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NEW ZEALAND INSTITUTE OF ECONOMIC RESEARCH

Stretching runway numbers

Review of cost benefit analysis of proposed Wellington Airport runway extension

NZIER report to BARNZ

February 2016

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Authorship

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Key points

Objective

NZIER has been engaged by the Board of Airline Representatives New Zealand (BARNZ) to provide an independent peer review of Sapere's draft cost benefit analysis of the proposed Wellington airport runway extension. We recommend Sapere take these issues into account in the final analysis and are willing to discuss our findings with Sapere.

Key finding: the central scenario BCR of 1.7 is significantly over-stated

The central scenario of the Sapere analysis concluded that extending the runway would deliver a benefit cost ratio (BCR) of 1.7 and that the project thus represented a valuable use of taxpayer funding.

The broad structure of the cost benefit analysis is appropriate but a number of troubling issues arise with the analysis.

Based on our understanding of these issues, and adjusting the Sapere estimates to better take them into account, we estimate that in the central scenario, a more realistic BCR is something lower than 1.0. That is, the net costs to New Zealand are greater than the net benefits.

There are numerous gaps in the draft analysis

Our review suggests that a number of key aspects of the analysis warrant further examination in order to produce a more robust estimate of the costs and benefits of the runway extension:

- About half the net benefits are attributed to goods and services purchased by new visitors to New Zealand. However:
  - The value of these benefits is overstated by $610 – 730 million through not properly accounting for the opportunity cost of labour, plant and machinery
  - There is no recognition of the corresponding disbenefits of more New Zealanders travelling abroad and taking their spending offshore
  - The value for travel time savings (per hour) used in the analysis is too high for New Zealand. New Zealand-specific values are likely to be around 29%-83% lower than the internationally-derived, and inadequately-adjusted figures that Sapere use. This overstates the net benefits by between $230 million and $720 million
- When adjustments are made to correct for the opportunity cost of labour and the value of travel time, the central scenario BCR reduces from 1.7 to 1.3
- The forecasts of additional passenger volumes (1.25 million) are too high by a factor that may be up to 5. More conservative, and we believe more reasonable, estimates would see around 250,000 additional passengers coming into Wellington
- Adjusting the analysis to account for this over-optimism further reduces the BCR to below 1.0

It is entirely possible that the BCR should be less than 1

The results of Sapere's draft CBA are not strongly positive despite the upward bias in the analysis. The proposed runway extension is a risky project which should be reflected in an economic analysis by either requiring a higher BCR than 1.7 or using a higher discount rate than 7%. A higher discount rate would reduce the value of future benefits relative to costs, lowering the BCR.

Under all but the most optimistic assumptions the runway extension is not a good investment proposition for the New Zealand taxpayer with a BCR of 1.7 (lower than some roading projects with lower risk), but when corrected for the issues above and recognising the omission of increased New Zealanders' tourism expenditure abroad the ratio would fall further below 1.0. This indicates the project would be a wasteful investment and a drain on the national economy.

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1. Introduction

This report presents a review of the draft cost benefit analysis of the proposed runway extension at Wellington airport prepared by Sapere Research Group in November 2015.

The capital cost of the extension is $298 m, plus $8.8 m for two gates to handle Code E aircraft used on long haul routes. In the base model capital is assumed to be paid by government so an additional 20% ($61.4 m) is charged to cover the deadweight cost of tax funds, as per Treasury guidelines.

The expected economic life of the runway extension is 100 years and for the Code E gates is 50 years, so analysis includes residual values for the runway ($19.2 m) and gates ($2.9 m). The cost benefit analysis covers a period of 43 years using a discount rate of 7% in line with Treasury's guidelines for generic public infrastructure investments. Benefits are expected from an increase in direct long haul flights between Wellington and destinations in Asia and potentially North America.

1.1. What the terms mean

The elements in Sapere's cost benefit analysis are summarised in their report's Appendix 3: Results of cost benefit analysis of short-listed options, which shows the present value totals for each item of costs and benefits and the overall net benefit over costs. While some of these elements are relatively self-explanatory, others are specific to transport or airline usage and clarified below.

1.1.1. Cost benefit analysis

Cost benefit analysis (CBA) is a method for weighing up the gains and losses across a community from a given course of action. It focuses on the incremental gains and losses compared against what would have happened without the action, and it aims to identify the net gain after all attributable costs have been accounted for, over a prolonged period of time.

Its purpose is to estimate the value of economic surpluses enjoyed by both producers and consumers of goods and services, over and above the costs incurred in creating those surpluses. Such surpluses comprise producer surplus, which roughly corresponds to a business's operating surplus or profit, and consumer surplus which represents the value to consumers of reductions in the prices they pay for their consumption or increases in the choices they face (see below).

CBA is distinct from financial analysis, which looks at the costs and resulting revenues from the perspective of a single entity, as it covers the benefits and costs for all affected entities including, potentially, effects on the wider natural environment which affect other human activities. CBA examines the value return from deployment of resources to establish the scale of net benefits, not how best to achieve them from the deployment of particular funding arrangements. It also differs from economic impact analysis, which measures economic activity in terms of expenditures or employment but does not account for all costs.

1.1.2. Incremental costs and benefits

The purpose of CBA is to assess the change in outcomes from a given project, so the focus is on the incremental gain in benefits and costs of resources used, relative to what would have prevailed in the absence of the project. A starting point in this process is to define a counter-factual or expected situation without the project. In the case of the runway extension, the incremental net benefit is the difference between the increases in benefits enabled by the extension less the increased costs of installing and operating the extension, both relative to the situation without the runway extension.

1.1.3. Generalised costs

Generalised cost is a term used in transport economics to describe the sum of monetary and non-monetary costs of a journey.

- Monetary costs include fares on public transport or airline services, and the costs of fuel, wear and tear on private vehicle journeys.
- Non-monetary costs cover the time spent undertaking the journey, which is converted to monetary values which vary according to the traveller's income and the purpose of the trip (e.g. business or leisure).

The generalised cost is thus a measure of total journey cost and is used as equivalent to the price of travel, and demand is expected to respond to changes in generalised cost.

1.1.4. Value in exchange of additional passenger airline services by outbound residents

This is the value that outbound New Zealanders pay for new airline services, such as the incremental increase in trips because of the availability of direct flights from Wellington. The term 'new passenger services' implies an incremental increase in New Zealanders taking outbound trips on long haul services from the extended Wellington airport, not just diversion of traffic from other international airports. The value to New Zealand of each new service is net of the corresponding cost of supply that is the opportunity cost of all inputs used, such as labour, plant and machinery.

1.1.5. Consumer surplus

Consumer surplus is one of the main components of economic well-being as measured in cost benefit analysis. It is founded on the notion that consumers get more value from their purchases than they reveal in market transactions, i.e. they are willing to pay more for something than they actually do pay, so that providing more of that something confers a benefit over and above the observed market transactions around its provision. In cost benefit analysis the focus is on marginal changes from incremental expansion or contraction of consumption.

1.1.6. Value of additional goods and services to international visitors

The value of additional goods and services represents the sales by New Zealand firms to new overseas visitors who arrive because of the existence of new flight opportunities brought about by the extended runway. This benefit item also has a corresponding cost of supply, reflecting the New Zealand suppliers' opportunity cost of all inputs and imports used in supply.

