

Comments Welcome

**Birth and Death**

by

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First Version: January 2016  
Revised: March 2016

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## Acknowledgements

This article is an adaptation of Chapter 10 of *Time and the Generations*, a book I am preparing around my Arrow Lectures at Stanford University (1997), Columbia University (2011), and the Hebrew University of Jerusalem (2012), respectively, and my 2011 Munich Lectures in Economics. Valuing potential lives and the related idea of optimum population have intrigued me ever since I was a graduate student, and I am grateful to the late James Meade for arousing my interest in them. The subject is hard, so hard that over the years I have fumbled about to find ways to express my disquiet with the dominant formulation of the problem and the literature surrounding the paradoxes it harbours. And I am all too conscious that readers may find me fumbling even now. Parental desires and needs in the face of socio-economic and ecological constraints are the basis on which economic demography has been built. Moral philosophers in contrast study population ethics, but shy away from characterising the constraints under which the ethics is to be put to work. No system of ethics should be expected to yield unquestionable directives in all conceivable circumstances, even to the same person. If we are to arrive at satisfactory policies, a suitable accommodation has to be found for the economist's concerns, the environmental scientist's predilections, and the philosopher's sensibilities. These are early days even to attempt an integrated study. So I go about matters in a piecemeal fashion here. My idea is to construct a structure for population ethics that accommodates contemporary sensibilities over birth and death.

The present essay builds on Dasgupta (1969, 1989, 1994, 2005). Over the years I have learned greatly from discussions with Geir Acheim, Scott Barrett, Simon Blackburn, Charles Blackorby, John Bongaarts, Christopher Cowie, Aisha Dasgupta, Shamik Dasgupta, David Donaldson, Paul Ehrlich, Karl-Goran Maler, Eric Maskin, James Mirrlees, Edmund Phelps, Martin Rees, Paul Seabright, Amartya Sen, Itai Sher, and Menahem Yaari. I have also been much stimulated by the criticisms of my writings on population ethics by John Broome (Broome, 1996, 1999, 2004).

My greatest debt is to Kenneth Arrow, discussions and collaboration with whom have regularly clarified my understanding of inter-generational ethics. This essay is dedicated to him.

An earlier version of this article was prepared for a lecture on 14 January 2016 at a conference on Discounting and Climate Change held at the University of Oxford. For their comments I am grateful to Paul Kelleher, Kian Mintz-Woo, Matthew Rendall, Dominic Roser, and Ingmar Schumacher. The present version has benefited greatly from the written comments of Christopher Cowie and Rae Langton.

## Abstract

It has long been known that in finite economies the Utilitarianism of Henry Sidgwick commends large populations. It has been known also that the stronger is the aversion to inequality in the standard of living the lower is the optimum living standard, and that it tends in the limit to Sidgwick's "hedonistic zero". A version of the latter feature of the theory was subsequently named the Repugnant Conclusion (RC). Most escape routes from RC have invoked the language of "gains" and "losses", which are familiar notions in social cost-benefit analysis. Those notions have been found to lead to paradoxes involving the Non-Identity Problem. A notable escape route from RC, Critical-Level Utilitarianism, hasn't invoked the language of benefits and harms but has insurmountable problems of its own. In this paper I start with Sidgwick's theory in its pristine form - the maximization of the sum of utilities - but recast it in a contemporary language: the ground of binding reason is taken to be "well-being", not "happiness" or "agreeable consciousness". Sidgwick erred in his interpretation of the hedonistic zero, which may explain why the pro-natalism inherent in his theory has been found to be repugnant by philosophers. Problems with Utilitarianism lie elsewhere. An example is presented which invites an additional but relatively mild notion of person-hood into any theory that says that personal well-beings should be the basis for ranking states of affairs. We call the revised formulation, Generation-Relative Utilitarianism. It has however been argued that the theory is incoherent because it does not yield a binary relation between states of affairs. I show that the incoherence arises only when states of affair are not specified with care. Generation-Relative Utilitarianism is then put to work in a model economy facing an indefinite future and a finite flow of resources. I make use of contemporary global statistics to get a feel for the theory's implications for both population numbers and the standard of living. Population numbers are found to be smaller and the living standard higher than they would be under Sidgwick's Utilitarianism. The theory is then used to understand the nature of loss that would be suffered in the face of human extinction. Generation-Relative Utilitarianism is shown to arrive at the view that each generation is a trustee of the capital it inherits from its predecessor.

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Our children are both ends and means. The mix of motivations depends variously on the customs and institutions we inherit, and on our character and circumstances. That children are ends is emotionally so compelling that it may seem too obvious to require acknowledgement, but social anthropologists have shown that children are ends not only in the innate desire we have to bear and rear them, but also in the dictates of tradition and religion, perhaps too in the feeling that children are the clearest avenue open to self-transcendence. A common refrain, that our children are priceless, is an expression of that range of emotions.<sup>1</sup>

In places where formal institutions are underdeveloped, children also substitute for other assets, which is why children as a means to parental ends is most apparent in the poorest regions of the world. Children serve as security in old-age in places that have neither pension schemes nor adequate land markets. They are also a source of labour in households possessing few labour saving devices. Children mind their siblings, tend to domestic animals, pick berries and herbs, collect firewood, draw water, and help with cooking. Children in poor countries are valued by their parents also as capital and producer goods.<sup>2</sup>

### **1 Economic Demography<sup>3</sup>**

Those childhood activities are so unfamiliar today in the West that they direct us to study the mix of motivations governing procreation by contrasting rich regions from poor regions. There are notable exceptions of course, but broadly speaking fertility and mortality rates are high and health status and education attainments are low in poor countries, whereas the corresponding statistics in rich countries read the other way. Table 1, which presents a snap shot (year 2010), speaks to that by displaying the classification used at the World Bank, where "rich" and "poor" are defined in terms of GDP per capita. Countries have been known to make a transition from one category to the other (that's what economic development is usually taken to mean), moreover the bulk of the world's population and a majority of the world's poorest people live in neither rich nor poor countries, and international statistics say there are enormously rich people in poor countries. It nevertheless pays to study sharp contrasts, as in Table 1. In this, economic demography is no different from population ethics.

Reproductive decisions have consequences for others (including our descendants) that are unaccounted for. Economists use the term "externalities" to denote those consequences of our decisions for others that are unaccounted for. Externalities raise deep ethical issues. Not only do they extend to contemporaries and can be expected to extend to future people, it is also that some people will be born in consequence of the decisions we take, while some who would have

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<sup>1</sup> One such injunction emanates from the cult of the ancestor, which takes religion to be the act of reproducing the lineage. See Fortes (1978).

<sup>2</sup> In South Asia children have been observed to be at work from as early an age as six.

<sup>3</sup> This section has been taken from Dasgupta and Dasgupta (2016).

been born had we acted otherwise will not be born.<sup>4</sup>

Caldwell (1981, 1982) drew on a suggestion implicit in the contrast displayed in Table 1; that the inter-generational transfer of resources is from children to parents in poor societies, but from parents to children in rich societies. The suggestion has been easier to confirm in rich countries, where the rate of investment in children's education has been found to be as high as 6-7% of GDP (Haveman and Wolfe, 1995). Confirming the reverse flow in poor countries has been a lot harder, in part because data are sparse but in part also because even within poor regions there are significant differences in attitudes toward reproduction. Those differences are traceable to kinship structures, marriage practises, and rules of inheritance. The implied line of thinking says that over the long run it is differences in institutions and social norms - originating perhaps in some measure in geography - that are the reasons behind differences in reproductive behaviour among groups. Theoretical models have been built on that premise. Causality isn't traced to differences in income or wealth. It is not that fertility and mortality rates are high and health status and education attainments are low in poor regions *because* people there are poor, it is that very low incomes go hand in hand with those features of life. The variables are mutually determined over time.<sup>5</sup>

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<sup>4</sup> Decisions on consumption, production, and our use of the natural environment also create externalities. They are connected to reproductive externalities. Here I focus on decisions over reproduction.

<sup>5</sup> For theoretical models that speak to the mutual determination, see Dasgupta (1993, 2010), Brander and Taylor (1998), Harford (1998), and Dasgupta and Ehrlich (2013). Sub-Saharan Africa has long been regarded as special, even among poor regions (Goody, 1976; Bledsoe, 1994; Guyer, 1994; Bongaarts and Casterline, 2013). In an early review of fertility intentions Cochrane and Farid (1989) noted that both the urban and rural, the educated and uneducated in sub-Saharan Africa have more, and want more, children than their counterparts in other less-developed regions. Even young women there expressed a desire for an average of 2.6 more children than women in the Middle East, 2.8 more than women in North Africa, and 3.6 to 3.7 more than women in Latin America and Asia. Updated versions of these figures are available, but it is worth considering the data from the mid-1980s because the income gap between Africa and the rest of the developing world was smaller at that time than it is now.

Total fertility rate (TFR) is the number of successful pregnancies that a woman expects to experience during her reproductive years. In a notable article, Pritchett (1994) analysed data from household surveys conducted by the World Fertility Survey and the Demographic and Health Surveys programmes, which included women's responses to questions regarding their preferences and their behaviour. Demographers had earlier derived several indicators of the demand for children from these data. One such indicator, the "wanted TFR" (Bongaarts, 1990), can be compared to the actual TFR for the purpose of classifying births or current pregnancies in a country or region as wanted or unwanted. Regressing actual fertility on fertility desires in a sample of 43 countries in Asia, Africa, and Latin America, Pritchett found that about 90 percent of cross-country differences in TFRs are associated with differences in desired fertility. Moreover, excess fertility was found not to be systematically related to the actual TFR, nor to be an important determinant of the rate. 90 percent may prove to be an over-estimate, but it hasn't yet been proven to be greatly so. These features of reproductive behaviour, and the tenuousness of the idea of "reproductive rights" that might be seen to flow from them, are discussed at greater length in Dasgupta and Dasgupta (2016).

Table 1 is a snapshot. There is no suggestion that poor regions will remain poor, nor that rich regions may not find their place reversed in the long run. Regional differences in fertility, education, and output per capita were slight until the start of the Early Modern era (roughly, 1500 CE). Global aggregates of earlier eras look much the same as their regional aggregates.<sup>6</sup> Although regional aggregates have diverged since then, global aggregates (a weighted average of regional statistics) have shown a steady move toward and beyond the "fertility transition", that is, the transition from high fertility and mortality rates to low fertility and mortality rates.

Economists have offered a number of explanations for the historical experience.<sup>7</sup> What is common to them is a presumption that parental choices over fertility, consumption, and investment determine long run outcomes. The models trace the relative urgencies of parental needs, desires, and obligations to the constraints on choices facing parents in each generation. Some authors stress economic constraints, others pay attention to social and ecological constraints. Economic demographers have commonly avoided moral theories in their study of reproductive behaviour.<sup>8</sup>

Philosophical discourses on population are built on normative reasoning. Moral philosophers have however avoided offering even a sketch of the constraints under which that reasoning is to be put to work. No system of ethics should be expected to yield incontrovertible directives in all conceivable circumstances. In order to arrive at satisfactory demographic policies, a suitable accommodation has to be found for the economist's concerns, the environmental scientist's predilections, and the philosopher's sensibilities. These are early days even to attempt an integrated study. So I go about matters in a piecemeal fashion here. The above is a summary of the questions economic demographers have sought to answer and the tools they have used to address them. In the remainder of the paper I study population ethics with an eye on ecological constraints.<sup>9</sup>

## **2 Utilitarian Ethics**

In his introduction to *Utilitarianism* Sidgwick (1907: 415-416) wrote:

"... if we take Utilitarianism to prescribe, as the ultimate end of action, happiness as a

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<sup>6</sup> The classic on this is Maddison (2001), who provided estimates of expectancy of life at birth, population size, and output from 1 CE until year 1998 in various regions of the world.

<sup>7</sup> See the references in footnote 4, and Galor (2011).

<sup>8</sup> "Parental choices" are only a contemporary way of alluding to choices that are often, perhaps even usually, influenced by the extended family, kinship, and the couple's peer group. On this see Dasgupta (1993, 2010).

<sup>9</sup> There is an economics literature from the first half of the twentieth century that took J.S. Mill's Average Utilitarianism to be the basis for population ethics. Gottlieb (1945) is a well known account of that literature.

whole, and not any individual's happiness, unless considered as an element of the whole, it would follow that, if the additional population enjoy on the whole positive happiness, we ought to weigh the amount of happiness gained by the extra number against the amount lost by the remainder. So that, strictly conceived, the point up to which, on Utilitarian principles, population ought to be encouraged to increase, is not that at which average happiness is the greatest possible ... but that at which the product formed by multiplying the number of persons living into the amount of average happiness reaches its maximum."

There is a problem with the opening sentence. Sidgwick starts by noting that the ground of binding reason is total happiness ("happiness as a whole") but goes on to appeal to gains and losses when applying the Utilitarian calculus. That the two aren't equivalent if the timing of conceptions (never mind the number of conceptions) is affected by decisions was noted by Parfit (1976), Schwartz (1978), and Adams (1979) and shown to give rise to what is now known as the Non-Identity Problem.<sup>10</sup>

I start here with Sidgwick's Utilitarianism in its pristine form. The criterion for evaluating states of affair is the sum of personal utilities: period. Sidgwick (1907: 119-150) contains three chapters on empirical hedonism, where the sense in which "happiness" is used is a lot more considered than is suggested in the frequent criticism that Utilitarianism views humans to be mere pleasure machines. The sense in which I want to use the word "utility" is however a long way beyond even Sidgwick. The notion that corresponds best is "well-being". I borrow Thomas Scanlon's formulation and understand personal well-being to mean a numerical measure of the extent to which those of one's informed preferences that can be justified to others in terms of

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<sup>10</sup> I have taken the attribution from the essay by Kavka (1982) which, with an accompanying essay by Parfit (1982), explored the complexities of the Non-Identity Problem. The problem, as Parfit (1982, 1984) posed it, goes like this:

"A woman suffers from a medical condition. There is a large chance that if she were to conceive now, the child would suffer from a disability but would otherwise enjoy a good life. However, a minor medical treatment would cure the woman within a month. Once cured, any child she bears will be free of the disability and enjoy a life of high quality. The woman is somewhat impatient to conceive. Ought she to wait a month, or would it be reasonable of her to conceive now?"

