The Impact of Ferry Services on an Island Economy

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Abstract

This paper examines ferry fares and quality of service to a remote island region and analyses how this affects the economy of the islands. Taking the Western Isles in Scotland as a case study, the paper identifies the links between fares, service, and economic development and attempts to quantify this impact. A new methodology is developed to estimate the impact of service frequency.

Our findings show that a reduction in ferry fares and, in particular in increase in service frequency, will have substantial income and employment benefits to the local economy, running into millions of pounds annually. It is also revealed that there is potential to increase the quality of service to the Isles, and reduce fares in some cases, with no increase in public subsidy towards operating costs. This is achieved by taking a more radical perspective to the routes and services operated, and by more closely matching service provision to the demands of communities within the islands.

Introduction

This paper reports on the findings and methodology behind a study undertaken by the authors into alternative ferry fare mechanisms in the Western Isles, Scotland, UK. The Western Isles are a remote island chain lying approximately 55km off the north west coast of Scotland. The inhabited isles stretch around 180km from the Isle of Vatersay in the south to the Isle of Lewis in the north. The total population of the islands is 26,500, and the land area is 2,896km^2 giving a low population density of 9.15 people per km^2. There is only one town, Stornoway, with a population of around 8,000, the remaining settlements being small, scattered settlements. The Western Isles traditionally relied on small scale subsistence agriculture (crofting), fishing and textiles, however, in common with many rural areas, has seen a decline in these industries and a rise in the importance of the public sector, tourism and other service industries. The Western Isles Economy is estimated at £221 million or £7,827 per head in terms of Gross Regional Domestic Product (GRDP), with the main sectors being public services and administration; distribution; fishing/fish farming; agriculture; health and education (Western Isles Enterprise, 2005)

The islands continue to experience population decline and ageing population. Over the last century, the population of the Western Isles has declined to just over half its 1900 level, indicating long-term economic decline relative to the rest of the UK and even Scotland. However, this level of decline is not inevitable as illustrated by comparison with other island groups, such as the Isle of Man and the Faroe Islands.

Figure 1: Population Trends Compared

Decade	*Western Isles*	*Isle of Man*	*Faroe Islands*
1900s	46,000	50,000	16,000
1960s	33,000	47,000	40,000
2000s	27,000	76,000	46,000

Of course, these islands have differing political, economic and physical characteristics from the Western Isles, in particular fiscal autonomy, which has allowed them to focus on differentiating their economies to achieve economic growth in ways that may not be open to the Western Isles. However, within Scotland, the Isle of Skye has been able to sustain rapid economic and population growth over the last three decades within the similar geography and the same political and fiscal framework as that of the Western Isles. This is partly attributable to good transport links with the Scottish mainland, in particular the Skye Bridge, an excellent link which is now toll free, the benefits of which have been discussed by McQuaid and Greig (2002). Despite a relatively high public subsidy, charges for vehicles on ferries within and to/from the Western Isles remain high as compared with subsidised operators in other areas within the UK and elsewhere.

This study will consider how a revised ferry fares mechanism and operating pattern could help turn around the Western Isles' downward economic and population trend, through increasing traffic volume and income on island ferry services and thereby enhance the economic performance of the Western Isles, while minimising economic subsidy. The specific aims of this study are to assess the current ferry operation under the existing fare pattern, identify potential ferry fare and operational models that could be applied or adapted to Western Isles ferry routes, assess the economic and social impact of the models identified, and to recommend the most effective model for stimulating economic growth in the Western Isles.

Ferry Fare Models

It has long been the goal of transport planners to create conditions for ferry transport to islands and other remote areas such as peninsulas, which are truly comparable with those on the mainland. In practice, this means considering the appropriate ferry and shipping links as roads or bridges. *"The car ferry to an island and the piers are, in fact, parts of a flexible road over which cars and commercial vehicles can pass to and from islands."* HIDB (1974)

From this view, the concept of "Road Equivalent Tariff" or "RET", as developed by Pedersen (1974) based on the Norwegian fare system, was developed. The rationale for this is that payment of road tax entitles road users to drive anywhere on the road system. Tax is used to construct and maintain roads. Roads go everywhere, except for reasons of geography to islands and a few very remote peninsulas. If it were possible to build conventional roads to islands, in the same way as they are provided between points on the mainland, these would have been provided. Islanders pay road tax but are uniquely denied access to the great bulk of the road system without paying a substantial ferry surcharge. Vehicle ferries act as roads between island and mainland. To be equitable, the cost to the road user of crossing the ferry ought to be related to the cost of travelling along an equivalent length of road. This would be achieved by charging a vehicle the equivalent of its road running costs when the vehicle is being conveyed on the ferry. The shortfall between resultant revenue to the ferry operator and his costs would be met from taxation.

Vehicle operating costs can be expressed on mileage basis and related to the length of each type of vehicle. A formula was created to translate this concept into a lineal ferry charge. The formula included a “toll”, equivalent to 4 kilometres of distance; similar to tolls charged to road users for exceptional capital expenditure, such as on certain bridge crossings. Thus a one kilometre crossing would be charged as a five kilometres, two kilometres as six, etc. The formula was set out as follows:

$$C = L\,O\,D + T \quad \text{or} \quad L\,O\,D + 4\,L\,O$$

Where: C = charge for a single journey

O = operating cost per km, per meter of vehicle length (average)

L = length of vehicle in meters

D = passage distance in kilometres

T = toll element = 4LO

A criticism made was that the application of a formula of this kind detached the charge levied for passage from an exact link with the operating cost of the vessel. It was in fact doubtful then, that such exact link existed, with the charging regime in force then nor indeed exists now. As a counter argument, an analogy can be made of the postal service which does not surcharge island letters and parcels despite the necessity for the cost of sea or air transport. Ultimately, RET has generated much interest, and continues to do so, but has yet to be implemented in the UK on grounds of expense. There is therefore a clear need to develop a fare mechanism that provides the equality benefits of a system such as RET, but which can be implemented with the aid of less public subsidy.

