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# Egalitarianism under population change: Age structure does matter[☆]

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ABSTRACT

We study the compatibility of the optimal population size concepts produced by different social welfare functions and egalitarianism meant as "equal consumption for all individuals of all generations". Social welfare functions are parameterized by an altruism parameter generating the Benthamite and Millian criteria as polar cases. The economy considered is in continuous time and is populated by homogeneous cohorts with a given life span. Production functions are linear in labor, (costly) procreation is the unique way to transfer resources forward in time. First, we show that egalitarianism is optimal whatever the degree of altruism in "perpetual youth" model, that is when lifetime span is finite but age structure does not matter: in this case egalitarianism does not discriminate between the social welfare functions considered. Then we show that, when life span is finite but age structure matters, egalitarianism does not arise systematically as an optimal outcome. In particular, in a growing economy, that is when population growth is optimal in the long-run, this egalitarian rule can only hold when the welfare function is Benthamite. When altruism is impure, egalitarianism is impossible in the context of a growing economy. Either in the Benthamite or impure altruism cases, procreation is never optimal for small enough life spans, leading to finite time extinction and maximal consumption for all existing individuals.



## 1. Introduction

Population growth, and notably the consequences of overpopulation on the living standards of present and future generations, are on the top of research agendas of many demographers, philosophers and economists. In particular, the role of population size in the genesis of inequality has become central in the so-called population ethics. Dasgupta (2005) is an excellent survey of research in this area. A considerable part of the related contributions has been devoted to study the extent to which the classical forms of utilitarianism can make the job of ranking populations of different sizes according to the kind of equality meant. Throughout our paper, we study equality in terms of welfare as measured by utility from consumption. This is certainly a benchmark (see the basic model in this area in Dasgupta, 2005) but consumption can be taken, as always, in a very broad sense. A central contribution in the area of population ethics is Parfit (1984). According to Parfit, total utilitarianism (that is the Benthamite social welfare function) may lead to prefer a situation with a very large population size while the standards of living are quite low compared to a situation with a smaller population and better standards of living (as measured by consumption per capita for example). Parfit calls this outcome a *repugnant conclusion*.[1] Actually, Edgeworth (1925) was the first to claim that total utilitarianism leads to a bigger population size and lower standard of living. So this discussion has also always been important in normative economic theory as well. An interesting connected theoretical question is the notion of optimal population size, which is admittedly another old question in economic theory (see for example Dasgupta, 1969). Typically, in all the papers that have been written to study the robustness of Edgeworth claim (see a short survey below), population size is chosen so as to maximize

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[1] Dasgupta (2005) discusses to which extent the term "repugnant" is appropriate.

the considered social welfare functions. *In fine*, the key question is: is the optimal population size concept produced by this or that social welfare function compatible with standard and less standard egalitarian principles? This is indeed the question we treat in this paper in a novel framework, which will be described later.

First if all, let us mention that population ethics is currently a very active research area with many open questions and debates. Two literature streams have emerged. One, a sort of natural continuation of the Beckerian endogenous fertility model (see for example, Barro and Becker, 1989), is concerned by the construction of Pareto efficiency principles in overlapping-generations models involving quite naturally external effects within dynasties running from parents to children and vice versa. A subtle representative of this type of literature is Golosov et al. (2007) which presents several efficiency concepts depending on the way unborn are treated.[2] The second stream is much more directly connected to the literature initiated by Parfit (1984). In particular, this stream does not rely on the dynastic model and is not concerned with the externalities inherent to its structure. Representatives of this approach are either axiomatic (Blackorby et al., 2005, or Asheim and Zuber, 2012) or non-axiomatic (Nerlove et al., 1982, or Palivos and Yip, 1993).

