# Taxes and Entrepreneurial Activity: Theory and Evidence for the U.S.

by

Julie Berry Cullen and Roger H. Gordon
*University of Michigan and University of California at San Diego*

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**Abstract.** Entrepreneurial activity is presumed to generate important spillovers, potentially justifying tax subsidies. How does the tax law affect individual incentives? How much of an impact has it had in practice? We first show theoretically that taxes can affect the incentives to be an entrepreneur due simply to differences in tax rates on business vs. wage and salary income, due to differences in the tax treatment of 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 these aspects of the tax law have had large effects on actual behavior.

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**Address.** Corresponding author: Roger Gordon, Department of Economics, University of California at San Diego, La Jolla, CA 92093-0508. Fax: 1-858-534-7040. Telephone: 1-858-534-4828. Email: rogordon@ucsd.edu.

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**Abstract:** *Entrepreneurial activity is presumed to generate important spillovers, potentially justifying tax subsidies. How does the tax law affect individual incentives? How much of an impact has it had in practice? We first show theoretically that taxes can affect the incentives to be an entrepreneur due simply to differences in tax rates on business vs. wage and salary income, due to differences in the tax treatment of 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 these aspects of the tax law have had large effects on actual behavior.*

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. The "new growth" literature suggests that spillovers of information such as from entrepreneurial activity play an important role in explaining economic growth. Given such spillovers, market incentives alone can generate too little entrepreneurial activity.

Given these positive spillovers generated by entrepreneurial activity, there are clear reasons to try to subsidize such activity through the tax system. The objective of this paper is to assess to what degree the tax system affects the amount of entrepreneurial activity, both theoretically and empirically.

The stylized view we adopt in this paper is that entrepreneurial activity consists primarily of start-up firms pursuing highly risky projects. These new firms will normally enter as noncorporate firms, and then later incorporate if successful.[1] The objective of the paper is then to explore the degree to which the tax system has affected the amount of risk-taking observed among noncorporate (so presumably recent start-up) firms.

There are a variety of possible mechanisms through which the tax system can affect an individual's incentives to undertake risky projects. For one, small business owners can much more easily underreport their taxable income than can wage and salary earners. The higher are tax rates, the stronger the incentive to open up a business as a means to avoid taxes.

Another reason why high marginal tax rates may encourage risk-taking was originally described in Domar and Musgrave (1944).[2] While high tax rates may discourage effort and investment in the economy as a whole, Domar and Musgrave argue that high tax rates make risky projects *relatively* more attractive. High tax rates mean that substantial risk is transferred to the government through random tax payments. If adverse selection in

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[1] As seen below, this lifecycle pattern for a firm is implied by the incentives created by the tax law.

[2] For a more recent exploration of the effects of a proportional tax on risk-taking, see Sinn (1996). Bird (2001) provides some empirical evidence, using a cross-country panel data set, that countries with higher tax rates have more variable incomes, consistent with this hypothesis.

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.[3] With more risk sharing available, an entrepreneur's risk premium will be lower, and risk taking should be greater.

Gentry and Hubbard (2000) 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. The more progressive the tax schedule, therefore, the more risk-taking lowers the expected after-tax return from the project. As a result, a progressive rate schedule discourages risk-taking.[4]

An important omission from this last argument is the option firms always 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.[5] In recent years in the U.S., the corporate tax rate for a small firm could be as low as 15%, which is below the marginal personal (plus payroll) tax rate faced by effectively all individuals. As a result, a firm generating tax losses will prefer to be noncorporate so that the entrepreneur can deduct these losses against other personal income, saving on personal income taxes. When and if the firm generates profits, in contrast, for tax purposes the entrepreneur will prefer to incorporate so that these profits are taxed at the lower corporate tax rate.[6] This option to choose the organizational form ex post[7] based on the outcome provides a net subsidy to risk-taking. The higher are personal relative to corporate tax rates, the larger is the subsidy arising from this option. As with any option, this option to incorporate is more valuable the greater the risk faced by the entrepreneur. In itself, therefore, this option subsidizes risk-taking. Section 1 develops these various hypotheses in more detail.

The size of corporate vs. personal tax rates in the U.S. has varied substantially over time, and the changes have differed substantially by income bracket, making it feasible

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[3] However, if financial markets succeed in allocating efficiently across investors the risk embodied in firm shares, Gordon (1985) showed that a proportional tax does not affect the relative attractiveness of risky vs. less risky projects.

[4] There have also been several papers examining taxes and self-employment rates that use a more reduced form approach. Recent examples include Bruce (2000), Schuetze (2000), and Fairlie and Meyer (2000). The first two papers find that higher marginal income tax rates encourage self-employment, while the third finds no clear effects of taxes.

[5] For an early recognition of this point, see Feldstein and Slemrod (1980). Gordon and Slemrod (forthcoming) provide empirical evidence on the importance of income shifting between the personal and the corporate tax bases. Gordon (1998) points out more explicitly the potential resulting subsidy to risk-taking, and discusses under what conditions this subsidy would generate an efficiency gain.

[6] In principle, if the corporate income is taxed at a rate above that due on the individual's personal income, then there is an incentive to have a project owned by a corporation while it generates tax losses and then spun off to a noncorporate (e.g. sub-chapter S) firm when it generates profits. For this to work, given the no-loss-offset provisions under the corporate tax, a loss-making project must be owned by a corporation generating profits from other activities.

[7] By law, firms face the constraint that they cannot change their form of organization more than once every five years. We ignore this constraint, on the presumption that the key uncertainty is simply whether and when the firm will become profitable.

to test empirically for the effects of these various tax effects on business activity. We make use of *Statistics of Income Tax Return* data to test empirically for each of the above effects of the tax law on the amount of entrepreneurial activity. Section 2 describes our estimation strategy, while results are reported in section 3. Section 4 summarizes the forecasted sensitivity of entrepreneurial activity to tax policy, while section 5 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 project undertaken by an individual (the standard deviation per dollar of expected income), but also on the average scale of the project (the number of dollars of expected income), as well as on the number of individuals who engage in at least some business activity. In addition, the chosen scale of the project will depend on how much of the entrepreneur's own time and savings are invested in the project, as well as on how many other people she hires and how much capital she obtains from outside investors. 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 $A$.[8] This individual can divide her time between a salaried position, paying $w$ per hour before tax, 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 (noncorporate) activities, we assume that the resulting pretax income $\pi(\tilde{\epsilon})$ equals

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

where $a$ is an entrepreneurial ability parameter (varying by individual), $L$ equals the number of workers hired at market wage $w_m$,[9] $K$ is the amount of own and borrowed funds invested in the firm,[10] 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.

[8] 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.

[9] 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 sharp 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 such contracts more readily.

[10] 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 equation (3) vs. equation (2).) One further assumption is that the individual cannot sell equity in her firm to outside (venture capital) investors, due to lemons' problems. The only real issue is whether the extent of this venture capital financing varies over time, with changes in the tax incentives faced by venture capitalists. Implicitly, we will control for possible changing incentives in the empirical work through use of time dummies.

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.[11] In addition, let $Y$ denote any other income, e.g. spouse's income. Total pre-tax income, denoted by $\tilde{I}$, therefore equals[12]

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

Of course, the nature of the tax law is key in analyzing individual incentives. Let $T_p(.)$ represent the personal tax schedule,[13] while $\tau(.)$ represents the corporate tax schedule (including any personal taxes owed on dividend or capital gains income). Wage income is always subject to personal income taxes. 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 $0 \leq C \leq \pi(\tilde{\epsilon})$ if the firm has profits, and $\pi(\tilde{\epsilon}) \leq C \leq 0$ if the firm has losses.[14]

Shifting $C$ to the corporate sector not only affects tax payments, but may also create nontax benefits (or costs).[15] Denote these benefits by $\theta|C|$.[16] In choosing this functional form, our intent is simply to assume that the nontax benefits/costs are proportional to the scale of the firm, where firms are presumed to be large if they have *either* large profits or large losses. These nontax benefits then make any corporate profits larger, and any corporate losses smaller, than they would have been otherwise.

Given U.S. tax provisions, we assume that losses are deductible from other income under the personal tax but that corporate losses do not result in any tax refunds.[17] If the entrepreneurial project remains entirely noncorporate, the individual's personal income tax

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[11] While we allow explicitly only for investments in bonds, all investments in equilibrium yield a certainty-equivalent after-tax rate of return equal to that on bonds.

[12] 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 (2000), who find that self-employment is more common in U.S. states that have more generous bankruptcy provisions.

[13] For simplicity of exposition, we ignore payroll taxes (and any offsetting pension benefits) here, even though they are taken into account in the empirical work.

[14] These constraints, limiting the extent of income shifting between the corporate and personal tax bases, are a simple but rather ad hoc way to derive an equilibrium allocation of income between the two tax bases. In practice, firms are often able to do better, e.g. profitable corporations can rent their building or lease their equipment from a noncorporate partnership that generates tax losses on its investments, leading to $C > \pi(\tilde{\epsilon})$. Such tax shelter activity will show up in the data as noncorporate losses among those in the top personal tax brackets, and should be more extensive the larger the difference between the top personal tax rate and corporate rates.

[15] For example, access to both limited liability and public trading of shares should make it easier and cheaper for corporations to raise funds from outside investors.

[16] The empirical evidence reported in Gordon and MacKie-Mason (1994) suggests that the parameter $\theta$ is positive in all industries except finance, insurance, and real estate.