In addition to fares, route frequency, has economic consequences for island regions. The experience of vehicle ferry operation in countries such as Norway, has revealed the potential benefits of the "shortest route" principle in reducing fares, operating costs and the requirement for subsidy, while increasing frequency. To illustrate the point, if a 30 mile (two hour) crossing can be replaced by a (one hour) passage of 15 miles, a ferry would be able to make five or six round trips per day instead of three. Therefore to carry the same volume of traffic a ship of roughly half the size and roughly half the operating costs is required. Increased frequency coupled with reduced charges always generates new traffic and a requirement for increased capacity, which in turn provides the potential for growth in GDP.

This paper explores the likely impact of a number of alternative scenarios, with differing fares and frequencies, on the economy of the Western Isles and will inform decision making on the best choice of mechanism to take forward.

The Baseline Scenario: Current Routes and Fares

To put the current fares structure in context it is necessary also to examine the overall characteristics of each route. The following table shows route distances and frequencies for Western Isles ferry services considered in this study. The routes are a combination of longer distance and shorter island-mainland routes, together with 2 inter-island ferries.

Figure 2: Routes, Distances and Frequencies

Route	*Distance (km)*	*Daily Frequency (Averaged)*	
Mainland-Island		Summer	Winter
Castlebay-Oban	144	2	1
Lochboisdale-Oban	144	1	1
Castlebay-Lochboisdale		1	0.5
Uig-Lochmaddy	48	3	3
Uig-Tarbert	47	3	1.5
Stornoway-Ullapool (Pax/Vehicle)	84	5	4
Stornoway-Ullapool (Freighter)	84	2	2

Island-Island			
Berneray-Leverburgh	18	8	5
Barra-Eriskay	10	10	8

Note: The above frequency figures represent the number of single journeys per day. Thus two single journeys represent one round trip.

2003 traffic statistics for each route are provided by the ferry operator for passengers, cars, coaches and commercial vehicles (CVs) and are provided for the summer (29 March to 19 October) and winter respectively. The current structure of fares and charges is composed of three separate elements for passengers, cars and commercial vehicles, the later including busses and coaches. The most recent fares available for the study are detailed below.

Figure 3: Current Fares Comparisons (2004-05)

Route	*Summer*		*Winter*		*Half m*
	Pax	*Car*	*Pax*	*Car*	*CV*
	£	*£*	*£*	*£*	*£*
Oban/Castlebay/L'boisdale	20.20	74.00	15.70	64.00	12.89
Castlebay/L'boisdale	5.75	33.50	5.75	33.50	6.65
Uig/Lochmaddy/Tarbert	9.15	44.00	8.15	37.50	7.25
Ullapool/Stornoway	14.05	69.00	11.70	55.00	10.36
Berneray/Leverburgh	5.20	23.70	5.20	23.70	6.37
Barra/Eriskay	5.50	16.25	5.50	16.25	4.44

There are a number of anomalies apparent in the current fares.. For example, the passenger fare on the short (10 km) Barra – Eriskay crossing is more than on the longer (18 km) Berneray – Leverburgh crossing. Also, the CV rate on the Berneray – Leverburgh crossing is almost as high as that on the Uig – Lochmaddy/Harris crossing, which is over twice the distance.

To calculate operating profit, it is necessary to determine revenue and costs. Although the ferry operator was in receipt of substantial (around £18m) of public subsidy for the financial year 2002/3, the company is not obliged to publish route by route revenue and cost information. Therefore it was necessary to construct a model that computes on a route by route basis, current income from fares and other revenue, and then to set these against costs of operation and capital charges.

Our starting point was to take published traffic data for each route for the year 2003, and from this to calculate derived revenues based on peak and off-peak single ticket prices for passengers and cars. Commercial vehicle and coach income for the longer routes was based on an average vehicle length of eleven meters; slightly shorter for the short inter-island routes. Estimated on-board sales were then added and commissions subtracted. This total theoretical or nominal total figure was then discounted to 80% of the derived sum to allow for return fares, children, freight discounts, etc. The total computed revenue for the Western Isles ferry routes is some £13.6 million per annum based on 2003 traffic figures and 2004 fares and charges.

The next element of the modelling process was to calculate the direct operating expenses of each route/ship. For the most part this is relatively straight forward as the crewing levels are known and wages, social costs, fuel consumption and other costs are based on those that apply in the UK maritime industry and augmented by the consultants' knowledge, local research and the operator's accounts. It should be stressed that as the resulting figures are not based on company data they are, therefore, an approximation of actual costs but are sufficiently accurate for the purposes of comparability.

By subtracting the calculated direct operating expenses for each route from the estimated revenue, an estimate of computed direct operating loss for each route can be arrived at, the total for all Western Isles routes by our calculation being just under £4 million.

