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On the Effects of Redistribution on Growth and Entrepreneurial Risk–Taking

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Abstract

This paper investigates the redistributive effects of taxation on occupational choice and growth. We discuss a two–sector economy in the spirit of Romer (1990). Agents engage in one of two alternative occupations: either self–employment in an intermediate goods sector characterized by monopolistic competition, or employment as an ordinary worker in this sector. Entrepreneurial profits are stochastic. The occupational choice under risk endogenizes the number of firms in the intermediate goods industry. While the presence of entrepreneurial risk results in a suboptimally low number of firms and depresses growth, non–linear tax schemes are partly capable of compensating the negative by effects by *ex post* providing a social insurance.

Keywords: OLG, endogenous growth, entrepreneurship, occupational choice, redistributive taxation

JEL–classification: D31, E62, O41, P16

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1 Introduction

This paper investigates the effects of redistributive taxation on occupational choice and long–run growth. The analysis combines the issue of occupational choice under risk in the tradition of Kihlstrom and Laffont (1979) and Kanbur (1979*a*,*b*, 1980) with modern approaches to endogenous growth à la Romer (1990) or Grossman and Helpman (1991) in the framework of a macroeconomic overlapping generations model. The paper thus adopts the Knightian view on the role of entrepreneurship (Knight, 1921), considering risk–bearing to be an essential task of entrepreneurs.

In the model suggested here, the long–run growth rate of the economy is positively correlated with the population share of entrepreneurs. This reflects recent empirical observations by Audretsch and Thurik (2000), Audretsch *et al.* (2002) as well as Carree *et al.* (2002), who find for a cross section of 23 OECD countries that entrepreneurship is a vital determinant for economic growth.

The agents engage in one of two alternative occupations: Either they set up a firm in a market of monopolistic competition, which exposes them to a non–diversifiable profit risk. Or they decide to be a worker in this sector, thereby earning a safe wage income. Non–surprisingly, the attitude towards risk turns out to play central role for the extent of entrepreneurial risk–taking, a finding which is empirically supported by Cramer *et al.* (2002) and Ilmakunnas *et al.* (1999).

We observe two counteracting forces. On the one hand, the prospect of yielding monopoly profits provides an incentive to set up a firm. On the other hand, risk averse agents are concerned with avoiding the income risks being associated with self–employment. The latter negative incentive effect prevails, such that the market equilibrium is characterized by a suboptimally low number of monopoly firms in the intermediate goods sector. This carries over to the long–run growth rate of the economy, which is a function of the population share of entrepreneurs. Hence, our approach also provides an explanation for the empirically documented negative relationship between risk and growth (Ramey and Ramey, 1995).

The riskiness of self–employment is also expressed in high failure rates of entrepreneurial ventures (cf. Quadrini, 1999). According to U. S. data from the Panel Study of Income Dynamics (PSID), first year exit rates amount to 35%. Heaton and Lucas (2000) point out that the incomes of entrepreneurs exhibit a considerably higher volatility than wage incomes, although evidence on the

return to private (entrepreneurial) equity relative to public equity hardly indicates the presence of a positive risk premium; see also Moskowitz and Vissing-Jørgensen (2002). Germany experienced an ongoing growth in business failures throughout the last decade, in absolute numbers from about 11,000 in 1992 to 40,000 in 2004. Recent data from the German "Bundesagentur für Arbeit" reveal that about one fifth of the participants in the specific public program subsidizing small start–up enterprises ("Ich–AG") left the market within the first two years.

If now the presence risk goes along with less entrepreneurial activity and subsequently lower growth, a natural question to ask is to what extent an appropriately designed public tax–transfer–scheme might stimulate firm ownership, if private markets for pooling individual risks are not available due to credit market imperfections or moral hazard problems. These considerations draw from an argument first brought forward by Varian (1980), Eaton and Rosen (1980) and Sinn (1996). The authors point out that redistributive taxation — being effective *ex post* — acts as a social insurance, thereby providing incentives to already increase risk–taking from an *ex ante* point of view.

Carried over to the context discussed here, the argument suggests that an increase in redistribution causes a rise in the number of agents choosing to be an entrepreneur, hence ultimately promoting growth, although the *ex ante* extent of income inequality becomes larger too. Our subsequent analysis makes explicit the conditions under which this line of argument yields the desired results and when it fails to do so.

The important role which entrepreneurial risk might play for long–run growth has been of little interest, when we review the development of modern growth theory throughout the last two decades. Authors like Romer (1990), Grossman and Helpman (1991) or Aghion and Howitt (1992) emphasize the Schumpeterian view on entrepreneurship. The contributions stress the innovative potential of firm ownership by focusing on R&D efforts and associated monopoly profits due to exclusive property rights. But even if innovations are considered to follow random processes, those firms undertaking research are usually assumed to be indifferent towards risk.

A notably exception is the contribution of Garcia Peñalosa and Wen (2004) who, similar to Clemens (2004), establish a causality between individual income risk, entrepreneurship, and growth. Garcia Peñalosa and Wen (2004) focus on the riskiness of innovations in the R&D sector, yet, at the cost of not

taking into account the intertemporal savings decision and the accumulation of physical capital. Contrary, in our model, occupational choice affects the long–run growth rate of the economy via the equilibrium return to capital. This enables us to derive more general results regarding the growth and welfare effects of redistribution.