1.1.7. Deadweight cost of tax revenue

The deadweight cost of tax revenue recognises that the opportunity cost of taxation is greater than the face value of tax collected, both because the cost of collection and enforcement necessitates recovering more tax than is needed for the original purposes, and because the existence of tax distorts use of resources and encourages avoidance and evasion. To avoid under-costing funds raised by tax, Treasury recommends marking up the face value of tax funds by 20%.

1.2. Summary of Sapere's base CBA

The results from Sapere's report of the central estimate of Option 1 (runway extension) are summarised in Table 1 below. The layout has been changed to show where benefits correspond to costs falling on the same groups of affected parties.

Arranged in this way a number of things stand out apart from the headline results of a net present value of benefits of $2.1 billion, a benefit cost ratio of 1.7, and a ratio of net benefit over capital cost of 6.8. Among these salient points are:

- A major part of the estimated value is associated from new overseas visitors spending time and money in New Zealand, equivalent to 44% of gross benefits, 40% of costs, and 49% of the estimated net benefit
- Another large item is the generalised cost of additional passenger services used by outbound New Zealand residents, an amount equal to the fares paid by travellers for services and an imputed value for the time involved in travelling and waiting for connections
  - Generalised cost for passengers accounts for 26% of the estimated costs and 18% of estimated benefits, with the net effect equivalent to about 7% of the net economic benefit
  - The same number ($778.7 m) appears as a generalised cost of additional passengers services and the exchange value of additional passenger services, which cancel each other out in the analysis
  - A similar doubling up of the same number occurs for generalised cost of additional freight services, with the same mutually cancelling effect
- The supply of additional services to aircraft and passengers provides a benefit for Wellington airport (PV$166.2 m+$128.2 m) over four times that of the cost of supplying the services (PV$39.9 m+$30.8 m), yet these benefits still fall well short of covering the cost of the runway extension that would be needed for commercial viability

- The analysis accounts for flow on effects for other airports handling lower throughput from reduction in connecting passengers to other gateway airports due to direct long haul flight capability at Wellington (value loss of $18.1 m less supply cost savings $4.3 m), and new services at those airports (value $39.4 m less supply cost $7.5 m) but this makes a very small contribution to gross and net benefits in the analysis
- The analysis omits one item (entered in the table in blue) which is the lost value for New Zealand firms from additional overseas spending by New Zealanders i.e. to the extent that direct long haul flights makes it easier for New Zealand residents to take their holidays and spending overseas, the economy increases its imports (of tourism services) at the expense of New Zealand firms supplying such services, which is a corollary of the value of additional business from more overseas visitors in New Zealand

Table 1 Results of central estimate of Sapere draft CBA

Present values over 43 years at 7% real discount rate

		Costs	Benefits
Airports		***PV$ m***	***PV$ m***
Cost of extending the runway (including contingencies)	298.133		
Cost of additional Code E aircraft gates	8.760		
		306.893	
Supply of additional aircraft services at Wellington		39.896	166.235
Supply of additional passenger services at Wellington		30.791	128.234
Residual value of runway extension			19.296
Residual value of Code E gates			2.887
Other airports in New Zealand (flight adjustments)			
Value of airport services no longer used by diverted flights (net of supply cost savings)		18.109	4.346
Supply of additional airport services		7.534	31.393
Total incremental economic costs and benefits for airports		**403.223**	**352.391**
New Zealand Airlines supplying additional services at WIA:		**0**	**5.742**
Users of airline services			
Generalised cost of additional passenger services used by outbound residents		778.663	922.928
Exchange value of additional passenger services used by outbound residents			778.663
Consumer surplus derived from additional passenger airline services used			73.140
Reductions in generalised costs of travel for existing airfreight users			2.876
Generalised cost of using additional airfreight services		523.036	523.036
Total incremental economic costs and benefits for users of airline services		**1,301.699**	**2,300.643**
Wider New Zealand community			
Value of additional goods and services supplied by New Zealand firms		1,195.120	2,209.054
Additional GST revenue collected on sales of goods and services			183.977
Deadwweight cost of using tax revenue to fund capital costs of extended runway		61.379	
Total incremental economic costs and benefits for wider New Zealand community		**1,256.499**	**2,393.031**
Totals		**2,961.421**	**5,051.807**
NET INCREMENTAL BENEFIT			**2,090.386**
Benefit:Cost ratio			**1.71**
Ratio of Net benefit over Capital Cost			**6.81**

Source: NZIER re-ordering of Sapere Appendix 3 results data, Option 1 Most Likely scenario

This review proceeds by first examining the structure and approach of Sapere's cost benefit analysis, then examining issues with the data and assumptions behind some of the largest items, showing the effects of alternative estimates of these items. It concludes with comments on the sensitivity analysis and interpretation of results,

and argues that the net benefit of the runway extension has been substantially overstated on a number of counts.

2. Approach and structure of analysis

Sapere's cost benefit analysis of the proposed runway extension at Wellington airport is a conventional CBA, informed by Treasury's 2015 Guide to Social Cost Benefit Analysis.

Its period of analysis is 43 years (2016-2059), assuming construction between 2017 and 2019 and commencement of operations on the extension in 2021. Costs and benefits are projected in real 2016 $ terms, and discounted to present values at 7%, the rate Treasury currently recommends for transport infrastructure.

The CBA compares 3 options: building the runway now (Option 1), deferring the runway extension by 10 years (Option 2), and funding of promotional transport hub to achieve an equivalent traffic boost on the existing runway (Option 3). Each option has low, medium and high estimates, and all estimates are compared against a counterfactual of continued operation of the airport with current runway facilities.

The analysis takes a national perspective (effect on New Zealand Inc) and separately identifies effects on different parties. The main elements in the analysis are:

- Cost of building the runway extension and the additional Code E gates to handle larger aircraft
- On-going supply of additional airport services to aircraft and passengers at Wellington
- Effects on other airports in New Zealand due to direct long haul flights from Wellington displacing some demand for connecting traffic to other gateway airports in New Zealand
- Effects on airlines currently operating out of Wellington due to supposed operational efficiencies from higher loadings enabled by the longer runway; but no effects of airlines supplying new long haul services from Wellington, as these are all assumed to be foreign-owned companies beyond the scope of a national cost benefit analysis[1]
- Effects on generalised costs of fares and time for passengers and freight users of Wellington airport
- Effects on the wider New Zealand community in supplying goods and services to additional inbound (overseas) visitors, including the GST collected on those goods and services.

All of these categories have costs and benefits expressed as incremental value changes relative to the counterfactual without runway extension. This is because the runway extension may create both costs relative to business as usual (e.g. in the operations of the airport and handling of its clients) and benefits (e.g. from improvements that enhance value), which should partly offset each other in the analysis.

[1] Although Qantas and Jetstar are foreign owned companies, their operations within New Zealand contribute to domestic product in New Zealand and fall within the scope of a national cost benefit analysis.

There is one item omitted from the draft analysis coverage. Just as the new services from an extended runway can attract more overseas tourists to visit New Zealand, so New Zealanders may be able to make more trips because of the improved availability and accessibility to flights. Part of this consumer benefit is captured in the savings in generalised costs, but there is currently no accounting for the incremental increase in money such outbound tourists spend overseas. Such money increases New Zealand "imports" of tourist services and displaces spending that would otherwise be spent in New Zealand enhancing GDP and economic surplus for New Zealand suppliers.[2]

A CBA of this sort could in principle also include environmental effects from the runway extension, such as the possible displacement of recreation activity from changes in the Lyall Bay wave patterns. Sapere's draft report contains some discussion of environmental impacts that concludes that mitigation measures provided by the airport will neutralise adverse effects and perhaps enhance positive environmental effects, but makes no attempt to quantify or value them. This is not unreasonable, but it means that proposed mitigation measures (such as enhancements to surf waves from an artificial structure) are excluded from the costs of the extension.

