

Measurement and Collection of Economic Rent in a Managed Tuna Fishery

Évaluation et collecte
de la rente économique
dans une pêcherie thonière gérée

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I Introduction

Fishery rent is defined as the difference between the landed value of fish and the full economic costs of bringing a catch to port, net of any other types of rent which may be earned. However, at any one time not all of this surplus is necessarily the rent that is attributable to the scarcity of the fish resource. Some of the surplus may reflect short term supply and demand imbalances, with “above normal” profits being the market signal required to induce greater investment in the fishery.

In a competitive market, free entry and exit of economic agents will ensure the absence of economic rent. In an open access fishery, fishing effort will be at a level which ensures the same result. However, this

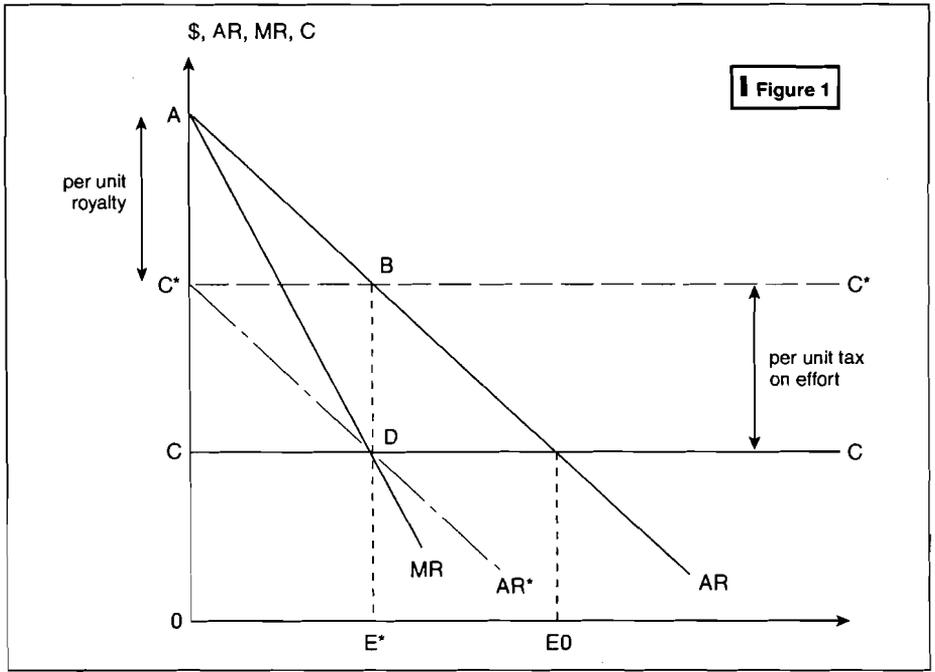
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level will be reached in the absence of any sustainability constraints, and there would be a natural tendency for the fishery stock to be over exploited. In the absence of discrete and enforceable property rights over the resource, individual fishermen would have little incentive to conserve the fish stock or to harvest the fish efficiently because the benefits of doing so may be appropriated by other fishermen. Some form of government intervention is generally required therefore to conserve the resource and to promote a more efficient level of harvesting.

This paper addresses the question of the optimal determination of license or access fees by island nation states whose exclusive economic zones (EEZs) contain highly productive fishing grounds. These nations own the resource, but frequently permit its extraction by vessels from distant water fishing nations (DWFNs) in return for license or access fees generally based on the reported catch. The important question of compliance by DWFNs with their obligations to report catches in the EEZs will not be considered here, except to state that the advent of obligatory in-port transshipment in countries belonging to the Forum Fisheries Agency (FFA) appears to have produced a significant improvement in compliance procedures.

Economic Rent and the Value of Access in a Managed Tuna Fishery

An open-access or unmanaged fishery does not generate resource (or fishery) rent, although some of its participants may earn other kinds of rents. This is because the advantages of the fishery in terms of its natural productivity are offset by competitive forces resulting in over-exploitation, which in turn lowers the return to fishing effort. This is illustrated in Figure I which shows the average and marginal return to fishing effort in a single species, single location fishery. The average return to effort is the average catch per unit effort for the fleet multiplied by the extra harvest which would result from an extra unit of fishing effort. The unit cost of effort is its opportunity cost, defined as the value of output which the factors of production involved in



