PROGRESSIVE TAXATION, MORAL HAZARD, AND ENTREPRENEURSHIP

CHRISTIAN KEUSCHNIGG

University of St. Gallen (IFF-HSG), CEPR, and CESifo

SØREN BO NIELSEN

Copenhagen Business School, EPRU, CEPR, and CESifo

Abstract

This paper considers the general equilibrium and welfare effects of a linear progressive income tax with entrepreneurship and moral hazard. A competitive intermediation sector diversifies risk associated with entrepreneurial activity, but full risk consolidation is prevented by moral hazard. Since effort is not observable, risk bearing of entrepreneurs is required for incentive reasons. The extent of risk consolidation is endogenously explained. We find that a nonredistributive tax is neutral. A progressive tax always impairs entrepreneurship while the effect on welfare can be positive or zero, depending on the specification of moral hazard. Some results may also depend on the concrete formulation of preferences.

1. Introduction

This paper considers the effects of progressive income taxation on entrepreneurial risk taking and welfare in the presence of moral hazard. Agents may choose between starting a firm in an “innovative” and highly risky sector or accepting a safe job in a traditional sector. Having no own funds, risk-averse entrepreneurs must sell part of their firm to obtain a minimum amount of safe income. Outside finance, however, is not easily obtained because of a

Christian Keuschnigg, University of St. Gallen (IFF-HSG), Varnbuelstrasse 19, CH-9000 St. Gallen, Switzerland (christian.keuschnigg@unisg.ch). Søren Bo Nielsen, Copenhagen Business School, Solbjerg Plads 3, DK-2000 Frederiksberg, Denmark (sbn.eco@cbs.dk).

The paper was presented at the CEPR workshop on “Dynamic Aspects of Taxation” at Tilburg university, September 2000, and the IIPF congress in Linz, 2001. We are grateful to seminar participants and, in particular, to Dieter Bös, and our discussant Kai A. Konrad, for helpful comments. The paper significantly improved upon very useful suggestions by two anonymous referees and an associate editor.

Received February 2001; Accepted November 2002.

© 2004 Blackwell Publishing, Inc.

Journal of Public Economic Theory, 6 (3), 2004, pp. 471–490.

moral hazard problem. Success of start-up firms critically depends on the effort of the entrepreneur, which is not observed by financiers. While competitive intermediation firms can, in principle, costlessly consolidate independent risks by the law of large numbers, full insurance is prevented by moral hazard. Much of the literature on risk taking and entrepreneurship simply assumes the absence of risk markets. This paper, in contrast, endogenously explains risk sharing and the extent of risk consolidation as the market solution to the moral hazard problem. Entrepreneurial risk bearing is essential to retain incentives for effort. The traditional tax literature has stressed the benefits of income taxation in providing social insurance in the *absence* of private risk markets (e.g., Varian 1980, Kanbur 1980, Kihlstrom and Laffont 1983, Boadway, Marchand, and Pestiau 1991. Recent contributions have argued that such an effect might be counterproductive when incomplete risk consolidation is the optimal arrangement of private agents to cope with moral hazard (Buchholz and Konrad 2000). Does income taxation then interfere with private risk sharing to the effect that welfare is reduced?

We demonstrate, in a model where agents are endowed with logarithmic preferences, that an income tax which redistributes from entrepreneurs to workers, may very well boost welfare, even though it tends to retard entrepreneurship. This result is *not* due to the government having better information than private financiers but rather depends on the specification of the moral hazard problem. It thus reflects the fact that, in a second best economy, lump-sum redistribution can shift incentive constraints and thereby lead to Pareto improvements via general equilibrium price effects (see Hoff 1994, Hoff and Lyon 1995, Greenwald and Stiglitz 1986). This insight though does not yield any simple policy rules. Correspondingly, the results from the applied literature tend to be not entirely robust but hinge on the specific formulation of the incentive problem. Kanbur (1980), for example, analyzes an economy in which entrepreneurs engaged in risky ventures hire the remaining agents as workers. He does not explicitly model an informational friction but rather assumes complete absence of private risk markets. He finds that government can raise welfare by taxing the risky occupation and subsidizing the safe one, thereby restricting entry into the risky activity. In the presence of costly state verification and partial private insurance, Black and de Meza (1997) find the opposite result that subsidizing entry into the risky activity boosts welfare. In their case, government does not have superior information but can create collective insurance more cheaply through its influence on equilibrium prices.

Our finding that progressive income taxation may enhance welfare in a sense reestablishes the results of Kanbur, except that we endogenously explain the extent of unconsolidated risk as a result of moral hazard rather than simply assuming the absence of risk markets. Since expected income of entrepreneurs is higher than a worker's wage, the linear progressive tax implies a net tax on risky activities and a subsidy to safe ones. It discourages entry into

the risky occupation, yet raises welfare as in Kanbur (1980) because it transforms highly risky income of entrepreneurs into safe income for both groups of agents. We also restate and extend a neutrality result due to Buchholz and Konrad (2000), who excluded redistribution between entrepreneurs and workers by assuming that the tax revenue from each population group is refunded to the same group. Since this non-redistributing tax is neutral, the effects of progressive taxation indeed derive from its redistributive content.

In our paper, we emphasize in particular how the welfare effects of progressive taxation depend on the specific formulation of the incentive constraint. There is no unique choice with respect to the precise nature of shirking. In the major part of the analysis, we assume that entrepreneurs, when shirking, tacitly divert part of their time to earn some extra wage outside the firm. A prominent example of this approach is found in De La Fuente and Marin (1996). With this formulation, we still retain the neutrality of non-redistributive taxation. A small progressive income tax, however, yields a first-order welfare gain. We then consider the alternative and perhaps more traditional assumption that shirking amounts to consumption of leisure rather than earning outside income. While all other results remain robust, the marginal welfare gain of a small progressive tax is reduced to zero. This suggests that particular attention must be devoted to modeling shirking behavior and formulating incentive constraints. To make our point in the simplest way, we keep with the case of logarithmic preferences, which is also a realistic one as the empirical evidence suggests.¹ The analysis quickly becomes rather complicated, however, if we deviate from the logarithmic specification. As we mention below, some of our results might be sensitive to this choice of preferences to some extent.

