A multi-period perspective on tourism's economic contribution – a regional input-output analysis for Sweden

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Abstract

Purpose – *Previous studies on tourism input-output (IO) primarily focus on a single year's snapshot or utilize outdated IO coefficients. The purpose of this paper is to analyze the multi-period development of regional tourism capacities and its influence on the magnitude of the industry's regional economic contribution. The paper highlights the importance of applying up-to-date IO coefficients to avoid estimation bias typically found in previous studies on tourism's economic contribution.*

Design/methodology/approach – *For the period 2008-2014, national IO tables are regionalized to estimate direct and indirect economic effects for output, employment, income and other value-added deffects. A comparison of Leontief inverse matrices is conducted to quantify estimation bias when using outdated models for analyzing tourism's economic contribution.*

Findings – *On the one hand, economic linkages strengthened, especially for labour-intensive sectors. On the other hand, sectoral recessions in 2012 and 2014 led to an economy-wide decline of indirect effects, although tourists' consumption was still increasing. Finally, estimation bias observed after applying an outdated IO model is quantified by approximately US$4.1m output, 986 jobs full-time equivalents, US$24.8m income and US$14.8m other value-added effects.*

Research limitations/implications – *Prevailing assumptions on IO modelling and regionalization techniques aim for more precise survey-based approaches and computable general equilibrium models to incorporate net changes in economic output. Results should be cross-validated by means of qualitative interviews with industry representatives.*

Practical implications – *Additional costs for generating IO tables on an annual base clearly pay off when considering the improved accuracy of estimates on tourism's economic contribution.*

Originality/value – *This study shows that tourism IO studies should apply up-to-date IO models when estimating the industry's economic contribution. It provides evidence that applying outdated models involve the risk of estimation biases, because annual changes of multipliers substantially influence the magnitude of effects.*

Keywords *Tourism economic contribution, Estimation bias, Flegg location quotient, Multiplier analysis, Regional input-output model*

Paper type *Research paper*

Introduction

The multiplier concept is considered as a significant base for conducting tourism economic analyses in a specific geographic area (Stabler *et al.*, 2010; Stynes, 1998; UNWTO, 2013). Traditionally, one prevailing approach for conducting economic analyses in tourism is the input-output (IO) methodology (Hara, 2008). Although it is especially important to take into consideration the limitations of this methodology (Van Wyk *et al.*, 2015), a common issue observed in most tourism IO studies is that the base of analysis is given by either the most recent available IO model for one particular (calendar) year (Ünlüönen *et al.*, 2011; Kim and Kim, 2015) or by a comparison of two (calendar) years separated by a gap of several years

(Surugiu, 2009; Sun and Wong, 2014). Researchers usually argue that underlying IO tables are infrequently published, e.g. every 5-10 years, with the result that IO models utilized for tourism economic analyses are often outdated (Eurostat, 2016; Hara, 2008; Khanal *et al.*, 2014; Kookana *et al.*, 2008; Martínez-Roget *et al.*, 2013; Miller and Blair, 2009; Munjal, 2013; Sun and Wong, 2014; Surugiu, 2009; Ünlüönen *et al.*, 2011). However, production techniques, typically denoted in economic terms as economy's "technical coefficients" change over time, which, in turn, affects the magnitude of industries' economic contribution in the long-term (Miller and Blair, 2009, p. 304). It is, therefore, crucial to consider the timeliness of IO data to avoid any generalization of results obtained from one-year snapshots as a representation for an entire period of analysis, or, at least, the analysis should be performed with caution (Miller and Blair, 2009).

Despite the partial availability of annual IO publications[1], tourism literature is lacking of empirical evidence from economic analyses based on multipliers changing over consecutive years. In addition, IO models are rarely readily available on a sub-national level, thus hampering their region-specific application. Modelling economies at the regional level are, however, especially important to reflect regional peculiarities, such as tourism clusters and regional production structures, which usually differ significantly from the national one (Miller and Blair, 2009). Region-specific models further provide valuable insights on regional industry capacities, as multipliers indicate an industry sector's level of self-sufficiency (Miller and Blair, 2009; Scott and Storper, 2003). More specifically, economic sectors in regions with relatively low multipliers require higher importation rates, resulting in high leakages. In contrast, high levels of multipliers are characterized by high self-sufficiency and low leakages in the respective regions (Stabler *et al.*, 2010).

This paper combines a *multi-period* and a *regional* perspective on tourism's multipliers. More precisely, the economic contribution of tourism activities is quantified for the period of 2008-2014. By doing so, this paper demonstrates that risks of over- and/or underestimation of economic effects occur if outdated models are used. Miller and Blair (2009, pp. 310-311) have recently emphasized this problem as follows: "The main point of the IO model is precisely that it generates results at the sectoral level, and for this kind of detail out-of-date tables can produce considerable error". Thus, by applying up-to-date models, it is possible to reliably re-construct the effects of economic shocks occurring during a particular year (period), which can only be captured if the underlying IO model stems from the same year (period). For instance, the major Swedish Airline, Scandinavian Airlines Systems (SAS), seriously suffered from the global economic crisis after 2008 from high fix and operations costs, as well as strong price competition triggered by low-cost carriers (SAS, 2013). The long-term economic consequences for the Swedish tourism region of Jämtland from salary and job cutting at SAS on both the air transport and its related sectors can be quantified through an economic analysis on a multi-period base.

The Swedish county of Jämtland (NUTS 3 region), which is chosen as the study area, is located in the mid-west of Sweden. With a population of approximately 127,000 (2.6 inhabitants/km^2), Jämtland can be considered as a typical nature-based and winter sport destination with Åre, one of Sweden's most popular winter sport area. Jämtland's capital city, Östersund, is member of the UNESCO Creative City Network focussing on gastronomy. The city hosts several events, ranging from international music festivals to the annual Biathlon World Cup, the Biathlon World Championship in 2019 and the Alpine World Ski Championships in 1954, 2007 and 2019. Despite its predominance of winter tourism, Jämtland can be considered as an all-year-round destination. However, existing regional tourism statistics only refer to *direct* expenditure data, employment generation and tax incomes (Resurs, 2016). Accordingly, in 2015, the regional tourism industry employs 4,360 people and records a turnover of SEK 4.65bn (i.e. US$550m), equivalent to an increase of 4.3 per cent compared to 2014. More than 10 per cent of tourism sales are generated through ski-pass sales. Approximately 10.3 million overnights are registered, of which the

majority (i.e. 5.8 million) relate to private accommodation, while 2.9 million are registered at commercial accommodation providers (JHT, 2016).