[17] We ignore therefore the potential benefits from tax-loss carryforwards, on the grounds that the failure rate of new start-ups is too high to make this option attractive. In addition, we ignore the possibility of a corporation with tax losses merging with a firm with taxable profits, so implicitly assume that real costs of such a merger outweigh any tax benefits.

payments equal $T_p(\tilde{I})$.[18] If instead the firm reports some corporate income, the combined personal plus corporate tax liabilities, minus the nontax benefits from incorporation, equal $T_p(\tilde{I}-C)+\tau(C+\theta|C|)-\theta|C|$.[19] The entrepreneur will choose $C$ to minimize this expression, subject to the constraint that $sign(C) = sign(\pi(\tilde{\epsilon})-C)$. It quickly follows that a profitable firm will report nonzero corporate income as long as $\tau' < [T_p'(\tilde{I}) + \theta]/(1+\theta)$, while a loss-making firm will report nonzero corporate income only if $\theta > T_p'(\tilde{I})$. 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 minus any nontax benefits from incorporating by some function $T[Y + wH_e + r(A-K), \pi(\tilde{\epsilon})]$. We will refer to $T$ as the "effective" tax payments.

Because only business income can be shifted, we know that $T_1 \geq T_2$, where $T_1 \equiv \partial T/\partial Y$ and $T_2 \equiv \partial T/\partial \pi$. Since only business income can be reclassified as corporate, the inequality will be strict whenever the individual would want to shift more than all of her business profits to the corporate sector, implying that $\tau' < [T_p'(\tilde{I} - \tilde{\pi}) + \theta]/(1+\theta)$, or whenever she reports corporate losses and $T_p'(\tilde{I}) > \theta$. For purposes of discussion, we will assume that $T_1 > T_2$ over some nonnegligible range of $\tilde{\epsilon}$'s.

Figure 1 provides an example, based on the 1993 tax code, for an individual with expected pretax income of \$150,000. This income is assumed to consist of \$30,000 in expected business income and \$120,000 in other income. After-tax income is graphed if the firm is always corporate vs. always noncorporate.[20] In fact, the entrepreneur will choose ex post which form is best depending on which yields the highest after-tax income. In this case, the firm will be corporate if profits are positive, and noncorporate otherwise.

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 $H_p + H_e = H$. For simplicity, assume that utility depends on just the mean and the variance of income,[21] so that the individual maximizes $\mathrm{E}U(\tilde{I}_N) = \mathrm{E}(\tilde{I}_N) - .5(\beta/wH)\mathrm{var}(\tilde{I}_N)$, where $\tilde{I}_N \equiv \tilde{I} - T$ equals after-tax income, and $\beta$ is a taste parameter measuring the cost of risk-bearing.[22] The one decision we assume can be made ex post, once $\tilde{\epsilon}$ is observed, is whether or not to incorporate. All other decisions are made ex ante.

[18] For simplicity, we ignore tax vs. economic depreciation, and any other statutory differences between taxable and true profits. These differences apply to all real investments, whereas our focus is on the degree to which real investments occur in entrepreneurial projects.

[19] We assume here that the nontax benefits from incorporation are reflected in the firm's taxable profits.

[20] In this graph, we assumed that $\theta = .12$, consistent with the empirical estimates reported below.

[21] As a result, we assume no direct effect on utility from the choice to enter entrepreneurial activity, holding certainty-equivalent income fixed. This is in contrast to Carroll et al (2000), who introduce tastes per se for being an entrepreneur, and assume an income elasticity of greater than one for being an entrepreneur. In their setting, because of these tastes, a higher uniform tax rate can discourage entrepreneurial activity. While they provide supporting evidence that the income of sole proprietorships went up following the cuts in personal tax rates enacted in 1986, this evidence can also be explained by the drop in personal tax rates *relative* to the corporate tax rate, so does not require introducing differential tastes for the two types of jobs.

[22] We chose this functional form, which implies constant absolute risk aversion (ignoring the $wH$ dividing $\beta$), in order to simplify the derivations. However, we divided $\beta$ by the individual's potential labor income $wH$ in order to approximate the results that would arise under constant relative risk aversion.

Let $\bar{T}$ denote the expected value of tax payments minus any nontax benefits of incorporating. Then

$$\bar{T} \equiv \int_{-\infty}^{\infty} T[Y + wH_e + r(A-K), \pi(\tilde{\epsilon})]\phi d\tilde{\epsilon}$$

where $\phi$ is the density function for $\tilde{\epsilon}$. Expected after-tax income equals

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

The variance of after-tax income equals $\mathrm{E}(\tilde{I}_N - \mathrm{E}(\tilde{I}_N))^2 \equiv \mathrm{E}(sf\tilde{\epsilon} - T + \bar{T})^2$.[23]

Given the first-order condition for $H_e$, we find that the optimal choice for $H_e$ satisfies:

$$w \geq awf_H \left[1 + \frac{T_1^e - T_2^e}{1 - T_1^e} - (\beta/wH)\mathrm{cov}\left(\tilde{I}_N, s\tilde{\epsilon}\left(\frac{1-T_2}{1-T_1^e}\right)\right) - s\frac{\mathrm{E}(\tilde{\epsilon}T_2)}{1-T_1^e}\right]. \qquad (1)$$

Here,

$$T_1^e \equiv \int_{-\infty}^{\infty} T_1 \phi d\tilde{\epsilon} - (\beta/wH)\mathrm{cov}\left(T_1, \tilde{I}_N\right),$$

and

$$T_2^e \equiv \int_{-\infty}^{\infty} T_2 \phi d\tilde{\epsilon} - (\beta/wH)\mathrm{cov}\left(T_2, \tilde{I}_N\right)$$

measure the marginal utility of receiving the random amounts $T_1$ or $T_2$. Given the mean-variance utility function, this marginal utility equals the expected value minus the required risk premium, where the risk premium takes the standard form of the covariance of the payments with ex post after-tax income.

If the individual chooses not to engage in any entrepreneurial activity, e.g. due to low entrepreneurial ability $a$, then the inequality in equation (1) will be strict. In general, this equation forecasts that all individuals above some ability 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 $w$ (but unobserved $a$) will be an entrepreneur.

To understand the role of taxes in this equation, consider first how taxes would enter if the tax system were proportional, so that $T_1 = T_2 = t$ for some fixed value $t$ that does not depend on $\tilde{\epsilon}$.[24] Under a proportional structure, $(T_1^e - T_2^e)/(1 - T_1^e) = 0$. In addition, $\mathrm{E}(\tilde{\epsilon}T_2) = t\mathrm{E}\tilde{\epsilon} = 0$. All the explicit tax terms therefore drop out of equation (1). However, $\tilde{I}_N - \mathrm{E}(\tilde{I}_N) = (1-t)sf\tilde{\epsilon}$, so that the risk premium term is smaller the higher the tax

[23] We (along with Domar and Musgrave) make the simplifying assumption that the random return to each entrepreneurial project is statistically independent from that on other projects, being affected solely by technological uncertainty, so that there is no risk in aggregate tax revenue. As a result, there is no extra term in $\tilde{I}$ capturing the individual's share of the risk in aggregate tax revenue. Given these assumptions, if the entrepreneur could diversify all her risks through the market, then $\tilde{I}$ would no longer be risky, and the risk-premium term would disappear entirely.

[24] Note that such a proportional system requires not only a proportional personal tax schedule but also a corporate tax rate equal to the personal tax rate.

rate $t$. This is the Domar-Musgrave effect. In particular, with a proportional tax rate $t$, taxes would reduce the variance of business income in proportion to $(1-t)^2$, but reduce expected income only in proportion to $(1-t)$, on net making risky activities relatively more attractive.[25]

With a nonproportional tax system, arising from a corporate rate differing from personal tax rates as well as from a progressive income tax schedule, taxes affect the allocation of labor in more complicated ways. To begin with, we see from the first term in equation (1) that entrepreneurial activity is encouraged to the degree that $T_2^e < T_1^e$. This term 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.

Taxes continue to affect the size of the second (risk-premium) term, in a form closely analogous to what happens with a proportional tax system. However, the details are messier. For example, with a nonlinear tax structure, the risk from extra entrepreneurial activity depends on the marginal effective tax rate, while the size of $\tilde{I}_N$ depends on the average effective tax rate.

The final term, $\mathrm{E}(\tilde{\epsilon}T_2)$, measures the expected tax payments on the random return $\tilde{\epsilon}$. Under a proportional tax, this term equals zero. If losses were deductible subject to a high personal tax rate while profits are taxed at a lower corporate tax rate, then expected tax payments on $\tilde{\epsilon}$ will be negative, making entrepreneurial activity more attractive. Conversely, if we ignore the option to incorporate, so that income is subject to a progressive personal tax, then this term is necessarily positive, penalizing entrepreneurial activity.[26] As a result, this term can be negative for richer entrepreneurs, lowering the cost of undertaking more risk, but will normally be positive for entrepreneurs in lower personal tax brackets. In Figure 1, this term will be negative if the upper envelope of the after-tax income schedules is predominantly convex over the relevant range, whereas this term will be positive if the after-tax income schedule is predominantly concave.

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 equation (1), given the increase in $T_1^e - T_2^e$ in the numerator of the first term (since corporate income escapes the increased tax rate), given the increased risk-sharing with the government captured by the numerator of the second term, and given the more negative value of $\mathrm{E}(\tilde{\epsilon}T_2)$ (as losses are subject to higher personal tax rates but profits remain subject to an unchanged corporate rate). Higher corporate tax rates, in contrast, reduce the first and third terms, but make the second term less negative; 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,

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[25] Intuitively, the tax system allows entrepreneurs to diversity $t$ percent of their risks with the rest of the population, to that extent lowering the net costs of risk bearing.

[26] This possibility was the focus in Gentry and Hubbard (2000). Note, however, that the actual U.S. tax schedule is not strictly progressive, due for example to the EITC and the phasing out of the payroll tax above some income level.

the optimal choice for $K$ satisfies

$$r = f_K \left[ 1 + \frac{T_1^e - T_2^e}{1 - T_1^e} - (\beta/wH)\text{cov}\left(\tilde{I}_N, s\tilde{\epsilon}\left(\frac{1-T_2}{1-T_1^e}\right)\right) - s\frac{\text{E}(\tilde{\epsilon}T_2)}{1-T_1^e}\right]. \quad (2)$$

Here, taxes affect investment incentives in exactly the same way they affect the allocation of labor effort to the firm.[27]

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:

$$w_m \leq f_L \left[ 1 - (\beta/wH)\text{cov}\left(\tilde{I}_N, s\tilde{\epsilon}\left(\frac{1-T_2}{1-T_2^e}\right)\right) - s\frac{\text{E}(\tilde{\epsilon}T_2)}{1-T_2^e}\right]. \quad (3)$$

The key difference from the previous expressions is that the income-shifting term now disappears, since all transactions are within the firm. Taxes still provide a net subsidy to hiring new workers, at least as long as $\text{E}(\tilde{\epsilon}T_2) < 0$.

