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Combined CGE and Satellite Accounts Methodologies for the Measurement of the Impacts of Tourism – A Literature Review

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RESUMO/ABSTRACT

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The main focus is on the models that have been built to improve our understanding of the tourism cluster and how it can be modelled as such. Particular attention is devoted to the models that provide a comprehensive view the sector, highlighting advantages and disadvantages. The final purpose is to identify how the specificities of tourism can be directly integrated in CGE models. The final purpose of the literature review is to set the background of a study of the Azores, an insular region of Portugal, for the implementation of a combined TSA/CGE model of this economy.

Keywords: Tourism Cluster; CGE for Tourism; TSA/CGE tourism models

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Abstract

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Introduction

The tourism sector, usually linked to leisure, natural, religious, cultural and other attractions (Cabugueira, 2005), produces huge impacts in the local and national economy (Carvalho and Vaz, 2005). Some negative impacts are also to be expected.

Tourism can produce positive and negative impacts, not only when seen at the local, national and international level (Song, Dwyer, Li and Cao, 2012), or when approached from a cultural, social and environmental perspectives (Zhang, Chong and Ap, 1999; Tisdell, 2001) or even when seen according to different economic dimensions. Governments and policy makers are consequently interested in using tourism policies to make the economy grow, in income and employment, while minimizing negative impacts. For this reason, it is important to provide decision makers with the analyses and instruments to better define the best policies to maximize the positive economic contribution (Frechtling, 2011), and promote a sustainable tourism (UNWTO, 2008) and the socio-economic development.

Changes in tourism expenditure are known to generate multiplier effects (Kido-Cruz, Kido-Cruz and Killough, 2015) on the economy, through "the generation of significant added value, but also by the ability to motivate the development of other economic activities" (Ferreira and Estevão, 2009, p. 42). Pratt and Blake (2009) break these effects into direct, indirect and induced.

Various types of economic models have been used in order to estimate the impacts of tourism in the economy, namely econometric models; Tourism Satellite Accounts (TSAs); Input-Output (I-O) models; the Social Accounting Matrix (SAM) models and; Computable General Equilibrium (CGE) models, also called as Applied General Equilibrium (AGE) models (Kido-Cruz et al., 2015; Frechtling, 2011).

TSAs are known "to provide a systematic and integrated framework of information on tourism's supply and demand", but it is not an "accurate method of measuring the sector’s contribution to the added value or gross domestic product (GDP)", being it clear that "it considers only the direct effects" (Kido-Cruz et al., 2015, p. 2). Indirect effects can be estimated, for example, using I-O models that determining the I-O multipliers. This method constructs a series of tables with information about the various

transactions between the economic agents of an economy (Stimson, Stough and Roberts, 2006; Kido-Cruz et al., 2015).

Another way to estimate direct, indirect and induced effects of tourism is by using SAM models, which are "an extension of the input-output tables", that provide a disaggregated snapshot "of consumers and factors of production, and it relates the calculation of added value with its distribution by institutional sectors" (Kido-Cruz et al., 2015, p. 2), including inter-institutional transfers.

CGE models are also used to assess the direct, indirect and induced effects, representing goods markets, services and factors of production, as well as productive sectors and demand groups (households). They generate a system of equations that characterize "production, consumption, trade and government activities" (Dwyer, Forsyth and Dwyer, 2010, p. 317) within an economy, incorporating the entire mechanism of the TSAs, I-O models and SAMs, and the mechanism to study congestion effects among activities, markets and sectors. Therefore, CGE models "are not used specifically to estimate the contribution made by tourism to the GDP or to imports, but rather to construct scenarios that simulate the potential impacts on the whole economic system associated with certain changes (arrivals, spending, taxation, etc.)" (Kido-Cruz et al., 2015, p. 3).

Some studies have attempted to combine and integrate the various models to capture both the macro and microeconomic effects of policy changes on the economy as well as on the various players in the economy. These involve integrating TSAs with CGE models (Blake, Durbarry, Sinclair and Sugiyarto, 2001; Blake, Durbarry, Eugenio-Martin, Gooroochurn, Hay, Lennon, Sinclair, Sugiyarto and Yeoman, 2006; Ahmed and O' Donoghue, 2007; Laffargue, 2009; Rossouw and Saayman, 2011; Pratt, 2015a; among others). It has become clear that different combinations or integration of model types are recommended when dealing with different issues, and particularly in the tourism sector.

