some additional technical complications that were taken into account in the estimation, including the controls for sample selection.
We estimate the resulting specification using OLS. Throughout, we report robust standard errors. Three of the underlying parameters (the variability of entrepreneurial income, \( s \), the degree of risk aversion, \( \beta \), and the nontax benefits of corporate activity, \( \theta \)) enter in a nonlinear fashion into the definitions of \( \tau_{1qt} \) and \( \tau_{2qt} \). We will estimate these parameters by minimizing the sum of squared residuals.

2.6. Measurement of the tax variables

Measuring the implications of taxes, as captured by the terms within the brackets in Eq. (1a), involves many complications. To begin with, since these terms capture marginal incentives, their values depend on the particular allocation of time and resources that the individual has chosen. The standard procedure here would be to include the endogeneous measures of tax incentives in the specification, and then to use instrumental variables to estimate their coefficients. To calculate each individual’s marginal incentives, however, we would need to observe at a minimum \( w_H \) and \( s \) for each individual. Our data set does not include enough information to approximate either value.

We chose instead to measure the tax incentives at one common point for all individuals. Starting from this point, we calculated the values of each tax term for each individual, taking into account the uncertainty in \( \tilde{\epsilon} \) and the option to divide ex post income between the corporate and personal tax bases, conditional on any given values for \( s \), \( \beta \), and \( \theta \). The resulting estimates for each \( \tau_{ijt} \) then represent the average of these individual tax terms across all individuals in a quantile.

This measure of the tax incentives calculated at a common point should be highly correlated with the true marginal incentives, and should capture well the effects of the tax law on behavior. The specific coefficients of the tax terms must be interpreted with caution, however, given that the tax measures are used as proxies rather than as instruments.

There were then a variety of complications that arose in characterizing the relevant tax schedules at any date. For example, the effective tax rate on noncorporate business income depends on the earned income tax credit (introduced in 1975) and the maximum tax on earned income (in effect during 1971–80) as well as the regular personal income tax schedule. In addition, as emphasized by Bruce (2000), we felt it important to take into account the effects of the payroll tax. The payroll tax can encourage entrepreneurial activity since the tax is avoided when income is shifted to the corporate sector. However, the tax can discourage risk taking since noncorporate business losses are not deductible under the payroll tax even though noncorporate profits are taxable.

Another important consideration for the tax treatment of noncorporate losses is the opportunity for individuals owing no current taxes to use excess losses to offset taxes paid in the previous few...
years, or in subsequent years, so that these losses are deductible against a positive tax rate. For a new business, the previous few years would presumably be ones in which the individual was a full-time employee, so in a much higher tax bracket, making this opportunity of particular value.41

The effective tax rate on entrepreneurial income shifted to the corporate sector depends on whether that income represents profits or losses. Consider first the effective tax rate on positive income. Positive corporate income is subject to the corporate income tax as well as any personal taxes due on the resulting income. According to Sommerfeld and Jones (1991), during virtually all of our sample period small corporate businesses could easily split their income among multiple corporations so that all of the income would be taxed at the lowest rate in the progressive corporate tax schedule.42 In most of our results, we therefore assume that any corporate entities that might later be formed from these noncorporate businesses will be able to take advantage of this income splitting and face the minimum corporate tax rate. While perhaps an appropriate assumption for small firms, larger firms may find the nontax costs of maintaining multiple corporations too high to justify the tax savings. All key results are also reported, assuming that any corporate income must be consolidated, so face the full corporate tax schedule.

The resulting net-of-tax corporate income is then subject to personal income taxes when it is paid out as dividends or when the shares are sold. A small closely held firm would rarely pay dividends, given the resulting tax penalty, so we ignore dividend taxation. When an entrepreneur sells shares in her firm, capital gains taxes are due. Following Bailey (1969) and Feldstein, Dicks-Mireaux, and Poterba (1983), we assume that the effective tax rate on positive capital gains equals \(0.25gt\), where \(t\) is the person’s ordinary tax rate and \(g\) is the fraction of capital gains included in taxable income.43

Corporate losses, in contrast, are assumed not to generate any corporate income tax savings, given no-loss-offset provisions.44 However, they do still generate capital losses for the entrepreneur on her personal income taxes. IRC Section 1244 allows capital losses on small business stock to be treated as ordinary losses, regardless of holding period, and imposes much higher limits on the amount of losses that can be taken compared with other capital losses.45 Note

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41 We assume that the expected tax savings on loss carrybacks equal \(0.5t\), where \(t\) is the tax rate the individual would have faced as a full-time employee and where \(0.5\) is an estimate of the fraction of loss carrybacks, in present value, that ultimately are deductible.

