

SNF-Working Paper No. 44/06

**Ethics vs. profits in the management
of petroleum resources**

by

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SNF Project No. 4326

Konkurransestrategi, tilgangsprising og investeringsincentiv i
et europeisk integrert gassmarked

The project is financed by the Research Council of Norway

INSTITUTE FOR RESEARCH IN ECONOMICS AND BUSINESS ADMINISTRATION
BERGEN, NOVEMBER 2006

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Ethics vs. profits in the management of petroleum resources^{*}

Gjermund Nese^{**}

Abstract

Many of the decisions made by policy makers today may affect not only the people belonging to the present generation, but can have long-term effects that reach far into the future and thus significantly affect the life of future generations. The social rate of discount, which is the way that future consequences often are evaluated in present-day decision-making, unavoidably raises difficult issues of inter-generational justice. Greenhouse gas emissions caused by the use of non-renewable energy sources like oil and natural gas is an obvious example involving both economical and ethical concerns. The discussion in this paper is further motivated by the increasing demand for energy and the fact that more and more of the energy sources needed to fulfill this demand seem to be located in environmentally vulnerable areas. Norwegian authorities are faced with such a dilemma when considering whether to increase the petroleum activity in the Barents Sea. The concern is that such activity may cause irreversible environmental damages to the Barents Sea area. Furthermore, the petroleum resources are non-renewable meaning that for each unit of oil and gas produced today there will be one unit less left in the ground for future generations, leading to a debate about income distribution between generations. This paper focuses on some of the economic and philosophical arguments surrounding the debate about how social decision makers of the present generations should value the consequences their decisions may have on future generations.

1. Introduction

Many of the decisions made by policy makers today may affect not only the people belonging to the present generation, but can have long-term effects that reach far into the future and thus significantly affect the life of future generations. To what extent, if any, should people living today include such long-term consequences and the well being of future generations in their decision-making? This fundamental question has been puzzling economists, philosophers and others for centuries. During the last decades this issue has become even more relevant as policy makers are faced with more and more decisions that involve long-term effects. Due to the technological progress in many fields we have the power to affect the life of future generations significantly. Examples can be the use of nuclear technology, toxic waste disposal, depletion of non-renewable resources, etc.

* Financial support from the Norwegian Research Council through the PETROPOL research programme is gratefully acknowledged.

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Energy production is an activity in which there exist a number of relevant issues in this respect. In particular this applies to energy production from fossil fuels like coal and petroleum, i.e. oil and natural gas. We can easily identify at least three relevant issues connected to e.g. environmental consequences and income distribution. First, the supply of non-renewable resources is by definition limited. This means that e.g. the oil and natural gas that is not produced today may be produced tomorrow, or at some later point in time. Or equivalently, the more is produced today, the less is left to produce in the future. Thus, there is a question about the distribution of these resources between generations. Is it ethically responsible by present generations to produce all the oil and natural gas they want without taking future generations' need for these resources into account? For Norway, as a large petroleum producer, this aspect obviously also has a financial side, as the export of petroleum provides the country with huge incomes. The distribution of these incomes between different generations gives raise to a similar ethical debate. Second, the utilization of fossil fuels causes emissions of so-called greenhouse gasses like e.g. carbon dioxide, CO₂. These emissions have the potential of hurting the global environment and thus affecting not only present generations but also, and probably mainly, future generations. Third, energy is vital for the world economy. A significant part of this energy is produced from fossil fuels. However, the exploration, development and production of oil and natural gas often comes to conflict also with local environmental considerations at the places where these resources are located. The continuously growing demand for oil and natural gas is likely to increase the frequency of such conflicts. One example is the ongoing debate about whether Norway should increase their petroleum activity in the Barents Sea north of Norway.¹ This area is by many considered to be extremely vulnerable to such activity. According to the Norwegian Ministry of Petroleum and Energy (MPE), 29 % of the estimated undiscovered petroleum resources at the Norwegian continental shelf (NCS) are located in the Barents Sea (Factsheet, 2005). Thus, this geographical area attains increasing attention from both Norwegian authorities and the petroleum companies. The following statement by the MPE is illustrative: *“In these areas, it is still possible to make major new discoveries. The potential for such discoveries in the frontier areas serves to sustain the competitiveness of the NCS from an international perspective, and the areas retain the potential for attracting interest from the biggest multinational oil companies. More and more of the southern NCS is now mature. This has triggered the need to investigate the conditions for petroleum activities in the large frontier*

¹ Parts of this area are already used by Norway for natural gas production, e.g. at the so-called Kristin field. In addition Russia engages in extensive petroleum production in their part of the Barents Sea.

*areas that remain in the northern sections of the continental shelf.”*² Especially the environmental organizations are critical, saying that further opening of the Barents Sea for oil and gas production could result in heavy damage to fisheries and the environment in this area. Norwegian authorities acknowledge this problem and a report have been made which assesses the feasibility of coexistence between the fisheries and petroleum industries in the area from Lofoten northwards, including the Barents Sea, see MPE (2004). In a recent report the Ministry of the Environment (ME) presented a management plan (“Integrated Management of the Marine Environment of the Barents Sea and the Sea Areas off the Lofoten Islands”) for this area. According to Norwegian authorities, the management plan sets the overall framework for both existing and new activities in these waters, and facilitates the co-existence of different industries, particularly the fisheries industry, maritime transport and petroleum industry. As a result of this management plan, some areas in this region will still not be opened for petroleum activities. In other areas, however, the oil and gas companies may now start exploration for these valuable resources. See ME (2006) for the whole report.

For policy makers, dealing with these kinds of issues will often involve making a trade-off between ethics and profits. Many economists will make such a trade-off a debate about welfare economical consequences. However, in order to make their decisions, policy makers will have to include not only economic considerations but also ethical and moral aspects. Obviously, the above mentioned issues regarding resource management in energy production are controversial. For a petroleum producing country like Norway, it is definitely also a matter of great economic importance due to the significant incomes generated by the production of oil and natural gas. It seems obvious that ethics and moral should be involved when making decisions about e.g. producing oil and gas from environmentally vulnerable places, when deciding about how fast to empty the non-renewable petroleum resources and how to distribute the income generated by the petroleum activity between different generations. The economic consequences associated by such decisions make it difficult for the policy makers to give priority to later generations at the cost of a lower welfare level for people living today. Thus, this typically boils down to questions about ethics and moral, and how much the present generation should care about the welfare of future generations.