We find that the tax subsidy term for $K$ is proportionately larger than that for $L$, by the ratio $(1-T_2^e)/(1-T_1^e) > 1$. 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.[28] Note, however, given the definition of profits, that any increase in the capital/labor ratio, holding expected output fixed, reduces the chance of losses, since profits are measured net of labor costs but not net of capital costs. This will be important below.

The choice for $s$ is clearly a key issue when considering the effects of taxes on risk-taking. The first-order condition can be expressed as

$$f_s = (f + sf_s)\left[\frac{(\beta/wH)\text{cov}\left(\tilde{I}_N, \tilde{\epsilon}(1-T_2)\right)}{1-T_2^e} + \frac{\text{E}\left(\tilde{\epsilon}T_2\right)}{1-T_2^e}\right]. \quad (4)$$

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 reduce these costs of risk-bearing for two reasons. The first corresponds to the Domar-Musgrave effect, while the second again captures the expected tax payments on the random return $\tilde{\epsilon}$. Both terms are proportional to those appearing in the other first-order conditions.

One omission from the above model is tax evasion. Small businesses should find it relatively easy to underreport their taxable income, e.g. by selling output for cash and

[27] Recall that, for simplicity, we have assumed that statutory taxable income equals economic profits. If we assume that tax depreciation is less than economic depreciation, then there would be an additional negative effect of high tax rates on investment, in proportion to $T_2^e$.

[28] Carroll et al (1998) provide empirical evidence that entrepreneurs have fewer employees when they face a higher tax rate. While they attribute this to the higher tax rate discouraging entrepreneurial activity, our model suggests instead that the higher tax rate may simply be inducing these firms to substitute capital for labor.

not registering the sale, or by reporting as business expenses the purchase of personal consumption items. As a result, a firm should face an *effective* tax rate below the statutory rate on revenue and an *effective* rate at least equal to the statutory rate on expenses. Unfortunately, in our data set, we do not observe revenue and expenses separately for individual businesses, only the net profits, making any test for tax evasion difficult. We did try testing whether the effective tax rate on firms with net profits was reduced, relative to what would be forecast based on statutory rates. While estimates were in the expected direction,[29] standard errors were so large that we felt unable to pursue this complication in the current paper.

## 2. Estimation strategy

*Data set*

Our empirical tests make use of a series of cross-section samples of personal income tax returns made available by the *U.S. Statistics of Income*, for twenty-two years between 1964 and 1993.[30] For each tax return in a year, there are data on all the major entries on the tax return.

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. It does suffer the drawback, however, that we have 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 over age 65. 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.

*Measurement of "entrepreneurial" activity*

Based on the tax return alone, there is no way to judge with confidence whether anyone in a household is engaged in "entrepreneurial" activity. To begin with, there is no way to distinguish corporate entrepreneurial income from income from passive financial investments in corporate equity. In particular, corporate entrepreneurial income is likely *not* to generate much dividend income — if the entrepreneur wants to extract money from her firm, wage payments, loans (either from the firm or with the firm's shares used as collateral), and sale of shares all dominate dividends for tax purposes. High dividend income therefore is *not* a good indicator of entrepreneurial activity, while capital gains from shares in one's own business would be indistinguishable from capital gains on passive investments.

Positive noncorporate income is also not a good indicator of entrepreneurial activity. As described above, most all entrepreneurs had a tax incentive to incorporate whenever their firms are profitable. Entrepreneurial profits would therefore be reported as noncorporate

[29] None of our other results were affected qualitatively.

[30] 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.

income only if they were small, so insufficient to raise $T_p'$ above $\tau' - \theta(1-\tau')$. As a result, positive noncorporate income would be subject to a potentially severe truncation bias, with a truncation point depending on relative tax rates.

In measuring entrepreneurial activity, we therefore chose to focus on reported noncorporate losses. As described above, anticipated entrepreneurial losses would be reported as noncorporate rather than corporate income, given the no-loss-offset restrictions under the corporate but not the personal income tax, as long as $\theta < T_p'(\tilde{I})$. In addition, given the typical lifecycle of a firm, losses likely indicate the recent entry of a firm, so should respond much more to recent tax changes than would the continuing income of older noncorporate firms.

Of course, not all noncorporate losses represent losses from self-employment. For example, prior to 1986 tax shelters generated considerable noncorporate losses. In order to try to screen out such tax shelter losses, so that the empirical work focuses more closely on entrepreneurial activity, we chose to classify reported noncorporate losses as "entrepreneurial" only if they were larger (in absolute value) than 10% of reported wage and salary income.[31] [32] As sensitivity tests, we tried both varying this cut-off percentage and restricting the sample to proprietorships.

In addition, we chose to limit our measure of noncorporate losses to losses from proprietorships, partnerships, and subchapter S corporations, specifically excluding losses from real estate and farming. Farming and real estate *normally* run losses for tax purposes, given the favorable tax treatment of both sectors,[33] so that the presence of losses in these sectors conveys different information than would be the case in other occupations.

In the empirical work, we focus simply on whether or not an individual reports large enough business losses, as defined above. This indicator of entrepreneurial activity is easily measured in our data set, and should be relatively free of selection biases.

One immediate question, though, is how closely this indicator of entrepreneurial activity corresponds to other measures of the extent of entrepreneurial activity. For any given individual, a natural measure of the extent of an individual's engagement in "entrepreneurial" activity is $sf/wH$, which measures the extent of their entrepreneurial risk-taking relative to their potential labor income.[34] Business losses will be greater in absolute value than ten percent of wage and salary income only if

$$\tilde{\epsilon} < -\left(\frac{wH}{sf}\right)\left(\frac{\mathrm{E}\tilde{\pi} + .1wH_e}{wH}\right) \equiv -B/A, \tag{5}$$

[31] While losses from proprietorships should not include losses from passive financial investments, we use the same sample restriction on proprietorship losses as well, in order to avoid treating different organizational forms differently. Otherwise, the estimates would in part reflect factors affecting the choice of organizational form.

[32] One further advantage of including this cut-off is that our estimates become less sensitive to possible fixed costs of becoming an entrepreneur, costs ignored in the above derivations.

[33] This favorable tax treatment arises in large part simply because land and buildings provide very good collateral for loans. Both activities therefore have unusually large interest deductions.

[34] It is the risk-taking, rather than self-employment per se, that should generate information externalities to others.

where $A = sf/wH$, and $B$ equals the second term. If $B$ does not vary across individuals, then there would be a one-to-one link between our indicator for entrepreneurial activity and this underlying desired measure, $A$.

While this second term, $B$, is unaffected at the margin by changes in $s$ or in $L$, it is an increasing function of $H_p$ and of $K$. Any increase in $B$ dampens the effects of changes in $A$, since they move in opposite directions in response to changes in $H_p$ and $K$. This has two implications. First, as seen below, we may be too conservative in our inferences about the effects of tax changes on this underlying measure of entrepreneurial activity, $sf/wH$. In addition, there will be a particular downward bias in the effects of the first tax term in equations (1) and (2) on our indicator of entrepreneurial activity, since this term affects $H_p$ and $K$ while not affecting $s$ and $L$, whereas the other two tax terms affect all four aspects of behavior equally.

*Sample selection*

The estimation sample was limited so that we could focus on a subset of individuals where the analysis would be clearest. To begin with, we excluded any observation reporting a deduction for being over age 65 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 ten percent of wage and salary income, since farmers have an additional choice whether to include nonfarm self-employment income on Schedule F.

Other sample restrictions were chosen in response to problems we faced in measuring the earnings ability of each individual. The likelihood of self-employment is inevitably a nonlinear function of this measure. One key problem is that for joint filers we do not know whether one or both members of the couple work, and who (if anyone) is reporting self-employment income. Given that the interpretation of the data for single individuals[35] is so much clearer than for joint filers, we chose to limit the empirical work to single individuals. Note that a sample of single taxpayers will tend to be younger and have lower taxable income than would a sample that included joint filers as well.

Finally, we wanted to measure an individual's earnings ability relative to that of others in the same year, requiring a stable sample selection in each year. Yet the characteristics of the set of individuals who choose to file tax returns changes over time, due 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 decided to drop the bottom few percent of the sample, based on forecasted earnings.[36]

[35] "Single" here is a shorthand for all nonjoint filers, including married filing separately, head of household, and widow, as well as single.

[36] 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 then 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 this percent and used it as the cut-off for 1977 (1980). The same procedure was then extended through the rest of the sample.

*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.[37] This information about earnings if not self-employed is also 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, so must be forecasted. Any forecasting procedure, however, must not create artificial differences between the self-employed vs. employees.[38]

The basic strategy we adopted was to search for instruments that help forecast earnings while not self-employed but which are not correlated with the self-employment decision. In choosing instruments, we were restricted to using information available on the tax returns. The instruments we chose were: indicators for each filing status, an indicator for other 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. See the Appendix for a description of the tests we undertook to justify this choice of instruments.

Let the resulting forecasting equation in year $t$ for earnings ability for individual $i$ equal[39]

$$\ln(w_{it}) = Z_{it}b_t + \tilde{\eta}_{it},$$

where $w_{it}$ is labor income while not self-employed and $Z_{it}$ is a vector of instruments. We estimated this equation using a sample of workers who were not self-employed. The resulting forecast for earnings ability, denoted by $\hat{w}_{it}$, is a key input in the estimation.

