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Notes on Biodiversity Conservation, The Rate of Interest and Discounting

by

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Clem Tisdell[†]

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[*] This is a contribution to a project organized by John Gowdy or Ransellear Polytechnic Institute, New York assessing the economics of biodiversity conservation and relates to a chapter entitled 'Discount Rates, Ethics, and Options for Preserving Biodiversity".

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Notes on Biodiversity Conservation, The Rate of Interest and Discounting[‡]

ABSTRACT

This article shows that there is no regular relationship between the level of the rate of interest and the extent to which the conservation of biodiversity is favoured. Microeconomic examples are given in which a rise in the rate of interest adversely affects biodiversity conservation as well as other cases in which the opposite is the case. When these alternative possibilities are taken into account, they suggest that rises in the rate of interest (other things held constant) are more likely than not to aid biodiversity conservation. This is expected to be so when there considerable upfront costs are involved in economic strategies that bring about environmental changes so that in the initial periods the private net benefits from these changes are negative although subsequently they can become significantly positive. Consideration of macroeconomic models reinforces the view that there is no definite association between changes in biodiversity conservation and the rate of interest. This is so assuming that there is a positive association on the whole, between the rate of (man-made) capital accumulation (the investment level) and biodiversity loss. From macroeconomic models, it is clear an increase in the level of aggregate investment can be associated with a rise or fall in the rate of interest (and vice versa) depending on the circumstances. This is illustrated by using a simplified form of the loanable funds theory originally developed by Wicksell but is also consistent with other general theories of the rate of interest. In conclusion, doubts are raised about our ability to enforce a zero (or very low) social rate of discount in market or mixed economy. It is, however, suggested that if a low ceiling is put on the rate of interest, this will reduce savings and consequently, investment and would be favourable to biodiversity conservation given that an increase in the rate of (man-made) capital accumulation is the main contributor to biodiversity loss. Finally, it is noted that mainstream economic models measuring possible welfare streams give no weight to the conservation of biodiversity per se. Therefore, policies designed to achieve the sustainability objectives specified by these models can continue to favour biodiversity loss on economic grounds.

[‡] I wish to thank Dr. Bruce Littleboy for discussing relevant aspects of the theory of interest with me.

Notes on Biodiversity Conservation, The Rate of Interest and Discounting

1. Introduction

Some economists have expressed support for a zero rate (e.g. Ramsey, 1928) or very low social discount rate and many economists have seen this as favourable to the conservation of natural capital, including biodiversity (e.g. Dasgupta and Mäler, 2000). However, it does not follow that a low interest rate is necessarily favourable to biodiversity conservation. In fact, there appears to be no regular relationship between the level of the real rate of interest and the extent to which biodiversity conservation is favoured. One needs to consider what forces cause the interest rate to be high or low and it is the nature of these forces that have critical impacts on the conservation of biodiversity. This will be explained using a very crude model of factors that determine the rate of interest. In this simplified macro-model the interest rate is determined endogenously. However, prior to considering this matter it seems worthwhile considering the conservation implications of microeconomic models in which the rate of interest is treated as an exogenous variable.

2. Micro-models in which the Rate of Interest is an Exogenous Variable

Colin Clark (1976) observed that an increase in the rate of interest (other things held constant) is likely to increase the probability of extinction of commercially exploited species if the cost of realizing (liquidating) their stocks is zero or very low and they are privately owned. As the rate of interest rises, those who own the biological asset are likely in these cases to increase their monetary gain by harvesting this asset to extinction and investing the net revenue obtained at the going rate of interest. Thus, for example, if a 5% annual net return is earned on the sustainable harvest of a species, it will be profitable to retain it if the rate of interest is less than 5% but not if it is in excess of 5%, say 8%. Note that it will also pay not to retain the species if it can be replaced at little upfront cost by another that gives a higher rate of private return. The lesson drawn from this example is that markets (free of economic failures) do not necessarily ensure the conservation of biodiversity.

If (on the other hand) the biological resource is an open-access one, harvesters of it take no account of user costs and their conservation decisions are not influenced by the rate of interest. Despite this, the rate of exploitation of the targeted resource (species) can be sensitive to the rate of interest. Other things held constant, a higher rate of interest can be expected to reduce investment in the exploitation of the species, for example, less investment in capital equipment is likely. Thus, in the case of open-access resources that are commercially exploited, a higher rate of interest is likely to be favourable to the conservation of biodiversity.

Even in the private ownership case considered by Colin Clark (1976), biodiversity conservation can be favoured by a high rate of interest if the **upfront** costs of conversion or realization of a biological asset are high and the benefits obtained by conversion or realization are not immediate. Usually, conversion or realization involves significant upfront costs because conversion, substitution or liquidation of stocks of species does not take place instantaneously. Therefore, decisions to engage in (land) conversion which leads to the extinction of some species or to liquidate species as assets may at first result in costs exceeding benefits with net benefits only becoming positive at a later time.

