Abstract

The paper studies the effects of tax policy on entrepreneurship and venture capital activity. Entrepreneurs pursue a single high risk project each but have no own resources. Financiers provide equity finance. They must structure the entrepreneur's profit share and base salary to assure their incentives for full effort and committment to the project. The extent of risk-diversification is, thus, limited by the presence of moral hazard. The contract must also be sufficiently generous to attract entrepreneurs who might pursue alternative career options. In addition to providing equity finance, venture capitalists assist with valuable business advice to enhance survival rates. Within a general equilibrium framework with a traditional and an entrepreneurial sector, the paper investigates the effects of taxes on entrepreneurship and the equilibrium level of managerial advice. It considers differential wage and capital income taxes, a comprehensive income tax, incomplete loss offset, progressive income taxation as well as investment and output subsidies to the entrepreneurial sector.

JEL Codes: D82, G24, H24, H25

Keywords: Entrepreneurship, venture capital, moral hazard, taxes, subsidies.

Tax Policy, Venture Capital, and Entrepreneurship*

by

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February 2000

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*We are grateful to seminar participants at Universities of Helsinki and Saarbruecken, and in particular to Vesa Kanniainen, for useful comments.

1 Introduction

Financing early stage businesses involves special problems and is fundamentally different from financing investments by mature and well established companies. Because of lacking collateral and the absence of any past track record, and due to their informational advantages, pioneering entrepreneurs often face severe difficulties in convincing banks to finance projects with potentially high returns but high risks as well. Another problem that contains the roots of business failure, is the commercial inexperience of new entrepreneurs. They tend to be equipped with excellent technical science expertise but usually lack business experience and

managerial training. Venture capital has come to specialize in financing early stage investment. Venture capitalists not only supply equity finance but also provide valuable business advice to enhance survival chances of new start-ups. Viewing start-up investment as a key source of innovation, growth and employment, policy makers often emphasize the need to enhance entrepreneurship and venture capital finance.[1] While there is a considerable finance literature on venture capital, an analysis of the effects of public policy has largely been neglected, however. Much of the traditional literature on entrepreneurship, risk bearing and taxation excludes an active role of financiers.[2] A more recent literature turns to problems of adverse selection in investment finance but similarly ignores a productive contribution of financiers in providing managerial advice as is typical in venture capital finance.[3]

Many business failures result from avoidable management mistakes that originate in

[1] A recent OECD report on Austria, for example, includes a special feature on promoting entrepreneurship, see OECD (1999). Similar issues are also discussed in European Commission (1999).

[2] See, for example, Peck (1989), Kihlstrom and Laffont (1983), Mintz (1981), Kanbur (1980), among others, and Buchholz and Konrad (1999) for a recent overview.

[3] DeMeza and Webb (1987,1988), Innes (1991), Konrad and Richter (1995). Gordon (1998) discusses a range of tax instruments relating to entrepreneurial activity, including considerations of asymmetric information. Boadway et al. (1998) study how adverse selection in credit markets interacts with labor market distortions to affect entrepreneurship.

the managerial incompetence of entrepreneurs in the early stages of their career. An active role of venture capitalists in providing valuable business advice might be an important factor in raising survival chances of start-up businesses. However, assisting young companies with industry experience and managerial advice is not without costs, but draws on tight resources on the part of the financier. It thus seems interesting to ask which factors determine the incentives to provide advice. Could taxes and other government activity improve upon such incentives and, thereby, boost survival rates by improving the 'quality' of venture capital finance? This paper proposes a stylized general equilibrium model of entrepreneurship and venture capital, featuring two sectors: one sector in which an 'innovative' goods results from successful entrepreneurial activity; and another one which produces 'traditional goods'. The paper extends the existing literature on entrepreneurship and taxation in allowing for an active role of financiers and providing an equilibrium analysis of various tax policy initiatives.[4] The model conforms well with some important stylized facts of venture capital finance.[5] Financiers provide start-up finance in exchange for an equity share. The typical arrangement consists of a low base salary combined with profit participation. In financing a portfolio of companies, venture capital firms are able to diversify risk and could, in principle, fully insure the entrepreneur. Risk diversification, however, is limited by the extent of moral hazard in the relation between entrepreneur and financier. The equity contract must thus be structured to retain the entrepreneur's full committment and effort in the face of a moral hazard problem that results from entrepreneurial effort being non-observable and non-verifiable. While the entrepreneur's effort certainly is critical for the venture to have any positive survival chance at all, the financier also contributes with valuable business advice to further enhance survival rates.[6]

[4]Keuschnigg and Nielsen (1999) discuss similar issues within a partial equilibrium framework.

[5]Sahlmann (1990), Lerner (1995), Gompers (1995), Black and Gilson (1998), among others, discuss basic aspects of venture capital finance.

[6]In focussing on the advisory activity and tax incentives, the paper obviously neglects other important aspects of venture capital finance such as two sided moral hazard between entrepreneurs and venture capital firms [e.g. Repullo and Suarez (1998)], or stage financing and convertible debt [e.g. Cornelli and Yosha (1997)]. Venture capital firms are also intensively screening projects. The effects of taxes in such

Apart from solving the incentive problems with respect to entrepreneurial effort, the venture capital contract must be sufficiently attractive to secure the entrepreneur's participation in the presence of alternative career opportunities. Agents may either go for a safe worker's salary in the traditional sector or opt for an entrepreneurial career with potentially high rewards but high risk as well. The equilibrium solution with occupational choice splits the population into entrepreneurs, consultants and workers, and endogenously determines the quality of venture capital finance (i.e. the extent of managerial advice). We then investigate the effects of a broad range of tax instruments such as differential wage and capital income taxes, progressive income taxation, incomplete loss offsets, an investment subsidy and a subsidy to output from portfolio companies. The paper now proceeds with presenting the model in section 2. Section 3 discusses the effects of tax policy on the equilibrium level of managerial advice and venture capital backed start-up investment. Section 4 addresses the welfare implications of policy. Section 5 summarizes and discusses future research.

2 The Model

2.1 Definitions

Overview: The economy consists of two sectors, producing 'traditional' and 'innovative' goods, respectively. A deterministic Ricardian technology is available for production of the traditional good with one unit of labor yielding one unit of output. Choosing the standard good as a *numeraire*, its price and the wage rate are both equal to one. Innovative goods result from an entrepreneurial activity which is inherently risky and requires a fixed start-up investment on top of the entrepreneur's input. Each entrepreneur pursues exactly one venture that yields one unit of output with probability p and nothing with probability

a context are discussed in the above mentioned literature on investment with adverse selection, although the intensity of screening is usually not considered.

$1-p$. Projects will fail with certainty, however, if entrepreneurs choose not to devote full effort and attention to their venture.