*Empirical specification*

The basic objective of the empirical work will be to estimate how the tax incentives described in equations (1) through (4) affect the probability that an individual has noncorporate losses exceeding ten percent of wage and salary income, controlling for an individual's earnings ability and time-varying factors. Given the large size of our data set (over two million individual tax returns), and given the need to simulate numerically the effects of entrepreneurial risk on each of the tax measures for each individual, we felt it necessary to group the data by predicted earnings ability, rather than estimate a discrete choice model using the individual data.[40]

In particular, we grouped the data each year into six quantiles based on each individual's value for $\hat{w}_{it}$. One quantile included all those whose forecasted earnings were in the

[37] Here, we define as self-employed anyone with an absolute value of noncorporate income (and not just losses) exceeding ten percent of wage and salary income.

[38] For example, Gentry and Hubbard (2000) measure the earnings ability of the self-employed by whatever wage and salary income they continue to earn. Since these individuals are not full-time employees, this systematically underestimates their earnings ability, introducing biases into the coefficient estimates.

[39] In fact, we estimated five different regressions, based on which instruments were available for each individual. See the Appendix for details.

[40] Even with this grouping into quantiles, constructing the data for each linear regression we ultimately run takes over a day of computer time.

bottom 70% of the population.[41] 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].[42] While this grouping implies that we ignore within group variation, little information is lost since forecasted earnings is the only independent variable of importance for each individual.[43]

Based on our assumption that omitted factors have a Weibull distribution, our initial specification is

$$\ln\left(\frac{P_{qt}}{1-P_{qt}}\right) = \sum_j \alpha_j \tau_{jqt} + \delta_q + \gamma_t + \tilde{\chi}_{qt}. \tag{6}$$

Here, $P_{qt}$ equals the observed fraction of quantile $q$ in year $t$ that has business losses exceeding 10% of wage and salary income, while $\tau_{jqt}$ is the average value for tax measure $j$ (to be defined below) in quantile $q$ in year $t$. In addition, $\delta_q$ and $\gamma_t$ represent quantile and time dummies respectively. This specification therefore represents a difference-in-difference estimation procedure, comparing the relative changes in tax incentives over time across different quantiles with the relative changes in the dependent variable.

One technical complication with this specification, that turns out to be of little matter empirically but that we felt we should take into account nonetheless, is that the predicted ability quantiles will not be entirely consistent over time. For example, our success in forecasting earnings depends on the fraction of people who itemize, a fraction that varies considerably over time. If we had instead started with an underlying model based on individual data which included (unobserved) true ability dummies, and aggregated this across individuals within each predicted-ability quantile, the resulting specification would include additional terms capturing the fraction in each predicted quantile that fall within each true ability quantile in a given year.[44] The specification we in fact estimate then equals

$$\ln\left(\frac{P_{qt}}{1-P_{qt}}\right) = \sum_j \alpha_j \tau_{jqt} + \delta_q + \gamma_t + \sum_a d_a \mu_{aq} + \tilde{\chi}_{qt}, \tag{7}$$

where $\mu_{aq}$ equals the fraction in each predicted-ability quantile $q$ that has true ability in quantile $a$.[45]

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[41] This group almost entirely consisted of those whose instruments were equal to zero except for the demographic dummy variables. These individuals therefore had virtually identical expected earnings.

[42] Again due to the large sample size, our calculations were based on a randomly chosen subsample of 25% of those in the bottom 70% of the population, a 50% subsample for those in each of the next four quantiles, and a 100% sample of the top quantile.

[43] Note that grouping the data introduces no statistical bias as long as the information used to allocate people to groups is independent of the residual. Our instruments were chosen based on this consideration.

[44] If we aggregate from individual data, though, the dependent variable becomes avg[$\ln(P_{it}/(1-P_{it}))$] $\approx$ $\ln(P_{qt}/(1-P_{qt})) - .5\mathrm{E}((P_{it}-P_{qt})/P_{qt})^2$. The predicted-ability quantile dummies are still needed to capture the effects of the second term in this equation.

[45] In particular, for any value for predicted ability, $\hat{w}_{it}$, the distribution of true ability, $w_{it}$ satisfies $\ln(w_{it}) = \ln(\hat{w}_{it}) + \tilde{\eta}_{it}$. Based on this probability distribution, 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.

We then estimate this equation using OLS. Throughout, we report robust standard errors. Given that the definition of the various $\tau_{jqt}$ depend on $\theta$ and $\beta$, we explore the implications of the data for these parameters by minimizing the sum of squared residuals, e.g. nonlinear least squares.[46]

Figure 2 graphs the resulting data for $P_{qt}$. Here, we see evidence of higher losses in 1973, at the time of the 1973 oil shock, and also perhaps during the recession of 1981-3. While these business cycle effects are not that dramatic, we still felt justified in including time dummies as controls, in part to capture as well any changes over time in the ease of self-employment due to changes in technology or in the legal climate.[47]

*Measurement of the tax variables*

Given the discussion in the theory section, we included the following tax variables in the analysis:[48]

1) $\tau_{1qt} \equiv \text{avg}_{i\in q}(T_1^e - T_2^e)/(1-T_1^e)$ ("income shifting")
2) $\tau_{2qt} \equiv \text{avg}_{i\in q} s\text{E}(\tilde{\epsilon}T_2)/(1-T_1^e)$ ("subsidy to risk")
3) $\tau_{3qt} \equiv \text{avg}_{i\in q}\left(\frac{\beta}{\hat{w}_{it}+\tilde{\eta}_{it}}\right)\text{cov}((\tilde{I}_N, s\tilde{\epsilon}(1-T_2))/(1-T_1^e)$ ("Domar-Musgrave term")

Measuring these tax variables involves many complications. To begin with, since they measure marginal incentives, their values depend on the particular allocation of time and resources that the individual has chosen. In general, there is a multidimensional schedule of these marginal incentives, looking across all possible individual allocation decisions. Given the individual's preferences, one point on these schedules maximizes utility, but this point is clearly endogenous.

In order to avoid any bias due to this endogeneity, we chose to summarize these schedules by calculating their values at one common point for all individuals.[49] Starting from this point, we calculated the values of each of the $\tau_{jit}$ for each individual, taking into account the uncertainty in $\tilde{\epsilon}_{it}$ and the option to report some income as corporate for any given ex post value of $\tilde{\epsilon}_{it}$.[50] The resulting estimates for each of the $\tau_{jit}$ are then averaged

[46] To justify this statistical procedure formally, we assume that the $\tilde{\chi}_{qt}$ are homoskedastic and distributed normally, in which case nonlinear least squares is equivalent to maximum likelihood. If the $\tilde{\chi}_{qt}$ are heteroskedastic and nonnormal, our estimates will still be unbiased, even though these deviations generate some inefficiency in the statistical estimation procedure.

[47] For example, the rules to qualify for subchapter S status were relaxed substantially during our sample period.

[48] Note that the denominator in the tax terms differs among the various first-order conditions. We conduct sensitivity tests below to see if this matters.

[49] In particular, we calculate the effects of marginal changes in behavior starting from a situation where each individual is spending 80% of her time as an employee and 20% working on the side as an entrepreneur. In forecasting potential wage and salary income, for those who are not self-employed we used their actual wages, while for those who are self-employed (those with either noncorporate profits or losses exceeding 10% of wage income) we drew a value for $\tilde{\eta}_{it}$ from a normal distribution with the estimated standard deviation. Self-employment income is assumed to be random and distributed normally with a standard deviation which we initially set equal to twice its mean (e.g., $s = 2$). We report sensitivity tests below for alternative values of $s$.

[50] We drew twenty representative values for $\tilde{\epsilon}_{it}$ for each individual, at the points where the cumulative normal distribution equals .025, .05, . . . , .95, .975. See the Appendix for further detail about the procedures.

across all individuals in each quantile.

There were a variety of complications that arose in characterizing the relevant tax schedules at any date. To begin with, due care is taken to include the effects of the earned income tax credit (introduced in 1975) and the maximum tax on earned income (in effect during 1971-80). In addition, as emphasized by Bruce (2000), we felt it important to take into account the effects of the payroll tax. While wage and salary income and (positive) partnership and proprietorship income[51] are both subject to the payroll tax, corporate income is not. Therefore, the payroll tax potentially provides a strong incentive encouraging entrepreneurial activity, and reporting business income as corporate.

While the statutory payroll tax rates are clear, the key complication is the fact that extra covered earnings under the payroll tax can increase future Social Security benefits. Diamond and Gruber (1997) find that the *effective* payroll tax rate is roughly the same across income levels. However, it is much lower for the primary worker in a married couple, and is much higher for the secondary worker. Unfortunately, we do not know the gender of a single worker or head of household, nor their past (or future!) marital status. For those who are not self-employed, we simply assume that the present value of added benefits in response to an extra dollar of covered income equals half of the combined statutory OASDI tax payments by both employees and employers. The self-employed receive the same benefits per dollar of covered earnings but can face different payroll tax rates. We pay careful attention to the details of the payroll tax code and any interactions with the personal income tax code.

There is also one issue that arises in the measurement of the corporate tax rate. As described in Sommerfeld (1981) and Sommerfeld and Jones (1991), except during a short period following a tax reform in 1974, firms have been allowed to divide their income among several corporations in order to take repeated advantage of the initial brackets of the corporate tax schedule. We therefore explore two alternative assumptions. In one, we simply set the corporate tax rate equal to the minimum available corporate tax rate. In the second, we ignore this flexibility to divide income among different firms and use the full corporate tax schedule.

