Monopolistic Competition and Entrepreneurial Risk–Taking

— Too many Cooks Spoil the Broth (but Everyone is better off) —

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Discussion Paper No. 303

October 2004

Abstract

This paper investigates the effects of monopolistic competition on entrepreneurial risk–taking in a general equilibrium model. In this context, occupational choice of risk averse agents is biased towards firm ownership. In this case, the inefficiencies due to the presence of non–diversifiable risk are partly compensated by inefficiencies arising from imperfect competition. Comparative static results show that too many firms remain in the market for an increase in the degree of risk aversion, thereby mutually deteriorating profit opportunities, which provides an explanation for the empirically observed comparably low risk premium on entrepreneurial risk.

ISSN 0949 – 9962
JEL classification: D4 – D5 – D8
Keywords: economics of uncertainty, occupational choice, monopolistic competition

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1 Introduction

This chapter investigates the effects from monopolistic competition on occupational choice under risk. The analysis combines issues of endogenous entrepreneurial risk–taking in the spirit of Kanbur (1979, 1980) with monopolistically organized markets in the formulation of Dixit and Stiglitz (1977), where consumer's preferences display a certain *'love for variety'* and each of the monopolistic producers is identified with one of the differentiated goods.[1]

The model presented here combines two well–known types of inefficiencies, one originating from the presence of risk, while the other one stems from imperfect competition. We are particularly interested in the question of how these sources of inefficiency interact in the determination of the general equilibrium and to what extent they affect occupational choice and entrepreneurial risk–taking. We will show that, in the risk averse society, occupational choice is biased towards firm ownership, the individual desire to yield extra profits partially offsetting the disliking for risk. Referring to the well–known result, that economic performance in an uncertain environment generally takes place at an inefficiently low level, we find that the compensating effect of imperfect competition on risk–taking may be accompanied by welfare gains, when compared to the perfect competition case. From this we conclude that monopolistically organized markets are not necessarily harmful for the economy as a whole, as long as non–diversifiable risk is involved.

In this context, our analysis is primarily inspired by the Knightian view on entrepreneurship (Knight, 1921), who suggests that the essential role of an entrepreneur is to bear the risk of production, whereas Schumpeter (1930) stresses the creative and innovative role of entrepreneurship. In our model, we combine the importance of uncertainty on entrepreneurial activity with the argument of Kirzner (1973), who defines an entrepreneur as an arbitrageur, seeking profit opportunities.

The present analysis is embedded in a broad body of literature on entrepreneurship and occupational choice.[2] The first to address the impor-

[1]See also Spence (1976) for an independent approach and Matsuyama (1995) for a survey.

[2]For a survey, see de Wit (1993). It is possible to identify three (sometimes overlapping) major strands of research in the literature, focusing on different causes of entrepreneurship: (a) entrepreneurial abilities, see e. g. Lucas (1978), Jovanovic (1982), Chamley (1983), Boadway *et al.* (1991) and Poutvaara (2002), (b) wealth endowments and liquidity constraints, see e. g. Ghatak and Jiang (2002), Ghatak *et al.* (2001, 2002), Lazear (2002), Meh (2002), and (c) risk and individual risk–tolerance, see the references given in the text.

tance of non–diversifiable risk for occupational choice in a general equilibrium context were Kihlstrom and Laffont (1979) as well as Kanbur in a series of contributions (Kanbur, 1979, 1980, 1982). The authors find the economic performance in risk averse economies to be inefficiently low, because too few individuals are willing to bear risk by opting for the entrepreneurial profession. Although profitable business opportunities are feasible for all agents, most individuals choose not to exploit them. In general, the willingness to own a firm is negatively related to the degree of risk aversion. Empirical support for this finding is provided by Cramer *et al.* (2002).

Ilmakunnas *et al.* (1999) obtain strong evidence in the OECD country panel for the Knightian view on entrepreneurial risk–bearing. They find the rate of entrepreneurship to vary greatly between European economies: In 1990, Norway (5.4%) and Austria (5.6%) showed comparably low rates, while Belgium (11.4%) and the UK (10.6%) displayed much higher rates. Ilmakunnas *et al.* (1999) demonstrate that these differences can significantly be explained with the differential social insurance of entrepreneurial and labor risk, which acts detrimental to entrepreneurship.

Following Quadrini (1999), the riskiness of self–employment is expressed in high failure rates of entrepreneurial ventures. According to U. S. data from the Panel Study of Income Dynamics (PSID), first year exit rates amount to 35%.[3] According to Heaton and Lucas (2000), the incomes of entrepreneurs exhibit a considerably higher volatility than wage incomes, although Rosen and Willen (2002), by employing a life–cycle argument, claim that it is the volatility of the consumption flow that counts in the end.

In general, the theory on occupational choice under risk predicts that entrepreneurial risk–bearing is compensated with a positive income differential, which can be viewed as a kind of risk premium. Yet, as Heaton and Lucas (2000) point out in their analysis, empirical 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) and Polkovnichenko (2002). Hopenhayn and Vereshchagina (2003) provide an explanation for this puzzle by introducing borrowing constraints into a model of endogenous entrepreneurial risk–taking, thereby contributing to the strand of research, which stresses the importance of wealth endowments and restricted access to capital markets (e. g. borrowing constraints, credit rationing) for occupational choice; see for instance Ghatak *et al.* (2001) or Keuschnigg and Nielsen (2002) for theoretical results, and

[3]Germany experienced an ongoing growth in bankruptcies throughout the last decade, in absolute numbers from about 11,000 in 1992 to 40,000 in 2003 (Der Spiegel 01/04, p. 69).

Evans and Leighton (1989), van Praag and van Ophem (1995), Lindh and Ohlsson (1996) or Blanchflower and Oswald (1998) for empirical evidence.

The monopolistic competition approach presented in this paper suggests an alternative explanation for this phenomenon. Although the risk premium of our model is defined as the expected income differential between uncertain profits and riskless wage incomes, we find that imperfect competition has a downsizing effect on the risk premium. The perfect competition version of occupational choice under risk in the formulation of Kanbur (1979) or Kihlstrom and Laffont (1979) predicts the risk premium to grow indefinitely for an increase in the degree of risk aversion, as less and less agents are willing to become entrepreneurs. Contrary, we are able to show that the risk premium even vanishes under the regime of monopolistic competition.

This somewhat counter–intuitive result can be ascribed to a well–known feature of the Chamberlinian–type models of monopolistic competition. Since aggregate variables respond more elastic to changes in the model primitives than, for instance, firm–specific demand and individual profits, too many firms remain in the market as the degree of risk aversion increases, thereby mutually deteriorating profit opportunities and reducing the risk premium even further.

The paper is organized as follows. Section 2 develops the model, while the market equilibrium is derived in section 3. As will be shown below, most comparative static effects can be assessed via the associated change in equilibrium occupational choice. Consequently, the considerations of section 4 start with a sensitivity analysis of the equilibrium conditions with respect to the population share of firms. We will show that the outcomes are closely related to the question of how large the population fraction of individuals in the entrepreneurial profession is in comparison to their accruing income share.

Due to the presence of two types of inefficiencies, the main part of the comparative static analysis splits into two sections correspondingly. Section 5 discusses the effects of a variation in the individual attitude towards risk, thereby deriving results regarding the efficiency of the underlying allocation. 6 examines the relation between competition and efficiency, by comparing the equilibrium allocation under perfect competition with the one resulting under a regime of monopolistic competition. Since the degree of competition is implicitly measured by the elasticity of substitution between goods, this section also discusses the response of the equilibrium relationships with respect to a change in this parameter. Section 7 concludes.

2 The Model and Individual Optimization

Households and firms We consider a static general equilibrium model of monopolistic competition with a continuum $[0,1]$ of identical agents. Each individual is endowed with one unit of labor, which she supplies inelastically. The households derive utility out of consumption c according to the following utility function with constant relative risk aversion

$$U(c) = \begin{cases} \dfrac{c^{1-\rho}}{1-\rho} & \text{für} \quad \rho \neq 1 \\ \ln c & \text{für} \quad \rho = 1\,. \end{cases} \tag{1}$$

where ρ denotes the Arrow/Pratt measure of risk aversion.

The consumer's preferences are characterized by *'love for variety'* in the spirit of Dixit and Stiglitz (1977). In this context, c represents a consumption index of product varieties j, $j \in [0,\lambda]$, and is described by the generalized concave CES form

$$c = \left[\int_0^{\lambda} c(j)^{\eta} \; \mathrm{d}\, j\right]^{1/\eta}, \qquad 0 < \eta < 1. \tag{2}$$

Additive separability of (2) in consumption goods ensures that the marginal utility of good j is independent of the quantity consumed of j'. The goods are close but not perfect substitutes in consumption. They are treated symmetrically in (2), where the pairwise elasticity of substitution ε between goods j and j' is identical for all goods and relates to η via $\varepsilon = 1/(1-\eta) > 1$. A higher η signifies that the goods are better substitutes in consumption, the case $\eta \to 1$ reflecting unlimited substitutability in a market of perfect competition.