The paper is organized as follows. Section 2 analyzes the moral hazard problem in the relationship between entrepreneurs and outside financiers within a general equilibrium model of occupational choice and linear progressive income taxation.² Sections 3 and 4 establish the central results that a non-redistributing tax is neutral while a progressive income tax may or may not boost welfare, depending on the assumed form of shirking. Section 3 assumes that shirking means to earn extra outside income rather than allocating all effort to one's own firm. Section 4 considers the alternative and

¹Logarithmic preferences are a special case of isoelastic preferences where both the (numerical) elasticity of intertemporal consumption substitution and its inverse, the coefficient of relative risk aversion, are constant at one. The empirical evidence emerging from microstudies finds this elasticity to be just below one, see Browning, Hansen, and Pestiau (1999, p. 552) and Attanasio (1999, p. 791).

²The model is a stripped down version of the one stated in Keuschnigg and Nielsen (2003). There, we assume that shirking is consumption of leisure while the working paper version from Keuschnigg Nielsen (2000) assumes that shirking yields outside income. This paper contrasts and integrates these two alternatives in a unified framework.

perhaps more traditional form of shirking where entrepreneurs consume a private benefit, or leisure, when shirking. In fact, we endogenously explain which form of shirking is the agent's preferred choice. Section 5 concludes with some final remarks.

2. The Model

2.1. Overview

In this section, we set up a stylized general equilibrium model of entrepreneurship and risk taking subject to moral hazard. The economy is populated by a mass one of risk-averse agents who divide into L workers and E entrepreneurs,

$$1 = L + E. \quad (1)$$

There are two goods. Agents demand quantities C of a traditional good and D of an "innovative" good. Taking the traditional good as the *numeraire*, we denote by Q the relative price of the innovative good. Production technologies are Ricardian. One worker produces with certainty one unit of the numeraire good, giving an aggregate supply of L . Production of the traditional good is standard and involves no informational problems. Given perfect competition, the wage rate is therefore fixed at $w = 1$.

Entrepreneurial activity, in contrast, is highly risky. Each entrepreneur starts one firm which produces one unit of the innovative good if successful, and nothing otherwise. Success of the project, or firm, critically depends on the entrepreneur's effort, which is only partly observed by outside agents. We assume that a minimum amount δ of the entrepreneur's time input is freely observable and must always be supplied, when a firm is started. The rest $1 - \delta$ of her time endowment equal to unity is subject to potentially opportunistic behavior.³ If a too large part of the firm's profit is taken by the investor, the entrepreneur might divert the discretionary part of her time to tacitly earn an extra outside income, which is beyond the investor's access.⁴ Only high effort, indicating that the entrepreneur fully concentrates on the firm and devotes her entire time including the discretionary part $1 - \delta$ to the project, secures a positive success probability $p > 0$. Even then the project fails with probability $1 - p$. With low effort, the time input $1 - \delta$ is diverted to alternative uses not conducive to success. With shirking, the project never succeeds and fails for sure, $p = 0$. In equilibrium, entrepreneurs must be given sufficient incentives for full effort to have any output at all. With large numbers, a fraction p of

³The case $\delta = 1$ naturally identifies the first-best, full information case where the entire time input is observable, and no moral hazard problem exists.

⁴Section 4 considers the alternative case where entrepreneurs allocate their unobserved time to consume leisure, or a private benefit.

projects succeeds, and aggregate supply is pE . The market clearing conditions for the two goods are, thus,

$$C = L, \quad D = pE. \quad (2)$$

Agents are risk averse and identical *ex ante*. When opting for entrepreneurship, they give up a safe, alternative wage in the traditional sector and have no other market income than what they obtain from their firm. To insure against the income loss in the bad state when the firm fails, risk-averse agents may sell a share $1 - s$ of their company to financial intermediation firms for a price b to obtain some minimum safe income. This price is the initial equity investment of the financier. Retaining a share s of the firm, expected market income of the entrepreneur, prior to any taxes and transfers is

$$c = spQ + b. \quad (3)$$

Buying a share $1 - s$ in the firm at a price b , the financier derives expected profits of

$$\Pi = (1 - s)pQ - b = pQ - c. \quad (4)$$

The expected value of the project thus satisfies $pQ = \Pi + c$. The next subsection will explain how profits are shared among the two parties.

Agents are also endowed with shares in the intermediation firms giving a safe dividend Π^i per agent. In financing a collection of projects with independent risks, financiers can fully diversify risk and pay safe dividends. Introducing government agents also receive safe transfers T^E or T^L per capita which may, or may not, be differentiated across workers and entrepreneurs. The government taxes income, including transfers,⁵ at a proportional rate τ . Disposable income of agent i is spent on the two goods,

$$C^i + QD^i \leq (1 - \tau)Y^i, \quad Y^i = \begin{cases} \tilde{c} + T^E + \Pi^i & \text{entrepreneur,} \\ 1 + T^L + \Pi^i & \text{worker,} \end{cases} \quad (5)$$

where $\tilde{c}$ is the entrepreneur's state dependent market income if effort is high.⁶ It is either high ($sQ + b$ with probability p) or low (b with probability $1 - p$), and equal to c in expected value, see (3).⁷

In total, dividends $\Pi E = \int_0^1 \Pi^i di$ from a mass of E projects are distributed (individual dividends received, Π^i , must be distinguished from profit

⁵Nontaxable transfers will lead to equivalent results throughout.

⁶In deriving consumption and aggregate income, we do not need to consider the entrepreneurs' potential income from shirking, since it is excluded in equilibrium by the incentive compatibility condition.

⁷Note that c is also the expected cost of the financier of acquiring the firm, see (4).

Π per project). Denoting total transfers by T , aggregate gross income is

$$Y = \int_0^1 Y^i di = cE + L + T + \Pi E, \quad T = T^E E + T^L L. \quad (6)$$

The government redistributes revenues from income taxation in lump-sum form,

$$(\tau Y^E - T^E)E + (\tau Y^L - T^L)L = 0 \Leftrightarrow \tau Y = T. \quad (7)$$

From the viewpoint of the individual agent, the tax transfer scheme is linear progressive. Ignoring profits Π^i ,⁸ market income of an agent is $y^i = Y^i - T^i$ and her disposable income $(1 - \tau)(y^i + T^i)$. Accordingly, the effective, *net* tax payment amounts to $\tau y^i - (1 - \tau)T^i$, giving an average tax rate equal to $\tau - (1 - \tau)T^i/y^i$, which obviously increases with market income for any given government policy.⁹

2.2. Individual Decisions

The following sequence of decisions occurs: First, government sets fiscal policy. Second, financiers propose a financial contract specifying a price b in exchange for a share $1 - s$ of the firm. Third, knowing the terms of contract, agents accept the offer and become entrepreneurs, or they reject and take a job in the traditional sector. Fourth, entrepreneurs choose effort conditional on the terms of contract, which determines the success probability. Fifth, risk is resolved and income is paid. Finally, agents allocate expenditure and derive utility from consumption. The model is solved by backward induction.