According to Figueiras (2015), even though tourism has a big expression in Algarve, Lisbon and Madeira, only recently has it become an important sector for the Azores. Just a few studies have addressed the impact of tourism in the Portuguese economy (for example Bento and Santos, 2012) and in the regional/local economy (for example

Eusébio 2006; Pereira, Bessa and Simões, 2012; Silva, 2009).

The main objective of the current work is to present a review of the most relevant literature regarding TSA, I-O, SAM and CGE models, for the measurement of tourism impacts on the economy with a special emphasis on combined CGE models and TSAs methodologies, for application in an insular reality – the Azores.

The next section presents a brief overview of the research on the economic impacts of tourism. The third section addresses the delimitation of the tourism cluster; the fourth addresses the issue of tourism impacts on the economy; the fifth section presents a literature review of the several models capable of measuring the impacts of tourism; the sixth section explores the combined use of CGE models and TSAs. Some final considerations are presented in the seventh section.

A brief overview over research on tourism

The study of tourism from the economic perspective can be traced back to the sixties by Guthrie, Gerakis and Gray (Song et al., 2012), who focused on the analysis of the demand for tourism in international markets and the consequent evolution of tourism revenues. Since then, a large set of literature addressing tourism economics has been published. Still in the seventies, Leiper (1979) presented the framework of tourism, towards a definition of tourism, tourist, and the tourist industry. More recently, Mazumder, Al-Mamun, Al-Amin and Mohiuddin (2012) reviewed the literature and methodologies for the period from 1969-2011 concerning the economic impact of tourism.

Up to the nineties, research on tourism was focused, mostly, on tourism demand, with some insights on supply and sustainability issues. For example, Eadington and Redman (1991) identified key research areas, such as economic impacts and policies, demand elasticities and their modelling techniques, as well as market structure and ownership. Crouch (1994), reviewed the studies of international tourism demand. Witt and Witt (1995) reviewed empirical research on forecasting tourism demand; Lim (1997) reviewed international tourism demand models; Sinclair (1998) published a review on tourism, emphasizing the developments on "the system-of-equation approach to

demand analysis and computable general equilibrium (CGE) modelling for economic impact assessment" (Song et al., 2012, p. 2), referring to the importance of addressing sustainable tourism through CGE models, while incorporating issues such as taxation and regulatory policy; Tremblay (1998) addressed the economic organization of tourism and; Butler (1999) published the state-of-the-art of sustainable tourism.

In the current century, tourism demand analysis continued to have a relevant seat at the research arena, but now with researchers more focused on the analysis of demand in order to inform policy makers and on the improvement of modelling processes and forecasting. Song and Li (2008) reviewed tourism demand modelling and forecasting. Hjalager (2010) reviewed innovative research in tourism. Dwyer, Forsyth and Papatheodorou (2011) performed a literature review of tourism economics, focusing mostly on the implications of the 2008 global financial crisis. Vellas (2011) looked at "methodological resources for measuring the indirect impacts of tourism on the economy" (Vellas, 2011, p. 3), focusing on how they affect GDP, job creation and other economic sectors. One year later, Song et al. (2012) made a survey of tourism economics, addressing the main highlights related to the approaches, applied methodologies and topics for further research.