One can argue that it is reasonable she conceives now. After all, or so the argument could go, the woman's feelings matter and the child she conceives now can't complain later that she was unfair to him, that she should have waited and undergone the medical treatment, that had she done so he would have had a better life. The reason he would not have grounds for complaint is that had she waited, the child she would have conceived wouldn't have been him. Nor, or so the argument may continue, can some unconceived child complain that the woman prevented him from being born by being hasty. Nonetheless, as Parfit and others observed there is a strong intuition that the woman should wait. And the intuition is built not only on the thought that good lives are an intrinsic good, but also that better lives are intrinsically even better. Notice that in this intuition the basis for evaluation is not "gains" and "losses", but total utility.

There has been a revival of interest in the Non-Identity Problem. Boonin (2014) is a book-length treatment and has a comprehensive set of references. I have gained much from reading an unpublished paper on the subject by Christopher Cowie (Cowie, 2015).



principles they could not reasonably reject are realized. That's the roughest outline of the formulation. But it's clear enough that in that account rights are built into personal well-being; which is why there is no clean distinction between deontological and consequentialist reasonings in the framework I work with.<sup>11</sup>

"Well-beingism" reads distinctly odd. So we will call the theory that is applied here Utilitarianism, even though the raw material out of which it is constructed is personal well-being, not personal utility. Section 3 explores how far that theory is able to guide population ethics before running into trouble. I do that by putting the theory through its paces in a world with finite resources. For simplicity of exposition the world I imagine is timeless. The corresponding analysis in an economy moving through time was presented in Dasgupta (1969).

My idea here is to construct a framework for population ethics that accommodates contemporary sensibilities over birth and death. In Section 4 I show that Sidgwick erred in his reading of a life that goes neither well nor badly. That error recurs in contemporary writings on population ethics. Criticisms of the theory built on that misreading and the paradoxes the theory is thought to harbour are thus misplaced. In Section 5 an example is constructed to show that problems with Sidgwick's (or Classical) Utilitarianism (I use the terms inter-changeably) lie elsewhere. I explore a way that suggests itself for amending the theory. The amended version is Generation-Relative Utilitarianism. In Section 6 Generation-Relative Utilitarianism is applied to a timeless world with finite resources. The theory is shown to recommend a smaller population than Utilitarianism. Parfit (1976) and following him Broome (2004: 157-162) have argued that Generation-Relative ethics is incoherent because it doesn't yield a binary relation between states of affairs. I show that the incoherence arises only when states of affair are not specified with sufficient care. In Sections 7-8 the theory is applied to a world that moves through time. So as to allow for comparison with the timeless world of Sections 3 and 6, the model I construct does not permit capital accumulation: the ethical trade-off is between population numbers and Earth's capacity to support life. The model is presented in Section 7. We find that the optimum can only be implemented by an implicit contract among the generations.

In Section 8 global economic statistics on total and per capita incomes are applied to the model. I conduct a sensitivity analysis of Generation-Relative Utilitarianism by varying key ethical parameters. In all cases the theory is found to recommend a smaller population in stationary state than Classical Utilitarianism. In consequence the standard of living is higher. Because I make use of global statistics, I am able to lay bear the quantitative differences between the two theories.

Like Classical Utilitarianism, Generation-Relative Utilitarianism offers a way to get a

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<sup>11</sup> Scanlon (1998) is a book-length treatment of the idea I am appealing to. Griffin (1986) has an excellent discussion of problems that arise in measuring well-being. His notion of well-being is however different from Scanlon's.

measure of the loss that is suffered when someone dies. And like Sidgwick's Utilitarianism the theory can be used to get a measure of the loss that would be entailed if the human race were to become extinct. Loss in the latter case would be forward looking; it would reflect the value of lives that would be foregone on account of extinction. In a remarkable work the late Jonathan Schell drew our attention away from that line of reasoning and spoke of the loss each of us would suffer if we were to learn that no one will follow us. In Section 9 I review Schell's argument and modify it by enlarging the scope of that loss. By extending the sphere of human motivations we avoid a free-rider problem to which Schell's ethics could be vulnerable. The deep human need to live through time rather than in time is then used in Section 9 to arrive at a view of personal - and thereby collective - stewardship of Earth. Acknowledgement of stewardship points also to an implicit contract among the generations to protect and promote Earth's ability to support life. But it arrives at it from a different direction from the one we are led to by Generation-Relative Utilitarianism. The amended account of personal motivation is not meant to be a substitute for Generation-Relative Utilitarianism, it will be found to be a complement to it. Nor is the implicit contract among generations contrary to Utilitarianism's idea of the universal good. Or so I will argue.

### 3 The Genesis Problem

Utilitarianism in the form Sidgwick cast it was applied to a timeless economy by Meade (1955) and extended by Dasgupta (1969) to a world facing an indefinite future. In the latter publication it was shown that the theory encourages large populations. I reproduce that finding by working with a stripped-down version of the model in Dasgupta (1969).

We imagine a timeless world, endowed with a finite stock of resources (Nature) of size  $K$ . Because I want the model to reflect the constraints our finite Earth imposes on us over the long run in the simplest possible way, I assume there is no production. The resource serves only as a general consumption good (ecological services). As the world is timeless, stocks (Nature) and flows (ecological services) are the same.

People are identical. If  $C$  is someone's consumption level ( $C$  defines her living standard), her personal well-being is  $U(C)$ .  $U$  is taken to be an increasing and continuous function of  $C$ , and is assumed to increase with  $C$  at a diminishing rate.<sup>12</sup> Positive well-being records life as good,

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<sup>12</sup> Edgeworth (1881) routinized the assumption of diminishing marginal well-being.

The presumption that the sole factor in well-being is consumption may seem otiose. People have argued that what shapes one's life are personal and social engagements. (There are other factors such as genetic endowment, which at least for now are not subject to choice by the person. We may regard them as parameters of the  $U$ -function.) But because all engagements require goods and services, we may think of engagements as production activities, in which goods and services are inputs. Partaking a meal (alone or in the company of others) is an engagement, but food items are the inputs that make the meal possible. Friendship involves investment in time, which is a scarce resource. And so on. Goods and services come with various characteristics, and for each person there is (given the resources at her command) a best way of obtaining the commodities that are best suited for the activities that are from her point of view

negative well-being records life as bad.  $U$  is positive at large values of  $C$  but negative at small values of  $C$ . It follows that there is a unique value of  $C$  at which  $U$  is zero. I write the standard of living at which  $U = 0$  as  $C^s$ . Thus  $U(C^s) = 0$ . Sidgwick would have called  $C^s$  the living standard at the "hedonistic zero"; Meade (1955) called it "welfare subsistence". Because the notion of personal well-being here differs from the one adopted by Sidgwick and Meade,  $C^s$  is more accurately called "well-being subsistence". Figure 1 depicts a well-being function  $U(C)$  with those features.

### 3.1 Zero Well-Being

Sidgwick (1907: 124-125) spoke of "neutral feeling" when suggesting ways to identify the hedonistic zero:

"If pleasure ... can be arranged in a scale, as greater or less in some finite degree, we are led to the assumption of a hedonistic zero, or perfectly neutral feeling, as a point from which the positive quantity of pleasures may be measured... For pain must be reckoned as the negative quantity of pleasure, to be balanced against and subtracted from the positive in estimating happiness on the whole; we must therefore conceive, as at least ideally possible, a point of transition in consciousness at which we pass from the positive to the negative. It is not absolutely necessary to assume that this strictly indifferent or neutral feeling ever occurs. Still experience seems to show that a state at any rate very nearly approximating to it is even common: and we certainly experience continual transitions from pleasure to pain and *vice versa*, and thus (unless we conceive all such transitions to be abrupt) we must exist at least momentarily in this neutral state."

Zero well-being is a defining notion in population ethics. We are thinking of someone's life as a whole, not the quality of her life at a moment in time. There are thinkers who believe the whole is the sum of its momentary parts; there are others who believe the whole to be a non-linear functional of those parts. We don't need to adopt a position on that here because excepting for the model we analyse in Section 7, there will be no occasion to slice someone's life into parts. Zero well-being is the value of a life that, taken as a whole, goes neither well nor badly. Sidgwick's reference to neutral feeling points, at least tangentially, to a comparison with non-existence. In the former we assess life from the inside, in the latter we seek to compare life with

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the best for her to engage in. Of course, the best way of obtaining goods and services with those characteristics involves further engagements (getting a job, making contacts), and so on; but the regress is circular, meaning that it is closed. The economist's presumption that the only things people care about are goods and services should be seen as a filtered expression of their projects and aims. Commodities have instrumental value; they don't necessarily have intrinsic worth. However, irrespective of what a person values, she will be found to value commodities. The  $U$ -function in the text should be interpreted in that light. I make the innocuous further assumption that  $U(C)$  is a differentiable function of  $C$ . That enables us to use the calculus for solving for the optimum population size.

something outside our experience. Nagel (1979) famously suggested that death is not an unimaginable condition of the persisting person, but a mere blank, and that it can have no value whatever, positive or negative. I can't tell whether by that Nagel meant the blank can't be assigned the number zero, as a benchmark against which other states of affairs are compared, but he went on to suggest that one can imagine non-existence by imagining being in a coma for the rest of one's life. For Nagel non-existence is the real blank, being totally unconscious for the rest of one's life is a simulation of that blank. Even that simulated state takes some strain to imagine, but it isn't absurd to imagine it.<sup>13</sup>

In conversations I have heard it suggested that  $U = 0$  is the point of indifference between dying and continuing to live, or the point of indifference between life and death. In Section 4 we will uncover the reason that interpretation is entirely misconceived. That reason also steers us away from the thought that  $C^s$  is a poverty line, in the sense the notion has been articulated in such figures as the World Bank's "dollar-a-day", or even the "two-dollars a day" benchmark.  $C^s$  should be searched for in a higher range of figures, possibly a lot higher.  $C^s$  is the standard of living at which life is neither good nor bad. No doubt it is difficult to determine it, but the idea underlying well-being subsistence cannot be bypassed in population ethics. Identifying  $C^s$  involves a deep and difficult value judgment.

### 3.2 The Sidgwick-Meade Rule

In applying Utilitarian reasoning to population ethics it is simplest to apply it first to the Genesis Problem. Genesis is also the scene where Utilitarianism doesn't run into any meaningful trouble. So we imagine Earth to be devoid of people. Let  $N$  be the number to be created. Because marginal well-being declines as the living standard increases, an equal distribution of  $K$  among all who are created is the ideal. If  $N$  people were created each would receive  $K/N$  units of the consumption good. Thus  $C = K/N$ . Utilitarianism tells us to search for the value of  $N$  at which  $NU(K/N)$  attains its maximum value.

Routine arguments show that if  $K$  is large ( $N$  in that case can be regarded as a continuous variable), optimum  $N$  satisfies the condition,

$$dU(C)/dC = U(C)/C. \tag{1}$$

Equation (1) says that the solution of the Genesis Problem is a population size at which marginal well-being equals the ratio of average well-being to average consumption (Figure 1). The equation is fundamental to Utilitarianism. We will call it the Sidgwick-Meade Rule.

The intuition behind the Rule is this:

At the Genesis Optimum neither a small hypothetical increase in population nor a small

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<sup>13</sup> Nagel (1979: 2): "... the value of life and its contents does not attach to mere organic survival: almost everyone would be indifferent (other things equal) between immediate death and immediate coma followed by death twenty years later without reawakening." I develop this point in Section 5, but apply it to a different purpose from Nagel's.

hypothetical decrease would alter total well-being. Suppose now a marginal increase is contemplated. (The argument associated with a marginal decrease is analogous.) The additional person would share  $K$  equally with the population that was originally contemplated. The increase in total well-being that would obtain if that additional person were created is her well-being, which is  $U(C)$ . But there would also be a decrease in total well-being, which is that each of the others would have slightly less consumption. That potential loss in well-being is  $C[dU(C)/dC]$ . At the Genesis Optimum the potential gain and the corresponding potential loss in total well-being must be equal. The Sidgwick-Meade Rule asserts this. We denote the solution of equation (1) by  $C^o$  and the corresponding population size by  $N^o$ . So,  $N^o = K/C^o$ .  $N^o$  is the optimum population size and  $C^o$  is the optimum living standard.

### 3.3 Overpopulation

Total well-being is the product of population size ( $N$ ) and average well-being ( $U$ ). Rawls (1972: 162-163) noted that the trade-off between  $N$  and  $U$  in the product is such that no matter how small is  $U$ , so long as it is positive larger and larger values of  $N$  would raise total well-being. Numbers can compensate for average well-being no matter how low a value the latter happens to be (as long as it is positive of course). Parfit (1984: 425-441) found that feature of Sidgwick's Utilitarianism paradoxical, so he named it the Mere Addition Paradox. He also found the implication repugnant, so he called it the Repugnant Conclusion (RC). Previously Dasgupta (1969) had noted that Utilitarianism is pro-natalist, in that the optimum standard of living  $C^o$  in standard economic models is not far from well-being subsistence  $C^s$ . The analysis also showed that the larger is the personal aversion to risk in one's living standard the lower is the optimum standard of living, and that the latter tends in the limit to the value at which well-being is zero. To reconstruct the argument in the timeless economy, suppose as in Dasgupta (1969) that

$$U(C) = B - C^\sigma, \quad B > 0 \text{ and } \sigma > 0. \quad (2)$$

In equation (2)  $U(C)$  is defined by two parameters,  $B$  and  $\sigma$ , both of which are positive numbers (Figure 1).  $U$  is an increasing function of  $C$  and is bounded above by  $B$ .  $1+\sigma (> 1)$  is the elasticity of marginal well-being with respect to consumption. Ramsey (1928) named  $B$ , Bliss.<sup>14</sup>

Routine calculations show that on using equation (2) in the Sidgwick-Meade Rule,

$$C^o/C^s = (1 + \sigma)^{1/\sigma} > 1. \quad (3)$$

Equation (3) is informative because it relates the optimum living standard to well-being subsistence.<sup>15</sup> For population ecologists however, it proves more natural to recast the equation

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<sup>14</sup> The  $U$ -function in equation (2) is unbounded below. In applied work that should be an unacceptable feature of the  $U$ -function because unboundedness is inconsistent with the theory of decision under uncertainty (Arrow, 1965), but here we are engaged in theoretical reasoning. The  $U$ -function in equation (2) has the virtue of revealing the structure of Utilitarianism in a very simple manner.