2.2.1. Preferences

Agents are endowed with homothetic preferences $V = \ln(u)$, where u is an index of real consumption that is linear homogeneous in the two goods, $u(C, D) = u_0 C^\alpha D^{1-\alpha}$ with $u_0 = \alpha^{-\alpha} (1 - \alpha)^{-(1-\alpha)}$. The specification of preferences is chosen for simplicity and implies constant relative risk aversion of degree one. All agents have a time endowment of unity. A worker's use of time is freely observable and verifiable by assumption; she must thus always supply high effort and devote the entire time endowment to fulfil the required tasks. Otherwise, she would not be paid any wage.

The entrepreneur's use of time, in contrast, is not fully observable and verifiable, which creates room for opportunistic behavior. While $0 < \delta < 1$ is the observable part of her time input to the firm, the other part $1 - \delta$ is under her discretion. High effort means that the entrepreneur devotes not only the observable part δ but also the discretionary, unobservable part of her time

⁸With perfect competition and free entry of financiers, dividends are zero in equilibrium, $\Pi^i = 0$.

⁹Using (4)–(7), we have Walras' law, i.e., $(C - L) + Q(D - pE) = 0$.

input to the firm. Low effort means that she diverts the discretionary part $1 - \delta$ of her time to other uses. Several alternative specifications of shirking are possible. In this and the following section, we assume that the shirking entrepreneur allocates the time to tacitly earn an outside wage income $(1 - \delta)w$ in the traditional sector, which will obviously impair the survival prospects of the firm. Utility again depends on the total level of consumption that is afforded out of total income including the shirked income. A second, alternative formulation of shirking involves the consumption of leisure and is explored in Section 4.

2.2.2. Demand

In solving backwards, we determine consumption conditional on disposable income $(1 - \tau)Y^i$ as it results from preceding stages of decision-making. Maximizing utility subject to (5), we obtain demand and indirect utility V^i :

$$\begin{aligned} C^i &= \alpha(1 - \tau)Y^i, & D^i &= (1 - \alpha)\frac{(1 - \tau)Y^i}{Q}, \\ V^i &= \ln(u^i), & u^i &= \frac{(1 - \tau)Y^i}{Q^{1-\alpha}}. \end{aligned} \quad (8)$$

2.2.3. Effort

Entrepreneurs choose high effort if the resulting income yields higher expected utility than the income derived from shirking. Since effort is not observable and verifiable, financiers cannot tell, whether failure is due to bad luck despite high effort, or is simply a result of shirking. Outside financiers cannot make the contract contingent on effort. The entrepreneur thus receives the same price b in both states, supplemented by a transfer T^E from government, irrespective of her effort choice. Given high effort, this is the only income obtained in the bad state, since nothing is produced and no profits are distributed in case of failure. In the good state, one unit of output of the innovative good is produced and sold at a price Q . Thus, the value of the project is also Q . We denote the entrepreneur's profit income in case of success by θ and her safe income by β , i.e.,

$$\theta \equiv sQ, \quad \beta \equiv b + T^E. \quad (9)$$

When supplying full effort, the entrepreneur derives net income $(1 - \tau)(\theta + \beta)$ in the good state and $(1 - \tau)\beta$ in the bad state, giving expected disposable income equal to $c^N = (1 - \tau)(p\theta + \beta)$.¹⁰ When the entrepreneur

¹⁰Substituting in (9) and using (3), expected disposable income is linked to the expected cost c of the financier by $c^N = (1 - \tau)(c + T^E)$; see also (4) and (5).

shirks, the firm always fails, yet she obtains a safe but low income β . In addition, she derives a benefit from shirking. When shirking, she earns an outside wage income of $1 - \delta$ from tacitly working in the traditional sector which is not shared with the investor. It is assumed that the government cannot tax shirked income either. Shirking thus yields a safe income of $(1 - \tau)\beta + (1 - \delta)$ in total. The entrepreneur exerts full effort if this yields higher expected utility than shirking. With indirect utility as in (8), the price term cancels from the utility comparison.¹¹ The incentive compatibility condition IC for high effort is given by

$$\text{IC: } p \ln(\theta + \beta) + (1 - p) \ln(\beta) \geq \ln\left(\beta + \frac{1 - \delta}{1 - \tau}\right). \quad (10)$$

2.2.4. Occupational Choice

A financier must not only enlist high effort to obtain revenues from start-up firms, but must also make sure that agents are willing to give up alternative job opportunities. The contract must make expected utility from entrepreneurship at least as high as utility from a worker's job. The participation constraint PC is, thus,

$$\text{PC: } p \ln(\theta + \beta) + (1 - p) \ln(\beta) \geq \ln(1 + T^L). \quad (11)$$

2.2.5. Contract Choice

The financier offers a price b for a stake $1 - s$ in the firm. It is clear from (3) and (4) that she wants to minimize the expected income that she must cede to the entrepreneur. For any given market price Q , the choice of s determines the entrepreneur's profit income θ in the good state. The financier's problem is, thus,¹²

$$c = \min_{\theta, b} \{p\theta + b \text{ s.t. PC and IC}\}. \quad (12)$$

Since the cost line is linear, the minimum cost solution is at the intersection of the PC and IC constraints. We get β from the intersection and then read off θ from the PC constraint, $(\theta + \beta)^p \beta^{1-p} = 1 + T^L$. Invoking the incentive constraint in (10),

$$\beta = 1 + T^L - \frac{1 - \delta}{1 - \tau}, \quad \theta = \beta \left[\left(\frac{1 + T^L}{\beta} \right)^{1/p} - 1 \right], \quad b = \beta - T^E. \quad (13)$$

¹¹Writing real income in (8) as $u = zy$ with $z = (1 - \tau)/Q^{1-\alpha}$, the incentive constraint $p \ln[z(\theta + \beta)] + (1 - p) \ln[z\beta] \geq \ln[z(\beta + \frac{1-\delta}{1-\tau})]$ results in (10), since z cancels out.

¹²The financier's cost compares with net expected income of the entrepreneur, $c^N = (1 - \tau)(p\theta + \beta)$.

In the absence of taxes (so that $\tau = T^i = 0$), we have $\beta = b = \delta$ and $\theta = \beta[\beta^{-1/p} - 1]$. The solutions for θ and β reflect the desired risk sharing arrangements in the presence of moral hazard. Knowing the solution for θ and β , Equation (9) implies the entrepreneur's profit share s combined with a safe income or price b that the financier pays for the remaining share $1 - s$.