² See Factsheet (2005).

The social rate of discount, which is the way that future consequences often are evaluated in present-day decision-making, unavoidably raises difficult issues of inter-generational justice.³ The problem that arises with discounting is that it discriminates against future generations. This discount rate has been a frequent subject of technical debate among economists. However, from a broader perspective the selection of an appropriate social discount rate involves considerations of questions that to a large extent are related to public philosophy. According to standard economic theory, both individuals and social decision makers tend to favor immediate benefits at the expense of more distant ones, leading to the use of a positive discount rate. There is, however, no consensus among economists neither about the appropriate discount rate, nor on how it should be calculated. In addition, this practice to discount the future involves clearly a lot more than just economic considerations, as the choice of a discount rate puts a weight on the welfare and the importance of the well being of future generations relative to the present one. As mentioned above, this raises a number of ethical questions about e.g. what moral obligations we have to future generations. In the discussion below we will go through a number of both economic and philosophical arguments surrounding the practice of discounting benefits accruing to future generations. Throughout the discussion we will use the management of Norwegian petroleum resources as an illustrative case.

Most economists seem to argue for a positive discount rate. Philosophers, however, have often written as though future human beings are just as real as present ones. They just happen to differ from present human beings with respect to the time at which they exist. Time, these philosophers would argue, is not a morally significant property. Therefore, the interests of the future generations are just as important as those of the present generation. Govier (1979) refers to L. W. Sumner who once claimed that: *“If we give a preference to presently existing human beings in our moral reasoning, if we weight their needs and interests more heavily than those of human beings who do not exist yet, we are violating moral canons of impartiality”*.

This issue is of course a large and complicated one, and agreeing on how to treat future generations relative to the present represented by a uniform discount rate is maybe just not

³ Throughout the paper we will use the terms *social rate of discount* and *time preferences* interchangeably when referring to how future benefits (or costs) are weighted relative to present ones. The *social* rate of discount is used to reflect that investments with long-term effects usually will be implemented by the public sector and not by private investors.

possible. Solow (1999) recognizes this as he states: *“Maybe the idea of a unitary decision maker – like an optimizing individual or a wise and impartial adviser – is not very helpful when it comes to the choice of policies that will have distant-future effects about which one can now know hardly anything.”*

In general there exists a large literature on this area. A comprehensive survey of the interplay between ethics and economics can be found in Hausmann and McPherson (1993). See also e.g. Sen (1987) and Broome (1991).

We will start by discussing the cost-benefit analysis, which is the standard method of investment analysis, and in which the significance of the choice of the social discount rate is seen quite clearly. Thereafter we will look at two different principles for determining the social rate of discount; opportunity cost and consumers’ time preferences. Then we present three often-used arguments for using a positive social discount rate; diminishing marginal utility, uncertainty, and the paradox of infinite time horizons. Section 5 looks at time preferences from the point of view of Utilitarianism, while section 6 presents some potential conflicts between the Utilitarian views on time preferences and the representation of these in a democratic state. In this section we also discuss the Norwegian Petroleum Fund, which is a fund meant to limit the speed at which Norwegian petroleum incomes is used. Thereafter, in section 7 Jon Elster’s (by many considered as one of the leading social scientists in the world today) thoughts on time preferences are briefly presented, before we in section 8 ask the question if cost-benefit analysis is the appropriate tool for evaluating long-term projects like the management of non-renewable resources? Finally, section 9 summarizes.

2. Cost-benefit analysis

The standard method of investment analysis is to do a cost-benefit analysis in which one makes forecasts about the benefits and costs associated with the project considered. If the value of the benefits exceeds the value of the costs, the project will be implemented. In most cases it will take some time before an investment starts to produce benefits, while the investment costs typically will have to be paid here and now. For the case of e.g. reducing the speed of petroleum production at the Norwegian continental shelf, the costs will be represented by lost profits today at the benefit of increased profits for future generations. Closing the Barents Sea area for petroleum production will also imply a loss of potential

profit for the present generation, while the benefits in the sense of a “clean” Barents Sea can be enjoyed also by later generations. Economists will typically take these long-term aspects into account by comparing the discounted values of the benefits and costs. Through the use of a positive rate of discount, the present value of the benefits (or costs) that apply in the future will be lower the further into the future they are realized, implying that we favor the present on expense of the future. For short-term projects where both the costs and benefits are realized within a short time period the level of the discount rate will not be of particular importance. However, special concerns apply to projects whose benefits are expected in the distant future. With almost any positive rate of discount, the benefits will not appear to justify the costs. In addition the result of the cost-benefit analysis could be very sensitive with respect to different assumptions about the level of discount rate.

As an illustration, assume that the policy makers are using a discount rate of 10 percent. The present value of € 1 billion of benefits fifty years from now is then worth approximately € 8.5 million today when discounted at 10 percent. However, discounting at 3 percent makes the present value of the benefits worth more than € 228 million. As an illustration, imagine closing the Barents Sea region for oil and gas production would generate environmental benefits worth \$1 billion fifty years from now.⁴ The costs associated by such a decision could be represented by loss of income from the potential petroleum production from the Barents Sea. For the case of the illustration we assume that this income will be realized immediately after allowing for oil and gas production in this area.⁵ The interpretation of these simple calculations would then be that, assuming a discount rate of 10 percent, the closing of the Barents Sea will only be implemented if the potential petroleum income is below \$ 8.5 million. Assuming the lower discount rate of 3 percent, however, implies that we would accept a loss of income that is more than 26 times higher than in the former case.

