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Evidence review of elasticities relevant to a visitor levy in Wales

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Glossary

Acronym/Key word	Definition
PED	<p>The price elasticity of demand (PED) measures the responsiveness of the demand for a good or service when its price changes. It is defined as the percentage change in quantity demanded divided by the percentage change in price. A PED of (-0.5) would therefore imply that a 1 per cent increase in the price of a good or service leads to a 0.5 per cent reduction in demand.</p> <p>A negative value for PED denotes a decrease in quantity demanded when price increases, and vice versa. Additionally, when the absolute value of the PED is larger than 1, the percentage change in demand is larger than the percentage change in price (elastic demand). An absolute value smaller than one denotes inelastic demand.</p>
YED	<p>The income elasticity of demand (YED) for tourism measures the responsiveness of (outbound or inbound) tourism demand to the changes in the income of visitors. YED is the percentage change in quantity demanded divided by the percentage change in income. A YED of 0.5 would therefore imply that a 1 per cent increase in income leads to a 0.5 per cent increase in demand.</p> <p>A positive YED exists for goods that are called “normal” meaning the demand would increase when the income increases. Normal goods can be “necessities” or “luxury goods”. Necessities have an inelastic demand and YED values between 0 and 1, while luxury goods exhibit elastic demand and YED values larger than 1. For goods with negative YED, the demand decreases when income increases, and they are called “inferior goods”.</p>

<p>XED</p>	<p>The cross-price elasticity of demand (XED) measures the change in the quantity demanded for a good in response to the change in another's good price. For example, an XED of (-1) for two goods would imply that a 1 per cent increase in the price of Good x would reduce the demand for Good y by 1 per cent. As such XED is similar to PED, but it shows the relation between a pair of different goods or services. A negative XED denotes "complementary goods" that are usually consumed together, while a positive XED denotes "substitutes" that can be consumed interchangeably.</p> <p>A variant of XED, the Morishima elasticity of substitution (ME), as defined in Fleissig (2021a), describes the degree of substitution in demand between two sub-industries for a change in the price of a given sub-industry. A positive ME indicates that the sub-industries are substitutes, while a negative ME indicates complementarity.</p>
<p>PES</p>	<p>Price elasticity of supply (PES) measures how the quantity supplied of a good or service changes in response to its price. A positive PES denotes an increase in the quantity supplied when its price increases, and vice versa. PES values larger than 1 denote an elastic supply and values smaller than 1 an inelastic supply. A PES of 0.5 would therefore indicate that a 1 per cent rise in the price of a good or service would lead to a 0.5 per cent rise in supply.</p>

Measure	Formula	Values and interpretations
PED	$\frac{\% \text{ Change in Quantity Demanded}}{\% \text{ Change in Price}}$	<p>$PED > 1$: Elastic demand</p> <p>$PED = 1$: Unitary elastic demand</p> <p>$0 < PED < 1$: Inelastic demand</p> <p>$PED = 0$: Perfectly inelastic demand</p>
YED	$\frac{\% \text{ Change in Quantity Demanded}}{\% \text{ Change in Income}}$	<p>$YED > 0$: Normal good</p> <p>$YED < 0$: Inferior good</p> <p>$YED > 1$: Luxury good (income elastic)</p> <p>$1 > YED > 0$: Necessity good (income inelastic)</p>
XED	$\frac{\% \text{ Change in Quantity Demanded of Good } x}{\% \text{ Change in Price of Good } y}$	<p>$XED < 0$: Substitution effect between the two goods</p> <p>$XED = 0$: No substitution or complementarity between the two goods</p> <p>$XED > 0$: Complementarity between the two goods</p>
PES	$\frac{\% \text{ Change in Quantity Supplied}}{\% \text{ Change in Price}}$	<p>$PES > 1$: Elastic supply</p> <p>$PES = 1$: Unitary elastic demand</p> <p>$1 > PES > 0$: Inelastic supply</p> <p>$PES = 0$: Perfectly inelastic supply</p>

1. Introduction

Policy Context

- 1.1 The visitor economy is a major source of jobs and economic growth across Wales. The Welsh Government's ambition is to grow tourism for the benefit of Wales by supporting local communities in a way that is sustainable for the land and environment of Wales, developing a framework which is mutually beneficial to both visitors and citizens.
- 1.2 The 2021-2026 Programme for Government – carried out in collaboration with Plaid Cymru, as part of the Co-operation Agreement – sets out the Welsh Government's commitment to introduce legislation permitting local authorities to raise a levy on visitors to Wales.¹
- 1.3 The introduction and subsequent use of such a levy would enable local authorities to raise additional revenue to re-invest in the conditions that make tourism a success. The levy would be implemented as a local tax with the powers to raise the levy being discretionary for local authorities. This will enable decisions to be taken locally, according to the needs of Welsh communities.
- 1.4 The levy would apply to those paying to stay overnight within a local authority area. Opportunities for wider contributions on the cost impact of other types of visitor activities on local infrastructure will be offered as part of the consultation on the levy. It is intended that the levy would apply to business travellers as well as tourists and is referred to in this report as a visitor levy.

Rationale for this study

- 1.5 This study has critically reviewed the evidence for elasticities relevant to a visitor levy in Wales, including price, income, and cross-price elasticities of demand, and price elasticities of supply. The outputs from this research project will support the Welsh Government and local authorities by:
 - informing the Welsh Government's formal consultation on the proposals for a visitor levy due to be launched in the autumn of 2022.

¹ Based on the Welsh Government's updated [Programme for Government](#)

- supporting the design and development of the levy.
- assisting local authorities in their decision-making regarding the implementation of the levy.
- informing the Integrated Impact Assessment (IIA) and the Regulatory Impact Assessment (RIA) that will be published alongside the introduction of a Visitor Levy Bill into the Senedd.

1.6 The research aims to identify and assess different forms of consumer responses to the levy, to provide evidence on whether the use of levy revenues has an impact on consumer or provider behaviour, and to detect any variations in levy design on supply or demand responses. The key research questions addressed by this study are presented in detail in the Rapid Evidence Assessment (REA) protocol in Appendix A.

Report structure

1.7 The structure of the remaining report includes the following chapters:

- Chapter 2 discusses the approach to conducting this study, including the research questions, the search strategy, and the inclusion/exclusion criteria of the REA.
- Chapter 3 details the key insights acquired through implementing the REA protocol. The section is divided in sub-sections by type of elasticity, with a further sub-section summarising findings from the review of grey literature (i.e., non-academic literature).
- Chapter 4 concludes by summarising the key learnings from the REA, including the implications of the results for a visitor levy in Wales and key evidence gaps.

2. Methodology

2.1 This report presents the results of a Rapid Evidence Assessment (REA) which reviews the literature on elasticities relevant to a visitor levy in Wales. The REA approach is a commonly used research methodology which allows researchers to prioritise and review studies from a large body of sources from across the academic and grey literature, using a transparent, well-defined, and replicable approach.

2.2 This chapter sets out the features of the REA protocol, including (i) key research questions, (ii) the search strategy for literature, and (iii) the inclusion/exclusion criteria that have been used to decide if the retrieved studies are relevant to the research questions of this evidence review (as detailed below).

Developing the REA protocol

2.3 An REA protocol was developed upon commencement of this review, outlining the key objectives of the evidence review, the search strategy, inclusion and exclusion criteria, and quality assessment criteria for the literature identified. The full REA protocol be found in Appendix A of this report.

2.4 The REA protocol was designed to identify and assess relevant, high-quality evidence to address a series of research questions, with the purpose of informing the development of a visitor levy in Wales. The REA has targeted reviewing evidence to address the following topics:²

- Identifying estimates of the elasticities of supply and demand for accommodation and wider tourism.
- Understanding the factors which may cause elasticities to vary.
- Understanding how elasticities may vary depending on the population of interest.
- Identifying evidence of variations in tax or levy design on supply or demand responses.
- Identification of evidence gaps relating to the above.

² The full set of research questions is available in Appendix A.