Consequently, the flow of net benefits from conversion of habitat resulting in species extinction, from the substitution of species or the liquidation of biological assets may typically display the type of pattern shown in Figure 1 by curve ABC. This implies that, as the rate of interest rises, the net present value of these strategies falls. Therefore, the profitability of adopting these strategies declines. In these circumstances, a rise in the rate of interest is favourable to biodiversity conservation.

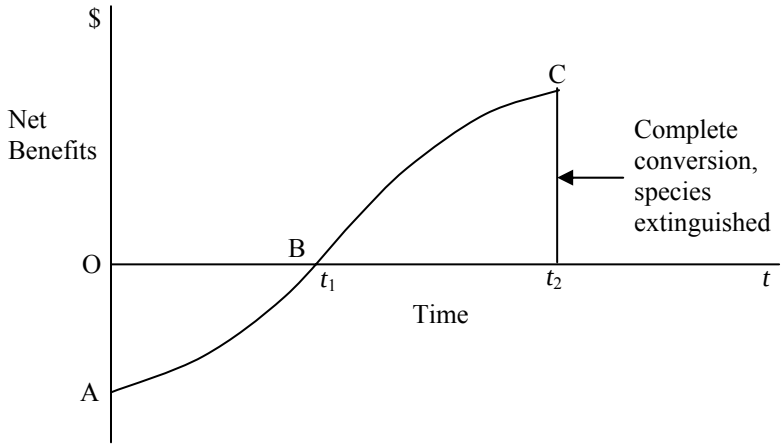

Figure 1: The 'typical' flow of possible net benefits from liquidating a species as an asset, substituting it by another or converting habitat which results in the loss of species. In the case illustrated, net benefits are negative initially (until t_1) and a rising rate of interest reduces private economic benefits from these strategies. In this private ownership case, a rising rate of interest is favourable to the conservation of biodiversity.

These microeconomic examples indicate that a rising rate of real interest can be favourable to biodiversity conservation and suggest that it is favourable in most cases. This is because the activities described usually require considerable upfront costs and their benefits are delayed. It is only in the special case described in the opening paragraph of this section that an increase in the rate of interest is unfavourable for biodiversity conservation.

3. Macroeconomic Considerations

In order to obtain a wider perspective on the relationship between the rate of interest and the extent to which biodiversity conservation occurs, it is necessary to take into account factors that determine the rate of interest. Macroeconomic models of the determination of the rate of interest are complex and varied. I shall use a simple and very crude model to make the point that there is not a close association between the rate of interest as such and the extent of biodiversity conservation. (However, note that my results would hold in the case of other models of interest rate determination.) In fact, I'll use a simplified form of the loanable funds theory of interest (Wicksell, 1936) to make my point even though Keynes made it clear that this theory has shortcomings. In other words, I maintain that a low rate of interest can be associated

with a high degree of biodiversity loss and so can a high rate of interest. This follows if the level of investment is man-made capital is regarded as the major factor leading to loss of biodiversity. In my view, this is a sound indicator of likely biodiversity loss (Tisdell, 2005, p. 250). That the accumulation of man-made capital is a major factor resulting in biodiversity loss has been pointed out for a long-time. For example, Harting (1880, p. 209) brings attention to the problem as does Tisdell (1982, p.378, 1991) and Swanson (1994).

For simplicity, assume that the real rate of interest depends only on the demand for loanable funds for investment and on the supply of these funds as a result of savings. Assume further that these demand and supply curves have normal slopes.

First, it can be observed that in this case, an increase in the rate of interest can come about either because the demand for loanable funds rises (due to an increase in the marginal efficiency of capital), other things kept constant, or due to fall in the willingness to save, other things unchanged. These two situations are illustrated in Figures 2 and 3 respectively. In the case shown in Figure 2, the demand for loanable funds rises from D_1D_1 to D_2D_2 and the supply curve of these funds remains unaltered as shown by S_1S_1. The equilibrium in the loanable funds market changes from E_1 to E_2 and the rate of interest rises from r_1 to r_2. The amount of funds invested goes up from X_1 to X_2. This result is unfavourable to biodiversity conservation because it results in more capital accumulation and conversion of natural resources into man-made capital. On the other hand, in the case illustrated by Figure 3, a rise in the rate of interest is associated with a reduction in the level of investment and therefore is favourable to biodiversity conservation. In this case, the demand curve for loanable funds, D_1D_1 is stationary but the willingness to supply loanable funds declines, as shown by the supply line being initially S_1S_1 and subsequently S_2S_2. Market equilibrium alters from E_1 to E_2 and the rate of interest rises from r_1 to r_2. However, in this case, the level of investment falls from X_1 to X_0, and the result is favourable to biodiversity conservation.