Given the sensitivity of the present values of different assumptions about the level of the discount rate we would prefer that the estimates of the rate to use lay within a narrow interval. However, there exists no agreement among economists or other policy analysts about the appropriate discount rate, and rates of 3 and 10 percent both lay within the range of rates that have been proposed and defended for evaluating e.g. energy policy decisions (Lind 1982).

⁴ Making such estimates of the value of future environmental benefits is of course not trivial. We will return to this issue later.

⁵ Obviously it will take many years from allowing for exploration before the petroleum production can actually take place and income will be generated.

The issue of discounting has attained renewed interest during the last decades. Among the reasons are the concerns about the present generation's use of resources that could result in climate changes in the future. Many scientists, environmentalists, politicians, and others favor strong action to slow the accumulation of so-called greenhouse gasses like CO₂. International meetings, like the Kyoto meeting, have tried to make countries agree on reducing the emissions of greenhouse gasses. These meetings have illustrated the difficulties associated by making countries agree on how to deal with these problems. There are at least two obvious reasons for this. First, reducing the emission of greenhouse gasses is costly. Second, the benefits from mitigation are uncertain and will probably not show until many decades or maybe even centuries from now, while the costs must be taken here and now and would necessarily imply sacrifices by the current generation in order to produce benefits for future generations. This necessitates some way of comparing these near-term costs with more distant benefits.

Of course, global climate change and management of petroleum resources are not the only problems for which solutions present this pattern of benefits and cost. Many other examples exist within the environmental field, e.g. how to handle radioactive waste disposal and the preservation of biodiversity. For the case of radioactive waste disposal, the largest share of the costs must be incurred up front, while the benefits of safe disposal will be felt for tens and hundreds of years because of the extraordinarily long half-life of radioactive wastes. Also, the costs of preserving biodiversity are incurred here and now, because once a species is lost, it is lost forever. Most of the benefits of successfully preserving it will, however, accrue to future generations.

These issues then lead to the basic and important question about how much we are willing to sacrifice today for the benefits that will be enjoyed later in our lives or in the lives of succeeding generations.

3. Opportunity cost or consumers' time preferences?

According to Robinson (1990) there are two principles competing for the role of determining the social rate of discount; some analysts would argue that in a democratic society the policy-makers are required to base its policies upon the preferences of its citizens. This would imply that the future effects of an investment should be discounted according to the discount rate

used by individuals in their private decision-making. Others would argue that as far as a public investment displaces investments in the private sector, one should base the choice of the social discount rate upon the principle of opportunity cost. Such a principle should then mean that public investments yield the same rate of return as private investments, leading to a social discount rate decided by the market forces.⁶

3.1 Opportunity cost

The intuition behind the principle of using opportunity cost as the basis for the social discount rate is that there will usually be more than one possible use of the investment funds available. When choosing between different investment alternatives, each alternative should be evaluated in light of the returns potentially available in other projects. In a perfect economy this principle would mean that every project yielding a rate of return higher than the market rate of interest should be implemented. The market rate of interest would identify the opportunity cost of displacing private investments with public ones, and should therefore be used as the social rate of discount.

The opportunity cost principle is, however, not unproblematic. As pointed out by Arrow (1966), the displacements of private investments have not only short-term effects. Private investments implemented today would generate investment and consumption possibilities also in future years. Further, the public investment would also have similar long-term effects as it would generate possibilities for the citizens and entrepreneurs in future years that would otherwise not have been available. Opening the Barents Sea for increased oil and gas production could for example also benefit future generations as the potential oil and gas resources probably will be productive for many years to come. In addition it takes many years before the eventual exploration activity materializes into production of oil and gas. Furthermore, incomes from the export of oil and natural gas produced in the Barents Sea may be invested to the benefit also of future generations. Thus, investing in petroleum exploration activity today may very well provide benefits like investment and consumption possibilities for later generations. Arrow therefore states that one should evaluate the whole stream of future consequences for the private sector, not only the immediate displacement of private investments. It is doubtful that the market rate of interest can capture these positive effects on future private investment of current public investments (Feldstein 1964).

⁶ Under perfect competition these two principles would yield the same social discount rate.

This discussion terminated, at least temporarily, by a compromise proposed by Lind (1982). Portney and Weyant (1999) summarizes Lind's proposal in three important themes that by that time had emerged from the discounting debate. First, to the extent possible, all future costs and benefits should be converted to equivalent changes in consumption for the individuals who will experience them. Second, to the extent that the costs (benefits) of a public investment displace private capital formation, their consumption-equivalent measure should be adjusted upward to reflect the marginal productivity of capital. And third, these adjusted streams of consumption equivalents should be discounted using the social rate of time preference.

Lind's compromise seemed to start falling apart as Arrow et. al. (1996) introduced more ethical principles in the choice of the social discount rate. The authors recognized two opposing schools of thought on the selection of a discount rate; referred to as the *prescriptive* and the *descriptive* approaches. Under the former, the discount rate is based on ethical principles relating to the way that the well being of different generations ought to be weighted. The latter approach involves an observation of the rates of return to capital invested in a variety of alternative assets to decide the discount rate. The authors meant that the prescriptive approach would result in the selection of a lower discount rate than what would be the case under the descriptive approach.

The debate culminated in a workshop arranged by Resources for the Future and Stanford University's Energy Modelling Forum, which brought together many of the world's best thinkers on discounting. The workshop resulted in a collection of papers issued in the book *Discounting and Intergenerational Equity*, Portney and Weyant (1999). This book should to a large extent represent the current status, within the field of economics, of the debate about the social rate of discount.

In their introduction of the book, Portney and Weyant states the following as the most important conclusion from the workshop: *Even while arguing for a lower discount rate than would be appropriate for a shorter horizon, as many of the chapters here do, the authors clearly believe that a failure to discount future benefits and cost would be a recipe for poor intergenerational policy-making*". They further summarize the lessons from this workshop by stating that the descriptive approach seemed to be considered as the appropriate for projects

with time horizons shorter than 40 years. For longer-term projects the discomfort sets in and different attitudes appear.