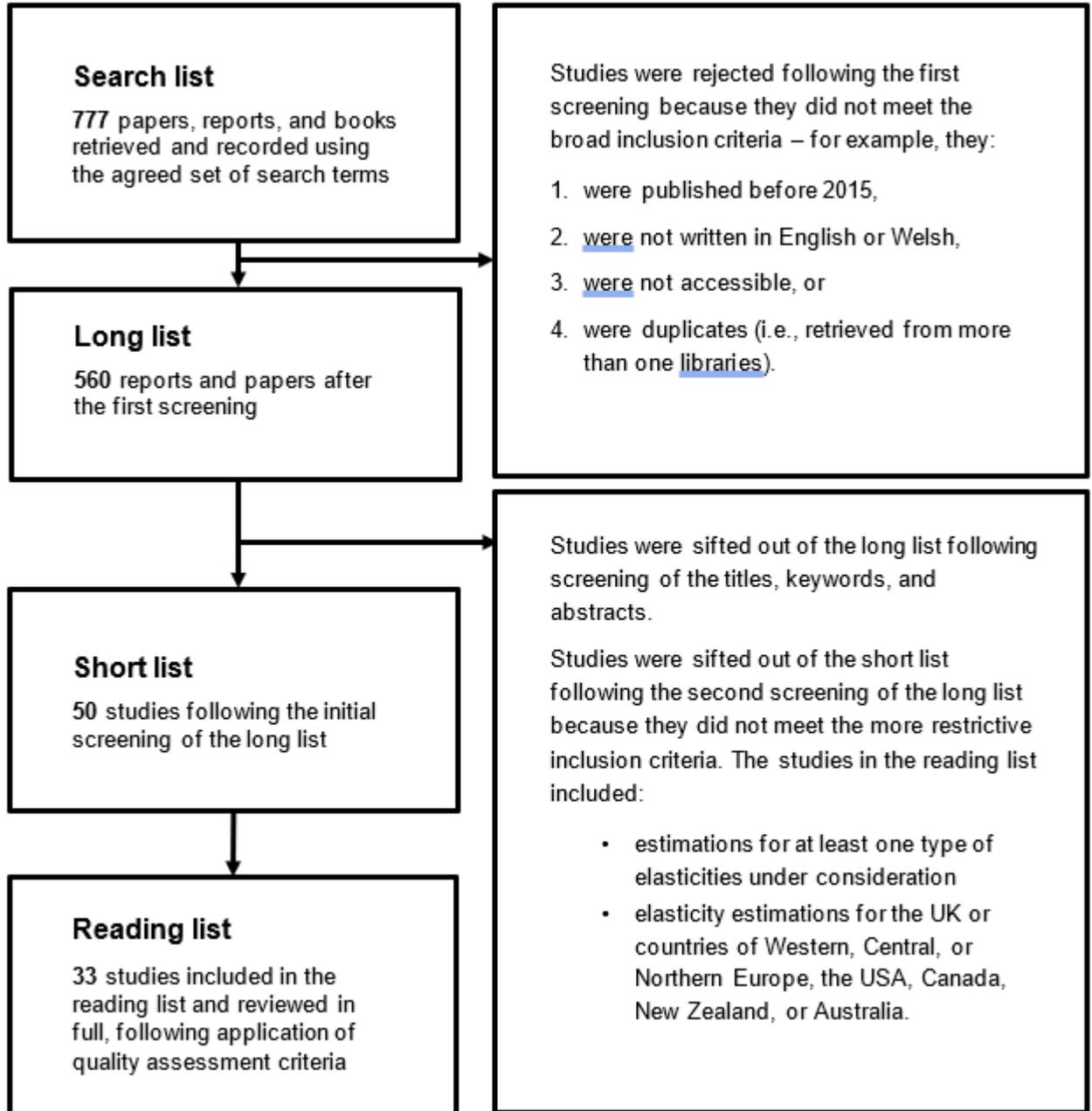
2.5 The protocol (i) outlined the inclusion criteria for the REA, defined which countries are in scope, and how recent publications needed to be for inclusion, (ii) set out the search strategy defining what search terms would be used, which databases were to be searched, and how records were to be kept, and (iii) defined the relevance and quality scoring used to judge the evidence's quality. The databases and online libraries that were searched included JSTOR, Science Direct, SAGE, RePEc IDEAS, Google scholar, and RePEc EconPapers.

REA protocol implementation

2.6 The implementation of the search strategy yielded an initial "search list" of 777 academic papers, reports, and books. To reach the final "reading list" of papers read in detail, the procedure described in Table 1 was followed.

2.7 The findings of the reading list studies were summarised in a Research Extraction Sheet (RES). Apart from the studies' title, authors, and publication year, the RES was filled with information on the type of elasticities measured in each study, the country or region of focus, the methodological approach, a summary of the key findings, and the extracted estimates of the examined elasticities. Finally, a quality scoring system was applied assessing each study in terms of credibility, methodological approach, and relevance to the project's objectives.

Figure 1: REA protocol implementation



Synthesis of key findings

2.8 The final stage of the REA involved synthesising key findings extracted from the literature review. This output is the present report that summarises the most useful insights and explicitly discusses the strengths and limitations of the evidence that was identified. The reviewed evidence was critically appraised for overall consistency, with evidence gaps identified, and the acquired insights were used to reach informed conclusions on elasticities relevant to a visitor levy in Wales.

Challenges and limitations

- 2.9 The evidence reviewed in this REA exhibited numerous limitations which made the drawing of firm conclusions on the likely size of elasticities relevant to a visitor levy in Wales challenging.
- 2.10 Studies varied across many facets including (but not limited to):
- Methodological approaches – studies spanned a range of quantitative methodologies, each using a unique set of assumptions. A key challenge faced by researchers was isolating the impact of key parameters – including prices and income levels – on tourism demand, given the range of potentially distorting factors which can also prove to be influential. The methodologies reviewed in this REA sought to address this challenge with varying levels of analytical rigour, with the quality assessment criteria adopted in the REA prioritising the studies judged to be most methodologically robust.
 - Definitions of key parameters – an inconsistent range of different measures were used across studies to estimate elasticities, with different definitions and sources of data used for key parameters such as tourism demand (for example, number of visitors, tourist expenditure), income, and prices. For expenditure, the precise nature of the tourist expenditure measured was often ambiguous.
 - Data sources – studies used a wide array of data spanning different time periods, jurisdictions of interest, and types (e.g., macroeconomic, longitudinal surveys etc).
- 2.11 The variation in approaches taken within the evidence base to estimate elasticities made the comparisons of results on a like-for-like basis challenging. Ultimately, this limited the ability of this study to identify clear trends in elasticity estimates across enquiries of interest (e.g., it was generally not possible to make reasonable comparisons of elasticity estimates across multiple studies for different types of jurisdiction or visitors of varying income levels). Nonetheless, some level of comparison could be made where individual studies provided multiple estimates.
- 2.12 In the absence of any evidence for elasticities in the context of Wales, the REA drew on evidence from jurisdictions that were deemed comparable, although there

is no guarantee that these results can be generalised to the context of a visitor levy in Wales.

- 2.13 Overall, despite the REA prioritising the most methodologically robust studies, it is recommended that the estimates and conclusions drawn from the findings included in this study are treated with a level of caution, given the inherent uncertainty in the true size of each elasticity and the unclear extent to which the findings are generalisable to the context of a visitor levy in Wales.

3. Findings

Price elasticities of demand

- 3.1 The price elasticity of demand (PED) measures the responsiveness of the demand for a good or service when its price changes. It is defined as the percentage change in quantity demanded divided by the percentage change in price. A PED of -0.5 would therefore imply that a 1 per cent increase in the price of a good or service leads to a 0.5 per cent reduction in demand. A negative sign for PED denotes a decrease in quantity demanded when price increases, and vice versa. Additionally, when the absolute value of the PED is larger than 1, the percentage change in demand is larger than the percentage change in price (elastic demand). An absolute value smaller than one denotes inelastic demand.
- 3.2 Of the 33 short-listed and examined papers, 21 included estimates relating to the PED for inbound tourism and 3 included PED estimates for outbound tourism in their regions of focus. Some studies focused on specific countries and groups of countries, whereas others were focused on specific features within countries (e.g., forests, rivers etc.) that attract tourists. A variety of methodological approaches were used to estimate elasticities, ranging from surveys to extensive empirical analyses, with the majority being some type of regression analysis or models driven by empirical data. A small number of studies took into consideration greater groups of countries, collating estimates from across many countries; these included a systematic review and a meta-analysis. The average of the mid-range estimates from the studies reviewed was -0.9, which would imply that tourism demand is slightly inelastic.
- 3.3 The meta-analysis of Peng et al. (2015) was a prominent source of estimates relating to the PED for international tourism. The study synthesised estimates from across 195 sources published during the last five decades and is widely referenced in the literature that has been reviewed. The authors found that the factors influencing the magnitude of PED estimates included (i) the visitors' country of origin, (ii) the destination, (iii) the time period of travel, (iv) the method used to estimate the elasticity, (v) the frequency of data and sample size. For European destinations, the average PED for inbound tourism was found to range between (-

1.37)³ and (-0.75) depending on the source of the visitor,⁴ while the overall PED for international tourism was estimated at (-1.28).

- 3.4 Peng et al. (2015) also found that estimates of PED depend on the type of tourism (e.g., business, leisure etc.) and that different tourism goods and services (e.g., accommodation and transportation) can exhibit different elasticities. The study estimated an average PED for tourist accommodation of (-0.73), implying that demand for accommodation from international tourists has a relatively low responsiveness to changes in price compared with other forms of tourist expenditure.
- 3.5 Martins, Gan and Ferreira-Lopes (2017) conducted an empirical study analysing data from 218 countries to estimate the influence of macroeconomic factors on the international demand for tourism. The study used three econometric model specifications, each using different measures for calculating tourism demand (i.e., tourist arrivals, real expenditures per arrival, and real expenditures per GDP), finding that factors which decrease relative prices (i.e., a depreciation of the national currency or a decline of relative domestic prices relative to abroad) increase the demand for tourism. The value of PED was found to vary depending on the measure used for tourism demand, with values ranging between (-0.33) and (-0.08) and demand being most responsive to price when measuring demand using tourist arrivals.
- 3.6 In an empirical study analysing data from a wide range of 191 countries around the world, Rosselló-Nadal and HE (2020) used (i) international tourist arrivals, (ii) tourist expenditures, and (iii) average expenditure per tourist, as measures of tourism demand. The PED estimates for international inbound tourism yielding from the study were (-0.02), (-0.07), and (-0.06), for each of the measures of tourism demand respectively. Similar to the results from Martins, Gan and Ferreira-Lopes (2017), this highlights how using different measures of tourism demand can yield different results.

³ All estimates are reported up to two decimal points.

⁴ More specifically, (-1.37) for American, (-1.21) for European, and (-0.75) for Oceanian visitors.