Figure 4: Direct Operating Losses £000

	OB/C Y/LB	*Uig*	*SY/UL*	*SY Fr*	*S of H*	*S of B*	*Totals*
Total Computed Revenue	1,807	3,649	4,778	2,381	710	285	13,610
Total Op Expenses	3,078	4,374	5,111	3,744	749	512	17,568
Operating Loss	- 1,271	- 725	- 333	- 1,363	- 39	- 227	- 3,958

We have assumed a total overhead allocation to Western Isles ferry services of £4.5 million. Adding this to the direct operating loss, the overall loss attributable to these services is brought to £8.5 million, as shown below.

Summary of Revenue, Costs and Losses £ million

Total net revenue	13.6
Subtract direct operating expenses	17.6
Giving direct operation losses	4.0
Add assumed overhead allocation	4.5
Giving an overall loss of	8.5

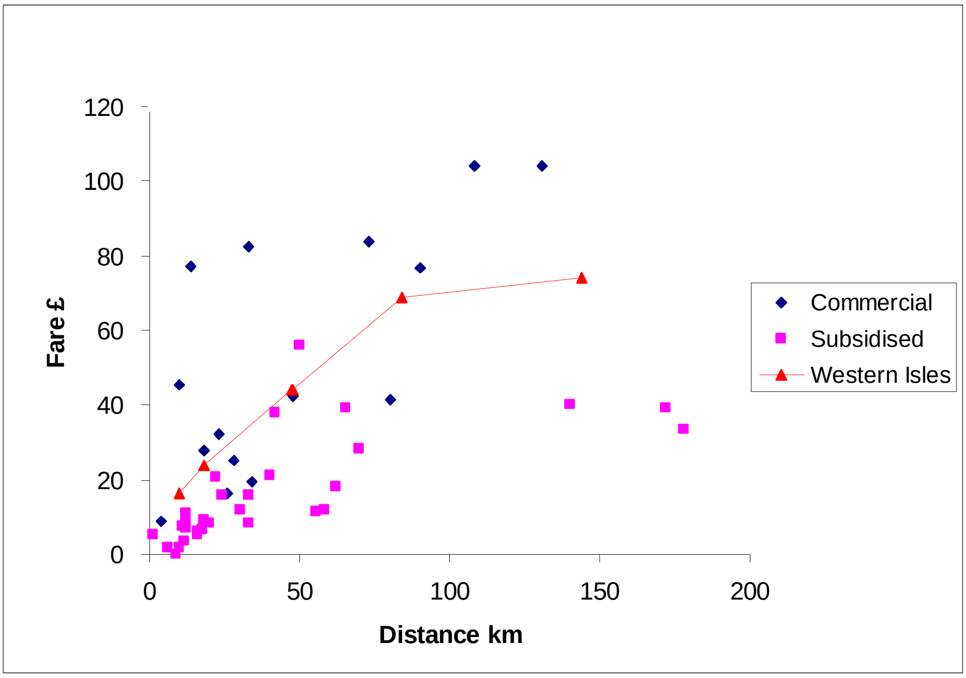
The above data suggests that route frequencies are low and some timetables inconveniently vary from day to day, on most routes passenger loadings are low, crewing levels and costs seem higher than necessary for passenger volumes carried, crew costs are about a third of all operating costs, vessel utilisation is less than optimum, and that fares are inconsistently applied and seem high due to high operating costs. Primary research carried out by the authors also revealed that local residents and businesses see fares as a serious economic constraint and that there is (understandably) widespread support for a moderate (30%) fare reduction and the introduction of a Lochboisdale-Mallaig service.

The above data and calculations provide a framework for comparisons with international ferry routes and for considering alternative fare mechanisms and operating patterns for Western Isles routes.

Comparator Routes

One way of identifying alternative fare mechanisms and operating practices with those that currently obtain in the Western Isles, is to look at different approaches taken by governments and ferry operators elsewhere in the UK and internationally. From the large amount of data assembled from an international selection of routes, we undertook a comprehensive analysis, comparing passage length, single high season passenger, fares, car and CV rates. Figure 5 shows Western Isles fares, compared with other subsidised and unsubsidised routes.

Figure 5: Comparison of Ferry Car Fares and Distance



The trend line shows Western Isles passenger fares in roughly the middle of the scatter but at the high end of the subsidised routes, and still higher in the case of the short Sounds of Barra and Harris routes.

A similar exercise was performed with peak single car and CV rates for each route with the passage distance, giving similar results. From the route comparisons it is apparent that there is a distinction to be made between subsidised ferry operations and those operating commercially to maximise profit. Western Isles passenger fares are around the middle of the comparative range but a high compared with other subsidised routes, and still higher in the case of the short Sounds of Barra and Harris routes. Western Isles car rates are relatively high compared with all routes and significantly higher than other subsidised routes. Western Isles commercial vehicle charges are very high compared with all routes and about three times higher than the general trend for other subsidised routes. The above comparisons with ferry routes world wide provide a framework for considering alternative fare mechanisms and operating patterns for Western Isles routes.

Alternative Fare Mechanisms

Fares systems cannot readily be separated form way services are operated. The advantage of a cheap fare may, for example be offset by poor timings or inconvenient hours of operation. In the case of the Western Isles ferry routes the reasons for the differences appear to be linked with: a multiplicity of routes, several of them long; low frequency of service; inconvenient and variable timetables; low passenger loadings; high crewing levels and costs; un-optimised vessel utilisation; high fares due to high operating costs; and fares inconsistently applied.

In the light of this we have looked at the task in two ways. Firstly: what alternative mechanisms are possible under *present* operating conditions, and secondly, what alternative mechanisms are possible under *altered* operating conditions?