3.2 Consumers' time preferences

The basis behind the perspective suggesting that the social discount rate should reflect the discount rate used by individuals in their private decision-making is that the only factor of ultimate concern is the distribution of consumption levels across time. Investment projects are only means for restricting present-day consumption in favour of future consumption.⁷ Consumers do this by saving money for future consumption as long as the interest rate is high enough to make this attractive instead of using the resources for present-day consumption. In a perfect economy this would imply the use of the market interest rate as the social discount rate. According to Robinson (1990), the existing preferences of individual consumers are accepted by mainstream economic theory as the foundation upon which normative arguments must be constructed. Philosophers, on the other hand, question the principle that the popularity of particular attitudes should constitute an evidence for their moral acceptability. The issue of consumers' time preferences will be treated more thoroughly later.

4. Reasons for discounting the future

We will now present three often used arguments for using a positive social discount rate: diminishing marginal utility, uncertainty, and the paradox of infinite time horizon.

4.1 Diminishing marginal utility

In the nineteenth century, economists known as "marginalists" systemized economic activity on the basis of a theory of utility. They held that every economic agent could derive a certain amount of utility or satisfaction from any amount of any commodity. Furthermore, subject to the limitations on available resources and information, each agent acquired the bundle of commodities that maximized the agent's utility. The marginalists held that the utilities associated with commodities are measurable in real units that enable us to say how much more an agent prefers one good to another. This view is called cardinal utility theory. From the assumption of cardinal measurable utility, economists were able to derive important results about how the demand of individuals and the supply of commodities varied with their prices. The marginalists claimed that the amount of utility derived from an additional unit of a

⁷ The Norwegian Petroleum Fund, which will be discussed in section 6 below, is an example of this way of thinking.

commodity – the so-called marginal utility – declines as more units of a commodity are acquired. This quite plausible assumption implies for example that the amount of utility a person derives from eating an apple may be large. However, if this person has already had two or three apples, the utility he or she derives from the fourth apple will be smaller. If marginal utility declines, then the individual's demand for commodities will decline at a given price. The marginalists put this psychological aspect into a law of *declining marginal utility*.⁸

Diminishing marginal utility is often used as a valid reason for discounting the future. Looking back at the history, each generation has been better off than its predecessors due to economic growth and technological development. Assuming that this trend continues into the future, generations following the present one will be wealthier and better off than people living today. Given that this is the case, the marginal utility of global consumption will decline over time as a result of rising consumption per capita. Resources invested now out of our own incomes will benefit people in the future who are expected to be better off than we are. This seems to be an argument for discounting of future benefits and costs. People belonging to the present generation should not feel morally obliged to make big sacrifices contributing to the welfare of people belonging to future generations who will be better off than us, even without this sacrifice. Thus, we should produce oil and natural gas at the speed that maximizes profit, without considering saving some of these resources for later generations.

Diminishing marginal utility could also be an explanation of the empirical observation that individuals usually are short sighted and prefer immediate satisfaction to more distant benefits. Individuals recognise that in the future they will most likely be better off than they are today. There is therefore no point in postponing consumption today for the benefit of increased consumption later.

Lagerspetz (1999) argues that the validity of the diminishing marginal utility argument presupposes that (i) economic growth will continue in the future and that (ii) other consequences of growth, like pollution, do not override the positive effects of growth. The author questions the plausibility of these presuppositions as he argues that although the

⁸ The concept of cardinal utility was difficult for many scientists to accept and by the early part of the century mathematical economists were able to show that most of the important results of theoretical economics could be derived from a much less psychological theory of rationality: one that required only that commodities be rank ordered and not numerically weighted.

present has shown economic growth there is no evidence that this will continue into the future. He therefore refuses to accept diminishing marginal utility as a general argument for time preferences.

4.2 Uncertainty

Uncertainty about the future is also often used as an argument for a positive social discount rate. Here it is natural to separate between individuals and societies. For individuals, the longer the time horizon, the more probable is it that we will be dead before it ends. This should give a clear reason to favor benefits that are closer to us in time. Societies, however, are not bound to die. Even if the time horizon of the social decision-makers is not the same as for individuals, they still have to take their decisions under a considerable amount of uncertainty. This uncertainty will also to some extent be a function of the time distance. Lagerspetz (1999) identifies three different sources of social uncertainty: Uncertainty about the consequences of decisions, uncertainty related to future knowledge and technology, and uncertainty about future tastes.

The development of modern science has definitely increased our ability to predict the consequences, but at the same time it has extended our ability to act in ways that may influence the future life more dramatically. Whether this development increases or decreases our uncertainty about the consequences of our actions is not clear. The uncertainty about future knowledge and technology is also providing ambiguous signals as on the one hand we would expect that we will be more capable of solving different problems more efficiently in the future, due to the same technological development as referred to above. This should be an argument for a positive discounting rate. Thus, maybe we should not care too much about the environmental consequences of our present actions and instead trust that technological development will make it possible to fix the possible damages later. On the other hand, it may be that in the future we will be able to utilize existing resources more efficiently, and thus we should not use them up now. The latter is then an argument against discounting the future. The last source of uncertainty referred to above, the uncertainty about future tastes, should constitute an argument for discounting. The present generation knows hardly anything about the preferences of future generations. How can we then be expected to make big sacrifices imposing on future generations' benefits that they may not even want? What we consider as benefits today may not necessarily be considered as such by people living 100 years from

now. Golding (1972) states rather radically that the more distant the generations we focus upon, the less likely is it that we have an obligation to promote it's good. However, there should be reason to believe that future generations will share at least some basic preferences with the present one. We can justify the protection of the ozone layer by saying that future generations are as likely to need it as we are. And we can think on several "basic needs" that most likely will be shared by future generations, like e.g. living in a world that is not overpopulated and breathing air that is not too polluted.