The agents choose between two types of occupations. They can decide to set up a firm and become an entrepreneur in the market for the differentiated consumption goods. Since this market operates under monopolistic competition, entrepreneurship is rewarded with positive but risky profits $\pi(j)$, where the risk stems from an idiosyncratic technology shock. The alternative is to become an employee in one of the monopolistic firms and supply labor services at the safe wage rate w. The population shares of entrepreneurs and workers will be denoted with λ and $1-\lambda$ correspondingly.

The budget constraint of a typical household i of income $y(i)$,$y(i) \in \{w, \pi(j)\}$ can then be written as follows

$$y(i) = \int_0^{\lambda} p(j)\, c(j) \; \mathrm{d}\, j\,. \tag{3}$$

Market entry in the production sector is costless.[4] Each producer j is identified by a good j. The monopolists produce according to the following short–run production function of Cobb–Douglas type

$$C(j) = \theta(j) L(j)^{\alpha} \qquad \alpha \in (0,1), \tag{4}$$

where labor is the single input of production, and $C(j)_L > 0$, $C(j)_{LL} < 0$. The production technologies of the λ monopolists differ only with respect to the realization of the i. i. d. random variable θ with density $\theta \in \Theta \subset \mathbb{R}^{++}$: $f(\theta)$. This idiosyncratic productivity shock is assumed to be lognormally distributed with $\mathrm{E}[\ln\theta] = \bar{\theta}$ and $\mathrm{Var}[\ln\theta] = \sigma^2$. There is no aggregate risk and no market for pooling the idiosyncratic risks.

By the time the households choose between the two types of occupation, they do not know the realization of the shock. By the time they compose their consumption profile, the income realization is known and the agents act under perfect information. Similar to Kanbur (1979), we posit that the entrepreneurs hire labor after the draw of nature has occurred. Consequently, workers do not face a layoff risk and all risk is effectively placed on entrepreneurs. We assume the costs of changing occupations to be prohibitively high, such that the employment decision, once made, is irreversible. By this, agents are prevented from switching between groups in case of a unfavorable realization of the shock.

Household optimization and aggregate demand for good j The typical consumer maximizes his utility as defined by (1) and (2) subject to the budget constraint (3), while taking the prices $p(j)$ of the differentiated goods $j \in [0,\lambda]$ as given. In order to solve the optimization problem, we set up the following Lagrangian

$$\mathscr{L} = \frac{1}{1-\rho}\left[\left(\int_0^{\lambda} c(j)^{\eta}\ \mathrm{d}j\right)^{1/\eta}\right]^{1-\rho} + \mu\left[y(i) - \int_0^{\lambda} p(j)\, c(j)\ \mathrm{d}j\right] \tag{5a}$$

The first–order conditions are:

$$\frac{\partial \mathscr{L}}{\partial c(j)} = \left(\int_0^{\lambda} c(j)^{\eta}\ \mathrm{d}j\right)^{\frac{1-\rho}{\eta}-1} c(j)^{\eta-1} - \mu p(j) = 0, \qquad \forall j \in (0,\lambda) \tag{5b}$$

$$\frac{\partial \mathscr{L}}{\partial \mu} = y(i) - \int_0^{\lambda} p(j)\, c(j)\ \mathrm{d}j = 0\,. \tag{5c}$$

[4]Imagine, for simplicity, that each agent is born with a business plan in mind. Since utility arbitrage between occupations decides on whether or not running a firm is worthwhile, the assumption of fixed costs of market entry (patents, R&D) is not crucial for the determination of the number of goods in the market and therefore complicates the analysis unnecessarily.

The necessary conditions imply the following optimal demand $c(j)$ of a single agent for a typical differentiated product j and given prices of the remaining goods j'

$$c(j) = \frac{y(i)\, p(j)^{\frac{1}{\eta-1}}}{\int_0^{\lambda} p(j')^{\frac{\eta}{\eta-1}} \,\mathrm{d}\, j'} \,. \tag{5d}$$

Obviously, the direct price elasticity of demand is constant and equals

$$\frac{\partial c(j)}{\partial p(j)} \times \frac{p(j)}{c(j)} = -\frac{1}{1-\eta} \,.$$

If we now substitute the individual demand function for good j into the CES index (2) and define the aggregate price index with

$$P \equiv \left[\int_0^{\lambda} p(j)^{\frac{\eta}{\eta-1}} \,\mathrm{d}\, j \right]^{\frac{\eta-1}{\eta}} \,, \tag{5e}$$

this implies for the consumption index

$$c = \frac{y(i)}{P} \,, \tag{5f}$$

which simply states, that the value of the entire consumption basket equals the household's real income. Finally, the single agent's demand for good j can be rewritten as follows

$$c(j) = \frac{y(i)}{P} \left(\frac{p(j)}{P} \right)^{\frac{1}{\eta-1}} \,, \tag{5g}$$

and reflects the standard result that the individual demand for good j depends on the agent's real income and on the price of good j relative to the aggregate price level.

The market demand for good j is the weighted sum of individual demands. If we define aggregate real income with

$$\frac{Y}{P} = (1-\lambda)\, \frac{w}{P} + \int_0^{\lambda} \frac{\pi(j)}{P} \,\mathrm{d}\, j \,, \tag{6}$$

the market demand of all agents i for good j can be derived as follows:

$$C(j) = \int_0^1 \frac{y(i)}{P} \left(\frac{p(j)}{P} \right)^{\frac{1}{\eta-1}} \mathrm{d}\, i = \frac{Y}{P} \left(\frac{p(j)}{P} \right)^{\frac{1}{\eta-1}} \,. \tag{7}$$

Profit maximization of firms The firms engage in a Bertrand competition. From the consumer's viewpoint, the differentiated goods are close but not perfect substitutes in consumption and the demand is downward sloping. The departure from perfect competition now means that the profit maximizing firm sets a price above marginal costs of production. The producer of good j, who decides to enter the market, takes account of the market demand (7) and technology (4), and chooses $p(j)$ to maximize his profit

$$\max_{p(j)} \quad \pi(j) = p(j)^{\frac{\eta}{\eta-1}} P^{\frac{1}{1-\eta}} \frac{Y}{P} - w \left[\frac{Y}{\theta(j) P} \left(\frac{p(j)}{P} \right)^{\frac{1}{\eta-1}} \right]^{\frac{1}{\alpha}} . \tag{8a}$$

The monopolist's optimal price setting behavior is characterized by the standard *mark–up pricing* rule

$$p(j) = \frac{w L(j)^{1-\alpha}}{\alpha\eta\, \theta(j)} . \tag{8b}$$

The price setting condition (8b) implies the following optimal labor demand of firm j

$$L(j) = \left(\frac{\alpha\eta\, \theta(j)\, p(j)}{w} \right)^{\frac{1}{1-\alpha}} . \tag{8c}$$

The labor demand is structurally identical for all firms and differs only with respect to the realization of the idiosyncratic productivity shock and the correspondingly adjusted price.

3 Market Equilibrium

We proceed now with the derivation of the general equilibrium. The first step of the solution strategy is bringing together the demand and supply of the λ goods to derive the market clearing amount $C(j)$ for each good j. This determines the output level of each monopolist j and simultaneously implies the input factor demand $L(j)$. The aggregate labor demand is obtained by summing up these firm specific labor demands. Market clearing on the labor market then determines the equilibrium real wage rate w/P. By this, the costs of production are fixed and the monopolists' prices $p(j)$ and real profits $\pi(j)/P$ can be derived residually. The aggregate real income Y/P then results as the sum of profit and wage incomes. Until this step, all equilibrium relationships are functions of the population shares of entrepreneurs and workers, which are still undetermined. An equilibrium distribution of households over the two types of occupation is characterized by a situation, where expected utility from being an entrepreneur and utility from being a worker are equal.

Market clearing for good j By utilizing the production function (4), the mark–up pricing rule (8b) can be rewritten as a function of $C(j)$. Setting the resulting expression equal to the market demand (7), leads to the following the market clearing amount of good j

$$C(j) = \left[\left(\frac{\alpha\eta Y^{1-\eta} P^{\eta}}{w} \right)^{\alpha} \theta(j) \right]^{\frac{1}{1-\alpha\eta}} . \tag{9}$$

Labor market equilibrium The labor market is characterized by perfect competition. The equilibrium wage rate is then determined by the usual marginal productivity conditions and derived by equating aggregate labor supply and demand. The aggregate labor supply equals the population share of workers, $L^S = 1 - \lambda$, due to the normalization of population size. The firm–specific labor demand is obtained by employing (9) and (4):

$$L(j) = \left[\frac{\alpha\eta Y^{1-\eta} P^{\eta}\, \theta(j)^{\eta}}{w} \right]^{\frac{1}{1-\alpha\eta}} . \tag{10a}$$

The aggregate labor demand is derived by summing up the individual labor demands

$$L^D = \left[\frac{\alpha\eta Y^{1-\eta} P^{\eta}}{w} \right]^{\frac{1}{1-\alpha\eta}} \int_0^{\lambda} \int_{\theta(j)\in\Theta} \theta(j)^{\frac{\eta}{1-\alpha\eta}} f(\theta)\, \mathrm{d}\theta \; \mathrm{d}j = \lambda \mathrm{E}[L(j)],$$

by the law of large numbers and the i. i. d. property of the firm specific technology shock. Taking expected values yields the following expression for aggregate labor demand

$$L^D = \lambda \left[\frac{\alpha\eta Y^{1-\eta} P^{\eta}}{w} \right]^{\frac{1}{1-\alpha\eta}} \exp\left\{ \frac{\eta\bar{\theta}}{1-\alpha\eta} + \frac{\eta^2\sigma^2}{2(1-\alpha\eta)^2} \right\} . \tag{10b}$$