More recently, researchers sought to improve methodologies and to disseminate their use, not only at the national but also at the regional level, extending economic analysis into the structure of society and environmental and institutional dimensions. Kumar and Hussain (2014) presented a review of issues and methods used to estimate the economic impact of business tourism. Page and Hall (2014) addressed the geography of tourism and recreation regarding environment, place and space. Page (2014) addressed tourism management. Tribe (2015) addressed the economics of recreation, leisure and tourism. Brida, Cortes-Jimenez and Pulina (2016) reviewed the literature on tourism and growth. Li, Chen, Li and Goh (2016), analysed tourism and regional income inequality in China. Bojanica and Lo (2016) examined the moderating effect of tourism reliance on the relationship between tourism development and economic development for countries and island economies, including “small island developing states” (SIDS). Zhang and Gao (2016) explored the impacts of international tourism on China's economic growth, energy consumption and environmental pollution. Paramati, Alam

and Chen (2017) studied the effects of tourism on economic growth and carbon dioxide (CO_2) emissions, performing a comparison between developed and developing economies. Liu and Jiang (2017) made a review of research on the contribution of tourism to economic growth. Torre and Scarborough (2017) compared "economic impact assessments and finds using benefit estimates" in order to estimate "benefits with limited data" (Torre and Scarborough, 2017, p. 1).

Even though much research has been focused on tourism demand (Li, Song, and Witt, 2005; Song and Li, 2008) supply has been addressed on a smaller scale (Sinclair, Blake and Sugiyarto, 2003). Despite the vast set of literature on tourism economic impacts (Stabler, Papatheodorou and Sinclair, 2010), tourism economics has been identified as a subject that needs further research (Song et al., 2012).

Delimiting the tourism cluster

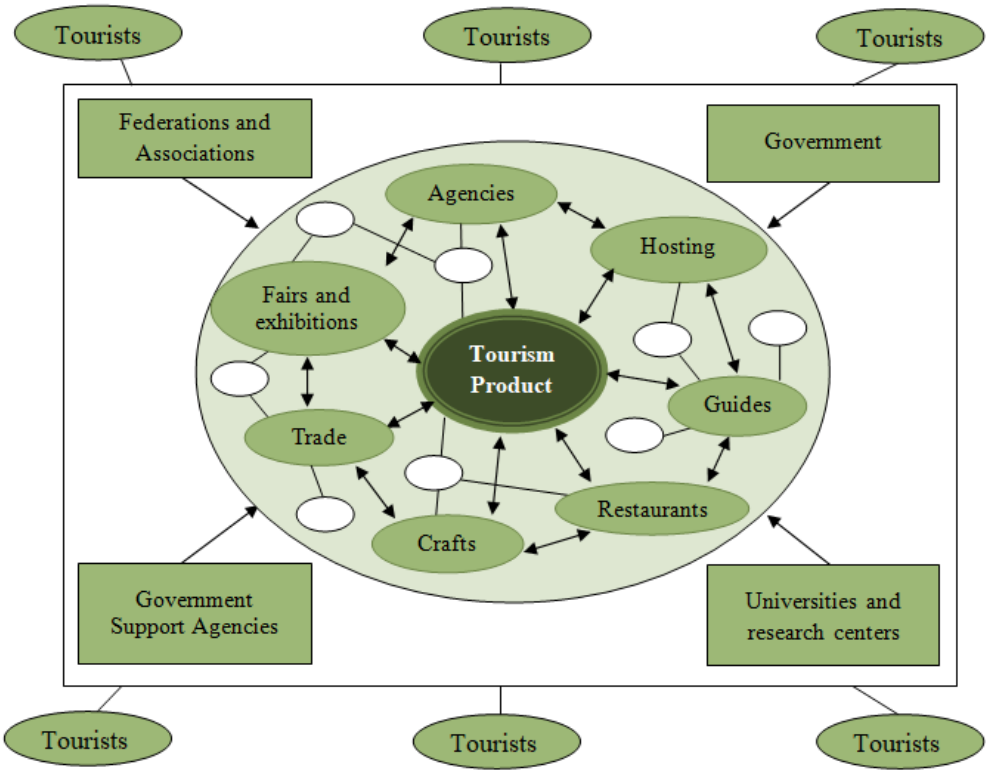
One of the first things to do when talking about tourism is to delimit the concept. Some approaches to the study of this sector automatically assume a definition of a cluster such as when using TSAs.