Households are risk averse and choose to become workers or entrepreneurs. Since entrepreneurs pursue only one project, they face an undiversifiable income risk. If the venture fails, any initial investment is lost, and no income accrues. To allow for any entrepreneurial activity in face of this existential income risk, financial intermediation is required that offers at least partial insurance. Assuming project risks to be stochastically independent, financiers are able to partially insure entrepreneurs by financing a diversified portfolio of projects. By the law of large numbers, the aggregate economy is free of risk.

Risk, Effort and Advice: Survival probability p is assumed to depend on effort e which cannot be verified and contracted by an outside investor. A minimum amount $0 < \delta < 1$ of the entrepreneur's time input is freely observable. Only the rest of time $1-\delta$ is under discretion and is assumed not to be observable by outsiders. High effort means that, in addition to the basic activity δ, the entrepreneur also devotes $1-\delta$ of her time exclusively to the venture. Low effort or shirking means that it is directed to some lucrative outside activity. Only high effort $e = 1-\delta$ implies a positive survival chance $p > 0$, while low effort $e = 0$ results in business failure for sure, $p = 0$. We suppress the effort variable in the probability p, knowing that

it is positive only if the entrepreneur supplies high effort. In addition to the entrepreneur's effort, we also postulate a productive contribution of the venture capitalist (VC) consisting of some managerial services a:[7]

$$p = p(a), \qquad p' > 0 > p'', \qquad p(0) = p_0 > 0, \qquad \lim_{a\to\infty} p(a) < 1. \tag{1}$$

Taxation of Portfolio Company: A corporate income tax (CIT) at rate τ and an output subsidy of σ to innovative goods give an expected net income of the portfolio

[7]We use p' as a short-hand for dp/da.

company equal to

$$(1-\tau)\left(pQ(1+\sigma)-b\right)-(1-z)\,K,$$

where Q is the consumer price of innovative goods. Profits are reduced by the entrepreneur's base salary b. Setting up a business also requires a fixed start-up investment K, part of which is subsidized with an investment tax credit at rate z. Investment demand is for traditional goods. In case of business failure, the company runs up a loss equal to the base salary and the start-up investment cost net of taxes. At this stage, we assume that VCs can offset any losses against income from successful projects.

Taxation of Venture Capitalist: To get the firm started, the VC must inject equity in the amount of $I=(1-\tau)\,b+(1-z)\,K$, which is in exchange for a share $1-s$ of the company's cash flow. The VC earns gross revenues $(1-s)\,Q\,(1+\sigma)$ and pays CIT on her own expected operating profits equal to $\tau\left[(1-s)\,(1+\sigma)\,pQ-a\right]$ where equity purchases equal to I are not deductible. VC firms must hire a 'consultants' per project to supply business advice. Note that the VC calculates with expected profits because she is assumed to hold a diversified portfolio of start-up companies that eliminates all income risk on her part. For each project, her expected, net of tax profits are

$$\Pi=(1-\tau)\left[(1-s)\,pQ\,(1+\sigma)-b-a\right]-(1-z)\,K. \tag{2}$$

The entrepreneur's income directly subtracts from the amount of income that may possibly be claimed by the VC. The expected cost of entrepreneurial compensation to the VC is

$$c=(1-\tau)\left[spQ\,(1+\sigma)+b\right]. \tag{3}$$

It will prove useful to write expected, net profits of the VC firm as

$$\Pi=(1-\tau)\left[pQ\,(1+\sigma)-a\right]-(1-z)\,K-c. \tag{4}$$

Taxation of Entrepreneur: Apart from a base salary b, the entrepreneur receives income from her equity share s in the company. Suppose, for simplicity, that the CIT

rate τ is equal to the personal tax rate on capital income whence there is no further tax burden at the individual level. The entrepreneur's base salary, however, is subject to a wage tax at rate t whence expected entrepreneurial income net of taxes amounts to

$$c^N = s\,(1-\tau)\,pQ\,(1+\sigma) + (1-t)\,b. \tag{5}$$

Demand: Commodity demand derives from utility maximization subject to a budget constraint, $(C_i + QD_i)\,(1+v) \leq Y_i$, where C_i and D_i denote consumption of traditional and innovative goods, respectively, and v is the rate of a uniform consumption tax. Being endowed with preferences $u = \ln\left(u_0 \cdot C^{\alpha} D^{1-\alpha}\right)$, where $u_0 = \alpha^{-\alpha}\,(1-\alpha)^{-(1-\alpha)}$ for convenience, agents with income Y_i choose

$$(1+v)\,C_i = \alpha Y_i, \quad (1+v)\,QD_i = (1-\alpha)\,Y_i, \quad V_i = \ln Y_i - \ln(1+v) - (1-\alpha)\ln Q. \tag{6}$$

Indirect utility V_i is concave in disposable income Y_i. The logarithmic specification of utility implies constant relative risk aversion equal to unity.

Labor Allocation: Given our technological assumptions, and with L denoting the number of workers in the traditional sector and E the number of entrepreneurs, the supply of traditional goods is L and that of innovative goods $S = pE$. Apart from the entrepreneurial input, production of the innovative good is enhanced by managerial advice which requires aE consultants in total. The production possibilities are thus traced out by an allocation of labor satisfying the resource constraint. Given a population of mass one, labor market clearing requires

$$1 = L + (1+a)\,E. \tag{7}$$

Income: All agents potentially receive profits Π_i from ownership of VC firms which will be zero, however, in equilibrium with free entry. Apart from this, individual disposable income depends on the agent's occupation. A worker obtains a safe salary equal to the

wage rate net of the wage tax t, i.e. $Y_i = 1 - t + \Pi_i$.[8] The entrepreneur's income is risky and equal to $c^N + \Pi_i$ in expected value. Given symmetry within each occupational group, aggregate disposable income is[9]

$$Y = \int_0^1 Y_i di = c^N E + (1-t)(L + aE) + \Pi E. \tag{8}$$

The aggregate budget constraint reads $(C + QD)(1 + v) = Y$.

Public Sector: The government collects taxes and hands out subsidies. Any net revenue is rebated as a consumption subsidy. It will become apparent that a proportional consumption subsidy or tax with a uniform rate is neutral and, thus, allows us to isolate the allocative effects of taxes.[10] The government budget constraint is

$$\tau\left(pQ(1+\sigma) - b - a\right)E + t\left(L + (b+a)E\right) + v\left(C + QD\right) = \sigma QpE + zKE. \tag{9}$$

Apart from the salaries of L workers, both the base salary b of each entrepreneur and the wage income of aE consultants are liable to the wage tax at rate t. While tax revenue from each project is risky, the government's revenue is deterministic since the law of large numbers consolidates stochastically independent risks.