Given the caveats about omissions expressed above, the structure of the analysis appears reasonable for a national cost benefit analysis of this type.

A distinctive feature is the starting assumption that the runway extension is funded by government tax revenues to provide a basic assessment of whether the project is worthwhile – i.e. has costs exceeded by benefits – from which to consider other funding options. This assumption is not unreasonable but has implications for the price faced by users and the demand for services which can affect the volume and value of benefits. The analysis does not demonstrate this is a good return on taxpayer funds compared to other alternatives, and is not designed to examine alternative funding arrangements or to distinguish commercial viability from social net benefits.

[2] As with the value of new incoming tourists, the expenditures on imports will need to be adjusted to arrive at the net cost or loss of economic surplus to New Zealand.

3. Inputs

In general, the Sapere draft report is long on verbal description and short on numbers, but, when combined with the spreadsheets, the analysis can be examined and understood (see Appendix A). It reports unit values used and a justification for how they have been derived, but not the physical quantities to which they are applied to help give an idea of the scale of effect.

For instance, the value of new overseas visitors is given in terms of median spending per trip from different origin countries in Table 16, but there is no corresponding information on volume of trips from different origins.

Examination of Sapere's spreadsheet model provides more explanation. However, there remain problematic issues with some of the input assumptions that are major drivers of the analysis results. These include:

- Additional goods and services supplied to non-resident visitors ($2.209bn, 44% of benefits)
- Reducing the generalised cost of airline services ($0.922bn, 18% of benefits)
- Exchange value of additional services for outbound residents ($0.778 bn, 15% of benefits)
- Costs of supplying additional goods and services to tourists ($1.195 bn, 40% of costs)
- Generalised cost of additional passenger services to outbound residents ($0.778bn, 26% of costs)
- Generalised cost of additional passenger services used by freight users ($0.523 bn, 18% of costs).

There are also significant questions around the traffic forecasts which affect a wide range of items in the analysis. These forecasts are examined in a separate accompanying NZIER report and the implications for the cost benefit analysis are examined later in this review.

This review focuses on Sapere's medium scenario for runway extension, but the same issues carry through in the low and high scenarios.

3.1. The value of new foreign visitors

Aside from the volume of additional visitors arriving/departing through Wellington, there is a major issue with the valuation of these additional arrivals for New Zealand tourist businesses. This is apparent in the size of the net gain from value of additional goods and services sold to these visitors, equivalent to half the runway extension's net benefits in present value terms.

The Sapere draft report estimates new spending by visitors to have a present value of $2.209 billion over the 40 year analysis period, nearly 44% of the total estimated incremental benefit of the runway extension. The estimate of benefit is made by multiplying the number of new inbound visitors from each origin for each year by an average expenditure in New Zealand specific to each country of origin.

The report also estimates the costs of supplying this new demand to have a present value of $1.195 billion, about 40% of the total incremental cost. The cost of supply is estimated using the ratio of intermediate consumption to output for tourism sectors as derived from Statistics New Zealand's Tourism Satellite Account (TSA).

This calculation procedure means **the cost of supply omits the opportunity cost of labour and of fixed capital depreciation and is therefore seriously understated**.

This can be corrected using a similar process to that in the Sapere report, by inferring a cost of labour and fixed capital consumption from the TSA and relevant sectors in the national Input Output tables and adding these to the cost of supplying this demand, thus reducing the economic surplus for producers (see Appendix B for more detail).

The results of making such adjustment are shown in Table 2. This allows for two separate estimates depending on the assumption of labour cost:

(i) If it is assumed the opportunity cost of labour supplying the additional demand is the average wage cost across New Zealand, the extent to which tourism related wages exceed average wages is a producer surplus earned by labour which adds to national benefits.

(ii) But if meeting that demand employs people with an opportunity cost only marginally different from their wages in non-tourism related activity, that producer surplus shrinks. At the extreme virtually all employee compensation can be accounted as a cost, reducing net benefit from this activity.

Table 2 Adjustments to costs of new goods and services

NZ$'000, discounted over 40 years at a real rate of 7% per year

	Adjustment to employee compensation $ m	Adjustment to fixed capital consumption $ m	Adjusted overall net benefit $ m	Benefit cost ratio
Sapere analysis	-	-	**2,090,386**	1.71
Adjusted with labour producer surplus	418.182	193.282	**1,478.922**	1.41
Adjusted with no labour producer surplus	535.745	193.282	**1,361.358**	1.37

Source: NZIER

Table 2 shows that adjusting for fixed capital consumption and labour cost using average wages as the opportunity cost of labour would increase costs by about $610 million, reducing the overall net benefit of the analysis by about 29% and lowering the benefit cost ratio from 1.71 to 1.41.

If all employee compensation is accounted as a cost, the costs of supplying new goods and services to new visitor demand would increase by nearly $730 million, reducing overall net benefit by 35% and reducing the benefit cost ratio to 1.37. Further explanation of these adjustments is given in Appendix B.

We do however endorse Sapere's decision not to follow MBIE's post event evaluation guidelines that suggest only 25% of the value of output is intermediate consumption and 75% as value added. The origins and evidence for that figure are unclear, but it is not supported by the TSA.

We also support Sapere's decision not to employ economic multiplier coefficients to estimate flow on effects through the economy. Economic multipliers are ratios of total economic impact over direct economic impact derived from static snapshots of inter-industry transactions in the national input-output tables. They provide an indication of the propensity for funds injected into the economy to leak away on imports and less productive activity, but their origins in static tables make them problematic if used to predict the amount of activity stimulated by a new project.

If a new project increases demand sufficiently for local input supplies to reach resource constraints, the price of constrained inputs will rise for all industries, causing some to lose profitability or contract, lowering the effective multiplier below that implied by the static multiplier. Because of potential misuse of multipliers in inflating effects of new projects, the Australian Bureau of Statistics no longer issues them, for reasons set out on its website.[3]

3.2. The effects on value for travellers

A runway extension that significantly changed the mix of direct and indirect long haul traffic out of Wellington would change the generalised cost of transport for passengers and freight users.[4]

Generalised costs cover the full costs of travel, including costs of international travel and of domestic travel links, and also the opportunity cost of time spent travelling or waiting for connections and the transaction costs of researching routes and fares and complying with regulations.

A runway extension could increase generalised costs for existing users to the extent that new direct long haul flights impact on other scheduled flight operations, for instance changing the frequency or timing of domestic connecting flights and increasing waiting times and airfares on these connections. For passengers seeking direct long haul flights a runway extension could reduce generalised costs by cutting out some of the domestic transport expenses and travel and waiting times.

Sapere estimate a generalised cost of $778.6 million for outbound resident travellers and $523 million for freight users using additional air services (their Table 13). These generalised costs are described (p52) as conservatively estimated as the average airfares for passenger services and average market prices of airfreight per kilogram.

These figures are exactly matched on the benefit side as incremental economic benefits for users of **additional** airline services (their Table 20). It is not clear why they should be the same – by definition the generalised cost should be larger than the exchange value because of the inclusion of time value. As defined by Sapere (p

[3] http://www.abs.gov.au/ausstats/abs@.nsf/Previousproducts/5209.0.55.001Main%20Features4Final%20release%202006-07%20tables?opendocument&tabname=Summary&prodno=5209.0.55.001&issue=Final%20release%202006-07%20tables&num=&view=

[4] Direct flights are long haul flights from Wellington to a destination in Asia or North America; indirect flights are international flights from Wellington connecting with long haul flights from Auckland, Christchurch, Sydney or Melbourne

70) generalised cost and exchange value are calculated in the same way, so these costs and benefits cancel each other out in the analysis.