According to Ferreira and Estevão (2009), which have carried out a literature review on clusters, and more specifically about clusters in tourism, there are many definitions of cluster, given the ambiguity of its concept. In order to present a more complete and coherent explanation of this term, certain definitions, from researchers such as Rosenfeld (1997), Porter (1994, 1998) and Flowers and Easterling (2006), should be combined or complemented. Thus, it can be said that a cluster is a "concentration of companies and institutions", operating "in a particular activity sector", producing synergy and fomenting "competition and cooperation", "through their geographical proximity and their interdependence" (Oye, Okafor and Kinjir, 2013, p. 2). Sector inter-relationships reinforce competitive advantages, where the value as a whole is "greater than the sum of its parts" (Osarenkhoe and Fjellström, 2017, p. 181). Approaching tourism through a cluster perspective facilitates higher levels of efficiency, which promotes regional development (Fortuna and Maciel, 2017).

The tourism cluster is composed by companies and institutions, from several sectors

of activity, and by governmental and public institutions, "specialized in education, information, research and technological support" (Ferreira and Estevão, 2009, p. 40). According to Cunha and Cunha (2007), the tourism cluster can be represented by Figure 1.

Figure 1: Representation of a tourism cluster.



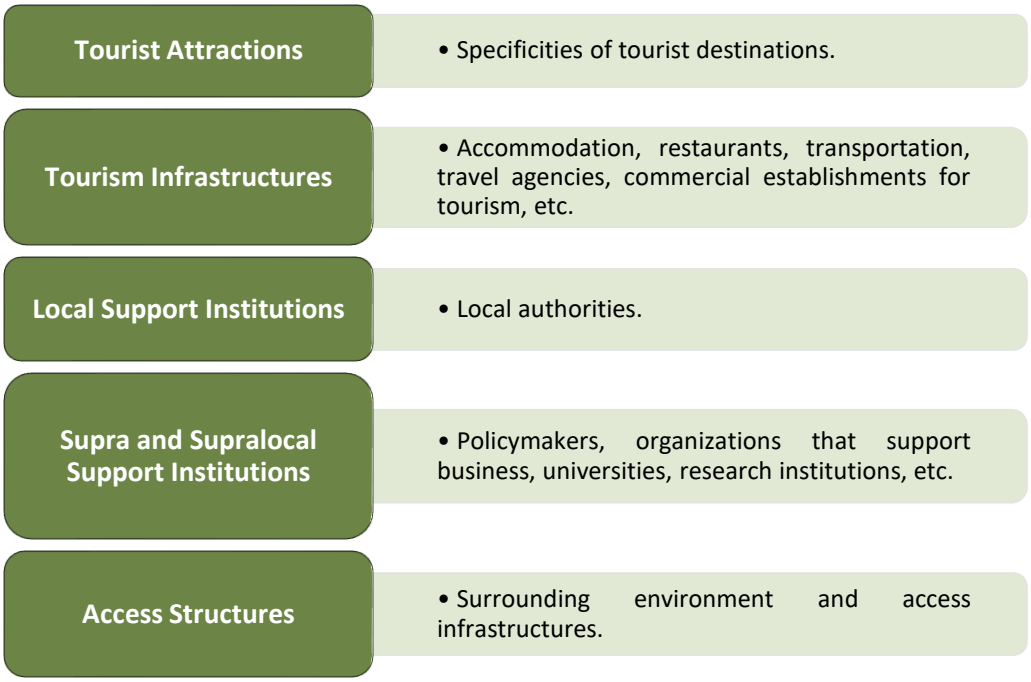
Source: Adapted from Cunha and Cunha (2007).

Authors, like Barbosa and Zamboni (2000), consider that for the delimitation of a tourist cluster one must take into account many other aspects. One can consider resources and attractions as comprising cultural, natural and historic places, as well as events, entertainment, traditions, touristic and accessibility infrastructures and related and supporting industries, comprising accommodation, bars, restaurants, nightclubs, leisure and tour operators, travel agencies, sports and cultural activities and diverse trade (Ferreira and Estevão, 2009). Moreover, since factor conditions include "human resources (training, labor law), capital resources, hygiene, physical and tourism support infrastructures, accessibility, safety, natural, historic and cultural resources" (Estevão

and Ferreira, 2009, p. 135), one can identify other companies and institutions which might be included in the tourism cluster.