<sup>15</sup> To confirm equation (3), notice first that  $C^s = B^{1/\sigma}$ . Next, use equation (2) in the Sidgwick-Meade Rule to show that  $C^o = (1+\sigma)^{1/\sigma}/B^{1/\sigma}$ . Equation (3) follows immediately.

in terms of population size. With that in mind define  $N^s = K/C^s$ . As we are modeling the global economy,  $N^s$  can be interpreted as *Earth's carrying capacity*.<sup>16</sup> Equation (3) can then be re-expressed as

$$N^s/N^o = (1 + \sigma)^{1/\sigma} > 1. \quad (4)$$

Recall now that if  $\sigma$  is positive,  $(1+\sigma)^{1/\sigma}$  is less than  $e$  (the base of natural logarithms), which in turn is approximately 2.74. It follows from equations (3)-(4) that

$$C^o/C^s = N^s/N^o = (1 + \sigma)^{1/\sigma} < e \approx 2.74. \quad (5)$$

Inequality (5) says that Utilitarianism favours large populations: no matter what the value of  $\sigma$  happens to be, the optimum living standard is less than 2.74 times well-being subsistence. The inequality also says that carrying capacity is less than 2.74 times the optimum size of population. To illustrate, suppose  $\sigma = 1$ . Then  $C^o/C^s = N^s/N^o = 2$ , which means optimum living standard is twice well-being subsistence, and carrying capacity is twice the size of optimum population. If Earth's carrying capacity is reckoned to be 10 billion people, optimum population would be 5 billion.

$\sigma$  is the percentage rate at which marginal well-being declines as the standard of living increases. Value pluralists using personal well-beings as the basis for population ethics could use  $\sigma$  as a measure of their aversion to inequality in the distribution of living standards. When the framework is applied to choice under uncertainty,  $\sigma$  is also a measure of a person's aversion to risk.<sup>17</sup> To obtain a feel for the way  $\sigma$  influences the optimum standard of living we subject the Sidgwick-Meade Rule to a full sensitivity analysis. To do that we compute  $C^o/C^s$  in equation (5) using alternative values of  $\sigma$ . It will be noticed that to vary  $\sigma$  is to vary well-being subsistence (equation (2)), but that's an acknowledgement that determining well-being subsistence involves

<sup>16</sup> Ehrlich and Holdren (1971) is the classic that introduced the metaphor, I=PAT, to draw attention to the significance of Earth's carrying capacity for population ethics. The authors traced the impact of human activities on the Earth system to population, affluence (read, the standard of living), and the character of technology in use. Contemporary demographers have in large measure ignored the Ehrlich-Holdren insight that nature doesn't calculate percentages (e.g. declines in the rate of growth of population), she responds to absolute quantities.

Cohen (1995) contains a wide-ranging discussion of Earth's carrying capacity and offers accounts of various estimates that were made of it during the last quarter of the 1900s. A tractable method for estimating an eco-system's carrying capacity is to estimate the rate at which it is able to provide ecosystem services, for example, its annual rate of primary production. Humanity's "ecological footprint" is the ratio of the rate at which we extract primary production to the rate at which Earth is able to supply it (adjusting for the supply to other species). Using the methods advanced by Rees and Wackernagel (1994), WWF (2008) estimated that humanity's ecological footprint today is about 1.56. That means to maintain the world's average living standard today (roughly 12,000 international dollars in the early 2000s), we would need 1.56 Earths.

<sup>17</sup> Vital contributions to the modern literature on income inequality measures are Kolm (1969) and Atkinson (1970) and to the measurement of risk aversion are Pratt (1964) and Arrow (1965). Dasgupta (2008) offered reasons why the plausible range of values for  $\sigma$  is (0,2]. Empirical studies of choice under uncertainty have usually revealed  $\sigma$  to lie in the range (0,1].

a value judgment.

How does  $C^o$  vary in relation to  $C^s$  as  $\sigma$  assumes different values? Equation (5) says that the larger is  $\sigma$ , the closer is  $C^o/C^s (= N^s/N^o)$  to 1.<sup>18</sup> If carrying capacity is 10 billion people and  $\sigma$  is very large, optimum population is close to 10 billion. For the value pluralist strong social aversion to consumption inequality recommends very large populations. I have known this result since my student days but still find it puzzling that inequality aversion should play so influential a role in applied population ethics. Admittedly the theory we are invoking here says that all who are born are to be treated equally; even so, it isn't *a priori* obvious why an attitude toward equality should so influence the optimum size of population.<sup>19</sup>

### 3.4 Critical-Level Utilitarianism

Blackorby and Donaldson (1984) suggested an escape from RC. They proposed that other things equal the creation of an additional person should be judged to be good only if her well-being were to exceed a positive, critical level  $U^c (> 0)$ . The authors called their theory "Critical-Level Utilitarianism".<sup>20</sup>

There is a basic problem with the move. Suppose the well-being of each existing person is expected to be  $2U^c/3$ . As this is a positive number, everyone alive expects a good life. Critical-Level Utilitarianism asks us to believe that other things equal creating an additional person whose well-being would be  $2U^c/3$  is a bad idea. I don't understand why it would not be a good idea.<sup>21</sup>

I have never understood why the pro-natalism of Utilitarianism should be found repugnant. So long as well-being is positive, a person's life is good. Life may not be very good, but it is good. The trade-off between population size and average well-being in Utilitarianism may not be to everyone's liking, but it can hardly be said to be repugnant.<sup>22</sup> The issue isn't a matter of semantics, nor does it hang on any particular notion of well-being. Once the ethicist settles on a figure for well-being subsistence, she simply has to acknowledge that life is good at any standard of living that exceeds it (the higher, the better, of course). In Section 4 we study a

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<sup>18</sup> That's because  $(1+\sigma)^{1/\sigma} \rightarrow 1$  as  $\sigma \rightarrow \infty$ .

<sup>19</sup> *Ex post* it is obvious of course.

<sup>20</sup> See also Blackorby, Bossert, and Donaldson (1997). Broome (2004: 199-202) offers a supportive account of the theory.

<sup>21</sup> Ng (1986) is one of the few writers who has acknowledged that if  $U$  is positive, life is good.

<sup>22</sup> The Repugnant Conclusion initiated a large literature. See for example McMahan (1981), Sikora (1981), Hurka (1983), Sterba (1987), Temkin (1987), and Cowen (1989).

possible reason Parfit and ethicists following him have found the trade-off in Utilitarianism between population size and average well-being repugnant.

### 3.5 Alternatives to Utilitarianism

Multiplying  $N$  and  $U$  is but one way to combine population size with average well-being. If the trade-off between  $N$  and  $U$  in the product  $NU$  is found repugnant, what alternatives are there?

The problem with Utilitarianism, as Parfit saw it, is that all indifference curves of  $NU$  (loci of  $(N, U)$  pairs for which  $NU$  is constant) asymptote to the  $N$ -axis as  $U$  tends to zero (Figure 2A).<sup>23</sup> This feature of Utilitarianism gives rise to the Mere Addition Paradox and from there to the Repugnant Conclusion (RC). Someone bent on avoiding RC within the broad confines of utilitarian reasoning would wish to go beyond the product formulation and rank states of affairs in terms of a numerical function  $V(N, U)$ , where  $V$  increases with  $N$  and  $U$ .<sup>24</sup> The idea would be to look for a functional form of  $V$  whose indifference curves asymptote to distinct values of  $U$  as  $N$  is made larger and larger.

Consider the function

$$V(N, U) = U - 1/N. \quad (6)$$

Figure 2B presents the indifference curves of  $V$ . Each curve asymptotes to a distinct value of  $U$  as  $N$  is made larger and larger. Indifference curves confined to the upper quadrant represent non-negative values of  $V$ , those that enter the lower quadrant at large values of  $N$  represent negative values of  $V$ . The underlying ethics does not lead to RC, but we should check how the ethics fares when it is applied to the Genesis Problem.

By using equation (2) in equation (6) we can express  $V$  in terms of  $N$ :

$$V(N, U) = B - K^{-\sigma} N^{\sigma} - N^{-1}. \quad (7)$$

Routine calculations show that if  $K$  is large,  $N^{\sigma}$  is less than  $N^{\delta}$ ; but that if  $K$  is small,  $N^{\sigma}$  exceeds  $N^{\delta}$ . In the former case optimum  $U$  is positive, in the latter case optimum  $U$  is negative (Figures 3A-3B).<sup>25</sup>

<sup>23</sup> In Figure 2A the broken curve depicts the outer boundary of realizable combinations of  $N$  and  $U$  in the economy we have been studying. The curve traces total well-being (as a function of  $N$ ):  $BN - K^{-\sigma} N^{1+\sigma}$ .  $N^{\sigma}$  is the value of  $N$  at which the feasible and the desirable are tangent to each other.

<sup>24</sup>  $V(N, U) = NU$  is a special case.

<sup>25</sup> To confirm the claims, differentiate  $V$  with respect to  $N$  and set the derivative equal to zero. That yields optimum population size:

$$N^{\sigma} = K^{1/(1+\sigma)} / \sigma^{1/(1+\sigma)}.$$

But  $N^{\delta} = B^{1/\sigma} K$ . The conclusion in the text follows immediately.

The finding is depicted in Figures 3A and 3B respectively. In each figure the broken curve depicts the outer boundary of realizable combinations of  $N$  and  $U$  in the economy. The curve traces  $V$  as a function of  $N$ :  $B - K^{-\sigma} N^{\sigma} - N^{-1}$ .  $N^{\sigma}$  is the value of  $N$  at which the feasible and the desirable are tangent to each other.



The finding could appear baffling, but it shouldn't baffle. The idea is to find the population size that maximizes  $V$ , and maximizing  $V$  can't ensure a positive  $U$ . For any value of  $K$  there are to be sure feasible  $(N, U)$  pairs in which  $U$  is positive; but the objective is to maximize  $V$ , it isn't to ensure that people's lives are good.

Equation (7) represents but one example of alternatives to Utilitarianism, but it shows that making ad hoc moves to overcome features of ethical theories that are thought awkward can introduce problems that are a lot more awkward. It can lead not only to absurd recommendations, but also to contradictions. That is shown next.

### **3.6 Measurability, Comparability, and the Aggregation of Personal Well-Beings<sup>26</sup>**

One reason it is inadvisable to go beyond Utilitarianism by ad hoc moves is that measurability, comparability, and the aggregation of personal well-beings are closely related matters. Before proposing alternatives to Utilitarianism it is wise to check that the proposals don't make incoherent demands on those connections.

There is no Platonic scale for measuring personal well-being. The theory of choice under uncertainty for example yields a measure that is unique up to positive affine transformations. That says if  $U_i$  is a measure of individual  $i$ 's well-being and if  $\alpha$  is a positive number and  $\beta$  is a number of either sign, then  $\alpha U_i + \beta$  is an equally valid measure of  $i$ 's well-being. Put another way, the ordering of states of affairs represented by  $U_i$  is the same as the ordering represented by  $\alpha U_i + \beta$ . In the latter scale  $\alpha$  represents the unit and  $\beta$  the level, and both are subject to the ethicist's choice. We say  $U_i$  in that case is a *cardinal* measure. Concerned as it is with well-being differences among alternative states of affairs, the theory does not require the notion of zero well-being.<sup>27</sup>

Population ethics in contrast requires that lives that go well be distinguished from those that go badly. A life that goes neither well nor badly scores zero; in Sidgwick's system of ethics it is the hedonistic zero. Personal well-being is *strongly cardinal* if its measure is unique up to positive linear transformations (i.e. proportional transformations). That says if  $U_i$  is a measure of  $i$ 's well-being and if  $\alpha$  is a positive number, then  $\alpha U_i$  is an equally valid measure of  $i$ 's well-being. Utilitarian population ethics requires personal well-being to be strongly cardinal.

When applying Utilitarianism to the Genesis Problem we made an implicit assumption, that well-beings are fully comparable among individuals. There was no need to mention it because people were assumed to be identical. In a heterogeneous population the assumption should be made explicit. Without full comparability of personal well-beings there would be no

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<sup>26</sup> This Section has been taken from Dasgupta and Maskin (2016).

<sup>27</sup> In his classic work Harsanyi (1955) built Utilitarianism on the basis of the theory of choice under uncertainty.

way to compare a Utilitarian population ethics with any other population ethics; in fact there would be no plausible system of ethics with which to derive population policies.<sup>28</sup>

The idea of full comparability is familiar from weights and measures. The masses of objects (measured, say, in a vacuum-sealed flask) are fully comparable. Suppose we find  $x$  to be a heavier object than  $y$ . If that is to be a meaningful finding, the units in which they are measured must be the same; it's no good measuring  $x$  in grams and  $y$  in ounces. Reference to grams and ounces tells us that we can say a lot more than merely that  $x$  is heavier than  $y$ : we can say how much heavier  $x$  is proportionately than  $y$ . The reason we can is that if  $x$  is found to be twice as heavy as  $y$  using one system of units (grams), it will be found to be twice as heavy as  $y$  using any other system of units (ounces). And that's because an ounce is proportional to a gram. We can move from one system of units to another with impunity so long as the corresponding transformations (grams to ounces) are applied consistently. In fact we can say even more. Because physical theories tell us that addition and subtraction are legitimate (even required) operations on masses, each scale in the set of admissible scales is proportional to any other scale in the set, and all scales that are proportional to a scale in the admissible set are also in the admissible set. Non-linear scales don't belong.