If an individual chooses to report self-employment income as corporate, an additional complication is any personal taxes due on this corporate income when it is paid out as dividends, or when the shares are sold generating capital gains income. A small closely held firm would rarely pay dividends, given the resulting tax penalty, so we ignore dividend taxation. Capital gains taxes are a more complicated issue. When an entrepreneur sells shares in her firm, capital gains taxes are due. The effective capital gains tax rate, however, needs to reflect the gains from deferral and possible write-up of basis at death. It has become common to assume, following Feldstein, Dicks-Mireau, and Poterba (1983), that the effective tax rate on capital gains from portfolio trades equals $.25gt$, where $t$ is the person's ordinary tax rate, $g$ is the fraction of capital gains included in taxable income, while the factor .25 reflects a presumed halving of the effective tax rate due to deferral

[51] Subchapter S income, in contrast, is not subject to the payroll tax, a complication we ignore given the small size of this sector. We did, though, investigate whether the fraction of large losses reported in subchapter S form varied depending on the difference in tax incentives, taking into account this effect of the payroll tax. Estimated effects were in the expected direction.

and another halving due to the write-up of basis at death. We will use this measure to calculate the effective value of $\tau'$ in most of our specifications.

While standard, however, this assumption about the effective capital gains tax rate clearly ignores a wide variety of issues. For example, the effective capital gains tax rate on new businesses differs from that on portfolio holdings of equity for several reasons. To begin with, 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.[52] In addition, the sale of shares is much more likely to involve a sale of the firm. Any purchaser of the firm will be able to take additional amortization and depreciation deductions beyond those still available to the original entrepreneur since the tax basis for the firm's capital jumps to the current market value. The resulting tax savings reduce the effective surtax above the corporate rate that is owed due to the realization of capital gains/losses, and can easily lead to a negative effective capital gains tax rate.[53]

A further consideration pushing in the opposite direction is that any deferral of the realization of capital gains may leave the individual facing a binding liquidity constraint, forcing a reduction in current consumption even though the present value of consumption increases. At the margin, the tax savings from further deferral are just offset by the utility loss from the associated deferral of consumption. If *any* deferral begins to reduce current consumption below the desired level, then the net gains from deferral would be approximately half of the associated tax savings, suggesting an effective capital gains tax rate of $.5gt$.

With these conflicting arguments, the Feldstein, Dicks-Mireau, and Poterba (1983) assumption that the effective capital gains tax rate equals $.25gt$ seems a good compromise. As a statistical test, however, we will also explore what happens if we ignore capital gains taxes, on the presumption that the certainty-equivalent additional tax payments are small or negative.

## 3. Estimation Results

In addition to the complications described above in calculating tax incentives, we also faced the problem that the tax variables depend on $\theta$, the fixed costs of incorporating, and $\beta$, the measure of risk aversion. Each of these parameters enters in a nonlinear fashion into the calculation of the tax effects. Given the substantial computer time required in the estimation, we found it infeasible to solve for the values of $\theta$ and $\beta$ that jointly minimize the sum of squared residuals. Instead, the results reported below provide a more limited summary of the effects of these parameters on the results.

### a. $\beta = 0$ and $\theta = 0$

Our initial specification searches impose the simplifying assumptions that individuals are risk neutral and that only taxes affect the decision to incorporate (i.e., $\theta = 0$). When

[52] For example, as of 1978 a single individual could take up to $50,000 in ordinary losses from such stock, in addition to the amount of capital losses that can normally be deducted.

[53] For further discussion, see Gordon, Hines, and Summers (1987).

$\beta = 0$, it immediately follows that $\tau_{3qt} = 0$, while $T^e_{1it}$ and $T^e_{2it}$ are expected values rather than certainty equivalents. By self-selection, entrepreneurs are likely to be much less risk averse than a representative member of the population, so this assumption may not be too extreme. In any case, we test it below. We also explore below possible nontax benefits/costs of incorporation.

Our initial focus is on various subsidiary assumptions used in the construction of the tax variables. Our own initial prior, as discussed above, was that the effective corporate tax rate equals the minimum corporate rate, following the claims in Sommerfeld (1981) that small corporations can easily be divided into multiple corporations for tax purposes. In addition, we followed the conventional approach and set the effective capital gains tax rate equal to $.25gt$, following Feldstein, Dicks-Mireaux, and Poterba (1983). In addition, we assumed that the coefficient of variation for entrepreneurial income equals 2, and classified noncorporate losses as "entrepreneurial" only if their absolute value exceeded ten percent of reported wage and salary income.

The resulting values for $\tau_{1qt}$ are graphed in Figure 3 for each of the quantiles used in the estimation. The comparable figures for $-\tau_{2qt}$ appear in Figure 4, with the sign reversed so that the expected correlation with the rates of large self-employment losses in Figure 2 is positive. As can be seen from the graphs, these tax incentives both grow quickly during the 1970's, due to the inflation-induced bracket creep, and then drop following the 1986 tax reform, as personal tax rates fall relative to corporate rates. This pattern very much corresponds to the patterns seen in Figure 2 for the fraction of individuals with self-employment losses. As seen for example in equation (1), the numerical value of $\tau_{1qt}$ ($\tau_{2qt}$) can be interpreted as a percent subsidy (tax) rate to $H_p$ or $K$ if positive, and a percent tax (subsidy) rate if negative. The question we will face in the empirical work, once we include year dummies and quantile dummies, is whether the relative changes in these tax rates over time correspond to the relative changes in self-employment rates.

The resulting estimates for the coefficients of $\tau_{1qt}$ and $\tau_{2qt}$ for our base case specification are reported in row 1 of Table 1.[54] The variable $\tau_{2qt}$ measures the expected tax payments on the random component of entrepreneurial income. If this expected payment is negative, yielding a subsidy to risk-taking, then $P_{qt}$ should be higher, implying a negative coefficient. The estimated coefficient in fact is negative, strongly statistically significant, and very large in economic terms. For example, if the average value, $\tau_{2qt}$, faced by those in the top quantile were replaced by the average value of those in the bottom quantile, a change of .049,[55] then the forecasted percent change in $P_{qt}$ satisfies

$$\frac{1}{P_{qt}} \Delta P_{qt} \approx \alpha_2 (1 - P_{qt}) \Delta \tau_{2qt}.$$

Given that individuals in the top quantile had an observed $P_{qt} \approx .08$ in 1993, shifting to the value of $\tau_{1qt}$ faced by those in the bottom quantile implies a 74% fall in the probability of being an entrepreneur!

[54] All specifications include time dummies, quantile dummies, and the variables $\mu_{aq}$ that measure the distribution of those in a given group across true ability quantiles.

[55] While $\tau_{1qt}$ would also change with such a tax reform, given the estimated coefficient of $\tau_{1qt}$ the estimated effect of this change is trivial.

The forecasted effect of $\tau_{1qt}$ is less clear. Our presumption has been that a high tax rate on wage and salary income compared with entrepreneurial income certainly should increase the probability of becoming an entrepreneur. However, as noted above, it also should lead new firms to use a higher capital/labor ratio, implying higher profits and a lower probability of tax losses. The estimated coefficient is in fact positive, but rather small and statistically insignificant.

We emphasized above some of the complications in measuring the effective capital gains tax rate and the appropriate corporate tax rate. To test the sensitivity of our results to our base-case assumptions, we explored alternatives in rows 2 and 3 of Table 1. In row 2 of Table 1, we set the effective capital gains tax rate to zero. In row 3, we assumed that corporations must consolidate their income for tax purposes, so face the full corporate tax schedule rather than the minimum corporate rate. In both rows, the qualitative results are unchanged, but the sum of squared residuals is a bit larger than in our initial specification. As a result, we will maintain our original assumptions in each case.

Another question in our initial specification is what level of risk faced in an entrepreneurial firm provides the best summary measure when constructing the tax variables. In particular, the larger this risk, the larger the degree to which nonlinearities in both the personal and the corporate tax schedule affect the constructed tax variables. Initially, we assumed that the standard deviation of entrepreneurial income is twice its mean ($s = 2$). In row 4 of Table 1, we assume instead that entrepreneurial income is riskless, implying by construction that $\tau_{2qt} = 0$. Now, the coefficient of $\tau_{1qt}$ is positive and strongly statistically significant — the larger the tax rate on wage and salary income compared with entrepreneurial income the higher the probability of becoming an entrepreneur.[56] However, the sum of squared residuals is much worse.[57] When we set $s = 1$ or $s = 3$ the sum of squared residuals in both cases was also worse than with $s = 2$, as seen in rows 5-6, suggesting that our original choice was a reasonable one.[58]

One minor ambiguity in our derivation is whether the denominator in the tax terms should include $T_1^e$ or $T_2^e$ — some first-order conditions contain one and some contain the other. As a sensitivity test, we reestimated our specification using $T_2^e$ instead in the denominator. The results appear in row 7 of Table 1. As expected, not much changes. Since the sum of squared residuals is slightly worse, we stick with our initial specification.

A further sensitivity test we tried was to interact each tax variable with a dummy variable indicating whether this tax variable, or both tax variables, had become more generous since the previous year. Our intuition was that ideas that are not quite profitable to pursue under current tax law may accumulate over time "on the shelf." If and when the tax law becomes more generous, there could be a surge of new entry. No such surge showed up in the data: the effects of increases and decreases in tax incentives appeared to be symmetric.

[56] This specification is included in part because it serves as a reduced-form summary of the data.

[57] Throughout the Tables, the reported sum of squared residuals have been divided by the degrees of freedom.

[58] When $s$ is smaller, nonlinearities in the tax schedules have a smaller numerical effect on the tax variables. We find that the size of the coefficients adjusts to compensate.

Another debatable assumption used in the construction of the data was the decision to classify noncorporate losses as "entrepreneurial" only if they exceed 10% of reported wage and salary income. Our hope was that this assumption would lead us to drop from the self-employed most of the individuals whose noncorporate losses simply arose from portfolio investments in tax shelters. Row 8 in Table 1 reports results using a 20% exclusion rule. The qualitative results are entirely unchanged.[59]

As an additional test of the plausibility of our assumption, we looked more closely at data in the tax returns for the period after the 1986 tax reform, when taxpayers were required to classify any partnership or S-corporate income as "passive" or "active."[60] Using data from 1990, we calculated the fraction of individuals classified as entrepreneurs based on our 10% rule (or some other percent rule) who are *not* active participants according to the tax return. Using the 10% rule, 10.1% of those we classify as entrepreneurs were "passive" investors according to the tax return. If instead we had used a 0% rule, implying no exclusions, the error rate would have jumped to 17.5%. Tightening the restriction to 20% of wage and salary income also leads to a slightly higher error rate of 10.8%.