In this paper, we also depart from the dynastic approach and take the latter avenue with a special emphasis on populations' age structures. More specifically, we revisit some old population ethics questions within the modern framework of endogenous growth, having in mind that growth, by relaxing resource constraints, might ease avoiding the paradoxical outcomes outlined by Parfit, and even might pave the way to reach more egalitarian allocations across individuals facing different time horizons at given date. Actually, the robustness of Edgeworth's claim when societies experience long periods (say infinite time periods) of economic growth has been already discussed in two previous papers, namely Razin and Yuen (1995) and Palivos and Yip (1993). We shall rely on the same class of parameterized social welfare functions used by these authors. The parameterization consists in weighting the utility of individuals at any given date $t$ by the term $N^{\gamma}(t)$ where $N(t)$ is the size of the population at $t$ and $0 \leq \gamma \leq 1$. When $\gamma$ increases, the time discount rate goes down, inducing a larger weight for individuals of future generations in the social welfare functions. In this precise sense, $\gamma$ measures a kind of degree of altruism towards individuals to be born in future dates as outlined by Palivos and Yip for example. To fix the terminology, we shall refer to $\gamma$ as the degree of altruism. This terminology is chosen for convenience.[3] When $\gamma = 1$ (Resp. $\gamma = 0$) one gets the standard Benthamite (Resp. Millian) social welfare function. We may treat $\gamma$ as a continuous parameter and interpret the cases where $0 < \gamma < 1$ as cases where altruism is impure or imperfect.

Using the same class of social welfare functions, Palivos and Yip (1993) showed that Edgeworth's claim cannot hold for the realistic parameterizations of their model. Precisely, they established their results in the framework of endogenous growth driven by an AK production function. The determination of the optimum relies on the following trade-off: on one hand, the utility function depends explicitly on population growth rate; on the other, population growth has the standard linear dilution effect on physical capital accumulation. Palivos and Yip proved that in such a framework the Benthamite criterion leads to a smaller population size and a higher growth rate of the economy provided the intertemporal elasticity of substitution is lower than one (consistently with empirical evidence), that is when the utility function is negative. Indeed, a similar result could be generated in the setting of Razin and Yuen (1995) when allowing for negative utility functions.[4] It goes without saying that the value of not-living is essential in the outcomes[5]: in the class of models surveyed just above, this value is typically zero, so that negative utility functions imply that living gives inferior value than not living.

Our paper goes much beyond the technical point mentioned just above. Essentially it aims at investigating the compatibility between utilitarianism and egalitarianism in an economy where human resources, and therefore population size, is the engine of growth. Specifically, our set-up has the following three distinctive features:

1. First, we shall consider a minimal model in the sense that we do not consider neither capital accumulation (as in Palivos and Yip, 1993) nor natural resources (as in Makdissi, 2001): we consider one productive input, population (that is labor), and the production function is AN with $N$ the population size. By taking this avenue, population growth and economic growth will coincide in contrast to the previous related AK literature (and in particular to Razin and Yuen, 1995). More importantly our model is clearly at odds with the typical *genesis problem* as presented by Dasgupta (2005) in his survey: not only we have constant returns to scale (*vs.* decreasing returns in Dasgupta), but apparently we do not have any type of investment to transfer resources to the future. As one will see, our model does actually entail a form of forward resource transfer simply through having children: having children is costly (investment) but they are the workers of tomorrow, and therefore they are the exclusive wealth producers in the future (forward income transfer). Because birth costs are supposed linear in our AN model, one would expect to have the same outcomes as in a standard AK model. In particular, detrended consumption would be constant. Since demographic and economic growth coincide in our model, one would infer that constant per capita consumption is a possible outcome. Indeed it is the latter important observation that led us to select this minimal model for the study of the compatibility between total utilitarianism and egalitarianism. Accordingly, one can choose "equal consumption per capital for all individuals and all generations" as the *natural egalitarian principle* in our framework.
2. Second, we bring into the analysis human life span and age structures of populations. Concerning life spans, we shall assume that all individuals of all cohorts live a fixed amount of time, say $T$. The value of $T$ will be shown to be crucial for the outcomes of the analysis. As outlined above, procreating is the unique way to transfer resources forward in time. Durability of these resources, captured by the life span $T$, is therefore likely to be key for the design of the optimal procreation plan. We shall assume that life span is exogenous in our model. Admittedly, a large part of the life spans of all species is the result of a complex evolutionary process (see the provocative paper of Galor and Moav, 2007). Also it has been clearly established that for many species life span correlates with mass, genome size, and growth rate, and that these correlations occur at differing taxonomic levels (see for example Goldwasser, 2001). Of course, part of the contemporaneous increase of humans' life span is, in contrast, driven by health spending and medical progress. We shall abstract from the latter aspect.

2 Another excellent reference is Conde-Ruiz et al. (2010).

3 We could have fixed the terminology referring more to the role of $\gamma$ in intertemporal discounting to show better the distance with respect to dynastic models.

4 See also Boucekkine and Fabbri (2013).

5 Dasgupta (2005) has already underlined the crucial nature of this point.