Market Clearing: Commodity market clearing requires

$$C + KE = L, \qquad D = pE. \tag{10}$$

Using (2), (5), (9), and (10), disposable income in (8) is also written as

$$Y = (1+v)(QpE + L - KE). \tag{11}$$

To verify Walras' Law, substitute the budget constraint $(C + QD)(1 + v) = Y$ into (11) and get $(C + KE - L) + Q(D - pE) = 0$. The sum of valued excess demands is zero.

[8] Recall that, the wage rate is unity by choice of the *numeraire*.

[9] Profits from VC firms are $\int_0^1 \Pi_i di = \Pi E$ but will be zero in equilibrium with free entry.

[10] Lump-sum per capita transfers, in contrast, are *not* neutral because they affect the incentive compatible provisions of the equity contract. They are introduced in a separate subsection.

2.2 Venture Capital Activity

2.2.1 Incentive Contract

The following sequence of events determines individual decision making. Occupational choice comes first, before project risk is resolved. Workers receive a safe wage, set their consumption levels and derive utility as in (6). If agents opt for an entrepreneurial career, they approach a venture capitalist to fund their project. An equity share and base salary is negotiated, and the VC promises to support the venture with a verifyable level of advice. Given the contractional arrangement, the entrepreneur chooses effort and the VC supplies managerial advice. Next, risk is resolved and state-dependent income determined. Knowing income, consumption and welfare of entrepreneurs is given as in (6).

The remuneration of entrepreneurs must provide sufficient incentives for her participation and effort. As is common practice, the VC buys an equity stake $1-s$ at a cost I that covers both the entrepreneur's base salary b and the fixed start-up investment K. The remuneration package is optimally specified in a venture capital contract. To maximize profits in (4), the VC chooses s and b as well as a level of advice a. Her maximization problem is conveniently decomposed into two stages. For any given level of advice, she first minimizes the cost c of obtaining the entrepreneur's participation. Knowing how contract cost depends on advice, she then chooses a to maximize profits. The second stage of profit maximization is taken up in the next subsection.

In contracting with the entrepreneur (agent), the VC (principal) structures the terms of the contract to solve the incentive problems arising from asymmetric information. Given the entrepreneur's other job opportunities, the contract must be generous enough to secure her participation. For this reason, the contract cost in part reflects the foregone alternative income such as a worker's safe salary equal to net wages,[11] $Y_i = 1 - t$. To retain survival chances of start-ups, remuneration of entrepreneurs must also provide sufficient incentives for high effort. However, the contract cannot be made contingent on

[11]From now on, we impose the zero profit condition $\Pi_i = 0$ that results from free entry of VCs.

non-verifiable effort but only on freely observable outcome. If effort is high, the VC thus concedes a gross income to the entrepreneur equal to $sQ(1+\sigma)+b$ if the venture succeeds but only b if it fails, where b is a safe, but moderate base salary. If the entrepreneur shirks, the business always fails. In this case the entrepreneur is left with the base salary b only, but may reap some outside income $1-\delta$ from shirking, giving $b+1-\delta$ in total. With taxes, the net income arriving at the entrepreneur is lower and may differ from the net cost to the VC. A proportional wage tax at rate t is subtracted from all sources of wage income while the CIT subtracts from profit income. Defining

$$\theta \equiv s\,(1-\tau)\,Q(1+\sigma), \qquad \beta \equiv (1-t)\,b, \tag{12}$$

the entrepreneur receives an expected income of $c^N = p\theta + \beta$ net of CIT and personal wage taxes if effort is high. The expected net cost to the VC is $c = p\theta + (1-\tau)\,b$ and may differ from c^N because of taxes. Since the base salary is deductible from the CIT, the effective cost to the VC is $(1-\tau)\,b$ while the entrepreneur receives $(1-t)\,b$ net of wage taxes. With logarithmic utility as in (6), the problem of the VC is now to obtain the venture at minimum cost,[12]

$$\begin{aligned} c = \quad & \min_{\theta,b} \quad p\theta + (1-\tau)\,b \qquad s.t. \\ & PC: \quad p\ln(\theta+\beta) + (1-p)\ln(\beta) \geq \ln(1-t)\,, \\ & IC: \quad p\ln(\theta+\beta) + (1-p)\ln(\beta) \geq \ln(\beta + (1-\delta)\,(1-t))\,. \end{aligned} \tag{13}$$

The contract must specify profit participation and base salary such that both the participation (PC) and incentive compatibility (IC) constraints are satisfied. The PC compares expected utility derived from entrepreneurship with utility from a safe worker's salary. The IC is fulfilled if expected utility from supplying high effort is higher than utility from shirking. Given that the VC cannot observe shirking, the base salary must be paid in all cases. Income from shirking thus consists of the base salary plus any outside income that the entrepreneur would derive from working $1-\delta$ of her time somewhere else.

[12] Given indirect utility as in (6), the constraints should take into account the logarithm of the consumer price index, $-\ln(1+v) - (1-\alpha)\ln Q$. These terms, however, cancel out on each side. The consumption tax – and indeed the CPI – are neutral with respect to the contract! Only net income flows matter.

As a benchmark, we first consider the full information case. When the principal is costlessly observing effort, the contract may be conditioned on effort without any incentive problems. Since the principal holds a fully diversified portfolio of companies while the risk-averse agent pursues a single project only, it is efficient to provide insurance. The PC requires $\theta = (1-t)\, b\left(b^{-1/p} - 1\right)$. Minimizing cost then gives an optimality condition $1 - \tau = (1-t)\left[p + (1-p)\, b^{-1/p}\right]$. The VC's marginal cost of raising the base salary is $1-\tau$ while the other side gives the savings from reducing the entrepreneur's profit participation in return. Only if tax rates are equal do we have full insurance with a base salary equal to gross wage rate ($b = 1$) and a zero profit share ($\theta = 0$). However, if tax rates differ, entrepreneurs and VCs no longer agree on the value of safe income. If the wage tax rate exceeds the CIT rate, the VC will shift some risk to the entrepreneur even in the absence of incentive problems because the VC's effective cost of providing a safe salary exceeds the amount that the entrepreneur obtains net of taxes. Put differently, the entrepreneur prefers low taxed profit income over high taxed wage income and will accept some risk in exchange for the tax advantage. In Figure 1, the slopes of the PC and the cost line differ at the full insurance point.