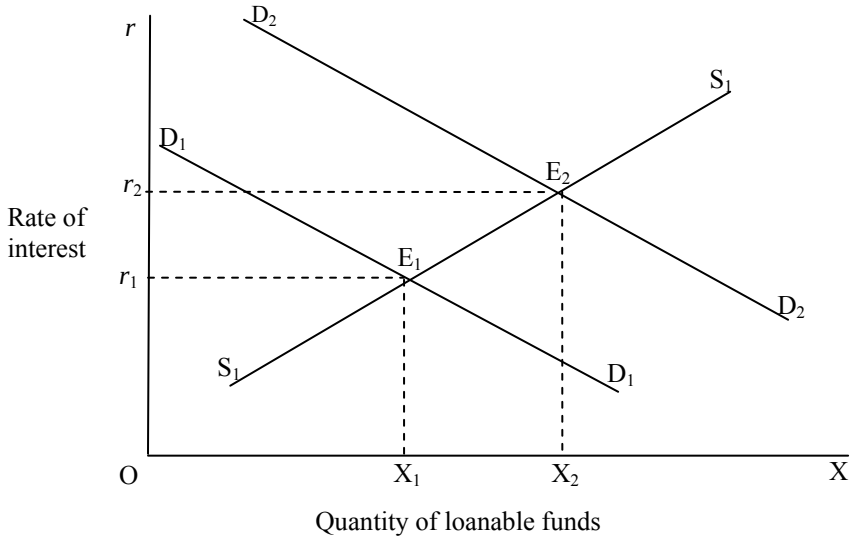

Figure 2: A case in which a rising rate of interest is associated with a rise in the level of investment in man-made capital; a consequence likely to have an adverse impact on biodiversity conservation.

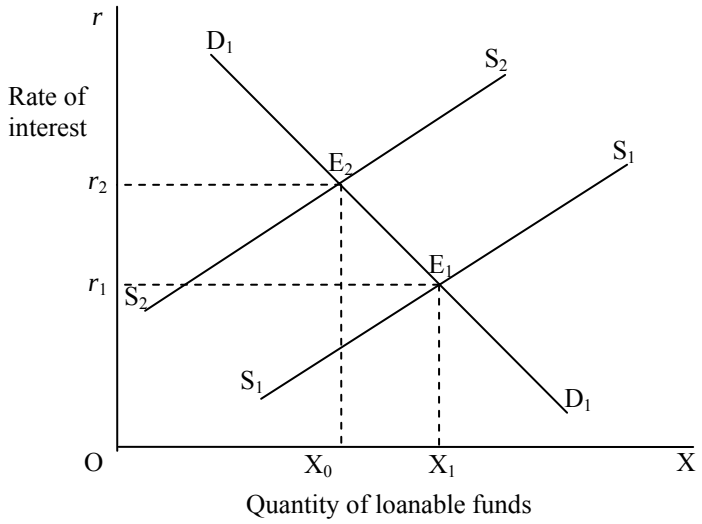

Figure 3: A case in which a rise in the rate of interest is associated with a decline in the level of investment in man-made capital. This case is likely to be favourable to biodiversity conservation.

Converse results also apply. If the demand curve in the case illustrated in Figure 2 shifts downwards rather than up, the rate of interest falls but investment does likewise. On the other hand, if the supply curve of loanable funds moves downwards in the case illustrated by Figure 3, the interest rate falls but the level of investment rises. The fall

in the interest rate in the former case is favourable to biodiversity conservation but not in the latter one.

Other examples could also be given. The above, however, is sufficient to show that at the macro-level, changes in the rate of interest can (depending on the circumstances) be associated with an increase or decrease in the level of investment in man-made capital. Dr. Bruce Littleboy has pointed out to me in a private communication that historically both rising and also falling interest rates have been associated with increased levels of investment. If investment in man-made capital is seen as the main threat to biodiversity conservation (which is a reasonable proposition) then it can be concluded that there is no close connection between the level of the real rate of interest and the degree of biodiversity conservation. This suggests that the focus of concern ought to be on variations in the level of man-made capital rather than on the rate of interest as a major influence on biodiversity conservation.

4. Discussion

4.1 The progress of the accumulation of man-made capital

The discussion in the previous section only provided a limited insight into the determinants of capital accumulation. For instance, savings and investment levels tend to rise as aggregate income increases. Investment is usually the basis for further capital accumulation because of its impact on economic growth – rising incomes result in greater levels of saving and investment (Deane, 1935). Since the Industrial Revolution there has been a massive increase in capital accumulation with extremely adverse consequences for the conservation of biodiversity.