These error rates are not large overall, but in part because "proprietorship" income is always viewed to be active. In contrast, the error rate for partnerships under our 10% rule is 48.7% — of the partners whose losses we count as entrepreneurial, almost half were classified as "passive" investors under the tax law.[61] Since income from proprietorships is always viewed to be active, we tried as an alternative sensitivity test looking at the probability that an individual has proprietorship losses exceeding 10% of labor income. The resulting estimates are in row 9 of Table 1. Again the estimates are in line with the previous rows. They would be expected to be slightly smaller, since we are including fewer forms of entrepreneurial activity. The coefficients perhaps also should be a bit smaller because the choice to set up a proprietorship vs. a partnership or subchapter S firm can be correlated with these tax incentives — when tax incentives are stronger, the resulting firm is likely to be larger so is more likely to have more than one owner. The estimated coefficients are in fact slightly smaller, but by little enough that we see no evidence of any important bias in our original specification.

One other implicit assumption in our specification is that all quantiles are equally responsive to tax incentives, since we have a common coefficient on the tax variables for all quantiles. Yet we know little about the underlying distribution of entrepreneurial ability, $a$, in the population, so have no strong basis to impose this assumption on the data. To test for differences in responsiveness across quantiles, we chose to hold fixed the coefficients on $\tau_{1qt}$ and $\tau_{2qt}$, and interact this weighted-average tax variable with the six

[59] Note that the sum of squared residuals is no longer comparable, since the definition of the dependent variable has changed.

[60] The restrictions that needed to be satisfied for income to be "active" according to the tax law, however, may be tighter than would be appropriate given our objective to measure start-up activity. For example, if a partner works fewer than 500 hours in the firm, then the income is reported as "passive" unless (s)he is the principle manager for this activity. Yet many start-up partnerships may be second jobs for individuals, at least initially, in which case the income will likely be classified as passive according to the tax law, except for one of the partners.

[61] This error rate is again higher at a 0% or a 20% cut-off. The error rate for subchapter S corporations, in contrast, is only 10.1%.

quantile dummies. The resulting coefficient on the tax variable for the lowest quantile was slightly larger than the others, which were all tightly grouped. However, the resulting F-test for whether we could reject equal coefficients for the six quantiles had a p-value of only .306. Given the lack of any statistical support for differing responsiveness by quantile, we maintained our assumption of equal responsiveness.

A related assumption is that all quantiles are equally responsive to macroeconomic changes, as captured by the time dummies. To test this, we interacted a group of explicit macroeconomic variables, described below, with the expected-earnings dummies. The tax coefficients were left qualitatively unaffected, and we saw no obvious patterns and very few significant coefficients among these various interaction terms.

Based on these initial sensitivity tests, we feel confident in sticking with the specification in row 1 as our base case.

**b.** $\theta \neq 0$, $\beta = 0$

In Table 2, we first explore alternative values for $\theta$. Our base case is reproduced as row 1. In row 2, we test the alternative extreme assumption that $\theta = -\infty$, implying sufficient nontax costs from incorporating that firms would always remain noncorporate.[62] Under this assumption, the sum of squared residuals is far worse, neither coefficient has the expected sign, and both are very close to zero and statistically insignificant. The option to incorporate is certainly of importance to potential entrepreneurs according to our estimates.

One key complication in testing alternative values of $\theta$ is that any nonnegative value of $\theta$, implying a nontax advantage to incorporating, creates a selection bias in our sample of entrepreneurial losses. Since business losses are deductible against other income under the personal tax while we assume that corporations with tax losses simply pay zero corporate taxes, all firms with expected tax losses will be noncorporate when $\theta = 0$. In general, however, any firm with tax losses that faces $T'_p < \theta$ would instead choose to incorporate: the nontax savings from incorporating then outweigh the potential gains from deducting business losses under the personal tax.

Let $\xi$ denote the fraction of individuals in a quantile with business losses that choose to remain noncorporate, so face $T'_p \geq \theta$. We then observe not the true probability $P^*$ that an individual has business losses exceeding 10% of wage and salary income, but instead observe $P \equiv \xi P^*$. Given our theory, the correct dependent variable would be $\ln(P^*/(1-P^*))$, whereas the dependent variable we have been using is $\ln(P/(1-P))$. However, since $P^*$ is very small (from under .01 to a maximum of about .15), we know that

$$\ln\left(\frac{P}{1-P}\right) \approx \ln\left(\frac{\xi P^*}{1-P^*}\right) = \ln\left(\frac{P^*}{1-P^*}\right) + \ln(\xi).$$

When considering positive values of $\theta$, we will then add $\ln(\xi)$ as an additional control variable on the right-hand side, with an expected coefficient of one.[63]

[62] This was the implicit assumption, for example, in Gentry and Hubbard (2000) and in Carroll et al (2000).

[63] We construct the forecasted values of $\xi$ using the same assumptions employed in constructing the various tax variables.

We then conducted a grid search over several values of $\theta$. The value that minimized the sum of squared residuals is approximately $\theta = .12$,[64] implying that a firm can obtain a 12% increase in pretax profits by incorporating.[65] The resulting estimates for the other coefficients are reported in row 3 of Table 2. The coefficient on the selection term, $\ln(\xi)$, equals 1.00: since its standard error is large, it is certainly not statistically different from 1.00! The other two tax coefficients hardly change.[66]

In order to test for the statistical significance of our estimate for $\theta$, we chose to use a likelihood ratio test. According to this test, $\sqrt{(n-k)(R-1)}$ should have a $t$ distribution, where $n-k$ is the degrees of freedom left in row 3, and $R$ is the ratio of the sum of squared residuals in row 1 to those in row 3.[67] Given the estimates reported in Table 2, the value of this statistic is 2.6, implying that $\theta$ is statistically different from zero.[68]

**c.** $\theta = .12$ and $\beta > 0$

The mean-variance objective function used above is consistent with the underlying utility function $U(C) = -\mathrm{E}e^{-bC}$ if we can assume that $C$ is distributed normally.[69] Under this assumption

$$U(C) = -e^{b(\mathrm{E}C-(b/2)\mathrm{var}(C))}.$$

Maximizing this function is equivalent to maximizing $\mathrm{E}C-(b/2)\mathrm{var}(C)$. We allowed tastes to vary by individual, however, assuming that $b = \beta/wH$, for some $\beta$. Given this functional form, the coefficient of relative risk aversion at any value of $C$ equals $\beta C/wH$. Since, over a lifetime, the present value of $C$ equals the present value of $wH$, the coefficient of relative risk aversion is approximately equal to $\beta$ for all individuals.

The past literature has focused on such a case of constant relative risk aversion, and many estimates for this parameter have been reported in the literature. A recent paper, based on survey data and reported in Barsky et al (1997), reports a mean value for $\beta$ of 4.17. Our prior was therefore that $\beta$ should be in this range.

While our specification builds in an assumption of constant relative risk aversion when looking over time and across people, however, it still assumes constant absolute risk aversion for a given individual when evaluating the certainty equivalent value of any risky project. With respect to this source of identification for $\beta$, our priors are less well formed. While we will focus on results for $\beta = 4$, given this ambiguity in interpretation we also search for the value of $\beta$ that minimizes the sum of squared residuals.

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64 The other values we tried locally were .10 and .14.

65 Using a totally different approach, Gordon and MacKie-Mason (1994) also estimated the nontax gain from incorporating, by industry, and found much larger figures in most industries.

66 Note, however, that the values of $\tau_{jqt}$ are affected by $\theta$, since individuals now incorporate even when they could have saved some taxes by remaining noncorporate, making the coefficients hard to compare without more effort.

67 Here, we take the ratio of the sum of squared residuals *not* normalized for degrees of freedom.

68 Technically, this is a joint test of the significance of both $\theta$ and the coefficient of $\ln(\xi)$.

69 Ignoring the tax law, we in fact have built in this assumption of normality into the construction of the distribution of entrepreneurial income for each individual.

When we allow for $\beta \neq 0$, various things change. First, we need to add $\tau_{3qt}$ to the specification, in order to control for the after-tax cost of risk bearing faced by an entrepreneur, but not faced by employees. In addition, we now need to calculate the certainty-equivalent rather than the expected tax rates $T_1^e$ and $T_2^e$, based on the simulated covariances. Because of its effect on the these tax rates, $\beta$ enters in a nonlinear fashion in the estimation. In searching over possible values of $\beta$, we set $\theta = .12$, based on our previous results.[70]

In rows 4-7 of Table 2, we report results for $\beta = 2$, $\beta = 4$, $\beta = 10$, and the value of $\beta$ which minimizes the sum-of-squared residuals, which turns out to be $\beta = 50$.[71] In all cases, the tax coefficients each have the expected sign, and almost all are statistically significant. The selection term is also never statistically different from one.

The coefficients of $\tau_{2qt}$ and $\tau_{3qt}$ strongly interact, however, due to the correlation between these two tax expressions. The theory forecasts that these two coefficients should be equal, since they enter together in all relevant first-order conditions. As seen in the Table, they are in fact virtually equal when $\beta = 2$,[72] providing some support for a value of $\beta$ in this range. Since the past literature estimating the coefficient of relative risk aversion has tended to find somewhat higher values, around four, we thought it preferable to focus on our results assuming $\beta = 4$, on the presumption that these past estimates provide a more convincing approach for estimating the coefficient of relative risk aversion than we have available.