With asymmetric information, both constraints are binding whence we obtain the solution by computing the intersection of them. Figure 1 illustrates. Moving away from full insurance along the PC, the reduction of the base salary must be compensated by ever higher profit shares such that expected income exceeds the safe alternative by a premium to reward for risk bearing. If $\tau = t$, we have $c = c^N$, and expected income c^N from the equity contract exceeds the net wage of a worker by the risk premium. For an analytical solution, substitute the definition of β and get $\ln(1-t) = \ln\left[\beta + (1-\delta)(1-t)\right]$ or $b = \delta$. The PC then gives $1 - t = (\theta + \beta)^p \beta^{1-p}$, or

$$\theta = \beta\left(\delta^{-1/p} - 1\right), \qquad b = \delta, \qquad \frac{d\theta}{dt} = -\frac{\theta}{1-t} < 0, \qquad \frac{d\theta}{d\tau} = \frac{d\theta}{d\sigma} = 0. \tag{14}$$

We note some immediate implication for tax incidence. The base salary just compensates for the opportunity cost in terms of foregone wages of the entrepreneur's basic time input δ and is exogenous. For a given survival rate p, the entrepreneur's profit income θ depends

only on the base salary net of the wage tax. Since $\theta = s\,(1-\tau)\,Q(1+\sigma)$, the CIT is thus fully shifted to the VC while the entrepreneur is compensated by an increase in the profit share to obtain the same overall income in case of success. Similarly, the output subsidy σ fully accrues to the VC while entrepreneur is able to capture not even a part of it. In contrast, a higher wage tax reduces the alternative income and allows the VC, ceteris paribus, to cut the entrepreneur's profit share and still retain her participation and high effort. The burden of the wage tax lies as much with entrepreneurs as with workers. In equilibrium, however, the survival rate is endogenously determined which will then affect this pattern of tax shifting.

The overall contract cost that the VC must incur to attract the entrepreneur determines her residual expected income and willingness to invest. It depends on taxes. In raising survival chances $p\,(a)$ through more intensive managerial advice, the VC herself may control the cost. The appendix proves the following properties:

Proposition 1 (Cost of Contract) *The cost* $c\,(p;\tau,t) = p\theta + (1-\tau)\,b$ *of incentive compatible compensation of the entrepreneur satisfies*

$$c' \equiv \frac{dc}{dp} < 0, \quad c'' \equiv \frac{d^2c}{dp^2} > 0; \qquad \frac{dc}{dt} = -\frac{p\theta}{1-t} < 0, \quad \frac{dc}{d\tau} = -b < 0.$$

There are two offsetting influences of p on cost. On the one hand, a higher survival rate raises cost since the high income must be paid with higher probability. On the other hand, when project risk declines, the principal is able to ensure participation of the entrepreneur with a smaller risk premium. The VC is therefore able to squeeze the entrepreneur's profit share in the successful state, $\frac{\partial\theta}{\partial p} < 0$. The second effect dominates and marginal cost falls. Furthermore, the cost function is unambiguously convex in the survival rate. The wage tax allows to cut the entrepreneur's profit share and, thereby, reduces the VC's contract cost since it makes the alternative career option less attractive. The CIT also squeezes cost. Since the base salary is tax deductible in the portfolio company, the government effectively pays for part of it. Note finally that contract cost is completely independent of

the output subsidy σ to innovative goods. The subsidy boosts the company's cash flow in case of success but the VC simply cuts the profit share and appropriates all of it.

2.2.2 Managerial Advice

Only successfully launched businesses eventually contribute to the VC's revenues. According to (1), however, VCs may themselves contribute to higher survival chances of their portfolio companies and strengthen their revenues by giving valuable business advice. In raising the survival rate, more advice also allows to squeeze the entrepreneur's risk premium over safe wage income by making entrepreneurial income more certain whence the venture may be obtained at a lower contract cost. Advice, however, is costly and results in operating costs gross of taxes equal to a per project. The profit maximizing level of advice is most easily analyzed by rewriting (4) as

$$\Pi = \max_{a} \; p\left[(1-\tau)\,Q(1+\sigma) - m\right], \qquad m \equiv \frac{c\,(p;t,\tau) + (1-\tau)\,a + (1-z)\,K}{p}. \tag{15}$$

We refer to m as cost to market which is the expected cost incurred in order to produce one unit of the innovative good. On average, one must start $1/p$ projects to accomplish this. Apart from savings in contract cost, an increase in the survival rate now reduces cost to market because a smaller number of projects need to be started for each successful one. The necessary and sufficient conditions for the VC's advisory activity are, thus,[13]

$$\begin{aligned} \Pi' &= p'\left\{(1-\tau)\,Q(1+\sigma) - m\right\} - pm' \\ &= p'\left[(1-\tau)\,Q(1+\sigma) - c'\right] - (1-\tau) = 0, \\ \Pi'' &= p''\left\{(1-\tau)\,Q(1+\sigma) - m\right\} - 2p'm' - pm'' \\ &= p''\left[(1-\tau)\,Q(1+\sigma) - c'\right] - p'p'c'' < 0. \end{aligned} \tag{16}$$

The second order condition is fullfilled by the curvature properties of $p\,(a,g)$ and $c(p,t,\tau)$.

[13] p' and Π' denote derivatives with respect to a, while c' denotes the derivative w.r.t. p.

2.3 Equilibrium

Zero Profits and Managerial Advice: As long as they make additional profits, VCs attract ever more entrepreneurs E and generate more business start-ups. In equilibrium, the price of innovative goods must satisfy the zero profit condition relating to (15),

$$(1-\tau)\,Q\,(1+\sigma) = m. \tag{17}$$

With free entry and zero profits, the cost m of bringing a venture to the market must be equal to the market price Q, net of the CIT and the output subsidy. If cost to market is determined, zero profits fix a price $(1-\tau)\,Q(1+\sigma)$. The intensity of managerial advice and the equilibrium market price are, thus, solved recursively. To see this, we impose the zero profit condition (17) on the individual optimality condition of the VC in (16),

$$\Pi' = -pm' = p'\,(m-c') - (1-\tau) = 0, \tag{18}$$

where c depends on a only via its effect on p. With government policy given, this equation autonomously fixes the level of managerial advice. In equilibrium, the VC's marginal benefit of supplying more advice is $p'\,(m-c')$. More advice boosts survival rates which directly reduces cost to market, and does so indirectly as well, since a lower risk allows to cut the profit share of the entrepreneur. In providing more advice, the VC incurs a marginal cost equal to $(1-\tau)$. Given the level of advice, p, c, m and the output price Q are fixed for any given set of government parameters.