We say personal well-beings are fully comparable if multiplying each person's well-being by a constant positive number  $\alpha$  is ethically of no significance. Other things equal a Utilitarian would rank the pair of personal well-beings  $\{4,11\}$  above the pair  $\{5,9\}$ , because 15 is bigger than 14. Full comparability says that if we multiply each person's well-being by a positive number  $\alpha$ , the ranking of the resulting pairs remains the same. They remain the same under Utilitarianism because  $4\alpha+11\alpha (= 15\alpha)$  is bigger than  $5\alpha+9\alpha (= 14\alpha)$  for all positive  $\alpha$ . The Utilitarian can choose any value of  $\alpha$  she likes without compromising her ethics.

The reasoning confirms that the Sidgwick-Meade Rule is invariant with respect to  $\alpha$ .<sup>29</sup> Notice that well-being subsistence,  $C^s$ , remains the same under all proportional transformations of the  $U$ -function. That's because  $\alpha U(C^s) = 0$  for all positive  $\alpha$ . Utilitarian population ethics presumes  $U$  to be strongly cardinal. In the model we used here to study the Genesis Problem,  $\alpha$  was set equal to 1 so as not to add another symbol. The move was ethically neutral.

Ethical theories requiring  $U$  to be measurable with fewer degrees of freedom than strong cardinality should be rejected because they make untenable demands on the very idea of well-being. The ethics underlying the function  $V$  in equation (7) suffers from that weakness: it is not

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<sup>28</sup> Sen (1970) is the classic on this point. By extending his analysis to population ethics it is easy to show that if you drop full comparability you only obtain a partial ordering of population policies. Partial orderings may be the best that the ethicist can hope for in practice, but no *theory* of social ethics should start with partial orderings.

<sup>29</sup> If  $U(C)$  is replaced by  $\alpha U(C)$  in equation (1) and  $dU(C)/dC$  by  $d[\alpha U(C)]/dC$ ,  $\alpha$  cancels from the two sides.

invariant to the choice of  $\alpha$ . If you replace  $U$  by  $\alpha U$ , the entire set of indifference curves between personal well-being ( $U$ ) and population size ( $N$ ) changes.  $V$  requires that there is a unique scale in which  $U$  is to be measured. That requirement is inadmissible.

#### **4 Death**

In a moving discourse on the place of autonomy and responsibility in personal well-being, Williams (1993: 50-102) drew attention to an aspect of personal responsibility that starts not from what others may demand of someone, but from what that someone demands of himself. Williams reminded readers that Sophocles had reported that Ajax, being slighted by the award of Achilles' arms to Odysseus, had intended to kill the leaders of the Greek army. To prevent the massacre, Athena made Ajax mad. It is significant that Ajax's condition didn't affect his purposes; rather, it altered his perception. Thinking that he was killing Odysseus and the others, Ajax slaughtered the army's flock of sheep and cattle. In Sophocles' account the despair arising from the shame Ajax felt on awakening left no option open to him but to take his own life. And Williams observed (p. 76) that when Ajax says he must go, "... he means that he must go: period."

Modern ethicists in contrast have frequently offered a view of life that is not only at odds with Sophocles' account but also with commonly-held notions of life's quality and of the reasons for the fear and horror that death holds for us. In the chapter that introduces Utilitarianism to his readers, Sidgwick (1907: 414-415) wrote:

"... I shall assume that, for human beings generally, life on the average yields a positive balance of pleasure over pain. This has been denied by thoughtful persons: but the denial seems to me clearly opposed to the common experience of mankind, as expressed in their commonly accepted principles of action. The great majority of men, in the great majority of conditions under which human life is lived, certainly act as if death were one of the worst of evils, for themselves and for those whom they love..."

Nagel (1979) concluded that if death is an evil, it is the loss of life that is objectionable. The conclusion is incontrovertible to the secular mind, but there are at least three circumstances of death that should be distinguished, and they don't point in the same direction. There is death that comes naturally to one in the fullness of time; there is death that comes from natural causes before one's time; and there is death that is brought on one by one's own deliberate action. Nagel contrasted the first two, but didn't speak to the third. And it is the latter that should make us pause before accepting Sidgwick's conclusion that life, all in all, is a positive good for most people.

Religious prohibition, fear of the process of dying (the possibility of suffering pain, the feeling of isolation), the thought that one would be betraying family and friends, and the deep resistance to the idea of taking one's own life that has been built into us through selection pressure would cause someone even in deep misery to balk. It may even be that no matter what

life throws at us we adjust to it, if only to make it possible to carry on.<sup>30</sup> But the acid test for the conclusion that life, all in all, is invariably a good is to ask ourselves whether we shouldn't pause before creating a person so as to imagine the kind of life that is likely to be in store for the potential child.<sup>31</sup> The desire to procreate springs from our deep emotional needs, and the direct motivation we have to create children can be traced to a wide variety of reasons (we noted a few in Section 1), but here we are concerned only with the life of the prospective child.

The view that life overall is always good have led philosophers to conclusions that should be unacceptable. In the passage in which he presented the Repugnant Conclusion, Parfit (1984: 388) recognized Utilitarianism's pro-natalist character, but then interpreted it in the following way:

"For any possible population of at least ten billion people, all with a very high quality of life, there must be some much larger imaginable population whose existence, if other things are equal, would be better, even though its members have lives that are barely worth living."

One wouldn't question that the image is repugnant, but it belongs nowhere, not even within the confines of Sidgwick's Utilitarianism. We are asked to consider a figure for world population that will almost certainly be reached in the second half of this century (a figure that many ecologists think cannot be sustained at reasonable material comfort), and are then made to imagine an Earth where, because of population pressure, people scramble for resources so as to eke out an existence, *having lives that are barely worth living*.

But someone whose life is barely worth living doesn't enjoy a life of positive quality, she suffers from *negative* well-being. In the contemporary world over a half billion people are malnourished and prone regularly to illness and disease, many of whom are also debt ridden, but who survive and tenaciously display that their lives are worth living by the fact that they persist in wishing to live. If you were to say that you would not wish the circumstances they endure on anyone, I wouldn't take you to mean their lives aren't worth living; I would take you to be saying that their circumstances are so bad that you wouldn't wish them on even your worst enemy, that something ought to be done to improve their lives, that if you were to disregard the countervailing needs you and your household may have, you wouldn't want to *create* children facing those circumstances.

Death *relieved* the intolerable pain Ajax experienced on awakening from the madness

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<sup>30</sup> Suicide isn't that rare a phenomenon. Annually over 1 million people take their own life worldwide (approximately 1.8 per cent of deaths are suicides) and 20-30 million people attempt suicide.

<sup>31</sup> Nagel acknowledges that the loss encountered when someone's life is cut short can't be balanced on a one-to-one basis by replacing that someone with a new birth. In my readings on the subject I have found him (and Narveson, 1967, and Heyd, 1992) to be among the very few who (at least until recently) acknowledged the asymmetry. Below (Section 5) I make use of the asymmetry in developing population ethics.

Athena had inflicted on him. Ajax knew it would, which is why he chose it. It was better for him that he paid the price of death than that he carried on. The inference Sidgwick drew from the fact that death is generally thought to be one of the worst evils is altogether unfounded, and I cannot imagine how so profound and careful a thinker could have made such an elementary arithmetical error. That death is a horror to most people doesn't imply that life is on balance pleasurable. On the contrary, the greater is the horror that taking one's own life poses to someone (betrayal of one's family and friends, revelation of one's misery to others when one wants it to remain undisclosed even after death), the *more* he would be willing to carry on in a state of despair. That is why estimating well-being subsistence from people's behaviour or responses to questionnaires is a mistake.<sup>32</sup>

## 5 Sleeping Beauty

In the Genesis Problem Earth is devoid of people. The domain of discourse consists only of potential persons. In an Actual Problem Earth is inhabited. The question is whether further people should be created. The two settings are wildly different.

Consider a problem like Sleeping Beauty. She is alive but in a state of total unconsciousness (Sidgwick would regard her state to be the hedonistic zero). What makes her an interesting case for us here is that her life expectation is the prevailing average, in that with a modicum of medical attention she can be expected to complete the natural lifespan in a state of total unconsciousness. A small expenditure can however revive her immediately and fully, in which case it is confidently expected her lifetime well-being will be  $U^*$  ( $> 0$ ). That's option  $X$  for her parents. Option  $Y$  is for her parents to conceive another child who would enjoy a lifetime well-being equal to  $U^*$ . However, under  $Y$  Sleeping Beauty will remain unconscious. We suppose that the couple have no special feelings for Sleeping Beauty. She was born unconscious, so they have never got to know her. Assume now that in all other respects  $X$  and  $Y$  have the same consequences. What should Sleeping Beauty's parents choose?

If, as in a literal interpretation of Sidgwick's Utilitarianism, agreeable consciousness is the sole good and if the fact that something good would be the result of one's action is the basic

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<sup>32</sup> To illustrate Sidgwick's error, imagine that in the units chosen to measure  $U$  the horror of suicide for someone is -300. The person would choose to continue to live so long life offered her a value in excess of -300; and that could be as low as -299.99.

Broome (1991: Ch 9) takes it as given that the  $U_i$ s are non-negative. To illustrate what he calls "communal egalitarianism" he even takes the logarithm of the  $U_i$ s and then adds them (p. 184), which is a move that can only be made if personal well-beings are always non-negative.

Numerical measures of subjective well-being have been taken to be non-negative in all the large-scale surveys on happiness and life satisfaction that have been conducted in recent years (see Helliwell, Layard, and Sachs, 2013, for an account of the findings). It would look as though designers of the questionnaires that have shaped the literature on empirical hedonism have also been much influenced by the thought that life can never be miserable (otherwise why do people continue to want to live?). The presumption that life on balance is inevitably good precludes reasoned discussions on population policies.

reason for doing anything, the couple in question should be indifferent between  $X$  and  $Y$ . But there are at least three reasons  $X$  should be viewed as the right option. Together they point to the view that actual persons have a special place in ethical deliberations.

### (1) Parental Obligation to Sleeping Beauty

$X$  is the right option because Sleeping Beauty's parents have an obligation toward her which they don't have toward a potential child. They have an obligation toward Sleeping Beauty because they were responsible for conceiving her. People don't have an obligation to become parents, but they acquire one if they choose to become parents. It has often been argued that parents have an obligation toward their offspring that no one else has. Parental obligation provides an argument for choosing  $X$  over  $Y$ .<sup>33</sup>

### (2) Sleeping Beauty's Claim Rights

By the same token Sleeping Beauty has claim rights over her parents. She is a person, it is *her* well-being that is subject to parental choice. She has a right to demand that she be acknowledged by her parents, she has a right to be heard by them even though she is unable to speak. The potential child has no comparable rights.<sup>34</sup>

### (3) The Value of Sleeping Beauty's Life

Nagel (1979:2) suggested that life has a value to the person living it that is independent of anything she may experience:

"The situation is roughly this: There are elements which, if added to one's experience, make life better; there are other elements which, if added to one's experience, make life worse. But what remains when these are set aside is not merely *neutral*: it is emphatically positive. Therefore life is worth living even when the bad elements of experience are plentiful, and the good ones too meager to outweigh the bad ones on their own. The additional positive weight is supplied by experience itself, rather than by any of its contents."

I am not sure I understand what Nagel meant, but one interpretation is that life has a value that is independent of whether it goes well or badly (it is "supplied by experience itself, rather than by any of its contents").<sup>35</sup> Call that stand-alone value,  $\Omega$ . It sits outside the calculus

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<sup>33</sup> In his interesting comments on the population problem Seabright (1994) framed parental obligation in terms of the parents' notion of "family". He argued that the family has a special place in ethics.

I am ignoring the obligation people may have (at least to themselves) to procreate in special cases, such as a population at risk of extinction from non-fecundity. See Section 8, on existential risks.

<sup>34</sup> Gosseries (2010) has a good discussion of this. He studies the obligations people have to one another, not simply parents toward their children.

<sup>35</sup> When I first read the passage just quoted, I interpreted it differently. I took Nagel to be saying that (invariant) value is so high that no matter how terrible the person's experiences may be throughout her life, the net value is positive. For the claim to be believable, one must imagine

of good and bad. When we say life is precious, even sacred, we point to  $\Omega$ . That life has a stand-alone value  $\Omega$  is not a reason for creating a person, but is a reason for awakening Sleeping Beauty even if her life were predicted not to be one of positive quality.<sup>36</sup>  $\Omega$  enters the moral calculus only when it is applied to actual persons. Sidgwick's Utilitarianism appears to me to be consistent with that reasoning. The theory says other things equal someone whose utility can be predicted to be negative should not be created.

### **Wider Cases**

A problem like Sleeping Beauty gives rise to a number of variations. Suppose  $X$  is not an option. Her parents could argue that she should be released from the indignity of living in coma for the rest of her natural life. In that case they would give their consent to having her life-support system disconnected.

Consider now a case where  $X$  is not available, but  $X'$  is. In  $X'$  Sleeping Beauty is revived at a small cost, but her life will not be good. Even though she will be able to function, she will suffer from discomfort and pain and will not lead a fulfilling life. All in all it is expected that her lifetime well-being will be  $U^{**}$ , a not-too-large negative number. Contemporary sensibilities would favour that she be revived, on grounds that Sleeping Beauty should be allowed to exercise her agency, her right to live a life. That's one way to justify  $X'$ . Another is simply to point to  $\Omega$  and revive her.