4.3 The paradox of infinite time horizon

Treating all moments of time and all individuals equal implies using an infinite time horizon in social decision-making. The combination of an infinite time horizon and a negative time preference would necessarily lead to a paradoxical situation as one could never enjoy any benefits because they will always be more valuable in the future. In the case of deciding the use of non-renewable resources, treating the future as infinite would mean that no generation has a right to exploit the resources (see Von Mises 1949). An analogous paradox rises in the case of a zero social discount rate. Looking at the benefits accruing from the use of a limited non-renewable resource assuming that the planning horizon is infinite and that the law of diminishing returns holds, a zero discounting rate implies that this problem has no optimal solution. It will always be so that the less we use the resource during a given time period, the more there is left for future generations and the better is the result. At the limit, when the exploitation of the resource is zero, the result is, however, the worst possible, as the resource doesn't produce any benefits at all. The core of this problem is of course that infinite planning horizons for limited resources do not make sense. As Von Mises, many will argue that this is an argument for positive time preferences.

5. Utilitarianism and time preferences

Individual preferences are central to the contemporary versions of utilitarianism upon which normative economic theory is based. Economists will thus be careful to deviate from reliance upon individual preferences in the discounting of future benefits and costs. Jeremy Bentham and David Hume, the founders of utilitarian theory, did, however, not see time preferences to be a justification of public devaluing of future events. Rather they meant that the fact that individuals seem to discount future events provides a strong argument for the existence of a government to counteract the effects of this. Both Bentham and Hume are strong advocates

for the existence of an active state, and justify the government by the consequences of its actions for individual welfare. Bentham characterizes individuals' time preferences to be something that legislators must be aware of when designing policies. He also interprets government as having an important active role in determining what is the social good and in guiding individuals in direction with that good. According to Hume (1739), "*there is no quality in human nature, which causes more fatal errors in our conduct, than that which leads us to prefer whatever is present to the distant and remote, and make us desire objects more according to their situation than their intrinsic value*".

Time preferences came to play a central role in economic theories about saving, investment, and for the role of the state in a market economy. Alfred Marshall's influential *Principles of Economics* (1890) dominated economic theory for decades. Marshall viewed time preferences as an intellectual and moral weakness by individuals. His view was in line with e.g. John Stuart Mill, who looked at individual time preferences as one of the exceptions to the rule that individual are the best judges of their own interest.

Arthur C. Pigou and Frank P. Ramsey drew the implications of Marshall's views further. Pigou (1920) separates between needs and wants and points at the divergence between them as a major problem to normative economics, as market prices only measure the consumers' subjective desires for some commodities rather than their usefulness in satisfying true human needs. Pigou meant that time preferences are responsible for a tendency to wasteful exploitation of Nature's gifts, as the methods used by present people to satisfy their current desires destroys the Nature much more than they themselves gain. He further states that the State should protect the future in some degree against the effects of our irrational discounting. Thus, he would probably support Norwegian petroleum policy, at least when it comes to the active role that Norwegian authorities play in most parts of the resource management at the NOCS. The whole petroleum sector is strongly regulated and the Norwegian state owns large parts of the biggest petroleum producing companies.

Ramsey (1928) developed the mathematical implications of utilitarian ethics and economics for intergenerational justice. In his model the consequences of utilitarianism for the current generation was that the required saving rate was far in excess of that which anyone would suggest, implying that the sacrifices required from the people living today was way above what could be accepted. Even if Ramsey in many ways shared the view of Marshall and Pigou

that time preferences are unethical, he never followed the logic from his own model to advocate intergenerational utilitarianism without discounting. This led to a new discussion where one, even if being negative towards time preferences, recognized the problems associated by the state putting equal weight to consumption in every period. Dobb (1960) approved of social discounting based on the principles of diminishing marginal utility and on the uncertainty about future consumption relative to present consumption, but not based on consumer time preferences per se.

Marshall, Pigou and their associates' concept of utility was an objective one. In the 1930's a number of economists proposed an abandonment of concepts of objective well being in favor of concepts of subjective utility. This body of thought came to be known as the "New welfare economics". At the same time it was an increasing understanding among economists that discussions of the appropriate distribution of income are outside the professional competence of economists, since they are based on normative values rather than scientific analysis. The preference based concept of utility had major implications for the ways economists came to view intergenerational transfers and the social rate of discount. While the traditional utilitarian view emphasized equal valuing of individuals regardless of the generation to which they belong, the new welfare economists defined the appropriate rate of discount for governmental projects as the rate preferred by the majority of contemporary members of society.

Despite the arguments that individual preferences should decide the social discount rate, there were concerns about the extent to which market data on individual choices between consumption and saving validly reflected people's true attitudes on the benefits of long-term public investments. Eckstein (1957) and Marglin (1963), for example, argued that people possess different sets of preferences for individual and collective decisions, with the preferred rate for public projects being lower than the preferred rate for private investments.

Although differing among themselves in many respects, these various economic analyses accept two basic principles neither of which derives from economic theory. First, individuals know best what is good for them, and so subjective time preferences in one year are adequate guides for public investments that will influence utility in future years. Second, only the preferences of current members of the society are relevant for public policy; the subjective rate of time preference of the present generation is a valid guide for investments affecting future generations.

Economists' use of consumer sovereignty principles as a justification of discounting meets a number of philosophical objections. Philosophers tend to reject the automatic identification between the satisfaction of an individual's preferences and the furthering of that individual's interests. As stated by Goodin (1982): "*There is no more reason for public policy to reflect consumer preferences than it is for it to reflect people's incapacity to think rational about large numbers or to perform fancy arithmetic.*"

Arguments that principles of consumer liberty and sovereignty demand that individuals are allowed to make their decisions without paternalistic interference from the government should be irrelevant for decisions that have mostly long-term effects to future generations. Rawls (1972) and Parfit (1984) are among the critics. They refuse to accept that avoiding incorporating individual preferences into the social discount rate would be a rejection of democratic principles. Rawls sees the use of consumer time preferences as the basis for the social discount rate as an abandonment of the search for a valid principle of intergenerational justice. Parfit stresses that the reason for discounting should not be that the importance of future generations well being declines, but more that present generations cannot be morally required to make excessive sacrifices for the sake of future generations.