Number of Entrepreneurs: We impose labor market clearing and budget constraints and solve for the number of entrepreneurs that equilibrate the market for innovative goods. Walras' Law then implies market clearing for standard goods as well. Given neutrality of the consumption tax, equilibrium will be independent of its rate. We start with the observation in (6) that agents spend a fixed share of disposable income $(1+v)\,(C+QD) = Y$ on innovative goods. Spending on innovative goods is $QD = \frac{(1-\alpha)Y}{1+v} = (1-\alpha)\,Y^G$ where

$Y^G \equiv C + QD = Y - v(C + QD)$ denotes gross factor income.[14] Before we equate demand and supply, we compute gross income by replacing the consumption subsidy from the government budget in (9). Using (8), (7), (5) and (12), disposable income is $Y = [p\theta + (1-t)b]E + (1-t)(1-E)$ where the zero profit condition, by way of (15) and (13), implies $p\theta E = [(1-\tau)(pQ(1+\sigma) - a - b) - (1-z)K]E$. Taking vY^G from (9) and replacing L from (7), gross income emerges as

$$Y^G = Y - vY^G = 1 + pQE - (1 + a + K)E.$$

Equate supply and demand in the entrepreneurial sector, $pE = (1-\alpha)Y^G/Q$. Note in particular that in zero profit equilibrium, managerial advice, survival probability, contract cost c and cost to market m are all autonomously determined in (18) independently from the rest of the model. Figure 2 illustrates the solution for the untaxed equilibrium with the number of entrepreneurs being the equilibrating variable. In this case, gross income is $Y^G = 1 + (c-1)E$. A part $(1-\alpha)/Q$ of demand is autonomous but it increases with E for the simple reason that average income of entrepreneurs exceeds wages by a risk premium $c - 1$. The slope of the demand schedule falls short to an extent that the equilibrium number of entrepreneurs given by the intersection is smaller than unity. By the zero profit condition (17), the equilibrium number of entrepreneurs is $E = \frac{1-\alpha}{1-\alpha+a+K+\alpha c} < 1$. By the same steps, entrepreneurship in the taxed equilibrium is given by

$$1 - \alpha = E \cdot \Omega, \qquad \Omega \equiv (1-\alpha)(1 + a + K) + \frac{\alpha p m}{(1-\tau)(1+\sigma)}. \tag{19}$$

3 Entrepreneurship

3.1 Managerial Advice

VCs not only provide equity finance but also supply valuable business advice. Do taxes impair incentives to provide managerial advice? Condition (18) implicitly determines the

[14] To rebate tax revenues, the government gives a consumption subsidy, i.e. $v < 0$. A consumption tax is charged only when an output or investment subsidy must be financed.

extent of consulting when market entry is free and competition eliminates profits in VC finance. Taking the differential thereof shows how policy induces VCs to adjust advice in equilibrium. Using the partials listed in (B.2) yields

$$\Pi'' da = \frac{\mu\theta p'}{1-t} dt - \left[1 - \frac{(a+b)\,p'}{p}\right] d\tau + \frac{Kp'}{p} dz,$$

where the elasticity μ is defined in (A.2). Henceforth, we use r to denote a comprehensive income tax, i.e. $r = t = \tau = z$. With signs determined in (B.2), the equilibrium effects of taxation on incentives to give advice are summarized as

$$\frac{da}{dt} < 0, \qquad \frac{da}{d\tau} > 0, \qquad \frac{da}{dz} < 0, \qquad \frac{da}{dr} = 0. \tag{20}$$

A higher wage tax discourages managerial advice in industry equilibrium and thereby squeezes survival chances of start-up companies. A higher investment tax credit works in the same direction. The CIT, however, seemingly holds ambiguous incentives for managerial advice. As indicated by (15) and (18), the marginal benefit $p'(m - c')$ of giving more advice is a higher survival rate which saves costs, since fewer projects need to be started for each successful one. On the one hand, a higher CIT reduces the marginal benefit of business advice by $p' \frac{\partial m}{\partial \tau} = -(a+b)\,p'/p$. When start-up cost becomes smaller due to the implicit tax subsidy associated with a higher CIT rate, then less is saved by raising the survival rate and the marginal benefit of advice declines accordingly. On the other hand, since advisory costs are tax deductible, a higher CIT rate reduces the marginal cost of advice by $-d\tau$ and thereby encourages managerial support. The net effect is positive.[15] A comprehensive income tax avoids interfering with VCs' incentives to provide managerial advice since it affects marginal benefits and costs proportionally.

3.2 Cost to Market

The level of entrepreneurial activity is easily derived if we recognize that the condition in (18) is equivalent to $m' = 0$ which is also the condition for minimum cost to market

[15] Since $x \equiv 1 - (a+b)\,p'/p > 0$ as shown in (B.2) of the appendix, the effect of the CIT is positive, $\frac{da}{d\tau} = -x/\Pi'' > 0$, since $\Pi'' < 0$.

$m = \min_a \frac{c(p,t,\tau)+(1-\tau)a+(1-z)K}{p}$. Profit maximization combined with free entry is, thus, equivalent to cost minimization and yields the same level of advice.[16] Applying the envelope theorem to the cost minimization problem and using also proposition 1 gives

$$\frac{dm}{dt} = \frac{-\theta}{1-t} < 0, \qquad \frac{dm}{d\tau} = -\frac{a+b}{p} < 0, \qquad \frac{dm}{dz} = \frac{-K}{p} < 0, \qquad \frac{dm}{d\sigma} = 0. \tag{21}$$

Wage taxation allows to cut entrepreneurial compensation since alternative wage income after taxes falls. Wage taxes thus reduce cost to market and boost profits of VC firms. They start to attract more entrepreneurs and will bring more start-up companies to market. The market price falls until, in equilibrium, profits are sqeezed to zero again and no more projects are funded. Because the base salary and advisory costs are tax deductible, the CIT effectively subsidizes these expenditures and reduces cost to market as well. A subsidy z to start-up investment cost similarly reduces cost to market. An output subsidy to the start-up firm is unable to affect cost to market and, thereby, the zero profit producer price. It is completely passed on to consumers by reducing their demand price Q.

3.3 Entrepreneurship

With an endogenous survival rate, the number of entrepreneurs E willing to start up new projects is no longer proportional to and must be distinguished from the number of successful projects pE. How then is tax policy affecting entrepreneurship and supply in the innovative sector? The quality of VC finance, i.e. the intensity of consulting and its effect on survival chances, further encourages agents to opt for an entrepreneurial career. Are the tax incentives for managerial advice in line with the more direct tax effects on occupational choice?

To build intuition, consider first the market for innovative goods in the untaxed equilibrium which is $p(a)E = E(1-\alpha)[1+(c-1)]/m$ by the zero profit condition $Q = m$.

[16] Imposing zero profits on (16), the necessary and sufficient conditions of the two problems are related according to $\Pi' = -pm' = 0$ and $\Pi'' = -pm'' < 0$ whence the cost function m is indeed convex.

In holding a constant, we identify some direct effect of taxes on the demand side. For a given number of entrepreneurs, taxes contribute to aggregate income and boost demand if they raise the risk premium, i.e. the income differential, of entrepreneurs. This income effect is enhanced by a price effect if taxes reduce cost to market and thus allow for a lower demand price. To eliminate excess demand, the number of entrepreneurs must increase. The indirect effect of taxes works through incentives for managerial advice. More intensive advice boosts survival chances and add to aggregate supply when a larger fraction of start-up projects is successful. In reducing risk, more advice squeezes the income premium of entrepreneurs and erodes demand. Note also that a marginal increase in advice fails to affect the output price since $m' = 0$. If taxes encourage more intensive advice, they contribute to excess supply of innovative goods. The number of entrepreneurs must decline to restore equilibrium. With these transmission channels in mind, we now consider how various taxes affect entrepreneurship and industry supply.