The market clearing real wage rate is derived by equating the economy–wide labor demand (10b) with the aggregate labor supply

$$\frac{w}{P} = \alpha\eta \left(\frac{Y}{P} \right)^{1-\eta} \left(\frac{\lambda}{1-\lambda} \right)^{1-\alpha\eta} \exp\left\{ \eta\bar{\theta} + \frac{\eta^2\sigma^2}{2(1-\alpha\eta)} \right\} , \tag{11}$$

which eventually implies producer j's equilibrium real profit income

$$\frac{\pi(j)}{P} = (1-\alpha\eta)\,\theta(j)^{\frac{\eta}{1-\alpha\eta}} \left(\frac{Y}{P}\right)^{1-\eta} \left(\frac{1-\lambda}{\lambda}\right)^{\alpha\eta} \exp\left\{-\frac{\alpha\eta^2}{1-\alpha\eta}\left(\theta+\frac{\eta\sigma^2}{2(1-\alpha\eta)}\right)\right\}. \tag{12}$$

The aggregate real income (6) can be derived as $\frac{Y}{P} = (1-\lambda)\,w/P + \lambda\mathrm{E}[\pi(j)/P]$. Taking expectations of (12) and collecting terms finally leads to

$$\frac{Y}{P} = (1-\lambda)^{\alpha}\,\lambda^{\frac{1-\alpha\eta}{\eta}} \exp\left\{\bar{\theta}+\frac{\eta\sigma^2}{2(1-\alpha\eta)}\right\}. \tag{13}$$

The income variables (11), (12), and (13) depend on the (yet undetermined) population shares, the technology parameters $\alpha, \bar{\theta}, \sigma$ and the degree of substitution between goods, measured by the parameter η.

Equilibrium occupational choice An equilibrium distribution of households over the two types of occupation is characterized by a situation, where the marginal individual is indifferent between owning a firm or going to work, that is, if expected utility from being an entrepreneur equals the utility derived out of the safe real wage income when being a worker. Each person (in expectation) is at least as well off in the chosen occupation if compared to the other. The utility of a worker is determined by substituting (13) into (11) and inserting the resulting expression into (1), while additionally taking account of (5f)

$$U(c|w) = \frac{1}{1-\rho}\left[\alpha\eta\lambda^{\frac{1-\eta}{\eta}}\left(\frac{\lambda}{1-\lambda}\right)^{1-\alpha} \exp\left\{\bar{\theta}+\frac{\eta\sigma^2}{2(1-\alpha\eta)}\right\}\right]^{1-\rho}. \tag{14a}$$

The expected utility of starting a business and running a firm can be derived analogously by utilizing (12)

$$\begin{aligned}
\mathrm{E}[U(c|\pi(j))] &= \left[(1-\alpha\eta)\lambda^{\frac{1-\eta}{\eta}}\left(\frac{1-\lambda}{\lambda}\right)^{\alpha}\exp\left\{\frac{1-\eta-\alpha\eta}{1-\alpha\eta}\left(\bar{\theta}+\frac{\eta\sigma^2}{2(1-\alpha\eta)}\right)\right\}\right]^{1-\rho} \\
&\quad\times \frac{\mathrm{E}\left[\theta(j)^{\frac{\eta(1-\rho)}{1-\alpha\eta}}\right]}{1-\rho} \\
&= \frac{1}{1-\rho}\left[(1-\alpha\eta)\lambda^{\frac{1-\eta}{\eta}}\left(\frac{1-\lambda}{\lambda}\right)^{\alpha}\exp\left\{\bar{\theta}+\frac{[1-\eta(\alpha+\rho)]\,\eta\sigma^2}{2(1-\alpha\eta)^2}\right\}\right]^{1-\rho}
\end{aligned} \tag{14b}$$

Equating (14a) with (14b) leads to the following expression for the equilibrium population share of entrepreneurs in the economy

$$\lambda = \frac{1-\alpha\eta}{1-\alpha\eta+\alpha\eta\exp\left\{\frac{\rho\eta^2\sigma^2}{2(1-\alpha\eta)^2}\right\}}, \tag{14c}$$

and the population share $1-\lambda$ of workers residually. The distribution of the population over occupations is constant in equilibrium and depends on the primitives of the model, which are the preference parameters η, ρ and the technology parameters α, σ. It is independent of the mean $\bar{\theta}$ of the productivity shock. This result can be related to the assumption of CRRA preferences, where the degree of risk aversion does not depend on the level of income. Obviously, the population share is strictly located in the unit interval, if we take into account the initially stated conditions on the size of the model parameters.

Figure 1 summarizes the results for the economic variables for easy reference throughout the following analysis. It also renders the equilibrium value of the risk premium, which is defined as the difference between real expected profit and wage incomes, and includes an expression for social welfare as the weighted sum of individual utility.

Before we proceed with the comparative static analysis, we would like to highlight the characteristic features of our model. First, the occupational choice of households endogenizes the number of firms in the consumption goods industry in terms of a population share, thereby simultaneously determining the range of goods available to the consumer. Second, the monopolists' profits are always positive, because a utility arbitrage argument decides upon choosing this profession. Insofar does the standard argument in monopolistic competition not apply, which claims vanishing profits in the course of the market entry of new competitors.

4 Comparative Statics: Population Share of Firms

The model developed in the previous section displays two types of inefficiency. The first one can be attributed to the fact that individual decision–making takes place in a risky environment, while the second one stems from imperfect competition on the market for consumption goods. The comparative static analysis will consequently focus on changes in the two relevant parameters ρ, η, one measuring the agent's desire to avoid or seek risk, the other indirectly measuring the market power of a single firm via the household's willingness to substitute goods in consumption.

Population share of entrepreneurs	$$\lambda = \frac{1-\alpha\eta}{1-\alpha\eta+\alpha\eta\exp\left\{\frac{\rho\eta^2\sigma^2}{2(1-\alpha\eta)^2}\right\}} \qquad \text{(GE–1)}$$
Wage rate†	$$\frac{w}{P} = \alpha\eta\,\lambda^{\frac{1-\eta}{\eta}}\left(\frac{\lambda}{1-\lambda}\right)^{1-\alpha}\exp\left\{\bar{\theta}+\frac{\eta\sigma^2}{2(1-\alpha\eta)}\right\} \qquad \text{(GE–2)}$$
Expected profit†	$$\frac{\mathrm{E}[\pi(j)]}{P} = (1-\alpha\eta)\,\lambda^{\frac{1-\eta}{\eta}}\left(\frac{1-\lambda}{\lambda}\right)^{\alpha}\exp\left\{\bar{\theta}+\frac{\eta\sigma^2}{2(1-\alpha\eta)}\right\} \qquad \text{(GE–3)}$$
Aggregate income	$$\frac{Y}{P} = \lambda^{\frac{1}{\eta}}\left(\frac{1-\lambda}{\lambda}\right)^{\alpha}\exp\left\{\bar{\theta}+\frac{\eta\sigma^2}{2(1-\alpha\eta)}\right\} \qquad \text{(GE–4)}$$
Individual expected utility	$$U(c) = \frac{1}{1-\rho}\left[\alpha\eta\lambda^{\frac{1-\eta}{\eta}}\left(\frac{\lambda}{1-\lambda}\right)^{1-\alpha}\exp\left\{\bar{\theta}+\frac{\eta\sigma^2}{2(1-\alpha\eta)}\right\}\right]^{1-\rho} \qquad \text{(GE–5)}$$
Social Welfare	$$V = (1-\lambda)\,U\left(\frac{w}{P}\right)+\lambda\mathrm{E}\left[U\left(\frac{\pi(j)}{P}\right)\right] \qquad \text{(GE–6)}$$
Expected price to price index ratio	$$\frac{\mathrm{E}[p(j)]}{P} = \lambda^{\frac{1-\eta}{\eta}}\exp\left\{\frac{(1-\eta)\,\sigma^2}{2\,(1-\alpha\eta)^2}\right\} \qquad \text{(GE–7)}$$
Risk premium $\phi \equiv \frac{\mathrm{E}[\pi(j)]}{P}-\frac{w}{P}$	$$\phi = \lambda^{\frac{1-\eta}{\eta}}\left(\frac{1-\lambda}{\lambda}\right)^{\alpha}\frac{1-\alpha\eta-\lambda}{1-\lambda}\exp\left\{\bar{\theta}+\frac{\eta\,\sigma^2}{2\,(1-\alpha\eta)}\right\} \qquad \text{(GE–8)}$$
Expected employment per firm j	$$\mathrm{E}[L(j)] = \frac{1-\lambda}{\lambda} \qquad \text{(GE–9)}$$
Expected output per firm j	$$\mathrm{E}[C(j)] = \left(\frac{1-\lambda}{\lambda}\right)^{\alpha}\exp\left\{\bar{\theta}+\frac{\sigma^2\,(1-\alpha\eta^2)}{2(1-\alpha\eta)^2}\right\} \qquad \text{(GE–10)}$$

† Values derived by substitution of (GE–4) into (12) and (13).