The paper is organized as follows: the overlapping generations general equilibrium model is developed in the next section, which also characterizes optimal individual behavior of households and firms in the intermediate as well as in the final goods sector. Section 3 introduces the non–linear redistributive tax–transfer–scheme and also describes the equilibrium occupational choice under risk. Section 4 determines the market equilibrium and the long–run growth rate of the economy. We examine the growth and welfare effects of changes in the amount of redistribution due to changes in the degree of tax progression.

2 The Model

Households We consider a discrete–time overlapping generations economy in the tradition of Samuelson (1958) or Diamond (1965). The identical households live for two periods. We normalize the population size of each cohort to unity. There is no population growth. Each member of the young generation is endowed with one unit of labor, which she supplies inelastically. At the beginning of their life, citizens choose between two alternative types of occupation. They can decide either to set up a firm and become a monopolistic entrepreneur in the intermediate goods industry, or they become employed in this sector. λ_t denotes the share of entrepreneurs within the generation which is active in period t. The corresponding share of workers is given by $1-\lambda_t$.

While employment is payed the riskless wage income w, self–employment yields risky profits π_j per monopoly j. The risk stems from a idiosyncratic technology shock. By the time the households choose between the occupations, they do not know the realization of the shock.

By the time they compose their intertemporal consumption profile, the income realization is known and the agents act under perfect foresight. We assume the costs of switching between occupations to be prohibitively high, such that the employment decision once made is irreversible. All individuals retire after the first period. When old, savings and interest payments are used to finance retirement consumption. There are no bequests.

The individuals spend their income on a single final good, which can be consumed or invested respectively. Lifetime utility of a member of a cohort i is additively–separable and given by

$$U\left(c_{i,t}, c_{i,t+1}\right) = \frac{1}{1-\rho}\left[c_{i,t}^{1-\rho} + \beta\, c_{i,t+1}^{1-\rho}\right], \quad \rho > 0\,. \tag{1}$$

The current period utility functions are characterized by constant relative risk aversion, measured by the parameter ρ. For simplicity, the attitude towards risk is assumed to be identical for all agents, although Kihlstrom and Laffont (1979), Kanbur (1981), and Cramer *et al.* (2002) stress, that the entrepreneurial occupation is more likely to be chosen by agents who are less risk averse.[1] The agents discount future consumption, where the discount factor β satisfies $0 < \beta < 1$.

Let $y_{i,t}$ denote the period t income of a member of generation i, where this income is either wage income or profit income. Then, the intertemporal budget constraint can be written as follows

$$\begin{aligned} c_{i,t} &= y_{i,t} - s_{i,t}\,, \\ c_{i,t+1} &= s_{i,t} R_{t+1}\,. \end{aligned} \tag{2}$$

R_{t+1} is the gross rate of interest paid on savings held from period t to period $t+1$.

Because we assumed the income realizations to be known by the time of intertemporal choice, optimization is performed under certainty and yields the familiar Euler condition

$$U'(c_{i,t}) = \beta R_{t+1} U'(c_{i,t+1})\,. \tag{3}$$

Given the functional form of utility (1), we arrive at the following savings function

$$s_{i,t} = \phi(R_{t+1})\, y_{i,t} = \frac{1}{1+\beta^{-1/\rho}\, R_{t+1}^{(\rho-1)/\rho}}\, y_{i,t}\,, \tag{4}$$

which implies that all period t households save the identical fraction $\phi(R_{t+1})$ of the individual income earned, while being economically active.

Given optimal savings, (1) can be used to express maximized lifetime utility of agent i active in generation t as a function of his income $y_{i,t}$

$$U\left(c_{i,t}, c_{i,t+1}\right) \equiv V(y_{i,t}) = \frac{\beta\, R_{t+1}^{1-\rho}\, \phi(R_{t+1})^{-\rho}}{1-\rho}\, y_{i,t}^{1-\rho}\,. \tag{5}$$

[1] Incorporating heterogeneity with respect to the degree of risk aversion is a worthwhile extension of the model, but beyond the scope of this paper.

Occupational choice is related to the labor market and intermediate goods market equilibrium and will be discussed below.

Final goods sector The representative firm of the final goods sector produces a homogeneous good Q_t using capital K_t and varieties of a differentiated intermediate good $\{x_{j,t}\}_{j=0}^{\lambda_t}$ as inputs. Production in this sector takes place under perfect competition and the price of Q_t is normalized to unity. We assume a production function of the generalized CES–form; see Spence (1976), Dixit and Stiglitz (1977) and Ethier (1982).