Economic analysis of tourism – the input-output approach

Literature on tourism's economic contribution and impact discusses and compares a set of popular models and methodological approaches, such as Keynesian, IO or computable general equilibrium (CGE) models (Klijs *et al.*, 2012; Watson *et al.*, 2007). Social accounting matrices (SAMs), as an extension of the IO framework, incorporate a comprehensive view on the economy by considering the detailed roles of (disaggregated) households, factors of production and social institutions (Miller and Blair, 2009). Nevertheless, the IO/SAM framework is often criticized for its underlying assumptions and limitations that might lead to false conclusions if wrongly interpreted (Van Wyk *et al.*, 2015). More precisely, assumptions behind IO/SAM imply that industries consist of linear input structures; produce one representative good or service; exhibit constant return to scale; and are capable to provide unlimited labour and capital at fixed prices (Miller and Blair, 2009). CGE models, on the other hand, are capable to address these limitations by applying a system of equations directly derived from (neoclassic) economic theory. These systems of equations describe the behaviours of economic actors, such as producers and consumers, and the outcome of economic activity and impose market-clearing constraints (Burfisher, 2017; Dwyer, 2015). Accordingly, results can be improved as effects from both price changes and factor substitution are incorporated. Nevertheless, the relationship between CGE modelling and IO-based frameworks is still present, as the former requires SAMs as a framework for its core data input (Burfisher, 2017, p. 58). However, the complexity from additional assumptions on market actors and clearance mechanisms makes the comparability and verification of CGE models, as well as the communication and dissemination of their findings, particularly difficult (Hara, 2008; Klijs *et al.*, 2012).

Despite their well-documented limitations (Dwyer *et al.*, 2004), literature argues that IO models are a reasonable compromise (especially regarding its time and data efficiency), if a study's purposes are well-considered and underlying methodological assumptions and limitations are clearly interpreted (Hara, 2008; Martínez-Roget *et al.*, 2013; Robison, 2009; Van Wyk *et al.*, 2015). IO models are particularly suggested as an appropriate tool if the purpose of the study is to measure the gross change in economic activity associated with tourism activities (Watson *et al.*, 2007, p. 142), such as an ex post perspective of tourism's current or past economic contribution to a regional economy. In other words, IO models are capable of quantifying how much of the region's output, income, employment and other value-added effects are associated with tourism demand (i.e. spending) during a specific time period (Watson *et al.*, 2007). This approach, however, does not take into account net changes and differs from predictive uses to estimate the economic impact from hypothetical shocks/scenarios of changes in final demand in a certain region (Robison, 2009; Watson *et al.*, 2007). Accordingly, Bonn and Harrington (2008) showed in their comparison study that IO modelling is still widely recognized as an appropriate tool for a comprehensive economic tourism industry analysis. This observation is supported by Teigeiro and Díaz (2014), who highlight the importance of IO modelling for economic analyses in tourism. Mazumder *et al.* (2012, p. 291) conclude that "economic impact studies of tourism should utilize static and dynamic Input-Output models to derive macro-economic multipliers for the tourism industry".

Several authors have conducted applications of IO modelling on the sub-national level, where most of them faced the problem of outdated models. For instance, Martínez-Roget *et al.* (2013) investigated the economic contribution of academic tourism in the Spanish region Galicia, utilizing a regional IO table for the calendar year 2005. Daniels (2004) presented an innovative paper that estimates the contribution of sport events to regional income. For this purpose, IO-based employment multipliers for Mecklenburg County (USA)

are related to occupational wage data to estimate total income generated by sport events for different occupation types. Saayman and Rossouw (2011) applied multipliers based upon a SAM for the year 2000 to estimate direct, indirect and induced effects of festivals in the Eastern Cape Province of South Africa. The study by Zhang and Rassing (2000) shows a regional IO table for the island of Bornholm (Denmark), which has been extended by 12 tourism sub-sectors on the base of survey data. By doing so, income and employment effects induced by the tourism industry are estimated. Finally, the paper by Kim and Kim (2015) highlights IO modelling as the leading tool for measuring economic contribution of the tourism industry, offering "policymakers [...] a variety of quantitative industrial information for a better decision-making process" (Kim and Kim (2015, p. 136). Based on *output, income and employment* multipliers, the authors contrast two hospitality industries (i.e. *hotels* and *other accommodations*) with the remaining industries in the US state of Texas. As a major finding, both industries perform lower than the average of all 440 sectors in terms of income and employment multipliers. Interestingly, however, tourism sectors outperform other industries in terms of output multipliers. A comparison between the *hotel* and *other accommodation* sector shows that the former generated more labour income and employment, whereas the latter sector created relatively more output. Thus, in total, both sectors contribute to the state-wide economy mainly through strong *induced* output effects. With relation to the study at hand, a major limitation indicated by Kim and Kim (2015) is that multiplier analyses solely based on one single year are not sufficient for a deeper investigation of economic contributions from the state-wide hospitality sector (Kim and Kim, 2015, p. 146). To relax this limitation, this paper proposes a multi-period IO analysis capable of deducing insights on the multi-period development of regional tourism capacities, sectoral interrelationships and tourism's total economic contribution to the region.

Methodology

Input-output modelling

IO frameworks describe monetary flows of goods and services between various sectors of an economy over a specific period (Miller and Blair, 2009). The system quantifies interrelationships among the sectors of an economy in a matrix format, where the columns display the monetary value of received input units and the rows reflect the corresponding output. An IO table represents a fixed price equilibrium system, where input equals output. More precisely, the matrix is expressed as $X = AX + Y$, where X is the output vector, A is the input coefficient matrix and Y is the (final) demand vector. The model $\Delta X = (I - A)^{-1} \Delta Y$ describes the marginal change of total output resulting from a marginal change in final demand (Miller and Blair, 2009). As previously stated, following assumptions are made:

- Each sector produces only one representative good.
- Inputs have fixed proportions.
- Capacity constraints for labour and capital do not exist (Lindberg and Hansson, 2009).

