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Using Discount Rate for Water Sector Planning in Bangladesh under Climatic Changes

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Abstract

Using discount rate for project analysis is a controversial issue. Researchers and policy makers are concerned using different discount rates as these influence the results of any specific projects. Socially efficient discount rate are used in social cost benefit analysis and welfare analysis for optimal allocation of natural resources. This study used the review of secondary literature for using discount rates for optimal planning of water management projects for longer time horizons in Bangladesh. It is found that social rate of discount rate is used besides the market rate of discount for sustainable use of natural resources. It is suggested that discount rate in water management under climate change need to be used in a way that not only discounted future but also makes proper redistribution of limited resources to the present and future generations of a country.

Keywords: ***Discount rate, water management, climate change***

I. Introduction

There has been considerable debate about the appropriate method of discounting as well as the specific estimate of the social discount rate (SDR). Estimation of SDR and the selection of the appropriate method of discounting are the issues of long term debate (Boardman, Moore, & Vining, 2008). A number of studies found using different discount rates in cost benefit analysis in different countries and under different settings (Boardman et al., 2008; A. K. Dasgupta & Pearce, 1972; Dimson, Marsh, & Staunton, 2002; Harrison, 2010; Karim & Ahmed, 2011). It is found that efforts have been emphasized in most of the studies to achieve market efficiency and to ensure social welfare when discounted future. The aim of this paper is to review the literatures of using discount rate and to stretch an idea of discounting future for managing water resources under climate change in Bangladesh.

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II. Use the appropriate rate of discount

The choice of discount rate greatly influenced the results of any project analysis. The discount rate is used to calculate the present value of any future cash flows (Fama, 1977). Harrison (2010) discussed about the social discount rate using in cost benefit analysis. He described perspective and normative approach and descriptive approach as two major schools of thought for the selection of discount rate. The perspective and normative approach directly specifies a discount rate that society should use to discount future consumption flow based on ethical principles. According to this approach, the society should use a discount rate that is based on ethical principles. Prescriptive approach market efficiency and social equity and specifies the use of the social discount rate in a project that affects future generations. Boardman et al. (2008) refers the prescriptive approach as the standard one in modern welfare economics for calculating the social discounting rate. They proposed using optimal growth rate (OGR) model developed by Ramsey for estimating SDR. This approach not only relies on individual preferences but also society as a whole. It is difficult for individual for making inter-temporal choices between the public and private goods but it is possible for the society because society should make public investment.

The combination of ethical judgment and empirical information are used to determine an appropriate social discount rate (Conceicão, Zhang, & Bandura, 2007). Ramsey rule is applied in case of prescriptive approach. According to the Ramsey rule social discount rate is the sum of the rate of pure time preference and the rate of increased welfare derived from higher per capita income in the future is shown by the following equation.

$$r=\rho+\eta g \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (i)$$

Where,

r = social discount rate

ρ = a pure time preference

η = elasticity of marginal utility of consumption g = growth of GDP per capita

Ramsey formula gave us a suggestion to make less effort in future in case of a larger growth in the economy. For doing this it is necessary to raise the discount rate.

A descriptive approach is based on the efficiency criterion and benefit forgone of drawing funds from the private sector (Harrison, 2010). Sometimes the Ramsey rule is taken under the descriptive approach to estimate the discount rate by using population's rate of time preference. Individuals have different income after taxation because the marginal tax rate varies from person to person (ibid). The single Ramsey rule indicates to some sort of average of different consumption rules but the relevant weights are not taken into account. The

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descriptive model uses the Ramsey rule as a positive model of an economy showing the relationship among the macroeconomic variables related to interest rates.

The market rate of return to safe investments is conserved in the descriptive approach when funds can be conceptually invested in risk free projects and can be used to increase the consumption of future generations when funds can be conceptually invested in risk free projects and can be used to increase the consumption of future generations. A real risk free rate like the discount rate is proposed to use in this case (Partnerships Victoria, 2003). The credit market is assumed to be efficient in the descriptive approach that sets the equilibrium interest rate by the interaction of rate of return of capital and the householders' willingness to improve their future. According to this principle different discount rates are recommended that are found in several international literature. Dimson, Marsh, & Staunton (2002) suggested using low discount rate in developed countries because the average real risk free rate is below 2 percent per year over the twentieth century. This rate is not incompatible with the larger rate of return in financial markets. Financial market rate of return includes the premium to compensate the risk.

