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AN EVALUATION OF FISHERIES POLICIES AVAILABLE TO AUSTRALIA FOR THE MANAGEMENT OF SOUTHERN BLUE FIN TUNA FISHERY

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ABSTRACT

In the absence of proper management, fishery resource tends to be exploited as a common property resource with a tendency towards over-exploitation. In the absence of appropriate property rights, the exploitation of a common property such as the fisheries may lead to over exploitation (and possible extinction of a species but not with migratory species such as the southern blue fin tuna) and externalities both contemporaneous and inter-generational. The paper aims to identify the various economic policy instruments that may be available and then uses a 'cubic' model to select the best model suitable for the blue fin tuna fishery. Price control is selected as the appropriate policy instrument, even though individual transferable catch quota is also a possibility. Price control is based on levying a tax on catches and is oriented towards economic efficiency.

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1. Introduction

It is claimed that the purpose of fisheries management should be to control the fishery in a manner, which will continue to yield net benefits for the community, and is in accord with national goals. If society exercises no control over capital and labour, fishery resources will attract excess investments and economic rents will be dissipated (Anderson and Wilson, 1977).

Furthermore, every period of good harvest or high prices tends to result in an increased inflow of new boats and gear (Department of Primary Industry, 1986). These fishermen are not easily driven out again when the market is weak, because fishermen are notably immobile (Christy, 1976, Crutchfield, 1986).

In the absence of property rights the operation of the free market does not lead to a socially rational allocation of resources, even though it may appear to the individual crew to be rational. This is because individual fishermen may impose costs on one another, such as congestion cost (a contemporaneous externality), that are not transmitted through normal market forces. Thus from a fisheries management point of view, it is important to internalise these externalities.

Maintaining a constant stock of renewable fishery resource is a necessary condition for sustainable exploitation of a fishery. Maintaining a constant stock of fishery resource is necessary to meet both the present and future needs of the population. In other words, it is aimed at maintaining inter-generational equity.

It is a well-known fact that in a common property situation, reducing the use of the resource by one individual will contribute to the available supply of the other users. Therefore, the user has no incentive to conserve the resource in a sustainable manner. This action could ultimately lead to the depletion of the renewable resource beyond recovery (not in the case of migratory tuna). Therefore, to overcome this problem some form of quasi property rights have to be given to these resources as giving pure private property rights is not possible with migratory species such as the southern blue fin tuna. This is only possible by some sort of administrative mechanism.

The other necessary conditions for sustainable fisheries management is:

- To prevent crowding externality and
- To prevent the dissipation of rent.

Crowding externality

This arises because of over commitment of resources to the common property. That is too many boats and too many fishermen resulting in too much effort. The operation of the free market system in the fishing industry does not lead to a rational allocation of resources as far as the society is concerned, even though it may appear to the individual to be rational. This is because individual fishermen may impose costs on one another, such as congestion cost, that are not transmitted through normal market forces. To explain this let us take the case of a boatman travelling between two points A and B and using one channel. The demand for travel between these two points is shown in Figure 1 by a downward sloping demand curve DD.

INSERT FIGURE 1

The average cost per boat journey is given by the curve EFJKH and the marginal cost curve by EFILG. Up to point F, the average cost is equal to the marginal cost because there is no congestion externality. However, as the congestion increases, the average cost begins to rise because of lost time, additional cost of fuel and even possibility of greater susceptibility to accidents. When average cost rises the marginal cost will be above the average cost. This happens at point F. But when average cost is constant the marginal cost will be equal to the average cost, this is between points E and F.

In a common property situation individuals base their decision on average cost and not on the collective marginal cost due to additional traffic. Given the demand curve and cost curves shown, boatman will make V_2 boat journeys per unit of time. But in terms of economic efficiency V_1 boat journeys are optimal. This is because at V_1 the demand, which measures the marginal private benefit, is equal to the marginal private cost.