42 To quote their assessment on p. 54, income splitting among multiple corporations “was widely observed and utilized in the United States for decades prior to a critical change” that went into effect in 1975. They then describe how tax lawyers quickly got around the new statutory restrictions, and conclude on p. 58: “After a few years of living with the new provisions, and after an important Supreme Court decision [U.S. v Vogel Fertilizer, 455 U.S. 16 (1982)], however, there was a rebirth of multiple corporations.”

43 The factor 0.25 reflects a presumed halving of the effective tax rate due to deferral and another halving due to the write-up of basis at death. For \(t\), we used the individual’s tax rate while a full-time employee, on the grounds that the gains will be realized after the individual has left self-employment. Among omitted complications, the sale of entrepreneurial shares can easily involve a sale of the firm. Prior to 1986, there was a tax incentive to treat this as a sale of assets rather than of equity, generating a potentially large compensating benefit from a write-up of the basis for depreciable capital, though since then it also generated an extra corporate-level capital gains tax. Pushing in the opposite direction, any deferral of the realization of capital gains may leave the individual facing a binding liquidity constraint.

44 A few (presumably larger) corporations with accumulated losses may be acquired by a profitable corporation, transferring these tax losses to the acquiring firm. If this possibility is anticipated, then the firm has a strong tax incentive to be corporate from the beginning, in which case the firm would not appear in our sample of noncorporate businesses.

45 Since there is still deferral of the tax deduction until the shares in the firm are sold, we assumed that the effective tax rate on capital losses is \(0.5t\), where \(t\) is the tax rate the individual faces as a full-time employee, subsequent to selling the business.
that the opportunity to take capital losses as ordinary losses combined with the favorable tax treatment of capital gains creates an important subsidy to risk taking.

3. Data summary

In introducing the empirical work, we first graph the data that will be used in the estimation. Fig. 1a–c graph the average values for the three tax terms in each quantile in each year, graphed in each case so that a higher value implies stronger incentives to engage in entrepreneurial activity.\(^{46}\) In Fig. 1a, we see that the “income-shifting” term grew during the late 1970’s, due to bracket creep in the personal tax schedule and due to a drop in the minimum corporate tax rate in 1979. The increase in the capital gains tax rates in 1986, in contrast, reduced this source of entrepreneurial incentives.

Similar patterns show up in the “risk-subsidy” term, since the increase in personal tax rates during the 1970’s reduced net losses, while profits largely remained subject to the corporate tax.

\(^{46}\) In calculating these values, we assumed that \(s=2.6, \beta=0.9, \) and \(\theta=0\), based on the estimated results reported below.
Fig. 1c, in contrast, shows a fall in the amount of “risk sharing” in 1979, due to the drop in the corporate rate, and a jump in 1987 due to the increase in the capital gains tax rate.

Combining the three graphs, the key changes in tax incentives are the increase in incentives during the late 1970’s, and the drop in incentives after the 1986 Tax Reform.

Fig. 2 then graphs the data compiled from the individual tax returns on the fraction of each quantile in each year who report business losses exceeding 10% of labor income, our measure for \( P_{qt} \). Here, we see clear evidence of higher losses in 1973, at the time of the 1973 oil shock, and also perhaps during the recession of 1981–3.\(^47\) We include time dummies to control for such business-cycle factors as well as any changes over time in technology or in the legal climate. We also see that higher ability quantiles are much more likely to engage in entrepreneurial activity, even taking into account any differences in tax incentives, justifying including quantile dummies in the empirical work.

The dominant remaining patterns are a strong increase in entrepreneurial activity in the late 1970’s, and a drop starting in 1988. These changes are just what would be expected given the changes in tax incentives seen in Fig. 1a–c.

\(^{47}\) In a comparable figure for business profits, in contrast, the dominant variation is an increase in the early 1980’s and then again in the late 1980’s. In each case, these changes follow a drop in personal relative to corporate tax rates, suggesting to us that activity may be shifting from corporate to noncorporate form in response to these changes in relative tax rates. Selection issues, rather than overall changes in entrepreneurial activity, therefore seem to be playing a major role affecting reported noncorporate profits.
In the empirical work, by including year dummies and quantile dummies, we do not make use of the time-series variation that is apparent from the graphs, but instead compare the relative changes in these tax incentives across different quantiles to the relative changes in the frequency of large entrepreneurial losses.

4. Estimation results

Table 1 contains our main estimation results forecasting the probability that individuals have large business losses. In row 1, we assume that entrepreneurial activity involves no risk, so that only the “income-shifting” term enters. This term has a positive coefficient, as expected, that is strongly statistically significant.