2.3. Free Entry Equilibrium

Free entry of competitive financiers implies zero profits. The value of projects, equal to the market price Q , is thus linked to the expected cost of entrepreneurial compensation:

$$\Pi = pQ - c = 0. \quad (14)$$

The equilibrium number of entrepreneurs follows from market clearing of innovative goods and the resource constraint. Note that $\tau Y = T$ by (7) and, therefore, $(1 - \tau)Y = Y - T = 1 + (c - 1)E$ by (14), (6), and (1). According to (8), aggregate spending on innovative goods amounts to $QD = (1 - \alpha)(1 - \tau)Y$. Imposing market clearing $pE = D$ and zero profits as in (14), we obtain the equilibrium number of entrepreneurs,

$$1 - \alpha = E[1 + \alpha(c - 1)]. \quad (15)$$

Using the same identities, the public sector budget (7) in net form amounts to

$$(1 - \tau)T = \tau[1 + (c - 1)E]. \quad (16)$$

3. Progressive Income Taxation

We now consider the general equilibrium and welfare effects of a small income tax with moral hazard.¹³ First, we state a neutrality result for the case, where the income tax is non-redistributive in the sense that revenue raised from entrepreneurs (workers) is returned as a transfer to the same group. Next, the income tax finances the same transfer to everyone and thus becomes redistributive. It is then no longer neutral and has nontrivial effects on entrepreneurship and welfare.

3.1. A Neutrality Result

To prepare the intuition for the effects of progressive income taxation, we first restate a neutrality result due to Buchholz and Konrad (2000). Their analysis

¹³To reiterate, shirking is assumed to occur by using the unobserved time to tacitly earn an extra outside income. Instead of "shirking for income," Section 4 turns to the alternative formulation where an entrepreneur consumes leisure, or a private benefit, when shirking.

is confined to a partial equilibrium model. We extend and strengthen their result by showing that it also holds in a general equilibrium context with occupational choice and free entry of financiers. Suppose the government abstains from redistribution across entrepreneurs and workers by rebating revenues separately to each group, $T^E = \tau Y^E$ and $T^L = \tau Y^L$, with $Y^E = c + T^E$ and $Y^L = 1 + T^L$, see (7) and (6). Each group receives in form of transfers exactly what it pays, on average, in taxes. Even though the tax payment of each individual entrepreneur is risky, the government taxes a large number of them and is therefore able to pay riskless transfers. With the above definitions, the government's two separate budget constraints are $T^i = \tau(y^i + T^i)$. Rearranging, we have

$$T^i = \frac{\tau}{1-\tau} y^i, \quad T^i + y^i = \frac{1}{1-\tau} y^i, \quad y^E = c, \quad y^L = 1. \quad (17)$$

We compare the equilibrium resulting from this tax transfer policy with the market equilibrium, where $\tau = T^i = 0$. Denoting values in the untaxed state by a subindex 0, we have $\beta_0 = b_0 = \delta$, $\theta_0 = \delta[(1/\delta)^{1/p} - 1]$, $c_0 = p\theta_0 + b_0$, $Q_0 = c_0/p$, $s_0 = \theta_0/Q_0$, and $c_0^N = c_0$.

PROPOSITION 1 (Non-Redistributive Taxation): *Income taxation is neutral if it avoids redistribution across workers and entrepreneurs as in (17). The taxed equilibrium satisfies*

$$\theta = \frac{\theta_0}{1-\tau}, \quad \beta = \frac{\beta_0}{1-\tau}, \quad c^N = c_0^N, \quad Q = Q_0, \quad E = E_0. \quad (18)$$

Proof: In the taxed equilibrium, we have $\beta = 1 + T^L - (1 - \delta)/(1 - \tau) = \beta_0/(1 - \tau)$ from (13) and (17), and therefore $\theta = \beta_0/(1 - \tau)[(1/\beta_0)^{1/p} - 1] = \theta_0/(1 - \tau)$. Also, $b = \beta - T^E = \beta_0/(1 - \tau) - (\tau/(1 - \tau))c$. Substituting into $c = p\theta + b$ and using $\beta_0 = b_0$, we have $c = c_0$, which implies $Q = Q_0$ by the zero profit condition (14) and $E = E_0$ by (15). Note finally that $c^N = (1 - \tau)(p\theta + \beta) = c_0^N$ and $(1 - \tau)(1 + T^L) = 1$ so that disposable incomes, prices and demand remain constant. ■

With non-redistributive taxation as in (17), financiers adjust the profit shares and the purchase price b such that pretax income of entrepreneurs including transfers, $\theta + \beta$ in the good state and β in the bad state, are increased by an amount that leaves their disposable income *net* of taxes in each state unchanged, i.e., $(1 - \tau)(\theta + \beta)$ and $(1 - \tau)\beta$ remain constant. In particular, the profit share s is adjusted so that $s = s_0/(1 - \tau)$. Private agents simply offset tax policy to obtain the same risk sharing arrangement by adjusting pretax income. This preserves the required incentives for high effort in (10) where the tax factor $1/(1 - \tau)$ falls out. Policy (17) also leaves the entrepreneur's alternative wage income net of taxes unchanged, since it simply gives back as transfers what it collects as taxes. Entrepreneurial income in all states as well as wage income $1 + T^L$ are raised by the same factor $1/(1 - \tau)$, which then

cancels from the PC constraint in (11). The policy, therefore, is also neutral with respect to occupational choice. This extends the result of Buchholz and Konrad (2000, p. 115), who do not explicitly consider career choice and taxation of alternative wage income.

While the financier raises θ , she cuts back on the price b to an extent that leaves the expected cost $c = p\theta + b = c_0$ unchanged.¹⁴ The market equilibrium is therefore not affected by this policy, see (15). The reason is that the price of the innovative good in the free entry equilibrium remains unchanged as well, $Q = Q_0$. This combined with constant disposable income net of taxes of all agents prevents any change in demand and supply.

Non-redistributive taxation is neutral when the government *cannot* tax shirked income. In this case, the possibilities for risk consolidation by private financiers and government are exactly the same, as none of them has access to shirked income. Noting $pQ = c$ with zero profits, the public budget (17) is $\tau pQ = (1 - \tau)T^E$. Government thus takes a share τ of expected profits and rebates it as a safe (net) transfer $(1 - \tau)T^E$. This is the same as the financiers' policy of paying a price (safe income) b in exchange for a profit share $1 - s$, see (4). Proposition 1 says that financiers, having found an optimal risksharing solution already, will simply undo the extra insurance provided by the government. However, given that we interpret shirking as tacitly earning a wage in the traditional sector, government may actually have access to this income by means of commodity taxation.¹⁵ If transfers alternatively are financed by a consumption tax, the neutrality result no longer holds. The government then can tax shirked income and can do better than private financiers. The neutrality result thus depends to some extent on how the outside option of entrepreneurs is formulated, and whether government can effectively access shirked income or not.