- 3.7 Gunter and Smeral (2016) and Balcilar, Aghazadeh and Ike (2021) analysed tourism demand for 32 OECD countries, using regression analysis and other modelling approaches to come to a range of PED estimates. Gunter and Smeral (2016) estimated PEDs of (-0.74) and (-0.28) for destinations in Northern Europe and Central/Western Europe respectively. Balcilar, Aghazadeh and Ike (2021) investigated the outbound PEDs for tourism of OECD countries, finding that tourist demand was somewhat more responsive in the long-run compared with the short-run. They also tried to distinguish between short-run and long-run elasticities. In the short-run the study estimated the PED for outbound tourism to be (-1.3), (-0.80), and (-0.68) depending on the model specification used, compared with long-run estimates of (-1.56), (-0.88), and (-0.83).
- 3.8 Divisekera (2016), using an Almost Ideal Demand System (AIDS) method,⁵ estimated the PED of tourism (expenditure) from the US to the UK to be (-0.92).⁶ The study also estimated that the PED for transportation to the UK from the US was (-0.62), implying that transportation is somewhat less responsive to changes in price than expenditure on tourist goods and services more widely.
- 3.9 Other empirical studies providing relevant estimates of PED were Seetaram, Forsyth and Dwyer (2016), Pham, Nghiem and Dwyer (2017), Stettler (2017), Zervas, Proserpio and Byers, (2017), Falk and Lin (2018), Gunter and Önder (2018), Emili, Figini and Guizzardi (2020),⁷ Gunter, Önder and Zekan (2020), Petricek, Chalupa and Chadt, (2020), Fleissig (2021a), and Fleissig (2021b), while Button (2022) used an experimental approach to measure price elasticity.⁸ The PED estimates from these studies ranged from (-6.4) to (0.0).
- 3.10 More specifically, the studies of Zervas, Proserpio and Byers (2017), Gunter and Önder (2018), and Gunter, Önder and Zekan (2020) examined elasticities in the

⁵ AIDS approaches are demand models used by economists to study consumer behaviour, and they have been widely used in research around tourism.

⁶ Divisekera (2016) also investigated the elasticities of tourism and transportation demand from the USA towards Australia and New Zealand, and from the UK towards these three countries.

⁷ The country of focus in this paper is Italy, a non-comparable country according to the REA protocol. However, its findings are included in the report because the study also examines areas in Italy that are not considered 'sea and sun' but 'business' and 'cultural' destinations (i.e., the areas of Milan and Florence).

⁸ However, the measured elasticity of Button (2022) was in terms of demand for framed artworks (usually bought as souvenirs), not in terms of demand for accommodation or tourist arrivals. The estimations ranged between (-3.27) and (-1.76).

context of shared economy platforms,⁹ like Airbnb, investigating how such markets have influenced the market for tourist accommodation. The estimates of PED yielding from these studies ranged from (-0.69) to (-0.2).¹⁰ Gunter and Önder (2018), and Gunter, Önder and Zekan (2020) found that the Airbnb markets in Vienna and in New York are price inelastic, with demand in these areas influenced by factors including the size of the listing, the number of photos, and the host's responsiveness, whereas traditional accommodation and neighbouring listings can work as substitutes. Zervas, Proserpio and Byers (2017) found that demand for lower priced hotels was more responsive to demand for accommodation on shared platforms, with price responsiveness also being greater during periods of peak demand.

- 3.11 The studies of Stettler (2017) and Falk and Lin (2018) focused on inbound tourism in Switzerland. Estimates of PED varied significantly across the studies, with the former study finding an average PED of (-0.74) and (-0.97) depending on the source market, and the latter study finding a range for PED of roughly 0 to (-5) between 2000 and 2015.
- 3.12 Seetaram, Forsyth and Dwyer (2016) and Pham, Nghiem and Dwyer (2017) estimated the PED for outbound and inbound tourism in Australia. Seetaram, Forsyth and Dwyer (2016) estimated that the PED for outbound tourism ranged between (-1.07) and (0.00). Pham, Nghiem and Dwyer (2017), on the other hand, investigated the drivers of Chinese visitors to Australia, yielding significantly higher estimates with PED for Chinese tourism in Australia found to be (-4.4) and (-6.4) in the short- and long-run respectively.
- 3.13 The studies of Fleissig (2021a), and Fleissig (2021b) estimated the PED and YED of six tourism sub-industries in the USA (i.e., air transportation, food and beverage, recreation and entertainment, shopping, travellers' accommodation, and other transportation-related commodities). Their PED estimates ranged from (-1.86) to (-

⁹ Also known as peer-to-peer markets.

¹⁰ ZERVAS, PROSERPIO and BYERS (2017) focused on Texas, USA, Gunter and Önder (2018) focused on Vienna, Austria, and Gunter, Önder and Zekan (2020) focused on New York city, USA.

0.2), with the accommodation PED estimate of Fleissig (2021a) ranging from (-0.4) to (-1.4), and the central estimate of Fleissig (2021a) being (-0.68).

- 3.14 Estimates of elasticities were generally calculated at the national level, although there were limited examples of sub-national estimates. The studies of Borzykowski, Baranzini and Maradan (2017), Grilli et al. (2018), Tomáš (2019), Opstad, Hammervold and Idsø (2021), and Díez-Gutiérrez and Babri (2022) investigated the PED for inbound tourism in very specific regions, including nature resorts such as forests, rivers, campsites, and mountains. The PED estimates from these studies ranged between (-1.91) and (-0.08), depending on the region that was considered in the study and the methodology used. In the case of Díez-Gutiérrez and Babri (2022), PED was also found to decrease significantly as the price of the underlying tourist good or service increased. The results from these studies provided no insight as to how sub-national elasticities might differ from elasticities at a national level.
- 3.15 Finally, the study of Kusumah (2018) yielded estimates of PED for outbound tourism demand in the EU, USA, and Australia – all major source markets for inbound tourism in Wales - with estimates ranging between (-0.01) and (-1.29).¹¹

Price elasticities of supply

- 3.16 Price elasticity of supply (PES) measures how much the quantity supplied of a good or service changes in response to its price. A positive PES denotes an increase in the quantity supplied when its price increases, and vice versa. PES values larger than 1 denote an elastic supply and values smaller than 1 an inelastic supply.
- 3.17 The REA yielded limited evidence concerning the PES of tourism goods and services, with the initial search strategy identifying no sources with estimates of PES. An evidence gap around estimates of PES was also identified in Chen et al. (2021).¹²

Income elasticities of demand

- 3.18 The income elasticity of demand (YED) for tourism measures the responsiveness of (outbound or inbound) tourism demand to the changes in the income of visitors.

¹¹ According to the Welsh government report [Welcome to Wales: Priorities for the visitor economy 2020-25](#)

¹² This review is discussed in the subsequent section on findings from the grey literature.

YED is the percentage change in quantity demanded divided by the percentage change in income. A positive YED exists for goods that are called “normal” meaning the demand would increase when the income increases. Normal goods can be “necessities” or “luxury goods”. Necessities have an inelastic demand and YED values between 0 and 1, while luxury goods exhibit elastic demand and YED values larger than 1. For goods with negative YED, the demand decreases when income increases, and they are called “inferior goods”.

- 3.19 Of the short-listed academic papers, 23 provided estimates of the YED for international tourism. There was a significant cross-over with the literature for PED, with many studies, like the aforementioned studies of Peng et al. (2015) and Martins, Gan and Ferreira-Lopes (2017), providing estimates of both YED and PED.
- 3.20 Peng et al. (2015) estimated a range for YED of between 1.27 and 2.40 depending on which continent the visitor came from,¹³ with the overall YED for international tourism estimated at 2.53. The YED for accommodation was generally found to be significantly less than that for tourism more widely, with an average estimate of 1.17 verifying that demand for accommodation generally less responsive to changes in price or income than other tourist goods and services.
- 3.21 The YED estimates of Martins, Gan and Ferreira-Lopes (2017) ranged from 0.43 to 1.15, with the lowest estimate being produced using real expenditure per arrivals (in USD) as a measure for tourism demand, and the highest estimate being produced by using the real expenditures (in Euros) per Arrivals as a measure. The estimates' signs were therefore found to be positive, in accordance with economic theory, but the conclusions were not clear as to whether tourism was a luxury good.¹⁴
- 3.22 Rosselló-Nadal and HE (2020) also found positive YED estimates with results varying depending on the measure of demand for tourism adopted: (i) taking expenditure as the measure of tourism demand yielded a YED of 0.42, (ii) using aggregate arrivals as the measure of demand returned a YED of 0.57, and (iii) taking the average expenditure per tourist as the measure of demand returned the highest YED estimate of 0.99.

¹³ More specifically, 1.27 for Oceanian, 1.81 for American, and 2.4 for European visitors.

¹⁴ When income increases, the percentage consumption of a luxury good increases more than 1 for 1.