Figure 1: *General equilibrium values of the economic variables*

If we look at the equilibrium values of the wage rate, expected profits, national income and expected output of firms — as summarized in Figure 1 — it becomes obvious that the population shares $\lambda, 1-\lambda$ provide an important channel for the transmission of economic effects due to a variation in the primitives of the model. For this reason, we will first discuss the response of the equilibrium values of the economic variables to changes in occupational choice, before we proceed with the comparative static analysis as described above.

The following result on the functional distribution of income will be convenient for the analysis below. The aggregate income shares of entrepreneurs and workers are given by

$$\frac{\lambda \mathrm{E}[\pi(j)]/P}{Y/P} = 1-\alpha\eta \quad \text{and} \quad \frac{(1-\lambda)\, w/P}{Y/P} = \alpha\eta\,. \tag{15}$$

Note that the aggregate income shares are constant and invariant with respect to changes in the occupational distribution. Compared to the standard neoclassical world with perfect competition, we find that the income share of labor is — by the factor η — smaller than its partial elasticity of production. As we would have expected, monopolistic competition shifts the functional income distribution in favor of profit incomes.

Changes in λ affect the key variables of the economic system as follows:

Proposition 1 *An increase in the population share of entrepreneurs implies*

(i) an increase (a decrease) in aggregate real income Y/P, as long as λ is smaller (larger) than the income share of monopolists. The national income is maximized, if the population share of firms equals the profit income share

$$\frac{\partial(Y/P)}{\partial\lambda} = \frac{Y}{P} \times \frac{1-\alpha\eta-\lambda}{\lambda\eta\,(1-\lambda)} \gtreqless 0 \quad \textit{for} \quad 1-\alpha\eta \gtreqless \lambda, \tag{16a}$$

(ii) a rise in the real wage rate w/P

$$\frac{\partial(w/P)}{\partial\lambda} = \frac{w}{P} \times \frac{1-\alpha\eta-\lambda(1-\eta)}{\lambda\eta\,(1-\lambda)} > 0, \quad \forall \alpha,\eta,\lambda \in (0,1)\,, \tag{16b}$$

(iii) a decrease in real expected profit incomes $\mathrm{E}[\pi(j)/P]$, as long as the population share of firm owners is greater or equal to their income share.

$$\frac{\partial \mathrm{E}[\pi(j)/P]}{\partial\lambda} = \frac{\mathrm{E}[\pi(j)]}{P} \times \frac{1-\alpha\eta-\lambda-\eta(1-\lambda)}{\lambda\eta\,(1-\lambda)} < 0, \quad \forall \lambda \geqslant 1-\alpha\eta\,, \tag{16c}$$

The effect is of ambiguous sign for $\lambda < 1-\alpha\eta$. Here,

$$\frac{\partial(\pi(j)/P)}{\partial\lambda} \geqslant 0 \quad \textit{for} \quad \lambda \leqslant 1-\frac{\alpha\eta}{1-\eta}, \quad \lambda \in (0,1)\,, \tag{16d}$$

(iv) a decrease in the risk premium ϕ*, as long as the population share of entrepreneurs is greater or equal to their income share:*

$$\frac{\partial\phi}{\partial\lambda} = \frac{1}{\lambda\eta\,(1-\lambda)}\left[\frac{1-\alpha\eta-\lambda(1-\eta)}{1-\lambda}\times\frac{\mathrm{E}[\pi(j)]-Y}{P}-\frac{\eta\,\mathrm{E}[\pi(j)]}{P}\right]\,. \quad (16e)$$

By (16b) *and comparison of* (GE–3) *with* (GE–4)*, we find* $\mathrm{E}[\pi(j)] \lesseqgtr Y \iff \lambda \gtreqless 1-\alpha\eta$*, such that the overall sign of* (16e) *is negative in these cases.*

Equation (16e) *is of ambiguous sign for* $\lambda < 1-\alpha\eta$*. Here, the risk premium is maximized for*

$$\lambda_{1,2} = 1-\alpha\eta \pm \sqrt{\frac{\alpha}{1-\eta}(1-\alpha\eta)}, \quad \lambda \in (0,1)\,. \quad (16f)$$

(v) a fall in expected output $\mathrm{E}[C(j)]$ *per firm* j

$$\frac{\partial\,\mathrm{E}[C(j)]}{\partial\lambda} = -\frac{\alpha\,\mathrm{E}[C(j)]}{\lambda\,(1-\lambda)} < 0\,, \quad (16g)$$

(vi) an increase in the expected price ratio $\mathrm{E}[p(j)]/P$*.*

$$\frac{\partial\,\mathrm{E}[p(j)/P]}{\partial\lambda} = \frac{1-\eta}{\eta}\times\frac{\mathrm{E}[p(j)/P]}{\lambda} > 0\,, \quad (16h)$$

(vii) an increase (a decrease) in aggregate welfare V*, as long as* λ *is smaller (larger) than the aggregate income share of monopolists. A social optimum is attained for* $\lambda = 1-\alpha\eta$

$$\begin{aligned}\frac{\partial V}{\partial\lambda} &= (1-\lambda)\,\frac{\partial(w/P)}{\partial\lambda}\times\left(U_{\frac{w}{P}}-\mathrm{E}\left[U_{\frac{\pi(j)}{P}}\right]\right)+ \\ &\qquad +\mathrm{E}\left[U_{\frac{\pi(j)}{P}}\right]\frac{Y}{P}\times\frac{(1-\eta)\,(1-\alpha\eta-\lambda)}{\lambda\eta(1-\lambda)},\end{aligned} \quad (16i)$$

and

$$\frac{\partial V}{\partial\lambda} \gtreqless 0 \quad \textit{for} \quad \lambda \lesseqgtr 1-\alpha\eta \quad \textit{and} \quad \left.\frac{\partial^2 V}{\partial\lambda^2}\right|_{\lambda=1-\alpha\eta} < 0\,. \quad (16j)$$

Proof: The last derivative is obtained by differentiating (GE–6) with respect to λ, and utilizing the equilibrium condition $U(w/P) = \mathrm{E}[U(\pi(j)/P)]$. The income differential vanishes for $\lambda = 1-\alpha\eta$, and so does the second term on the RHS of (16j). Also, the marginal utility from wage incomes equals marginal utility from profit incomes, such that the first term vanishes, too. □

Intuitively spoken, only if their share in the population equals their expected income share, the right number of agents has chosen to own a firm. If more firms enter the market, this is accompanied by a decline in aggregate labor supply. Excess demand on the labor market then implies a new equilibrium at a higher wage rate. The increase in competition among entrepreneurs goes along with a drop in expected output per firm, which is followed by a decline in aggregate output and eventually in social welfare.

It is possible to give an intuitive explanation for the ambiguous effects on expected profits and the risk premium in the opposite case of too few firms in the market, if we utilize the concept of income and demand elasticities related to the population share of entrepreneurs. Let $\varepsilon_{x,\lambda} \equiv \frac{\partial x}{\partial y} \cdot \frac{y}{x}$ define the elasticity of a variable x with respect to y. Then:

Proposition 2 *The real wage rate always responds more elastically to changes in the population share of firms than aggregate real income, the latter being more elastic than real expected profits. Aggregate demand always responds more elastically to changes in the population share of firms than the expected demand per firm j*

$$\varepsilon_{\frac{w}{P},\lambda} > \varepsilon_{\frac{Y}{P},\lambda} > \varepsilon_{\frac{E[\pi(j)]}{P},\lambda} > \varepsilon_{E[C(j)],\lambda} \,. \tag{17}$$

The elasticity of expected profits with respect to λ can be decomposed into a positive price and a negative quantity effect

$$\varepsilon_{\frac{E[\pi(j)]}{P},\lambda} = \varepsilon_{\frac{E[p(j)]}{P},\lambda} - \varepsilon_{E[C(j)],\lambda} = \frac{1-\eta}{\eta} - \frac{\alpha}{1-\lambda} \,. \tag{18}$$

The first two statements of Proposition 2 reflect well–known results. Since the labor market operates under perfect competition, we would expect the response to changes in λ to be more elastic than on the goods market. The other result, claiming aggregate demand to be more elastic than firm–specific, too, is a common outcome of this Chamberlinian–type of model. Expected profits increase with a rise in the population share as long as the price effect dominates the quantity effect, which can only occur if the initial population share is smaller than the optimal value reflected by the equilibrium profit income share (15).

5 Comparative Statics: Risk and Efficiency

In what follows, the focus lies on the issue of inefficiency related to the presence of risk. We will demonstrate that under the regime of monopolistic competition most, but not all of Kanbur's (1979) major statements on this topic are sustained. We find an analogy with respect to the result that an efficient allocation is characterized by *certainty equivalence* regarding the distribution of agents over occupations. Since certainty equivalence can only be observed for risk neutral behavior, we will contrast this allocation with the associated general equilibrium variables for economies with risk averse or risk loving agents respectively.[5] Differences between our model and the perfect competition setting of Kanbur (1979) turn up, when it comes to the response of expected profits and the equilibrium risk premium to changes in the degree of risk aversion.