And so on. None of these cases is straightforward, but that only shows our intuitions over life and death are unsteady. One point however is incontrovertible: A person could regard her life to be worth living even if she expects it to be one of misery.

## **6 Actual Problems and Generation Relative Ethics**

The distinction between actual persons and potential people gives rise to an ethics that responds to the special claims of existing persons. I shall call it Generation-Relative Utilitarianism. It will prove useful to put the theory to work on the timeless model of Section 3.

### **6.1 Population Ethics in a Timeless World**

The world is inhabited by  $N_0$  identical people. The capital stock is  $K$ . As before, if  $C$  is someone's living standard, her well-being is  $U(C)$  in the chosen scale. The question is whether creating further people would add to social well-being. To have an interesting problem we assume that the world is thinly populated - that is,  $K$  is large relative to  $N_0$ . On their own their well-being would be high.<sup>37</sup> Suppose an additional  $N_1$  people are considered. If created they would share  $K$  equally with the existing population. Each person's living standard would then

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with Nagel (although Nagel left the thought unsaid) that the value of life for a person, qua life, is infinite. To me that read odd. I now believe I have interpreted Nagel correctly.

<sup>36</sup> Provided of course that her life will not be of utter misery.

<sup>37</sup> If  $K/N_0$  is small, the optimum value of  $N_1$  is 0.

be  $K/(N_0+N_1)$ . The weight awarded to the well-being of existing people is taken without loss of generality to be 1. Imagine that the weight awarded to the well-being of potential people is  $\pi$ . We assume  $\pi$  is a number between 0 and 1. Denote social well-being as viewed by the existing population by  $V$ . Generation-Relative Utilitarianism says

$$V = N_0 U(K/(N_0+N_1)) + \pi N_1 U(K/(N_0+N_1)). \quad (13)$$

The problem is to choose  $N_1$ .

Routine calculations show that the Sidgwick-Meade Rule under Generation-Relative Utilitarianism is

$$dU(C)/dC = [U(C)/C][\pi(N_0+N_1)/(N_0+\pi N_1)] < U(C)/C. \quad (14)$$

Equations (1) and (14) say that optimum consumption in an Actual Problem ( $C^{oo}$ ) is larger than optimum consumption in the Genesis Problem ( $C^o$ ). That is shown in Figure 4. It follows that optimum population is smaller in an Actual Problem than in the Genesis Problem. The smaller is  $\pi$ , the fewer are the additional numbers,  $N_1$ , under Generation Relative Utilitarianism.<sup>38</sup>

## 6.2 Coherence

The problem that is Sleeping Beauty shows why a morality requiring parents to award the same ethical weight to their potential children as to children they already have is unacceptable. Narveson (1967) had noted that particular difficulty and had recast Utilitarianism by observing that "we (utilitarians) are for making people happy, not for making happy people" (Narveson, 1973: 73). He called his theory Person-Affecting Utilitarianism.<sup>39</sup>

Parfit (1976) observed that the theory yields an incoherent notion of goodness. As his critique would apply equally to Generation-Relative Ethics, here is an example of what he, and in endorsing the criticism Broome (2004), meant.

We consider individual A and a potential person B, and apply the *ceteris paribus* clause on all other people. The prevailing state of the world,  $X$ , is one where A's well-being is expected to be 11. But A has the option of creating B. Two states of affair that include B are possible. In one (we label it  $Y$ ) A's and B's well-beings would each be 6. In the other (we label it  $Z$ ) they

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<sup>38</sup> The general solution can be stated in the following way: There exists a function  $N(\pi)$ , which decreases with  $\pi$ , such that if  $N_0 < N(\pi)$ , then equation (14) yields the optimum population size. But if  $N_0 > N(\pi)$ , the optimum policy is to not add to the prevailing population. Personal well-being in the latter case is  $U(K/N_0)$ . If the existing population were to have the misfortune of being too many ( $N_0 > N^s$ ), personal well-being would be negative. *That* is over-population.

<sup>39</sup> Narveson argued that we are under no obligation to procreate, even if, other things equal, it was guaranteed that the person born would have an outstandingly good life. Obligation is a strong word. In this paper I am exploring a particular way to evaluate states of affairs, in which "well-being" serves as the coin with which the evaluation is conducted. Generation-Relative Utilitarianism is a lot closer to Total Utilitarianism than Narveson's theory. However I have friends who regard Generation-Relative Utilitarianism to be infested with Ontological Elitism. The criticism comes close to regarding potential persons as actual persons, a view that should be rejected.



would be 8 and 4, respectively.  $Y$  and  $Z$  differ by way of the extent to which  $A$  and  $B$  share resources, a feature of those states of affairs that are taken into account by  $A$  when contemplating whether to create  $B$ . We label the states of affairs - or "social states", to use the economist's term -  $X$ ,  $Y$ , and  $Z$  as  $\{11\}$ ,  $\{6,6\}$ , and  $\{8,4\}$ . The problem is to rank them in a situation where  $A$  exists but  $B$  doesn't. We say that  $B$ , were he to be created, would be of a different generation from  $A$  - hence the term "Generation-Relative Ethics".

Denote ethical dominance by " $>$ " and ethical equivalence by " $=$ ". We imagine  $A$  to be a Generation-Relative Utilitarian. Suppose the weight  $A$  awards to the well-being of a potential person is half the weight awarded to the well-being of an actual person, the latter being set equal to 1. That means so long as  $B$  is a potential person,  $X > Z > Y$ . But if  $B$  were born, he would be an actual person. The ethical relation between  $Y$  and  $Z$ , the only remaining social states, would then be  $Y = Z$ . That's Parfit's criticism.

The trouble with the criticism is that it harks back to the Genesis Problem. As the name suggests, the Genesis Problem is viewed by someone residing nowhere. That is why Classical Utilitarianism would say  $Y = Z > X$  before  $B$  is conceived. Parfit took exception to Narveson's Person-Affecting Utilitarianism because the binary relation between social states is dependent on whether  $B$  is an actual person. Generation-Relative Utilitarianism has that same feature. In the present example it is  $A$  who is evaluating social states. She does that from somewhere, she is not nowhere.<sup>40</sup>

There are five states of affair, not three.  $X$  is a social state, but there are two social states that were conflated into one labelled  $Y$  and there are two that were conflated into one labelled  $Z$ . It is key to Generation-Relative Ethics that the ethical content of the pair  $\{6,6\}$  in a world where  $B$  is only a potential person differs from the ethical content of the pair  $\{6,6\}$  in a world where  $B$  is an actual person. The two social states should therefore be distinguished. Let us label them as  $\{6,6\}_p$  and  $\{6,6\}_a$ , respectively. And let us do the same for the other pair of social states and label them as  $\{8,4\}_p$  and  $\{8,4\}_a$ , respectively.

Denote the ranking of social states under Generation-Relative Utilitarianism by the relationships " $>_G$ " and " $=_G$ ". As  $A$  subscribes to the theory, she would choose not to add to the population, because

$$\{11\} >_G \{8,4\}_p >_G \{6,6\}_p. \tag{15}$$

In  $B$ 's absence  $\{8,4\}_a$  appears as  $\{8,4\}_p$  to  $A$  and  $\{6,6\}_a$  appears to her as  $\{6,6\}_p$ . Inequalities (15) reflect  $A$ 's ethical perspective when  $B$  is only potential.

If  $B$  were to be present,  $A$ 's ranking of the two available social states would be

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<sup>40</sup> I am borrowing the wording from Nagel (1998), who presented a powerful set of arguments to show that the view from nowhere is no guide to action. Here I am making use only of a weak version of Nagel's argument. As I understand it, he would argue that the view from nowhere isn't possible.

$$\{6,6\}_a =_G \{8,4\}_a. \quad (16)$$

There is no contradiction here because inequalities (15) and (16) relate different sets of social states.<sup>41</sup>

## 7 Population Ethics Across The Generations

Further problems arise when population ethics is applied to a world moving through time. To study them I build on the timeless model of the previous sections.

### 7.1 The Model

Time is divided into periods and is denoted by  $t$  ( $t = 0, 1, \dots$ ). The horizon is indefinite, but there is a positive risk of extinction of the human race at  $t$  should it have survived until then. That rate is taken to be a constant,  $\delta$  ( $> 0$ ).  $\delta$  operates like a constant discount rate of time. Define  $\theta = 1/(1+\delta)$ .  $\theta$  assumes the role of a "time discount factor" here. I imagine that other than humanity's survival there is no future uncertainty.<sup>42</sup>

In each period the economy is provided with  $K$  units of ecological services.  $K$  is rather like manna from heaven. We interpret  $K$  to be the quantity of a non-storable, all-purpose consumption good. To retain the parsimony of the timeless economy, I imagine there is no production activity and no possibility of investing or dis-investing. I realize that's a stretch, but the stretch is mainly in the thought that Earth's ecosystems cannot be destroyed. In other respects the model is sensible. For example, in not allowing for the possibility of capital accumulation, the model encourages us to focus on the limits set by the Earth system:  $K$  captures environmental constraints.<sup>43</sup>

People live for two periods. In their first period (childhood) they are maintained by their parents. At the beginning of their second period (adulthood) - should humanity survive until then - they choose how many children to have and how to share  $K$  among themselves and their children. The way I have phrased matters could suggest that the society we are studying is wholly authoritarian and centralized. It isn't. Rather, we suppose people of the same generation

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<sup>41</sup> Classical Utilitarianism and General-Relative Utilitarianism are not the same normative theory. The binary relations over social states that are implied by the two are different. We should therefore distinguish them. Label them as  $>_C$  and  $=_C$  for Classical Utilitarianism. Were A to have subscribed to Classical Utilitarianism, she would have favoured B's creation. That's because

$$\{6,6\}_p =_C \{8,4\}_p >_C \{11\}. \quad (7.2)$$

<sup>42</sup>  $\delta$  describes a Poisson process. We may think of it as reflecting the possibility of a pandemic or a nuclear holocaust. Rees (2003) offers a sobering assessment of the likelihood of such a global disaster.

<sup>43</sup> Dasgupta (1969) studied optimum population in a world where capital can be accumulated, but in which there is also an essential fixed factor of production (land). The central result in that paper was that optimum population is constant in the long run and personal well-being is positive. A global value of  $K$  is estimated in Section 8.

are identical and that adults in any period have the same ethical motivation. So, even though it is individuals who do the choosing, we may speak as though each generation chooses the size of the next generation.

People die at the end of their second period. There are thus two generations of people in any period. This is not good demography, but it turns out not to matter. To include realistic demographic features would not add to the substance of population ethics.

Let  $N(t)$  be the number of adults at  $t$ , should the world survive until then. I will call them "generation- $t$ ". The number of children at  $t$  is  $N(t+1)$ . The two generations make a total population of  $N(t)+N(t+1)$ , sharing  $K$ . In period  $t+1$ , assuming the world survives, the  $N(t+1)$  children of the previous generation are adults (they constitute generation- $(t+1)$ ); and they give birth to  $N(t+2)$  children and share  $K$  with them. And so on.

Well-being is a function of consumption. Adults and children have the same well-being function,  $U(C)$ , and  $U$  has the same technical properties as in the previous section. So, generation- $t$  has two choices to make: the size of the next generation ( $N(t+1)$ ) and the basis on which to share  $K$  with them. In view of the properties of the  $U$ -function we have assumed, the latter choice is simple enough: parents share their resources equally with their children. Let  $C(t)$  denote an individual's rate of consumption at  $t$ . Then  $C(t) = K/(N(t)+N(t+1))$  and  $U(C(t))$  is the well-being of someone alive at  $t$ .

The normative criterion that each generation adopts to choose the number of children to have is a notion of "inter-generational well-being". How would Classical Utilitarianism give expression to the notion? Here is Sidgwick (1907: 414) on the matter:

"It seems ... clear that the time at which a man exists cannot affect the value of his happiness from the universal point of view; and that the interests of posterity must concern a Utilitarian as much as those of his contemporaries, except in so far as the effect of his actions on posterity - *and even the existence of human beings to be affected* - must necessarily be more uncertain." (Italics added)

Let  $V(t)$  denote inter-generational well-being as viewed by generation- $t$ . Classical Utilitarianism would regard  $V(t)$  to be the expected sum of each person's well-being, from  $t$  into the indefinite future. Generation-Relative Utilitarianism amends it by introducing a mild notion of person-hood. It does so by encouraging generation- $t$  to make its choices so as to maximize an amended form of  $V(t)$ , which is presented below.

The economy we are studying has a stationary structure. That means generation- $t$  can reason that future generations will make their choices with the same motivation as theirs. Therefore  $V(t)$  and  $V(t+1)$  are related by the recursive relation

$$V(t) = N(t)U(K/(N(t)+N(t+1))) + \pi N(t+1)U(K/(N(t)+N(t+1))) + \pi\theta V(t+1), \quad 0 < \pi, \theta < 1. \quad (17)$$

Equation (17) binds each generation to its descendants. The present is taken to be  $t = 0$ .

Generation-0 is  $N(0)$  in number.

The analysis that follows is informal. Beyond supposing that  $N(0)$  is small relative to  $K$  (otherwise generation-0 will choose not to reproduce), I do not enter into technicalities. An optimum population profile under Generation-Relative Utilitarianism is a sequence of reproductive choices  $\{N^*(1), \dots, N^*(t+1), \dots\}$  with the property that  $N^*(t+1)$  maximizes  $V(t)$  on the supposition that all generations following  $t$  will choose in accordance with the profile. That common supposition has the status of an *implicit contract*. Because each generation has an understanding of the choices its descendants will face (assuming there will be descendants!), it can anticipate the choices they will make. Its own choice is based on a forecast of its descendants' choices. That said, the exercise isn't exclusively forward looking. Each generation looks back at the choices their ancestors had made, if only to reassure itself of the implicit contract and confirm that its own choice is guided by it.<sup>44</sup>

## 7.2 Extreme Theories

Classical Utilitarianism represents one extreme set of values. At the other extreme is a theory that is easy to describe but is also questionable. It involves the thought that *no* weight should be awarded to potential well-being. The viewpoint was explored by Enke (1966) in his study of social cost-benefit analysis of family planning programmes in poor countries. Enke sought ways to measure the economic value of prevented births, which he took to be the discounted sum of the differences between an additional person's consumption and the person's output over his lifetime. Children in Enke's theory have value only if they pay their way. In our formal model Enke's theory would amount to setting  $\pi$  equal to zero.