Ongoing growth of per capita incomes is facilitated through human capital externalities à la Romer (1986) such that, in the aggregate, production is linear in the capital stock and displays increasing returns to scale. The production technology of the final goods sector is given as follows

$$Q_t = A K_t^{1-\alpha} \bar{K}_t^{\alpha} \int_0^{\lambda_t} x_{j,t}^{\alpha} \, \mathrm{d}\, j \,, \tag{6}$$

with $0 < \alpha < 1$, $A > 0$. $\bar{K}_t$ denotes the aggregate stock of capital, which the individual firm takes as exogenously given and therefore neglects in optimization.

We identify each type of intermediate good employed in the production of the final good with one monopolistic producer in the intermediate goods sector. Consequently the number of different types is identical with the population share of entrepreneurs in the economically active generation. Additive–separability of (6) in intermediate goods ensures that the marginal product of input j is independent of the quantity employed of $j' \neq j$. The intermediate goods are close but not perfect substitutes in production, with the elasticity of substitution between goods j and j' given by $\varepsilon_{j,j'} = 1/(1-\alpha)$.

The time t profit of the representative firm in the final goods sector is given by

$$\Pi_t = Q_t - r_t K_t - \int_0^{\lambda} p_{j,t} x_{j,t} \, \mathrm{d}\, j \,, \tag{7}$$

where p_j denotes the price of intermediate good j. We further assume a constant rate δ of depreciation of physical capital over time, such that the interest factor is given by $R_t = 1 + r_t - \delta$. Optimization then yields the profit maximizing

factor demand conditions from marginal productivity theory

$$K_t = (1-\alpha)\,\frac{Q_t}{r_t}\,, \tag{8}$$

$$x_{j,t} = \left(\frac{\alpha A K_t}{p_{j,t}}\right)^{1/(1-\alpha)}\,, \tag{9}$$

where we also make use of the fact that in equilibrium $K_t = \bar{K}_t$. The monopolistic producer of intermediate good x_j faces the isoelastic demand function (9), with the direct price elasticity of demand given by $\varepsilon = -\frac{1}{1-\alpha}$.

Intermediate goods sector The intermediate goods sector is populated by a large number λ_t of small firms, each producing a single variety j of a differentiated good. The producers engage in monopolistic Bertrand competition. Labor L_t is the single input of production. We assume that all the monopolists of the intermediate sector produce according to the identical constant returns to scale technology of the form

$$x_{j,t} = \theta_{j,t}\, L_{j,t}\,. \tag{10}$$

Firms differ only with respect to the realization of the idiosyncratic (firm specific) productivity shock θ_j with density $\theta_j \in \Theta \subset \mathbb{R}^{++} : f(\theta)$, which is assumed to be non–diversifiable, uncorrelated across firms and lognormally distributed, with mean $\mathrm{E}[\ln\theta] = \bar{\theta}$ and variance $\mathrm{Var}[\ln\theta] = \sigma^2$. Similar to Kanbur (1979*b*), we posit that the entrepreneurs hire labor after the draw of nature has occurred. This also implies that workers do not face a layoff risk. Recall that earlier we assumed the costs of changing occupations to be prohibitively high, such that agents are prevented from switching between groups in case of unfavorable realizations of the shock.

Given (9) and (10), the time t profit of a typical producer in this sector then reads as

$$\pi_{j,t} = \left(\frac{\alpha A K_t}{p_{j,t}}\right)^{1/(1-\alpha)} \left[p_{j,t} - \frac{w_t}{\theta_{j,t}}\right]\,. \tag{11}$$

The firm problem essentially is a static one. Under perfect competition on the labor market, the producer treats the wage rate w_t as exogenously given. Price setting behavior implies the following solution for the monopoly price

$$p_{j,t} = \frac{w_t}{\alpha\theta_{j,t}}\,. \tag{12}$$

The profit maximizing price of a typical entrepreneur in the intermediate goods market is the markup $1/\alpha > 1$ over the marginal costs of production.

Using the demand function for intermediate good j given by equation (9), mark–up pricing then results in the following quantity produced of each intermediate good j

$$x_{j,t} = \left(\frac{\alpha^2 A K_t \theta_{j,t}}{w_t} \right)^{\frac{1}{1-\alpha}} . \tag{13}$$

By substitution into (10), we derive the labor demand of entrepreneur j as follows

$$L_{j,t} = \left(\frac{\alpha^2 A K_t \theta_{j,t}^{\alpha}}{w_t} \right)^{\frac{1}{1-\alpha}} . \tag{14}$$

Labor market The labor market is characterized by perfect competition. The equilibrium wage rate can then be derived upon equating the aggregate labor supply with expected labor demand. If we take account of (14), the i. i. d. property of the firm–specific technology shock and the characteristics of the underlying distribution, the aggregate labor demand is given by[2]

$$L_t = \lambda_t \left(\frac{\alpha^2 A K_t}{w_t} \right)^{\frac{1}{1-\alpha}} \exp\left[\frac{\alpha}{1-\alpha} \left(\bar{\theta} + \frac{\alpha}{1-\alpha} \frac{\sigma^2}{2} \right) \right] . \tag{15}$$

The aggregate labor supply equals the population share of workers, $L_t = 1 - \lambda_t$, due to the normalization of population size. Equating this expression with (15) allows us to solve for the market clearing wage rate w_t

$$w_t = w(K_t, \lambda_t) = \alpha^2 A K_t \left(\frac{\lambda_t}{1-\lambda_t} \right)^{1-\alpha} \exp\left[\alpha \left(\bar{\theta} + \frac{\alpha}{1-\alpha} \frac{\sigma^2}{2} \right) \right] . \tag{16}$$

The equilibrium wage rate is a function of the yet undetermined population shares of workers and entrepreneurs. Since we are dealing with a general equilibrium model, each change in the number of firms simultaneously affects aggregate labor supply and therefore the market clearing prices.