We again used a likelihood ratio test to judge the joint statistical significance of the addition of $\tau_{3qt}$ and the modifications to $\tau_{1qt}$ and $\tau_{2qt}$ implied by setting $\beta = 4$ rather than $\beta = 0$. The resulting value of $\sqrt{(n-k)(R-1)}$ is 3.3, providing statistical support for importance of risk aversion in the self-employment decision.

We did not attempt a grid search over both $\theta$ and $\beta$ simultaneously. The required computer time would have been too great.

## 4. Discussion

Our coefficient estimates are of the expected signs, and largely significant statistically, indicating that taxes do matter for the decision to become self-employed. How large are the estimated effects, however?

As one indication of the role of taxes, we first explore how taxes affect the cross-sectional variation across quantiles in our indicator measure of entrepreneurial activity. These forecasts appear in Tables 3a-c, with Table 3a reporting forecasts based on the coefficient estimates in row 1 of Table 2, those in Table 3b using the coefficient estimates from row 3 of Table 2, and Table 3c using those from row 5 of Table 2.

Consider the results first in Table 3a, which are based on our original specification without risk aversion or nontax benefits from incorporation. Here, the interpretation is easiest. Row 1 of Table 3a reports the forecasted rates of large business losses for each quantile based on the tax law in 1993. The last column reports the aggregate amount

[70] Results with $\theta = 0$ are very similar, though have larger sum-of-squared residuals.

[71] The closest alternatives we tried were 40 and 60.

[72] When we constrained these two coefficients to be equal, the value that minimized the sum-of-squared residuals was between two and three.

of entrepreneurial activity, as measured by a weighted average of the probabilities that individuals in each quantile will report noncorporate losses exceeding 10% of labor income, weighted by their earnings ability.[73] These figures imply that entrepreneurial activity is heavily concentrated among the top one percent of the population. Row 2 reports how these forecasts change if the minimum corporate tax rate were reduced by .05, from 15% to 10%, reducing the tax rate on business profits. Here we find that entrepreneurial activity more than doubles in each quantile, and in aggregate. Row 3 reports the comparable forecasts if instead personal income tax rates were uniformly cut by five percentage points, largely reducing the tax savings from business losses. Our indicator of entrepreneurial activity is now forecasted to drop by 30% in aggregate, with larger percent drops among the highest earning quantiles. Line 4 shows what would happen under a flat tax, such as proposed by Hall and Rabushka (1995), assuming a flat tax rate of 20%.[74] 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 much more important — the aggregate value of our indicator of self-employment activity is forecasted to increase by 15%. Consistent with the more detailed forecasts, though, entrepreneurial activity decreases for those in the top percentile. Line 5 provides forecasts of what will happen to the rate of self-employment once the tax reforms of 2001 are fully enacted. Since these reforms left the corporate tax rates unaffected but cut personal tax rates, particularly at the top, we find that aggregate forecasted entrepreneurial activity drops, by 20%, with this drop heavily concentrated in the top percentile. Finally, the last line describes what would happen if the zero bracket were eliminated, as under a negative income tax, so that business losses would continue to result in tax savings even when overall taxable income is small or negative. Here, we find a sharp jump in our indicator of the self-employment rate. The lack of deductibility of large losses turns out to be of major importance in the decision to become an entrepreneur.

Table 3b then reports the comparable forecasts, using the specification that includes a nontax advantage to incorporating. By the theory, $(1-\xi)$% of those with business losses larger than 10% of wage and salary income will have incorporated, due to the nontax advantages of operating in the corporate form, implying that the true rate of self-employment losses is $1/\xi$ times the rate calculated from reported noncorporate losses. When we take this selection bias into account in row 1, the forecasted aggregate rate of self-employment losses under the existing tax law in 1993 is 2.5% rather than 2.0%. Most of the other forecasts are very similar to those in Table 3a. One minor difference is that reducing the minimum corporate tax rate matters more for those in the lowest tax brackets, since the nontax advantage to incorporating means that these individuals are more likely to face the corporate tax. Similarly, the negative income tax matters less in all brackets, since fewer businesses with losses are noncorporate.

Table 3c then reports forecasts using the specification that includes risk aversion as well as a nontax advantage to incorporating. Here the results change more dramatically.

[73] Specifically, we set this measure equal to $[\sum_q P_{qt}\bar{w}_{qt}]/\sum_q \bar{w}_{qt}$.

[74] 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.

The forecasted effects of risk aversion are very large. Increases in the tax rate on business income are now more likely to encourage entrepreneurial activity, by providing greater risk-sharing through the government. For example, a drop in the minimum corporate tax rate is now forecast to reduce the self-employment rate, in spite of the effects from the other two tax terms pushing in the opposite direction. Similarly, a 20% flat tax is forecast to raise the self-employment rate much more than in the other cases — by raising the tax rate on corporate income from 15% to 20%, there is additional risk sharing, a benefit that gets substantial weight according to our estimates. Since the specification used in Table 3c not only provides the best fit but captures expected effects of both risk aversion and nontax advantages to incorporating, we put more weight on these forecasts. Any forecasts that are particularly sensitive to the specification choice have to be viewed to be more tentative, however.

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 on average face much 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.

How, though, do changes in this indicator for entrepreneurial activity relate to changes in other more basic measures of entrepreneurial activity? As argued above, a natural measure of the extent of entrepreneurial activity for any individual is $sf/wH$, which we denoted by $A$. From equation (5), we find that any self-employed individual will report tax losses from self-employment exceeding ten percent of wage and salary income if and only if $\tilde{\epsilon} < -B/A$. For a given level of potential labor income, the fraction of people, $P$, who report such large losses then can be approximated by $P \approx \Phi(-B/A)(1 - F(a^*))$, where $\Phi$ is the cumulative normal distribution function, $a^*$ measures the minimum entrepreneurial ability level at which an individual chooses to become an entrepreneur, and $F(.)$ is the cumulative distribution function for entrepreneurial ability.[75]

If the main change in behavior is simply in the number of people who engage in entrepreneurial activity, so in $a^*$, then the percent change in $P$ simply equals the percent change in the number of entrepreneurs. If instead, the main change in behavior is in $s$ or in $L$, then we need to relate changes in $P$ to changes in $A$. If the function $\Phi$, rather than being a cumulative normal, equaled $\alpha A/B$, for some $\alpha$, then the percent changes in $A$ and $\Phi$ are exactly equal. When the cumulative normal distribution is more (less) convex than this alternative function, then the percent change in $A$ will be smaller (larger) than the percent change in $P$. Given the shape of the cumulative normal distribution function, the percent changes in $A$ implied by any given percent change in $P$ is an increasing function of the value of $-B/A$, since the cumulative normal becomes less convex and then concave as $-B/A$ becomes larger (less negative). The two percent changes are about equal for $-B/A \approx -.75$, in which case the chance of large business losses for a given entrepreneur is around 23%. By our indicator, around 2.5% of people are self-employed, whereas according to the SIPP by self-assessment 10.6% report being self-employed.[76] Comparing these fig-

[75] The approximation is that $B$ and $A$ here measure "typical" values for those who engage in entrepreneurial activity, rather than allowing values to vary as a function of each individual's ability, $a$.

[76] We would like to thank Michelle White for providing this figure.

ures, we infer that around 23.6% of those who are self-employed have large business losses in any given year. Starting from this point, therefore, percent changes in $P$ are roughly equal to the percent changes in $A$.

Finally, if the main change in behavior is in $H_p$ or $K$ among existing self-employed individuals, then $B$ changes as well. In this case, the percent change in $A$ would exceed the percent change we would infer above, for any value of $-B/A$, due to the offsetting changes in $B$.

As another indication of the role of taxes in entrepreneurial activity, we decompose the time-series variation in entrepreneurial activity in Figure 5. The solid line describes the forecasted aggregate pattern of entrepreneurial activity over time, using our base-case estimates. The dotted line describes the forecasted pattern, using the coefficient estimates from our base case had the tax law provided neutral incentives, so that $\tau_{1qt} = \tau_{2qt} = 0$. Here, the variation over time in our forecast arises solely from the time dummies. The difference between the two curves captures the forecasted effects of taxes.

One striking observation in Figure 5 is that a truly neutral tax structure is forecasted to generate *far* more entrepreneurial activity than arises under any of the tax reforms examined in Table 3a. Even a flat tax still leaves large tax distortions discouraging entrepreneurial activity. This occurs because entrepreneurs frequently have negative overall taxable income under the personal tax, due to large enough business losses. These losses face a 0% tax rate while smaller losses and profits face the 20% flat tax, implying that a flat tax still discourages risk taking.[77]

As is clear in Figure 5, our estimated time dummies imply that much of the time-series variation in rates of entrepreneurship is caused by other factors. To explore the role of some other factors, we regressed these time dummies (coming from our base case regression) against a list of macro controls.[78] Results are reported in Table 4. The first variable is a control for the average taxable profit rate among large firms in that year, taken from *Statistics of Income* figures for firms with over a million 1993 dollars of real assets. When large firms are more profitable, due to changes in the definition of taxable income as well as due to the business cycle, new entrants are less likely to have losses. Through simulating the impact on the forecasted self-employment rate, we find that if the profit rate for large firms goes up by .01, the forecasted fraction of individuals reporting self-employment losses goes down by 23% of its initial value. In addition, we find that the unemployment rate has a negative effect on the self-employment rate: a .01 increase in the unemployment rate leads to a 3.7% drop in the self-employment rate. Plausibly, individuals are more reluctant to enter into self-employment if getting back into a regular job in case of failure is difficult.[79] A higher real interest rate (the T-Bill rate minus the inflation rate in the CPI), also discourages self-employment: a .01 increase in the real rate lowers the

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[77] The payroll tax also distorts entrepreneurial decisions in complicated ways. Noncorporate profits are taxable under the payroll tax, but noncorporate losses are not tax deductible, discouraging risk-taking. However, corporate profits escape the payroll tax while wage and salary income does not.

