

# The Future of Dublin Zoo

Eddie Dowse

## Introduction

Having studied closely the numerous and extensive references to Dublin Zoo, I would like to put forward my own solutions to its predicament. This solution rests on the assumption that the Zoo is a pure public good.

Classification of Dublin Zoo as a pure public good allows the construction of a model. This model will highlight the extent to which it is, at present, underfunded by the private sector, and will outline some more cost-efficient and equitable ways to finance it, rather than the current policies of throwing the money to the lions. At the moment, the Zoo is financed by the Royal Zoological Society, a non-profit organisation. They shall be treated as one individual in this model to avoid unnecessary complications. There will be no charge for use of the Zoo in this model, and use is restricted to the population of Dublin which stands at one million.

Dublin Zoo has the characteristics of a pure public good in the sense that its use is non-exclusive, because, if it is available to one person, it is available to all. In addition, one individual's consumption does not reduce the amount that is available for others to consume. The extra or marginal cost of providing the Zoo to another person is zero because, for

example, it is equally costly to provide twenty penguins for one person as it is for two or more.

## The model

With this in mind, how much, if any of the Zoo should be provided? Assume in this model that there are two goods  $Y_i$ , which constitutes all private goods, and  $Z$ , which constitutes the Zoo. The productive sector can transform units of  $Y$  to  $Z$  at a ratio of one to one i.e. the marginal rate of transformation (MRT) equals one, that is to say, we must give up one unit of  $Y$  to obtain one extra unit of  $Z$ .

Ivor Blogg is a typical Dubliner, who is also known to his friends as  $i$ , and has a utility function that can be written  $U_i = V_i(Z) + Y_i$ . The absence of an index on  $Z$  captures the fact that  $Z$  is a public good. Ivor's utility from  $Z$  depends on the sum of the function  $V_i$ . This function is separate between private and Zoo consumption.  $V_i$  is a well behaved function that is smooth, continuous and concave.

The marginal utility (MU) for  $i$  from a one unit increase in the Zoo is the slope of  $V_i(Z)$ . It is also equal to the marginal rate of substitution (MRS). This measures how much of  $Y$  Ivor is prepared to give up for one extra unit (another trip) of the Zoo.

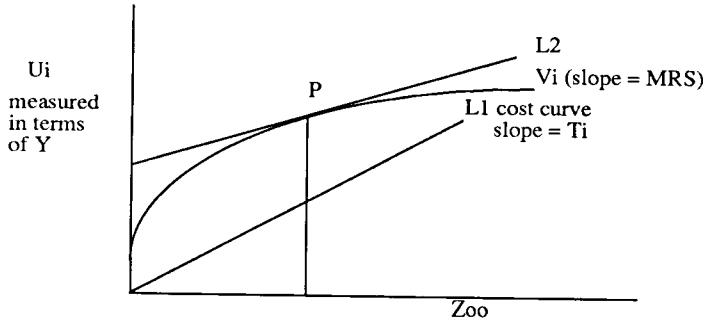


Figure 1

$W_i$  represents Ivor's initial quantity of Y. For the population of Dublin  $Z + \sum Y_i = \sum W_i$  for all i (1) must hold for the model to be feasible. The total benefit of the Zoo to Dublin is

$$V_1(Z) + V_2(Z) \dots V_n(x), \quad n = 1m \quad (2)$$

The total cost is Z and the net benefit (B) is equal to

$$V_1(Z) + V_2(Z) \dots V_n(Z) - Z \quad (3)$$

To maximise net benefit we differentiate (3) with respect to Z to get

$$MRS_1 + MRS_2 \dots MRS_n - MRT = 0 \quad (4)$$

As the marginal rate of transformation equals one we have

$$\sum MRS_i = MRT = 1 \quad (5)$$

This is known as the Samuelson Optimality Condition for public goods and it must satisfy Pareto optimality conditions.