3.2. Progressive Taxation

3.2.1. Tax Transfer Policy

Policy (17) provides a useful benchmark case. Since average income of entrepreneurs is higher by a risk premium, they would receive higher per capita transfers than workers. In reality, however, progressive taxes redistribute not only within each class, but also across population groups with different average incomes. We therefore investigate the consequences for entrepreneurship and welfare of having equal per capita transfers $T^E = T^L = T$, which consequently redistribute from entrepreneurs to workers. The public budget is given by (16) with transfers now being uniform. To avoid overly messy calculations, we provide comparative static results from the untaxed equilibrium

¹⁴The reduction in the price b amounts to $b = b_0 - (\tau/(1 - \tau))p\theta_0$.

¹⁵Except for this possibility, income and consumption taxes are equivalent in our static model.

position where $\tau = T = 0$, $\beta = b = \delta$, $\theta = \beta(\beta^{-1/p} - 1)$, and $c = c^N$. The differential of (16) gives the per capita transfer that can be financed with the income tax,

$$dT = [1 + (c - 1)E] d\tau. \quad (19)$$

How redistributive taxation shifts incentive constraints, is not easily anticipated. We find the following proposition.

PROPOSITION 2 (Cost of Contract): *Introducing a linear progressive income tax affects contract payments both via the tax rate and the per capita transfer. The partial effects on the cost of the contract to the financiers are*

$$c_T \equiv \frac{\partial c}{\partial T} < 0, \quad c_\tau \equiv \frac{\partial c}{\partial \tau} > 0, \quad c_T + c_\tau = c - 1. \quad (20)$$

Furthermore, $\delta > 1 - p$ is a sufficient condition for $1 + Ec_T > 0$.

Proof: See the Appendix.

For intuition, note that the government taxes income from high effort but cannot tax shirked income. With a higher tax rate, agents find it more attractive to shirk rather than supply effort. A financier must then leave a larger risk to the entrepreneur in order to elicit effort. She leaves a larger share to the entrepreneur, acquires a smaller stake for herself, and accordingly pays a smaller price. The entrepreneur's safe income b (and β) fall while her profit income θ in the good state increases, see (A1) and (A2) in the Appendix. The entrepreneur must be given a higher risk premium to compensate for increased risk bearing, which raises the expected cost of entrepreneurial compensation as in (20), $c_\tau > 0$.

In giving larger transfers, the government raises the entrepreneur's safe income β in the risky occupation along with the safe income from an alternative job. Since transfers provide insurance, the risk premium is reduced, implying that expected income need not increase by the same amount as transfers. Indeed, transfers reduce the cost that financiers incur to compensate entrepreneurs, $c_T < 0$. Financiers are thus able to acquire a larger share of the firm at the same price b , leaving a smaller share s (and hence θ) to entrepreneurs, see (A1) and (A3). It turns out that the sum of the two partial derivatives listed in (20) is just equal to the risk premium in the initial, untaxed equilibrium.

3.2.2. Entrepreneurship

Agency costs are a barrier to entrepreneurship as is evident from the equilibrium condition (15). If there were no moral hazard problem, a diversified financier could fully insure the entrepreneur and buy the entire firm at a price $b = 1$ equal to the wage rate. With $\theta = 0$, there would be no further cost of risk bearing, giving $c = 1$ and allowing for a maximum number of

entrepreneurs equal to $E = 1 - \alpha$. With moral hazard, entrepreneurial risk bearing becomes essential for incentive reasons. At the same time, the cost of compensating entrepreneurs for risk bearing must be reflected in the price of the innovative good in the zero profit equilibrium, $pQ = c$, which depresses demand and reduces the number of entrepreneurs in (15), $E < 1 - \alpha$. Proposition 2 states that income transfers by government reduce agency costs while a higher tax rate inflates them. The net effect therefore depends on the magnitude of transfers that can be financed out of a given increase in the tax rate. We state the following proposition.

PROPOSITION 3 (Entrepreneurship): *If $\delta > 1 - p$, introducing a linear progressive income tax retards entrepreneurship,*

$$\frac{dE}{d\tau} = -\frac{\alpha E^2}{1 - \alpha}(c - 1)(1 + Ec_T) < 0. \quad (21)$$

Proof: From (15), $dE = -(\alpha/(1 - \alpha))E^2 dc$ where $dc = c_T dT + c_\tau d\tau$. Substituting (19) and using (20) gives $dc = (c - 1)(1 + Ec_T)d\tau$, which is positive as argued in Proposition 2. ■

The condition $\delta > 1 - p$ is only sufficient, not necessary. A small expenditure share $1 - \alpha$ for innovative goods, instead of the condition $\delta > 1 - p$, also establishes the sign $1 + Ec_T > 0$, as can be seen from (A5) in the appendix. Since agency costs squeeze the number of entrepreneurs below this share, $E < 1 - \alpha$, the negative term c_T cannot dominate the sign of $1 + Ec_T$. With these conditions, the effect of the tax rate on agency costs dominates over the opposite effect of the transfer payment. In raising agency costs, progressive taxation discourages entrepreneurship.

3.2.3. Welfare

Occupational choice equates expected utility of entrepreneurs with utility of workers. The PC must hold with equality in equilibrium. Social welfare W is thus given by utility of a worker in (8) who earns a safe income of $(1 - \tau)(1 + T)$.

PROPOSITION 4 (Welfare): *If shirking yields outside income, then a small progressive income tax raises welfare,*

$$\frac{dW}{d\tau} = (c - 1)E - \frac{1 - \alpha}{c} \frac{dc}{d\tau} = (1 - \alpha)(c - 1)E \frac{c_\tau}{c} > 0. \quad (22)$$

Proof: By (16), the disposable wage is $(1 + T)(1 - \tau) = 1 + \tau(c - 1)E$, giving utility $W = \ln[1 + \tau(c - 1)E] - (1 - \alpha) \ln Q$ in (8). Take the derivative at the untaxed position, refer to (21) for $dc/d\tau = (c - 1)(1 + Ec_T)$, and use (14), (15), and (20). ■