A comparison is made between the present fares regime and ferry services, and the economic impact of five selected scenarios, each of which is described in the following section.

1. RET under current conditions
2. A Tailored tapered tariff (TTT) under current operating conditions

3. A reduced fare TTT (TTTR) under current conditions
4. TTT under our illustrative alternative operating conditions
5. TTTR under our illustrative alternative operating conditions

Each scenario will result in differing levels of increased local resident and visitor expenditure, and increased business competitiveness.

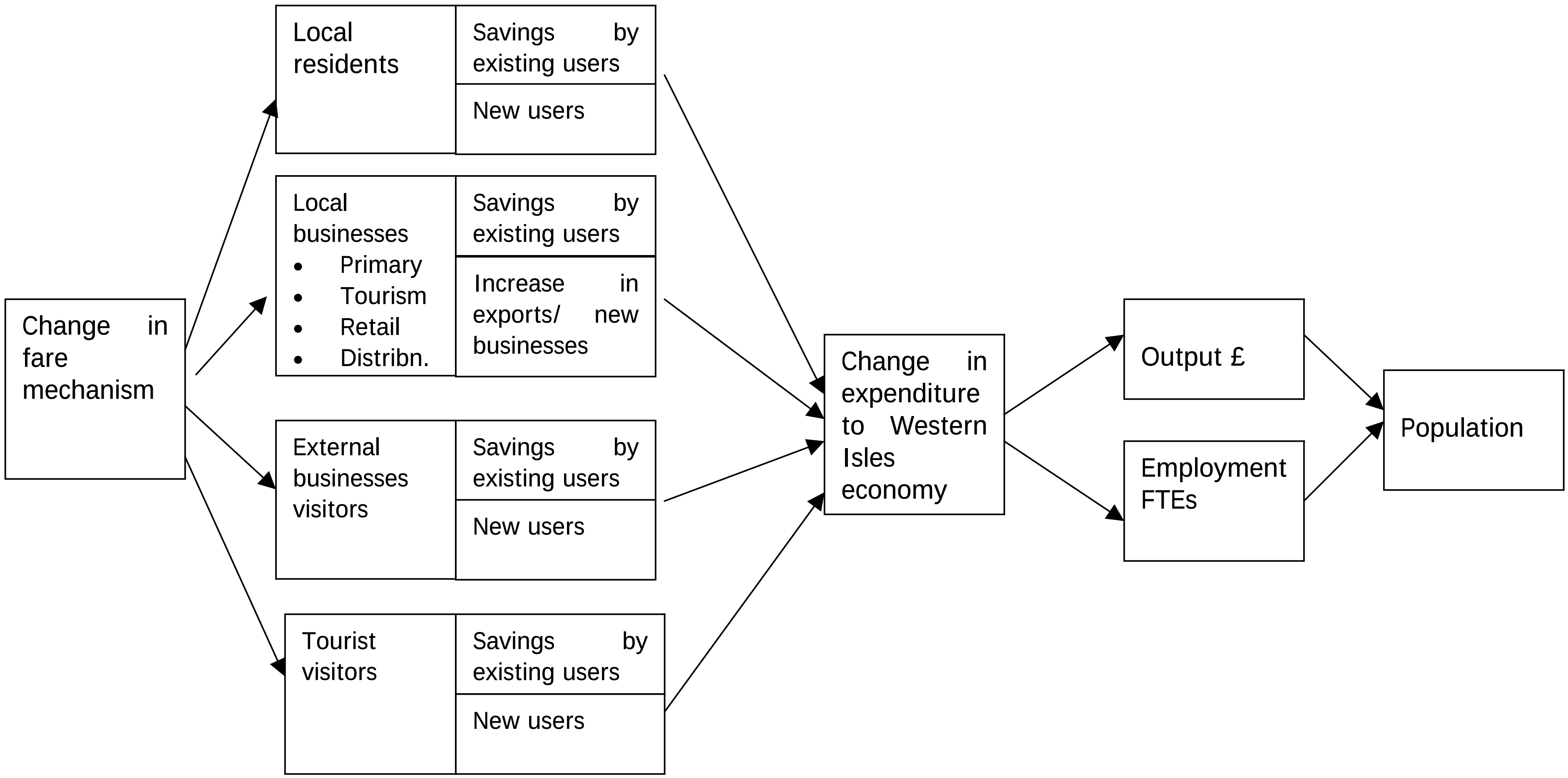
Methodology

The methodology used has been adapted from McQuaid and Greig (2002) and involves using the scenarios to estimate the likely effects of changes in the fare structure, taking the current fare mechanism as a baseline. This analysis will involve the following stages.

1. Calculate the changes in fares for each scenario
2. Estimate the change in cost for existing users resulting from each scenario.
3. Estimate the price and frequency elasticities of demand (i.e. the % change in demand resulting from the % change in price or frequency) for each user group and calculate the change in traffic that would result from altering the current mechanism
4. Separate the change in traffic into each main user group – local residents and visitors
5. Estimate the resulting change in expenditure for each user group
6. Estimate resulting changes in annual output and employment in the Western Isles by applying appropriate multipliers to changes in expenditure
7. Estimate the impact on business efficiency, i.e. change in exports

A summary of the model of the short-term impacts is shown in Figure 6 below.

Figure 6: Summary of Economic Impact Methodology



Changes in Fares Only

Changes in fares under each scenario were estimated by applying the appropriate formula to current fares. For RET, this involved the formula

$$C = L\ O\ D + T$$

As described above.