V_2 journey instead of V_1 journey results in a dead weight social loss given by area IKL which is the difference between the collective marginal cost between V_1 and V_2 journeys (given by area V_1ILV_2) and the value of the additional journey to the boatman (given by area V_1IKV_2). Therefore at V_2 number of boat journey per unit of time between the two fixed points, there is a loss in economic efficiency, because the additional marginal cost exceeds the additional marginal benefit. Only at point I, the marginal cost equals the marginal benefit. Thus V_1 is the Pareto efficient point with regard to the number of boat journeys per unit of time. The efficiency aspect implies that this should be the level of effort that any management tool should try to achieve in the open access fisheries.

<u>Dissipation of rent</u>

In a common property situation the fishermen do not care for marginal productivity but cares only for the average productivity. This is because the average productivity is the one that indicates where the greater total catch may be obtained by any tuna boat. That is for individuals who are unable to appropriate property rights to any part of the fishery; the average revenue product of effort is the relevant measure to compare his income in alternative employment (Tisdell, 1983). Therefore the fishermen will continue to exploit the fishery up to the point where their average cost of exploitation of a tuna boat is equal to their average revenue productivity of that boat. When average product is equated to average cost, rent is dissipated. As natural resources belong to the society it is important to prevent any rent dissipation.

Therefore in a common property situation, all profits will be competed away at the point where the average revenue product of effort is equal to the average cost. In Figure 2 it is at effort level equal to E_0.

INSERT FIGURE 2

If on the other hand, private property rights prevailed in this fishery, then the marginal revenue product of individual boat's effort is the relevant measure with which to compare someone's income from alternative employment. In such a situation the marginal cost will be equated to the marginal revenue product and the rent from the resource will be maximised (Sathiendrakumar, 1996). Thus, with private property rights the optimum allocation effort will be E_1, where the marginal cost of effort is equal to the marginal revenue product of effort (see Figure 2) and the maximum rent will be denoted by the area WRFS.

Thus, common property implies a dissipation of rent equal to area SAM, which is precisely equal to area WRFS. Also note that the average revenue product with private property rights (point F) is greater than the average revenue product with common property rights (point A), ceteris paribus. That is, with private property, production will result in higher effort productivity.

Therefore the aim of any management strategy should be to give some form of private property rights to the fishery. The allocation of property rights should not be aimed at giving those rights to the powerful and rich lobby groups only. Economically rational exploitation of fisheries would effectively raise fishermen's incomes.

2. Selection criteria for tuna fishery management strategies

Any economic instrument used in managing the southern blue fin tuna fishery should satisfy the following three important criteria, namely:

- The economic efficiency principle or the cost minimisation principle. That is, it should provide a least cost solution, including the administrative and compliance cost.
- The equity principle. That is, its effect on the distribution of wealth and on other supplementary goals such as employment must be considered.
- The acceptability principle. That is it should be acceptable to both the politicians and the fishermen as a tool that will effectively control fishing effort. Acceptability also includes flexibility so that it will allow for proper reaction to changes in both economic and biological conditions. That is, it is dynamic in nature.

3. The cubic model

We could represent the above three principles, namely: efficiency, equity and acceptability principles as a ‘cubic’ model. The framework in Figure 3 is in the form of a cube whose surfaces represent cost effectiveness, equity and acceptability principles.

INSERT FIGURE 3

The eight corners of the cube are labelled as ‘A’, ‘B’, ‘C’, ‘D’, ‘E’, ‘F’, ‘G’, and ‘H’. The positions ‘A’, ‘B’, ‘C’, and ‘D’ are the ones that satisfy the efficiency principle (or cost effectiveness principle). Likewise, the corners ‘E’, ‘F’, ‘A’ and ‘B’ are the ones that satisfy the acceptability principle. The corners ‘A’, ‘D’, ‘E’ and ‘H’ are the ones that satisfy the equity principle. Therefore, the policy instrument that satisfies all three principles is in position ‘A’. The position that satisfies at least two of these three principles is corners ‘E’, ‘D’, and ‘B’. In reality it is not possible to achieve these corner solutions. Therefore we draw concentric circles using the effectiveness of all our three objectives mentioned before for each of the policy instrument around these corners and select the policy instrument whose concentric circle is closer to the desired corner ‘A’. Thus we could use the above framework to select the appropriate policy instrument that could be used to satisfy the principles that we aim to achieve namely; efficiency, equity, and acceptability. The economic instruments that are considered are discussed in the next section.