There are also savings in generalised costs for existing users of air services, of $922 million for passengers and $2.8 million for freight users (Table 20). This passenger value is a significant item in the benefits assessment, and is described as due to reduced transport costs on avoided connecting flights within New Zealand and avoided road transport; potential reductions in airfares and airfreight charges to the extent that existing airlines pass on user cost savings from the longer runway; and reducing the time that passengers and airfreight spend travelling between Wellington and their long haul destination through avoided connections.

The values for travel time are overstated

Page 68-69 notes the opportunity cost of passenger time derived from Australian studies translates to NZ$53.60/hour for non-business and $76.20/hour for business passengers, but these are high for an opportunity cost compared to New Zealand's median hourly earnings in the region of $23/hour for males and $20/hour for females, or compared to values used by the New Zealand Transport Agency in its Economic Evaluation Manual.

The report's unit values could inflate the travel value component by double or more – although it is hard to tell how much from the report. Reductions in generalised freight costs are trivial compared to generalised passenger costs, suggesting the individual's time value assumption is crucial.

Sapere's opportunity cost of passenger time has been obtained from the Australian Civil Aviation Safety Authority Standard Economic Values Guidelines for 2010, inflated to 2015/16 dollars and adjusted for the exchange rate. The use of these guideline figures is problematic for several reasons:

- The values are **substantially higher than those used by NZTA** for land transport options, which are based on the wage rate or a fraction of it (for non-working time) and these range from $28.54-$33.87 for work time travel and from $4.33-$9.80 for non-work (leisure) travel (July 2014 NZ dollars)
- The CASA guidelines themselves note there are no local Australasian studies of travel time value for air travel and **rely on European based values**:
    - They cite three sources which show varying values between waiting time (lower than) travel time, private travel (lower than) business travel and air carrier (lower than) general aviation and it is not clear which Sapere has been used and why it is chosen over others
    - The European values have been inflated and converted to Australian dollars by CASA using Purchasing Power Parity exchange rates
- International literature and meta analyses from OECD and similar authorities show that a major determinant of the value of travel time and other non-market attributes like safety is the per capita income of the countries concerned, but **adjustment for relative incomes between countries is something that neither Sapere nor their CASA source material appears to have done** – the PPP exchange rates account for differences in pricing between countries, not incomes.

While there is an argument that the value for air travel time savings is likely to be higher than that for surface transport modes, the unit values used by Sapere in this instance are still likely on average to overstate the value of time for New Zealand resident air travellers.

Table 3 compares the Sapere time values with alternatives and shows the effect of changing these values on Sapere's central estimates of net benefit and benefit cost ratio. It suggests these **net benefits are over-estimated by between $230 million and $720 million**.

Sapere use a non-work time value almost as high as the work time value after adjusting for income differentials between New Zealand and Australia. Its non-work value is almost double the work time value recommended by NZTA. While it may be argued that air travellers value their time more highly than surface transport users, there is no empirical basis for choosing such high values of time in New Zealand.

Table 3 Changes to the value of travel time

	Value of non-work time NZ$/hr	Value of work time NZ$/hr	Net benefit PV$ m	Benefit cost ratio
Sapere analysis	57.02	81.03	**2,090.386**	1.71
Adjusted for income differences	40.74	57.92	**1,860.544**	1.63
NZTA values	9.80	33.87	**1,373.215**	1.46

Source: NZIER

3.3. Lost expenditure of outbound New Zealand residents

Just as direct long haul flights into Wellington could attract more overseas tourists to spend time and money in New Zealand, it could also enable more New Zealanders to take trips overseas. While Sapere's analysis estimates a generalised cost saving for existing New Zealand resident passengers and a value of new air services for new passengers, **the money that New Zealand tourists spend overseas is not included in the analysis**. In economic accounting terms it is an import of tourism services and a cost on the economy.[5]

To include this item in the cost benefit analysis it would be necessary to know how much is spent other than on airfares by the new outbound tourists and what that money would have otherwise been spent on.

New Zealand statistics are opaque on the spending patterns of New Zealanders overseas, apart from broad categories collected for balance of payments. There are no readily available details on where New Zealanders go, how long for and what they spend. It might be assumed that new overseas trips would displace domestic holidays in New Zealand, but the domestic tourism survey, before it was discontinued in 2012,

[5] Outbound New Zealand tourists will obtain consumer surplus whether they spend $1,000 on imports or on domestic tourism, but imported services provide no economic surplus for domestic suppliers in New Zealand.

indicated that a lot of domestic tourism was for relatively short stay trips and relatively low expenditure. Overseas travel would typically cost more on a per person per day basis, drawing more money out of the New Zealand economy.

In the absence of a reliable basis of estimating this item, we do not quantify it, but note that **a potentially significant cost item has been excluded from the analysis**.

3.4. Treatment of fixed capital costs

While the Sapere report suggests the runway extension would entail increased operating costs with a present value of $39.9 m on aircraft services and $30.1 m of passenger services [Table 11 p 40], it is not clear whether these figures include repair, maintenance and renewal of the new facilities, particularly the runway extension which is engineered as a "fatigue structure" that deteriorates with use and is exposed to whatever the sea throws at it.

At the workshop at Wellington Airport on 30 November 2015 the consultants were asked about this and replied that maintenance was not included and was not a significant item.

The Sapere report [p40-41] is incorrect to claim that analysis with the real discount rate covers the economic depreciation in the value of the asset from factors such as physical wear and tear: the discount rate covers only the recovery of initial investment plus a rate of return. Physical deterioration in the asset needs to be accounted for separately through on-going maintenance and renewal of the asset over its lifetime to sustain its constant capability, otherwise it becomes a wasting asset that loses value.

As these items do not include the costs of infrastructure maintenance and renewal, their omission from the analysis understates project costs.

3.5. Traffic forecasts

As around half the net benefit of the CBA is derived from additional spending by foreign visitors arriving in Wellington, air traffic forecasts are a major driver of the results. NZIER (January 2016) has already provided a review of the forecasts by InterVISTAS on which the Sapere CBA relies.

That review found that:

- Forecasts for China and Other Asia sources **do not account for the future decline in income growth predicted by OECD and other forecasters**, and hence provide rather bullish traffic forecasts
- Using InterVISTAS' demand equations with OECD input data suggests **demand for China and Other Asia is more likely to be consistent with the Low scenario** than the Medium scenario in the analysis
- The airline economics that might support long-haul routes from Wellington to multiple overseas destinations are unclear from the information provided in the InterVISTAS forecasts – in particular the impact of fare changes on demand are not clear in the forecast reports.