The TTT fare mechanism is a distance related tariff constructed by inserting a "taper" in the scale such that above a selected distance the rate per kilometre of passage distance is reduced. On a graph the "taper" is represented by a kink. The effect of this "kink" is to lower the charges for long routes to below those that would obtain on a "pure" distance related tariff. The Reduced TTT, is calculated in exactly the same way, only fares are adjusted to give a an initial approximate match to current charges, revenue and subsidy levels, resulting in an approximate 30% reduction in fares.

Alternative Operating Scenarios

The above scenarios represent the effects of applying a variety of fares mechanisms to the Western Isles ferries as currently operated. It is not, however, possible to achieve a significant reduction in fares unless one of two things happens, i.e. subsidy is increased or operating costs per unit are reduced. The level of subsidy is already high and we have assumed that a major increase would be difficult to justify. We therefore consider whether alternative operating styles can reduce unit costs, and therefore, reduce fares overall without a large increase in subsidy and whether it is possible at the same time to improve services.

The changes made to ferry services under the alternative operating conditions are: Shortening the Stornoway Route; providing a dedicated vessel for each of the Uig routes; introduction of a Lochboisdale-Mallaig route, combined with downgrading of the Oban-Castlebay-Lochboisdale route; extending the operating hours of the inter-island routes.

Impact on Existing users

The savings made by existing users will have a positive impact on the Western Isles economy, as a proportion of money saved on ferry fares will be spent elsewhere within the Isles. Savings by existing users have been estimated by calculating the change in fare under each scenario, and scaling this up to current (2003) traffic levels. In calculating savings, we have assumed no multi-journey discounts. Figure 7 below, provides our estimates of savings made by existing users under each scenario.

Figure 7: Savings made by existing users

	Current Expenditure	**Scenario Expenditure**	**Saving Over Current**
Current CFARES	£11,922,976	£11,922,976	£0
RET	£11,922,976	£4,364,365	£7,558,611
TTT	£11,922,976	£10,488,523	£1,434,453
TTT reduced by 30%	£11,922,976	£5,758,474	£6,164,502
TTT Alt Mechanism	£11,922,976	£9,130,258	£2,792,718
TTT Alt Mechanism reduced by 30%	£11,922,976	£6,070,869	£5,852,107

Calculating the impact of this increase in expenditure requires a breakdown of existing users. Based on the 2003 traffic figures for the Western Isles, it is assumed that across all routes, existing users consist of 61% tourists and business visitors and 39% local residents and businesses. This distinction between local residents and visitors is important in calculating the economic impact of ferry fare changes, primarily because only a small proportion of fare revenue saved by visitors will be actually spent in the Western Isles, whereas a much larger proportion of fare savings by residents will be spent there. For the purposes of this study, we have assumed 5% of savings by existing visitors and 100% of savings by existing residents would be spent in the local economy.

New Traffic - Price and Frequency Elasticity

A reduction in ferry prices under any of the scenarios will also result in new users and therefore new ferry traffic. New users will be either local residents or visitors. To estimate the overall increase in traffic, the price elasticity has been calculated. Price elasticity measures the responsiveness of ferry traffic demand to a change in fare. The higher the value the more responsive traffic will be to a change in price. We selected values for car and passenger traffic from the Scottish Office Industry Department (SOID, 1992) study on fare price elasticities. This is the most comprehensive elasticity study conducted to date and has the advantage of estimating values specifically for Western Isles routes. The value for CV price elasticity was taken from the SOID (1993) study on the evaluation of impact of ferry subsidies. Values are given below.

Figure 8: Price Elasticity of Demand

	Pax	**Cars**	**Coach/CVs**
Barra/Eriskay	-1.4	-1.1	-0.55
Berneray/Leverburgh	-1.4	-1.1	-0.55
Uig/Lochmaddy	-0.8	-1.4	-0.55
Uig/Tarbert	-0.8	-1.4	-0.55
Ullapool/Stornoway	-0.8	-1.4	-0.55
Lochboisdale/Mallaig	-0.8	-1.4	-0.55
Oban/Castlebay/L'boisdale	-1.5	-2.2	-0.55

Price is, however, not the only stimulant of traffic. Increased frequency, improved passage time and extended operating hours can also reduce the barrier to travel or “impedance” which a ferry crossing presents. Scottish examples of this are the competing Cowal – Inverclyde ferry services where the short frequent, Western Ferries service operating till late at night has developed a large new traffic flow and captured four fifths of the business despite slightly higher fares in some categories. Likewise the recently introduced Gill’s Bay to St Margaret’s Hope (Orkney) short frequent vehicle service has developed new traffic and captured much of the existing traffic that formerly went via Scrabster and Stromness. These effects especially revealing when it is borne in mind that both services are wholly unsubsidised and profitable.

While there is strong empirical evidence that traffic will increase with improved frequency, regularity and hours of operation, we are not aware of any systematic analysis previously undertaken of the actual elasticity of these “impedance” factors. We have, however, been able to estimate a “frequency elasticity of demand” (FED) by examining data on a number of comparable routes, e.g. islands with similar populations but with dissimilar fares and frequencies. These ‘comparator’ routes were similar in length and destinations served, to those in the Western Isles, but with a higher service frequency. In most cases the comparator routes were also cheaper, but in one case (Kennacraig – Islay/Jura) the route was more frequent and more expensive. On these routes, we estimated the likely difference in traffic that could be accounted for by the lower/higher fare, using the above elasticities. Any residual change in traffic after taking this into account was then assumed to be due to higher frequency on the comparator route. On this basis we were able to work out a frequency elasticity of demand (i.e. the responsiveness of ferry traffic to a change in service frequency) for each of the comparator routes and apply this value to the Western Isles routes to estimate the likely change in traffic on each route resulting from application of our alternative mechanisms to these changed operating patterns. The frequency elasticity of demand was calculated to be 0.1 for Oban/Castlebay/Lochboisdale and 1.04 for all other routes. Frequency elasticity was only applied to passengers and cars to reflect the source data.