4. Choice of economic instruments in managing migratory blue fin tuna

There are many fisheries management measures that can be considered by a government (Department of Primary Industry, 1986). For the purpose of our discussion, three principal management mechanisms listed bellow will be examined in this section as they could easily be applied to the southern blue fin tuna fishery in Australia. These measures are namely:

- Limited entry
- Catch quotas (open or individual)
- Financial controls

Limited entry

A limited entry system enables the achievement of economic efficiency in the fisheries sector (Christy, 1976) in the long run, by controlling all dimensions of effort so as to achieve the optimal level of effort. This will prevent dissipation of rent.

Limited entry involves the setting of a maximum limit on the number of boats allowed to participate. Limited entry system prevents the dissipation of economic rents in fisheries. Limited entry in its simplest form does not impose any restrictions on boat size; gear type etc. except for setting limits on the number of tuna boats. Therefore, some form of licensing of tuna boats is required to restrict this number

Economic theory predicts that in the absence of zero elasticity of substitution between the restricted and the unrestricted dimensions of effort, the unrestricted dimensions of effort will be substituted for the restricted ones. This substitution will be possible only for the rich fishermen because of the high cost of the unrestricted dimensions of effort. Therefore, this policy will be regressive in terms of equity.

Pearce and Willen (1979); and Kailis (1982) document examples of restrictive licensing of just a few effort components resulting in the expansion of other components such that the least cost combination is not achieved. Therefore this fails in the cost minimisation aspects as well. .

Furthermore, restricting all dimensions of effort through licensing will hinder technical progress in the fishing industry in the long-run and therefore will not be efficient.

Catch quotas.

Catch quotas may be either open quotas or individual transferable quotas. Either type of quota can be affective in achieving the biological goal of stock protection. However, with a migratory species such as blue fin tuna that breeds in Western Australia and migrates through South Australia, New South Wales and goes up to Japanese cost, protection of stock levels is only possible with a concerted united joint action by all countries that fish for southern blue fin tuna in this region.

With open quotas individual fishermen tend to increase their effort in order to take a larger share of the total allowable catch. This in turn will result in over capitalisation of tuna boats and the resulting under-utilisation of fishing boats. Therefore, the use of open quotas in managing the blue fin tuna fishery will not be considered.

With individual transferable quotas, individual quotas are allocated as a share of the total catch. Therefore, it is left to the individual fishermen to determine the most profitable way of harvesting the fish. This will satisfy the cost minimisation strategy. Therefore, such a policy will satisfy all three objectives of our ‘cubic’ model.

Financial controls

Management by financial controls involves providing access to all subject to the payment of an appropriate tax. This financial control could be of two forms

- Tax on inputs
- Tax on catch

Tax on inputs

This is based on the fact that a tax on effort will increase the cost of fishing, which in turn will reduce the total effort by removing those fishermen who are unwilling or unable to pay the tax. But "tax on effort is likely to induce changes in the method of production, leading to higher total costs for society" (Anderson and Wilson, 1977 p.711). This will result in regulation induced inefficiency. Furthermore, tax on inputs will be successful only if it is possible to prevent alternative non-taxed inputs being used by the fishermen to increase their effort or when tax is applied to all dimensions of effort.