According to Figure 1, the response of the economic variables to changes in the attitude towards risk can directly be assessed via the associated change in the population share of entrepreneurs.

Proposition 3 *The population share of firms decreases with an increase in the degree of risk aversion. The distribution of agents over occupations only matches the one obtained in the absence of technological risk (i. e. certainty equivalence), if the agents of the economy are risk neutral. Then, the population share of entrepreneurs equals the aggregate profit income share*

$$\frac{\partial \lambda}{\partial \rho} < 0, \quad \textit{and} \quad \lambda \gtreqless 1 - \alpha\eta \equiv \lambda^* \quad \textit{if} \quad \rho \lesseqgtr 0\,. \tag{19}$$

Corollary 1 *From Proposition 3 follows immediately:*

(i) The aggregate real income Y/P and social welfare V are maximized in an economy of risk neutral agents. The efficient population share of entrepreneurs, λ^*, equals the profit income share.

(ii) The real wage rate declines with an increase in the degree of risk aversion.

(iii) By (18) *and* (19)*, real expected profits rise with an increase in the attitude towards risk, as long as the quantity effect dominates the price effect and vice versa. The expected profit is maximized if both effects offset each other. Given the optimal value for the population share of firms,* (16d)*, the associated degree of risk aversion can be determined as*

$$\rho = \frac{2(1-\alpha\eta)^2}{\eta^2\sigma^2} \ln\left[\frac{1-\alpha\eta}{1-\alpha\eta-\eta}\right] > 0, \quad \forall\, \alpha, \eta, \lambda \in (0,1). \tag{20}$$

[5] We are only able to derived closed–form solutions for the model, because we initially assumed that firms hire labor after the uncertainty has resolved. This additionally implies that our model neglects the usual business size effect, which emerges for expected utility maximizing firms and is negative for risk averse individuals and positive for risk lovers. It should additionally be taken into account, when comparing the allocations under certainty and risk; see Kihlstrom and Laffont (1979). Risk neutrality provides us with *certainty equivalence* results regarding the equilibrium distribution of agents over occupations, but should not be confused with the absence of risk.

(iv) *The expected risk premium is positive in risk averse and negative in risk loving economies. The real wage rate and real expected profits coincide, when the agents are risk neutral and the risk premium vanishes.*

Given the associated optimal values of the population share (16f)*, the risk premium is maximized for*

$$\rho_{1,2} = \frac{2(1-\alpha\eta)^2}{\eta^2\sigma^2} \ln \left[\frac{1-\alpha\eta}{\alpha\eta} \times \frac{\alpha\eta \mp \sqrt{\frac{\alpha}{1-\eta}(1-\alpha\eta)}}{1-\alpha\eta \pm \sqrt{\frac{\alpha}{1-\eta}(1-\alpha\eta)}} \right] . \tag{21}$$

(v) *The expected output* $\mathrm{E}[C(j)]$ *per firm* j *increases with a rise in the degree of risk aversion, whereas the expected price ratio* $\mathrm{E}[p(j)]/P$ *declines.*

Proposition 3 and the associated Corollary 1 show that efficiency is closely related to risk neutrality, thereby extending the results of Kanbur (1979) to the case of monopolistic competition. The finding that the population share of entrepreneurs decreases with an increase in the degree of risk aversion suggests itself, as more and more agents avoid the income risk associated with the ownership of a firm. This goes along with adjustments on the labor market and the market for consumption goods. On the one hand, the increase in labor supply causes a decline in the equilibrium wage rate. On the other hand, the expected output of the firms remaining in the market increases.

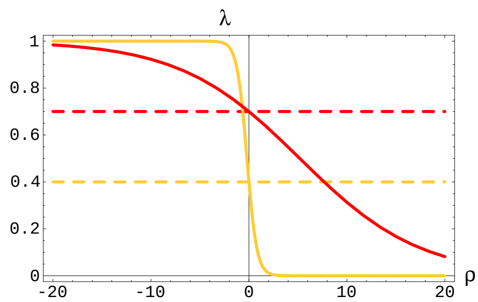
Figure 2 displays the response of the equilibrium relationships to changes in the degree of risk aversion. The reference results for the perfect competition case are depicted by the light grey lines,[6] whereas the dashed lines represent the associated values for the risk neutral economies. The parameters were set according to: $\alpha = 0.6$, $\eta = 0.5$, $\sigma = 0.8$, $\bar{\theta} = 1$.[7] Figures 2(c) to 2(e) illustrate the findings on the relation between wage and expected profit incomes. The income levels coincide for the risk neutral economy, and simultaneously equal aggregate income due to the normalization of population size. Accordingly, the risk premium approaches zero.

If agents are risk averse, the expected profit exceeds the riskless wage rate. The entrepreneurs demand a positive risk premium for bearing the production risk. The risk premium becomes negative for risk lovers.

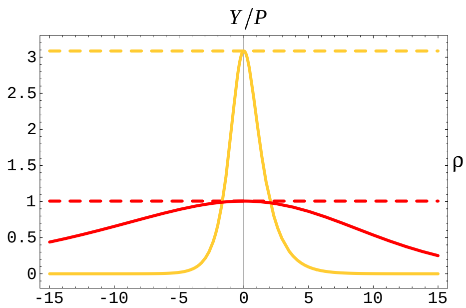
Up to now, our findings are in line with those of Kanbur (1979), derived for the perfect competition economy. Nevertheless, we find differences with respect to the response of expected profits and the risk premium to changes

[6]A detailed comparison of perfect with imperfect competition is subject of section 6.

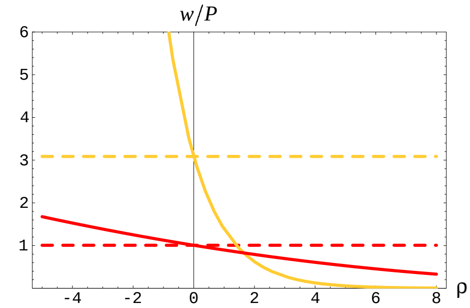
[7]This yields an empirically plausible value of $\lambda \approx 0.12$ for an estimated degree of risk aversion around $\rho \approx 1$ in the perfect competition economy.



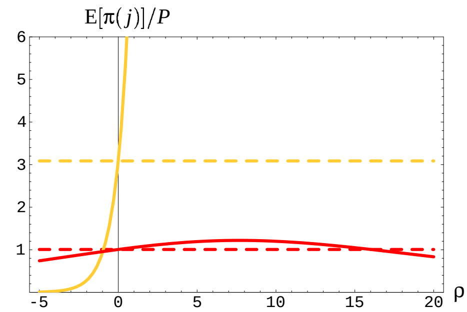
(a) Population share of firms



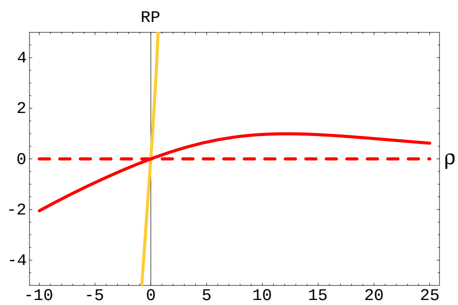
(b) Aggregate income



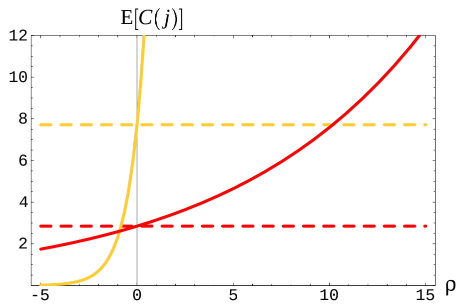
(c) Wage rate



(d) Expected profit



(e) Risk premium



(f) Expected output of firm j

Figure 2: *Changes in the attitude towards risk*

in the attitude towards risk. Whereas, under the regime of perfect competition, expected profits unambiguously increase with a rise in ρ in the course of more and more firms leaving the market (see Figure 2(d)), this is not the case for monopolistic competition. Here, we first observe the predicted increase, but then expected profits are maximized for a degree of risk aversion as determined by (20), and decline for larger ρ.

This somewhat counter–intuitive result can be explained, if we recur to Proposition 2, which claims that expected profits respond less elastically to changes in λ than aggregate income. This keeps more firms in the market than are necessary to let profits grow without bound, when ρ becomes infinitely large. Informally spoken, although entrepreneurs leave the market when the economy becomes more risk averse, not enough of them choose to do so, such that *'too many cooks spoil the broth'*. Again, this result can be ascribed to the counter–acting price and quantity effects of Proposition 2. It is important to remember at this point that the first one does not appear under the regime of perfect competition.

The results for expected profits are reflected in a similar but slightly more complex manner by the response of the risk premium to increases in the degree of risk aversion. The risk premium grows at first, then reaches a maximum according to the values given in (21), and declines afterwards.

6 Comparative Statics: Competition and Efficiency

The second part of the comparative static analysis deals with the question of inefficiency related to the presence of monopolistic competition. The analysis splits into two parts: First, we proceed with comparing the equilibrium allocation of our model, summarized by equations (GE–1) to (GE–10) in Figure 1, with the one resulting under the regime of perfect competition, characterized by an infinitely large elasticity of substitution between consumption goods ($\eta = 1$). We are interested in obtaining general comparative results regarding the size of population shares, incomes, and output levels. Second, we will discuss the effects of changes in the consumer's willingness to substitute between goods in consumption, by letting η vary in the range of feasible values $\eta \in (0, 1)$.