Figure 2 shows what happens if one

individual wants to provide/purchase a Zoo. The total costs outweigh the benefits to the individual and the Zoo will not be provided/purchased. If however, as is the case with the Royal Zoological Society (ZS), some like-minded individuals get together, we get the provision of the Zoo as shown in figure 3. The Zoological Society wish to maximise  $U_{zs} = V_{zs}(Z) + Y_{zs}$  subject to the budget constraint  $Z + Y_{zs} = W_{zs}$ . Thus the Zoological Society wish to maximize  $V_{zs}(Z) - Z$ . At  $Z^*_{zs}$  the vertical distance between the two curves is at a maximum as the slopes are equal, i.e.  $MRS_{zs} = MRT_{zs} = 1$ .

But what will the other 999,999 users of the Zoo do?  $Z^*_{zs}$  is the amount of the public good that Ivor Bloggs is getting free, therefore Ivor will not provide any more units of the zoo unless

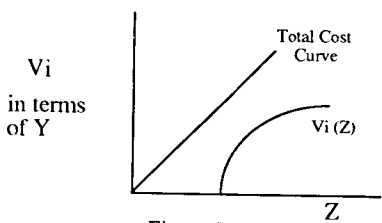


Figure 2

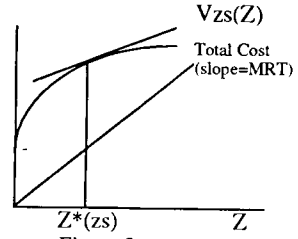


Figure 3

it will increase his benefit. If  $V_i(Z_{zz}) < 1$ , the marginal utility to Ivor will be less than the cost, and if he increased his consumption of Z, he would be worse off. This means that he will free ride at the Society's expense. The final equilibrium will be characterised by the following:

1. For at least one individual (the Zoological Society),  $V_{zz}(Z) = 1$ .
2. For all  $i$ , the slope of  $V_i(x) < 1$
3. The amount paid by all depends on the amount paid by the society.

With public goods, the private costs exceed the private benefits as shown in figure 2. People will only look at the private benefits they receive personally, not the aggregate or social benefits which are shown by  $\Sigma MRS_i$ .

Assume that  $MRS_i = 0.5$  for all  $i$ , and that the  $MRS_i < MRS_{zz} = 1$ . There is no incentive for Ivor to buy any more Zoo beyond that which is already being provided, and he will free ride. However, with a population of  $n = 1,000,000$ ,  $\Sigma MRS_i$  is far greater than  $MRT_{zz}$  (which equals unity). This proves a gross under-provision of Zoo facilities if left to the market system.  $Z_{zz}^*$  is far from optimal and we must look at other ways of financing the Zoo, namely public financing and fixed tax shares.

### Financing the Zoo - an alternative

We know through diverse means such as polls, media interest and public comment that most people desire the provision of Zoo facilities. The proposals for funding this, however, remain vague. What could be done is to

decide the level of provision by fixing everybody's tax share and then letting people decide upon the output by majority voting.

$T_i$ -i's individual tax share is equal to  $1/1,000,000$  and each individual wishes to maximise  $V_i = V_i(Z) + Y_i$  subject to  $Y_i + T_i Z = W_i$ . That is, Joe wants to maximise  $V_i(Z) - T_i Z$  which is the vertical distance between his benefit and cost curves.

The cost curve may be the same for all individuals but the benefit curves differ. The government may carry out a series of elections to decide by majority voting on the level of Zoo facilities to be provided. Under fixed tax shares and majority voting, the level desired by the median voter always wins. This scheme has the advantages of being simple, comprehensive and some level of Zoo facilities will be provided, and unlike other schemes such as the Wicksell-Lindahl one, the incentives for cheating are not as pronounced. Unfortunately the tax paid is not always related to the benefit received and it may be the case that  $V_i(Z)$  is not equal to  $T_i$ . This means that Pareto-optimality may only be achieved by random chance. In general, it fails the Samuelson test.

### Conclusion

In this model I have defined Dublin Zoo as a public good and have shown that the present provision under the free market system is below what the public as a whole would wish it to be. This highlights the need for government intervention to finance it using the scheme outlined. Although

not providing a Pareto-optimal outcome it would ensure a much greater provision than at present, and could salvage to an extent the future of Dublin Zoo.