- 3.23 The YED estimates of Gunter and Smeral (2016) were 0.56 on average for destinations in Northern Europe and 0.23 for destinations in Central/Western Europe. The findings of Balcilar, Aghazadeh and Ike (2021) yielded results which were significantly larger in magnitude in both the short-run and long-run. In the short-run, depending on the model specification used the YED for outbound tourism was found to be either 1.28, 1.01, and 0.75, while in the long-run the estimates were 0.79, 1.14, and 0.98. In contrast to the results for PED, the extent to which demand for tourism is more responsive to income in the long-run is ambiguous.
- 3.24 Divisekera (2016) found that US demand for tourism to the UK, as measured by tourist expenditure, is expenditure-elastic (1.26), implying that the proportionate change in demand is greater than the corresponding proportionate increase in income (i.e., a 1 per cent income increase (measured in terms of total expenditures) would lead to a 1.26 per cent increase in expenditures for tourism). In contrast, the YED for transportation was found to be 0.67, implying that tourism demand is more expenditure- and price-elastic than is the demand for transport services to the UK.¹⁵
- 3.25 Waqas-Awan, Rosselló-Nadal and Santana-Gallego (2021) conducted a study which examined how the level of personal income can affect the income elasticity of tourism demand, measured in terms of international tourist arrivals. The authors derived results for different specifications of a gravity model,¹⁶ using annual data from 1995 to 2016 on the bilateral tourism flows between 192 countries. The findings validate the hypothesis that the richest and poorest individuals tend to react less (in terms of visitor numbers) to changes in their income, compared with middle-class individuals. Using GDP per capita as a measure of individual wealth, the study estimated a YED for low-income countries of 0.59 and 0.45, or (-0.05) or 0.15 for high-income countries, compared with significantly higher estimate of 0.78 or 1.1 for middle-income countries. The average YED across all countries was found to be around 1.0.

¹⁵ Expenditure elasticity of demand measures how much the demand of a good changes in response to a change in the total expenditures of consumers. The level of expenditure can be considered a measure of income; hence, the expenditure elasticity of demand can be seen as a form of YED.

¹⁶ Gravity models provide an intuitive framework examining the determinants of flows like trade, migration, and capital between countries. Gravity models can easily be derived from theoretical models, and they are considered a credible approach for studies around tourism.

- 3.26 The studies of Smeral (2018) and Smeral (2019) provided insights into how the YED for outbound tourism can vary not only through business cycles,¹⁷ but also seasonally. Smeral (2018) applied tourist demand modelling techniques to identify cyclical variation in tourism demand, focussing on data from Canada, the EU 15 countries, and the USA. Evidence of fluctuating YED estimates for tourism were found, with the YED estimates varying from 0.51 to 5.52 depending on the stage of the business cycle and the season. For Canada and the USA, the YED estimates were found to be consistently lower during economic downturns, whereas for the EU YED was found to be higher during economic downturns. The author attributed the findings for the EU to the loss aversion of consumers and uncertainty caused by the economic crisis. The authors also found variation in YED across quarters and countries, although no clear pattern was found.
- 3.27 The paper of Smeral (2019) examined the seasonality of YED in more detail in the context of improving the forecasting of tourism demand. The author applied two different versions of a tourism demand model to yield the following estimates for YED for Canada, the EU 15, and the USA, finding significant variation in YED depending on the season (e.g., YED was found to be highest for the EU 15 in the latter two quarters of the year).
- 3.28 Gunter, Önder and Zekan (2020) estimated YED for accommodation in New York City, yielding a range of results from 1.31 to 4.9 depending on the area and the type of the offered accommodation. These findings therefore find accommodation in New York to be a luxury good, with demand changing proportionately more than the change in visitor income.
- 3.29 The estimates of Falk and Lin (2018) for the YED of tourism demand (as measured by visitor overnight stays) in Switzerland was found to range between roughly 0.8 and 1.0 between 2000 and 2015. Pham, Nghiem and Dwyer (2017) estimated the YED for Chinese tourists to Australia to be between 3.8 and 5.5, while the findings of Emili, Figini and Guizzardi (2020) varied between 0.9 and 5 for British visitors and between 1 and 4 for German visitors.

¹⁷ Business cycles in an economy are the intervals of economic expansion usually followed by recession in economic activity. Business cycles may vary in terms of intensity and length.

- 3.30 Fleissig (2021a) found that YED varied between 0.1 and 1.5, with the YED for accommodation varying between 0.22 and 1.1. The YED estimates of Fleissig (2021b) ranged from 0.37 to 1.67, with the YED for accommodation being 0.74 in the short-run and 0.97 in the long-run.
- 3.31 Stråle (2021) investigated the household level variation in YED for international leisure travel. To that end, data on Swedish household level expenditures were analysed using regression analysis and other modelling approaches, yielding estimates for YED ranged of 0.95 to 5.71. The findings implied that demand was more income responsive for households who consumed relatively lower levels of tourism generally.
- 3.32 Similar to the case for PED, the studies of Engström and Kipperberg (2015), Fredman and Wikström (2018), Tomáš (2019), and Opstad, Hammervold and Idsø (2021) provided sub-national estimates of YED relating to nature resorts in specific regions of Norway and the Czech Republic – these included campsites, mountains, fjords, and national parks. The estimates from these studies ranged from (-0.24) to 1.45, with results varying across regions of interest and research methodologies.
- 3.33 Lastly, the studies of Alegre and Pou (2016) and Bronner and de Hoog (2017) examined outbound tourism demand in the USA and the Netherlands, respectively. These studies analysed data from national level surveys, including responses to a set of hypothetical questions on preferences for different types of holiday, to understand the responsiveness of demand for tourism to changes in visitor incomes. The YED estimates of Alegre and Pou (2016) ranged from 0.12 to 2.74. Whilst Bronner and de Hoog (2017) did not arrive at specific estimates for YED, it was found that depending on the type of travel, YED was either elastic or inelastic; for day trips and short vacation YED was typically elastic, whereas for the main summer vacation it was inelastic, implying that demand for longer vacations is typically less responsive to changes in income than for shorter vacations. Kusumah (2018) – in an empirical study estimating YED for Australia, the European Union (EU), and the USA tourism markets – found YED values ranging between 0.74 (EU) and 1.73 (USA).

Cross-price elasticities of demand

- 3.34 The cross-price elasticity of demand (XED) measures the change in the quantity demanded for a good in response to the change in another's good price. For example, an XED of (-1) between two goods would imply that a 1 per cent increase in the price of Good x would decrease the quantity demanded for Good y by 1 per cent. As such XED is similar to PED, but it shows the relation between a pair of different goods or services. A negative XED denotes "complementary goods" that are usually consumed together, while a positive XED denotes "substitutes" that are consumed interchangeably.
- 3.35 The REA identified relatively few studies yielding estimates of XED relating to tourism, with only five of the examined academic papers providing relevant estimates. These studies typically examined the impact on demand for different categories of tourist goods and services (including accommodation, transportation, and shopping) following a change in relative prices.
- 3.36 Martins, Gan and Ferreira-Lopes (2017) estimated the relationship between the relative prices of various tourist goods and services, with estimates for XED ranging between (-0.97) and (-0.08), suggesting that different tourist goods and services are complements when relative prices change. The findings suggest that relative prices are an important consideration for visitors when they make consumption decisions at their destination.
- 3.37 Fleissig (2021a) measured the Morishima elasticities of substitution in demand (ME) among the six examined tourism sub-industries.¹⁸ ME describes the extent of substitution between two sub-industries for a change in the price of a given sub-industry. A positive ME indicates that the sub-industries are substitutes, while a negative ME indicates complementarity. The study estimated that ME ranged between (-0.65) to (1.1) depending on the groups of sub-industries that were examined. For price changes in air transportation, all sub-industries were found to be complements except for other transportation-related services which were found to be substitutes. An increase in the price of shopping was found to have little

¹⁸ The Morishima elasticity of substitution (ME), as measured in (Fleissig, 2021a), shows substitution between two sub-industries for a change in the price of a given sub-industry. A positive ME indicates that the sub-industries are substitutes, while a negative ME indicates complementarity.

impact on food and beverage purchases by tourists, which implies they were deemed necessary, but had large impact on demand for accommodation and air transportation. ME estimates between accommodation and food and beverages were found to be negative, implying complementarity in tourists' consumption preferences.

- 3.38 The findings of Fleissig (2021a) also showed that substitution between sub-industries is not constant and fluctuates through the business cycle. Moreover, the ME estimates can be non-symmetric. For example, substitution between air transportation and other transportation-related services exhibited greater substitution for changes in the price of air transportation compared to the price changes of other transportation-related commodities. Likewise, there is considerably more variation in the complementary relationship between accommodation and food and beverages for price changes in accommodation and not vice versa.
- 3.39 The findings of Fleissig (2021b) confirm those of Fleissig (2021a). The estimates ME ranged from (-0.73) to (1.35), with the highest estimate relating to the XED for transportation with respect to the price of air transportation. This finding implies high and elastic substitution between these two transportation alternatives. Nevertheless, a price change in other means of transportation would not induce the same elastic response in demand for air transportation (0.74). The lowest estimate related to the XED for accommodation with respect to the price of air transportation, implying high (but not elastic) complementarity between the two services.
- 3.40 Concerning the XED for accommodation with respect to the prices of the other four services examined in Fleissig (2021b), the highest degree of complementarity was observed between accommodation and other means of transportation (-0.43) and between accommodation and recreation (-0.26). A change in the price of food and beverage or shopping would induce a highly inelastic response in demand for accommodation, with this XED estimated at (-0.1) and (-0.03). On the other hand, a change in accommodation prices would induce a still inelastic, but considerably higher, response in the demand for food and beverage and shopping with estimates at (-0.33) and at (-0.19).

- 3.41 Divisekera (2016) estimated the XED between tourism and transportation demand from the US towards the UK to be in the range of 0.04 to 0.7, depending on changes in the prices of tourism and transportation in the UK, as well as prices in Australia and New Zealand. The findings showed that a rise in the price of UK inbound tourism does not lead to a significant shift in US demand towards Australia or New Zealand. This would suggest that, for US visitors, Australia and New Zealand are weak substitutes for the UK. Moreover, there is a positive relationship between tourism spending in the UK and transport demand, implying substitutability between the two and strong preference for UK tourism by US visitors.
- 3.42 The XED estimates of Gunter, Önder and Zekan (2020), estimated as the change in hotel room demand in response to an increase of the price of the shared houses in New York, ranged between 0.11 and 0.54. The XED value was found to depend on the area of focus (Manhattan or all listings), and the type of house listings included in the sample (i.e., commercial or private type, and entire homes or specific rooms).¹⁹ The XED estimates were higher when listings of entire homes or listings only in Manhattan were taken into consideration.