We next allow for risk but assume risk neutrality. As a result, the second tax term now enters, but includes just the “risk-subsidy” effect. In estimating this specification, we search for the value of $s$ that minimizes the sum of squared residuals. The resulting value for $s$ is 2.5, implying a standard deviation of entrepreneurial income 2.5 times expected income. Using a likelihood ratio test for the joint significance of introducing risk into the measurement of the tax variables and adding the second tax term (and a selection correction term), the resulting test statistic is 4.65, implying strong statistical support for the importance of risk.

The resulting tax coefficients are reported in row 2. The coefficient of the “risk-subsidy” effect is large, with the expected sign, and strongly statistically significant. The “income-shifting” coefficient now has the wrong sign, though it is statistically poorly defined.

We next allow for risk aversion as well as risk, so that the second tax term now includes both the “risk-subsidy” and the “risk-sharing” effects. Effective tax rates are now certainty equivalents, as described following Eq. (1). We jointly choose the degree of risk aversion, $\beta$, and the amount of risk entrepreneurs face, $s$, to minimize the sum of squared residuals. The resulting value for $s$ is now 2.6, while the choice for $\beta$ that minimizes the sum-of-squared residuals is 0.9. To test the statistical significance of $\beta$, we again chose to use a likelihood ratio test, yielding a test statistic of 2.21 — there is solid statistical support that risk aversion is important.

Row 3 reports the resulting values of the tax coefficients. The coefficients on the two tax terms both now have the expected signs and both are strongly statistically significant. Their numerical values are remarkably close, consistent with the first-order conditions for $H_p$ and $K$, suggesting that taxes affect mainly these two choices.

48 Without risk, this term simply compares the marginal tax rate on an extra dollar of wage vs. business income.
49 This figure implies a roughly 35% chance that a firm has business losses. According to our calculations using the PSED, 40% of new firms have business losses.
50 The reported standard errors for the tax coefficients are computed taking the value of $s$ as given, in order to maintain comparability with subsequent specifications. In order to judge the degree to which such estimates are misleading, we also computed the standard errors for the specification in row 3 using an explicit maximum-likelihood estimator, assuming normally distributed errors to justify choosing parameters to minimize the sum of squared residuals. In this case, the resulting standard errors computed using the techniques described in Berndt et al. (1974) are larger by 64%, 14%, and 7% respectively when the simultaneous choices of $s$ and $\beta$ are taken into account. The resulting standard error of $\beta$ is 0.32 while that for $s$ is 0.015.
51 Given the substantial time needed to estimate $s$, in all further reported results (unless reported otherwise) we fixed $s$ at 2.6.
52 This estimate cannot easily be compared to a standard estimate of relative risk aversion, in part because the value is very sensitive to our choice about the fraction of time spent as an entrepreneur (20%), and because we normalized $\beta$ by current labor income rather than by the certainty-equivalent present value of resources available for consumption.
53 They are also large economically, though we will wait to show this until the next section.
Next, we allowed for nontax benefits/costs $\theta$ of operating as a corporate rather than a noncorporate firm. Corporations have the advantage of limited liability, making it easier to attract equity investors, while the unlimited liability faced by noncorporate owners can make it easier to obtain debt finance. In estimating a value for $\theta$, we are testing for the extent to which firms at the margin have a nontax preference for one form or the other. The estimate for $\theta$ that minimized the sum-of-squared residuals was $\theta = .01$, implying a trivial nontax advantage of the corporate form. However, this figure was not statistically significantly different from zero. We therefore focus on results with $\theta = 0$, so use row 3 as our base case.

In row 4, we report results assuming instead that $\theta = -1$, implying that firms always remain noncorporate. While the fit is clearly worse, the tax variables continue to have the expected

54 These nontax benefits are tied to the legal form of organization, which to some degree can be chosen independently of the choice of corporate vs. personal tax schedule. For example, if a corporation chooses subchapter S status, then it is legally a corporation but pays taxes under the personal tax schedule. To the extent that the legal choice of form is not tied to the choice of tax status, then $\theta = 0$ since $\theta$ measures the nontax implications of the choice of tax status.

55 In the Appendix, we describe a list of sensitivity tests, varying detailed assumptions used in defining both the tax terms and our measure of entrepreneurial activity. Results proved to be qualitatively robust, and the assumptions used in row 3 provide a marginally better fit than any alternatives.

56 This was the implicit assumption, for example, in Gentry and Hubbard (2004) and in Carroll et al. (2000). Note that the “income-shifting” term remains nonzero due to distortions arising from the payroll tax.
signs and remain statistically significant.57 The worse fit suggests that the option to incorporate is important to potential entrepreneurs.