6. The State and time preferences in a democracy

The view that the social discounting rate should be based on the discount rate used by individuals is to a large extent built on the idea that in a democratic society, individuals as voters and taxpayers have the right to control the actions of their representatives. As argued above, utilitarianism opposed this view strongly by stating that the objective of the government was actually the opposite, as it should counteract the myopic nature of its citizens. Even if one should accept that the social decisions makers should behave in the utilitarian way there would still be some potential problems. Would it at all be possible for the state to use a lower discounting rate than the one used by its citizens? If individuals in general are myopic, wouldn't that also be the case for the politicians? In addition, one of the major concerns for politicians is typically to be re-elected. Given the usually relatively short election periods, it could actually be so that the decision makers are even more shortsighted than their voters. In trying to maximize their possibilities to get re-elected they could be tempted to direct all the attention to those decisions that have immediate, visible effects.

This is perhaps putting too much egoism to the preferences of the decision makers. It is possible to imagine that the preferences of the voters are not all that matters in a democracy, and that the politicians, to some extent at least, are able to take into account long-term effects of their decisions. In addition, this critic would apply to non-democratic forms of governments with an even greater force. The power of democracy will also be limited by the constitution upon which it is built. A constitution could not force the decision makers to use any particular policy, but it could put constraints on policies. Constitutionalism is the means by which democratic decision makers can commit themselves in a democratic way: in constitution-making the democratic polis democratically limits its own power (Holmes 1988). The purpose of the constitutions is to restrict the present generations' power over future generations. This does, however, lead to the classical problem: On the one hand, we want to choose our own values instead of just uncritically adopting the values transmitted to us by earlier generations. On the other hand we want to commit future generations to values that we ourselves regard as the right ones.

There is no simple solution to this problem. It is quite obvious that the present generation cannot base its decisions on any other values than those they share at the moment. However, our decisions will be evaluated by coming generations according to their own values. It is not possible for the present generation to know the preferences of future generations, but it is also clear that we, through our decisions today, are able to some extent affect the values of people living in the future.

6.1 The Norwegian Petroleum Fund

In Norway, the Government Petroleum Fund represents a kind of a constraint on the use of the incomes from Norwegian petroleum production. The Petroleum Fund was established in 1990 after a decision by the Norwegian Parliament to counter the effects of the forthcoming decline in income and to smooth out the disrupting effects of highly fluctuating oil prices. According to the management strategy laid down by the Norwegian Ministry of Finance: "*The Petroleum Fund shall be managed in a prudent manner, with the objective of a high return for moderate risk, thereby helping to safeguard the basis for future welfare, including pensions.*" The capital in the Fund is invested in foreign financial instruments (bonds, equities, money market instruments and derivatives). The fund is administered by the Norwegian Central Bank and reached a portfolio value of over \$170 billion in the first quarter of 2005. As of July 2005 it

was valued at around \$190 billion. In 2004, Norwegian authorities established ethical guidelines for the management of the fund and an Advisory Council on Ethics was appointed. According to the Ministry of Finance, the ethical guidelines for the Government Petroleum Fund are based on two premises:⁹

- The Government Petroleum Fund is an instrument for ensuring that a reasonable portion of the country's petroleum wealth should benefit future generations. The financial wealth must be managed with focus on generating a sound return in the long term, which is contingent on sustainable development in the economic, environmental and social sense. The Fund's financial interests should be consolidated by using the Fund's ownership interests to promote sustainable development.
- The Government Petroleum Fund should not make investments which constitute an unacceptable risk that the Fund may contribute to unethical acts or omissions, such as violations of fundamental humanitarian principles, serious violations of human rights, gross corruption or severe environmental degradation.

Even if these ethical guidelines are quite new, we have already seen some effects related to the last bullet point above. Part of the background for establishing these guidelines was that the Petroleum Fund has been criticized for making investments in companies whose products or behaviour were considered "unethical". Already a number of such companies have been excluded from the fund. The latest decision was to exclude 8 companies from the Petroleum Fund. . The reason was, according to a press release from the Norwegian Ministry of Finance: "*According to the Petroleum Fund's Advisory Council on Ethics, these companies manufacture key components for cluster bombs*".¹⁰ From the same press release we can also read: "*The exclusions are the outcome of a systematic review by the Petroleum Fund's Advisory Council on Ethics. The Council will continue its effort to identify any other companies whose operations are contrary to the Petroleum Fund's ethical guidelines*". Furthermore, a recent statement by the new Norwegian Minister of Finance suggests that she wants to use the Petroleum Fund actively when it comes to ethical issues: "*We want to be world leading in handling the petroleum incomes in a ethically sound way*". In this way she

⁹ Further detail about the ethical guidelines for the Petroleum Fund can be found at the following web address: <http://www.odin.dep.no/fin/english/topics/p10001617/p10002777/006051-990433/dok-bn.html>.

¹⁰ See e.g. a press release from the MPE about the exclusion of 8 companies from the Petroleum Fund at: <http://odin.dep.no/fin/english/topics/p10001617/p10002777/pressreleases/006071-070662/dok-bn.html>

wants to use the Petroleum Fund to actively affect the way the behaviour of the companies in which the fund invests.¹¹

Thus, the distribution and use of the petroleum incomes in Norway are subject to ethical considerations. The existence of such a fund may represent test on politicians' abilities to think in the long term. Having access this kind of large financial resources will always make it tempting to "use a little bit more" on different kinds of "worthy" cases. In Norway there is a continuous pressure from politicians arguing that Norway should use more of the petroleum incomes. And according to our discussion so far, it is not obvious who is right and who is wrong.

7. Jon Elster on time preferences

In his book *Nuts and Bolts for the Social Sciences* (1989), Jon Elster offers some interesting thoughts on, among many other issues, individuals' time preferences. His discussion does not focus directly on long-term effects of decisions, in the sense of effects spanning to future generations, but concentrates on individual decisions that have their effects within the time frame of the individuals' life.