Swedish input-output table

To especially address limitations regarding the short time-horizon of previous tourism IO studies (Kim and Kim, 2015; Mazumder *et al.*, 2012; Sun and Wong, 2014), a multi-period regional IO analysis is conducted for the years 2008-2014 for the Swedish region of Jämtland. Among the 65 sectors (i.e. economic activities) considered by the national Swedish IO table, the closest tourism-related sector is identified as "Accommodation and food services" (SNI code: I55-56). In addition, the following six industry sectors regularly offer tourism-related activities: *wholesale and retail trade* (G45-47); *land transport services* (H49); *air transport service*s (H51); *travel agencies and tour operators* (N79); *creative, arts,*

entertainment, museum and other cultural services (R90-92); and *sporting, amusement and recreation services* (R93). Swedish tables from 2008 and later are compiled on the basis of the ESA2010 standard (Eurostat, 2013), whereas releases before 2008 were constructed on the basis of ESA1995. It is, however, not recommended to take the latter into consideration because of differences in the definition of economic sectors (Statistiska centralbyrån (SCB), 2017).

Regionalization of the Swedish input-output table

Unlike the US-based IMPLAN database (Minnesota Implan Group, 2015), Sweden and other countries do not necessarily provide regional IO tables. Hence, economic multipliers for tourism-related sectors are rarely available on the regional level (Kowalewski, 2012). To address this issue, various regionalization techniques have been developed, such as the survey, non-survey or mixed-method approach (Hewings, 1985; Richardson, 1972). For this study, the cost- and time-efficient non-survey method has been adopted. Accordingly, regional intra-sectoral transactions are derived by modifying the national IO table, resulting in region-specific IO coefficients. By applying the Flegg location quotient (FLQ), the structure of regional industry sectors is deduced from the national employment structure (Flegg and Webber, 2000). FLQ is based on employment figures linking the volume of importations with the relative size of the regional economy (Kuhar *et al*., 2009). On the base of the industry technology assumption, which implies that the production technology is the same within each industry sector (Var and Quayson, 1985; Gerking *et al*., 2001), the level of self-sufficiency of each sector and the corresponding importation requirements can be estimated (Flegg and Webber, 1997; Miller and Blair, 2009). Accordingly, for the respective year *t*, FLQ is defined as:

$$FLQ_{ijt} = \frac{REi/NEi}{REj/NEj}\left[log_2\left(1+\frac{TRE}{TNE}\right)\right]^{\delta}$$

where subscripts *i* and *j* indicate the supplying and purchasing sectors, respectively; *RE* is Jämtland's regional employment; *NE* is the national employment; *TRE* reflects Jämtland's total employment; and *TNE* is Sweden's total employment. The term $log_2\left(1+\frac{TRE}{TNE}\right)^{\delta}$ is a weighted measure for the regions' relative size. The parameter δ takes values between 0 and 1 (Flegg and Tohmo, 2011). The larger a region, the greater the input coefficient and the smaller the importation coefficient. Previous literature recommends δ = 0.3 as the most accurate value (Bonfiglio and Chelli, 2008; Flegg and Webber, 1997, 2000; Flegg and Tohmo, 2011; Lindberg *et al*., 2012), which is, therefore, adopted for the Jämtland model. National and regional employment data for the years 2008-2014 are obtained from SCB. As multipliers compiled upon closed models tend to overestimate the effect from omitting net changes (Miller and Blair, 2009, p. 253; Watson *et al*., 2007), the Jämtland model is specified as an *open model*, thus compiling *Type I multipliers* which provide *indirect* effects measuring gross changes in *output, employment, income* and *other value-added effects*.

Tourisms direct and indirect effects on the regional economy

The subsequent annual economic analysis between 2008 and 2014 specifies the final demand vector by considering tourists' regional consumption rates per sector. Data are obtained from the National Tourism Database, a database that is populated through representative annual telephone surveys focussing on domestic and international travel behaviour, also utilized for official national statistics, such as Sweden's Tourism Satellite Account (Resurs, 2016; JHT, 2016; Tillväxtverket, 2016). The data consider new money from outside the region spent within the region of Jämtland on six expenditure categories: *accommodation, groceries, restaurant, transportation* (including gasoline), *shopping* and

tourism activities. The following allocation was conducted to match expenditure categories with industry sectors as represented in the IO table: *accommodation* and *restaurant* are matched with the IO sector *accommodation and food services*, *shopping* with *wholesale and retail trade* and *tourism activities* with *sporting, amusement and recreation services*. As a matter of fact, most tourists travelling to and inside Jämtland use their own vehicle as a mode of *transport*. Accordingly, approximately 85 per cent of transportation expenditures refer to fuel costs (Resurs, 2016), which are allocated to the *wholesale and retail trade* sector. The remaining 15 per cent have been omitted for this study, as there is no further information on the specific type of transportation available. The final demand vector is constructed on the basis of the regional capture rate, which takes into consideration the share of locally produced goods and margins staying within the region (Stynes, 1998). Imports from outside the region have been deducted accordingly.