Wage Tax: In the general case, we start from a taxed equilibrium. Take the differential of (19) and use the f.o.c. $m' = 0$. Defining $\Phi \equiv 1 - \alpha + \frac{\alpha m p'}{(1-\tau)(1+\sigma)} > 0$, we have

$$\frac{dE}{dt} = \frac{-E^2}{1-\alpha}\frac{d\Omega}{dt} = \frac{E^2}{1-\alpha}\left\{\frac{\alpha p \theta}{(1-\tau)(1+\sigma)(1-t)} - \Phi\frac{\partial a}{\partial t}\right\} > 0. \tag{22}$$

As a direct effect, the wage tax reduces cost to market and thereby strengthens demand by means of a lower output price. On the other hand, lower net wages render the entrepreneur's alternative career option less attractive. The VC is thus able to save on entrepreneurial compensation which reduces demand. The price effect is seen to dominate, and VCs will fund more projects and attract more entrepreneurs to restore equilibrium. The second term in the curly bracket is an indirect effect of the wage tax that stems from the diminished incentives for managerial advice, see (20). Less intensive advice contributes to excess demand and further stimulates entrepreneurship.

A higher wage tax entices more start-ups but each one receives less intensive advice from VCs and is, thus, less likely to succeed. What is then the net effect on pE, the

supply of innovative goods? Using (22) and introducing $\Psi = 1 - \alpha - pE\Phi/p'$, we obtain

$$\frac{d(pE)}{dt} = \frac{\alpha\theta\,(pE)^2}{(1-\alpha)\,(1-\tau)\,(1+\sigma)\,(1-t)} + \frac{p'E\Psi}{1-\alpha}\frac{\partial a}{\partial t} > 0, \quad \Psi < 0. \tag{23}$$

To sign Ψ, we write $\Psi = 1-\alpha-\frac{pE(1-\alpha)}{p'}-\alpha pEQ$, where $Q = \frac{m}{(1-\tau)(1+\sigma)}$ by (17). Replace p' in the 2nd term by (18) and rearrange, $\Psi = 1-\alpha-pEQ-pE\,(1-\alpha)\left(\sigma Q - \frac{c'}{1-\tau}\right)$. Equation (19) helps in signing Ψ. Expand Ω such that $\Omega = pQ-(1-\alpha)\,[pQ-(1+a+K)]$. Then, (19) implies $1-\alpha < EpQ \Leftrightarrow [pQ-(1+a+K)] > 0$. The condition holds in the untaxed equilibrium where $pQ = pm = c+a+K$. In this case, $[pQ-(1+a+K)] = c-1 > 0$ is equal to the risk premium. By continuity, the condition will be satisfied as long as tax rates are not too large. With a comprehensive income tax and a zero output subsidy, i.e. $t = \tau = z > 0$ and $\sigma = 0$, the condition is again related to the entrepreneur's risk premium, $[pQ-(1+a+K)] = \frac{c}{1-t} - 1 = \frac{c^N-(1-t)}{1-t} > 0$, and is therefore satisfied even for large taxes. With the inequality $1-\alpha < EpQ$ thus established, the first two terms in Ψ are negative, and the third term is negative in any case. With $\Psi < 0$, the wage tax is seen to boost output of innovative goods. The fact that the wage tax discourages consulting, reinforces the direct effects on entrepreneurship and aggregate supply.

Capital Income Tax: Similar calculations reveal the effects on entrepreneurship and supply of innovative goods that are induced by the CIT and the investment subsidy, respectively:

$$\begin{array}{ll} \frac{\partial E}{\partial z} = \frac{E^2}{1-\alpha}\left\{\frac{\alpha K}{(1-\tau)(1+\sigma)} - \Phi\frac{\partial a}{\partial z}\right\} > 0, & \frac{\partial (pE)}{\partial z} = \frac{pE^2\alpha K}{(1-\alpha)(1-\tau)(1+\sigma)} + \frac{p'E\Psi}{1-\alpha}\frac{\partial a}{\partial z} > 0, \\ \frac{\partial E}{\partial \tau} = \frac{-E^2}{1-\alpha}\left\{\frac{\alpha[p\theta+(1-z)K]}{(1-\tau)^2(1+\sigma)} + \Phi\frac{\partial a}{\partial \tau}\right\} < 0, & \frac{\partial (pE)}{\partial \tau} = \frac{-pE^2\alpha[p\theta+(1-z)K]}{(1-\alpha)(1-\tau)^2(1+\sigma)} + \frac{p'E\Psi}{1-\alpha}\frac{\partial a}{\partial \tau} < 0. \end{array} \tag{24}$$

While an increase in the investment subsidy leads to a rise in both the number of entrepreneurs and the number of successful projects. The investment subsidy lowers the cost to market of innovative goods which expands supply and attracts additional entrepreneurs. By discouraging VC advice, the investment subsidy reinforces both the number of start-ups and aggregate supply and thereby expands the entrepreneurial sector. The CIT has opposite effects. The CIT likewise lowers the cost to market, but since it

hits revenues even more forcefully, the relative market price of innovative goods is higher, which reduces output and the demand for entrepreneurs.

Comprehensive Income Tax: A comprehensive income tax features common rates for the wage tax t, the CIT τ, and the investment subsidy z. A comprehensive income tax was shown to be neutral with respect to the level of managerial advice. It turns out that this broad based tax with full loss offset neither affects entrepreneurship nor the supply of innovative goods. In (19), the direct effect of the tax would enter through $m/(1-r)$ but the tax factor cancels out since all terms in m including θ as given in (14) are proportional to $(1-r)$. Consequently,

$$\frac{\partial E}{\partial r} = \frac{\partial (pE)}{\partial r} = 0. \tag{25}$$

Output Subsidy: In zero profit equilibrium with free entry of VCs, an output subsidy σ also avoids to distort incentives for advice. It affects neither survival chances nor cost to market. In subsidizing consumer prices, however, the subsidy boosts demand for innovative goods and, thereby, encourages entrepreneurship and aggregate supply,

$$\frac{\partial E}{\partial \sigma} = \frac{\alpha E Y^G}{1+\sigma} > 0, \qquad \frac{\partial (pE)}{\partial \sigma} = \frac{p\alpha E Y^G}{1+\sigma} > 0, \tag{26}$$

where we used $\frac{m}{(1-\tau)(1+\sigma)} = Q$ and $QpE = (1-\alpha) Y^G$.