Elster's starting point is that in "the state of nature",¹² people live in the present and care only about themselves. However, Elster recognizes that no known societies are quite like that; individuals always tend to show at least some minimum of self-restraint, and consider *foresight* – the ability to be motivated by long-term consequences of action – as a possible explanation of self-restraint. Viewing an action as generating an indefinite stream of outcomes or consequences, Elster identifies two extremes of how much importance an individual puts on his welfare at different times. He can be totally present orientated and thus, in making a decision between two alternatives, choose the alternative generating the highest present level of welfare, paying no attention at all to possible future benefits of these alternatives. The other extreme would be to attach equal importance to all years in his life. In the latter approach, the individual must, when evaluating the two alternatives, take into account that he does not know when he will die. His decision would then have to involve a discounting of the stream of welfare in successive years by the probability of being dead. Actual behavior, Elster states, is

¹¹ See: <http://www.siste.no/Innenriks/politikk/article1823799.ece>

¹² The state of nature is a fictitious state much used by philosophers.

somewhere between these extremes, as people discount the future more heavily than can be justified on the basis of mortality tables. Elster takes this attitude to be irrational: “*To discount the future simply because it is future is very much like irrational belief formation that attaches excessive importance to current events at the expense of past records.*” He continues by stating that a person who only cares about the present and not about the future consequences of his behavior can confidently be expected not only to mess up his own life, but also the life of other people. He is, thus, very much in line with the utilitarian view on time preferences.

Elster also points at the case of a declining discount rate, in the sense that people tend to not discount the future at a constant rate. One example could be an individual faced with the alternative of having one apple today or two apples tomorrow. If this is a myopic individual he may prefer the one apple for immediate consumption instead of waiting until tomorrow to get twice as many apples. It is quite plausible, however, that the same individual faced with the alternatives to get one apple in three days or two apples in four days will prefer the latter. Here the present counts for more relative to the near future than does the near future relative to the distant future. Because of this, preference reversal may occur, as at some point in time alternative A (getting one apple) ceases to be the preferred option and alternative B (getting two apples) begins to look more attractive right up to the time of choice. Because when the individual comes to day three his preferences tell him that he prefers the one apple today (day three) to two apples tomorrow (day 4). Elster refers to this as weakness of will – the inability to do what, all things considered, one believes one should do. One way of coping with this would be to go into various kinds of commitments, which will make sure that you cannot deviate from your original preferences. Elster uses the example of an individual who makes an appointment with his dentist in three weeks from now. To avoid that he calls the dentist to cancel the appointment the day before, he could commit himself by authorizing the dentist to bill him in advance. However, such commitments can be costly as they may prevent the individual to react upon unforeseen events. We can here see the corresponding lines to the above the discussion about constitutionalism and the example of the Petroleum Fund as ways by which democratic decision makers can commit themselves.

8. Is cost-benefit analysis the appropriate tool for evaluating long-term projects?

When projects like e.g. the management of petroleum resources span many generations, consideration of the distribution of both consumption and utility across these generations becomes significant and the discounted sum of either consumption or utility does not capture our concern for this distribution. In addition, transfers between generations typically must be made through series of intervening generations. This introduces the problem that intervening generation have the possibility, and temptation, to break the chain of transfers. Implementation of such transfer schemes would therefore be virtually impossible. This problem may also apply in the shorter term. As for the case of the Norwegian Petroleum Fund, politicians from different political parties significantly disagree about how much of the petroleum incomes should be spent now and how much should be saved. A change of government could therefore change the way the petroleum wealth is distributed between the generations.

A core problem in present generations sacrifices for the benefit of future generations is that future generations that would enjoy the benefits of e.g. reduced CO₂-emissions cannot compensate near-term generations that will pay the costs, nor can the present generations choose not to reduce CO₂-emission and instead compensate distant future generations by investing the savings from such a choice at a market rate of return and bestow the accumulated wealth on distant future generations to compensate them for the costs they will incur from climate change. Therefore, as stated by Lind (1999), compensation cannot be paid in either direction and this negates the logic behind the compensation test that is the foundation of the cost-benefit criterion.

A second major difference between short-term and long-term projects is that there is a much higher level of uncertainty about everything in a long-term project. This uncertainty applies to e.g. peoples' tastes, their income, technology, and to the state of the world. Forecasts about the distant future must necessarily be more or less based on speculations. In addition, we will get new information all the time, so these forecasts will have to be updated continuously. This provides good reasons for delaying decisions in order to wait for new information. Waiting will most likely provide us with better information and thereby increasing the possibilities for making a good forecast. Further, technological options will most likely increase as we wait,

and we can use the resources we would have spent on other investments. The case for immediate action can, however, be generated by irreversibility in the sense that some investment possibilities have a limited period in which they can be implemented, after this period the possibility is foregone. Many of the decisions involving investments to avoid future environmental problems may have the characteristics of irreversibility. Taking action now to prevent irreversible effects is like buying an option (see Dixit and Pindyck 1994).

Taking the example of climate change, given that the present generation who will pay the costs cannot be compensated by the future generations that will receive the benefits, any expenditure now for mitigation is a transfer from the present generation to those in the distant future. Schelling (1995) points at this and states that such mitigation investments must be analyzed as a gift to someone else, not as an investment for one's own future consumption. Therefore, the appropriate question for weighting costs and benefits in a dynamic decision process is, how much are people willing to pay today for the knowledge that we will have certain options open for dealing with climate change in the future given the information and technology available to society in the future?

This is a different concept of the relevant costs and benefits than in the traditional benefit-cost paradigm. And it does not imply that estimating the standard costs and benefits accruing into the future are not important. What we are willing to pay to preserve or create options at some point in the future will depend in large part on the potential net benefits in the future that having these options will generate. This approach suggests that the standard cost-benefit methodology is neither the way to formulate the problem nor does it provide a defensible basis for a policy choice.

Lind (1999) is very critical against approaches based on the utilitarian ethical system. He states: *"The problem is not that the utilitarian framework is in some absolute sense wrong. It is that it is neither well understood nor accepted by elected decision makers, and it implies that we should take actions that are totally inconsistent with the choices our society actually makes"*.