We next tried several robustness checks on this base specification in row 3. First, we allowed separate coefficients on the “risk-subsidy” and the “risk-sharing” tax terms.58 Here, we find as forecast by the theory that the two risk terms enter with substantively equal coefficients.59

Next, we used the full corporate tax schedule rather than just the minimum tax rate, so assumed forced consolidation of returns as might be a better approximation for the largest and most successful resulting firms. Here, we reoptimized over \( s, \beta, \) and \( \theta \). Again, we found that \( s=2.6 \), and again the optimal value of \( \theta \) was .01 but not statistically different from zero. We therefore report the coefficient estimates assuming \( \theta=0 \) in row 5. While the coefficient on the income-shifting term and the estimate of \( \beta \) change some, the overall fit is only very slightly worse, and as we will see below the forecasted effects of taxes are similar to those implied by the estimates in row 3.

An underlying complication in the interpretation of our estimates is the possibility that even large reported business losses reflect passive financial investments rather than true entrepreneurial activity. While the tax incentives affecting such passive investments are broadly similar to those affecting entrepreneurial activity, a key difference is that the 1986 Tax Reform Act disallowed deductions for passive losses, whereas losses from active businesses continued to be deductible.

We therefore explored three alternative specifications that each minimize the role of passive losses in the sample. In the first, we make use of the fact that proprietorships always represent active businesses, so were unaffected by the passive loss restrictions imposed in 1986. We then estimated the probability that an individual has proprietorship losses exceeding 10% of labor income. The resulting estimates are in row 6 of Table 1. The estimates are very much in line with the previous rows, suggesting that passive losses are not noticeably affecting our results.

In the second alternative, we dropped the top quantile from the sample. Tax shelter activity would have been important primarily for those in the top tax bracket, since they obtained the largest tax savings from deducting the resulting tax losses and could outbid other investors for any such shelters. Results are reported in row 7 of Table 1. Again, they are qualitatively unaffected.

As a further sensitivity test, we dropped the years 1984–7 from the sample, to avoid having any jump in tax shelter activity prior to the 1986 Tax Reform Act, or short-run income shifting following the Act, affect our results.60 Results are in row 8 of Table 1. While the coefficient on the income-shifting term drops a bit, results are qualitatively unchanged.

As seen from Fig. 1a–c, the 1986 Tax Reform Act was an important source of variation in tax incentives during our sample period. This tax act, however, involved many changes in statutory provisions beyond those we have taken into account explicitly in our calculation of tax

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57 Comparing the numerical size of the estimated coefficients across specifications is tricky, since the definition of the tax incentive variables has changed, as well as the value of \( \beta \). For example, while the estimated coefficient on the combined risk term halves, comparing row 4 with row 3, the “risk-sharing” term is now weighted by a value of \( \beta \) that has more than doubled so that its overall effect has increased.

58 Here, we fixed \( \beta \) at the value estimated in row 3. While in theory \( \beta \) still remains identified due to its role in the calculation of certainty-equivalent tax rates, in practice the likelihood function is now virtually flat with respect to \( \beta \), so that the data are uninformative about its value.

59 In particular, the “risk subsidy” term has a coefficient (standard error) of \(-11.39 (6.33)\) while the “risk sharing” term has a coefficient of \(-11.89 (5.32)\), compared with a combined coefficient of \(-11.67 (2.43)\). Other coefficients hardly changed. The only important change, therefore, is an increase in the standard errors, since the two risk terms are highly correlated.

60 A closer inspection of the data indicated that the partnership loss rate increased relative to the proprietorship loss rate during 1984–6 in the top quantile but not in other quantiles, suggesting that passive losses were important primarily in these three years.
To what degree do results change if we exclude the effects of the 1986 Tax Reform? To implement this, we reestimated the model over the fifteen sample years prior to the 1986 Tax Reform Act. Results are reported in row 9. While estimated effects are roughly halved, perhaps because the signal-to-noise ratio in the tax measures is lower, the estimates are not statistically different from those in row 3, and the qualitative story is still in line with prior results.

Our tax variables are identified based on both variation in the tax law over time and also changes in the distribution of predicted labor incomes. While variation in the tax law provides a truly exogenous source of variation in incentives, our assumption so far that the factors used in predicting labor income do not enter the specification directly can perhaps be questioned. To test for this, we added to the regression the average value within each quantile in each year of each of the variables used to predict labor income. In this specification, identification of tax effects is simply dependent on variation in the tax code. The resulting tax coefficients are reported in row 10, and are qualitatively unchanged.