Keynes thought it possible that capital could accumulate in modern times to such an extent that the marginal efficiency of capital would become zero (Keynes, 1936, Chapters 16 and 24). But of course, he only had in mind man-made capital. This would result in Keynes' view in the rate of interest being zero or close to it. Yet it can be hypothesized that in order to reach this stationary state that there would have been a tremendous conversion of natural resources into man-made capital resulting in great biodiversity loss. Consequently, a zero rate of interest can be associated in this instance with major loss of biodiversity.

4.2 How can a zero social discount rate be made operative in a market system?

A number of eminent economists favour a low or zero rate of social discount. To be operative in a market economy, this would seem to require that the rate of interest be regulated so that only a low value is allowed. This will, however, not result in the loanable funds market clearing if we use the model considered in the previous section.

In Figure 4, if line DD represents the demand for loanable funds and SS is their supply, market equilibrium is established at E with r_1 being the rate of interest and X_1 the equilibrium supply of loanable funds. Should the maximum allowable rate of interest be less than r_1, a shortage of funds occurs at the regulated rate of interest. If for example, the maximum permitted rate of interest is zero, X_2 of funds are demanded but only X_0 are available. Excess demand equivalent to $X_2 - X_0$ occurs.

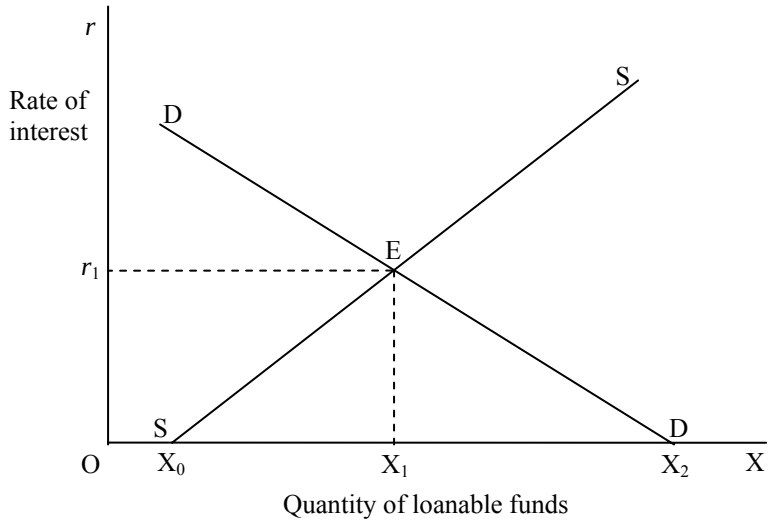

Figure 4: It may be difficult to bring the market rate of interest into line with a low or zero rate of social discount. However, in the case illustrated above, restricting the rate of interest could be favourable to biodiversity conservation because it results in a low level of accumulation of man-made capital.

Despite the problem of the failure of the loanable funds market to clear when the rate of interest is restricted to artificially low levels, the restriction would favour biodiversity conservation. In the case shown in Figure 4, if the rate of interest is restricted to zero, it reduces the rate of capital accumulation from X_1 to X_0.

5. Conclusion

It can be concluded that both from a microeconomic and a macroeconomic perspective, there is no general relationship between the level of the real rate of interest and the extent to which biodiversity is conserved. When the rate of interest changes, it is necessary to take into account additional factors to decide whether biodiversity conservation is advantaged or disadvantaged. While it might be appropriate to treat the welfare of future individuals on par with that of current generations (and therefore, apply a zero discount rate to measures of future human welfare), it is not clear how a zero (or low) discount rate would be put into practice in market or mixed economies. However, it is clear that some natural capital (including some degree of biodiversity) needs to be conserved to sustain future welfare. It is likely that the extent of biodiversity conservation would be greater if a regulated zero or low social discount rate is applied rather than a higher one and can be translated into practice. Nevertheless, it would most likely still result in continuing biodiversity loss because optimal growth objectives as specified by economists such as Pezzey and Toman (2002) are anthropogenic. This means that humankind is under no obligation to conserve species that do not add to human welfare. There are probably still many extant species of this type as well as others for which the opportunity cost of their retention exceeds whatever value they have for human beings. Thus, even a zero social discount rate could result in these species being eliminated if the common type of economic utility function is applied which maximizes the discounted flow of [human] welfare over time. It takes little account of man's responsibility for the stewardship of nature. It is a further indication that even comparatively perfect economic systems are not very favourable to biodiversity conservation per se.

It should also be noted that the analysis of biodiversity conservation is further complicated by uncertainty (see, for example, Bishop, 1978, 1979) and that the implications of this have not been allowed for in the above analysis. How best to respond to collective risks and uncertainties remains a major unresolved issue. While the precautionary principle (Tisdell, 1970; Arrow and Fischer, 1974) has been developed as one means of addressing the issue, the problem is far from resolved.

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