There are two problems with the latter approach. First problem is that such a measure will not encourage technological progress that may reduce the cost of fishing. Good management schemes should also allow for technical improvements, which can be reflected as a net gain to the society. The other problem is that effort is difficult to define and measure (Treschev, 1978), especially because it is subjected to continuous revision as technology changes. Since this management measure fails to satisfy the efficiency and the acceptability criteria, it is not recommended as a management measure for the blue fin tuna fishery.

Tax based on catch

The tax on catch is oriented towards economic efficiency. The economic effect of imposing a tax on catch is to increase the cost of fishing or reduce profitability. This increased cost or decreased revenue deters the marginal fishing fleet from fishing and therefore will result reducing the size of effort to the most efficient level. . In Figure 2 it will shift the equilibrium effort level to E_1 from E_0. That is achieving the maximum economic yield level of effort.

Tax on catch satisfies all three faces in our ‘cubic’ model, namely efficiency, equity and acceptability. Of all the alternatives, other than individual transferable catch quota that were discussed, tax on catch is the only policy instrument that satisfies all the three policy objectives. It also allows for technological progress in the long-run.

5. Conclusion

To give the blue fin tuna fishermen some incentive to conserve the fishery resource in a manner, which will not dissipate rent and also will not lead to crowding externalities, some form of quasi property rights have to be given. This is only possible by some sort of political/administrative mechanism. Such a mechanism will prevent the over-exploitation and diminishing returns to the society that is associated with the open-access to the fishery. In other words, a good fisheries management tool should prevent the destructive pattern of competition among fishermen for a share of the limited fishery resource.

At present biological overfishing leading to extinction of blue fin tuna may not a problem . Therefore the management policy should be to control economic over-fishing. In the context of blue fin tuna fishery only two management policies are feasible, namely tax on catch and transferable catch quotas that satisfies all the three policy objectives that were specified in the model. Furthermore, a tax on fish catch as well as individual transferable quotas also has the added advantage of not limiting technical progress in the future, unlike a tax on effort. Also this revenue from tax on catch, as well as generating money by auctioning the individual transferable quotas will provide the opportunity to generate funds that may be used to defray the cost of management. The revenue generated from this southern blue fin tuna fishery by the government should be only utilised to improve the living condition of any fishermen that may be displaced from the fishery or to improve the standard of living in the fishing community.

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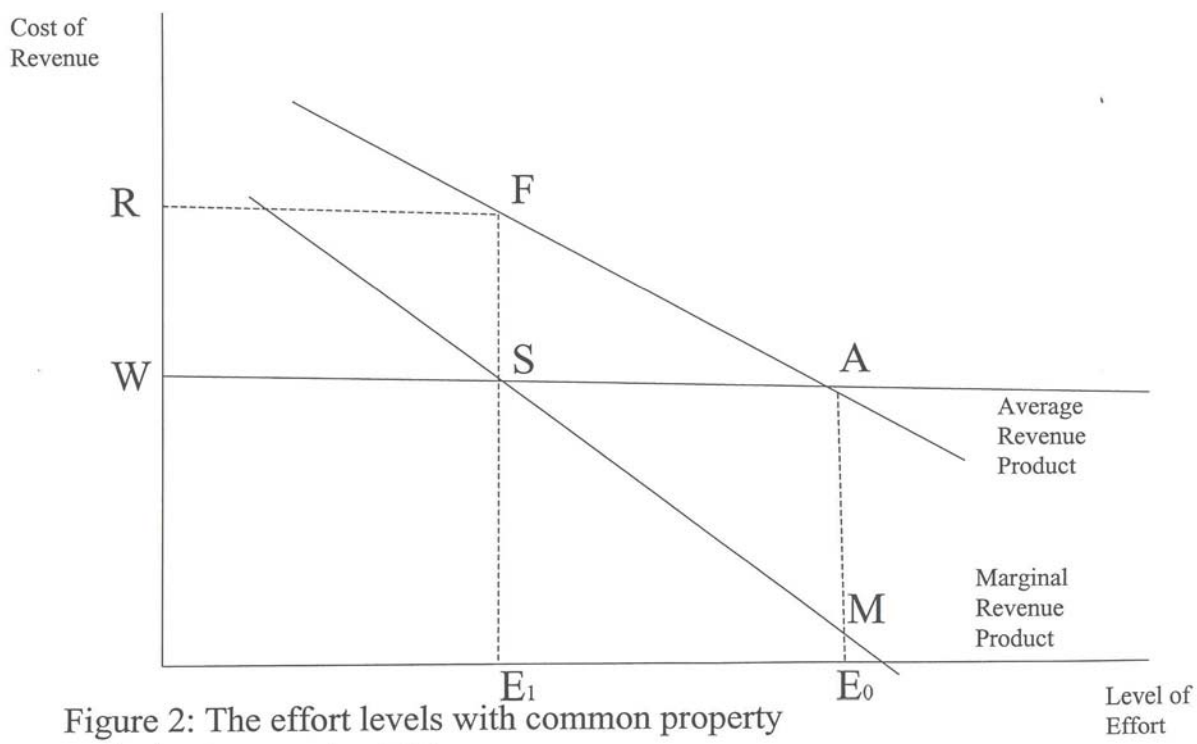