As expected given the patterns seen in Fig. 2, our coefficient estimates for the quantile dummies indicate substantial variation in the propensity to engage in entrepreneurial activity across quantiles, with the most able being far more likely to become entrepreneurs. Our specification assumes that these differences remain stable over time. Given the substantial evidence for skill-biased technical change, raising wage rates for more skilled relative to less skilled, there is at least the possibility that the relative returns to entrepreneurial vs. wage employment for different skill quantiles have also changed over time. To test for possible changes, we added separate time trends for each quantile to the specification. As seen in the results reported on row 11 in Table 1, the estimates hardly change.

In addition, we tried interacting a set of business-cycle indicators with the quantile dummies, to allow for the possibility that quantiles are affected differently by the business cycle. The resulting tax coefficients are reported in row 12. Again, they are qualitatively similar.

We also tested for differential responses to tax incentives among different quantiles. In particular, we took the coefficient-weighted sum of the two tax terms in row 3, and interacted that variable with the quantile dummies. We could not reject our assumption that all groups reacted similarly to taxes.

A remaining omission from the estimation so far is any attempt to capture the increased ease of tax evasion through entrepreneurial activity. Klepper and Nagin (1989) estimated that net profits on Schedule C (income from proprietorships) are understated (and net losses overstated) by 32% of true net income. Since in equilibrium the marginal cost of further evasion must just equal the marginal tax savings, to a first approximation the net gain from tax evasion should be half of this amount. As a rough sensitivity test, we then assumed that for tax purposes positive net income was underreported by 16% and net losses were overstated by 16%. Results are reported in row 13. The estimates are in line with prior results, though the sum of squared residuals is much worse.

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61 For example, individuals were no longer able to deduct interest payments except for a mortgage on a primary residence or for a business, and alternative minimum tax provisions were changed.

62 The coefficients on the predictor variables are available on request. The one result of note, consistent with prior findings, is that those with more financial income are more likely to have entrepreneurial losses. In particular, having 10% more financial income raises the probability of entrepreneurial losses by 2%.

63 The indicators we chose were the profit rate for the largest category of firms each year as reported in the Statistics of Income data, and the unemployment rate.

64 Formally, let the statutory tax rate be $t$, assume that the individual underreports taxable income by the fraction $f$, but gets caught cheating with a probability $P$ resulting in a fine $F$ in proportion to the amount evaded. The probability of being caught depends on $f$; assume for simplicity that $P = \alpha f$. The individual then chooses $f$ to minimize $t(1-f(1-P)+ Pf F)$, implying that $f = 1/[2\alpha(1+F)]$. The effective tax rate then equals $t(1-.5f)$. 
5. Discussion

Our coefficient estimates are of the expected signs, and strongly significant statistically, indicating that taxes do matter for entrepreneurial risk taking. How large are the estimated effects, however?

To assess the role of taxes, we first forecast the fraction of individuals in 1993 with business losses exceeding 10% of labor income, based on the tax law in 1993. These forecasts appear in row 1 of Table 2, using the coefficient estimates in row 3 of Table 1. The next to last column reports the weighted average of these probabilities, weighted by each quantile’s share of aggregate predicted earnings.

The last column reports the comparable aggregate figure if we simulate instead using the coefficient estimates from row 5 of Table 1, where we assumed that entrepreneurs could not set up multiple corporations, so could face much higher corporate tax rates. The intent here is to provide evidence on the sensitivity of our forecasts to alternative assumptions about the correct specification for tax incentives.

Row 2 reports how these forecasts change if personal income tax rates were uniformly cut by five percentage points in each tax bracket. Both forecasts for aggregate entrepreneurial risk taking drop by roughly 40%, evenly spread across quantiles. As a reminder, a cut in the personal tax rate makes each of the three tax terms less favorable for entrepreneurial risk taking, reducing the tax savings from being able to shift business but not labor income into the corporate tax base, reducing the tax savings from the deductibility of losses while leaving unaffected the taxation of profits when incorporated, and reducing risk sharing with the government.

Row 3 then forecasts the effects of the 2001 tax reform (once fully implemented) under which personal tax rates were cut with no change in corporate tax rates. Here again, the theory is clear that entrepreneurial risk taking should fall. According to both sets of estimates, the rate of entrepreneurial risk taking falls by about 30%.

Row 4 reports the comparable forecasts if instead corporate tax rates were reduced by .05 in each bracket. Here, the theoretical forecasts are ambiguous. Business income is now taxed more favorably overall, and risk is now more subsidized since the tax on profits falls while the tax savings on noncorporate business losses remain unchanged. The first two tax terms therefore become more favorable. However, less risk is shared with the government. So while it is more attractive to be in business, entrepreneurial risk taking may not necessarily go up. Here we find that the aggregate forecast for entrepreneurial risk taking increases by about a quarter based on one model and is unchanged based on the other model. Recall that the minimum corporate tax rate fell from 20% to 17% in 1979, coinciding with a sharp increase in measured entrepreneurial risk taking. While this aggregate time-series evidence was not used in the estimation, due to the inclusion of time dummies, this time-series evidence seems more consistent with the results from the model using the minimum corporate tax rate.