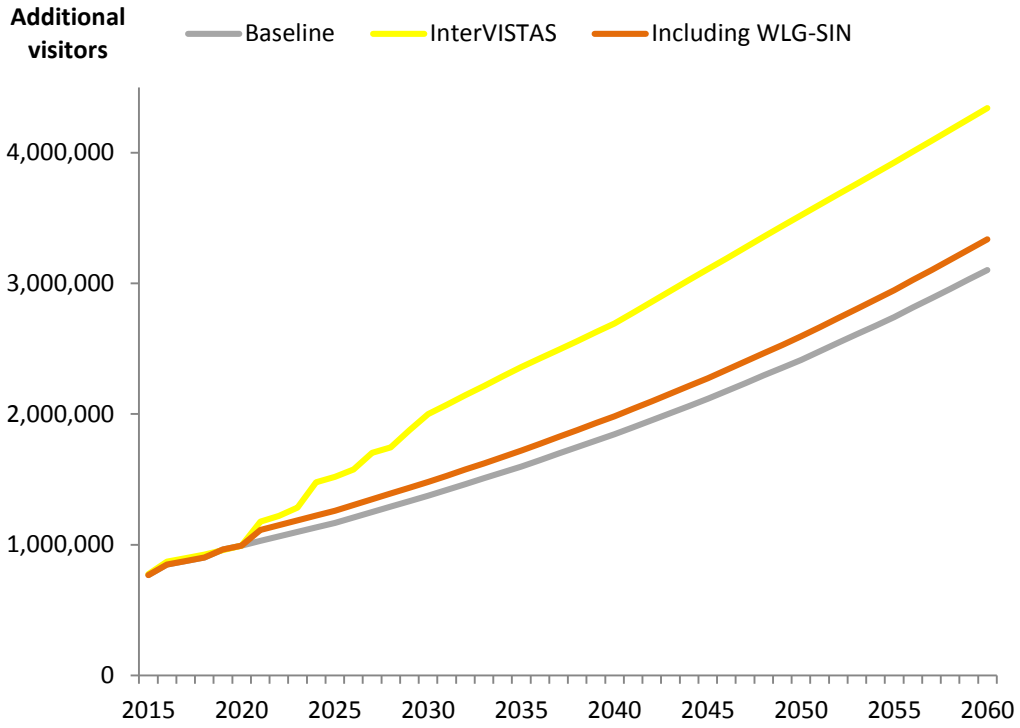
Overall the forecasts appear optimistic on the likelihood of new airlines establishing regular long haul services into Wellington and the volume of new traffic to be expected.

Flight frequency to long haul destinations is likely to be critical to user uptake and route viability: balancing the cost and convenience of cutting out internal connections to Auckland gateway against the inconvenience of fewer flights each week departing Wellington for long haul destinations.

A critical issue is whether Wellington would generate sufficient demand for the new long haul routes to sustain the frequency of flights needed to make the new services viable for their operators. Whereas Auckland is strategically placed to channel visitors to established tourist destinations in the geothermal areas and Northland, and Christchurch is a natural gateway to the scenic attractions of the South Island, Wellington has a rather constrained hinterland and less international attraction outside the city.

The NZIER review of the forecasts concluded that by 2060 there may be an increment of 250,000 from the runway extension, a million fewer international visitors than forecast by InterVISTAS.[6] That implies **InterVISTAS forecasts are 5 times larger than the NZIER assessment**, with effects on results explained in the next section.

Figure 1 Our assessment suggests far fewer additional passengers



Source: InterVISTAS, NZIER

[6] NZIER's review of demand forecasts assesses incremental addition of 250,000 passengers by 2060, whereas InterVISTAS forecasts 1.25 million, so the NZIER assessment is for growth at 20% of the rate forecast by InterVISTAS.

4. Interpretation

The Sapere report presents some big numbers, but it is useful to see how the results change with changes in the input assumptions discussed above. Table 4 presents Sapere's results using 7% discount rate and 43 year time period, and how that changes with the assumptions used (see Appendix C for changes made).

Table 4 shows Sapere's basic results in its left hand columns, then in the middle shows the effect of making adjustments to the results. These adjust the supply cost of goods to new visitors by the lower labour cost (set at the average wage), and adjust the value of time in the generalised costs by the NZTA values.

The net effect is to halve the net benefit of the analysis and reduce the benefit cost ratio from 1.71 to 1.27.

The right hand columns show the effect of reducing traffic forecasts to 20% those of the InterVISTAS reports, superimposed on the adjustments already made. A lot more items in the analysis are affected by this reduction in new traffic. The **overall effect is to produce a negative net benefit and a benefit cost ratio of 0.92**. This is very close to the break-even level, which on this analysis would occur with forecast traffic at 23% of the level of InterVISTAS.

These are relatively crude adjustments and do not go into detail of effects on particular markets, but they do indicate that using the approach in the Sapere analysis and some changes in key assumptions, the results are substantially different.

Distributional matters

Although not designed to show detailed results of who gains and who loses, the Sapere analysis does indicate broad distribution of effects.

Airports would bear higher costs than they recover (principally because of the cost of the runway extension and some loss of custom at other airports), existing airlines may make a small gain (from supposed operational efficiencies in achieving higher load factors on some flights), but the biggest benefits accrue to air service users and the wider economy mostly through additional tourism. Wellington Airport would not recover its costs despite achieving a wide margin on its supply of additional services.

Users of airline services appear to gain from this, but these results are problematic because of the same generalised cost figures appearing on cost and benefit sides of the table. The wider economy would appear to gain about $85 million a year, but if this were to properly account for labour costs and depreciation, that would fall by $45 - $55 million a year depending on the assumed opportunity cost of labour.

The Sapere report justifies use of the ratio of net benefits over capital cost by stating that it is inappropriate to dilute the capital return estimation with non-capital items [p82]. There can be a case for treating on-going costs as negative benefits in a net benefit figure when optimising the return from a fixed capital budget – e.g. comparing runway options 1 and 3, or the allocation of a fixed transport budget as in the references given by Sapere – but not when considering the overall return of a project. What Sapere call the "simple" BCR is more appropriate in reflecting the full cost of a project and is endorsed by OECD and other authorities.

Table 4 Costs and benefits with changing assumptions

Present values after discounting at 7% over 43 years

	Sapere original		*Input adjustments*		*Forecast changes*	
	Costs *PV$ m*	**Benefits** *PV$ m*	**Costs** *PV$ m*	**Benefits** *PV$ m*	**Costs** *PV$ m*	**Benefits** *PV$ m*
Airports						
Cost of extending Wellington runway and Code E gates	306.893		306.893		306.893	
Supply of additional aircraft services at Wellington	39.896	166.235	39.896	166.235	7.979	33.247
Supply of additional passenger services at Wellington	30.791	128.234	30.791	128.234	6.158	25.647
Residual value of runway extension		19.296		19.296		19.296
Residual value of Code E gates		2.887		2.887		2.887
Other airports in New Zealand (flight adjustments)						
Value of airport services no longer used by diverted flights (net of supply cost savings)	18.109	4.346	18.109	4.346	3.622	0.869
Supply of additional airport services	7.534	31.393	7.534	31.393	1.507	6.279
Total incremental economic costs and benefits for airports	**403.223**	**352.391**	**403.223**	**352.391**	**326.159**	**88.225**
New Zealand Airlines supplying additional services at WIA:		**5.742**		**5.742**		**5.742**
Users of airline services						
Generalised cost of additional passenger services used by outbound residents	778.663	922.928	778.663	411.637	155.733	82.327
Exchange value of additional passenger services used by outbound residents		778.663		778.663		155.733
Consumer surplus derived from additional passenger airline services used		73.140		73.140		14.628
Reductions in generalised costs of travel for existing airfreight users		2.876		2.876		0.575
Generalised cost of using additional airfreight services	523.036	523.036	523.036	523.036	104.607	104.607
Total incremental economic costs and benefits for users of airline services	**1,301.699**	**2,300.643**	**1,301.699**	**1,789.352**	**260.340**	**357.870**
Wider New Zealand community						
Value of additional goods and services supplied by New Zealand firms	1,195.120	2,209.020	1,806.557	2,209.020	361.311	441.804
Lost value by NZ from New Zealanders' additional overseas spending	?		?		?	
Additional GST revenue collected on sales of goods and services		183.977		183.977		36.768
Deadwweight cost of using tax revenue to fund capital costs of extended runway	61.379		61.379		61.379	
Total incremental economic costs and benefits for wider New Zealand community	**1,256.499**	**2,392.997**	**1,867.936**	**2,392.997**	**422.690**	**478.572**
Totals	**2,961.421**	**5,051.773**	**3,572.858**	**4,540.481**	**1,009.189**	**930.409**
NET INCREMENTAL ECONOMIC BENEFITS		**2,090.352**		**967.624**		**-78.780**
Benefit:Cost ratio		**1.71**		**1.27**		**0.92**
Ratio of Net benefit over Capital Cost		**6.81**		**3.15**		**-0.26**