There are some bottlenecks exists in descriptive approach that are the assumption of efficient financial market and not to offer the riskless assets for more than 30 years. The financial market may not be efficient due to market friction and the inability of the future generations to participate in the financial market of the limited time horizons. In the case of the climate change problem, interest rates for most maturities are not limited to 30 years' time horizons. In a perfectly competitive economy where no market distortions, the supply price of investible funds are shown by the social rate of time preferences and demand prices are shown by the social opportunity cost. Interaction of demand and supply gives the equilibrium capital market interest rate. This equilibrium interest rate is an appropriate social discount rate for achieving an efficient allocation of resources in the economy.

In real life situations, imperfections often distort the market. Tax imposing on corporate income and individual interest earning, risks, lack of information and externalities are the examples of market imperfections. These imperfections create a gap between SRTP and SOC and make the interest rate inefficient. For this reason market interest rate cannot reflect the marginal social opportunity cost of public funds and varies time to time. In this situation the question is what rate should be used to discount future benefit and cost in cost benefit analysis.

III. Summary of debate for estimating social discount rate

In absence of perfectly competitive market, the appropriate social discount rate can be used for weighting future cash flows. According to Nordhaus (2007) and Weitzman (2007), the

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long run real rate should be used to determine the consumption discount rate. (Stern & Great Britain Treasury, 2006) proposed to use lower discount rate but this raises the questions. No private agent or firm could logically support lower discount rate because it will lead to over investment with very low return. The Stern review used the Ramsey formula by applying the rate of pure time preference, growth of GDP per capita and annual growth rate as 0.1 percent 1.3 percent and 1, respectively. By applying all of these parameters values he found the equilibrium real interest rate is 1.4 percent. This rate is found lower comparatively in normal financial investment but it lies between the ranges of the suggested inter-generational interest rate. Why this value of lower interest rate is highly controversial because Stern assumed the climate change will cause significantly greater damage in the distant future so the forgone benefit is higher than that of today. Stern placed high weight in calculating discount rate in case of climate change. The main implication of using low values of ρ and η is that current generations should save more today compare to the observed rate in order to compensate losses incurred by the future generations. Stern placed the same weight on the pure time preference for the future generations from the ethical considerations. He also used the value 1 for the marginal elasticity of consumption that will reduce the transfer of benefit between the rich and the poor to establish low inequality. Though the climate change is associated with significant risk and uncertainties, a higher value of discount rate could be a possible reason for unpalatable damage in the future but a lower rate will help us to clearly address the effect of climate change.

The climate economists who propose the discount approach for estimating the discount rate for climate change adaptations; William Nordhaus is one of them. He disagreed with Stern review about the low discount rate. He argues that economic models should be based on individual actual behavior not the behavior of the society. He criticizes prescriptive approach because the supporter of this approach imposed the views of lower discount rate to the society even they did not care about society's view in about this rate. Nordhaus criticism about the Stern review and it proposed ambiguous discount rates are found in his several studies.

Nordhaus (2007, p. 691) reported that the review did not show any clear answer on how much, how fast and how costly address the problem of climate change so that he criticized the prescriptive approach based on Stern review:

> *"*The Review takes the lofty vantage point of the world social planner, perhaps stoking the dying embers of the British Empire, in determining the way the world should combat the dangers of global warming. The world, according to Government House utilitarianism, should use the combination of time discounting and consumption elasticity that the Review's authors find persuasive from their ethical vantage point*"*.