The practical effect of this FED is that doubling route frequency (i.e. number of single journeys per day) would have a similar effect as halving fares on an existing frequency. If at the same time both fares were halved and frequency doubled the two elasticities require to be multiplied, resulting significantly greater traffic growth than if only one elasticity applied.

The following tables show the estimated increase in ferry use, by route, for each of the scenarios.

Figure 9: Increase in Traffic Under RET

	Pax	**Cars**	**Coach**	**CVs**
Barra/Eriskay	35,009	5,186	24	232
Berneray/Leverburgh	50,965	8,954	38	747
Uig/Lochmaddy	27,149	13,090	54	1,566
Uig/Tarbert	41,141	12,103	78	267
Ullapool/Stornoway	95,967	24,170	142	4,011
Oban/Castlebay/L'boisdale	40,729	1,897	352	352
Total	290,960	65,399	688	7,175

Figure 10: Increase in Traffic Under TTT

	Pax	Cars	Coach	CVs
Barra/Eriskay	20,451	2,342	14	138
Berneray/Leverburgh	18,756	3,821	23	442
Uig/Lochmaddy	5,358	1,956	3	77
Uig/Tarbert	6,025	2,247	6	19
Ullapool/Stornoway	18,948	7,109	0	-6
Oban/Castlebay/L'boisdale	16,584	-729	0	-2
All routes	86,121	16,746	45	668

Figure 11: Increase in Traffic Under TTT Reduced 30%

	Pax	Cars	Coach	CVs
Barra/Eriskay	26,344	5,186	19	182
Berneray/Leverburgh	34,925	8,645	30	589
Uig/Lochmaddy	21,731	11,738	28	820
Uig/Tarbert	21,517	10,916	42	144
Ullapool/Stornoway	58,379	24,214	73	2,043
Oban/Castlebay/L'boisdale	29,353	6,291	13	183
All routes	192,249	66,990	205	3,960

Figure 12: Increase in Traffic Under TTT Alternative Mechanism

	Pax	Cars	Coach	CVs
Eriskay - Barra	34,613	7,482	14	138
Leverburgh - Berneray	43,739	12,468	23	442
Glendale - Lochmaddy	184,319	65,043	125	2,130
Uig – Tarbert	63,730	19,031	6	19
Stornoway - Aultbea	51,046	13,136	12	12,338
Lochboisdale - Mallaig	42,414	11,294	0	0
Oban – Barra/L'boisdale	3,333	-4,186	-97	-1,323
Stornoway freighter	-12,000	0	0	-12,000
All routes	411,195	124,268	82	1,745

Figure 13: Increase in Traffic Under TTT Alternative Mechanism Reduced 30%

	Pax	Cars	Coach	CVs
Eriskay - Barra	40,506	10,326	19	182
Leverburgh - Berneray	59,908	17,292	30	589
Glendale - Lochmaddy	195,334	71,624	142	2,631
Uig – Tarbert	79,223	27,699	42	144
Stornoway - Aultbea	90,477	30,242	85	14,388
Lochboisdale - Mallaig	52,593	16,037	0	0
Oban – Barra/L'boisdale	16,103	2,835	-97	-1,323
Stornoway freighter	-12,000	0	0	-12,000
All routes	522,144	176,055	220	4,610

New Traffic - Local Residents Versus Visitors

In terms of pure expenditure, an increase in ferry use by local residents will remove money from the economy, due to both increased spending on ferry fares and on goods and services purchased while outside the Western Isles. In contrast, an increase in visitor traffic will lead to increased local expenditure.

We have estimated the amount of new local resident traffic by applying the estimated percentage of current local resident traffic to the overall increase in ferry users. New visitor traffic has been estimated by applying the estimated percentage of current visitor traffic to the overall increase. To do this, we have made the following assumptions. Firstly, the proportion of visitor traffic is the difference between summer and winter foot passenger, cars and coach traffic on each route.[1] Second, traffic will increase in the same proportion to existing traffic, third, the remaining increase in car and passenger traffic will be local residents, fourth, CV traffic is 50% local and 50% non local all year round

Using these assumptions, the percentage annual visitor traffic is given below. The percentage local traffic will be the remainder of this, for example the percentage local passengers on Ullapool/Stornoway will be 100% - 43.7% = 56.3%

[1] There will be some winter tourists, but also in the summer an increase in local resident traffic. Therefore we regard this as a sensible approximation.