producing fishing effort could produce if they were employed in another industry. Opportunity cost is measured in a conventional way using market prices of inputs such as labour, capital, and fuel. The open-access equilibrium is at E_0 where the average return to effort equals its unit cost. At effort levels below E_0 the average return to effort is higher than its opportunity cost, indicating that additional entrants to the fishery could earn economic profits, i.e. profits in excess of the level required to generate a market rate of return on capital. At effort levels higher than E_0 the vessels in the fishery are making an economic loss, i.e. they are earning a lower rate of return than the market rate or, equivalently, they are not covering the cost of the effort they employ. Therefore, effort level E_0 is the long run open-access equilibrium level at which there is neither the incentive to enter nor exit the fishery. At this level of effort the fishery rent is zero as total revenues for the fleet are just equal to the total costs of generating those revenues.

One objective of fishery management is to maximise the amount of rent which could be generated. This could be achieved by restricting fishing effort to the level E^* . At that level the marginal return to effort is equal to the unit opportunity cost of effort. The total economic profit, or rent, earned by the fishery is given by the area C^*BDC which represents the economic profit per unit of effort, BD , multiplied by the amount of effort, E^* . This rent is the resource rent. It represents the return which the owner of the fish stock would receive in a perfectly competitive economy with a complete set of enforceable property rights over the resource. It is sometimes termed "management rent" in recognition of the fact that, given that an unmanaged fishery yields no economic rent in a purely competitive environment, with no property rights to the fish stock, a regulatory framework is required for rents to be realised.

Fishing effort can be restricted to E^* in two ways, both of which involve the collection of economic rent by the managers of the fishery. One way is to charge a royalty on the catch, reducing the average return per unit of effort until it equals unit cost at effort level E^* . The alternative is to impose a charge per unit of effort to raise the opportunity cost of effort until it equals the average return at E^* . These two methods are illustrated by the curves C^*AR^* and C^*C^* , which show the net of royalty return and the gross of access charge cost respectively. Most access fee agreements currently involve the imposition of an additional cost per unit of effort, the level of which is intended to be equivalent to a particular level of *ad valorem* royalty on the harvest.

Even if fishing within an EEZ can be treated as a single species, single area fishery, DWFNs have the choice of fishing in one of a number of EEZs, or on the high seas. At any point in time, the productivity of fishing grounds, as measured by the average and marginal returns to effort, will vary from one EEZ to another. There are two models of how fleets will be allocated among EEZs : one approach, based on the concept of open-access equilibrium argues that average returns to effort, net of access fees and transport costs, will be equalised across zones ; the other approach, based on the optimal allocation of fishing effort, argues that the fleets will allocate effort to the EEZs so as to equalise the net marginal return to effort. Assuming that the high seas pockets can be neglected, these two approaches will coincide when

the managers of the EEZs are charging the access fee C^*C and effort in each zone is at E^* .

Exclusive economic zones of island countries have the potential to yield 'rent' because of the natural productivity of their fishing grounds relative to others. The "value of access" can be regarded as an augmented rent that arises because a certain fishing zone, over which a third party has exclusive control of fishing rights, produces a higher rent than another zone. Under conditions of perfect competition and open access, the value of access would equal economic rent since the alternative fishing zone would return zero rent.

The value of access therefore is the value of a particular fishing zone which, if levied as a tax, would make a fishing company indifferent between fishing in that particular zone or in the next most productive zone.

For island countries, the value of access is generally regarded as the value of fishing in their EEZs as compared with the alternative of the neighbouring high seas. Ideally this "value" should determine the fees paid by DWFNs, since ownership of the resource resides with the island countries. Appropriation of this augmented rent would also assist in preventing overfishing. However, because of the migratory nature of tuna, the value of the annual catch of tuna in the EEZ of any one country will differ from year to year. It will also vary according to both environmental and market conditions. Thus the value of access will differ through both time and geographical space.

■ Measuring Fishery Rent and the Value of Access

Whilst fishery rent and value of access are simple terms to define, attributing an approximate numerical value to them would involve collection and evaluation of vast amounts of data. The size of any potential resource rent will depend on market prices, the technology available to capture and deliver the fish to market, the quality of the fishing ground, the quantity of fish available, and the location of the

fishery. However, not only will the magnitude of resource rent vary substantially from fishery to fishery at any one time, but within a fishery the same factors will cause the level of rent to vary in any one period. In addition, over time there will be changes in fisheries management, fishing technology, the cost of fishing inputs, the size of the fish stock, and other supply-side factors which can affect the operational and economic environment of fisheries. On the demand side, characteristics of the fishery may be altered by changes in consumer real income, changes in tastes, and various tariffs and taxes. The extent of such changes in supply and demand on the amount of rent will depend on the size of the changes and the extent to which the price elasticities of demand and supply are altered.