Given the equilibrium wage rate, it is now possible to derive a closed–form solution for the output level of a single entrepreneur

$$x_{j,t} = \theta_{j,t}^{\frac{1}{1-\alpha}} \left(\frac{1-\lambda_t}{\lambda_t} \right) \exp\left[-\frac{\alpha}{1-\alpha} \left(\bar{\theta} + \frac{\alpha}{1-\alpha} \frac{\sigma^2}{2} \right) \right] . \tag{17}$$

[2]There is no aggregate risk by the law of large numbers. Note that the assumption stated on the properties of the underlying distribution of shocks only refers to the sub–population of entrepreneurs measured by the share λ of the entire population.

We proceed with the determination of the equilibrium profit income of monopolist j in the intermediate goods market. Substituting (16) and (12) into (11) yields

$$\pi_{j,t} = \theta_{j,t}^{\frac{\alpha}{1-\alpha}} \alpha(1-\alpha) A K_t \left(\frac{\lambda_t}{1-\lambda_t}\right)^{-\alpha} \exp\left[-\frac{\alpha^2}{1-\alpha}\left(\bar{\theta} + \frac{\alpha}{1-\alpha}\frac{\sigma^2}{2}\right)\right] \equiv \theta_{j,t}^{\frac{\alpha}{1-\alpha}} \pi(K_t, \lambda_t). \tag{18}$$

The profit income of a typical producer j in the intermediate goods industry also depends on the equilibrium distribution of agents over occupations. Additionally, entrepreneurial incomes are positively related to the existing capital stock and the realization of firm–specific technology shock.

Having so far derived the equilibrium values of individual incomes, we are now able to determine the aggregate level of income Y_t generated in the intermediate goods sector, which equals overall income of the young generation being economically active in period t. It is given by the weighted average of individual incomes

$$\begin{aligned} Y_t &= (1-\lambda)\, w(K_t, \lambda) + \lambda \pi(K_t, \lambda)\, \mathrm{E}\left[\theta_{j,t}^{\frac{\alpha}{1-\alpha}}\right] \\ &= \alpha A K_t\, \lambda^{1-\alpha} (1-\lambda)^{\alpha} \exp\left[\frac{\alpha}{1-\alpha}\left(\bar{\theta} + \frac{\alpha}{1-\alpha}\frac{\sigma^2}{2}\right)\right]. \end{aligned} \tag{19}$$

Mean income in the intermediate goods sector also crucially depends on the size of the population shares of workers and entrepreneurs. Irrespective of the equilibrium outcome of occupational choice to be determined below, it is a worthwhile question to ask, whether there exists an 'optimal' population share of firms yielding a maximum output level in this sector. Indeed we find that the fraction $\lambda^* = 1-\alpha$ maximizes the aggregate income of the young generation.

3 A Redistributive Tax–Transfer–Scheme

As the productivity of the monopolistic firm is unknown at the time of decision, agents deciding to become entrepreneurs face an income risk. The individuals only possess information regarding the distributional properties of the productivity shocks. Consequently, we expect risk averse agents to show a certain behavior of risk avoidance by already adapting to the uncertain environment in advance.

In what follows, we assume that risk–pooling arrangements, which perfectly diversify the individual risk, are not available. The cause can, for instance, lie

in credit market imperfections or problems of moral hazard. If instead full risk sharing was possible *ex ante*, all individuals of the young generation would receive the identical mean income Y_t, as given by (19). This makes agents identical on an *a priori* level. But then the problem arises that the model lacks a selection mechanism allocating individuals among the two occupations and simultaneously establishing the income maximizing number of firms $\lambda^* = 1 - \alpha$.

Hence, under the assumption of incomplete insurance markets, a redistributive public tax–transfer–scheme provides *ex post* at least a partial insurance against the idiosyncratic income risk. Already Varian (1980) and Sinn (1996) pointed out that the insurance effect of redistribution might positively affect the individual inclination towards risk–bearing. If we carry this argument over to the present context, we expect a larger fraction of agents already *ex ante* choosing the entrepreneurial profession in the knowledge that part of the income risk will be socialized afterwards.

In what follows, we introduce a nonlinear tax–transfer–scheme, which is only imposed upon members of the young and economically active generation. Members of the retired generation are neither taxed nor do they receive any transfers, thereby making sure that the intertemporal allocation is not subject to distortionary taxation. Government intervention serves the sole purpose of redistributing market incomes earned in the intermediate goods sector. It maps pretax incomes into post tax incomes, thereby providing at least some insurance against the idiosyncratic productivity risks of entrepreneurs.