Other types of elasticities

- 3.43 Three studies yielded elasticity estimates other than those relating to PED, YED, XED, and PES (i.e, Engström and Kipperberg (2015), Sanchez-Rivero and Pulido-Fernández (2020), and Balcilar, Aghazadeh and Ike (2021)).
- 3.44 Engström and Kipperberg (2015), by using a regression analysis of international visitors' expenditures to the Western fjord-region of Norway, explored the elasticity of visitor expenditure with respect to (i) visitor length of stay (LOS), and (ii) travel party size (TPS). The study found that the elasticity of tourist demand with respect to LOS was estimated in the range of 0.51 to 0.68 implying a positive, but inelastic, relation between tourist expenditures and length of stay. It further found that the elasticity of tourist demand to TPS was in the range of (-0.84) to 0.41, depending on if total or personal expenditure on tourism was used as the measure of demand.

¹⁹ The authors differentiated between hosts that rent their property occasionally and the ones that rent it as a commercial activity.

- 3.45 Sanchez-Rivero and Pulido-Fernández (2020) provided an estimate of inverse demand-income elasticity (IYED), examining the relation between international tourist arrivals and income generated from tourism. The study investigated whether an increase in tourist arrivals would lead to an equal increase in tourism-generated income, yielding IYED estimates of around 0.95. These findings suggested that tourism-generated income was slightly inelastic, implying that tourist arrivals might not be the best measure of success for the tourism industry. The authors attributed the lower increase in income relative to the increases in tourist flows to the contraction of average tourist expenditure (as a direct result of the global economic crisis of 2007), and to the reduction of the average length of stay at the destination (as a result of changes in tourist habits, with a preference for shorter trips every year).
- 3.46 Balcilar, Aghazadeh and Ike (2021) examined how employment affects demand for tourism in the short-run and the long-run, controlling for the effects of income and prices. The short-run estimates were found to be approximately 0.02, while the long-run estimates were not statistically significant. These findings imply that demand for tourism in OECD countries was highly inelastic with respect to employment rates, attributing this finding to demographic factors in OECD countries and employment business cycles. The authors suggested that diminishing returns to employment, a general decline in the labour income share, a rising inequality of wage distribution among the working population, as well as an aging population, could also have played a contributory role to this phenomenon.

Grey literature findings

- 3.47 To supplement the evidence found in the academic literature, relevant policy documents and reports from various institutions, research centres, and organisations, were also searched for. The search was focused on, but not be limited to, publications by the UK Government and devolved administrations (including Welsh Government and Scottish Government), along with any reports produced by relevant research bodies.
- 3.48 One of the most relevant sources found in the REA was the Chen *et al.* (2021) Review of Evidence of Elasticities Relevant to Tourism in Scotland, which was

commissioned by the Scottish Government and aimed to support policymakers' understanding of the potential responsiveness of visitors and businesses to changes in prices of tourism. The study conducted a systematic review of the literature estimating elasticities for tourist destinations relevant to Scotland, including, considering estimates of PED, YED, and PES, as well as other factors influencing changes in demand and supply of tourism. Whilst there is a partial overlap with the Peng et al. (2015) meta-analysis in terms of studies which are included in the systematic review, Chen *et al.* (2021) focussed only on more recent (post-2010) research and so includes many studies not considered in the former.

- 3.49 The study reported PED and YED estimates of a wide range of values, with the studies also spanning a range of different methodologies and regions of interest. The study reported PED values for relevant destinations ranging from (-5.1) to 2.18 (the vast majority of studies reported a negative PED), with a median of (-1.5) and an average of (-1.36).²⁰ For European destinations, in general, the range was from (-7.49) to 5.15, with a median PED of (-1.02) and an average of (-1.26), implying that the European tourism market is elastic on average.
- 3.50 Chen et al. (2021) examined literature concerning the responsiveness of demand for outbound tourism from Scotland's top source markets and found a range for YED of between (-26.42) to 25.13, with a median of 1.32 and an average of 2.60. This implies that tourism is considered a luxury good, on average, by European visitors and visitors from Scotland's other top source markets. Regarding the outbound tourism demand of European tourist-generating countries, the estimated YED was found to vary from -26.42 to 25.13, with a median of 2.85 and an average of 3.78.
- 3.51 The study of PwC (2017) contained estimates of the PED for inbound tourism for 28 EU member states as of 2017. Examining the impact of different types of taxes (e.g., occupancy tax and VAT) on tourism sectors, the study found the elasticity of producer revenues in the accommodation sector to changes in occupancy taxes to range between (-1.4) and (-1.2). Producer revenues were found to be more elastic for leisure tourism compared with business tourism, whilst assuming a higher pass-

²⁰ These were Austria, Belgium, Denmark, France, Germany, Ireland, Italy, the Netherlands, Switzerland, and the UK.

through of occupancy tax increases to visitors was found to make producer revenues less elastic.

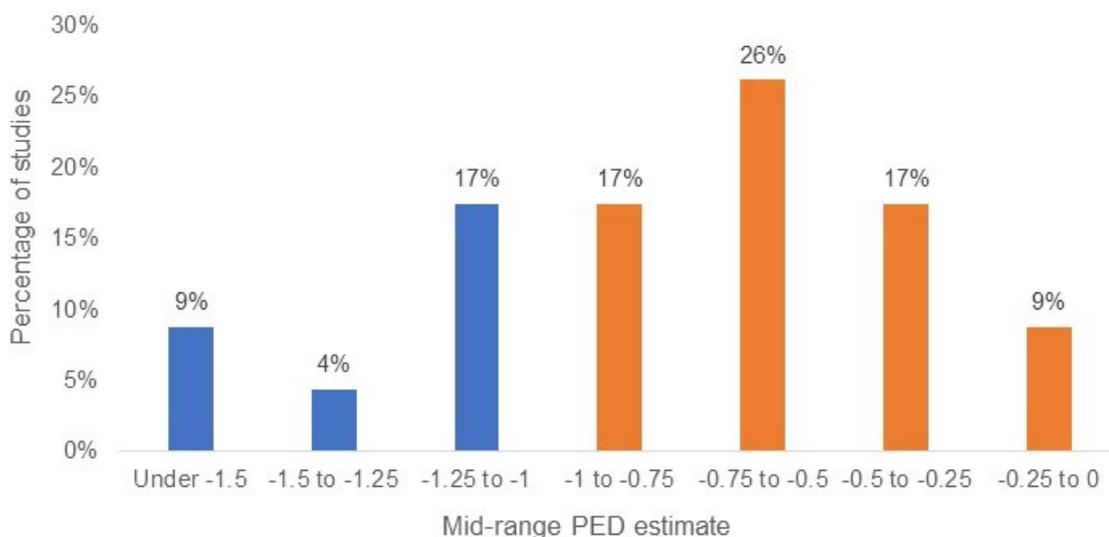
- 3.52 PwC (2017) cited academic literature indicated that a high degree of pass-through and a high PED increased the efficacy of a reduction in VAT in terms of stimulating tourist flows and economic growth, particularly in competitive tourist markets, although it was not made clear how generalisable this result is to all tourism markets. Conversely, this result implies that a low PED and a low degree of pass-through would reduce the extent to which an increase in VAT would cause similarly detrimental impacts.
- 3.53 As for an occupancy tax (a tax with similarities to a visitor levy), the findings of PwC (2017) suggested that an occupancy tax has the potential to place a disproportionate burden on the accommodation sector compared with other tourist sectors (by reducing profit margins for accommodation operators to the extent costs cannot be passed through to visitors) and can ultimately be welfare-reducing for tourists (through subsequent market distortions and inefficiencies). The study's review of the literature also found tourism to be generally price elastic, and therefore that increasing the cost of accommodation could risk diverting tourist expenditures from other parts of the industry (e.g., food or entertainment), with undesired impact on the wider economy.
- 3.54 The authors found that occupancy taxes could inherently favour some tourists over others and should, therefore, be designed or reformed with equity issues in mind. For example, the report highlighted that most levy occupancy taxes are structured on a per-person per-night basis (rather than a per-room basis) which can disadvantage large groups, who would pay a larger levy per room relative to a solo traveller. Additionally, it was highlighted that the occupancy tax in Berlin provides a specific exemption for business travellers.
- 3.55 Regarding the visibility of such taxes, the authors argued it is not just an administrative issue and could have implications for consumer behaviour. On that matter, there was no quantitative evidence, but their review of the literature suggested that visitors could experience frustration and psychological distress through incurring "hidden charges" they had not planned for.

4. Conclusions

Interpretation of findings

- 4.1 Where relevant evidence was found, there was a large variation in the magnitude of estimates of elasticities. Potential causes of this variation included differences in modelling methods, explanatory variables, destination-source market pairs, and the data used by the study (see discussion of challenges and limitations in chapter 2 for more detail). It is recommended that the findings in this report are interpreted with caution given the inherent uncertainty and lack of clarity of generalisability to Wales.
- 4.2 There was a large variation in the magnitude of the estimates, with demand for tourism being either price elastic or inelastic depending on the study concerned. The lack of comparability of studies on a like-for-like basis meant that no clear factors could be found to explain this variation across studies.