At least in theory, a resource rent tax or some form of auctioning of fishing rights would, under ideal market conditions, provide an ideal method for collecting licence fees based on the true value of access. Both approaches involve minimum distortion in the market, whilst also being very flexible with regard to changes in biological and economic conditions. In practice, however, these two alternatives suffer from a number of drawbacks that render them unattractive to many island countries. The inability of such countries to check the veracity of reported catches and cost levels of DWFNs would make a resource rent tax difficult to calculate and monitor, while the auction of fishing rights requires a reasonably competitive market to work at all. The latter condition does not appear to exist in tuna fisheries worldwide.

The current practice in the South Pacific of calculating access fees as a percentage of expected revenue or, as is the case with the United States Treaty, a flat fee, has only a fairly tenuous link with the "value of access". This preoccupation with a specific percentage for the access fee rate is, superficially, an attractive concept because of its simplicity. However, it ignores the reality of the distinction between an access fee based on total revenue compared to one based on the value of access. Effectively, the "percentage" method for calculating the access fee has more in common with an income tax than a resource rent tax.

For the South Pacific a number of studies have been undertaken to assess the value of access to the region's EEZs (reported in Maxwell and Owen, 1995), and the uncertainties and complexities inherent in

such work suggest that the figures be treated with caution. Nevertheless, it does appear that current fee rates may be lower (perhaps considerably lower) than could reasonably be charged on the basis of the value of access. This is an area where research funding is very necessary to clarify an extremely controversial issue.

Collection of Fishery Rent

There is a strong case for not attempting to appropriate the entire rent that a fishery may generate. Since the precise level of resource rent is difficult to quantify, over-estimating the rent would result in penal taxation and associated efficiency losses. Under-estimating the rent, however, has no efficiency implications. In fact, appropriating less than the full rent will give an incentive for innovative behaviour by fishermen. Allocating private property rights and deciding not to take the entire rent involves a one off transfer to the current generation of fishermen. The value of the rent foregone will become capitalised into the quota or license values which new entrants to the industry will have to purchase.

Alternative methods of rent collection will affect fisherman in different ways because of different technological and cost structures and varying levels of expertise. Essentially, rent collection can be achieved through a charge on output, on inputs, on accounting profit, or on net cash flow. For island countries dealing with DWFNs, input or output charges are invariably considered to be the appropriate method for capturing part of the rent, as the other schemes rely on accounting procedures and overseas taxation schemes which are generally inappropriate tools for assessing fee structures for non-residents.

Charges on the quantity or value of fish caught, or on the inputs used, have the virtue of being administratively simple compared with the alternative profits based charges. Although input or output charges can be used as the principal management measure to control effort in a fishery, any difference between the charge and the actual rent will be reflected in a departure from the optimum level of fishing effort.

A problem is that neither the value of output nor the value of inputs is necessarily related to profitability : it is profitability which should indicate the amount of rent in the fishery. The price of fish could fall so that no rent existed, but an output charge would still need to be paid. If output or input charges were to reflect profitability, then the amounts (percentage or fixed fee) would need to be renegotiated at frequent intervals. This process would be time consuming and costly for all parties.

A charge based directly on profitability would be less distorting than input or output charges, because it should represent a more accurate reflection of the level of rent. Profitability can be measured through accounts submitted for tax purposes and the charge for access to the fishery levied at the same time as individual or company tax, as a percentage of profits. However, profit measured for tax purposes generally differs significantly from economic profit, particularly in terms of depreciation allowances and the concept of the opportunity cost of capital. For this reason a charge based upon net cash flow may be more appropriate. This itself has a major drawback in terms of volatility, with cash flow being negative in years of major capital purchases and positive when such purchases are absent. The property of neutrality (and therefore of no economic loss of efficiency) can only be preserved if the negative cash flows are used to offset positive cash flows (appropriately discounted) in other years.

In underdeveloped fisheries the market can be used, through competitive bidding, to determine the level of the rent charge and who can participate in the fishery. Auctioning access rights has the advantage that administrative costs are often low relative to the value of the right being sold, and the rights are sold in a non-discriminatory manner to those best able to exploit the resource. However, if little is known about the potential yields from a developing fishery, bidders are likely to be cautious, and small operators who are unable to meet the cost of research into the economic viability of the fishery may be excluded.