With $y_{i,t}$ denoting an agent's pretax income, his post tax income $\hat{y}_{i,t}$ results according to the following scheme, previously employed by Bénabou (1996, 2000), Feldstein (1969) and Kanbur (1979*b*):

$$\hat{y}_t^i = {y_t^i}^{1-\tau} B_t \,, \quad \tau \leq 1 \,. \tag{20}$$

B_t denotes a lump–sum transfer and can be interpreted a some kind of subsistence income each agent receives. The progressivity of the redistributive scheme is measured by the elasticity of post–tax investment τ. For $\tau > 0$, the marginal rate rises with pretax income, for $\tau < 0$ the scheme is regressive. The level of the transfer B_t is indirectly determined by the government's budget constraint which requires net transfers summing to zero:

$$\int_0^1 y_t^i \,\mathrm{d}\, i = \int_0^1 {y_t^i}^{1-\tau} B_t \,\mathrm{d}\, i = \int_0^1 \hat{y}_t^i \,\mathrm{d}\, i \,. \tag{21}$$

Figure 1 displays the redistributive scheme for the case of progressive taxation. Those agents, whose incomes exceed the threshold of $B^{1/\tau}$ carry a net burden,

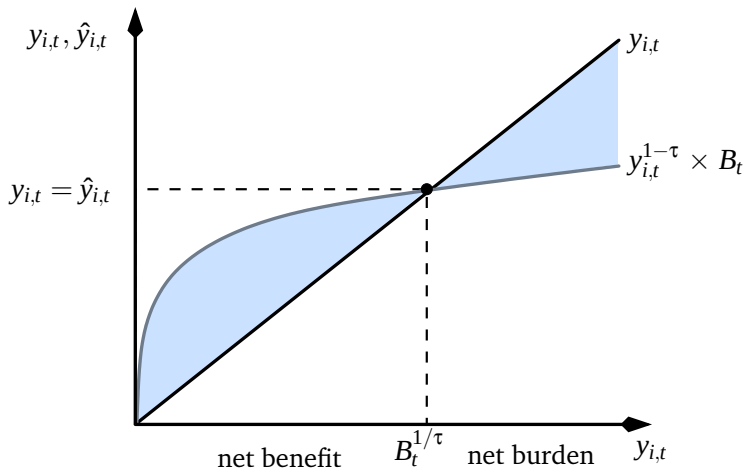

Figure 1: The redistributive tax–transfer–scheme

while those characterized by a low pre–tax income $y_t^i < B_t^{1/\tau}$ receive a net benefit from redistribution.

Equilibrium occupational choice An equilibrium distribution of households over the two types of occupation is characterized by a situation, where for a given redistributive tax transfer scheme, the marginal agent *ex ante* does not benefit from switching between occupations. This is tantamount to expected lifetime utility of an entrepreneur being equal to the lifetime utility of a worker.

Since the equilibrium wage rate is safe, by substitution of (16) into lifetime utility (5) and taking account of (20), the intertemporal welfare of a worker can simply be derived as $V\left(w(K_t,\lambda_t)^{1-\tau}B_t\right)$. The expected lifetime utility of being an entrepreneur in the intermediate goods sector in t can be determined as follows

$$\mathrm{E}\left[V\left(\theta_{j,t}^{\frac{\alpha}{1-\alpha}(1-\tau)}\pi(K_t,\lambda_t)^{1-\tau}B_t\right)\right]. \tag{22}$$

Equating $V\left(w(K_t,\lambda_t)^{1-\tau}\tilde{y}_t^{\tau}\right)$ with (22) finally yields the equilibrium population share of monopolists in the intermediate goods industry

$$\lambda_t = \frac{1-\alpha}{1-\alpha+\alpha\exp\left\{\left[1-(1-\rho)(1-\tau)\right]\frac{\alpha^2\sigma^2}{2(1-\alpha)^2}\right\}}. \tag{23}$$

We find $0<\lambda<1$, hence (23) is an interior solution. The population shares are constant in equilibrium and depend on the primitives of the model, that is the

degree of risk aversion ρ, the variance of the technology shock σ^2, the elasticity of substitution between two arbitrary intermediate goods j and j', implicitly measured by α, and finally, the degree of tax progression τ.

From (23), we immediately obtain the following result regarding the relationship between the equilibrium share of entrepreneurs and the extent of redistribution:

Proposition 1 (Redistribution and entrepreneurship) *The equilibrium share of entrepreneurs λ is time invariant. It is decreasing in the degree of risk aversion ρ as well as in the variance of the productivity shock σ^2. The effect of redistribution on the equilibrium share of entrepreneurs is ambiguous. λ is increasing in τ if $\rho > 1$, decreasing in τ if $\rho < 1$ and independent of τ if $\rho = 1$.*

Thus, whether or not the insurance effect accompanying a larger extent of redistribution actually stimulates entrepreneurship crucially depends on the degree of risk aversion, which we assumed to be uniform throughout the society. This result originates from the fact that redistribution gives rise to two counteracting effects on the share of entrepreneurs λ. The first one is the *direct* effect of redistribution. As already proposed by Varian (1980) and Sinn (1996), an increase in τ reduces the risk associated with post–tax profits, thus encouraging entrepreneurship. The second *indirect* one stems from the general equilibrium nature of our model. A rise in the number of entrepreneurs is tantamount to a decline in the populations share of workers, making labor more scarce and inducing a rise in the market–clearing wage rate. From an *ex ante* viewpoint, the safe profession becomes more attractive which establishes a negative incentive towards firm ownership.