The welfare effect is positive since $c_\tau > 0$ by (20). The gain emerges through two channels. First, progressive taxation redistributes from entrepreneurs to workers. It thereby strengthens workers' net wage, which is, by the participation constraint, also the certainty equivalent income of an entrepreneur. By converting risky into safe income, the policy makes entrepreneurs gain on account of lower risk even though they lose expected income. Both groups are thus better off. Second, the policy changes the price of innovative goods, $Q = c/p$, via its effect on c . Proposition 2 states that the tax raises the agency cost by making shirking more attractive. The transfer reduces the agency cost since it provides insurance and thereby allows for a smaller risk premium. By Proposition 3, the net effect depends on the amount of tax revenues raised and turns out positive. The price of the innovative good must therefore increase in zero profit equilibrium, which erodes real income and welfare. The increase in safe income on account of higher transfers dominates, however, giving an overall welfare gain from progressive taxation.¹⁶

4. Shirking for Leisure

Moral hazard arises from the fact that an outside investor cannot observe or verify whether the entrepreneur spends her full effort to the benefit of the firm. Having sold part of it to the investor, her reduced profit share weakens her incentives for effort but rather tends to encourage opportunistic behavior. Shirking may occur in several alternative forms. In the previous sections, it was assumed that an entrepreneur, when shirking, diverts part of her time to tacitly earn some extra outside income. The perhaps more traditional assumption is that the entrepreneur, when shirking, enjoys "private benefits" [see Tirole (2001) for a prominent example]. We model this by interpreting private benefits as consumption of leisure in the amount of the nonverifiable part $l = 1 - \delta$ of the time endowment. For this purpose, we augment the specification of the agent's preferences by introducing leisure. Given real income u and leisure l , the agent's utility amounts to $V' = \ln(u\gamma)$, where $\gamma \equiv 1 + \eta l \geq 1$. We use primes to indicate the model solution under shirking for leisure. The parameter η captures the strength of the agent's preference for leisure.¹⁷

¹⁶As already mentioned, Keuschnigg and Nielsen (2000) assume that shirking entrepreneurs tacitly earn some income elsewhere, which the government can tax when it is spent on consumption. In this case, the tax does not discriminate against effort provision and its effect on the agency cost disappears, leaving $c_\tau < 0$, which favors entrepreneurship and translates into a lower price Q . The real income gain due to a lower price then reinforces the worker's welfare gain from redistribution.

¹⁷Our approach links to the moral hazard literature based on effort costs. Interpreting effort as labor supply, $e = 1 - l$, and defining $v(u) = \ln(u)$ and $g(e) \equiv -\ln(1 + \eta(1 - e))$, we can write utility as $V' = v(u) - g(e)$. The effort cost function is increasing and convex, $g'(e) > 0$

With these preferences, we may view shirking as a two-stage decision. First, the agent decides whether to shirk or not and, second, she chooses among the two alternatives, shirking for outside income or shirking for leisure. Solving backwards, we first determine the optimal form of shirking. When shirking for income, the agent consumes no leisure but instead diverts the nonverifiable time input to earn outside income, giving total income $(1 - \tau)\beta + 1 - \delta$ from shirking. Writing net real income as $u^i = zY^i$ with $z = (1 - \tau)/Q^{1-\alpha}$ as in (8), and using $\gamma = 1$ in this case, utility amounts to $V = \ln[z(\beta + (1 - \delta)/(1 - \tau))]$. Alternatively, the agent may prefer to shirk for leisure and accept a lower income $(1 - \tau)\beta$ in exchange for leisure, giving utility

$$V' = \ln(z\beta\gamma), \quad \gamma = 1 + \eta(1 - \delta). \quad (23)$$

Obviously, shirking for income is preferred if

$$V > V' \Leftrightarrow 1 > \eta(1 - \tau)\beta. \quad (24)$$

Note that agents decide upon shirking only after the contract is determined whence the decision is conditional on a given value of β . Quite intuitively, if the preference for leisure, η , is sufficiently small, agents will definitely prefer shirking for outside income over shirking for leisure. This was implicitly assumed in the preceding sections where the relevant incentive constraint to prevent shirking was stated in (10).

When agents have a relatively high preference for leisure, the reverse inequality holds in (24), and agents prefer leisure instead of extra outside income. The entrepreneur's safe net of tax income amounts to only $(1 - \tau)\beta$ but welfare is augmented by the value of leisure. Utility from shirking is then V' as in (23). The higher the valuation of leisure, or private benefits, the more costly it is to prevent shirking. The incentive compatibility condition now takes the form

$$IC': p \ln(\theta + \beta) + (1 - p) \ln(\beta) \geq \ln(\beta\gamma). \quad (25)$$

The financier's least cost solution for the incentive compatible contract becomes

$$\beta' = (1 + T^L)/\gamma, \quad \theta' = \beta'[\gamma^{1/p} - 1], \quad b' = \beta' - T^E. \quad (26)$$

With high η , agents prefer leisure. In response, financiers adjust the terms of contract and offer β' and θ' instead. We must show that this reaction on the part of financiers does not cause entrepreneurs to switch to shirking for income. We first show that the financiers' offer is $\beta = \beta'$ when (24) holds with equality for a value η^* , making entrepreneurs indifferent between the two alternatives. If financiers anticipate shirking for leisure and offer β' ,

and $g''(e) > 0$. Our formulation is thus equivalent to a utility function "that has attracted much of the attention in the literature on moral hazard" (see Mas-Colell, Whinston, and Green 1995, pp. 479–480).

then the entrepreneurs' indifference condition reads $1 = \eta^*(1 - \tau)\beta' = \eta^*x/[1 + \eta^*(1 - \delta)]$, where we write $x = (1 - \tau)(1 + T^L)$ for short. Collecting the terms with η^* , this condition implies $1 = \eta^*[x - (1 - \delta)] = \eta^*(1 - \tau)\beta$. The last equality follows from (13). This proves that financiers indeed offer $\beta = \beta'$ if the preference for leisure is η^* . With lower values of $\eta < \eta^*$, agents prefer shirking for income, and financiers offer a price β as in (13), which is independent of η . With the reverse inequality $\eta > \eta^*$, agents prefer shirking for leisure. Financiers anticipate this choice and offer a more risky compensation package to prevent shirking, i.e., β' as given in (26) declines with η . We must show that this will not cause agents to switch to shirking for income. Indeed, using (26), the total value $\eta(1 - \tau)\beta' = x/(1/\eta + 1 - \delta)$ rises with η . While the value of choosing work elsewhere stays constant in (24), the value of choosing leisure thus increases in η . Despite the more risky compensation package, entrepreneurs therefore clearly prefer leisure over more outside income, if the preference for leisure rises beyond η^* .

With these preliminaries, we can now state the central results for linear progressive income taxation and moral hazard when shirking takes the form of private benefits, or leisure. Proposition 5 contains the effects on contract cost, entrepreneurship, and welfare.