Dissatisfaction with the level of access fees, and the widespread perception that DWFNs have, in the past, gone to great effort to under-record or under-report catches on which the fees are based, has encouraged many Pacific Island nations to consider the financial viability of establishing a domestic tuna fishing and/or processing

industry. The risks inherent in such ventures are clearly far greater than those associated with receiving access fees from DWFNs, but the perceived benefits are also significantly higher. The next section outlines the many considerations that must be addressed by Pacific Island nations considering this option ⁽¹⁾.

I Domestic Participation in a Tuna Fishery with Particular Reference to the South Pacific

Given the general scarcity of marketable natural resources in many island countries and the potential value of the tuna industry, optimal utilisation of the tuna resource to obtain maximum domestic benefit is important to island governments. In promoting domestic participation in tuna industries, governments are attempting to reap more benefits from the exploitation of their tuna stocks than if they had permitted stocks to be harvested only by the DWFN fleets in return for access fee payments.

The principle reasons for promoting domestic participation are:

- to broaden the economic base of island countries;
- to generate employment opportunities, foreign exchange, and government revenue; and
- to facilitate the transfer of fishing and related technology to the islanders.

Essentially there are three methods by which island countries can promote domestic participation in the tuna fisheries: by establishing a “domestic” fleet (either independently or as a joint venture with other nations), by establishing transshipment facilities, and by investing in the processing sector.

1. A comprehensive bio-economic analysis of the many issues relating to tuna fishing and processing from the perspective of an island state is given in Campbell and Owen, 1994.

In the South Pacific, there has been an increase in joint ventures over recent years, although experience to date has been disappointing with few having met the expectations of their Pacific Island partners in terms of generating profits and employment, or providing the level of training required for countries to allow them to play a larger role in the fishing operations or the management of the company.

Investment in a domestic fleet has been an option taken up, at one time or another, by most Pacific Island countries, with pole-and-line vessels being the usual form of participation. Over recent years they have accounted for around one-third of the total catch by such vessels. Although their importance in the longline and purse seine fisheries is increasing, Pacific Island country-flagged vessels only account for a very small percentage of the total catch. While the vast majority of longline vessels are foreign owned, there has been strong growth in the locally based longline fleet. The fact that they are locally based generates substantial economic benefits for the local economies through the employment of onshore staff, payment of government taxes and charges, and through the purchase of inputs for their fishing operations.

On June 15, 1993, FFA member countries introduced a ban on transshipment at sea. In the years prior to the ban, the Taiwanese and Korean fleets had routinely transhipped their catches at sea, creating favourable conditions for under-reporting, and minimising any shore-based fisheries service industry benefits that might have accrued to the Pacific Island countries. The intent of the ban was to improve monitoring and surveillance of the foreign purse seine fleet and to generate additional benefits to local economies, whilst at the same time reducing fishing pressure on the resource.

Countries involved in supplying transshipment facilities stand to gain financially from the registration, port and transshipment fees levied on the purse seiners and carrier vessels, as well as from expenditures made by the vessel operators and crews on provisions, fuel, agency services, entertainment, etc. However, potential benefits should be viewed with caution. Much of the anticipated local expenditure will be on goods that have to be imported (for example fuel and spares) and the net gain to the economy will be correspondingly lower.

There is considerable potential for revenue from this source to increase, particularly if an expanded range of services is offered. However,

there are also potential social and environmental costs associated with the arrival in ports of large numbers of purse seiners and carrier vessels. For example, Kosrae had to be closed to transshipments in late 1993 following the grounding of two Korean vessels on a reef near Okat harbour. Other real and potential problems include excessively high port charges, lack of local stevedoring services, social problems through foreign crews not observing local customs, and harbour pollution through rubbish dumping and emptying of bilges whilst in port.

Domestic processing of tuna is generally considered to take two possible forms : loining or canning (or a combination of both). The former requires considerably less capital expenditure than canning, and lower worker skills. However, correspondingly, the value added is very much lower and loining is currently viewed as being an investment of limited value by Pacific Island countries.

The major perceived constraints on island countries regarding establishment of processing facilities are lack of industry expertise and lack of funds for the initial capital investment. One way of overcoming this problem would be a joint venture with major fishing and processing companies, but experience in Fiji and the Solomon Islands suggests that transfer pricing concerns would be a major problem.