Let $\sim$ indicate the variables of the perfect competition economy.

Proposition 4 *The equilibrium population share of entrepreneurs is larger in an economy with monopolistic competition than under perfect competition, if agents are either risk averse or risk neutral. For risk loving individuals, the relation between the two population shares is of ambiguous sign.*

$$\lambda = \frac{1-\alpha\eta}{1-\alpha\eta+\alpha\eta\exp\left\{\frac{\rho\eta^2\sigma^2}{2(1-\alpha\eta)^2}\right\}} \gtreqless \frac{1-\alpha}{1-\alpha+\alpha\exp\left\{\frac{\rho\sigma^2}{2(1-\alpha)^2}\right\}} = \tilde{\lambda}$$

if

$$0 \lesseqgtr (1-\alpha)\left[\exp\left\{\frac{\rho\sigma^2}{2(1-\alpha)^2}\right\} - \exp\left\{\frac{\rho\eta^2\sigma^2}{2(1-\alpha\eta)^2}\right\}\right] + \frac{1-\eta}{\eta}\exp\left\{\frac{\rho\sigma^2}{2(1-\alpha)^2}\right\}. \tag{22}$$

Proof: For $\lambda > \tilde{\lambda}$, the term in square brackets on the RHS of (22) has to be of positive sign. The relation reduces to $\frac{1}{(1-\alpha)^2} > \frac{\eta^2}{(1-\alpha\eta)^2}$, since $\frac{1}{(1-\alpha)^2} > \frac{1}{(1-\alpha\eta)^2} > \frac{\eta^2}{(1-\alpha\eta)^2}$ for $\eta \in (0,1)$ and $\rho > 0$. Signs reverse for $\rho < 0$, and the term in brackets becomes negative. In this case, $\lambda > \tilde{\lambda}$ only, if the last term on the RHS of (22) is larger than the first. □

At least the results for risk averse and risk neutral agents respectively satisfy the common intuition that imperfect competition and the associated chance of yielding extra profits causes more agents to choose the entrepreneurial profession than perfect competition. In this sense, monopolistic competition mitigates the effects from risk aversion. $\rho \geqslant 0$ is a sufficient condition to establish this negative trade–off relationship between the attitude towards risk and the elasticity of substitution, as can easily be demonstrated, if we differentiate the population share of firms with respect to these variables. $d\lambda = 0$ then yields

$$\frac{d\rho}{d\eta} = -\left[\frac{2(1-\alpha\eta)^2}{\eta^3\sigma^2} + \frac{2\rho(1-\alpha^2\eta^2)}{\eta\,(1-\alpha\eta)^2}\right] < 0, \quad \text{for} \quad \rho \geqslant 0\,. \tag{23}$$

Monopolistic competition also partially absorbs the effects from risk loving behavior, where the population share of firms is excessively large. For a sufficiently large risk tolerance, the population share of the monopolistic competition economy is smaller than under perfect competition, and hence closer to the efficient level.

Proposition 5 *Comparative results for monopolistic and perfect competition:*

(i) Aggregate real income: $\frac{\tilde{Y}}{\tilde{P}} \gtreqless \frac{Y}{P}$, *if*

$$0 \gtreqless \alpha \ln\left[\frac{1-\lambda}{1-\tilde{\lambda}}\right] + (1-\alpha)\ln\left[\frac{\lambda}{\tilde{\lambda}}\right] + \frac{1-\eta}{\eta}\ln\lambda - \frac{(1-\eta)\,\sigma^2}{2(1-\alpha)(1-\alpha\eta)} \tag{24a}$$

(ii) Real wage rate: $\frac{\tilde{w}}{\tilde{P}} \gtreqless \frac{w}{P}$, *if*

$$0 \gtreqless \ln\eta + (1-\alpha)\ln\left[\frac{(1-\tilde{\lambda})\,\lambda}{(1-\lambda)\,\tilde{\lambda}}\right] + \frac{1-\eta}{\eta}\ln\lambda - \frac{(1-\eta)\,\sigma^2}{2(1-\alpha)(1-\alpha\eta)} \tag{24b}$$

(iii) Real expected profit: $\frac{E[\tilde{\pi}(j)]}{\tilde{P}} \gtreqless \frac{E[\pi(j)]}{P}$, *if*

$$0 \gtreqless \ln\left[\frac{1-\alpha\eta}{1-\alpha}\right] + \alpha\ln\left[\frac{(1-\lambda)\,\tilde{\lambda}}{(1-\tilde{\lambda})\,\lambda}\right] + \frac{1-\eta}{\eta}\ln\lambda - \frac{(1-\eta)\,\sigma^2}{2(1-\alpha)(1-\alpha\eta)} \tag{24c}$$

(iv) Expected risk premium: $\tilde{\phi} \gtreqless \phi$, *if*

$$0 \gtreqless \alpha \ln\left[\frac{\tilde{\lambda}}{\lambda}\right] + (1-\alpha)\ln\left[\frac{1-\tilde{\lambda}}{1-\lambda}\right] + \frac{1-\eta}{\eta}\ln\lambda - \frac{(1-\eta)\,\sigma^2}{2(1-\alpha)(1-\alpha\eta)} + \\ + \ln\left[\frac{1-\alpha\eta-\lambda}{1-\alpha-\tilde{\lambda}}\right] \tag{24d}$$

(v) Expected output per firm j: $\mathrm{E}[\tilde{C}(j)] \gtreqless \mathrm{E}[C(j)]$, *if*

$$0 \gtreqless \alpha \ln\left[\frac{(1-\lambda)\,\tilde{\lambda}}{(1-\tilde{\lambda})\,\lambda}\right] - \tfrac{1}{2}\alpha\sigma^2(1-\eta)^2 \tag{24e}$$

(vi) Expected price ratio: $\frac{\mathrm{E}[\tilde{p}(j)]}{\tilde{P}} \gtreqless \frac{\mathrm{E}[p(j)]}{P}$, *if*

$$0 \gtreqless \frac{1-\eta}{\eta}\left(\ln\lambda + \frac{\eta\sigma^2}{2(1-\alpha\eta)^2}\right) \tag{24f}$$

Corollary 2 (Risk neutral agents) *For* $\rho = 0$ *we find:*

$$(i)\quad \frac{\tilde{Y}}{\tilde{P}} > \frac{Y}{P}, \qquad (ii)\quad \frac{\tilde{w}}{\tilde{P}} > \frac{w}{P}, \qquad (iii)\quad \frac{\mathrm{E}[\tilde{\pi}(j)]}{\tilde{P}} > \frac{\mathrm{E}[\pi(j)]}{P},$$
$$(iv)\quad \tilde{V} > V, \qquad (v)\quad \tilde{\phi} = \phi, \qquad (vi)\quad \mathrm{E}[\tilde{C}(j)] > \mathrm{E}[C(j)]\,. \tag{25}$$

Sketch of Proof: Consider for instance (24a). $\tilde{Y}/\tilde{P}$ is always larger than Y/P if, for all $\eta \in (0,1)$, the function on the RHS of (24a) is negative. This is definitely true for the last two expressions, whereas the sign of the first two terms depends on whether the ratios $(1-\lambda)/(1-\tilde{\lambda})$ and $\lambda/\tilde{\lambda}$ are larger or smaller than unity, which decides upon the sign of the logarithm. In order to prove that the function (24a) is nonpositive in the entire interval of feasible η, we have to show that the lower and upper limits ($\eta \to 0, \eta \to 1$) are nonpositive, and that the function (24a) is monotonically increasing or decreasing between the two limits. We find

$$\lim_{\eta\to 0}\left[\frac{\tilde{Y}}{\tilde{P}} - \frac{Y}{P}\right] = -\infty, \quad \lim_{\eta\to 1}\left[\frac{\tilde{Y}}{\tilde{P}} - \frac{Y}{P}\right] = 0, \quad \forall\lambda, \qquad \text{and} \quad \partial\left[\frac{\tilde{Y}}{\tilde{P}} - \frac{Y}{P}\right]\Big/\partial\eta > 0 \quad \text{for } \lambda = \lambda^*.$$

The above derivative is of ambiguous sign for all $\rho \neq 0$. Here, (24a) is not monotonous, and clear–cut results on the relation between the aggregate incomes of the two economies cannot be stated. The remaining results of Corollary 2 are derived in an analogous way. □

If we compare the levels of economic activity for the two different types of competition, the main insight from Proposition 5 and the associated Corollary 2 is that clear–cut relations can only be pinned down for risk neutral economies. There, we observe the efficiency loss usually assigned to imperfect competition in its pure form. Although, from the viewpoint of risk–taking, the right fraction of agents chooses to become an entrepreneur, the occupational distribution is still biased towards firm ownership.