Study results

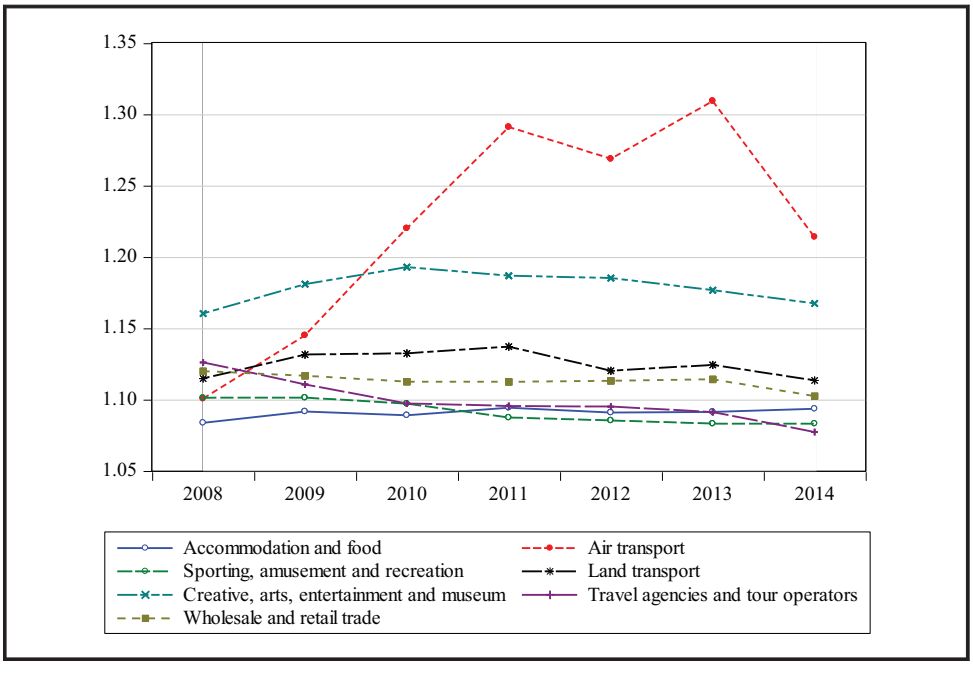
As mentioned, this study compiles *Type I* multipliers (Miller and Blair, 2009) estimating tourism's economic contribution considering four different measures: *output, employment, income and other value-added effects*. However, because of space limitations, we exemplarily provide a detailed description of the multi-period development only for *output* effects, and a summary of results for the remaining three indicators can be found at the end of this section.

Multi-period development of output multipliers

The output multiplier related to one sector indicates the change in total output within the entire regional economy by the increase of one unit of demand in that specific sector. Type I multipliers consider intermediate demand among industries, which is also expressed as indirect effects (Miller and Blair, 2009).

Overall, Type I output multipliers (Figure 1) across all tourism-related sectors range from 1.083 for *sporting, amusement and recreation* to 1.309 for *air transportation*. Both, low and

Figure 1 Type I output multiplier for tourism-related sectors



top end values have been registered in 2013. It can be clearly seen that the flow of intermediate demand developed quite differently among various tourism-related sectors. *Wholesale and retail trade; land transport; travel agencies and tour operators;* and *sporting, amusement and recreation* show a negative average annual growth rate of −0.22, −0.02, −0.63 and −0.24 per cent, respectively, and *air transport; accommodation and food*; and *creative, arts, entertainment and museum* developed positively over the years. Interestingly, *air transportation*, having the second lowest multiplier of 1.101 in 2008, increased its regional intermediate demand significantly by 2013, with temporary declines in 2012 and 2014. This equals the largest growth within seven years (10.30 per cent) for all seven analyzed sectors. The sector's decline in intermediate demand in 2012 is most likely explained by SAS, which suffered from a drop of demand due to the global economic crisis, high costs and price competition triggered by low-cost carriers (SAS, 2013) (Table I).

Oppositely, *travel agencies and tour operators*, having the second highest multipliers among all sectors in 2008 (i.e. 1.126), performed with a constantly negative growth over the whole period (i.e. −4.34 per cent), resulting in industry-wide lowest multipliers in 2014 (i.e. 1.077). This trend is possibly affiliated to recent developments in digitalization and disintermediation. By looking at the *accommodation and food* sector, the overall growth of Type I multipliers has been positive, i.e. 0.91 per cent, with alternating positive and negative changes over the years. Compared to all other sectors showing negative trends in 2014, *accommodation and food* is the only core tourism sector indicating a slightly positive growth of 0.20 per cent.

Multi-period development of tourisms contribution to regional output

IO modelling estimates change in total regional output, which are a result of an initial change in final demand (Miller and Blair, 2009). In this study, the final demand vector for each year is constructed from respective annual tourists' expenditures on three tourism-related sectors: *wholesale and retail trade; accommodation and food; and sporting, amusement and recreation* (i.e. first columns of each sector in Table II). Import rates applied to goods sold by the *wholesale and retail trade* sector significantly reduce the amount of money staying within the region (Stynes, 1998).

Figure 2 illustrates the development of *direct, indirect* and *total* output effects generated by Jämtland's combined tourism industry[2]. The line representing total output effects clearly shows that the contribution of tourism is consistently growing each year, from SEK 2,777m (approximately US$315m) in 2008 to SEK 3,713m (approximately US$421m) in 2014 – a distinctive increase of 33.69 per cent.

Interestingly, for the year 2012, a decline of intermediate effects by SEK 4m (approximately US$450,000) is indicated, although initial direct effects grew by SEK 29m (approximately US$3.3m). This contrasting trend is primarily explained by the

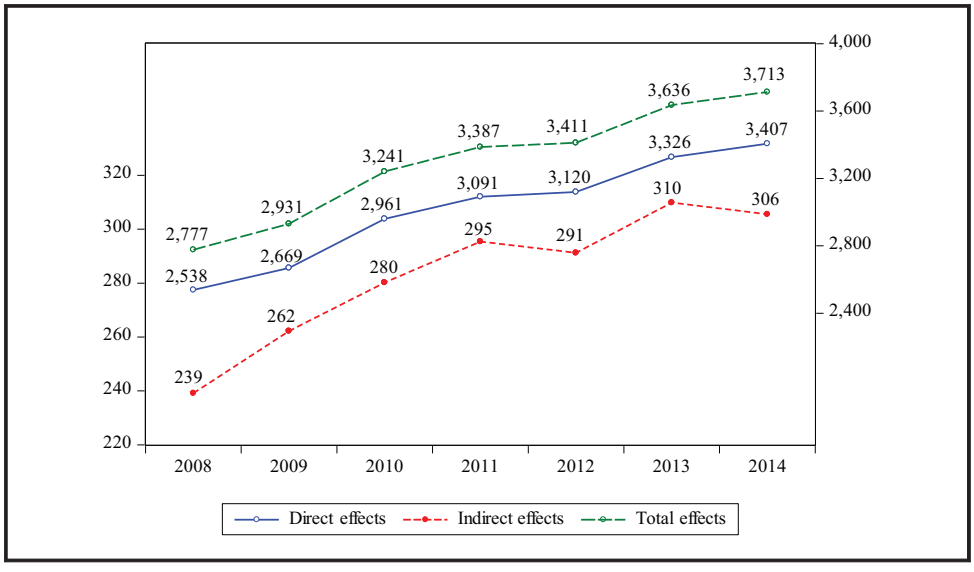
Table I Development of Type I output multipliers for tourism-related sectors