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65 Given the estimate for s of 2.6, firms have only a 35% chance of having any losses, so that the fraction of people engaged in entrepreneurial activity should be 1/0.35 = 2.9 times as large.

66 This figure measures the aggregate amount of entrepreneurial risk taking if, for each individual engaged in entrepreneurial activity, the amount of risk taking is a fixed proportion of her earnings ability. To the extent that tax changes not only induce more people to engage in entrepreneurial activity but also induce each entrepreneur to undertake a riskier project, our forecasts understate the overall change in entrepreneurial risk taking. See the Appendix for further discussion.

67 The forecasts by quantile are available from the authors. In all cases, the pattern by quantile is comparable across the two simulations.

68 In the results with the full tax schedule, the coefficients imply more weight on the risk-sharing term, where incentives worsen.
Row 5 shows what would happen under a flat tax, such as proposed by Hall and Rabushka (1995), assuming a flat tax rate of 20%.\textsuperscript{69} For those affected heavily by the progressive personal tax schedule under existing law, incentives should improve, while for those who gain most from the option to incorporate, incentives worsen. Overall among single individuals, the first group is more important: both forecasts for aggregate entrepreneurial risk taking increase by 15% to 20%. Forecasted entrepreneurial activity decreases, though, for those in the top percentile.

Row 6 describes what would happen under a negative income tax, under which any negative taxable income generates a tax refund based on the tax rate in the initial bracket. Now all business losses are shared to at least some extent with the government. Such increased deductibility of losses improves the risk-subsidy term, since large losses are now treated more favorably, and also leads to more risk sharing with the government.\textsuperscript{70} Here, we find more than a doubling of the forecasted amount of entrepreneurial risk taking! The incomplete deductibility of noncorporate losses appears to be a major drawback for individuals when deciding whether to undertake more risk.

Similarly, in row 7 we consider the effect of making noncorporate losses deductible under the payroll tax. This tax change again treats business losses more favorably, but unlike a negative income tax does not increase the marginal tax rate on wage income. Here both models forecast a large increase in entrepreneurial risk taking, though the specific size of the forecasted increase differs between the two models. This anomaly in the payroll tax law, whereby noncorporate profits are taxable but noncorporate losses are not deductible, has strongly discouraged entrepreneurial risk taking according to our figures.

Finally, row 8 describes the impact of cutting the capital-gains tax rate in half, a change in fact enacted in 1994. Due to Section 1244, we assume that capital losses are still converted

\textsuperscript{69} Note that important tax distortions remain, since individuals do not receive tax refunds if their overall taxable income is negative. Payroll tax distortions also remain.

\textsuperscript{70} The first tax term, though, is basically unaffected, since the tax rebate applies equally at the margin to wage vs. business income.
into ordinary losses, so that such a tax change affects only capital gains, not capital losses. Both models suggest that this tax change leads to a modest increase in entrepreneurial risk taking.

In interpreting these figures, it is important to keep in mind that our sample is not representative of the overall U.S. population, since it does not include joint filers. Joint filers tend to face higher marginal tax rates under the personal income tax. As a result, in a more representative sample of the U.S. population, forecasted effects in the top few quantiles would get much more weight than they do in this sample of single filers, for example making a flat tax less valuable as a mechanism for increasing entrepreneurial activity.

We should also note that the overall forecasts, taking into account changes in all three of the tax terms, can be very different than forecasts made based on changes in any one of these tax terms. Often the changes in the tax terms lead to offsetting effects. As a result, any study looking at one tax effect but ignoring others can generate misleading results.

6. Conclusions

According to our results, “animal spirits” are not the only factor affecting rates of entrepreneurship. Taxes matter as well, and in fact are very important. Contrary to conventional wisdom, though, we forecast that a cut in personal tax rates can substantially reduce entrepreneurial risk taking. Such a tax cut reduces the taxes saved from deducting business losses, while profits frequently remain taxed at the corporate tax rate. As a result, risk taking is discouraged. In addition, as emphasized by Domar and Musgrave (1944), a lower personal tax rate implies less risk sharing with the government, in itself making entrepreneurial risk taking less attractive to risk-averse individuals. The potential tax savings from going into business simply to reclassify earnings as corporate rather than personal income for tax purposes also falls when personal tax rates fall. Overall we forecast that a uniform cut in personal tax rates by five percentage points leads to a 40% fall in entrepreneurial risk taking.