PROPOSITION 5 (Shirking for Leisure):

- (a) *Non-redistributive taxation is neutral.*
- (b) *With a small progressive tax, contract cost increases with transfers, $c_T = c - 1 > 0$, but is independent of the tax rate τ .*
- (c) *A small progressive tax retards entrepreneurship,*

$$\frac{dE}{d\tau} = -\frac{\alpha E^2}{1 - \alpha}(c - 1)\frac{dT}{d\tau} < 0, \quad \frac{dT}{d\tau} = 1 + (c - 1)E. \quad (27)$$

- (d) *The marginal welfare effect of a small progressive tax is zero,*

$$\frac{dW}{d\tau} = (c - 1)E - \frac{1 - \alpha}{c}c_T\frac{dT}{d\tau} = 0. \quad (28)$$

Proof: (a) Using (26) instead of (13), the proof is analogous to Proposition 1. (b) The contract in (26) is independent of the tax rate. Starting from an untaxed state, (26) gives $d\beta' = (1/\gamma)dT$, $db' = d\beta' - dT = (1 - \gamma)/\gamma dT$, and $d\theta' = \theta' dT$. The differential of $c = p\theta' + b'$ is $c_T = p\theta' + 1/\gamma - 1 = c - 1$, where $\beta' = b' = 1/\gamma$ in the untaxed state. (c) By (15), $dE = -\alpha/(1 - \alpha)E^2 dc$. The inequality (27) then results from part (b) and (19). (d) Following the proof of Proposition 4, we get the first equality in (28). Substituting the derivatives c_T and $dT/d\tau$ as noted above, and making use of (15), we find that the two terms in (28) cancel. ■

The results are qualitatively the same as in the preceding section, except for the welfare effect. Key to understanding these results is our specification of

preferences over real income and leisure, $V(u, l) = \ln[u(1 + \eta l)]$, implying that any joint multiplicative term such as the tax factor $1 - \tau$ falls out of the PC and IC constraints, see (25) and (11). In taxing all types of income in all states proportionally, the tax factor cannot affect occupational choice in (11). Since leisure enters multiplicatively, or additively in logs, and since income deriving from high effort and shirking are taxed with the same factor, the terms of the contract in (26) become independent of the tax rate, which explains part (b) of the proposition. However, the contract cost now increases with higher transfers, $c_T = c - 1 > 0$, rather than declines as in (20) of the preceding subsection. By the participation constraint, the entrepreneur's compensation must be more generous as well when the alternative of a worker's salary $1 + T$ increases. This inflates the cost of contract and, in zero-profit equilibrium, the innovative goods price Q . Consequently, the entrepreneurial sector contracts, see part (c). The welfare effect in part (d) is now readily explained. It involves two offsetting influences. First, redistribution converts risky to safe income, and raises the worker's disposable income, as in the first term of (28). Second, expected income of entrepreneurs must increase, which inflates the cost of contract and the innovative goods price in free entry equilibrium. The resulting price increase erodes real income and depresses welfare by exactly the same amount, leaving a zero *net* welfare effect.

We conjecture that the welfare result is not entirely robust but serves as a valuable benchmark. For tractability, and in line with most of the moral hazard literature, we have eliminated income effects in labor (effort) supply by specifying preferences as separable in real income and leisure, $V(u, l) = \ln(u) + B$, where B denotes the private benefit of shirking for leisure, $\ln(1 + \eta l)$. More importantly, we have imposed constant relative risk aversion of unity by choosing a logarithmic function for the utility of real income, or goods consumption.¹⁸ The effort decision as reflected in the incentive constraint reflects a trade-off between leisure and real income. This trade-off in general must depend on the relative price and, therefore, on the tax factor $1 - \tau$. With more general preferences, the contract is *not* independent of the tax rate any longer. For example, a higher income tax rate makes high effort for income less attractive than the private benefit of leisure, which should raise the tendency to shirk. To prevent moral hazard, the financier must offer less insurance and expose the agent to higher risk. By this channel, the tax rate must also affect the cost of contract.¹⁹ This cost effect will trigger

¹⁸As mentioned in Section 1, a coefficient of relative risk aversion of unity is not incompatible with empirical microevidence.

¹⁹Consider $V(u, l) = v(u) + B$, where $v(u)$ is concave and $B = \ln(1 + \eta l)$ is the private benefit. Writing real income as $u = zy$ with $z = (1 - \tau)/Q^{1-\alpha}$, constraints (11) and (25) emerge as

$$\text{PC: } p v(z(\theta + \beta)) + (1 - p) v(z\beta) \geq v(z(1 + T)),$$

$$\text{IC: } p v(z(\theta + \beta)) + (1 - p) v(z\beta) \geq v(z\beta) + B.$$

important general equilibrium price effects as in the previous sections. The derivative c_τ will enter Proposition 5, parts (b) and (d), much as in Propositions 2 and 4. The linear progressive tax might well have a welfare effect different from zero, presumably depending on the degree of risk aversion. Unfortunately, an explicit analysis is excessively cumbersome and does not yield transparent results.

5. Conclusions

In an economy with occupational choice and incomplete risk consolidation due to moral hazard, an income tax is neutral only when it avoids redistribution between workers and entrepreneurs. A linear progressive income tax is redistributive, however, when risk bearing entrepreneurs have higher income on average than workers. We found that a small redistributive tax may raise welfare when shirking aims at consuming extra outside income rather than leisure. The result generally reflects the fact that “lump-sum” redistribution is no longer lump-sum when the economy is subject to such an incentive constraint. The direction of the welfare effects is not easily anticipated, since it also depends on the general equilibrium effects on prices. In our framework, the welfare gain emerges despite the fact that the progressive tax raises agency costs of financiers and prices in the entrepreneurial sector, thereby reducing real income. Since they are net recipients of the tax transfer scheme, workers nevertheless turn out to gain from progressive taxation. Entrepreneurs also benefit from government provided insurance. Due to the occupational choice condition, their gain in expected utility exactly matches the welfare gain of workers.

An alternative specification of moral hazard is that shirking is meant to consume leisure rather than outside income. The basic neutrality with respect to a non-redistributive tax is retained. We found, however, that the marginal welfare gain of a linear progressive, redistributive income tax is reduced to zero. We argued that this result might not be robust when the degree of relative risk aversion differs from unity. Our results imply that great caution must be exercised when analyzing welfare effects of taxes in an economy with risk-averse agents subject to moral hazard. The nature of the shirking options and the exact specification of preferences might turn out critical. No general policy implications are readily available and each experiment needs to be evaluated separately. Note finally that the paper is confined to an analysis of progressive taxes in an economy with moral hazard but identical entrepreneurs. It might be interesting to investigate whether a progressive tax could play a useful role in selecting good entrepreneurs from bad ones when agents differ in ability. This must be left for future research.