Proposition 2 (Entrepreneurship) *A wage tax, an investment subsidy, or an output subsidy on innovative goods all raise the number of entrepreneurs and the supply of innovative goods. The CIT works in the opposite direction. A comprehensive income tax with full loss offset is neutral with respect to advice, entrepreneurship and aggregate supply.*

4 Welfare

Tax policy affects the incentives of VCs to advise entrepreneurs and thereby influences the survival rates of start-up businesses. It also affects the propensity of households to opt

for an entrepreneurial career. What are the normative implications of tax policy from a welfare theoretic point of view? So far, the model economy seems to be devoid of any obvious market failures that would justify government intervention. The main complication compared to a standard competitive economy is the presence of asymmetric information in the relation between entrepreneurs and financiers. Financiers can only imperfectly observe the level of effort that entrepreneurs put into innovative activity. To avoid moral hazard and to retain survival chances of start-up ventures, the equity contract must be arranged to provide entrepreneurs with powerful incentives for full effort. For this reason, entrepreneurs must bear risk via profit participation even though full risk diversification would be possible in principle. In the presence of unconsolidated risk, taxation could provide further insurance. It is expected, however, that further diversification is counterproductive since it conflicts with private arrangements to contain moral hazard. We now proceed with an explicit welfare analysis to check this conjecture.

The Welfare Measure: To investigate the welfare consequences of tax policy, we analyze (ex ante) welfare of agents prior to occupational choice.[17] Suppressing other arguments that are identical across occupations, welfare varies with income Y_i of an agent, $V_i = V(Y_i)$, where V_i is indirect utility as given in (6). In equilibrium, expected utility from entrepreneurship is exactly matched by utility from a safe job in industry. The participation constraint holds with equality. Therefore, utility $V(1-t)$ of a worker which depends on after-tax wage income $1-t$, is a complete welfare measure.[18] The marginal welfare effect is

$$dV = -\frac{dt}{1-t} - \frac{dv}{1+v} - (1-\alpha)\frac{dQ}{Q}. \tag{27}$$

[17] Boadway et al. (1991) provide a welfare analysis in several models of occupational choice.

[18] This ex ante welfare measure also corresponds to a social welfare function which adds up the ex post utility levels of different types of individuals. The population splits into $1-E$ workers and E entrepreneurs of whom pE are successful and $(1-p)E$ fail. Given net income levels $Y_i \in \{1-t, \theta+\beta, \beta\}$, $\beta = (1-t)b$, social welfare amounts to $SWF = (1-E)\cdot V(1-t) + pE\cdot V(\theta+\beta) + (1-p)E\cdot V(\beta)$. Since the VC contract fullfills the participation constraint with equality, $pV(\theta+\beta) + (1-p)V(\beta) = V(1-t)$, social welfare is again given by $V(1-t)$ as in (6).

Welfare depends on the real wage net of taxes. Tax policy thus affects welfare via three channels: (i) the after-tax wage; (ii) the consumption tax; and (iii) the producer price of innovative goods. The wage tax determines (i) while (ii) and (iii) reflect the price index.[19] As indicated in (21), tax policy affects the cost to market m and, thereby, the producer price $Q = m/[(1-\tau)(1+\sigma)]$ which obtains under perfect competition and free entry of VCs. In particular, the welfare evaluation of taxes must take account of the fact that revenues are rebated by means of a consumption subsidy.

As a first step in evaluating (27), we compute the differential of the government budget constraint to obtain the adjustment in the consumption subsidy. For the rest of this section, we start from an untaxed equilibrium position and derive the marginal welfare effects of introducing small taxes from zero. This way, we avoid complicated tax base effects that would identify the excess burden of taxes. With small taxes, the excess burden is zero to the first order. The remaining welfare effect must then be due to other market distortions if there are any. Starting from the untaxed market equilibrium, the differential of the public sector budget constraint in (9) is

$$Ydv = -\left[1-(1-b)\,E\right]dt - (p\theta+K)\,Ed\tau + KEdz + (1-\alpha)\,Yd\sigma. \tag{28}$$

Using the zero profit condition $Q = m$ plus the contract cost $c = p\theta + b$, the corporate tax base is $pQ - b - a = p\theta + (1-z)\,K$. By way of (7), the wage tax base is $L + (a+b)\,E = 1-(1-b)\,E$. In the untaxed equilibrium, the tax base of the consumption subsidy is equal to income $Y = C + QD = 1 + E\,(c-1)$.

Marginal Taxes/Subsidies: We start with the introduction of a small wage tax that generates revenues $Ydv = -\left[1-(1-b)\,E\right]dt$. With free entry, $Q = m$ and, by (21), $dQ/Q = -\theta \cdot dt/m$. Substituting into the welfare differential in (27), and using $Y = 1 + (c-1)\,E$ and $c = p\theta + b$, we find

$$\frac{dV}{dt} = -1 + \frac{1-(1-b)\,E}{Y} + \frac{(1-\alpha)\,\theta}{m} = \frac{(1-\alpha)\,Y\theta - mpE\theta}{mY} = 0, \tag{29}$$

[19] Utility $V\,(Y_i) = \ln\,(Y_i/P)$ is increasing in real income where $P = (1+v)\,Q^{1-\alpha}$ is the price index.

where the last equality exploits the conditions for zero profits and equilibrium in the entrepreneurial sector, $mpE = QD = (1-\alpha)\,Y$. A small wage tax, with revenues rebated by means of a neutral consumption subsidy, boosts the number of entrepreneurs and supply of innovative goods, but it fails to raise welfare at the margin. There is no market distortion that would require a wage tax to correct private decisions. Starting again from the laissez-faire equilibrium, marginal changes in τ, z, and σ yield the same result [use (21), (28), and the conditions for zero profits, $Q = m/\left[(1-\tau)\,(1+\sigma)\right]$, and equilibrium in the innovative goods sector, $mpE = (1-\alpha)\,Y$].

Proposition 3 (Welfare Effects of Taxes) *Starting from an untaxed equilibrium, the welfare effects from a marginal increase in the wage tax, the CIT, the investment subsidy, or the subsidy to output of innovative goods are all zero.*

5 Conclusions

Promoting entrepreneurship and business formation is widely recognized as an important policy objective. Among others, the OECD has recently concluded that entrepreneurial activity needs strengthening.[20] The structure of taxes, the operation of financial markets, and the "entrepreneurial climate" are important areas amenable to policy intervention. This paper proposed a simple model of entrepreneurship and start-up investment that emphasizes risk-bearing on the part of entrepreneurs and its implications for occupational choice as well as the 'quality of equity finance'. Even though financiers may, in principle, diversify project risk, some risk-bearing on the part of entrepreneurs is nevertheless required to contain a moral hazard problem in the relation between VCs and entrepreneurs. Apart from structuring equity contracts, VCs also supply valuable business advice to strengthen survival chances of their portfolio companies. We analyzed how tax policy might influence the propensity for entrepreneurship as well as the incentives

[20] The recent OECD country report on Austria, for example, includes a special feature on promoting entrepreneurship and employment, see OECD (1999).

for managerial support by financiers. We found that a capital income tax improves the incentives for managerial advice but reduces the number of entrepreneurs while a wage tax holds precisely opposite incentives. A broad based income tax is neutral on all margins, distorting neither occupational choice nor incentives for business advice. An output and an investment subsidy to the start-up firm both stimulate entrepreneurial activity.