While a cut in corporate tax rates should stimulate business activity, it is less assured that it will stimulate business risk taking. In particular, entrepreneurs bear more risk when the corporate tax rate is cut, so may be reluctant to engage in as risky a business venture. Our forecasts here vary by specification, suggesting no change or a small increase in entrepreneurial risk taking in response to a cut in corporate tax rates.

There are several tax changes more specifically targeted at entrepreneurial activity that should have large effects. For example, we forecast that allowing business losses to be deductible under the payroll tax would increase sharply the amount of entrepreneurial risk taking, with forecasts ranging from a 50% increase to a doubling. A negative income tax is also forecast to lead to a sharp increase in entrepreneurial risk taking, since it again treats large business losses more favorably. Specifically, if negative taxable income generates a tax refund based on the tax rate in the first tax bracket, we forecast a doubling of entrepreneurial risk taking.

If entrepreneurial activity is in fact an important source of innovative ideas and economic growth, as suggested by Schumpeter (1976), then our forecast is that these same policies should result in faster economic growth rates. That poorer countries often have minimal personal income taxes and high corporate tax rates, for example, may be important contributing factors to their lack of entrepreneurial activity.71 These effects of tax structures on rates of entrepreneurship, and the

71 See Lee and Gordon (2005) for empirical evidence that high corporate tax rates have discouraged economic growth rates among poorer countries.
resulting impact on rates of economic growth, should be an important consideration in the debate over tax policies.

Appendix A

The purpose of this appendix is to provide technical details about the empirical analysis.

A.1. Measurement of entrepreneurial risk taking

We measure entrepreneurial activity for each individual by an indicator for whether this individual has noncorporate business losses exceeding 10% of wage income. How closely does this indicator of entrepreneurial activity capture the extent of entrepreneurial risk taking?

For any given individual, a natural measure of the extent of an individual’s engagement in entrepreneurial activity is \( \frac{sf}{wH} \), which measures risk taking relative to potential labor income. Business losses will be greater in absolute value than 10% of wage income only if

\[
\tilde{e} < -\left( \frac{wH}{sf} \right) \left( \frac{E \tilde{\pi} + 0.1wH_c}{wH} \right) \equiv -\frac{B}{A},
\]

where \( A = \frac{sf}{wH} \). The other term, \( B \), changes in the same direction as \( A \), but by a smaller percent, in response to changes in \( H_p, K, L, \) and \( s \). Changes in behavior therefore affect \( A \) and the probability that \( \tilde{e}_B < -\frac{B}{A} \) in the same direction. The percent change in the probability of large losses exactly corresponds to the percent change in entrepreneurial risk taking if the behavioral response is simply in the number of individuals engaged in entrepreneurial activity. If instead what changes is the amount of risk in each business, whether due to increases in \( H_p, K, L, \) or \( s \), then the percent change in our measure should understate the percent change in entrepreneurial activity (as measured by \( A \)) due to the offsetting changes in \( B \) in Eq. (A1).

A.2. Sample selection

In addition to excluding married couples filing joint returns, we excluded from the sample any observation reporting a deduction for being age 65 or over or reporting pension income, on the grounds that self-employment decisions of the elderly and retired can have very different patterns than those for younger taxpayers. Similarly, we dropped those who claimed to be a dependent of another taxpayer, or who reported neither wage nor self-employment income. In addition we dropped anyone reporting farming income larger in absolute value than 10% of wage income, since farmers have an additional choice whether to include non-farm self-employment income on Schedule F.

Finally, since we classify individuals according to their earnings ability relative to that of others in the same year, we require a stable sample selection in each year. Yet the characteristics of individuals who file tax returns can vary over time due, for example, to changes in minimum taxable income and the introduction in 1975 of the earned income tax credit. To minimize variation in our sample composition over time, we drop any observations with income below some small fraction of average forecasted earnings each year.\(^{72}\)

\(^{72}\) In particular, we started with 1979, and chose a cut-off for forecasted earnings so that 5% of the sample was dropped in that year. In 1977 (1980), we calculated the percent by which average forecasted earnings in that year differed from those in 1979 for those above the 1979 cut-off. We then adjusted the cut-off by that percent and used it as the cut-off for 1979 (1980). The same procedure was then extended through the rest of the sample.
A.3. Empirical specification

Our null hypothesis in the empirical work is that the probability that an individual of a given ability has large entrepreneurial losses follows a logistic function, allowing for year effects and quantile effects. This implicitly assumes that the propensity to engage in entrepreneurial activity depends on one’s percentile rank in the distribution of ability in a given year, rather than say one’s absolute ability level.