Figure 2: distribution of mid-range PED estimates across 23 studies



Note: analysis based on the mid-range of estimates where multiple estimates are provided by a study. Red bars denote inelastic demand and blue bars denote elastic demand.

- 4.3 Across the 23 studies reviewed in this REA which provided numerical estimates of the PED for tourism, a calculation of the average mid-range PED across all studies was found to be roughly unitary (-0.9), whilst the median mid-range PED was slightly lower at (-0.7).²¹ As shown in Figure 2 above, the majority of studies (70%)

²¹ The mid-range PED was used where a given study yielded multiple estimates of PED.

reported a PED of magnitude less than one (inelastic demand) with the remainder (30%) reporting a PED of magnitude greater than one (elastic demand).

- 4.4 Of relevance to the proposed visitor levy, accommodation was found by two studies to be relatively price inelastic (-0.7); that is, exhibiting a lower change in demand when prices increased compared with other tourist goods and services. This result should be interpreted with caution however given the limited number of studies.
- 4.5 YED estimates were typically found to be positive, implying demand for tourism increased (decreased) with rises (falls) in incomes for visitors, although again there was a large variation in the magnitude of the estimates, with tourism found to be a normal or luxury good depending on the study concerned.
- 4.6 There was some evidence within the literature of the XED between different pairs of goods and services consumed by tourists, with goods found to be substitutes or complements depending on the pair of goods and services concerned. There was limited evidence that demand for accommodation is generally complementary to other forms of tourist expenditure (such as shopping and recreational expenditure).

Evidence gaps

- 4.7 This REA has illustrated several evidence gaps relating to the research questions explored in this review. Evidence gaps identified included:
- Whilst there was a significant literature which sought to estimate PED and YED for a range of measures of tourism demand, no studies provided Wales specific estimates and only a small minority of studies considered the UK market.
 - There were relatively few relevant studies which sought to estimate XED, whilst there was almost no evidence on the PES of tourist goods and services.
 - There was generally very little evidence addressing the more nuanced research questions, including (i) insight into the drivers of visitor behaviour, (ii) the impact of visitor levies or similar on tourism demand, and (iii) how the explored elasticities may vary depending on the characteristics of tourists (e.g., based on protected characteristics).

4.8 In terms of priorities for addressing the identified evidence gaps, it is recommended that the Welsh Government considers the feasibility of commissioning research yielding robust empirical estimates of the PES for visitor accommodation in Wales, given its importance as a parameter in modelling the impact of a visitor levy.

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Appendix 1: REA Protocol

Rationale

The visitor economy is a major source of jobs and economic growth across Wales. The Welsh Government's ambition is to grow tourism for the benefit of Wales by supporting local communities in a way which is sustainable for land and the environment, developing a framework which is mutually beneficial to both visitors and citizens.

Following the political developments that have taken place since 2010,²² the 2021-2026 Programme for Government – carried out in collaboration with Plaid Cymru, as part of the Co-operation Agreement – sets out the Welsh Government's commitment to introduce legislation permitting local authorities to raise a levy on visitors to Wales.

The introduction and subsequent use of such a levy would enable local authorities to raise additional revenue to re-invest in the conditions that make tourism a success. The levy would be implemented as a local tax and the powers to raise the levy would be discretionary for local authorities. This will enable decisions to be taken locally, according to the needs of Welsh communities.

The levy would apply to those paying to stay overnight within a local authority area. Opportunities for wider contributions on the cost impact of other types of visitor activities on local infrastructure will be offered as part of the consultation on the levy. It is intended that the levy would apply to business travellers as well as tourists and is referred to in this document as a visitor levy.

Objectives

The core objective of this REA has been to understand the elasticities relevant to a visitor levy in Wales and to critically review the existing evidence on different types of elasticities (supply, demand, price, income, cross price) related to a visitor levy. The research also aimed to identify and assess different forms of consumer responses to the levy, to provide evidence on whether the use of taxation / levy revenues has an impact on consumer or provider behaviour, and to detect any variations in tax / levy design on supply or demand responses. These objectives are presented in detail in the next sections.

The outputs from this research project will help the Welsh Government and the Local Authorities to develop their policies on that matter by:

²² Developments having as a starting point the [2010 Independent Commission on Funding & Finance for Wales \(the Holtham Commission\)](#) and being followed by the milestones of the [Wales Act 2014](#) and the [2017 Welsh Tourism Alliance report](#), among others.

- informing the Welsh Government's formal consultation on the draft legislation due to be launched in the autumn of 2022
- supporting the design and policy development of the levy
- assisting Local Authorities in their decision-making regarding the implementation of the levy
- informing the Integrated Policy Impact Assessment and the Regulatory Impact Assessment (RIA) that will be published alongside the introduction of the Visitor Levy Bill into the Senedd.

Methods

This section sets out the research questions, the search strategy and the inclusion/exclusion criteria that have been used to decide if the retrieved studies fit into the evidence review.

The approach to the literature review was a flexible REA, which was targeted to maximise the relevance of the findings under the agreed time and resource constraints. The proposed search was systematic and allowed us to prioritise research from a variety of sources across the literature, using a transparent and well-defined protocol and search strategy.

Once the research protocol had been agreed upon, the next step was to search the literature and arrive at an initial "search list" including all the search results and then at a "long list" of studies. The studies included in the long list were subject to a review of titles and abstracts and were screened based on the inclusion criteria. The screening process led to a "short list" of relevant studies, and a second screening process led to the final "reading list" including papers that were read in detail. While reading the reading list, the relevant information of selected studies was recorded using a Research Extraction Sheet (RES). The information recorded was used to synthesise and summarise the evidence related to the research questions.

At every step of the REA, a reference management software (Zotero) was used to manage search findings. Different folders were created for every step of the process including the respective list of findings. Hence, had the following folders: (i) Search list, (ii) Long list, (iii) Short list, and (iv) Reading list.

Research questions

Based on the tight timescale of this project, and to ensure that available resources were used efficiently to answer the key research questions, a set of research questions were proposed that were targeted in both the search and review of literature. To address the

objectives discussed in previous sections, the REA sought to review and assess evidence in the following areas:

- The elasticities of supply and demand for accommodation and wider tourism including, where evidence allows, assessing how elasticities may vary depending on different levy aspects and different groups of people that the levy may affect. The aspects that will be considered are:
 - Tourism season.
 - Geographic region.
 - Design of the levy.
 - Displacement effects (where tourists choose to go elsewhere due to a change in price).
 - Pass through (the extent to which changes in taxation or fees are passed through to the customer/tourist).
 - Visibility of the levy.
 - Pass-through of the levy onto tourists.
- The REA will also focus on how a visitor levy would affect the behaviour of the following groups of people:
 - Those with protected characteristics, as set out in the Equality Act (2010).
 - Those from different socioeconomic backgrounds and income groups.
 - Those with different sized families.
 - Business and leisure travellers.
 - Domestic and international travellers.
 - Groups which use tourism overnight accommodation for other purposes e.g., those seeking refuge).
 - Those who do and do not use the Welsh language.
- Different forms of consumer responses:

- How the spending behaviour of visitors could be affected. For instance, they may spend more on accommodation, and less on other aspects of their trip, such as retail spending or meals.
- Variations in the lengths of trips, the type of quality accommodation they choose to stay in, or where they choose to stay.
- Variations in tax or levy design on supply or demand responses:
 - Flat rate versus a percentage of stay versus flat rates set in bands.
 - Payment in advance versus payment in person.
 - Payment to the accommodation owner directly versus payment through intermediary platforms such as Online Travel Agents.
 - Exemptions for particular groups.
- Whether the use of revenues from occupancy taxes or levies has an impact on consumer or provider behaviour. For example, whether hypothecation of revenue has an impact on behaviours.

Inclusion and exclusion criteria

Inclusion and exclusion criteria were used to decide if the materials identified from the search were suitable for answering the core research questions of this project. The criteria that were applied to move from a long list of materials towards a short / reading list of studies are listed in the table below.

Table 1: Inclusion and exclusion criteria

Theme	Inclusion Criteria	Exclusion Criteria
Type of elasticity	Price elasticities of demand of inbound tourists, income elasticities of demand from tourist origin nations, elasticities of supply for tourism goods and services, and cross elasticities of demand.	

Consumer types	Domestic and international travellers for leisure or business.	Domestic non-travellers.
Areas of impact of tax levy	Direct impact on visitor behaviour (number of visitors, level and distribution of tourist expenditure), local economy (supply of accommodation, prices), and other relevant indicators.	Indirect impact (externalities and multiplier effects).
Jurisdiction of estimate	Wales and other UK nations preferred. The REA will also consider results relating to the advanced economies of other liberal democracies including USA, Australia, New Zealand, Canada, and EU and EEA countries.	All other countries.
Methodologies	All econometric methods, meta-analyses, and evidence reviews. ²³	
Date of research	Published between 2015 - 2022.	Published earlier than 2015.
Language of study	English	Any other language
Type of studies	Peer-reviewed journal articles, non-peer-reviewed academic outputs, government-commissioned research, publications by research organisations, evidence by providers of interventions/support, government publications.	Newspaper articles and editorials/opinion pieces, magazine articles. Theses and dissertations. Books or other work of equivalent length.

²³ The robustness of methodologies will be assessed during quality assessment.

Information sources

This REA mainly retrieved evidence from academic literature although this was supplemented by relevant sources from the grey literature. For the search of academic literature, the REA focused on databases of published and unpublished academic literature: JSTOR, Science Direct, SAGE, IDEAS, EconPapers, and Google Scholar.