Period	*Wholesale and retail trade (%)*	*Land transport (%)*	*Air transport (%)*	*Accommodation and food (%)*	*Travel agencies and tour operators (%)*	*Creative, arts, entertainment and museum (%)*	*Sporting, amusement and recreation (%)*
Δ 2008-2009	−0.29	1.50	4.03	0.74	−1.37	1.77	0.02
Δ 2009-2010	−0.36	0.08	6.56	−0.25	−1.21	1.01	−0.38
Δ 2010-2011	−0.01	0.41	5.83	0.48	−0.16	−0.50	−0.89
Δ 2011-2012	0.06	−1.49	−1.73	−0.31	−0.04	−0.14	−0.19
Δ 2012-2013	0.10	0.36	3.20	0.04	−0.35	−0.72	−0.20
Δ 2013-2014	−1.06	−0.96	−7.28	0.20	−1.27	−0.79	0.00
Δ 2008-2014	−1.56	−0.12	10.30	0.91	−4.34	0.60	−1.64
Ø growth	−0.22	−0.02	1.41	0.13	−0.63	0.09	−0.24

Table II Direct tourist expenditures and the development of output effects induced by tourism-related sectors in Jämtland

	Wholesale and retail trade				*Accommodation and food*				*Sporting, amusement and recreation*			
Period	*Direct (in million SEK)*	*Direct Δ(%)*	*Indirect Δ(%)*	*Total Δ(%)*	*Direct (in million SEK)*	*Direct Δ(%)*	*Indirect Δ(%)*	*Total Δ(%)*	*Direct (in million SEK)*	*Direct Δ(%)*	*Indirect Δ(%)*	*Total Δ(%)*
2008	447				1,479				612			
2009	475	6.27	3.39	5.96	1,597	7.98	18.30	8.78	597	−2.45	−2.27	−2.43
2010	481	1.17	−2.34	0.81	1,800	12.71	9.41	12.43	680	13.90	9.16	13.47
2011	497	3.44	3.29	3.43	1,891	5.06	11.27	5.56	703	3.38	−7.01	2.46
2012	530	6.54	7.13	6.60	1,889	−0.11	−3.65	−0.41	701	−0.28	−2.65	−0.47
2013	532	0.49	1.52	0.59	2,069	9.53	10.06	9.57	725	3.42	0.73	3.21
2014	587	10.30	−3.46	8.89	2,065	−0.19	−0.93	−0.25	755	4.14	−0.80	3.76
Δ 2008-2014	140	31.34	9.51	29.01	586	39.62	51.31	40.52	143	23.37	−3.50	20.90
Ø growth	23.34	3.97	1.31	3.71	97.67	4.88	6.10	4.98	23.83	3.05	−0.51	2.75

Figure 2 Output effects in Jämtland (in million SEK)



combined effects from decrease of both direct effects and output multipliers for the sectors *accommodation and food* (i.e. −0.11 and −0.31 per cent, respectively) and *sporting, amusement and recreation* (i.e. −0.28 and −0.19 per cent, respectively). Similarly, also in 2014, indirect effects declined by SEK 3m (approximately US $340,000), although direct effects grew by SEK 81m (approximately US$9.2m). Although, as communicated by official tourism reports, regional tourism industry constantly grew and thus contributes to the region's development, additional tourists' expenditures seem not to be reflected to the same extent by intermediate demand across the sectors (Hara, 2008). Nevertheless, the year 2013 indicates a strong temporary boost of indirect effects by SEK 19m (approximately US$2.2m), due to increases in tourists' expenditures in all sectors and predominantly positive multiplier fluctuations. The latter finding indicates a strengthening of economic linkages between the tourism industries and the regional economy (Hara, 2008).

A more detailed perspective on the economic contribution of each of the three tourism-related sectors can be found in Table II, which displays change rates of total output triggered by each tourism sub-sector. For each sector, yearly fluctuations of multipliers show a strong influence on the development of indirect effects. For instance, direct expenditures for *wholesale and retail trade* increased by 31.34 per cent during the seven-year period, whereas indirect effects only increased by a rate of 9.51 per cent. In years 2010 and 2014, indirect effects even made contrasting developments, declining by 2.34 and 3.46 per cent, respectively. Similarly, indirect effects related to *sporting, amusement and recreation* activities declined in 2011 and 2014, even though direct tourists' expenditures increased in these years by 3.38 and 4.14 per cent, respectively. The predominantly negative growth of this sector's multipliers over the years is reflected in the overall decline of indirect effects by 3.50 per cent. This result implies that this sector has weakened its sectoral linkages continuously and, hence, decreased its contribution to the rest of the economy, whereas demand for *sporting, amusement and recreation* services was increasing by 23.37 per cent over the entire period.

In contrast, the economy-wide contribution triggered by *accommodation and food* activities increased tremendously between 2008 and 2014 by 51.31 per cent. As mentioned, only during 2012 and 2014, a negative growth of indirect output effects is shown, mainly

explained by decrease in direct tourists' expenditures in this sector. Nevertheless, during the remaining years, this sectors' contribution to regional output grew exceptionally by 18.30 per cent (2009), 9.41 per cent (2010), 11.27 per cent (2011) and 10.06 per cent (2013). These results clearly indicate that this core tourism sector needs to be considered as a significant contributor to the region's economic output, resulting in a growth of total output by 40.52 per cent over the past seven years.