A characterization of the government's role in promoting entrepreneurship and venture capital activity would be incomplete without an explicit welfare analysis. One might argue that government could consolidate private risks by the usual insurance aspect of taxes. On the other hand, such insurance would be counterproductive since risk-bearing is required to contain moral hazard on the part of entrepreneurs. We found indeed that none of the taxes or subsidies, with revenues rebated by means of a neutral consumption subsidy, had any effect on welfare at the margin. The decentralized market equilibrium seems to be optimal in our model of venture capital backed investment. To justify active government policy in promoting entrepreneurship and venture capital finance, one would then have to identify other possible market distortions such as imperfect competition among VCs, or learning and knowledge spillovers among them.

Further research is advised for a more complete discussion of the role of tax policy to promote entrepreneurship and venture capital type finance. The paper implicitely assumed complete loss offsets while real world tax systems are usually somewhat restrictive in this respect. Drawing on Mintz (1981), for example, it should be possible to offer an explicit analysis of imperfect loss offsets. Since much of the income from venture capital investments accrues in the form of capital gains, it would be urgent to study the effects of capital gains taxation in an enriched intertemporal version of this model. A final extension would be to analyze the effects of tax progressivity on the nature of contracts and equilibrium venture capital activity.

Appendix

A Cost of Contract: To prove proposition 1, note that a higher survival chance affects the entrepreneur's profit share according to

$$\frac{d\theta}{dp} = -\mu\frac{\theta}{p} < 0, \qquad \frac{d^2\theta}{dp^2} = \mu\frac{\theta}{p^2}\left\{2 + \frac{\theta}{\theta+\beta}\mu\right\} > 0, \tag{A.1}$$

where the elasticity is defined as

$$\begin{array}{rcl} \mu & \equiv & -\frac{p}{\theta}\frac{\partial\theta}{\partial p} = \frac{\theta+\beta}{\theta}\ln\left(\frac{\theta+\beta}{\beta}\right) > 1, \\ \frac{d\mu}{dp} & = & \frac{\beta\mu^2}{(\theta+\beta)p} - \frac{\mu}{p} = \frac{\mu}{p}\left(\frac{\beta\mu}{\theta+\beta} - 1\right). \end{array} \tag{A.2}$$

The elasticity is positive and, in fact, is larger than unity in value. To see this, use (13) and write $\frac{\theta+\beta}{\beta} = \frac{1}{x}$ where $x \equiv \delta^{1/p} < 1$. Therefore, $\frac{\theta+\beta}{\theta} = 1/(1-x)$. With these transformations, $\mu > 1$ is equivalent to $-\ln x > 1 - x$ which is fulfilled by concavity of the ln-function. Since x and therefore μ depend only on p, the elasticity is not (directly) affected by any policy parameters.

The base salary does not depend on p. The cost of contract now depends on the survival probability according to

$$\begin{array}{rcl} (a) \quad c' & = & \theta + p\frac{\partial\theta}{\partial p} = \theta(1-\mu) < 0, \\ (b) \quad c'' & = & (1-\mu)\frac{d\theta}{dp} - \theta\frac{d\mu}{dp} = \frac{(\theta\mu)^2}{p(\theta+\beta)} > 0. \end{array} \tag{A.3}$$

Differentiating the cost function and usting (14) gives the tax effects on contract cost.

B Managerial Advice: Next, we investigate how policy sets incentives for managerial advice. Taking the differential of the optimality condition $\Pi' = 0$ given in (18) yields policy effects on the equilibrium level of advice. As shown in (16), the second order condition is $\Pi'' < 0$. An investment tax credit, for example, is seen to discourage advice,

$$\frac{da}{dz} = -\frac{1}{\Pi''}\frac{\partial\Pi'}{\partial z} = \frac{Kp'}{p\Pi''} < 0. \tag{B.1}$$

The equilibrium effects of other policy instruments are similarly derived, and the following partials are used in the main text,

$$\begin{aligned} \frac{\partial \Pi'}{\partial t} &= p' \left(\frac{1}{p} \frac{\partial c}{\partial t} - \frac{\partial c'}{\partial t} \right) = \frac{-\mu p'}{1-t} < 0, \\ \frac{\partial \Pi'}{\partial \tau} &= 1 + \frac{p'}{p} \left(\frac{\partial c}{\partial \tau} - a \right) = 1 - \frac{(a+b)p'}{p} > 0, \\ \frac{\partial \Pi'}{\partial z} &= p' \frac{\partial m}{\partial z} = -\frac{Kp'}{p} < 0. \end{aligned} \tag{B.2}$$

In the first line, we have $\frac{\partial c'}{\partial t} = \frac{-c'}{1-t}$ by (A.3), (14) and the fact that the elasticity μ is independent of any tax rates as mentioned following (A.2). Proposition 1 then yields the effect of the wage tax. To verify that the sign of the second partial is positive, multiply $x \equiv 1 - (a+b)\, p'/p$ by $(1-\tau)$ and replace the tax factor on the r.h.s. by (18): $(1-\tau)\, x = p'(m - c') - (1-\tau)(a+b)\, p'/p$. Using (13) and (15) to replace m yields $(1-\tau)\, x = -p'c' + (p\theta + (1-z)\, K)\, p'/p > 0$ which is positive due to $c' < 0$. Finally, to obtain the effect of a comprehensive income tax with $r = \tau = t = z$ on advice, we compute

$$\frac{d\Pi'}{dr} = \frac{\partial \Pi'}{\partial t} + \frac{\partial \Pi'}{\partial \tau} + \frac{\partial \Pi'}{\partial z} = 1 + \frac{p'c'}{1-r} - \frac{p'}{1-r} \left[\frac{p\theta + (1-r)(b+a+K)}{p} \right].$$

The square bracket is simply m under the income tax. Using the efficiency condition (18), it is seen that a truly comprehensive income tax does not interfer with the VC's incentives to provide managerial advice,

$$\frac{d\Pi'}{dr} = -\frac{p'(m - c') - (1-r)}{1-r} = 0. \tag{B.3}$$

Alternatively, one may verify that all terms in (18) turn out to be proportional to a common tax factor $1 - r$, which therefore cancels. Note in particular that also θ is proportional to $1 - r$ which is obvious from (14).

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Figures

Figure 1: Equity Contract

Figure 2: Number of Entrepreneurs