But Enke's is an extreme point of view, as is Classical Utilitarianism: one awards no weight to potential well-being; the other awards the same weight to potential well-being as it does to the well-being of present or future people. Both views should be rejected. Generation-Relative Utilitarianism lies between two extremes and reflects the strength of each without giving in to the weaknesses of either. It prescribes neither a large population nor a small population. Instead, it offers a wide space in between, within which more detailed ethical considerations can be embedded. We should not expect an ethical theory to do more.<sup>45</sup>

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<sup>44</sup> In a highly original work Phelps and Pollak (1968) studied a model of consumption and saving in a world where future numbers are not subject to choice. They assumed that each generation subscribes to Generation-Relative Utilitarianism. Generations in their model were non-overlapping. Scheffler (1994) constructed a justification for the move Phelps and Pollak made in their paper. Scheffler's object was to study personal morality and uncovered a class of agent-centred prerogatives.

<sup>45</sup> This all too informal account of Generation-Relative Utilitarianism has side-stepped a deep ethical issue. Equation (18) is the stationary equilibrium of a "game" involving the generations that are born. In deriving it I assumed that each generation chooses the size of the generation that is to follow. In formal terms I took each generation's strategy to be a number. I have not checked whether the equilibrium is inter-generationally "efficient".

### 7.3 The Stationary Contract

Characterizing the implicit contract among the generations for arbitrary values of  $N(0)$  is tedious. So we study the contract that supports a stationary profile.<sup>46</sup> Along a stationary profile (we confirm presently that the optimum stationary profile is unique) the generations replicate their numbers. Let  $N^*$  be that common number. The idea underlying the  $N^*$ -profile can be expressed in the following way: Suppose  $N(0)$  just happens to equal  $N^*$ ; then replication would be the optimum choice of every generation if they were to suppose that all subsequent generations will replicate themselves.  $N^*$  is then a self-enforcing reproductive policy for every generation. The contract that implements the  $N^*$ -profile is only implicit of course. But because  $N^*$  is a self-enforcing choice for each generation, there is no call for a written contract, even less a constitutional directive! We now characterise the  $N^*$ -profile.

In each period there are  $N^*$  adults and  $N^*$  children, making a total population of  $2N^*$ . In each period each person consumes  $K/2N^*$  units of the consumption good. It is now simple to show that  $N^*$  is the solution of the equation,<sup>47</sup>

$$U(K/2N) = 2\pi(1+\theta)/[1+\pi(1+\theta+\pi\theta)]U(K/2N)/(K/2N), \quad (18)$$

where  $U(K/2N)$  is marginal well-being at consumption level  $K/2N$ .

Define

$$P = 2\pi(1+\theta)/[1+\pi(1+\theta+\pi\theta)]. \quad (19)$$

Equation (18) can then be re-written in the compact form

$$U(K/2N) = P[U(K/2N)/(K/2N)]. \quad (20)$$

$P$  represents the proportionate gap between marginal well-being and the average well-being per

The reason the problem deserves attention is that Phelps and Pollak (1968) studied savings behaviour in a world that is committed to Generation-Relative Utilitarianism but where future population is not a matter choice. They found the stationary equilibrium of their "savings game" to be inefficient. It would be reasonable to imagine though that once the generations in the Phelps-Pollak world come to realize that the saving policy they are pursuing is inefficient, they would want to enrich the space of strategies from which they choose. Instead of choosing a saving rate, each generation could in principle choose from saving policies (saving rates as functions of inherited wealth). Saving rates in equilibrium would then be the rates that are implied by equilibrium saving policies. Such a move can lift equilibria out of inefficiency (Dasgupta, 1974). I have not investigated how that move would look in the model economy we have just studied.

<sup>46</sup>  $V(t)$  is a weighted sum of concave functions. The stationary optimum is locally stable.

<sup>47</sup> To confirm that, we expand the recursive relation in equation (17) and obtain  

$$V(t) = N(t)U(K/(N(t)+N(t+1))) + \pi N(t+1)U(K/(N(t)+N(t+1))) + \pi\theta U(K/(N(t+1)+N(t+2))) + \dots, \quad 0 < \pi, \theta < 1.$$

As previously we suppose that  $N(t+1)$  is a continuous variable. Differentiating  $V(t)$  with respect to  $N(t+1)$ , setting the derivative equal to zero, and assuming that  $N(t) = N(t+1) = N$  at all  $t$  yields equation (18).

unit of consumption. The smaller is  $P$ , the greater is that gap. It is easy to confirm that  $P \leq 1$ .

Notice that  $P = 1$  if  $\pi = 1$ . But if  $P = 1$ , equation (20) reduces to the Sidgwick-Meade Rule. That is so no matter what  $\theta$  happens to be. The reason for the latter is simple: Because there is no production in the economy, the optimum policy in each period is independent of the risk of extinction.<sup>48</sup>

## 8 Quantitative Estimates

Equation (19) says that  $P < 1$  if  $\pi < 1$ . With  $P < 1$ , equation (20) represents the optimum living standard under Generation-Relative Utilitarianism. But  $P < 1$  implies  $dU(C)/dC < U(C)/C$ . It follows that personal well-being is greater under Generation-Relative Utilitarianism than under Classical Utilitarianism. Correspondingly, population is smaller.<sup>49</sup>

By how much? To investigate, let us consider once again the  $U$ -function in equation (2). Well-being subsistence is  $C^s = B^{-1/\sigma}$  and the system's carrying capacity is  $2N^s = K/C^s$ . Equations (19)-(20) say that if  $C^*$  is the optimum living standard, then

$$C^*/C^s = N^s/2N^* = [(\sigma + P)/P]^{1/\sigma} > 1. \quad (21)$$

Equation (21) is our fundamental result. It can be used to estimate  $C^*$  and  $N^*$ . We do that by putting the equation to work on contemporary global statistics.

### 8.1 Critical Parameters

The stumbling block proves to be  $C^s$  and  $P$ .<sup>50</sup> Of the pair,  $P$  is possibly the less problematic. One can imagine  $P$  being estimated from surveys on fertility intentions at the level of the household. No doubt household behaviour is not the exclusive source of moral facts (Sect. 1 drew attention to a number of reasons why), but it would be impudent (not to say authoritarian) to ignore household intentions altogether in reaching ethical directives.

The sticking point will almost certainly be  $C^s$ . Matters aren't helped by the fact that  $C^s$  has been mis-interpreted for over a century (Sect. 4). Identifying  $C^s$  involves a value judgment, but it is also embedded in cultural presumptions. To make matters even more problematic,  $C^s$  is politically sensitive. The latter problem would be eased if we were able to relate  $C^s$  to politically acceptable parameters such as absolute poverty lines (e.g. the World Bank's "dollar-a-day", or the institution's bolder criterion, 2 dollars-a-day). The analysis of Section 4 showed however that no such relationship exists. A correct reading of  $C^s$  says that it is a lot higher than what people today judge to be an absolute poverty line. An alternative would be to regard relative poverty as a surrogate for  $C^s$ ; but that too won't do. It would stick in the ethicist's throat

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<sup>48</sup> The case " $\theta = 1$ " requires comment because  $V(t)$  in that case is unbounded. In two classic papers, Ramsey (1928) and Koopmans (1965) discovered a way to re-frame the problem of optimum inter-generational well-being so as to overcome the problem. They introduced a method to re-normalize  $V(t)$ . Their move works here as well.

<sup>49</sup>  $\theta$  is pertinent to the case  $P < 1$ ; it influences  $N^*$ .

<sup>50</sup> We have noted that a widely used value for  $\sigma$  is 1.

to be told that well-being subsistence depends on a society's average level of income; it would certainly stick in mine.

The sad truth is that population ethics has been so comprehensively neglected in the social sciences that we have developed no informed intuition about either  $C^S$  or  $P$ . Economists and decision theorists have identified reasons for commending a value of 1 for  $\sigma$ , they have devised techniques for estimating the cost of carbon in the atmosphere and for identifying absolute poverty lines; but on ethical parameters that are crucial to population ethics, we have developed little intuition.

## 8.2 Sensitivity Analysis

Sensitivity analysis is about the best we can do today. But sensitivity analysis alone is not helpful. It informs but doesn't tell us how to proceed from there. One suggestion is to work backward: (i) start from the  $C^*$  and  $N^*$  that are implied by an arbitrary pair of figures for  $C^S$  and  $P$ ; (ii) revise the figures and estimate the corresponding  $C^*$  and  $N^*$ ; (iii) continue doing so until the evaluator who is engaged in the iteration reaches what Rawls would call a "reflective equilibrium" regarding  $C^*$  and  $N^*$ . Of course, a pair of figures for  $C^*$  and  $N^*$  that "feel" right may still be very wrong; but we would then want to know why they are wrong. That would force us to think on the matter and engage in discussions with others.

For simplicity of calculation, I suppose  $\sigma = \theta = 1$ .<sup>51</sup> To illustrate sensitivity analysis, I consider three sets of figures for  $C^S$  and  $\pi$  (the latter yields  $P$ ) and deduce the  $C^*$  and  $N^*$  that are implied by each pair. I start with "large" figures for  $C^S$  and  $\pi$ .

But first we need an estimate for  $K$ . We consider the world as a whole. Annual global income today is about 108 trillion international dollars.<sup>52</sup> Footnote 16 cited WWF (2008), in which humanity's ecological footprint in the early years of the present century was estimated to be slightly above 1.5. We should imagine that the footprint is somewhat larger now. Even so, let us use the conservative figure of 1.5. Making the simplifying assumption that GDP draws proportionately on ecosystem services at all levels, we conclude that the sustainable level of annual world income is 72 trillion (2x108/3 trillion) dollars. That gives us  $K$ .

We now study three illustrative cases:

(1) Suppose  $\pi = 0.1$ . Then  $P \approx 0.325$  and  $(\sigma+P)/P \approx 4$ . Now suppose  $C^S = 7,200$  dollars, which is approximately Guatemala's per capita GDP. It follows that  $N^S = 10$  billion (72 trillion/7.2 thousand). Now use equation (20) to confirm that  $2N^* = 2.5$  billion and  $C^* = 28,800$  dollars. The latter figure is the per capita GDP of Portugal. For easy comparison, I note that

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<sup>51</sup> Setting  $\theta = 0.97$  does nothing once the figures have been rounded.

<sup>52</sup> International dollars are a fictitious currency that is constructed to even out differences in the cost of living across countries. That is why international dollars are often expressed as dollars adjusted for purchasing power parity (PPP). In what follow I drop the qualifier and use the term "dollar".

world population today is 7.2 billion and average world income per person is 15,000 dollars.

With the parameter values being assumed here, Classical Utilitarianism advocates twice the population size and half the living standard of Generation-Relative Utilitarianism. That means Classical Utilitarianism would advocate a population of 5 billion, enjoying a living standard of 14,400 dollars, which is just under average world income per person today.<sup>53</sup>

(2) Suppose  $\pi = 0.05$ . Then  $P \approx 0.18$  and  $(\sigma+P)/P \approx 6.5$ . Now suppose  $C^\delta = 6,000$  dollars, which is roughly the per capita GDP of the Republic of Congo today. Then  $N^\delta = 12$  billion (72 trillion/6 thousand). We can now use equation (20) to confirm that  $2N^* = 1.85$  billion and  $C^* = 39,000$  dollars. The latter figure is the per capita GDP of France. In contrast Classical Utilitarianism would advocate a population of 6 billion, enjoying a living standard of 12,000 dollars.

(3) Suppose  $\pi = 0.01$ . Then  $P \approx 0.04$  and  $(\sigma+P)/P = 26$ . Now suppose  $C^\delta = 1,000$  dollars, which is just a bit over the per capita GDP of Niger, which is one of the world's poorest countries. Then  $N^\delta = 72$  billion (72 trillion/1 thousand); and so  $2N^* = 2.8$  billion and  $C^* = 26,000$  dollars. The latter is a bit above per capita GDP in Greece. In contrast Classical Utilitarianism would advocate a population of 26 billion at a standard of living of 2,000 dollars.

Three exercises don't reveal much, what they do reveal is that Generation-Relative Utilitarianism is most distinct from Classical Utilitarianism when  $\pi$  is small (and thereby  $P$  is small) and simultaneously  $C^\delta$  is small. I expected the former but didn't expect it would be come tied to the latter.<sup>54</sup>

### 8.3 How Many People Can Earth Support in Comfort?

Ecologists studying sustainable world population have usually taken a different analytical route to the one I am pursuing here. They haven't so much addressed population ethics as inquired into what human numbers the Earth system can support at an average living standard that can offer people options to pursue a wide variety of projects and purposes. Daily, Ehrlich, and Ehrlich (1994) is an interesting study along that line.<sup>55</sup> I follow their route here, but by using findings from global surveys on happiness and life satisfaction. Imagine then that we have an independent source of information about not so much  $C^*$  but a standard of living beyond which life is not statistically related to happiness. Call that living standard  $C^{**}$ . We could ask how

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<sup>53</sup> To confirm the latter, set  $\theta = \sigma = \pi = 1$  in equation (21). It could appear odd that Classical Utilitarianism advocates both smaller population and lower living standard than is the case in the contemporary world, but recall that our calculations pertain to a sustainable Earth ( $K$ ). At a world GDP of 108 trillion dollars humanity's living standard is not sustainable.