The inefficiencies arising from risk and from imperfect competition are capable of partly offsetting each other in risk averse as well as in risk loving economies. Figure 2 illustrates this result for a variation in ρ, while η is held fixed. Subfigure 2(b), for instance, shows that the aggregate income of the monopolistic competition economy exceeds the corresponding level of perfect competition, if agents become either increasingly risk averse or risk loving. This can explained with the less elastic response of Y/P to changes in the model primitives.[8] Nevertheless, since aggregate income is maximized for $\rho = 0$, there is no complete offset of effects. In this sense, imperfect competition only mitigates the effects stemming from risk and reduces the overall efficiency loss.

This finding can also be observed for the wage rate, expected profits and the risk premium (see Figures 2(c) to 2(e)), as well as for the individual firm's expected output (Figure 2(f)), where monopolistic competition reduces the deviation of the relationships from their efficient levels, if compared to perfect competition.

We now turn to the remaining part of the comparative analysis and examine the response of the economic variables to a change in the consumer's willingness to substitute goods in consumption.

Proposition 6 *The equilibrium population share of entrepreneurs unambiguously decreases with an increase in the elasticity of substitution between goods, if the agents are either risk averse or risk neutral*

$$\frac{\partial\lambda}{\partial\eta} = -\frac{\alpha \exp\left\{\frac{\rho\eta^2\sigma^2}{2(1-\alpha\eta)^2}\right\}\left[1+\frac{\rho\eta^2\sigma^2}{(1-\alpha\eta)^3}\left(1-\alpha^2\eta^2\right)\right]}{\left[1-\alpha\eta+\alpha\eta\exp\left\{\frac{\rho\eta^2\sigma^2}{2(1-\alpha\eta)^2}\right\}\right]^2} < 0, \quad \textit{for} \quad \rho \geqslant 0\,. \tag{26a}$$

For risk loving agents, we find

$$\frac{\partial\lambda}{\partial\eta} \gtreqless 0, \quad \textit{for} \quad 1 \lesseqgtr -\frac{\rho\eta^2\sigma^2}{(1-\alpha\eta)^3}\left(1-\alpha^2\eta^2\right)\,. \tag{26b}$$

Proposition 7 *The response of aggregate income Y/P, the wage rate w/P, expected profit income $\mathrm{E}[\pi(j)]/P$, the risk premium ϕ and the expected price ratio $\mathrm{E}[p(j)]/P$ to an increase of the elasticity of substitution between consumption*

[8] The corresponding condition is: $\varepsilon_{\frac{\tilde{Y}}{\tilde{P}},\rho} > \varepsilon_{\frac{Y}{P},\rho} \iff \varepsilon_{\frac{\tilde{Y}}{\tilde{P}},\tilde{\lambda}} \times \varepsilon_{\tilde{\lambda},\rho} > \varepsilon_{\frac{Y}{P},\lambda} \times \varepsilon_{\lambda,\rho}$.

goods is of ambiguous sign for risk averse and risk loving economies, whereas Y/P, w/P and $\mathrm{E}[\pi(j)]/P$ are increasing functions in η, if the agents are risk neutral.

(i) Aggregate real income:

$$\varepsilon_{\frac{Y}{P},\eta} \equiv \frac{\partial(Y/P)}{\partial\eta} \times \frac{\eta}{Y/P} = \varepsilon_{\lambda,\eta} \times \varepsilon_{\frac{Y}{P},\lambda} - \frac{1}{\eta}\ln\lambda + \frac{\eta\sigma^2}{2(1-\alpha\eta)^2}\,, \tag{27a}$$

$\varepsilon_{\frac{Y}{P},\eta} > 0$ *for* $\varepsilon_{\lambda,\eta} \times \varepsilon_{\frac{Y}{P},\lambda} \geqslant 0$

(ii) Real wage rate:

$$\varepsilon_{\frac{w}{P},\eta} = 1 + \varepsilon_{\lambda,\eta} \times \varepsilon_{\frac{w}{P},\lambda} - \frac{1}{\eta}\ln\lambda + \frac{\eta\sigma^2}{2(1-\alpha\eta)^2}\,, \tag{27b}$$

$\varepsilon_{\frac{w}{P},\eta} > 0$ *for* $\varepsilon_{\lambda,\eta} \times \varepsilon_{\frac{w}{P},\lambda} \geqslant 0$

(iii) Real expected profit:

$$\varepsilon_{\frac{\mathrm{E}[\pi(j)]}{P},\eta} = -\frac{\alpha\eta}{1-\alpha\eta} + \varepsilon_{\lambda,\eta} \times \varepsilon_{\frac{\mathrm{E}[\pi(j)]}{P},\lambda} - \frac{1}{\eta}\ln\lambda + \frac{\eta\sigma^2}{2(1-\alpha\eta)^2}\,, \tag{27c}$$

$\varepsilon_{\frac{\mathrm{E}[\pi(j)]}{P},\eta} > 0$ *for* $\varepsilon_{\lambda,\eta} \times \varepsilon_{\frac{\mathrm{E}[\pi(j)]}{P},\lambda} \geqslant \frac{\alpha\eta}{1-\alpha\eta}$

(iv) Expected risk premium:

$$\begin{aligned}\varepsilon_{\phi,\eta} = {} & \frac{\eta\sigma^2}{2(1-\alpha\eta)^2} - \frac{1}{\eta}\ln\lambda - \frac{\alpha\eta}{1-\alpha\eta-\lambda} \\ & + \frac{\varepsilon_{\lambda,\eta}}{1-\alpha\eta-\lambda}\left[(1-\alpha\eta)(1-\lambda)\,\varepsilon_{\frac{\mathrm{E}[\pi(j)]}{P},\lambda} - \alpha\eta\lambda\,\varepsilon_{\frac{w}{P},\lambda}\right]\end{aligned} \tag{27d}$$

(v) Expected output per firm j:

$$\varepsilon_{\mathrm{E}[C(j)],\eta} = \frac{(1-\eta)\,\alpha\eta\,\sigma^2}{(1-\alpha\eta)^2} - \varepsilon_{\lambda,\eta} \times \varepsilon_{\mathrm{E}[C(j)],\lambda} > 0, \quad \forall\rho \geqslant 0 \tag{27e}$$

(vi) Expected price ratio:

$$\varepsilon_{\frac{\mathrm{E}[p(j)]}{P},\eta} = \varepsilon_{\lambda,\eta} \times \varepsilon_{\frac{\mathrm{E}[p(j)]}{P},\lambda} - \frac{1}{\eta}\ln\lambda + \frac{(2\alpha-\alpha\eta-1)\,\eta\sigma^2}{2(1-\alpha\eta)^3}\,. \tag{27f}$$

Proof: By (16a), (16c), and (26a), the elasticities $\varepsilon_{\frac{Y}{P},\lambda}$, $\varepsilon_{\frac{\mathrm{E}[\pi(j)]}{P},\lambda}$ and $\varepsilon_{\lambda,\eta}$ depend on the size of λ and are of ambiguous sign for all $\rho \neq 0$. □

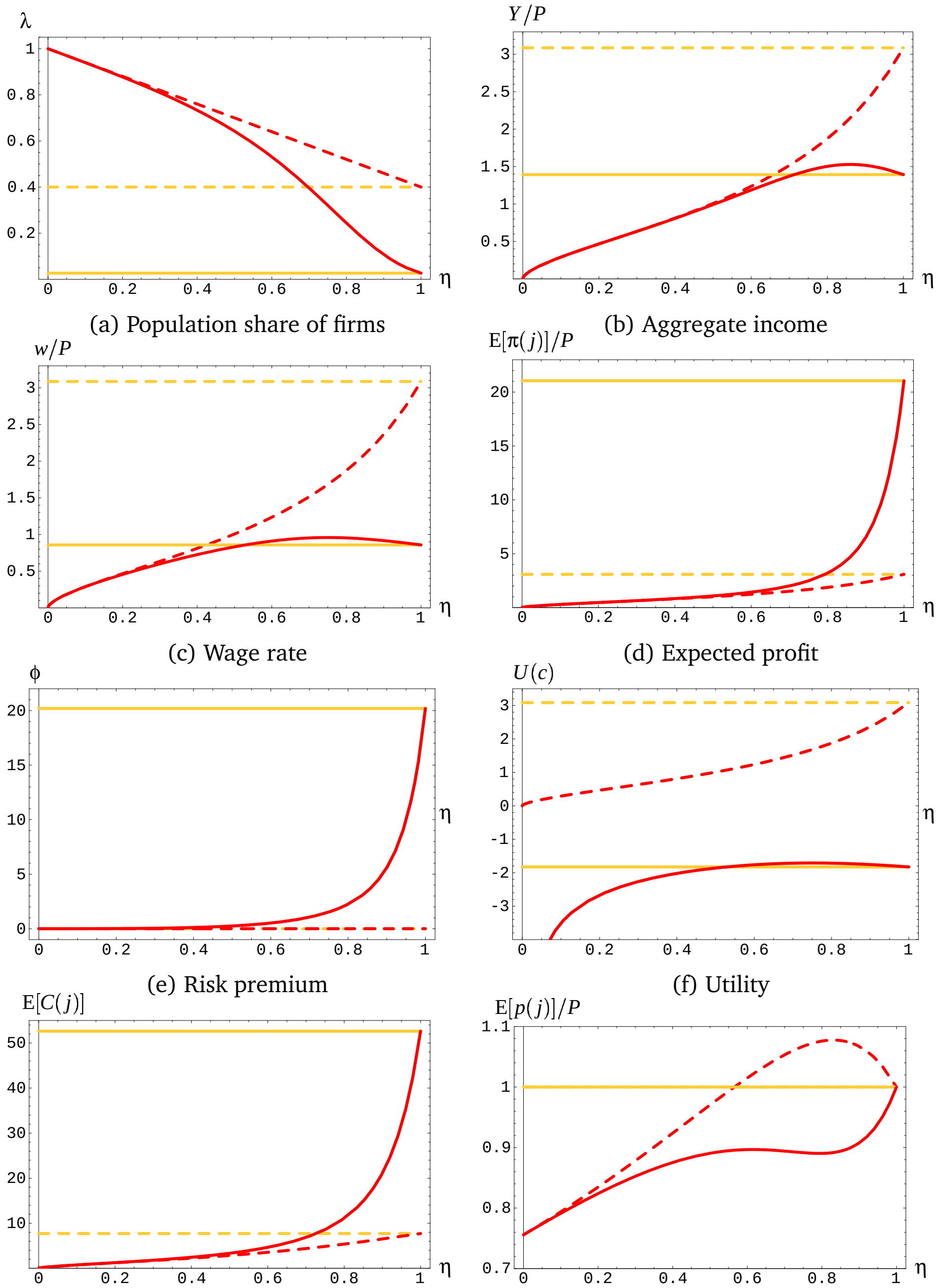
Of course, the results from Proposition 7 are closely related to the statements of Proposition 5 and the associated Corollary 2, where it was not possible to derive clear–cut relations between monopolistic and perfect competition, because the equilibrium values of the economic variables are non–monotonic functions in η.