Obviously, z does not cancel when utility is not logarithmic, or if the degree of relative risk aversion is different from unity. The solution then depends on both the tax factor and the goods price.

Appendix

Proof of Proposition 2: We first note how the tax rate and the uniform transfer enter in (13). Starting from a zero tax position, we have

$$d\beta = dT - (1 - \delta)d\tau, \quad db = -(1 - \delta)d\tau. \quad (A1)$$

The PC in (11) yields $p/(\theta + \beta)(d\theta + d\beta) + (1 - p)/\beta d\beta = dT$. Using (A1), we obtain the effect of the tax rate on θ ,

$$\frac{d\theta}{d\tau} = (1 - \delta) \left[1 + \frac{(1 - p)(\theta + \beta)}{p\beta} \right] > 0. \quad (A2)$$

In the case of transfers, we have $d\beta = dT$ by (A1). Evaluated in the zero tax state where $\beta = \delta$, the PC constraint now yields

$$\frac{d\theta}{dT} = \frac{\theta + \delta}{\delta} [X_1 - X_2] < 0, \quad X_1 \equiv \frac{\delta + p - 1}{p}, \quad X_2 \equiv \frac{\delta}{\theta + \delta}. \quad (A3)$$

We show $X_1 - X_2 < 0$. By (13), $\theta + \delta = \delta(\delta)^{-1/p}$, giving $X_2 = \delta^{1/p}$. Consider $X_1(\delta)$ and $X_2(\delta)$ for $0 < \delta < 1$. Since $X'_1(\delta) = 1/p$, we have $X'_2(\delta) = (\delta)^{1/p-1} X'_1(\delta)$. Furthermore, $X_1(1) = X_2(1) = 1$ and $X'_2(1) = X'_1(1) > 0$. The slope $X'_1(\delta)$ is independent of δ while $X'_2(\delta) < X'_1(\delta)$ for $\delta < 1$. Plotting the X schedules against δ shows that $X_1 - X_2 < 0$ for all $\delta < 1$, proving the sign of the partial derivative listed in (A3).

The change in contract cost is $dc = p d\theta + db$ which gives, upon using (A1)–(A3),

$$\begin{aligned} c_T &\equiv \frac{\partial c}{\partial T} = p \frac{\partial \theta}{\partial T} < 0, \\ c_\tau &\equiv \frac{\partial c}{\partial \tau} = p \frac{\partial \theta}{\partial \tau} + \frac{\partial b}{\partial \tau} = (1 - p)(1 - \delta) \frac{\theta}{\delta} > 0. \end{aligned} \quad (A4)$$

After some manipulations, (A3) and (A4) yield $c_T + c_\tau = p\theta + \delta - 1 = c - 1$, see the last result in (20). Finally, we must show $1 + Ec_T > 0$. From the arguments in (A3) we observe that $c_T \rightarrow 0$ for $\delta \rightarrow 1$.²⁰ A large δ thus establishes the desired result. Using (A4) and (A3), we have $c_T = [\delta - (1 - p)]\theta/\delta - (1 - \delta)$. Using (15), we thus have

$$1 + Ec_T = \frac{\alpha c + (1 - \alpha)\delta + [\delta - (1 - p)](1 - \alpha)\theta/\delta}{1 - \alpha + \alpha c}. \quad (A5)$$

The square bracket contains the sufficient condition noted in the proposition. ■

²⁰With full information, the entire time input is observed, i.e., $\delta = 1$. Without moral hazard, the financier buys the entire firm [$\theta = 0$ and $\beta = 1 + T$ by (13)] and offers full insurance. The risk premium disappears, $c \rightarrow 1$.

References

- ATTANASIO, O. P. (1999) Consumption, in *Handbook of Macroeconomics*, J. B. Taylor and M. Woodford, eds. North-Holland, 741–812.
- BLACK, J., and D. DE MEZA (1997) Everyone may benefit from subsidizing entry to risky occupations, *Journal of Public Economics* **66**, 409–424.
- BOADWAY, R., M. MARCHAND, and P. PESTIAU (1991) Optimal linear income taxation in models of occupational choice, *Journal of Public Economics* **46**, 133–162.
- BROWNING, M., L. P. HANSEN, and J. J. HECKMAN (1999) Micro data and general equilibrium models, in *Handbook of Macroeconomics*, John B. Taylor and Michael Woodford, eds. North-Holland, 543–633.
- BUCHHOLZ, W., and K. A. KONRAD (2000) Risiko und Steuern, in *Probleme der Besteuerung III*, Schriften des Vereins für Socialpolitik, N.F. Band 259/III, Norbert Ansel, ed. Berlin: Duncker & Humblot, 63–139.
- DE LA FUENTE, A., and J. M. MARIN (1996) Innovation, bank monitoring, and endogenous financial development, *Journal of Monetary Economics* **38**, 269–301.
- HOFF, K. (1994) The second theorem of the second best, *Journal of Public Economics* **54**, 223–242.
- HOFF, K., and A. B. LYON (1995) Non-leaky buckets: Optimal redistributive taxation and agency costs, *Journal of Public Economics* **58**, 365–390.
- GREENWALD, B. C., and J. STIGLITZ (1986) Externalities in economies with incomplete information and incomplete markets, *Quarterly Journal of Economics* **101**, 229–264.
- KANBUR, R. S. (1980) Risk-taking and taxation: An alternative perspective, *Journal of Public Economics* **15**, 163–184.
- KEUSCHNIGG, C., and S. B. NIELSEN (2000) Tax policy, venture capital, and entrepreneurship, CEPR DP 2626 and NBER WP 7976.
- KEUSCHNIGG, C., and S. B. NIELSEN (2003) Tax policy, venture capital, and entrepreneurship, *Journal of Public Economics* **87**, 175–203.
- KIHLSTROM, R. E., and J.-J. LAFFONT (1983) Taxation and risk-taking in general equilibrium models with free entry, *Journal of Public Economics* **21**, 159–181.
- MAS-COLELL, A., M. D. WHINSTON, and J. R. GREEN (1995) *Microeconomic Theory*. New York: Oxford University Press.
- TIROLE, J. (2001) Corporate governance, *Econometrica* **69**, 1–35.
- VARIAN, H. R. (1980) Redistributive taxation as social insurance, *Journal of Public Economics* **14**, 49–68.