Given that satisfaction of tourists depends on the appeal of the place's "primary attraction, but also on the quality and efficiency" of related business - hotels, restaurants, malls and transportation (Porter, 1998, p. 81) -, competitive advantages will "depend on local factors - knowledge, relationships, motivation, etc. - with which the geographically distant competitors cannot compete" (Ferreira and Estevão, 2009, p. 39). Therefore, it makes sense to apply the cluster concept to the tourism industry, as the product interacts with the local bases, leading to joint actions of inter-related companies, and therefore to agglomerates (Jackson and Murphy, 2002; Salvador, Lúcio and Ferreira, 2011). Figure 2 illustrates this comprehensive approach to defining the tourism cluster.

Figure 2: Local factors delimiting of tourism clusters.



Source: Adapted from Barbosa and Zamboni (2000).

Clusters increase the competitiveness of a regional industry, as they contribute positively to innovative processes, facilitate relations with other institutions and address

consumer needs, while allowing for the transfer of knowledge (Porter, 2002).

However, "to ensure their survival in the medium and long term", tourism clusters "need to promote competitive practices in a systematic way" (Ferreira and Estevão, 2009, p. 136). To that effect, Ferreira and Estevão (2009) presented a conceptual model of the tourism cluster competitiveness, with determinants and linkages between the several aspects, where related and supporting industries resources and attractions factor conditions, destination management, demand conditions, business strategy, structure and rivalry, along with government and universities, are considered to play a relevant role in the competitiveness of the tourism clusters. The same authors consider that destination management includes not only promotional marketing but also tourist information, entrepreneurship and pro-activeness, tourist support services and staff hospitality. Demand conditions include "sophistication, education, tourists' preferences and motivation, institutionalized marketing, quality control" and "increased leisure time". Moreover, the authors refer that business strategy, structure and rivalry include "barriers to entry and exit from the market" as well as the "dense business tissue" (Estevão and Ferreira, 2009, p. 135).

One can conclude that the construction of clusters for each location represents an enormous advantage, since they provide a better perspective on the organization of the tourist sector. It becomes crucial that regions promote and implement certain statistical instruments, with the TSAs and I-O models being the most common, whose elaboration can be very useful for the definition of clusters (Kozak and Andreu, 2006; Cunha and Cunha, 2007, Ferreira and Estevão, 2009; Cañada, 2013; Fortuna and Maciel, 2017).

Tourism impacts on the economy

Tourist impacts on the economy of local communities can be both positive and negative (UNWTO, Eurostat and OECD, 2008). These include direct and indirect local employment, "increased range of local facilities and services" and "increased congestion and intrusion arising from visitors" (Office for National Statistics, 2010, p. 8).

Economic models provide estimates of the volume and value of tourism activity, within a geographical area, and estimates of income generated and employment

supported by tourists' expenditure, identifying three main effects (The Tourism Society, 2017):

- ✓ Direct effect – from tourists spending in first-line businesses;
- ✓ Indirect effect – from direct businesses buying from their suppliers and so on down the supply chain (not all these effects arise in the local area since some of this expenditure will go to suppliers elsewhere in the region or nationally);
- ✓ Induced effect – from the wages earned in businesses directly and indirectly arising from tourist spending.