Figure 14: Percentage Annual Visitor Traffic by Route

	Pax	*Cars*	*Coach*	*CVs*
Barra/Eriskay	76.3%	66.3%	100.0%	50%
Berneray/Leverburgh	63.0%	49.3%	95.1%	50%
Uig/Lochmaddy	56.6%	52.8%	67.1%	50%
Uig/Tarbert	84.5%	80.0%	100.0%	50%
Ullapool/Stornoway	43.7%	37.9%	67.5%	50%
Lochboisdale/Mallaig	53.5%	46.8%	74.8%	50.0%
Oban/Castlebay/L'boisdale	60.2%	49.9%	89.7%	50%
Stornoway freighter	50.0%	-	-	50%

Estimating the Change in Expenditure for New Traffic

The estimated expenditure of the *new visiting* ferry users has been calculated using figures from the Western Isles Visitor Survey (MacPherson Research,1999), which gives average spend per person per trip in the Western Isles as £203. This includes visitors on holiday, visiting friends and relatives (VFR) and business visitors. This figure has been used to calculate expenditure for all users, except non-resident CV drivers, where we have calculated an average spend of £47, as this group of users will stay for shorter periods. This was multiplied by the estimated number of new visitors on routes to/from the mainland.

The estimated expenditure of *new local* ferry users, which will have a negative impact by removing money from the local economy, has been estimated by multiplying the traffic increase for passengers and for each vehicle type by the relevant fare for this.

Calculation of Changes in Output and Employment

The detailed process used to calculate the impact can be summarised as follows.

a) The change in expenditure for existing and new users, as detailed above, was taken

b) From this the amount entering the Western Isles economy was estimated

c) Appropriate multipliers were applied to give gross output change

d) The gross output change resulting from increased business efficiency was estimated (see below)

e) Appropriate employment multipliers were applied to gross output to calculate the change in employment.

a) Change in expenditure

The method for this is detailed above for new and existing users.

b) Expenditure Entering the Western Isles Economy

Only a proportion of money spent by local residents and visitors will remain in the Western Isles economy. Much of this will be spent on imported goods and services and taxation. It is only this remaining expenditure that will be retained in the economy and be subject to multiplier effects. Drawing on existing data for the Western Isles[2], we have made the following assumptions regarding expenditure.

- 48% of resident expenditure will remain in the local economy
- 71% of visitor expenditure will remain in the local economy

Gross Output Change from Additional Expenditure

Gross output measures the change in output of local businesses resulting from changes in ferry fares and services. Essentially, it measures the size of the Western Isles economy. This can be due to increased expenditure by locals or visitors, or increased profits earned by businesses as a result of increased competitiveness driven by lower import/export costs and more reliable connections. In calculating the gross output change resulting from increased expenditure, it was assumed that the multiplier for local resident spending is 1 and the multiplier for visitor spending is 1.49[3].

Gross Output Change from Business Competitiveness

In addition to extra spending by local residents and visitors, there will be increased competitiveness among Western Isles based businesses due to lower import prices and/or

[2] CnES (1999) Western Isles Regional Accounts

[3] Adapted from CnES (1999) Western Isles Regional Accounts

reduced cost of exporting goods and more frequent and reliable connections with markets and suppliers. The resulting increased business activity among export sector businesses will lead to increased output and employment in these sectors. There may also be a potential increase in the number of firms, although this is likely to be relatively small and is excluded from further analysis.

In summary, the increase in output was calculated in the following way. Six key exporting industries were selected: Agriculture; Sea fishing; Fish farming; Textiles; Fish processing, wholesaling etc.; and Other manufacturing. The baseline output in the Western Isles for each of the above sectors was taken. Estimates for ferry price final demand (FPFD) multipliers were then calculated using estimates from SOID (1993) – these measure the responsiveness of industrial output to a change in ferry fares. The FPFD (F) was then multiplied by the weighted average ferry fare change in each scenario (ΔP) to calculate the percentage change in output for each sector. This was applied to total current output (Y_{t-1}) to reveal estimated likely change in output for each of the key exporting sectors for each scenario. This can be summarised by the following equation.

$$\Delta Y_t = F\,\Delta P\,Y_{t-1}$$

The resulting change due to business competitiveness for each sector is shown below.

Figure **: Actual (%) Output Change £000 in WI Key Export Sectors

Sector	RET	TTT	TTT -30%	TTT Alternative	TTT Alt. -30%
Agriculture	£752 (8%)	£235 (3%)	£369 (4%)	£346 (4%)	£657 (7%)
Sea fishing	£0	£0	£0	£0	£0
Fish farming	£6,652 (20%)	£2,073 (6%)	£3,262 (10%)	£3,063 (9%)	£5,806 (18%)
Textiles	£2,719 (24%)	£848 (8%)	£1,333 (12%)	£1,252 (11%)	£2,373 (21%)
Fish process, wholesale, etc.	£3,104 (16%)	£968 (5%)	£1,522 (8%)	£1,429 (7%)	£2,709 (14%)
Other manufacturing	£1,968 (24%)	£613 (8%)	£965 (12%)	£906 (11%)	£1,718 (21%)
All key export sectors	£15,195 (16%)	£4,736 (5%)	£7,450 (8%)	£6,998 (7%)	£13,263 (14%)

It should be noted that although these figures are high, they are based on scaled down SOID figures (SOID, 1993), which themselves were designed to capture primarily the effect of lower import prices. Also this sectoral analysis includes only key exporting industries, excluding tourist related sectors. We do not therefore believe that these figures are unrealistic, although they are slightly dated, due to the information available.

Employment Change

To calculate the resulting changes in employment, employment coefficients from the 1997 Western Isles Regional Accounts (CnES, 1999) were applied. These show the number of FTE jobs required for each £1000 of output. The employment coefficients used were 0.03 for output resulting from domestic expenditure, and 0.04 for output resulting from changes in visitor expenditure, to reflect the balance of sectors likely to be stimulated – visitors tend to spend a higher proportion in sectors with higher employment coefficients. To calculate the overall change in employment, the employment coefficients were multiplied by the total gross change in output from extra expenditure and business competitiveness.