Figure 2: The effort levels with common property and private property rights

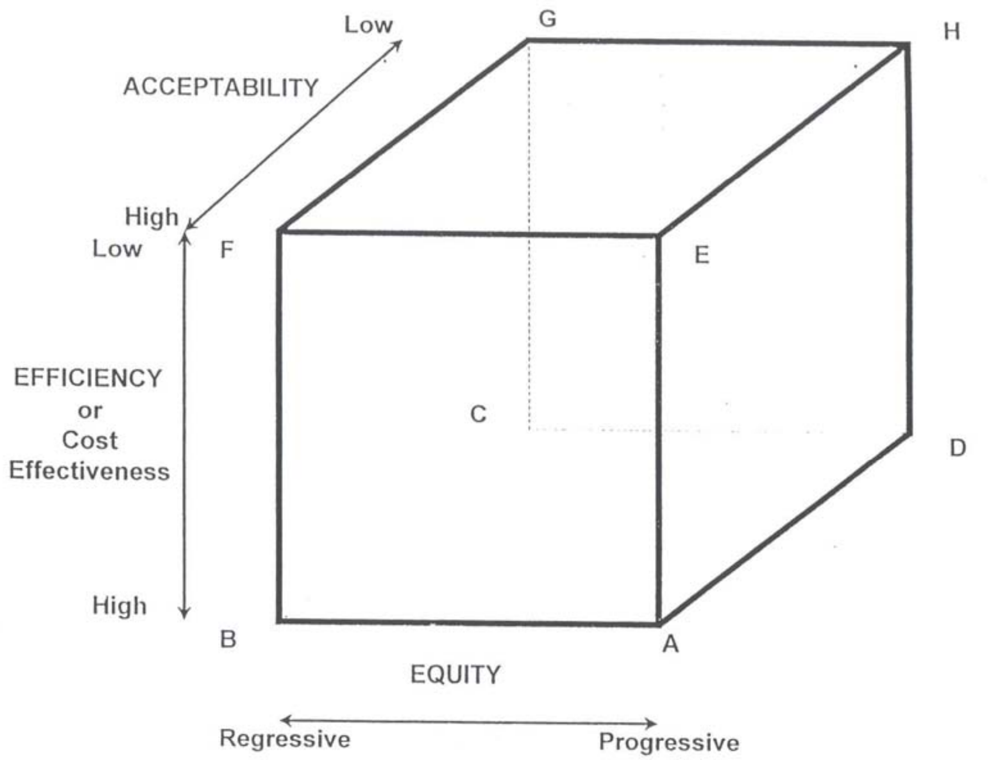


Figure 3: **Framework representing the cost effectiveness, Equity and the acceptability principle.**