In addition to the systematic search and approach to the literature, the REA retained flexibility to include studies obtained through backward snowballing (i.e., considering the literature cited on the references of a start set paper) and forward snowballing (i.e., tracking the literature that cites a paper that is reviewed). This could apply in cases when significant gaps in the relevance of literature or in the design of methods were identified such as to ensure a comprehensive understanding of existing techniques of interest.

Search strategy

The search strategy was designed to ensure it is targeted at thoroughly answering the key research questions. Table 4 illustrates the keywords that were used to identify relevant sources of evidence. This protocol was set to obtain the most relevant pieces of literature to address the primary research questions. Based on the time schedule and the scope of the review, the REA mainly built the search strategy through targeting keywords present in the title (main field) and the abstract (research question level).

During the scoping review, different combinations of words were tested to arrive at the following set of keywords. Search terms were combined into search strings using Boolean operators (AND/OR) and other database-specific search operators. Using these strings, a search list and a long list of studies were arrived at, which were then screened to see if they meet the inclusion/exclusion criteria.

Table 2: Illustrative keywords for literature search

Keyword 1 Elasticity	Elasticit* (elasticity, elasticities)
Keyword 2 Consumer types	Touris* (tourism, tourist, tourists), visit* (visitor, visitors, visiting), travel* (travel, travelling, traveller, travellers)
Keyword 3 Elasticity type	Price, demand, supply, income, cross

Different combinations of search terms and keyword fields were selected to identify relevant evidence. The search strings that used were the ones that returned a substantial, but

manageable, number of relevant results. The proposed strings are provided in the last section. During the scoping exercise, the proposed strings have been tested, but small changes might take place during the official literature search to increase relevance of results. For the more granular research questions e.g., elasticities by protected characteristics, relevant sources were searched for through supplementary search strings to those proposed.

Search strategy for grey literature

The aim of the grey literature search was on filling the gaps found in the academic literature. The REA targeted relevant policy documents, institutional reports, and programmes from different institutions, research centres and organisations. This included, but not be limited to, publications by the Welsh, Scottish, and UK Governments, along with reports that may have been produced by relevant think tanks (e.g., Bevan Foundation, WISERD, the Wales Centre for Public Policy). In addition, snowballing was used to source relevant items of grey literature.

Study records

Data management

To ensure the search process is comprehensive and transparent, a Research Activity Sheet (RAS) was used to record all searched terms, accessed sources, the date of the search and the number of search results. The REA recorded and maintained a list of the retrieved references in a specialist software package called Zotero. Zotero is a free, open-source reference management tool that stores citation information (e.g., author, title, and publication fields) and has the ability to organise, tag, and perform advanced searches.

Selection process and data collection

The REA selection process began by screening the titles of initial search results and removing any duplicate studies to compile a long list of relevant research papers and reports. The team then screened the abstracts to decide which studies to include in the short list. The screening process to select shortlisted papers was carried out according to the inclusion and exclusion criteria listed in Table 2. An independent researcher checked a random sample of decisions to verify agreement with the screening process. In case the members of the screening team were not in consensus about a decision, this would be escalated to Team Leader Lawrence Newland, who would make a final decision.

The screening process resulted in a final short list (the reading list) of papers to include in the review, which was read in full, of around 30-35 papers.

Data Extraction

To capture the key findings of each study included in the reading list a Research Extraction Sheet (RES) was used which included the following details for each study:

- Title
- Authors
- Type of publication
- Publication date
- Source
- Country/Region of focus
- Abstract/Executive summary
- Methodology
- Type of elasticity(s)
- Population of interest (e.g., leisure, business, all visitors, inbound, outbound)
- Relevant research question – primary
- Relevant research question(s) – additional
- Summary of findings
- Value of elasticity(s)
- Limitations
- Quality score

Assessing the quality and relevance of studies

To assess the quality of the studies included in the short list the criteria listed in Table 4 below were used. The quality assessment of the evidence was based on (i) credibility, (ii) methodology, and (iii) relevance of the study. For each category, a score of 1-3 or 4 (where 1 is the lowest score and 3 or 4 is the highest) was used. The REA excluded studies with the minimum score across the three categories (i.e., 1 out of 3 or 4 in each category).

Table 3: Quality assessment scoring

Category	Description	Score
Credibility	<p>Is the study coherent? Can findings be trusted? Does the author consider study limitations or alternative interpretations of the analysis? Has the study been peer-reviewed?</p> <p>3= Study is published in an academic journal. Study discusses information quality, sampling decisions and other aspects of the methodology. Study focuses on a relevant tourist/visitor market.</p> <p>2 = Study is unpublished, or study is informally published as a working paper/research report by a reliable source. Limited discussion around sources, information and data quality, or alternative interpretations of research findings. Study focuses on a relevant tourist/visitor market with adequate discussion around assumptions made.</p> <p>1 = Study has not been peer-reviewed, with conclusions drawn from limited data or theoretical discussion. Lack of transparency around data and no discussion of data quality, with no discussion around assumptions made.</p>	1-3
Methodology	<p>How robust is the evidence to contribute to the review?</p> <p>3 = The study uses a robust method to estimate the elasticity, with minimal limitations referenced.</p> <p>2 = Some concerns about sample size, specification, or choice of estimator.</p>	1-3

	1 = Methodology is weak and relies on uninformed opinions or unreliable data.	
Relevance	<p>Does the study help to answer the research question?</p> <p>4 = Study addresses an elasticity estimate pertaining to Wales or another UK nation. The research question or hypothesis is directly related to the proposed research questions.</p> <p>3 = Study addresses elasticity estimates pertaining to countries from Northern Europe and New Zealand. The research question or hypothesis is directly related to the proposed research questions.</p> <p>2 = Study addresses elasticity estimates pertaining to any other advanced economy of a liberal democracy (e.g. Southern Europe, Australia, USA, Canada). The research question or hypothesis is only somewhat related to the proposed research questions.</p> <p>1 = The research question or hypothesis is not directly related to the proposed research questions. Alternatively, the external validity of the study is not guaranteed, albeit the country would be comparable.</p>	1-4
Overall judgment	Considering the above categories, what is the overall judgment?	3-10

This quality score aimed at ensuring a comprehensive understanding of best practices, approaches, and discussion on the topics, maximising the relevance of the papers included in the review while decreasing the number of studies to a manageable amount, if necessary.

Data Synthesis

The final stage of the REA was to synthesise key findings from the literature to create a narrative that answers the research questions specified by WG, and to provide actionable insights and recommendations to practitioners.

Interactive evidence map

As part of the data synthesis, the results of the REA were translated to a web-based interactive map that will allow users to explore relevant studies by specific objective, outcome, or methodology. By using this map, the reader will be able to navigate through the findings of the REA quickly and in an intuitive way.

REA search strings

JSTOR

- (elasticity OR elasticities) AND (tourism OR tourists OR visitors) AND (price OR demand OR supply OR income OR cross) [included fields: all fields, filters: from 2015, Articles, reviews, research reports, English, Business, Economics, Public Policy and Administration]
- (elasticity OR elasticities) AND (tourism OR tourists OR visitors) AND (price OR demand OR supply OR income OR cross) [included fields: abstract, filters: from 2015, Articles, reviews, research reports, English]

Science Direct

- (elasticity OR elasticities) AND (tourism OR tourist OR visitor) AND (demand OR supply OR income OR cross) [included fields: title/abstract, filters: 2015-2022]

SAGE

- (elasticity OR elasticities) AND (tourism OR tourist OR tourists OR visitor OR visitors OR visiting OR travel OR travelling OR traveller OR travellers) AND (price OR demand OR supply OR income OR cross) [included fields: abstract, filters: from 2015]

IDEAS

- (elasticity | elasticities) + (tourism | tourist | tourists | visitor | visitors | visiting | travel | travelling | traveller | travellers) + (price | demand | supply | income | cross) [included fields: abstract, filters: from 2015]

Google Scholar

- allintitle: (elasticity OR elasticities) AND (tourism OR tourists OR visitors) AND (price OR demand OR supply OR income OR cross) [included fields: title, filters: from 2015]

- allintitle: (elasticity OR elasticities) AND (tourism OR tourist OR tourists OR visitor OR visitors OR visiting OR travel OR travelling OR traveller OR travellers) AND (price OR demand OR supply OR income OR cross) [included fields: title, filters: from 2015]

RePEc EconPapers

- (elasticity OR elasticities) AND (tourism OR tourist OR tourists OR visitor OR visitors OR visiting OR travel OR travelling OR traveller OR travellers) AND (price OR demand OR supply OR income OR cross) [included fields: keywords/title, Working papers, Journal articles]