If the agents' attitude towards risk is sufficiently low (i. e. $\rho < 1$), the second effect dominates the first one, such that the number of firms decreases as τ rises. Extending the amount of redistribution promotes entrepreneurship only, if the degree of risk aversion is sufficiently large, that is $\rho > 1$.

4 Market Equilibrium and Steady State Growth

The market for intermediate goods is cleared, if aggregate demand for goods $x_{j,t}$ equals aggregate supply. By utilizing equation (17), the equilibrium output of the final good can be derived as follows

$$Q_t = AK_t (1-\lambda)^{\alpha} \lambda^{1-\alpha} \exp\left[\alpha\left(\bar{\theta} + \frac{\alpha}{1-\alpha}\frac{\sigma^2}{2}\right)\right] . \tag{24}$$

From the first–order condition (8), we further get the market clearing rate of return to physical capital r_t as determined by marginal productivity theory. Hence, the gross rate of interest can be derived as follows

$$R_t = R(\lambda) = 1 - \delta + A(1-\alpha)\lambda^{1-\alpha}(1-\lambda)^{\alpha} \exp\left[\alpha\left(\bar{\theta} + \frac{\alpha}{1-\alpha}\frac{\sigma^2}{2}\right)\right] . \qquad (25)$$

The interest rate is constant for all t and also is a function of the equilibrium share of entrepreneurs λ.

Aggregate time t savings are undertaken by the members of the young generation, that is $S_t = \phi[R(\lambda)]Y_t$. Given (19), we therefore end up with the following growth rate γ of the economy

$$1 + \gamma(\lambda) = \phi[R(\lambda)]\,\alpha A \lambda^{1-\alpha}(1-\lambda)^{\alpha} \exp\left[\frac{\alpha}{1-\alpha}\left(\bar{\theta} + \frac{\alpha}{1-\alpha}\frac{\sigma^2}{2}\right)\right] - \delta . \qquad (26)$$

Apparently, the growth rate also crucially depends of the number of firms in the intermediate goods sector. From this follows:

Proposition 2 (Entrepreneurship and economic growth) *The growth rate of the economy γ is a non–monotonic function of the equilibrium population share of entrepreneurs. The growth rate is maximized if the fraction of firms equals $\lambda^* = 1-\alpha$. It is is increasing in λ for $\lambda < \lambda^*$ and decreasing in λ for $\lambda > \lambda^*$.*

The equilibrium value for the share of entrepreneurs in the absence of any public intervention (i. e. $\tau = 0$) can be obtained from (23) as follows

$$\lambda\big|_{\tau=0} = \frac{1-\alpha}{1-\alpha+\alpha\exp\left\{\dfrac{\rho\alpha^2\sigma^2}{2(1-\alpha)^2}\right\}} . \qquad (27)$$

A closer look at (27) reveals that, in a situation without public intervention, the growth rate is suboptimally low, since $\lambda_{\tau=0} < 1-\alpha$ for all $\rho, \sigma > 0$ and $0 < \alpha < 1$. This results reflects the risk avoiding behavior of risk averters, who sacrifice potential profits in favor of earning safe wage incomes. The fraction of agents choosing the entrepreneurial profession is too small, compared e. g. to a riskless environment.

Concerning the relationship between redistributive policies and long–run growth, we can state the following:

Proposition 3 (Redistribution and economic growth) *For $\rho > 1$, an increase in the extent of redistribution as measured by a corresponding increase in τ leads*

to a rise in the growth rate γ of the economy. The growth rate declines with more redistribution, if $\rho > 1$, while changes in redistributive policies leave the growth rate of the economy unaffected, if $\rho = 1$.

Let us now first consider the case of a society with a low degree of risk aversion, such that $\rho < 1$. Starting from a situation without redistribution (i e. $\tau = 0$), the growth rate increases with a rising fraction of entrepreneurs. According to Proposition 1, this only achieved by means of implementing a regressive tax–transfer–scheme, characterized by $\tau < 0$. From equation (23) it follows that the tax rate τ^* associated with the growth maximizing share of entrepreneurs $\lambda^* = 1 - \alpha$ can be determined as:

$$\tau^* = \frac{\rho}{\rho - 1} .$$

If, instead, the society is characterized by a comparably high degree of risk aversion, such that $\rho > 1$, a progressive tax–transfer–scheme fosters entrepreneurship and subsequently economic growth. Since the growth rate is monotonically increasing in τ, this implies that the greater the extent of redistribution the larger the growth rate. However, contrary to the case of a comparably small risk aversion, no redistributive scheme exists, which supports the growth maximizing number of firms. Even in the limiting case $\tau \to 1$ of complete *ex post* redistribution of incomes, the growth rate of the economy is smaller than the one associated with $\lambda^* = 1 - \alpha$.