Summary of multi-period developments of employment, income and other value-added effects

In addition to the estimation of regional output effects, this study further considers tourism's contribution to regional employment, income and other value-added effects. Employment multipliers estimate the number of jobs required (i.e. generated) throughout the regional economy if final (tourism) demand increases by SEK 1m (Miller and Blair, 2009). Findings show that the effects from an increasing tourism demand on regional employment has grown by an average rate of 3.01 per cent (Table III). In 2008, almost 3,200 jobs were directly and indirectly affiliated with tourism, and six years later, 3,937 jobs were required to meet the growing demand. In 2011, tourism demand increased in all major tourism-related sectors (i.e. *wholesale and retail trade; accommodation and food;* and *sporting, amusement and recreation*, see Table II). However, the economy-wide total employment effect decreased by around 1 per cent. The reason behind this development lies particularly in weak effects contributed from *sporting, amusement and recreation* activities. The employment effects from the *accommodation and food* sector remained relatively stable for that year (i.e. −0.03 per cent). Similarly, in 2014, slightly decreasing tourism demand for *accommodation and food* services (i.e. decrease by SEK 3m or approximately US $340,000) were causing a decrease in total employment effect by 1.26 per cent. In contrast, during 2009-2010, the total employment effect developed by 9.66 per cent mainly because of a significant increase in tourists' expenditures on *sporting, amusement and recreation* activities, thus compensating the decline in this sectors' employment multiplier.

In an analogous fashion, income multipliers indicate the income effect throughout the economy by the increase of one unit (e.g. SEK 1m) in final demand (Miller and Blair, 2009). The economy-wide income effect triggered by the tourism industry grew continuously by an annual rate of 5.11 per cent, and exceptional 41.79 per cent (i.e. SEK 313m or approximately US$35.5m), for the entire period. This strong positive development is primarily caused by the labour intensiveness of the *accommodation and food* sector, thus contributing the most to regional income and also indicating the largest growth for the entire period (i.e. 51.29 per cent). The underlying income multipliers for these sectors (*note*: not illustrated in this paper) reveal that both *accommodation and food* and *wholesale and retail trade* strengthened their effects by 8.64 and 5.65 per cent between 2008 and 2014, respectively. In contrast, although low growth rates of income multiplier are reported for

Table III Development of employment, income and other value-added effects

	Employment		*Income*		*Other value-added effects*	
Period	*Total*	*Δ(%)*	*Total (in million SEK)*	*Δ(%)*	*Total (in million SEK)*	*Δ(%)*
2008	3,199	–	747	–	1,310	–
2009	3,407	6.50	814	8.95	1,369	4.47
2010	3,736	9.66	886	8.81	1,492	8.95
2011	3,700	−0.97	925	4.45	1,565	4.96
2012	3,770	1.88	959	3.59	1,621	3.57
2013	3,987	5.76	1,032	7.69	1,734	6.98
2014	3,937	−1.26	1,060	2.63	1,784	2.87
Δ 2008-2014	738	23.06	313	41.79	474	36.16
Ø growth	123	3.01	52	5.11	79	4.51

sporting, amusement and recreation (i.e. 0.20 per cent), growing demand contributes to increased regional income by 3.02 per cent annually.

Other value-added multipliers depict the total value-added effect generated throughout the regional economy due to an increase of one unit (e.g. SEK 1m or approximately US $113,000) in final demand. The term "other value-added" considers each sector's compensation of employees (i.e. wages and salaries and employers' social contribution), taxes on production less subsidies and sectors' gross operating surplus and mixed income (Eurostat, 2016)[3]. According to Table III, tourism's contribution to regional value-added effects constantly grew on an average rate of 4.51 per cent, or SEK 79m (approximately US $9m), annually. An increase of about 9 per cent took place in 2010, which is explained by an especially high demand for *accommodation and food* services. However, the growth of other value-added effects during the entire period is not just explained by increasing direct expenditures on tourism activities. The underlying sectoral multipliers are also responsible for this trend. More precisely, for all three tourism sectors, multipliers related to other value-added effects grew between the range of 0.72-2.80 per cent. This development clearly shows that the tourism industry continuously strengthens its contribution to value-added effects and subsequently, the contribution to economic growth for the Swedish region of Jämtland.

Avoidance of estimation bias through multi-period input-output modelling

As mentioned in the Introduction, results from IO tables restricted to one specific year should not be generalized for longer periods of analysis, because of economy's changes in production techniques (i.e. "technical coefficients") over time (Miller and Blair, 2009). Indeed, regional tourism sectors are strongly affected by fluctuations, as illustrated above. The stability of IO coefficients can be assessed either by comparing direct input coefficients or by comparing Leontief inverse matrices of different years (Carter, 1970; Miller and Blair, 2009). This paper follows the latter approach. Accordingly, instead of a given set of final demand used for various Leontief inverses of past years, actual final demand of each year is compared using both "outdated" coefficients from 2008 and annually "updated" coefficients for 2009-2014. By doing so, the stability of coefficients can be assessed. Put differently, fluctuations and hence the magnitude of the economic contribution can directly be compared. This approach allows quantifying the effect from the non-availability of annual IO models, which has been problematic for most previous studies on the economic contribution of tourism. Thus, errors can be interpreted as over- or underestimation of the economic contribution. The net bias per economic indicator is shown in Table IV, where various degrees of over- and underestimations are presented.