[78] As before, we report robust standard errors.

[79] For similar evidence on the negative effect of the unemployment rate on self-employment activity, see Blanchflower (2000).

self-employment rate by 6.0%. While a higher real rate affects all firms, new entrants would normally have an unusually high investment rate, so that entry decisions would plausibly be more responsive to fluctuations in the cost of funds. Holding the real rate fixed, an increase in the inflation rate also discourages self-employment, perhaps because any loans must be repaid more quickly, imposing greater liquidity pressures on new firms: a .01 increase in the inflation rate is forecasted to reduce self-employment by 4.7%. As a result, we find that inflation not only creates large static distortions, as emphasized by Feldstein (1999), but it also discourages entrepreneurial activity. As seen in column 2, after controlling for taxes and these macroeconomic variables there is no remaining time trend in the self-employment rate.

In examining the residuals from this regression, to see if there might be any obvious remaining factors at work, the one obvious outlier was 1986, which is substantially larger in absolute value than any other residual. An easy explanation is that potential entrepreneurs in 1986 would base their entry decisions not on the existing law in 1986 but on the anticipated law enacted in 1986, but phased in during 1987-8. The new law provided much weaker incentives for entrepreneurship, leading us to overforecast self-employment rates simply focusing on the law in place in that year.

## 5. Conclusions

According to our results, "animal spirits" are not the only factor affecting rates of entrepreneurship. Taxes, and business cycle factors, matter as well. Contrary to conventional wisdom, we find that a cut in personal tax rates reduces entrepreneurial activity. Such a tax cut reduces the taxes saved from deducting business losses, while profits remain largely 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 self-employment 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.

Tax effects can be very large. For example, we forecast that a shift to a 20% flat tax would virtually triple the self-employment rate. Providing further sharing of losses with the government, through a negative income tax, is also forecast to have large effects on the self-employment rate.

Macroeconomic variables also clearly affect the rate of entrepreneurial activity. In particular, we find that rates of activity are lower the higher the unemployment rate, the real interest rate, and the inflation rate. Price stability therefore may be important for long-run growth as well as for static efficiency.

In sum, tax policy and macroeconomic policies seem to be key factors generating entrepreneurial activity. 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 result in faster economic growth rates. That poorer countries often have unstable macroeconomic policies and minimal personal income taxes, so minimal sharing of business losses with the government, is very much consistent with these forecasts. In future work, we hope to see if international data support such inferences about taxes and growth.

## APPENDIX A

*Forecasting Earnings Ability*

In order to avoid introducing endogeneity in our tax incentives and our measure of underlying earnings potential, we predict what the relevant components of income would be in the absence of self-employment for each taxpayer. The basic strategy is to use the sample of individuals who are not self-employed to establish the relationships between variables available in the tax data and reported earnings, taxable income, and adjusted gross income. We then use these estimated relationships to predict the income measures for individuals who are self-employed.

For the prediction to be valuable as a counterfactual, the variables used as predictors must be unaffected by an individual's decision to be actively engaged in a business. The instruments we chose were: an indicator for whether property tax deductions were reported, ln(property tax deductions if nonzero), an indicator for whether mortgage interest deductions were reported, ln(mortgage interest deductions if nonzero), an indicator for whether interest income is reported, ln(interest income if nonzero), an indicator for whether dividend income is reported, ln(dividend income if nonzero), an indicator for other dependents, ln(number of dependents if nonzero), a dummy variable for each filing status.

To check our presumption that these variables are unaffected by self-employment, we rely on the panel data set of individual tax returns available for 1979-1990. This exploratory analysis is based on the same sample of non-elderly taxpayers as that used in our cross-sectional analyses, except that we include joint filers as well as single filers in order to ensure adequate sample sizes. We track the level and existence of components of income before and after individuals enter active self-employment, using individuals who do not enter self-employment as a control group. Individuals are assigned to the control group if they remained not self-employed for three consecutive years, i.e. the absolute value of any noncorporate income was below ten percent of wage and salary income in each year. Individuals are assigned to the treatment group if they were not self-employed in the first year, but were self-employed in both subsequent years. In the middle of the three years, these individuals would have spent part of the year as an employee and part being self-employed. Therefore, we focus on changes between the first and the third year. The question is then whether the proposed instruments change differently over this two year period for those who choose to become self-employed, compared with those who instead remain employees.

The first two columns in Table A1 show the means for the two sub-samples when neither group is self-employed (year t-2).[80] There are some systematic initial differences between these two groups. Those who will enter self-employment in the following year (year t-1) report property tax deductions, interest income, and dividend income 43%, 65%, and 21% of the time, respectively. The same figures for those who will remain employees are 27%, 49.7%, and 12%. To account for these initial systematic differences, we weight observations in the control group to match the average observable characteristics of those

[80] These analyses are unweighted because only the cross-sectional weights are provided and these are no longer nationally representative given the over-sampling of higher income individuals.

who will become self-employed.[81] The third column in Table A1 shows the means for the weighted sample of employees, and the fourth column demonstrates that our treatment and weighted control groups are now very similar in the initial year.

The next two columns measure the changes in each of the proposed independent variables between the first and the third year in the two (weighted) subsamples, and the final column shows the difference in changes across the two groups. If the changes in the two subsamples are statistically indistinguishable, then the proposed independent variable would appear to be a valid instrument for underlying earnings ability, e.g. it is uncorrelated with omitted factors affecting the self-employment decision. In fact, other than the obvious and expected deviation in the path of wage and salary income, the only significant differences across the two groups are relative increases in the likelihood that those who enter self-employment report interest income and file jointly. While statistically significant, the increase in interest income reporting represents only a 5.7% change from the baseline rate, and should not introduce an important bias.

In Table A2, we repeat this analysis for transitions into self-employment with losses only, since this is our dependent variable of interest. For these transitions, the probabilities of reporting mortgage and property tax deductions, e.g. the probability of itemizing, changed differently over time for those who became self-employed, compared with those who did not. This probability dropped by about eight percentage points. Presumably, the drop in income when an individual first becomes self-employed means a drop in itemized deductions for state income and sales tax payments, leading some to shift instead to a standard deduction. Conditional on whether or not the individual itemizes, however, the size of the deductions remained statistically unaffected by the self-employment decision. Because this does not represent a particularly great change and itemization status provides valuable information about expected earnings, we decided to use the full list of proposed instruments. This might generate a slight systematic underestimate of the ability of the self-employed.[82]

We then apply this forecasting equation to our cross-sectional sample of non-joint tax-filers, forecasting *ln*(wage and salary earnings) using the above instruments for the set of individuals who appear to be full-time employees, e.g. no single component of business income exceeds 10% of wages in absolute value.[83] The estimation is done separately for each year for those in each of five groups: a) non-itemizers with no non-zero values for the continuous variables b) non-itemizers with either non-zero interest or dividend income c) itemizers with no non-zero values for the continuous variables d) itemizers with either non-zero interest or dividend income but no non-zero property or mortgage deductions e)

[81] We first run a probit to predict the likelihood individuals will enter self-employment given the proposed instruments, along with a dummy variable for having positive wages and ln(wages if positive). If the estimated probability of someone being self-employed is $P_i$, then the weight on each initial observation for someone who does not later become self-employed is $P_i/(1-P_i)$, while the weight is 1 on an observation where the individual does subsequently become self-employed.

[82] In particular, individuals become self-employed in part based on unobserved factors determining earnings ability. When some stop itemizing, their shift increases the average unobserved ability among both the self-employed who do not itemize and also among those that do still itemize. Using data from the not-self-employed, we therefore underestimate the average unobserved ability for both groups.

[83] All of our cross-sectional estimations incorporate the sample weights provided.

itemizers with non-zero property or mortgage deductions. This regression yields a forecast for wage and salary income ($\hat{w}_{it}$), based on the instrument set.[84] This forecast of expected earnings potential is used to assign all individuals to ability quantiles.

In order to calculate average tax incentives across ability quantiles that reflect the full distribution of possible earnings, we also need a forecast of earnings that preserves the observed degree of cross-sectional variation. For this, we assume that the residual is distributed normally, with the standard deviation as calculated for the individuals in each group. Each self-employed individual is then assigned a realization of earnings potential ($\hat{w}_{it}(1+\tilde{\eta}_{it})$) based on a random draw from the appropriate distribution. Observed wage and salary earnings are used for individuals who are not self-employed.

Also needed in calculating tax rates are parallel predictions for AGI and taxable income in the absence of self-employment.[85] We use the same set of independent variables and groupings to forecast each individual's $ln(AGI_{it})$:

$$ln(AGI_{it}) = X_{it}\gamma_t + \tilde{\psi}_{it},$$

where $\tilde{\psi}_{it}$ and the error from the regression of log wages are assumed to be joint normally distributed. Individuals are assigned a value for AGI based on the draw for the log wage residual and a draw from the conditional distribution of the log AGI residual. As before, we use observed AGI for individuals who are not self-employed.

Finally, to forecast taxable income, we rely on our assumption that the itemization status of the individual is unaffected by the self-employment decision. For those who do not itemize, we can calculate taxable income from AGI using the standard deduction and information about the number of exemptions. If individuals do itemize, then we estimate the ratio of taxable income to AGI as a function of the same basic set of instruments, with the continuous variables defined as shares of AGI, as well as a four-part spline in AGI divided by the maximum amount in each bracket. As before, these regressions were done separately on the five different groups, depending on what information was available. We again assume that the residual is normally distributed to assign self-employed individuals specific realizations.[86]

[84] We should note, however, that the sample of employed individuals used in the estimation is subject to a selection bias, since the self-employed are dropped from the sample. The fraction of the overall sample who become self-employed is very small, however, so that this bias should be trivial.

[85] Under the provisions imposing a maximum tax rate on earned income and providing an earned-income-tax credit, the formulae required information about AGI.

[86] If the resulting draw of the residual implied itemized deductions smaller than the standard deduction, then the standard deduction was used.

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