Journal of Public Economics 96 (2012) 727–738

Contents lists available at SciVerse ScienceDirect

Journal of Public Economics

journal homepage: www.elsevier.com/locate/jpube

Optimal taxation, critical-level utilitarianism and economic growth ☆

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ARTICLE INFO

Article history:
Received 25 March 2011
Received in revised form 11 April 2012
Accepted 6 May 2012
Available online 7 June 2012

JEL classification:
D63
E21
H21
J13

Keywords:
Taxation
Endogenous fertility
Critical level utilitarianism
Population

ABSTRACT

We analyze tax policies in an intertemporal economy with endogenous fertility under critical-level utilitarianism, both from a positive and a normative standpoint. On the positive side, we analyze the effects of a change in the tax on capital income and on fertility, both separately and combined so as to keep the per-capita public debt constant. On the normative side, we characterize the first- and second-best optimal tax structures, for both exogenous and endogenous labor supply.

1. Introduction

The issue of optimal dynamic taxation has a long tradition in economics. However, only recently the consequences of endogenous fertility on tax policies have been explored. In fact, traditionally the two topics have been analyzed separately: on the one hand, the problem of optimal taxation in dynamic general equilibrium models has been investigated extensively: see Atkinson and Stiglitz (1972) for the earliest results on finite-time economies; Judd (1985), Chamley (1986) and Judd (1999) for the results in infinite horizon economies based on Ramsey (1928); Erosa and Gervais (2002) and De Bonis and Spataro (2010) for overlapping-generations economies; see also Basu et al. (2004) and Basu and Renström (2007) for indivisible labor economies.

On the other hand, another strand of literature has been focusing on the optimal population growth rate (Samuelson, 1975; Deardorff, 1976 and, more recently, Jaeger and Kuhle, 2009; Renström and Spataro, 2011) and on the role of endogenous fertility on optimal welfare state design (in particular social security; see, for example, Cigno and Rosati, 1992; Zhang and Nishimura, 1992, 1993; Cremer et al., 2006; Yew and Zhang, 2009; Meier and Wrede, 2010).

In this paper we aim at addressing the issue of optimal taxation in presence of endogenous fertility in a unified framework. In particular, we tackle such an issue by assuming that agents are entitled with "critical-level utilitarian preferences" (see Blackorby et al., 1995).[1] Critical-level utilitarianism (CLU henceforth) is an axiomatically founded population principle that can avoid the repugnant conclusion (see Parfit, 1976, 1984; Blackorby et al., 1995, 2002).[2] The latter implies that any state in which each member of the population enjoys a life above "neutrality" is declared inferior to a state in which each member of a larger population lives a life with lower utility. Indeed, such a result is likely to emerge in economic models under classical utilitarianism and endogenous fertility, that is in presence of social orderings based on the (sum of) well-being (i.e. utilities) of the individuals who are alive in different states of the world.

There are several ways for avoiding the repugnant conclusion. Some earlier literature assumed objective functions of a particular form.[3] However, such objective functions may not have an axiomatic

☆ We are grateful to two anonymous referees and the editor for suggestions that greatly improved the paper. We also thank Laurent Simula and participants at the Chaire Quetelet Conference, Louvain-la-Neuve, 2009, the Annual Congress of the IIPF, Uppsala, 2010, and at the XI ISUS Conference, Lucca, 2011 for helpful suggestions.

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[1] Among other non utilitarian principles, see, for example, Golosov et al. (2007).

[2] Therefore, although several authors have criticized CLU, such as Parfit (1976, 1984), Hurka (2000), Arrhenius (2000), Ng (1986), Shiell (2008) -see Blackorby et al. (2005) and Renström and Spataro (2011) for a discussion of such critiques- we decided to maintain such an approach.

[3] E.g. Barro and Becker (1988) and Becker and Barro (1989).

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doi:10.1016/j.jpubeco.2012.05.001

foundation. We believe an axiomatic foundation is important, especially since tax policy affects births and the government then indirectly is determining whether some individuals will live or not. In fact, in a twin paper (Renström and Spataro, 2011) we have shown that CLU[4] can deliver a steady-state equilibrium entailing an interior solution for the rate of growth of population, provided that the critical level belongs to a positive, open interval. We recall here that the critical level α can be defined as the utility level of an extra-individual i who, if added to an otherwise unaffected population N with utility distribution u, would make the two alternatives socially indifferent, i.e. (N,u) as good as $(N,u;i,\alpha)$.

In the present work, we contribute to the field of second best taxation and endogenous fertility, in general equilibrium, under CLU, both from a positive and a normative standpoint. To the best of our knowledge, this has not been done before.

The paper is organized as follows: after presenting the model, in Section 3 we characterize the steady-state equilibrium and, in Section 4 we perform a comparative statics analysis in order to assess the effect of taxes on the equilibrium levels of consumption, capital and population growth rate. Moreover, in Section 5 we characterize the optimal structure of taxes both in the absence and in the presence of endogenous labor supply. Finally, in Section 6 we will extend the analysis to the case of linear costs for childbearing.