A technical complication with this specification is that the predicted ability quantiles will not be entirely consistent over time, given changes in the amount of information available in predicting ability. For example, the fraction of people who itemize varies considerably over time. We therefore add additional terms capturing the fraction in each predicted quantile that fall within each true ability quantile in a given year, so that the specification that we in fact estimate equals

\[
\ln \left( \frac{P_{qt}}{1-P_{qt}} \right) = \alpha_1 \tau_{1qt} + \alpha_2 \tau_{2qt} + \delta_q + \mu_t + \sum_n d_n v_{nqt} + \tilde{\zeta}_{qt},
\]

where \(v_{nqt}\) equals the fraction in each predicted ability quantile \(q\) in year \(t\) that has true ability in quantile \(n\). In particular, for any value for predicted ability, \(\hat{w}_{it}\), the distribution of true ability \(w_{it}\) satisfies \(\ln(\hat{w}_{it}) = \ln(\tilde{w}_{it}) + \tilde{\eta}_{it}\). Based on the probability distribution for \(\tilde{\eta}_{it}\) observed in the data, we can easily compute the probability for any given \(\hat{w}_{it}\) that true ability will be in each of the six true ability quantiles.

Another complication arises because some entrepreneurs have an incentive to incorporate so should not be part of our sample, leading to a potential selection bias. To correct for such a selection bias, we proceeded as follows: Let \(\xi\) denote the fraction of individuals in a quantile with active business losses that choose to remain noncorporate. We then observe not the true probability \(P^{\ast}\) that an individual has business losses exceeding 10% of wage income, but instead observe \(P = \xi P^{\ast}\). Given our theory, the correct dependent variable would be \(\ln(P^{\ast}/(1-P^{\ast}))\), whereas our observable dependent variable is \(\ln(P/(1-P))\). Since \(P^{\ast}\) is very small (from under .01 to a maximum of about .15), we know that

\[
\ln\left( \frac{P}{1-P} \right) \approx \ln\left( \frac{\xi P}{1-P^{\ast}} \right) = \ln\left( \frac{P^{\ast}}{1-P^{\ast}} \right) + \ln(\xi).
\]

We thus add \(\ln(\xi)\) as an additional control variable, with an expected coefficient of one.74 Across the empirical specifications we estimated, none of the coefficients on the selection term was statistically significantly different from one.75

73 If we had started with an underlying model based on individual data that included (unobserved) true ability dummies, and aggregated this across individuals within each predicted ability quantile, the resulting specification would include these additional terms. The dependent variable becomes \(\text{avg}[\ln(P_{it}/(1-P_{it}))] \approx \text{avg}[\ln(P_{it}/(1-P_{it}))-0.5E[(P_{it}-P_{jt})^2]/P_{jt}]\), so that the predicted-ability quantile dummies are still needed to capture the effects of the second term in this equation.

74 In our simulations used to construct the tax variables, for each possible draw for \(\tilde{\xi}_{it}\) we allow the individual to allocate this income optimally between the corporate and personal tax schedules. We then set \(\xi\) equal to the probability that the individual will choose to report noncorporate losses exceeding 10% of wage income, conditional on having overall business losses exceeding 10% of wage income.

75 The only exception was in the specification allowing for a nonzero \(\theta\). Coefficient estimates are available in the online version.
A.4. Robustness checks

In our baseline specification, we assumed that the degree of absolute risk aversion is inversely proportional to $\tilde{w}_{it}$. If $\tilde{w}_{it}$ captures well the present value of future lifetime resources, then the first-order conditions correspond to those assuming constant relative risk aversion, ignoring taxes. As a sensitivity test, we tried normalizing instead by the sum of forecasted labor income and income from dividends and interest income. Results proved to be quite robust.

We also found that results were robust to a number of other sensitivity tests, including: a) using $1 - T_2$ rather than $1 - T_1$ in the denominator, consistent with Eqs. (3) and (4), b) assuming that capital losses on equity are taxed at an effective rate of $.25gt$, thereby ignoring the more favorable tax treatment offered by Section 1244 for “small” firms, c) varying the assumed fraction of time spent as an employee vs. as an entrepreneur used when calculating marginal tax incentives, d) varying how large business losses must be relative to reported wage income to be called an entrepreneur, and e) redefining large losses to be losses greater than some dollar figure ($5000$ or $10,000$). In all the cases where a comparison is appropriate, the sum of squared residuals was worse than in our preferred specification.

Appendix B. Supplementary data


References


76 Results for these tests, as well as for the specification estimating a nonzero $\theta$, are available in the online version.
77 One resulting concern is that when financial assets enter into the definition of the tax variables, the tax variable may in part pick up variation in the extent of liquidity constraints across individuals as well as possible age effects (since financial assets vary strongly with age), so that the coefficients capture more than just tax effects. We therefore included in this specification the set of controls used in forecasting labor income, which include controls for financial income.