Lind's version of the opportunity cost argument for discounting is that investment in e.g. reducing CO₂-emissions that has relatively low internal rate of return will displace, or alternatively could have been channeled in to, very high-yield alternative investments. He

further proposes that in quantifying and dealing with these costs one should determine the impact of the displacement or the consumption stream. He concludes that, due to the long-term effects of certain investments, it is important to display the time paths of the variables, not just present values, especially for consumption over time. It is important, he states, to explore the opportunity cost of investing in e.g. mitigation instead of shorter investments with higher internal rates of return by plotting the two alternative consumption streams and looking at their differences. Thereafter, these differences could be converted to a present value through a discount rate. Lind's main argument is that substantial adjustments to the traditional form of cost-benefit analyses used on short-term investments are necessary before applying this analysis on longer-term projects. In particular, Lind's focus is that the analysis should be sequential.

9. Concluding remarks

Evaluating investment decisions that have consequences for people belonging to future generations, maybe living centuries from now, is definitely difficult in many respects. Uncertainty about the future state of the world seems to be maybe the hardest challenge when making up ones mind about how to treat future generations relative to the present one. The uncertainty comes into consideration in many ways; uncertainty about technological development, about the actual long-term consequences of the different policy choices, about economic growth, etc. Some will also include uncertainty about the preferences of future generations. This seems, however, not to be very significant, as many of the policy choices involving long-term effects have consequences that most likely will be considered approximately equal by people living in the future as by people living today. It is difficult to imagine future generations not caring about e.g. the quality of the environment. Thus, it seems that many of the relevant projects have long term consequences that affect what we may call "basic needs", i.e. needs that most likely will be considered as important by people regardless of the time to which they belong. Other kinds of uncertainty seem to be more relevant. Focusing on the issue of climate change, uncertainty about the consequences to future generations of increasing the emission of greenhouse gasses constitute a major challenge in the debate about how these costs should be valued by the present generation. Given the considerable costs associated by e.g. reducing CO₂-emissions, one would of course want to be absolutely sure about the necessity of making these investments. In addition it will be tempting to wait for possible technological progress that may make it possible to better

predict the consequences and maybe also provide more cost efficient solutions to the problem. An issue that further complicates this is the irreversibility aspect of many of these policy choices. For the case of climate change, one would clearly not want to pass an eventual point of no return when there is nothing we can do to avoid e.g. the damaging of the ozone layer.

In addition we have the ethical and moral issues that necessarily are of significant importance, as a key issue in the debate about discounting the future is our obligations to future generations. The discussion in this paper has made the point that even a very small social rate of discount would lead to an ignorable present value of most long term consequences of decisions made today. On the other hand, treating all generations equal, as proposed by utilitarianism, in the sense of a zero discount rate, would imply the present generations making sacrifices that are way above what seems appropriate.

Using the management of Norwegian petroleum resources as an example, we have pointed at a number of different ethical challenges connected to CO₂-emissions from the use of these fossil fuels, the speed of production, the distribution of petroleum incomes between generations and whether to open up new environmentally vulnerable areas like the Barents Sea for exploration and production of oil and natural gas. The Norwegian petroleum sector is strongly regulated and the Norwegian State enjoys large ownership shares in companies and production fields. Thus, the management of Norwegian petroleum resources is to a large extent placed in the hands of the politicians. The establishment of the Norwegian Petroleum Fund is clearly an example of concern about the distribution of the incomes generated from the non-renewable oil and gas resources. In this way, the speed of the petroleum production does not explicitly reflect future generations' need for oil and natural gas. Instead future interests are taken care of by saving some of the money generated by this production for later use. Whether future generations instead would prefer that some of the petroleum resources were left in the ground for their benefit is of course impossible to know. Furthermore, we have seen that ethical guidelines have been established for the operation of the Petroleum Fund. However, even if this introduction of ethics into the income distribution part of the resource management, the time perspective of these actions is relatively short. The Petroleum Fund is mainly meant to cover pensions for people already living today. The debate about increasing exploration for oil and gas in the Barents Sea may, however, have a longer term perspective. This is a debate that puts further challenges into the ethical debate as the possible environmental damages associated by this activity could affect also generations far into the

future. The potential income from petroleum production from the Barents Sea is significant and not utilizing this possibility would definitely be costly. Thus, avoiding using this area for such activity would put a high value on the benefits of maintaining a “clean” environment in the Barents Sea. However, as mentioned above, even if making such a decision today, it is difficult to commit future politicians and generations to do the same. It seems difficult to imagine that the Barents Sea and other environmentally vulnerable areas will be kept free of petroleum production for ever as long as the potential incomes are so large and the environmental consequences often are uncertain.

There is naturally some tension between economists and philosophers in this area. The brief overview of the arguments surrounding the issue of the social discount rate has shown that there is still a long way to go before reaching any consensus on this issue. In many ways this could very well be a neverending debate that maybe cannot reach any consensus. Even if economists should agree among themselves about the appropriate level and calculation process of the social discount rate, this will probably always be more or less in conflict with moral philosophical views. Economists need for mathematical models in order to evaluate whether a project with long-term effects should be implemented or not is difficult to combine with moral considerations of the obligation we have to future generations. In particular, on the basis of the above discussion, it seems like, as also pointed out by Lind (1999), that the cost-benefit analysis is maybe not the appropriate tool for evaluating investments with long term consequences.¹³ Still, this should not at all be an obstacle against debating these issues. On the contrary, there should be no doubt about the importance of the choice of a social discount rate and the necessity to debate the basis on which one build decision about investments with long-term effects. As argued in this paper, it is likely that more and more decisions will have the characteristics of affecting the future significantly and this makes a strong reason for a continuous debate. Both economists and philosophers should have every reason to believe that they can benefit from this debate, even if they maybe never will reach an agreement on the appropriate way to weigh present interest relative to the future.

¹³ Nash (1973) also makes this point.

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