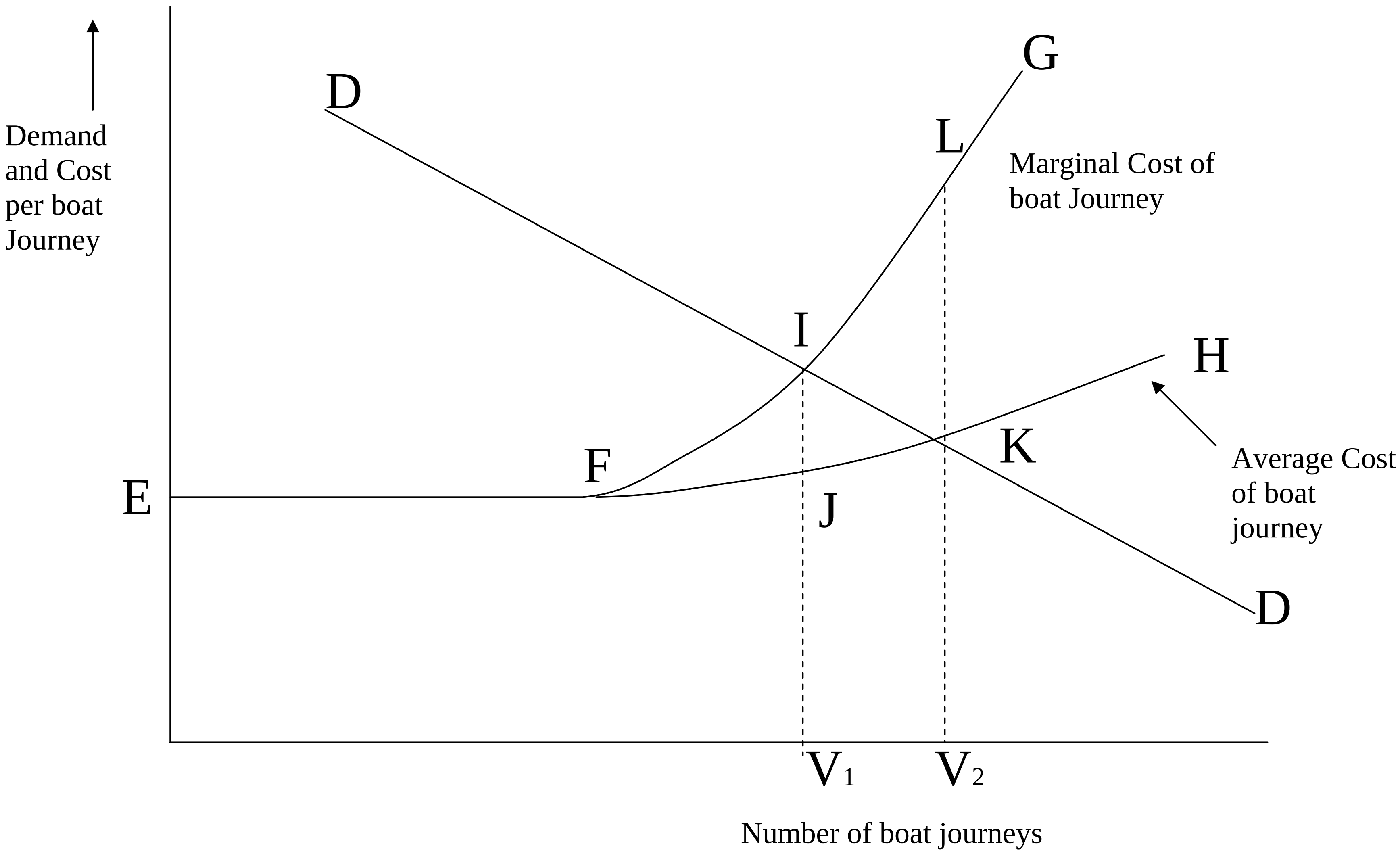
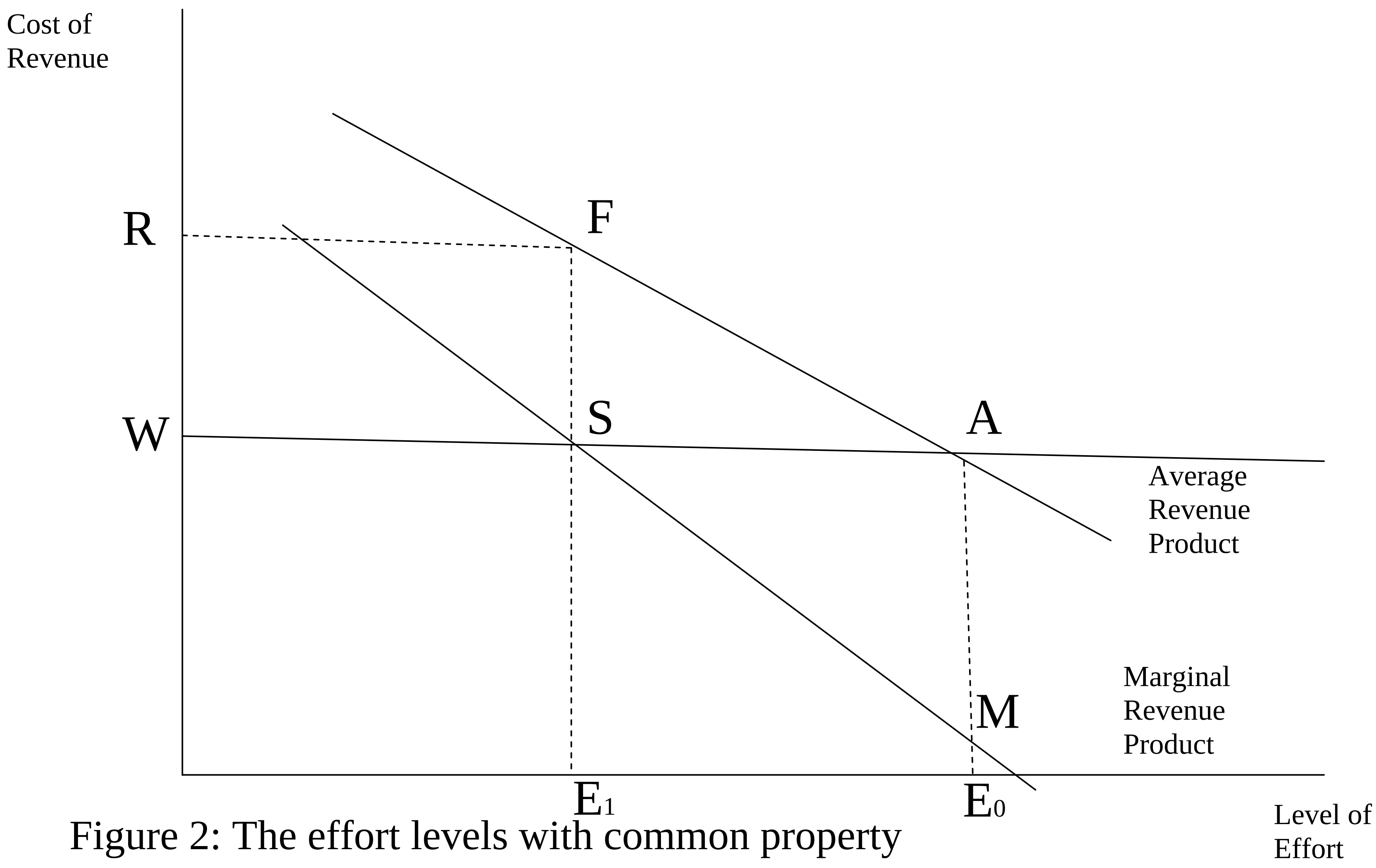


Figure 1: Total number of boat journeys per unit of time between two fixed points when congestion begins at point F



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