Results: Overall Economic Impact

A summary of the estimated expenditure and resulting impact under each scenario is given in Figure ** below. This shows the estimated additional expenditure entering the Western Isles economy and the resulting increases in output and employment under each scenario.

Figure 7.6.1 Overall Economic Impact

RET:	**Change in Expenditure**	**After leakages, VAT, receipts**	**Multiplier**	**Gross output change**	**Employment Coefficient**	**Employment change**
Amount entering WI economy by existing local residents & business	£2,947,858	£1,414,972	1	£1,414,972	0.03	42
Amount entering WI economy by existing visitors	£230,538	£163,682	1.49	£243,886	0.04	10
Amount entering WI through local residents	-£1,754,449	-£842,135	1	-£842,135	0.03	-25
Amount entering WI economy through visitors	£21,339,398	£15,150,973	1.49	£22,574,949	0.04	903
Amount entering WI economy through increased competitiveness				£15,194,866	0.03	456
Total	**£22,763,345**			**£36,927,680**		**1,334**
TTT Current						
Amount entering WI economy by existing local residents & business	£559,436	£268,530	1	£268,530	0.03	8
Amount entering WI economy by existing visitors	£43,751	£31,063	1.49	£46,284	0.04	2
Amount entering WI through local residents	-£499,209	-£239,620	1	-£239,620	0.03	-7
Amount entering WI economy through visitors	£4,942,574	£3,509,227	1.49	£5,228,749	0.04	209
Amount entering WI economy through increased competitiveness				£4,736,474	0.03	142
Total	**£5,046,552**			**£9,725,603**		**344**
TTT Current -30%						
Amount entering WI economy by existing local residents & business	£2,404,156	£1,153,995	1	£1,153,995	0.03	35
Amount entering WI economy by existing visitors	£188,017	£133,492	1.49	£198,904	0.04	8
Amount entering WI through local residents	-£1,488,602	-£714,529	1	-£714,529	0.03	-21
Amount entering WI economy through visitors	£13,538,517	£9,612,347	1.49	£14,322,397	0.04	573
Amount entering WI economy through increased competitiveness				£7,450,408	0.03	224
Total	**£14,642,088**			**£21,058,276**		**775**
TTT Alt. Scenario B						
Amount entering WI economy by existing local residents & business	£1,089,160	£522,797	1	£522,797	0.03	16
Amount entering WI economy by existing visitors	£85,178	£60,476	1.49	£90,110	0.04	4
Amount entering WI through local residents	-£4,221,122	-£2,026,139	1	-£2,026,139	0.03	-61
Amount entering WI economy by tourists	£39,734,122	£28,211,227	1.49	£42,034,728	0.04	1,681
Amount entering WI economy through increased competitiveness				£6,997,840	0.03	210
Total	**£36,687,338**			**£47,006,429**		**1,831**
TTT Scenario B -30%						
Amount entering WI economy by existing local residents & business	£2,282,322	£1,095,514	1	£1,095,514	0.03	33
Amount entering WI economy by existing visitors	£178,489	£126,727	1.49	£188,824	0.04	8
Amount entering WI through local residents	-£4,012,659	-£1,926,076	1	-£1,926,076	0.03	-58
Amount entering WI economy by tourists	£58,170,425	£41,301,002	1.49	£61,538,493	0.04	2,462
Amount entering WI economy through increased competitiveness				£13,262,627	0.03	398
Total	**£56,618,577**			**£72,875,043**		**2,802**

Conclusions

Using the methods detailed above, it has been possible to calculate the impact of number of widely differing fare and operating mechanisms on the economy of the Western Isles. Taking current operating mechanisms (routes, schedules, vessels) we examined a wide of options and permutations. Under RET all fares would be reduced, mostly very substantially, traffic would also increase substantially requiring capacity increase and subsidy would be increased significantly. Under a distance related (length based) (revenue/subsidy neutral) tariff CVs would be cheap, but passengers and cars would be expensive on long routes, therefore a Tailored Tapered Tariff (TTT) can be adjusted to match subsidy available and is fairer on long routes. If revenue neutrality were relaxed, a Reduced TTT would reduce fares and increased traffic but with some increased subsidy requirement. Under present operating conditions, however, the scope for reducing fares is limited unless subsidy is increased.

In view of the last above comment, we explored an illustrative alternative operating scenario featuring the TTT fares mechanism combined with shorter routes, new capital investment, different vessel types, utilisation and operating practices. Calculation of a frequency elasticity of demand has allowed the estimation of the effects on increased service frequency on traffic generation, and hence expenditure and output. This alternative scenario leads to beneficial effects on fares and traffic generation, with many fares and charges reduced, very significant traffic growth stimulated, increased revenue is generated. Overall subsidy requirements are reduced under TTT, including annualised costs of new capital investment, and with TTT reduced by approximately 30%, traffic would increase further but with some increase in subsidy. Such a radical improvement in ferry services would bring significant economic benefits to the Western Isles.

In conclusion, therefore, the methodology used has allowed us to more accurately estimate the true impact of a radical change in operating conditions, to allow direct comparison with a simple change in fares. Fuuture research will extend this methodology to examine the impact of changes in frequency on business competitiveness and to quantify the effect of timetabling and other ‘softer’ changes in service quality, such as customer service, harbour facilities and vessel comfort.

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