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Also Nordhaus used similar method of Ramsey rule in his estimation of long term real interest rate. He developed DICE model and used interest rates, growth rate and so on to validate the model considering the actual level of investment, consumptions and other variables. In the current version of DICE model (Nordhaus, 2008), he applies the value of current rate of productivity growth is equal to 5.5 percent per year, rate of time preference is 1.5 percent per year and elasticity of marginal utility is 2. Previously he suggested the value of social discount rate was 6 percent and elasticity of marginal utility was 3. Weitzman (2001) proposed a new theoretical approach by incorporating the probability distribution to estimate the discount rate in the uncertain future. He surveyed and got response from 2160 professional PhD level economists about the discount rate that should be applied to evaluate the cost benefits of mitigating climate change. Weitzman showed that the discount rate should be declining over time. Uncertainties in the economic growth, time preference, externalities and so on are greater in distant future than the uncertainties in near future. Interestingly, his survey report did not did not recommend any type of social discount rate for cost benefit analysis.

According to Dasgupta (2007), η is the elasticity of marginal wellbeing. The reciprocal η of Ramsey equation measures the coefficient of relative risk aversion whereas in Ramsey equation it measures the elasticity of marginal utility of consumption. He recommends rising values of η from 1 to 3.

Conceicão, Zhang, & Bandura (2007) interpreted η as a measure of personal risk aversion for uncertainties of future consumption. It means that η can be applied to measure risk aversion in case of intergenerational inequality. A low value of η indicates that present poor need to be sacrificed with low consumption for the future generations better off. A value of η measures the redistribution of income from present poor to future rich is low and consumption becomes more worth to the present poor. η can be also used to measure the aversion towards inequality across space.

The observed market rate can be reflected individual myopia whereas the lower rate of discount can be taken by the society as a whole in its collective attitude. Though individuals are mortal but society is not, risk death time preference can be used in calculating the social discount rate that reflects the social time preference (A. K. Dasgupta & Pearce, 1972). Moore, Boardman, & Vining (2013) proposed a time declining social discount rate for Canada to consider the intergenerational impact beyond 50 years then they suggested using the discount rate estimated by optional growth rate model.

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IV. Discount rates used in Bangladesh water sector planning

In cost benefit analysis, it is generally found to use one discount rate to all estimated future costs and benefits. But in case of policy decisions social discount rate should be used instead of market discount rate. Social discount rate discount future cost and benefit and represents the resource redistribution between future and current generations.

Bangladesh as a developing country should apply such a discount rate that not only discounted future but also makes proper redistribution of limited resources to its present and future generations.

Karim & Ahmed (2011) used the discount rate 12 percent discount rate with inflation rate for energy sector by applying 5 percent discount rate for agriculture sector. They emphasized to invest in water sector investment in adapting climate change in agriculture sector. They only consider market inflation rate besides discount rate but no clear rationale of using 5 percent discount rate in agriculture is absent in their study.

A discount rate is assumed 12 percent in "Economic Modeling of Climate Change Adaptation: Needs for Physical Infrastructures in Bangladesh" (MoEF, 2008). An integrated approach of cost benefit modeling is used to develop the economic modeling of climate change adaptation and the need for physical infrastructure for Bangladesh. The discount rate estimated by IPCC (2007) and Weitzman principles are mainly used in that study.

Jalil (2010) discussed various methods of estimating the social discount rate. He emphasized on the social rate of time preference (SRTP) and social opportunity cost (SOC) of capital framework. He employed Monte Carlo analysis. To calculate SRTP by applying other estimated SOC. He suggested using the optimal social discount rate 9 -11 per cent in public long term project that is similar to the neighboring country India and Pakistan.

Nishat, Khan, & Mukherjee (2011) discussed about the prescriptive and descriptive approach of using discount rate for water sector under climate change in the light of IPCC (2007). They proposed to use the combination of both approaches and used the discount rate 5 percent in their study for water sector investment but the justification of using that rate are not present in their study.

V. Conclusion

Planning for irrigation is a finite time horizon problem. In this case, use the discount rate followed by the neighboring county will not provide adequate options of investment for climate change adaptation. On the other hand, Stern proposed discount rate can be too low to estimate the future cost and benefit in an uncertain future and for intergenerational model. P. Dasgupta (2007) proposed 12 percent interest rate for ensuring proper resource redistribution from the present poor to the future rich generation. A significant variations are found in using different discount rate in different countries. From the review of literature on using discount

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rates, it can be said that no specific rate can be fit in different types of project management in a country. Therefore, this paper concludes that the use of discount rate can be 5 per cent with the sensitivity to 10 per cent for sustainable use of water resources under climatic changes.

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