Source: NZIER

The NBIR ratio of 6.8 is inconsistent with the rest of the table, which is predicated on tax funding and shielding of users from the full cost of benefits they receive, because it is based on the capital cost alone, excluding the deadweight cost of tax funding. If the deadweight cost is included, the ratio in Sapere's original analysis falls to 5.7.

Risks in the project

Sapere run sensitivity analyses on some input analyses and find little change in the results, but this obscures the fact that the results are not very strong. Airport extension is a risky project, involving substantial upfront costs and uncertain uptake of airlines and patronage, which should be reflected in an economic analysis by either requiring a higher BCR than 1.7 or a higher discount rate than 7%.

Commercial investors build up a required return by adding successive increments to the rate according to industry specific and other elements of risk. Treasury's recommended 7% is at the low end for infrastructure assessment, more appropriate to drains or roads with relatively predicable use patterns than airport infrastructure which is competing for traffic with other airports.

In Sapere's analysis the deadweight cost of taxation adjustment provides some allowance for risk. Private commercial interests would require a higher discount rate than 7%, given the risks and the analysis only achieves net benefits on the expectation of high traffic uptake, which may not be as high if the user beneficiaries were required to pay more of the cost towards receiving their benefits.

Appendix A Origin of inputs in Sapere report & spreadsheets

A.1 Number of additional visitors to New Zealand

The number of additional flights and visitors to New Zealand is a critical input to several components of the cost benefit analysis, including the additional goods and services supplied to non-resident visitors, the savings in generalised cost for existing passengers and freight to destinations that would be serviced by direct flights from Wellington, and the value of additional services for outbound New Zealand residents.

The Sapere worksheet calculations are based in sheet Forecast – Passengers. This draws its passenger numbers from the InterVISTAS Most Likely Forecast Summaries spreadsheet (October 2015), specifically the difference between the Enplaned/Deplaned numbers for each year in sheet ED Forecast (Runway) and sheet ED Forecast (Constrained). These forecasts allow for reduction in passengers on domestic flights connecting to long haul flights at existing international gateway airports, which detract from the increase in passengers on direct long-haul flights from Wellington (assuming these passengers would have otherwise used the indirect connected long haul flights).

Sourcing and cross-referencing of these numbers between the spreadsheets appears correct.

However, an earlier NZIER review of the InterVISTAS forecasts concluded they were on the optimistic side. In particular:

- Forecasts for China and Other Asia (excluding Japan) do not account for the future decline in income growth in these countries predicted by the OECD and other forecasters
- Even using InterVISTAS' demand equations combined with OECD forecasts suggests demand from China is likely to be half that forecast, and demand from Other Asian markets is likely to be consistent with the low scenario rather than the central baseline forecast
- The result is that new demand from these key Asian markets is overstated.

A.2 Additional goods & services supplied to non-resident visitors ($2.209bn, 44% of benefits)

External economic benefit to the wider community [p77] arises from:

- Incremental environmental benefit arising from the airport extension (not quantified in Sapere CBA)
- Incremental economic value of non-aviation goods and services supplied by New Zealand businesses to non-resident visitors
- Value of real options created for the wider community (not quantified)

- Benefit of reducing barriers to increased competition (not quantified)

Sapere's Table 28 shows a quantified estimate of the present value of the second bullet only, plus the GST split out from that total (as a "return" to government rather than businesses). The estimation method is described generally on p79, but without showing unit values (other than table 16's unit spending per trip by source) or volumes on which the estimates are made.

This item needs to be viewed in conjunction with the costs of supplying additional goods and services to new visitors, as together they give the net benefit of these visitors for New Zealand.

A.3 Costs of supplying additional goods and services to tourists ($1.195 bn, 40% of costs)

Sapere's pages 57-58 describe an estimation of costs of meeting tourist demands based on domestic value added, referring to the Tourism Satellite Account [TSA] to suggest tourism value added is 45.5% of total tourism demand and intermediate consumption of input costs is 54.5%.

The cost of additional goods and services to new tourists is estimated as the proportion of expenditure by non-resident visitors each year that comprises intermediate expenditure (1-GDP share) multiplied by the total spending non-residents are forecast to make in New Zealand. However, the resulting estimate is of tourism value added which is not an appropriate measure of the economic welfare benefits needed for CBA, because it includes cost items like Fixed Capital Consumption (covering economic depreciation that only maintains the country's position rather than leaves it better off).

It appears that Fixed Capital Consumption (FCC) and the opportunity cost of labour in tourism-supply activity are excluded from the costs in the CBA, understating the resource cost of supplying new demand. Appendix B explains the national economic accounting principles behind adjustments to correct this.

Assuming FCC accurately represents economic depreciation – the cost of repairs and renewals necessary to maintain the capacity of the airport runway extension to provide its new services – FCC should be included in the ratio of costs to Gross Output.

So too should Employee Compensation, assuming this represents the opportunity cost of labour in meeting new tourist demands. The TSA shows average compensation per employee in the sector exceeds the average earnings across New Zealand, suggesting employees in tourism on average may earn an economic rent over alternative employment.

Accordingly Sapere's cost:Gross Output ratio could be adjusted either:

- by deducting the full employee compensation, which would assume the rent for labour is negligible (i.e. tourism labour in its next best alternative would earn just as much as in tourism, which is not implausible given some people are drawn to tourism work because of lifestyle factors other than monetary return); or

- by deducting the value of employee time in the tourism sector valued at the national average wage, assuming the average is the opportunity cost of labour if it were not engaged in tourism.

The first, deducting full employee compensation, results in a bigger increase in cost: Gross Output ratio and a smaller net benefit from additional tourism spending. The second results in a smaller increase in the ratio and a larger net benefit, but it implies a relatively large economic rent from a sector known to include a large number of low earning employees, so the "true" adjustment may lie between these two extremes. Either way, however, Sapere's estimate of net benefit from new visitors' spending is miscalculated and over-stated to a significant extent.

Sapere's estimates can be adjusted by taking out labour and fixed capital consumption costs using proportions for appropriate sectors from the tourism satellite account (for employment) and from the national input output tables for FCC (which is not separated in the TSA). Adjusting the estimate on the assumption that labour does earn a producer surplus (by estimating the labour cost from the labour numbers in the TSA at the average national earnings), labour cost share of value added would be 42%, reducing Sapere's net benefit from new visitor spending from just over $1 billion to $402 million in present value terms over 40 years. Using employee compensation dollar values from the TSA the labour cost share would be 53%, not 42% of value added, and the adjusted benefit would be about PV$284 million.