<sup>54</sup> To confirm the latter, suppose  $C^\delta = 6,000$  dollars in the example. Then under Classical Utilitarianism  $C^* = 12,000$  dollars and  $2N^* = 6$  billion.

<sup>55</sup> Cohen (1995) conducts a similar study under a wide dispersion of assumptions regarding Earth's capacity to support human numbers and their demands.



many people could be supported indefinitely by the Earth system at  $C^{**}$ .

It could be thought that  $C^{**}$  is unboundedly large. The Sidgwick-Meade Rule was derived under that assumption (Fig. 1), and it is conventional to assume that  $U$  increases with  $C$  no matter how large  $C$  happens to be. But an analysis of one set of global surveys on happiness and their relationship with household incomes has revealed that in countries where per capita income is in excess of 20,000 international dollars, additional income is not statistically related to greater reported happiness.<sup>56</sup> I work with this figure even though I am not sanguine I understand the finding (20,000 dollars is the per capita income in Panama, Cuba, and Uruguay today, and it takes a stretch to imagine that happiness hits a material roadblock at 20,000 dollars). In Section 8.2 we estimated that sustainable world GDP is an annual 72 trillion dollars. That's  $K$ . So, if we take  $C^{**}$  to be 20,000 dollars, maximum sustainable population ( $N^{**}$ ) is 3.6 billion.

Suppose our goal was even less demanding; suppose humanity would be content with an average income of 10,000 dollars, a figure that is well below the global per capita income (15,000 dollars).<sup>57</sup> Sustainable global population would then be 7.2 billion. We are now 7.2 billion in numbers, moving toward 10 billion, and currently enjoying 15,000 dollars as a global average. In view of these figures it is hard to believe that the United Nations' Sustainable Development Goals (SDGs) are themselves sustainable. Crude though my calculations are, they are so far from what the SDGs promise that it is hard even to imagine that Earth's support system can deliver them on a sustainable basis.

## 9 Existential Risks and Rational Ends

In a deep meditation on the significance of a possible nuclear holocaust in which humanity suffers extinction, the late Jonathan Schell distinguished two types of death:

"It is of the essence of the human condition that we are born, live for a while, and then die... But although the untimely death of everyone in the world would in itself be an unimaginably huge loss, it would bring with it a separate, distinct loss that would be in a sense even huger - the cancellation of all future generations of human beings." (Schell, 1982: 114-115)

Schell's book was originally published as a three-part essay in *The New Yorker* in 1981,

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<sup>56</sup> Layard (2011: 32-35) reports the finding. See also Helliwell, Layard, and Sachs (2013). A number of explanations can be given, one being that what matters to a household beyond a certain level of income is its income relative to the average income in its peer group. To model this we should assume the well-being of household  $i$ , which we write as  $U_i$ , is not only a function of  $C_i$ , but also of  $C_i/C$ , where  $C$  is average consumption in  $i$ 's society. It is essential to the argument that  $U_i$  increases not only with  $C_i$ , but also with  $C_i/C$ . Veblen (1899,[1925]) based his theory of the leisure class on this particular psychology of consumption. The problem isn't that the Veblen-effect is implausible (it is all too believable), but that it dominates all other factors affecting the demand for goods and services beyond 20,000 dollars.

<sup>57</sup> To convey an idea of 10,000 dollars per person, it is the per capita income in contemporary Albania and Indonesia.

at a time the Cold War had created an especial chill. Schell was a writer, not a professional philosopher, but he made not one false move in philosophical reasoning in the crucial middle chapter, *Second Death*. Both Classical Utilitarianism and Generation-Relative Utilitarianism measure the loss from the *Second Death* in terms of the well-being of all who would not exist on account of human extinction. In the previous section we saw how those losses could be estimated.<sup>58</sup> Schell however made a radically different move. He spoke of the loss each of us alive today would suffer if we were to discover that there will be no one after we are gone. He located that loss not to any attachment we may have to humanity writ large, but to a devaluation of our own lives. And he used the artist and his art to make the point:

"There is no doubt that art, which breaks into the crusted and hardened patterns of thought and feeling in the present as though it were the prow of the future, is in radically altered circumstances if the future is placed in doubt. The ground on which the artist stands when he turns to his work has grown unsteady beneath his feet." (Schell, 1982: 163)<sup>59</sup>

Schell spoke of the artist, but he could have made the same case for all who create ideas and objects. Future people add value to the creators' lives by making their creations durable. Here the fact of a general assumption that people desire to have children is significant. An artist may regard his work to be far more important than parenting, but he is helped by the presumption that there will be future generations to bestow durability to his work.

The examples Schell pointed to were works of art and discoveries in the sciences. Those creations are public goods, and most people don't have the talent to produce them. Confining attention to public goods is not only limiting, it also raises an ethical dilemma: Suppose we all were indifferent to having children and stared only at the prospective costs of raising them. We would then free-ride, and the artist would be mistaken in his assumption that there will be future people to give durability to his work.

Nevertheless the direction Schell was pointing to is exactly right. Public goods aren't the only objects of ethical significance. Our values and practises are significant too. Many are private, even confined to the family, and it is important to us that they are passed down the generations. Procreation is a means of making one's values and practises durable. We imbue our children with values we cherish and teach them the practises we believe are right not merely because we think it is good for them, but also because we desire to see our values and practises survive. Those values and practices are not public goods. On the contrary, we cherish them *because* they are intimate. They are stories we tell our children about their grandparents' foibles, of our own joys, sorrows, and discomfiture, and we instruct them on the family rituals we

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<sup>58</sup> Sikora (1978) is an early exploration for a response to the question using Classical Utilitarianism as the guide.

<sup>59</sup> Scheffler (2013) has also observed that our own lives would be diminished if there were to be no future people.

ourselves inherited from our parents. It seems to me our descendants do something supremely important for us: they add value to our lives that our own mortality would otherwise deprive them of. That is the reason we would not practise reproductive free-riding even if we found reproduction to be personally costly. The springs that motivate humankind to assume parenthood are deep and abiding. Their genetic basis explains the motivation, but doesn't justify it. Justification is found elsewhere. Our children provide us with a means of self-transcendence, the widest avenue open to us of living through time, not merely in time. Mortality threatens to render the achievements of our life transitory, and this threat is removed by procreation. The ability to leave descendants enables us to invest in projects that will not cease to have value once we are gone, projects that justify life rather than merely serve it. Alexander Herzen's remark, that human development is a kind of chronological unfairness because those who live later profit from the labour of their predecessors without paying the same price; and Kant's view that it is disconcerting that earlier generations should carry their burdens only for the sake of the later ones, that only the last should have the good fortune to dwell in the completed building - or in other words, that we can do something for posterity but it can do nothing for us - are a reflection of an extreme form of alienation.<sup>60</sup>

The motivation transmutes from the individual to the collective. Every generation is a trustee of the wide range of capital stocks (be it cultural or moral, manufactured or natural) it has inherited from the past. Looking backward, it acknowledges an implicit contract with the previous generation, of receiving the capital in return for its transmission, modified suitably in the light of changing circumstances and increasing knowledge. Looking forward, it offers an implicit contract to the next generation, of bequeathing its stocks of capital that they in turn may be modified suitably by it and then passed on to the following generation. As was noted in our account of population ethics in a world moving through time, this perspective is not at odds with either Classical or Generation-Relative Utilitarianism. We are encouraged to internalize the potential well-being of our descendants. They are not us, but they are not outside us either.

Schell's reflections point also to the intrinsic value of Nature. It's a mistake to seek justification for the preservation of ecological diversity, or more narrowly the protection of, say, the giant redwoods, solely on instrumental grounds; that is on grounds that we know they are useful to us or may prove useful to our descendants. Such arguments have a role but they are not sufficient. Nor can the argument rely on the welfare of the members of such species (it does not account for the special role that species preservation plays in the argument), or on the "rights" of animals. A full justification bases itself as well on how we see ourselves, on what our rational desires are. In examining our values and thus our lives, we should ask if the destruction of an entire species-habitat for some immediate gratification is something we can live with

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<sup>60</sup> Rawls (1972: 291) has a characteristically profound criticism of Kant's perspective.

comfortably. The idea of inter-generational exchange is embedded in the perspective of eternity, but the intellectual source of such exchange is a far cry from the conception that balked Herzen in his effort to locate mutually beneficial terms of trade. The mistake is to see procreation and ecological preservation as matters of personal and political morality. It is at least as much a matter of personal and political ethics.

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Table 1  
Social Statistics from Rich and Poor Regions (Year 2010)

	rich	poor
Population (millions)	1,127	796
GDP per capita (international dollars)	37,000	1,300
Total fertility rate*	1.8	4.1
Under-5 mortality rate (per 1000)	6	108
Life expectancy at birth (years)	80	59
Percentage enrollment in secondary education	100	39

Source: World Bank (2012)

\* Total fertility rate (TFR) is the number of successful pregnancies that a woman expects to have during her reproductive years. The number 2.1 is usually taken to be the TFR that, over the long run would lead to a stable population.

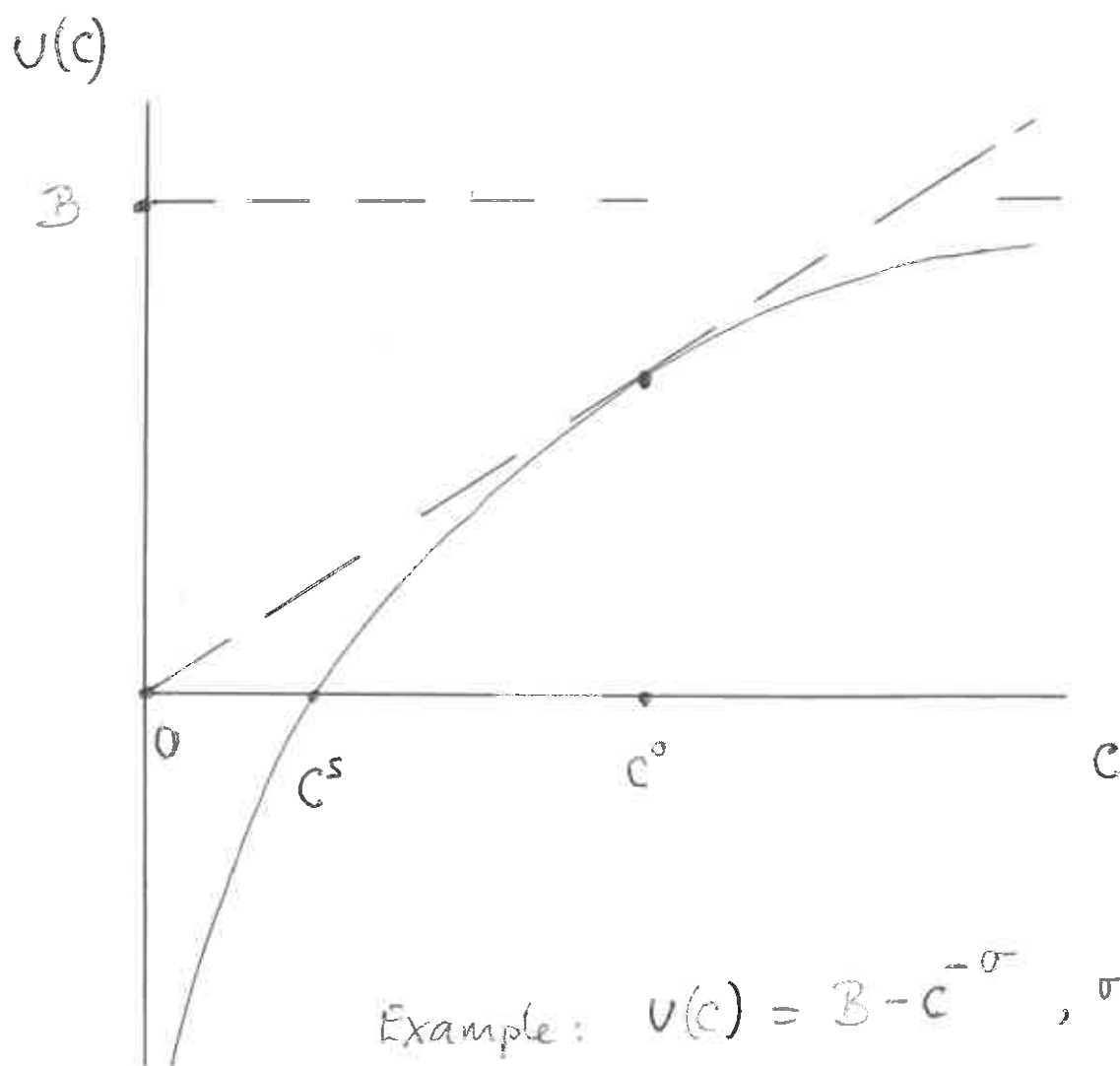
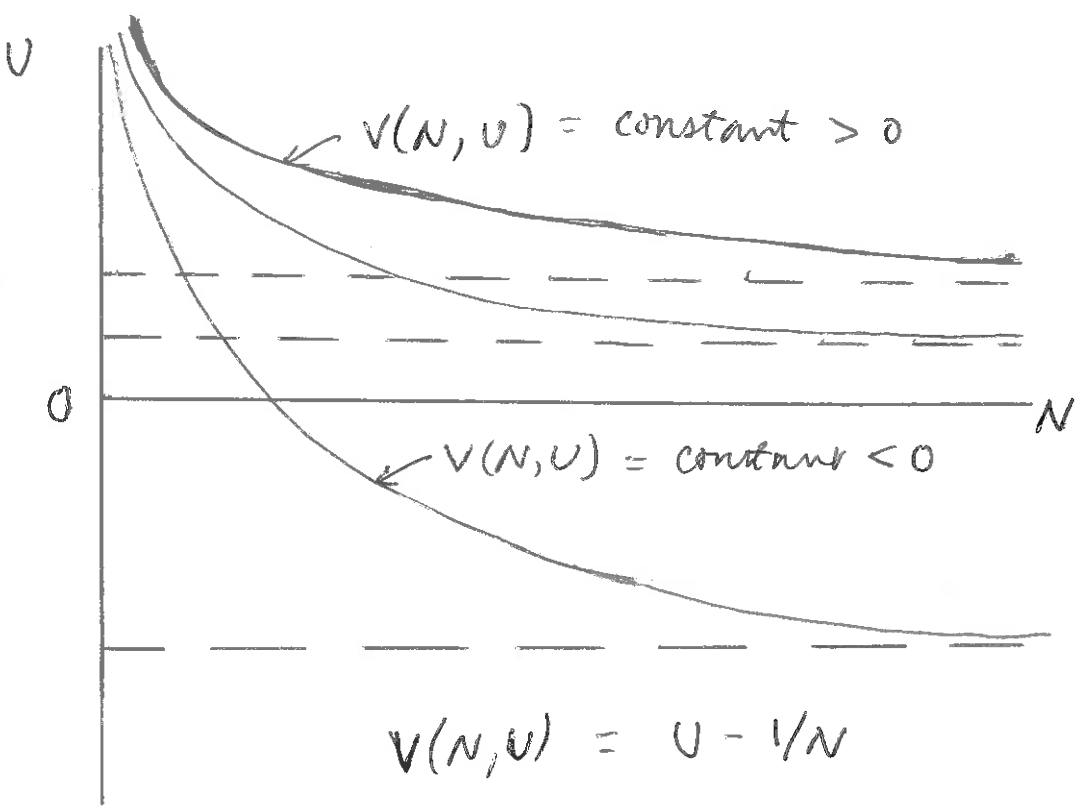
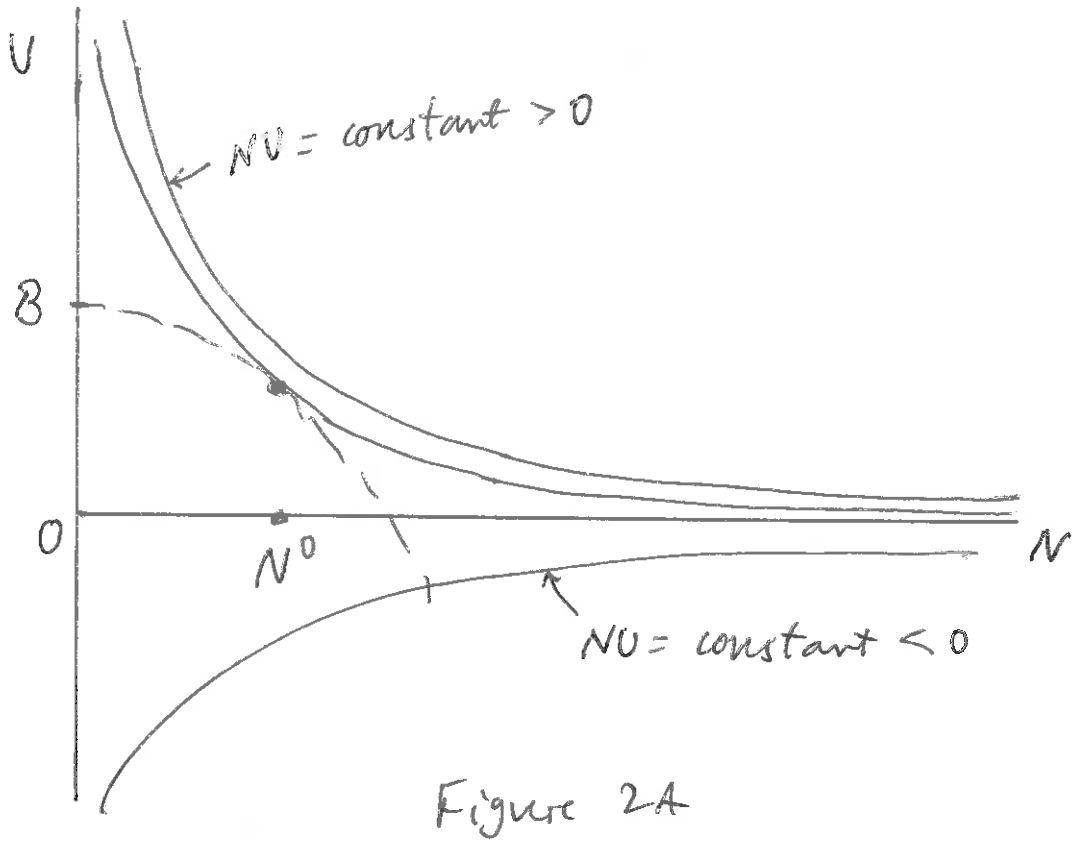