Interestingly, especially employment effects for the regional economy would have been strongly overestimated if an outdated model was used for the years 2010-2014. Although, in

Table IV Under-/overestimation of results obtained using 2008 coefficients

	Indirect output		*Employment*		*Income*		*Other value-added effects*	
Period	*Total Δ (in million SEK)*	*Δ(%)*	*Total Δ*	*Δ(%)*	*Total Δ (in million SEK)*	*Δ(%)*	*Total Δ (in million SEK)*	*Δ(%)*
2008	0	0.00	0	0.00	0	0.00	0	0.00
2009	−11.34	−4.33	−46	−1.35	−29.43	−3.61	9.53	0.70
2010	−3.32	−1.19	2	0.05	−15.95	−1.80	31.42	2.11
2011	−6.60	−2.23	204	5.51	−17.33	−1.87	23.98	1.53
2012	1.08	0.37	164	4.35	−41.86	−4.37	−13.53	−0.83
2013	0.25	0.08	213	5.34	−56.11	−5.44	−24.72	−1.43
2014	13.86	4.54	358	9.08	−58.39	−5.51	−27.20	−1.52
Ø annual dispersion	6.08	±2.12	164	±4.28	36.51	−3.77	21.73	±1.35
Total dispersion	36.45	12.74	986	25.68	219.07	22.6	130.38	8.12

2009, the effect would have been underestimated by −1.35 per cent (equivalent to −46 jobs), employment for the following years would be overestimated by up to 9.08 per cent (i.e. 358 jobs). This leads to an average dispersion rate of ±4.28 per cent per year. In contrast, income effects seem to be clearly underestimated per year, on average by −3.77 per cent (i.e. SEK 36.5m or approximately US$4.1m). The estimation bias for indirect output and other value-added effects is rather volatile, where some years are strongly underestimated and some are overestimated with average dispersion rates of ±2.12 and ± 1.35 per cent, respectively. Different developments over the seven-year period are illustrated by Figures 3 and 4.

Discussion and summary of findings

This paper investigates the economic contribution of tourism demand between 2008 and 2014 for the Swedish region of Jämtland. By proposing a multi-period IO approach, direct and indirect effects from tourist expenditures on the regional economy are quantified. FLQ has been applied on annual national IO tables to generate regional-specific (i.e. Type I) multipliers for four economic impact measures: output, employment, income and other value-added effects (Miller and Blair, 2009). Results for the multi-period development of regional *output* multipliers show a trend towards stronger linkages of the three sectors: *air transport; accommodation and food;* and *creative, arts, entertainment and museum* with the rest of the regional economy. In contrast, *wholesale and retail trade*; *sporting, amusement and recreation;* and especially *travel agencies and tour operators* can be characterized by weakening inter-sectoral linkages with other economic sectors over time. Exceptional is the strengthening of *air transportation* multipliers, which is a clear sign of improving linkages within the region, thereby reducing the rates of importation (Flegg and Webber, 1997). SAS's temporary decline in economic performance in 2012 is well reflected in the model as well. More precisely, the years 2012 and 2014 are characterized by a recession, reflected by predominant negative growth rates of output multipliers. Interestingly enough, although output multipliers of the entire tourism industry declined in 2014, the core tourism sector *accommodation and food* could further strengthen its linkages as the only sector.

Following the discussion of sector-specific multipliers, tourism's economic contribution to the region is estimated by constructing the final demand vector from tourism expenditures

Figure 3 Under-/overestimation of output and employment effects (in thousand SEK)

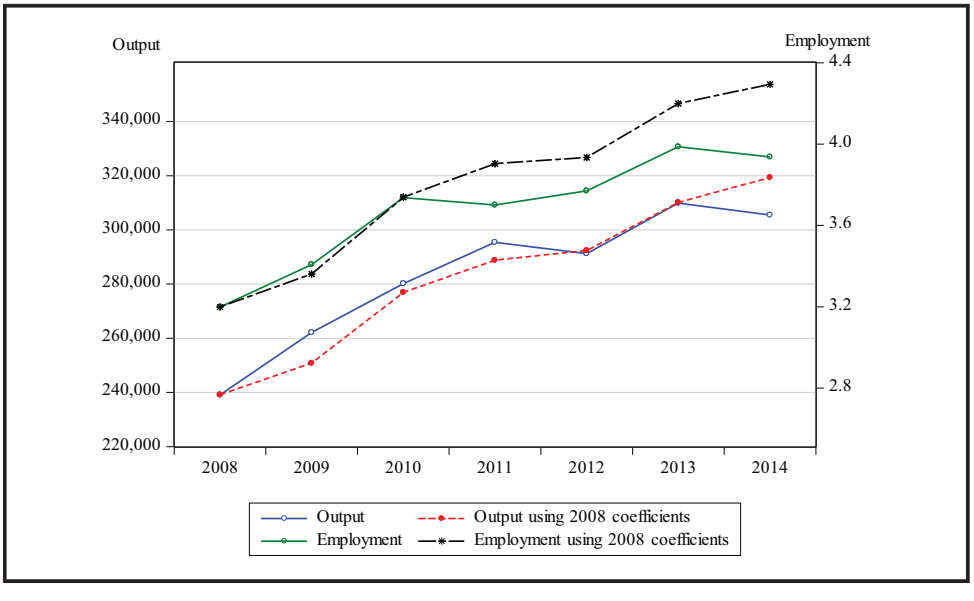
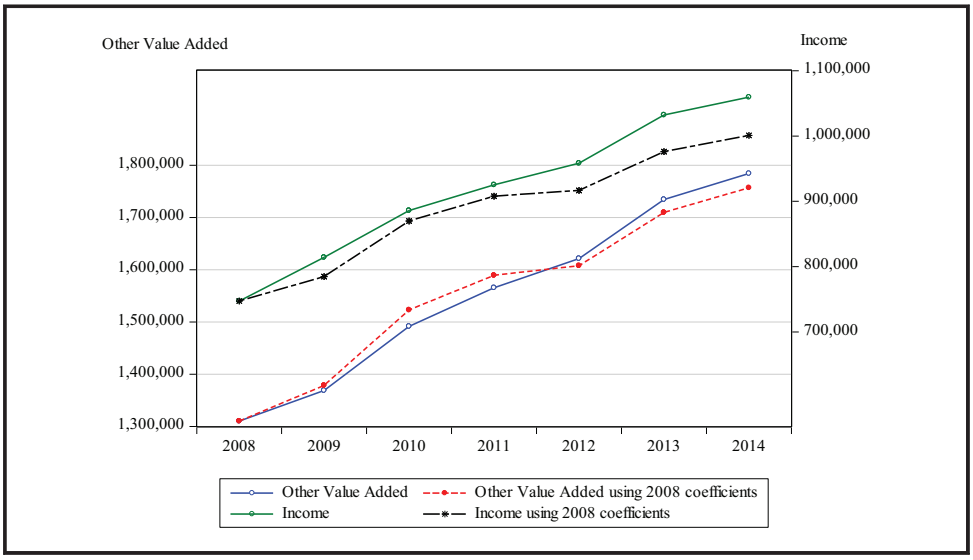