Appendix 2: detailed evidence

Table 4: Summary of elasticity estimates by source

Author(s)	Publication year	Region of focus	Methodology	Income elasticity of demand	Price elasticity of demand	Cross-price elasticity of demand	Price elasticity of supply	Other type of elasticity	Quality assessment score
Luís Filipe Martins, Yi Gan, Alexandra Ferreira-Lopes	2017	Multiple countries (218)	Empirical analysis (various proxies for demand)	From 0.43 to 1.15	From -0.33 to -0.01	From -0.97 to -0.08			10
Divisekera, Sarath	2016	Multiple countries (4)	Empirical analysis (Almost Ideal Demand System)	1.26	-0.92	From 0.04 to 0.7			10
Bo Peng, Haiyan Song, Geoffrey I. Crouch, Stephen F. Witt	2015	Multiple countries (Global)	Meta-analysis (195 studies reviewed)	<ul style="list-style-type: none"> • From 1.27 to 2.40 • Overall YED: 2.53 • Accommodation YED: 1.17 	<ul style="list-style-type: none"> • From -1.37 to -0.75 • Overall PED: -1.28 to -0.73 • Accommodation PED: -0.73 				9
Truls Engstrom, Gorm Kipperberg	2015	Northern Europe (Fjord Norway)	Empirical analysis	<ul style="list-style-type: none"> • From -0.04 to 0.38 				<ul style="list-style-type: none"> • Elasticity with respect to Length of Stay (LOS): from 0.51 to 0.68 • Elasticity with respect to Travel Party Size (TPS): from -0.84 to 0.41 	9
Ulrich Gunter, Irem Onder	2017	Central / Western Europe (Austria, Vienna)	Empirical analysis		<ul style="list-style-type: none"> • From -0.55 to -0.37 • From -0.38 to -0.20 				9
Adrian R. Fleissig	2021	Other Western countries (USA)	Empirical analysis	<ul style="list-style-type: none"> • From 0.1 to 1.5 • From 0.22 to 1.1 for accommodation 	From -1.65 to -0.2	From -0.65 to 1.1			9

Author(s)	Publication year	Region of focus	Methodology	Income elasticity of demand	Price elasticity of demand	Cross-price elasticity of demand	Price elasticity of supply	Other type of elasticity	Quality assessment score
Marcelino Sanchez-Rivero, Juan Ignacio Pulido-Fernández	2020	Multiple countries (93)	Empirical analysis					Inverse demand-income elasticity: 0.96 / 0.95	9
Adrian R. Fleissig	2021	Other Western countries (USA)	Empirical analysis (Forward looking dynamic model)	Short-run • From 0.37 to 1.67 Long-run • From -0.42 to 1.16	Short-run • From -0.88 to -0.22 Long-run • From -1.86 to -0.24	Short-run • From -0.73 to 1.35			9
Jonathan Strale	2021	Northern Europe (Sweden)	Empirical analysis (Censored quantile regression)	From 0.95 to 5.71					9
Stettler, Christian	2017	Central / Western Europe (Switzerland)	Empirical analysis		• On average -0.74 / -0.97 • From -1.83 to 0.02				9
Fredman, Peter; Wikström, Daniel	2018	Northern Europe (Fulufjället National Park)	Empirical analysis	0.83 / 0.94					9
Falk, Martin; Lin, Xiang	2018	Central / Western Europe (Switzerland)	Empirical analysis (A time-varying cointegration (TVC) model)	Domestic • 1.0 (2015) Foreign • 0.8 (2015)	Domestic • -0.5 (2015) Foreign • -5.0 (2015)				9
Smeral, Egon	2019	Multiple countries (EU 15, Canada, USA)	Empirical analysis (two versions of the Standard tourism demand model)	Elasticities varying by season (Canada / EU 15 / USA): • Q1: - / 0.54 / 3.02 • Q2: 1.23 / 1.42 / 4.54 • Q3: 1.48 / 1.07 / 2.66 • Q4: 1.40 / 1.70 / 2.46					9

Author(s)	Publication year	Region of focus	Methodology	Income elasticity of demand	Price elasticity of demand	Cross-price elasticity of demand	Price elasticity of supply	Other type of elasticity	Quality assessment score
Gunter, Ulrich; Smeral, Egon	2016	Multiple countries (32)	Empirical analysis (Standard tourism demand model)	<ul style="list-style-type: none"> • N. Europe: 0.56 • C. & W. Europe: 0.23 	<ul style="list-style-type: none"> • N. Europe: -0.74 • C. & W. Europe: -0.28 				9
Opstad, Leiv; Hammervold, Randi; Idsø, Johannes	2021	Northern Europe (Norwegian campsites)	Empirical analysis	0.57	-0.82				9
Alegre, Joaquin; Pou, Llorenç	2016	Other Western countries (USA outbound tourism)	Empirical analysis of survey data (Heckman model on microdata drawn from the Consumer Expenditure Survey)	From 0.12 to 2.74					9
Smeral, Egon	2018	Multiple countries (EU 15, Canada, USA)	Empirical analysis (Modified Growth Rate (MGR) - a variation of the tourism standard model)	From 0.51 to 5.52					9
Nicolas Borzykowski, Andrea Baranzini, David Maradan	2017	Central / Western Europe (Swiss forests)	Empirical analysis and phone survey		From -0.08 to -0.8				8
Gianluca Grilli, Gavin Landgrafa, John Curtisa, Stephen Hynes	2018	The UK (Ireland's salmon fisheries)	Survey		-1.04				8
Petricek, Martin; Chalupa, Stepan; Chadt, Karel	2020	Central / Western Europe (Czech Republic)	Empirical analysis		From -1.05 to 0.85				8

Author(s)	Publication year	Region of focus	Methodology	Income elasticity of demand	Price elasticity of demand	Cross-price elasticity of demand	Price elasticity of supply	Other type of elasticity	Quality assessment score
Seetaram, Neelu; Forsyth, Peter; Dwyer, Larry	2016	Other Western countries (Australia, outbound tourism)	Empirical analysis (Dynamic OLS using two different proxies for prices)		From -1.07 to -0.00				8
Gunter, Ulrich; Önder, İrem; Zekan, Bozana	2020	Other Western countries (New York, USA)	Empirical analysis	From 1.31 to 4.90	From -0.69 to -0.4	From 0.11 to 0.55			8
Emili, Silvia; Figini, Paolo; Guizzardi, Andrea	2020	Other Western countries (specific regions of Italy)	Empirical analysis (Augmented demand functions)	From 0.9 to 5	From -0.7 to -0.3				8
Balcilar, Mehmet; Aghazadeh, Sahar; Ike, George N.	2021	Multiple countries (the 32 OECD countries)	Empirical analysis	Short run • 1.28 / 1.01 / 0.75 Long run • 0.79 / 1.14 / 0.98	Short run • -1.30 / -0.80 / -0.68 Long run • -1.56 / -0.88 / -0.83			Short run • Employment: 0.02 / 0.02 / 0.02 Long run • Employment: 0.01 / 0.01 / 0.02	8
Waqas-Awan, Aon; Rosselló-Nadal, Jaume; Santana-Gallego, Maria	2021	Multiple countries (192)	Empirical analysis (Gravity model)	By period average YED • All sample YED: 0.91 • 2008 – 2016 (post-crisis) YED: 1.06 By GDP per capita of the countries of origin (Average income / World Bank classification): • Low income YED: 0.59 / 0.45 • Middle income YED: 0.78 / 0.76 • Middle-high income YED: 1.10 / 0.68 • High income YED: -0.05 / 0.15					8

Author(s)	Publication year	Region of focus	Methodology	Income elasticity of demand	Price elasticity of demand	Cross-price elasticity of demand	Price elasticity of supply	Other type of elasticity	Quality assessment score
Button, Dixie	2022	Other Western countries (Charleston, USA)	Field experiment		From -3.27 to -1.76				8
Pham, Tien Duc; Nghiem, Son; Dwyer, Larry	2017	Other Western countries (Australia)	Empirical analysis	<ul style="list-style-type: none"> • Short-run: 3.8 • Long-run: 5.5 	<ul style="list-style-type: none"> • Short-run: -4.4 • Long-run: -6.4 				8
Tomáš, Jeřábek	2019	Central / Western Europe (region of Czech Republic)	Empirical analysis (Cointegration analysis under the vector error correction model (VECM) approach)	From 0.66 to 1.45	-1.21 / -0.84				8
Zervas, Georgios; Proserpio, Davide; Byers, John W.	2017	Other Western countries (USA)	Empirical analysis (Difference-in-Difference)		-0.39				8
Kusumah, A. H. G.	2018	Multiple countries (outbound tourism of EU, Australia, USA)	Empirical analysis	Unstandardised / Standardised: <ul style="list-style-type: none"> • Australia YED: 1.11 / 0.82 • EU YED: 0.74 / 0.42 • USA YED: 1.73 / 1.27 	Unstandardised / Standardised: <ul style="list-style-type: none"> • Australia PED: -0.88 / -0.30 • EU PED: -1.29 / -0.10 • USA PED: -1.09 / -0.41 			8	
Rossello - Nadal, Jaume; He, Jianan	2020	Multiple countries (191)	Empirical analysis	0.42 / 0.57 / 0.99	-0.07 / -0.02 / 0.06				8
Bronner, Fred; de Hoog, Robert	2017	Central / Western Europe (Dutch outbound tourism)	Empirical analysis of survey data	<ul style="list-style-type: none"> • Day trips / short vacations: YED>1 • Main summer vacation: YED<1 					8

Author(s)	Publication year	Region of focus	Methodology	Income elasticity of demand	Price elasticity of demand	Cross-price elasticity of demand	Price elasticity of supply	Other type of elasticity	Quality assessment score
Díez-Gutiérrez, María; Babri, Sahar	2022	Northern Europe (Geiranger fjord, Norway)	Empirical analysis		From -1.91 to -0.10				8
Grey literature and other sources									
PwC on behalf of the European Union (Report)	2017	EU 28	Systematic evidence review		UK From -1.4 to -1.16				10
University of Surrey on behalf of the Scottish Government (Report)	2021	Multiple countries	Systematic evidence review	Overall average estimate for outbound tourism from Scotland's top source markets: 2.6		<ul style="list-style-type: none"> • For European destinations - 1.02 • Overall average estimate for inbound tourism: -1.26 			10