However, canneries have great appeal for island countries suffering from high levels of unemployment, since the work is very labour intensive. A cannery capable of processing around 30,000 tonnes a year would cost around US\$ 40 million and would employ about 1000 workers directly and about 700 indirectly. The same amount would purchase four super seiners but would only provide direct employment for around 40 islanders.

A potential benefit of establishing canneries close to the fishing grounds is the time saving involved by unloading locally rather than delivering to canneries located closer to the major consuming nations. This not only saves on fuel, but may also permit additional fishing trips arising from the time saving.

There are, however, a number of factors that present potential barriers to undertaking a cannery venture. Access to a considerable, reliable, fresh water supply (amounting to around 1.3 million litres a day for

a 30,000 tonnes-a-year cannery, about 30 % less if sea water is used to thaw the tuna) is essential. This would immediately disqualify many island countries unless investment in water desalination plants is to be part of the cannery investment. In addition, a reliable and relatively cheap source of electric power is required, amounting to around 3,500 kilowatts on a sustained basis. There is also the major operation of waste disposal, particularly waste-water, since this carries a potential threat to tourism if not handled properly. Finally, acquisition of cans and lids could prove a major concern if they were not manufactured domestically.

A financially successful cannery would provide major direct and indirect employment benefits for an island country. The local economy would be expanded through the increase in local spending power by the cannery workers and the revenue associated with servicing and provisioning the fishing vessels. However, these “multiplier” effects should not be exaggerated. In most (if not all) island countries the majority of consumer goods are imported and thus “leakage” of spending power out of the domestic economy is likely to be fairly rapid.

Other economic benefits which could arise include improved levels of infrastructure and services, and training and employment opportunities. Apart from direct employment in the cannery itself, there would be an increased demand for labour to fill the requirement of tuna support operations, for example stevedoring, net repair, provisioning, transport, chandlery, hospitality, engineering, and electronics. In turn, there would be an increased demand for banking, legal, customs, and travel industry services.

Government revenue should be enhanced in three respects:

- income and sales taxes paid by employees of the cannery;
- revenue taxes paid by the canning company (following any tax holiday); and
- taxes and duties paid both directly and indirectly by vessel owners and crews.

To the extent that any reduction in access fees were offered to vessels landing their catch at the proposed facility, there would be a corresponding reduction in government revenue from this source.

Economic costs would be the deleterious effects of the investment. These will largely be environmental : noise and odour from the plant; increased traffic activity (and perhaps accidents) on local roads; and any adverse effects on alternative revenue-generating activities (for example tourism).

A factor which appears, in the past, to have played a significant role in determining the profitability of canned tuna exports has been the underlying trend in real exchange rates. Indonesia, the Philippines, and Thailand have all benefited from favourable movements in their competitive positions because of declining real exchange rates, whereas those of South Pacific nations have remained relatively static (2).

A major constraint to development of domestic-based tuna industries in island countries with relatively small economies is that the size of the investment could well exhaust the planning, management, and government advisory capacity of the country. For example, the GDP of Kiribati is currently about US\$ 50 million in 1993. Thus investment in a cannery of the size outlined above would involve an investment amounting to 80% of GDP. Even one super seiner would involve expenditure amounting to around 20 % of GDP. There is also a high risk associated with such investments relative to the comparatively low cost investment in fishing support facilities. This is because the services sector is less affected by short-term fluctuations in catches or prices than are canning or fishing operations. To a large extent, many vessel and cannery inputs are required irrespective of the level of profit and, provided the vessel is covering its running costs, it is rational to continue fishing and canning at a loss in the short term.

2. See Chapter 17 of Campbell and Owen, 1994, for an analysis of exchange rate fluctuations and comparative competitive advantage in canned tuna exporting nations.

Conclusion

This paper has discussed the measurement and collection of economic rent in a managed tuna fishery with particular reference to Pacific Island nations. In general, these nations do not participate extensively in the harvesting of the tuna resources from their waters. To achieve any benefit from their renewable resources within their EEZs, they are therefore dependent on revenue raised from the access fees that can be extracted from the DWFNs. However, it was concluded that the current practice of calculating access fees has only a tenuous link to the “value of access” and that alternative taxation regimes should be evaluated with the objective of more adequately reflecting the true value of access. The only alternative for these island nations to benefit from their tuna resource is to, either individually or jointly, increase their direct participation in the harvesting and, if considered financially viable, the processing of tuna. The risks associated with such actions, however, are considerably greater than those inherent in the collection of fees from DWFNs.

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