2. The economy

We assume, for the sake of simplicity, that each generation lives for an instant of time, and life-time utility is $u(c_t)$, where c_t is life-time consumption for that individual. We also follow the convention that $u=0$ represents neutrality at individual level (i.e. if $u<0$ the individual prefers not to have been born), and denote the critical level as α. We start our analysis by assuming that labor supply, l_t, is exogenously fixed and normalized to 1; we will relax this assumption in Section 5.2. An individual family chooses consumption, savings and the number of children (i.e. the change in the cohort size N_t).

We also assume that raising children is costly. There are two approaches in the literature. One strand assumes the cost per family member in the number of children, θ, is linear (as in Becker and Barro, 1989; Cremer et al., 2006), while the other assumes it is strictly convex (as in Tertilt, 2005; Growiec, 2006). Convex cost implies decreasing returns-to-scale in childrearing. In the present work we take the convex-cost approach as our benchmark, and later in Section 6 we show the implications of assuming linear costs for childbearing.

As for firms, we assume perfectly competitive markets and constant returns-to-scale technology. The consequence of the assumptions on the production side is that we retain the "standard" second-best framework, in the sense that there are no profits and the competitive equilibrium is Pareto efficient in absence of taxation. Otherwise there would be corrective elements of taxation. Finally, we assume the government finances a stream of exogenous per-capita expenditure by issuing debt and levying taxes.

To retain the second-best, we levy taxes on the choices made by the families, i.e. savings and population (fertility). Consequently we introduce the capital income tax and a population tax proportional to the number of children. Regarding the population tax, it does not matter if we tax the present generation or the future, because of altruism. For simplicity we assume that the children pay the population tax, making it proportional to N and when parents make choice of the number of children they take into account this tax liability and resulting reduction in their children's consumption. Consequently the population tax distorts fertility choice.

[4] Allowing for discounting of the utilities of future generations, as in Blackorby et al. (1997).

2.1. Individuals

The problem of each household is to maximize the following birth-date dependent critical level utilitarian objective function:

$$\int_{t=0}^{\infty} N_t e^{-\rho t}[u(c_t)-\alpha]dt \tag{1}$$

$$\text{s.t. } \dot{A}_t = \bar{r}_t A_t + w_t N_t - c_t N_t - \tau_t^N N_t - \theta(n_t) N_t \tag{2}$$

where $u(c_t)$ is the instantaneous utility function, increasing and concave in c_t, $\rho>0$ is the intergenerational discount rate and $\alpha>0$ is the critical level.

The childrearing cost, $\theta(n)$, is specified over the number of children each parent has, and is then a function of the population growth rate. In equilibrium each parent has the same number of children, so the per family member population growth rate becomes the economy wide one. We assume that such a cost is increasing in the number of children and, thus, in the population growth rate (n), i.e. $\theta'(n)>0$; moreover, we assume $\theta(0)$, the cost of raising one child, to be positive (when $n=0$ population is constant, which implies that each adult generates one child). Moreover, in the benchmark model we assume strict convexity of $\theta(n)$, i.e. $\theta''(n)>0$, while the linear cost case, with $\theta(n)=\theta'\cdot(1+n)$ (θ' constant), will be presented in the extension provided in Section 6.[5]

Since we fix neutrality consumption to zero (i.e. $u(0)=0$), this implies that c^{α}, satisfying $u(c^{\alpha})=\alpha$, is strictly positive. Moreover, A_t is household wealth, $\bar{r}_t = r_t(1-\tau_t^k)$ is net of tax interest rate, and τ_t^k and τ_t^N are the tax rate on capital income and on the population (household) size, respectively.

The population size, N_t, grows at rate n_t, i.e.

$$\frac{\dot{N}_t}{N_t} = n_t. \tag{3}$$

We assume that there are lower and upper bounds on the population growth rate: $n_t \in \left[\underline{n}, \bar{n}\right]$. Realistically, there is a physical constraint at each period of time on how many children a parent can have. There is also a constraint on how low the population growth can be. The reason for the latter assumption is twofold: first, we do not allow individuals to be eliminated from the population (in that there is no axiomatic foundation for that); moreover, even if nobody wants to reproduce there will always be accidental births and/or accidental deaths. For this reason, while we assume $\bar{n}$ to be positive, we allow $\underline{n}$ to take negative values. Clearly, from Eq. (1) the problem has a finite solution only if $\rho > \bar{n}$ which we assume throughout our analysis.

2.2. Firms

Assuming constant returns-to-scale production technology, $F(K_t,L_t)$, zero capital depreciation rate and perfect competition, firms hire capital, K, and labor services, L, on the spot market and remunerate them according to their marginal productivity, such that

$$F_{K_t} = r_t \tag{4}$$

$$F_{L_t} = w_t. \tag{5}$$

Normalizing individual labor supply to unity implies $L_t = N_t$ (this will be relaxed in Section 5.2).

[5] A concave cost function, in our analysis becomes equivalent to a linear one, in the sense the equilibrium population growth rate is at a corner value during the transition. Tertilt (2005) and Growiec (2006) in fact assume convex cost in order to have an interior solution.