Figure 4 Under-/overestimation of other value-added effects and income effects (in thousand SEK)



between 2008 and 2014 (Hara, 2008; Watson *et al.*, 2007). Our study revealed that even though tourist expenditures increased in 2012 and 2014, declining multipliers in those years caused the economy-wide contribution to sectoral output to drop by more than SEK 4m (approximately US$450,000). This is mainly due to the weak performance of the *accommodation and food* sector, showing both declining multipliers and declining tourism demand in 2012 and 2014. Nevertheless, indirect effects and hence the sectors' contribution to the region's output increased tremendously because of *accommodation and food* activities (51.31 per cent) and *wholesale and retail trade* (9.51 per cent). By contrast, the contribution from *sporting, amusement and recreation* services decreased by 3.50 per cent. These findings show that changes in sectoral multipliers can have significant effects for the regional economy. Results further show that strong increases in initial tourist expenditures can mitigate the effects from declining multipliers. For example, in 2010, output multipliers of the *accommodation and food* sector declined by 0.25 per cent, whereas the corresponding indirect contribution to the overall economy increased by 9.41 per cent, because of strong increases in initial direct tourist expenditures (12.71 per cent).

To sum up, our analysis of multi-period economic contributions revealed valuable insights on the effects from temporal changes of inter-industry linkages on tourism's total contribution to a regional economy. It clearly shows that linkages among industry sectors change from year to year and thus have significant effects on the estimation of tourism's economic contribution. By looking at the socio-economic measures, it can be seen that the tourism industry constantly contributed to regional employment and income. In addition, the recessions in 2012 and 2014, leading to declining indirect output, have not affected the economy-wide income effect negatively. This shows that temporary negative trends primarily affect sectoral output but to a lesser extent affect employment, income and other value-added effects.

Most importantly, as hypothesized by Miller and Blair (2009), our proposed multi-period analysis demonstrates that significant risks for estimation bias, indeed, exist if outdated IO models are applied. While employment effects were clearly overestimated, income effects would have been continuously underestimated. Especially, temporary sectoral and/or economy-wide shocks affect multipliers and hence affect the accuracy of the estimation of tourism's economic contribution. Output effects would have been under-estimated until

major declines of multipliers in 2012 and 2014 lead to overestimations. When an outdated model was used, also employment effects, in a similar way, indicated opposing growth rates in the years 2011 and 2014 compared to up-to-date models. These findings highlight the importance of the availability of annual IO models when measuring tourism's economic contribution. The insights should, thus, motivate countries' national statistic bureaus to compile IO tables on an annual base.

Conclusions and study limitations

The proposed multi-period perspective for tourism economic analyses reveals valuable insights on annual changes in structural interdependencies within a regional economy. More precisely, multiplier developments indicate how the regional tourism industry either strengthens, weakens or maintains its level of self-sufficiency over time (Var and Quayson, 1985). In particular, the core tourism sector *accommodation and food*, as well as the tourism-related sector *air transportation*, positively developed its inter-dependency with other economic sectors in the study region. This paper shows how tourism multipliers fluctuate on an annual basis, thus highlighting considerable reliability issues if tourism's contribution to a regional economy is not estimated on the base of current IO coefficients. Thus, from a practical point of view, the additional costs for generating annual tables can be paid off when considering the improved accuracy in measuring tourism's economic contribution. Furthermore, in addition to the usual "optimistic" view of standard tourism statistics focussing on direct tourist expenditures, the estimation of indirect effects sheds light on the total economic contribution of tourism based on regional interlinkages of the respective economic sectors. Taking into consideration such additional information can be particularly valuable for tourism stakeholders when arguing pro-regional development incentives in favour of the tourism industry, because in our case, the analysis revealed that the tourism core sectors tended to strengthen their linkages with the regional economy over time (Stynes, 1998; Pike *et al.*, 2017).

This study has methodological limitations, in particular, regarding the used regionalization technique (Flegg and Tohmo, 2011) and the inherent assumptions of the IO methodology (Miller and Blair, 2009). In fact, the most cost-effective approach has been chosen for the regionalization of the national (i.e. Swedish) IO table. Thus, as suggested in the literature (Hewings, 1985), in future attempts, more precise mixed-method approaches are suggested. By doing so, regional tourism-related sectors are modelled on the basis of survey data (Kuhar *et al.*, 2009). In addition, IO assumptions can be further relaxed using a non-linear IO model, as suggested by West and Gamage (2001), or by including additional constraints on domestic capacities (Wanhill, 1988). Moreover, the utilization of a multi-period CGE model also allows the incorporation of induced effects through net changes in economic output (Dwyer *et al.*, 2004; Watson *et al.*, 2007). Finally results should be cross-validated by means of qualitative interviews with representatives of the respective tourism sub-sectors (Creswell, 2010). By following a study by Daniels (2004), IO results on the basis of the proposed multi-period perspective can be further enriched by adding occupational data. By doing so, long-term changes in the distribution of income among various job types can be estimated.

Notes

1. Until recently, some countries started to compile IO models on an annual basis, such as the USA (BEA, 2017), Korea (Kim *et al.*, 2015), Denmark (Statistics Denmark, 2017) and Sweden (SCB, 2017). Also, the Organisation for Economic Cooperation and Development (OECD, 2017) published IO tables annually only until 2011. The 2011 IO table for Sweden, for instance, is, however, based on the outdated Industry classification SNI 2002. In contrast, the official Swedish national statistical bureau SCB provides annual tables since 2008 based on the updated SNI 2007 (SCB, 2017).
2. Total effects usually refer to the sum of direct, indirect and induced effects (Stynes, 1998). However, for the study at hand, the results are obtained using the open model, i.e. induced effects are not compiled.

3. The latter refers to the remuneration of work carried out by the owner of an unincorporated enterprise, as it cannot be distinguished from entrepreneurial profits of owners (Eurostat, 2016).

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