A.4 Reducing the generalised cost of airline services to existing outbound residents ($0.922bn, 18% of benefits)

Generalised cost that can be reduced from the counterfactual [p8] arises from:

- Higher airfares and freight charges because of lower efficiency of smaller aircraft
- Additional airfares and freight charges on domestic flights connecting to international airports for passengers and exporters
- Opportunity cost of additional time spent waiting for and travelling on connections for long-haul flights

The estimate is set out in Sapere's Table 20 [p67] with no detailed explanation of how it has been made (or how the value of time is factored into the estimate).

From the spreadsheet Benefits for Existing Users, this benefit is built up from:

- Benefits for existing business users of PV$111m over 40 years
- Benefits for existing non-business users of PV$811m over 40 years

This is based on assumptions that

- 80% of passengers between origin and destination will fly direct
- The proportion of passengers who are tourists varies between 84% and 93% depending on route
- Reduction in generalised cost per trip comprises
  - Assumed market price of domestic connection flight per passenger

- Reduction in travel time valued at opportunity cost

Page 68-69 notes the opportunity cost of passenger time derived from Australian studies translates to NZ$53.60 /hour for non-business and $76.20/hour for business passengers, but these are high for an opportunity cost compared to New Zealand's median hourly earnings in the region of $23/hour for males and $20/hour for females. For NZTA the opportunity cost of time is based on the wage rate or a fraction of it (for non-working time) and these range from $28.54-$33.87 for work time travel and from $4.33-$9.80 for non-work (leisure) travel (July 2014 NZ dollars). The report's unit values could inflate the travel value component by double or more - though it is hard to tell how much from the report. Reductions in generalised freight costs are trivial compared to generalised passenger costs, suggesting individual's time value assumption is crucial.

Sapere's travel time figures are sourced from standard value guidelines from the Australian Civil Aviation Safety Authority, which in turn quote figures from European Eurocontrol source. CASA has updated Eurocontrol's figures and converted them to Australian dollars with purchasing power parity exchange rates. Sapere has done the same to bring figures up to 2015 values (Sheet – Assumptions Costs rows 80-90).

While there is an argument that the value of travel time savings for air travel will be higher than for surface transport (because people can be observed to be willing to pay more for the higher speed of air travel than for surface transport – although not always) meta-analyses of studies of willingness to pay for non-market attributes of travel, like time saving and safety, show that income is a major determinant of value across countries, and a factor that should be adjusted in translating figures across countries. Neither CASA nor Sapere make any adjustment for income differences between countries, with the result that their estimates are likely to be overstated with respect to New Zealand values.

In purchasing power parity terms, the New Zealand GDP/head is currently at about 0.76 the value of the Australian level. If Sapere's time values were adjusted for differences in income (as well as price through the PPP adjustment) the figures would become NZ$40.74 /hour for non-business and NZ$57.92/hour for business travel time. This is still higher than the corresponding values for surface transport, but is 24% less than the values used in Sapere's report.

A.5 Exchange value of additional services for outbound residents ($0.778bn, 15% of benefits)

Value in exchange is described in Sapere's page 70 as "what users had to pay for additional airline services, which is equal to the generalised cost of using those additional services multiplied by the quantity of these additional airline services used, plus the additional value that users derive from additional airline serves they use that exceeds what they actually paid (i.e. the additional consumer suplurs)". This is predicated on the runway extension services reducing the costs of travel, increasing travel to and from Wellington by both outbound New Zealanders and in-bound non-resident visitors (although correctly do not quantify the latter as outside the scope of a national CBA).

This is calculated as the market price of passenger services (a nominal international airfare in 2015 NZ dollars) times the forecast passengers to each destination country;

calculated for each country over time and summed across countries. Refer to worksheet Value in use of additional services, cell H44, for formula trail, drawing off Assumptions benefits sheet for airfares and Forecast passengers sheet for volumes. This calculation includes the value of travel time for each group of passengers, so is effectively a generalised cost. It is calculated as exactly the same as the generalised cost that passengers would incur to use additional passenger airline services, so appears on both costs and benefits sides of the ledger and cancels out in the analysis.

A.6 Exchange value of additional passenger services used by freight users ($0.523bn, 10% of costs)

As for the exchange value of outbound residents, this is calculated as a market price for airfreight times the airfreight volume changes from the sheet Forecast changes in air freight.

A.7 Consumer surplus from additional airline services used

In spreadsheet Value in use of additional services, this figure of PV$73.1 million over 40 years consists of $66.1 million for non-business passengers and $7.0 million for business passengers. The formula for each group of passengers (business and non-business) comprises:

0.5
x Proportion of passengers who are tourists
x reduction in generalised cost for existing users
x additional outbound passengers

In other words it is using the change in volume of resident passengers times proportion of new passengers who are tourists (or not in the case of business travellers) times reduction in generalised cost (fare savings and time value) times a half to estimate the Harberger triangle in a supply and demand diagram.

A.8 Generalised cost of additional passenger services to outbound residents ($0.778bn, 26% of costs) and of additional freight services ($0.523bn, 18% of costs)

Page 51 states that Option 1 "could be expected to reduce the economic costs of supplying airport and airline services at Wellington airport, thereby reducing the generalised costs of existing airline services to users", but if generalised cost is based on changes in fares or freight charge that is simply a transfer from consumers to cover the real resource costs incurred by airport/airlines i.e. the real resource effects are incurred once and passed down the pricing chain, not counted at each level. If airline savings are not passed on to passengers there may be savings in both categories, but it is not explained in the report how that potential split has been handled.

The generalised cost of additional passenger services is sourced in the spreadsheet Value in Use of Additional Services, cell H44. This is the same figure, and cell, as the calculation of exchange value of additional services for outbound residents. The two totals thus cancel each other out in the cost benefit analysis. Also, as the H44 is

simply the calculation of passenger numbers times airfares, it's not clear why this should be regarded as a generalised cost of travel, which includes travel time costs as well as fare levels.

The same issue arises with the generalised cost of additional freight usage. It is sourced from the Value in Use of Additional Services, cell H75, the same cell as is used to source the Exchange Value of additional freight services. These cost and benefit items cancel each other out for reasons that are unclear.

The Sapere report on page 52 (bottom paragraph) describes the generalised cost of additional services used by existing users of Wellington Airport that increase their use, and new users of airline services at Wellington Airport, as being "conservatively estimated as being equal to the average market prices charged by airlines for those passenger services". Further it notes that actual generalised cost incurred by passengers will exceed market prices by an amount equal to the value of any remaining opportunity cost of time spent travelling. On page 53 similar reasoning is used to explain the "conservative" estimation of generalised costs of airfreight users.

Thus this part of Sapere's cost benefit analysis systematically understates the costs of this item by using a market price as if it is a generalised cost, ensuring costs and benefits will cancel out. However, the generalised cost will consist of airfares plus some time cost, which on the current calculation method would lead to a net cost on these items. As generalised cost savings have been counted as benefits for existing passengers, it would be consistent to count generalised cost impositions on new users.

A.9 Correct accounting for runway repairs and maintenance

The runway extension would entail increased operating costs with a present value of $39.9 m on aircraft services and $30.1 m of passenger services [Table 11 p 40]. It is not clear whether these figures include repair, maintenance and renewal of the new facilities, particularly the airport extension which is engineered as a "fatigue structure" that deteriorates with use and is exposed to whatever the sea throws at it.

The Sapere report [p40-41] is incorrect to claim that analysis with the real discount rate covers the economic depreciation in the value of the asset from factors such as physical wear and tear: the discount rate covers only the recovery of initial investment plus a rate of return, and physical deterioration in the asset needs to be accounted for separately through on-going maintenance and renewal of the asset over its lifetime to sustain its constant capability.