Moreover, a problem similar to the one already discussed above for perfect *ex ante* risk–pooling emerges. The agents know in advance that market incomes will be perfectly redistributed afterwards. Hence, they are *ex ante* indifferent between the two occupations. Since equating expected utilities does not work in this case, the model again lacks a selection mechanism, allocating agents among the professions. Any arbitrary population fraction of firms $\lambda \in (0,1)$ may result, which by no means necessarily has to be equal to $\lambda^* = 1 - \alpha$.

Finally notice that, unlike in deterministic models of endogenous growth, maximization of the growth rate of the economy and maximization of welfare not necessarily coincide in case of stochastic growth models. The equilibrium distribution of individuals among occupations resulting from utility maximizing behavior does not inevitably maximize the long–run growth rate of the economy and subsequently overall income.

Income distribution and welfare Our model yields straightforward results concerning the distributional consequences of redistributive policies in the economically active generation. Income inequality unambiguously declines among the members of the young generation as τ rises.

Regarding the relationship between inequality, redistribution, and growth, we find that this is primarily governed by the mechanisms already described in Proposition 3. Long–run growth in a society with a comparably low aversion towards risk (i. e. $\rho < 1$) is positively affected by a decrease in the degree of tax progression, which is accompanied by an increase in income inequality. Contrary, in a society of relatively strong risk averters (i. e. $\rho > 1$) growth improvements are only achieved by means of a more progressive tax scheme, thereby also yielding less income inequality.

If it comes to the welfare effects of changes in redistributive policies, these can be evaluated by comparing the pure market equilibrium without public intervention to the allocation resulting from the implementation of a specific tax–transfer–scheme, if we additionally assume that in $t = 0$ the tax rate is immediately effective and then remains constant over time for all $t = 0, 1, \ldots, \infty$.

Let us now first consider the effects occurring when the fiscal scheme gets implemented in period $t = 0$. Due to the insurance effect of progressive taxation, the net income of an agent born in $t = 0$ will increase. If the degree of risk aversion in the society is comparably large (i. e. $\rho > 1$), the population share of entrepreneurs will increase too. This raises output in the intermediate as well as in the final goods sector and will also increase the marginal productivity of physical capital. A rise in the real interest rate then immediately carries over to a larger long–run growth rate of the economy. Simultaneously, the income of the currently old generation increases too, due to the rise in capital returns. From this follows that the static as well as the dynamic effects of a progressive tax–transfer–scheme are unambiguously positive, since not only the young generation born in $t = 0$ as well as the currently old one benefits from redistribution. Additionally, all future generations experience an increase in their expected lifetime utility. A larger extent of *ex post* redistribution in the case of $\rho > 1$ induces positive welfare effects and therefore reflects a Pareto–improvement, despite the fact that the degree of *ex ante* inequality becomes larger.

From a welfare point of view, this result inevitably suggests perfect redistribution to be the measure of choice, where the limiting case $\tau \to 1$ results in

complete *ex post* equality of individual incomes. Again, this gives rise the problem of indeterminate occupational choice which we already described above. A way out of this dilemma could be to take account of efficiency costs of redistribution which usually accompany public interventions into market outcomes. If we also considered distortionary effects — for instance, within the labor–leisure choice — the determination of an optimal tax rate might as well yield an interior solution, weighing the costs against the benefits from redistribution.[3]

Let us now switch to the case of a sufficiently low degree of risk aversion in the society, that is $\rho < 1$. Contrary to the high risk aversion scenario discussed above, here, increases in the extent of redistribution can never yield Pareto–improvements. A rise in tax progressivity induces a decline in the population share of entrepreneurs which is followed by a corresponding decline in the output levels in both, the intermediate and the final goods sector. The market clearing wage rate falls as well as the equilibrium return to capital does, which ultimately depresses long–run growth. If we sum up the associated welfare effects, we observe that, due to lower wages, lifetime utility of a worker declines. Moreover members of the initially old generation are harmed too, due to the income losses resulting from the decrease in capital return. The dynamic effects of less growth also erode welfare of future generations.

This conclusion also holds for an arbitrarily chosen regressive tax–transfer–scheme (i. e. $\tau < 0$). Although growth and welfare effects relating to future generations are generally positive in this case, the first generation gets harmed due to an increase in income inequality. This generation cannot be compensated by the future benefits of regressive taxation. Hence a rise in the degree of tax regression cannot be valued a Pareto–improvement.

The welfare results we derive in our model stand at odds to the conclusions Garcia Peñalosa and Wen (2004) derive in a closely related framework. They generally assume a comparably low degree of risk aversion (i. e. $\rho < 1$) and demonstrate that Pareto–improvements are possible if certain conditions are met. The differing outcomes can mainly be ascribed to the fact that Garcia Peñalosa and Wen (2004) abstract from capital accumulation and therefore do take account of welfare consequences for the currently old generation.