Figure 1



$$V(N, U) = U - 1/N$$

Figure 2B

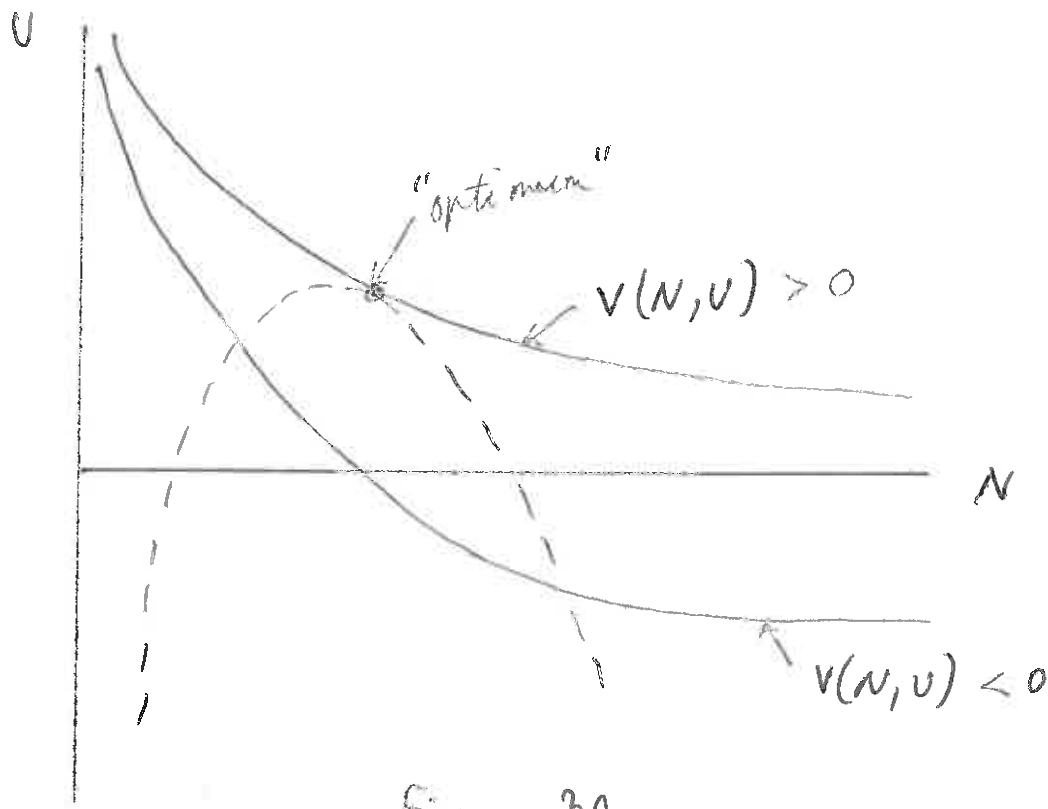


Figure 3A

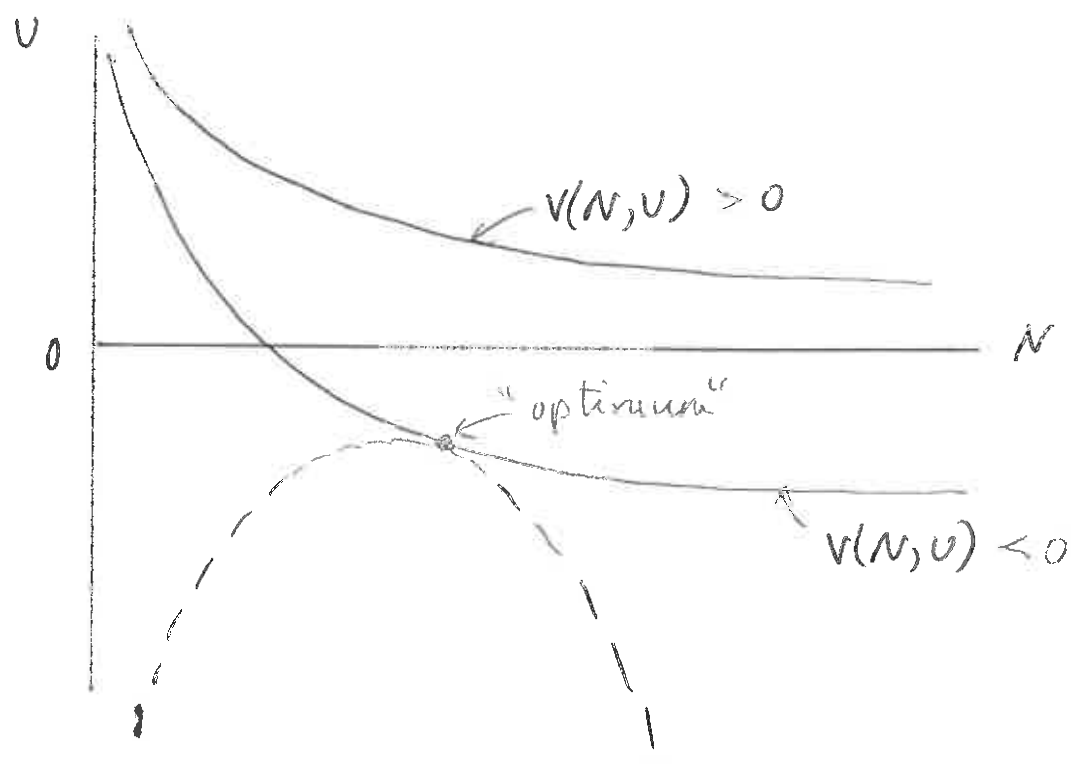


Figure 3B

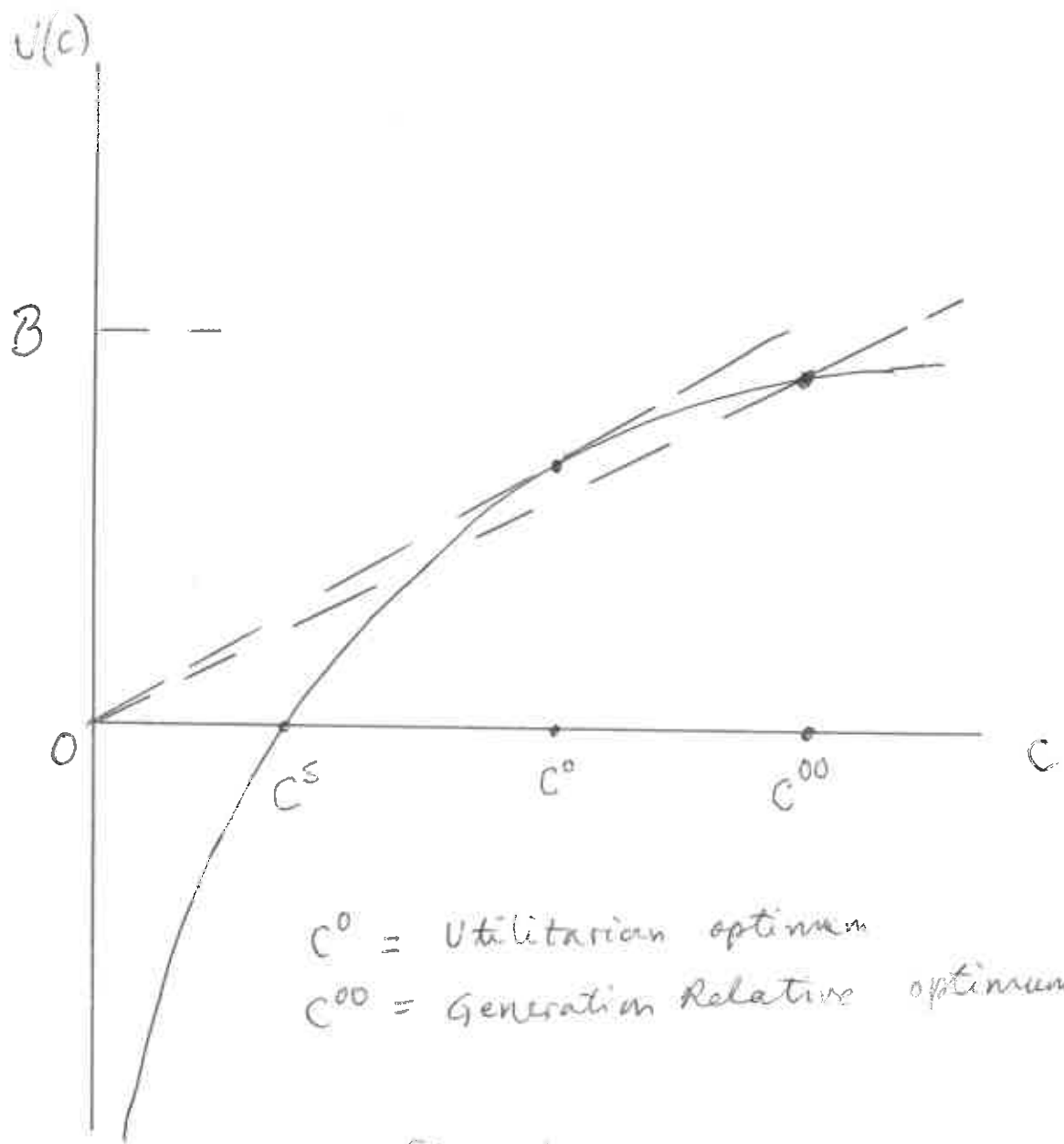


Figure 4