The Sapere analysis includes residual values for runway extension and gates, which implies they have been maintained in a constant condition. The question is whether the $39.9 million is enough to cover runway maintenance and renewal as well as other airline services provided by the airport. The omission of maintenance and renewal from the analysis could be potentially significant.

Appendix B The value of new tourism activity

The Sapere draft report identifies a significant economic gain from the spending of new tourists in New Zealand using the services enabled by an extended runway. In its central scenario for Option 1, the report estimates new spending with a present value of $2.209 billion over the 40 year analysis period, nearly 44% of the total estimated incremental benefit of the runway extension.

It also estimates the costs of supplying this new demand to have a present value of $1.195 billion, about 40% of the total incremental cost. The net gain from new visitors has a present value of $1.014 billion, accounting for 49% of the overall net benefit from the analysis.

The value of new visitors is driven by the expectation of new flight patterns with the runway extension, which is open to debate. Apart from this the estimates are incomplete.

The estimate of benefit is made by multiplying the number of new inbound visitors from each origin for each year by an average expenditure in New Zealand specific to each country of origin, to obtain an aggregate expenditure or output for the new tourism. The cost of supply is estimated using the ratio of intermediate consumption to output for tourism as derived from Statistics New Zealand's Tourism Satellite Account (TSA). This means the cost of supply omits the opportunity cost of labour and of fixed capital depreciation and is understated.

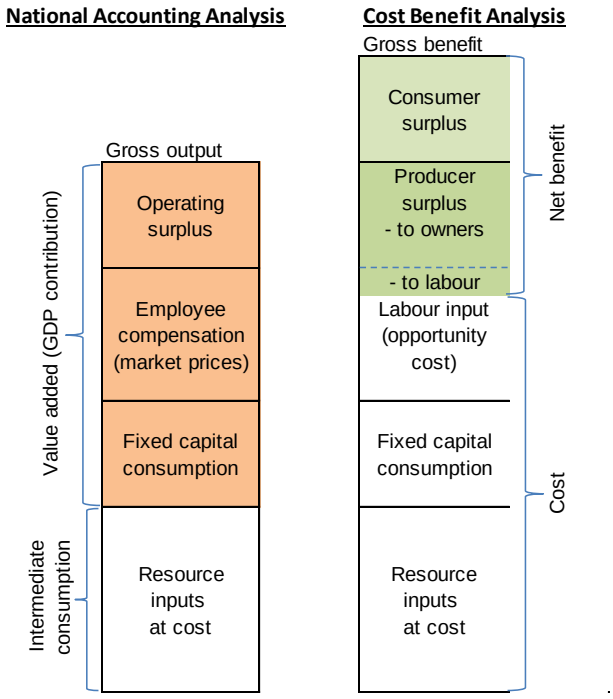
To see why, it is necessary to understand the differences between the national accounting framework on which the TSA is based, and the approach of cost benefit analysis with its focus on identifying the economic surplus from a project or proposal. In Figure 2 below, the left hand columns represent the national accounting approach, in which value added (or contribution to GDP) can be calculated as the difference between gross output and the intermediate consumption of inputs used in producing that output (the production approach); alternatively as the sum of incomes to different factors in that production, in particular producers/owners (operating surplus), labour (compensation of employees), physical capital depreciation (fixed capital consumption) and government (indirect taxes less any subsidies paid out).

A cost benefit analysis also measures the output of a new activity, but needs to net off all the resource inputs used in creating that output, valued at their opportunity cost. The main components of benefits are the economic surpluses that accrue to producers and to consumers from a new project, relative to what would occur in its absence.

There is a close correspondence between operating surplus in national accounting data and the producer surplus estimated in CBA, and in some circumstances there can be additional producer surplus accruing to labour if it earns more than it would otherwise do. But aside from that employee compensation and fixed capital consumption are costs deductible from the benefits of the project.

In the case of the runway extension, the TSA (Table 22) identifies the employee compensation as comprising 53% of tourism value added, or 41% if valuing labour at the national average wage, counting compensation above this as producer surplus. TSA does not record fixed capital consumption, but the FCC share of value added for each tourist-characteristic or tourist-related sector in the national input output tables can be used as a proxy to provide an estimate of this cost for the CBA. These figures represent additional costs of supply not covered in the Sapere analysis.

Figure 2 Cost benefit analysis and national accounting



Source: NZIER

Making such adjustments to Sapere's estimates would reduce the net benefit from about $1 billion to $402 million in present value terms, as shown in Table 5. This would lower Sapere's benefit cost ratio from 1.7 to 1.4, other things held constant.

Table 5 Adjusting estimates for labour and capital consumption costs

New Zealand firms supplying additional goods & services to overseas visitors

		VA share	*PV$ m*
Gross Output	Value of additional goods and services supplied		2,209.054
Intermed Cons	Cost of supplying additional goods and services		1,195.120
Value Added	Net additional benefit per Sapere report		1,013.934
LESS	Employee Compensation (Labour cost)	52.8%	535.745
	Subtotal		478.189
LESS	Fixed Capital Consumption	19.1%	193.282
	Net benefit of added overseas visitors	**28.1%**	**284.906**

Source: NZIER, drawing from Statistics NZ TSA, Input Output table and Income Survey

Appendix C Summary of adjustments in Table 4

Table 4 applies the adjustments described in Tables 2, 3, and 5 to the Sapere's results as summarised in Table 1 of this review (middle columns). It then applies changed forecast passenger assumptions to the adjusted results to illustrate how the results of Sapere's analysis could differ under alternative expectations.

Value of additional goods and services to new visitors to New Zealand

This adjustment is made by changing the ratio of input costs applied to the value of additional sales, to include costs of labour and fixed capital consumption. The adjustment process is described in Appendix B. The adjustment assumes the labour cost is the national average wage applied to labour in the tourism-related sectors as a conservative adjustment which is smaller than the alternative of assuming the opportunity cost is equal to the full employee compensation in those sectors.

Generalised cost of additional services for outbound residents

We have replicated Sapere's spreadsheets to calculate the generalised cost of additional services for outbound New Zealand residents, in order to test alternative values for travel time for business and non-business travellers. Two substitutions have been made: Sapere's value of time figures adjusted by the ratio of Australian and New Zealand per capita GDP, and NZTA's values for work and non-work time.

Table 4 presents results using the NZTA values. As the adjustments only affect the time value component, there is no change to GST with these adjustments.

Changes in traveller forecasts

We have replicated Sapere's spreadsheets that calculate the values of additional inbound international passengers by origin/destination to estimate expenditures of new overseas visitors and additional passengers embarking and disembarking (international) to estimate effects on generalised cost for outbound residents.

In line with the NZIER review of demand forecasts (2016) which suggests a million fewer international origin/destination visitors by 2060 and an increment of 250,000 from the runway extension at that date, we assume only 20% of the demand materialises for these two items in the analysis. Table 4's right hand columns include the effect of both adjustments to input variables and the reduction in forecast traffic.

We also reduce to 20% other items that are most variable with passenger traffic, including airports' supply of additional aircraft and passenger services, the consumers' surplus from additional airline services used, and the additional GST collected on sales of goods and services.

Summary results

For each of the three variants, Table 4 sums the costs and benefits and calculates the net incremental economic benefit, the benefit cost ratio, and the ratio of net benefit to capital cost, to compare with Sapere's original "most likely" estimates.