[3] At the moment our model neglects such distortions. A comparably easy way to introduce efficiency costs is to assume that the amount $\int_0^1 \tilde{y}$ to be redistributed by the government falls short of the level of pre–tax income $\int_0^1 y_t^i$ by a factor $\kappa(\tau)$ which is increasing in the degree of tax progression τ.

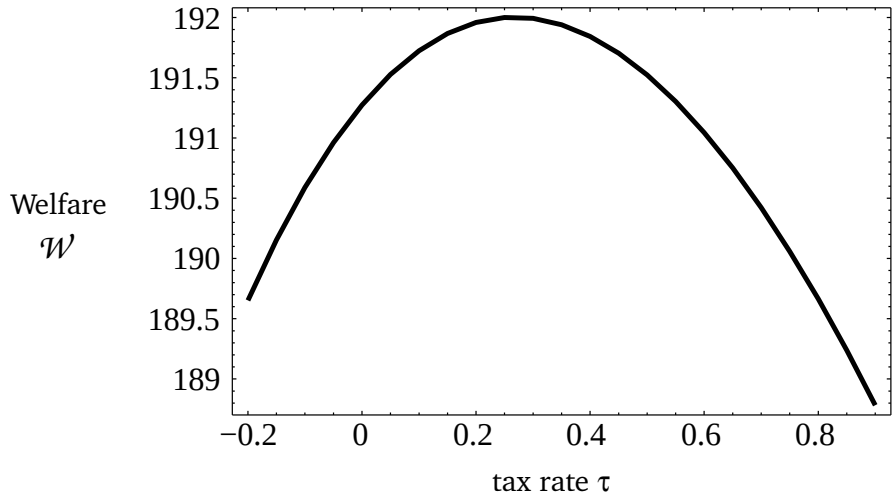

Figure 2: *Welfare and tax progression*

Even if redistribution does not not always allow for Pareto–improvements in their model, Garcia Peñalosa and Wen (2004) demonstrate by using a utilitarian social welfare function and providing numerical simulations that the welfare maximizing redistributive scheme at least is always characterized by progressive taxation. Transferred to the context discussed here, overall welfare in the society can be expressed as the discounted sum of future *ex ante* expected lifetime utilities $\mathcal{W}$:

$$\mathcal{W} = \sum_{t=0}^{\infty} b^t V\left(w(K_t,\lambda)^{1-\tau} B_t\right), \quad 0 < b < 1 . \tag{28}$$

Assuming this utilitarian welfare measure, we are able to derive results similar to Garcia Peñalosa and Wen (2004) for appropriate parameterizations of the model.[4] Figure 2 shows that the degree of tax progression maximizing the discounted sum of expected utilities is positive.

5 Conclusions

This paper combined an OG two–sector model of endogenous growth with the issue of occupational choice under risk in order to analyze the effects of redistributive taxation on macroeconomic performance and welfare. It was motivated by empirical findings indicating that, on the one hand, the attitude

[4]The parameters were set according to: $\alpha = 0.75$, $\sigma^2 = 0.1$, $\bar{\theta} = -\sigma^2/2$, $A = 0.7$, $\rho = 0.5$, $\beta = 0.95$, $b = 0.9$ and $\delta = 0.1$.

towards risk is a major determinant of entrepreneurship, while, on the other hand, firm ownership is an important factor for long–run economic growth.

A central result of our analysis is that the individual profit risk has a detrimental effect on the equilibrium population share of entrepreneurs in the economy and is subsequently depressing the growth rate, if markets for pooling idiosyncratic risks are not available. This gives rise to the question, as to whether redistributive policies might improve upon this situation, by providing an *ex post* social insurance.

We were able to demonstrate that the argument, brought forward by Varian (1980) or Sinn (1996) and more recently by Garcia Peñalosa and Wen (2004), indicating that the prospect of *ex post* redistribution of income already improves entrepreneurial risk–taking in advance, is only valid, if certain conditions are met. The agents' response to changes in the degree of tax progression is primarily governed by the individual attitude towards risk. This result can partly be ascribed to the general equilibrium nature of our approach. The positive incentives towards risk–taking stemming from the associated reduction in the variability of profit incomes counteract negative incentives due to an increase in overall wages, as labor supply decreases and the population share of firms rises.

Moreover, we could show in this context that utility maximizing behavior not necessarily also implies maximum growth. The social insurance which is *ex post* provided by a redistributive tax–transfer–scheme is inferior to a perfect *ex ante* risk pooling, in the sense that agents still have the incentive to avoid risk. Consequently, the rate of firm ownership is suboptimal low if compared to its growth and income maximizing value.

Up to now our theoretical analysis neglects two important factors also determining the interaction between entrepreneurship, taxation and growth. On the one hand we did not take account of costly redistribution, such that progressive taxation does not entail any efficiency costs. On the other hand, the agents of our model are not exposed to any kind of liquidity constraints concerning capital formation. This stands in contrast to empirical evidence provided, for instance, by Evans and Leighton (1989) or Blanchflower and Oswald (1998), who find financial constraints to play an important role in the decision as to whether or not to start up a firm. This issue is devoted to future research.

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