Figure 3 displays our findings for a risk averse economy with $\rho = 1.6$, which is in the range of empirically plausible estimates (see Campbell, 1996; Carroll and Samwick, 1997). Again, the dark lines represent monopolistic competition, the light lines perfect competition, and the dashed lines the respective efficient allocation. Figure 3(a) shows the main result from Proposition 6, which postulated a declining population share of entrepreneurs as substitutability of products increases. This is accompanied by an increase in expected output per firm which is displayed in Figure 3(g). We also see that the aggregate real output, the wage rate and expected profits are generally increasing, too. Nevertheless, there is a range of values of η, where wages overshoot their corresponding perfect competition level before converging. The non–monotonic response of wages to changes in η is reflected by the associated change in aggregate income.[9]

As long as $\lambda > \tilde{\lambda}^*$, which means as long as the population share of entrepreneurs is even larger than the efficient population share under the regime of perfect competition, the inefficiencies stemming from both, risk and imperfect competition, act in the same direction, thereby adding up to a suboptimally low level of economic activity. But, in the range $\tilde{\lambda}^* > \lambda > \tilde{\lambda}$, we observe the above mentioned mitigating effect of monopolistic competition. As postulated by the trade–off relationship (23), here, the inefficiency loss from risk due to its negative effect on entrepreneurial risk–taking is partly offset by the positive effect of imperfect competition, the latter implying a comparably larger population share of firms.

This result extends to the response of the equilibrium value of utility to changes in η, as displayed in Figure 3(f). A ranking of allocations then shows that, of course, the first–best optimum is achieved in a perfect competition economy with risk neutral agents. With ρ exceeding unity, we assumed a comparably high degree of risk aversion. Under this condition, a second–best optimum is characterized by a situation, where the inefficiency from risk is eliminated, while the inefficiency from imperfect competition is preserved. Figure 3(f) shows that — for a certain range of values of η — monopolistic competition under risk is capable of supporting a third–best allocation, by

[9]The non–monotonic behavior of the economic variables is amplified with ρ increasing and vanishes for $\rho \to 0$.



(a) Population share of firms (b) Aggregate income

(c) Wage rate (d) Expected profit

(e) Risk premium (f) Utility

(g) Expected output of firm j (h) Expected price ratio

Figure 3: *Changes in the elasticity of substitution (risk averse agents)*

yielding a higher level of utility than perfect competition through partly compensating efficiency losses from risk.

To complete our analysis, we conclude with summarizing the asymptotic results for the upper and lower limit of the elasticity of substitution. As expected, we find:

Proposition 8 (Asymptotic results) *Monopolistic competition converges towards perfect competition for $\eta \to 1$, that is, if the elasticity of substitution between consumption goods becomes infinitely large. For $\eta \to 0$, the allocation is non–feasible. The population share of entrepreneurs tends to its upper bound $\lambda = 1$, where output and incomes approach zero.*

*limit**variable*	λ	V	$\frac{Y}{P}$	$\frac{w}{P}$	$\frac{\mathrm{E}[\pi(j)]}{P}$	ϕ	$\mathrm{E}[C(j)]$	$\frac{\mathrm{E}[p(j)]}{P}$
$\eta \to 1$	$\tilde{\lambda}$	$\tilde{V}$	$\frac{\tilde{Y}}{\tilde{P}}$	$\frac{\tilde{w}}{\tilde{P}}$	$\frac{\mathrm{E}[\tilde{\pi}(j)]}{\tilde{P}}$	$\tilde{\phi}$	$\mathrm{E}[\tilde{C}(j)]$	$\frac{\mathrm{E}[\tilde{p}(j)]}{\tilde{P}} = 1$
$\eta \to 0$	1	0	0	0	0	0	0	$e^{-\alpha+\frac{\sigma^2}{2}}$

7 Conclusion

This paper investigated the effects of imperfect competition on entrepreneurial risk–taking in a general equilibrium model of occupational choice à la Kanbur (1979). The analysis is embedded in the monopolistic competition context of Dixit and Stiglitz (1977), where households display a 'love for variety' and goods are imperfect substitutes in consumption.

The main feature of this setting, compared to the standard model of monopolistic competition, is that, by endogenizing occupational choices, this also determines the population share of firms and simultaneously fixes the range of products available to the consumer. Moreover, we have shown that profits do not vanish in (long–run) equilibrium, which also contradicts the outcome of the standard deterministic model, where new monopolistic competitors enter the market, as long as positive profits can be observed.

The economy of our model shows two types of inefficiencies, one stemming from the presence of risk, the other originating from imperfect competition. Regarding the first, we provided a condition characterizing an optimal (efficient) population share, maximizing aggregate income, and demonstrated that this notion of efficiency is tightly connected to the size of the aggregate income shares accruing to the members of the respective occupational group. Later on, we pointed out that the efficient outcome is also closely related to the allocation obtained under certainty equivalence, only to be observed in a risk neutral society.

Occupational choice is biased towards firm ownership in the risk averse economy, while the reverse is true for the risk loving society. Regarding expected profits of the monopolistic entrepreneurs, the comparative static results derived for a change in the attitude towards risk differ substantially from the ones of the perfect competition economy. Although entrepreneurs leave the market for an increased disliking of risk, this does not necessarily imply rising profits for the remaining firms. Since the change in profits is determined by counter–acting quantity and price effects, and, in general, is less elastic than aggregate income, too many firms ultimately remain in the market, deteriorating each others profit opportunities (meaning: *too many cooks spoil the broth*). This result is also reflected in the associated response of the expected income differential between entrepreneurs and workers, i. e. the risk premium, which vanishes with an increase in the degree of risk aversion. From this we conclude that imperfect competition might provide an explanation for the empirically observed comparably low risk premium on private equity (cf. Heaton and Lucas, 2000).

Referring to the second source of inefficiency, namely the monopolistic nature of competition, we are able to show that this has a mitigating effect on entrepreneurial risk–taking. Whereas both allocations in risk–sensitive societies, the perfect as well as the monopolistic competition economy, are characterized by an inefficient distribution of individuals over occupations, the population share of firms in the latter is always closer to the corresponding efficient value.

If the society is risk averse, we observe a negative tradeoff relationship between the coefficient of risk aversion and the elasticity of substitution between goods, the latter implicitly measuring the degree of competition between firms. This is tantamount to the result that under monopolistic competition a larger fraction of the population chooses the entrepreneurial profession. The reverse outcome can be found in the risk loving society.

If it comes to the question of ranking allocations, clear–cut results can only be obtained for risk neutral economies, where the inefficiency in occupational choice related to risk is eliminated, whereas the inefficiency originating from the monopolistic market structure remains effective. Here, we derive the standard result that imperfect competition cannot improve upon perfect competition.

This finding does not necessarily extend to the comparison of the risk–sensitive societies. Especially for the risk averse economy, we demonstrated that the two types of inefficiencies are capable of partially offsetting each other, such that aggregate output and expected utility under the regime of monopolistic competition exceed the corresponding values of perfect competition (meaning: *everyone is better off*). This outcome can, in general, be explained with the less elastic response of the economic variables in the monopolistic setting to changes in the model primitives.

From this we conclude that monopolistic structures do not necessarily harm the economy as long as non–diversifiable risk is involved. Nevertheless, this only represents a kind of second–best result, since imperfect competition cannot completely offset the inefficiency of the occupational distribution arising from the risk–sensitive behavior of households. From the viewpoint of economic policy, our findings imply that measures directed towards implementing the efficient distribution of a risk neutral economy are welfare enhancing, whereas measures which improve competition among firms might cause welfare losses.

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