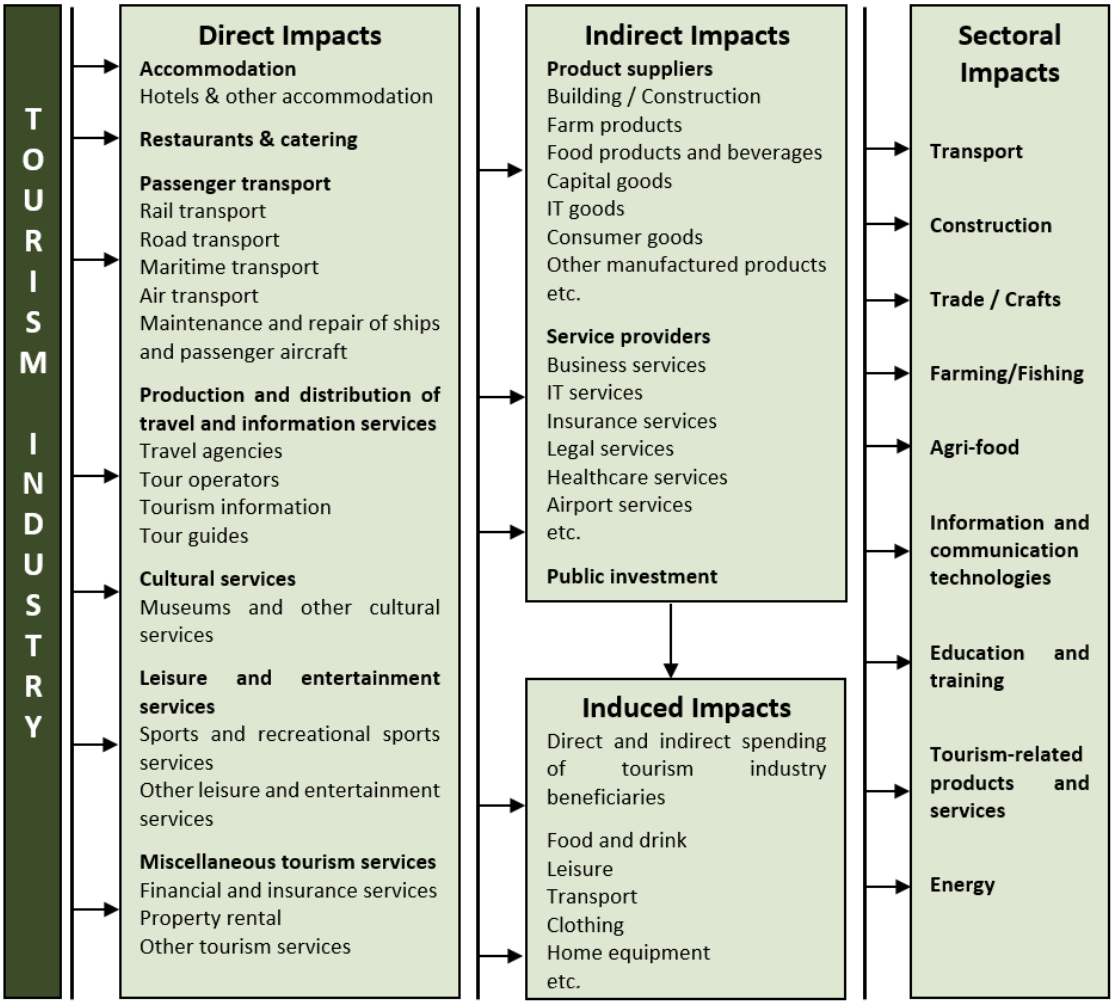
In other words, indirect effects come from initial spending which induce further purchases by industries in the supply chain of final products consumed by tourists, such as food or furniture. In turn, these purchases induce further rounds of spending from each of the industries that produce these goods, representing these induced effects, occurring from changes in labour requirements, resulting from demand shocks to industry outputs. These two impacts are also known as secondary effects, often referred to as "multiplier effect" (Gieryn, 2008, p. 9) or “multiplier concept” (Frechtling, 2011). Therefore, the overall change in output, or total economic influence of tourism, is the summation of the direct, indirect and induced effects (Office for National Statistics, 2010). Figure 3 presents a summary of these impacts.

The economic impact of tourism has been analysed using several methodologies, such as "simple comparisons of trends in tourism activities with those of key economic indicators through to cost-benefit analysis (CBA), proportional multiplier methods, input-output models [...] linear programming models" (Rossouw and Saayman, 2011, p. 756) and contingent valuation, being I-O analysis the most widely used approach (Lindberg and Johnson, 1997; Rossouw and Saayman, 2011).

In order to estimate direct effects, models generally include tourists and business surveys. However, in order to estimate indirect and induced effects models are needed that apply multipliers to the direct spending data (The Tourism Society, 2017). The value of the multiplier reflects what is the total economic impact of an increase of 1€ in tourism spending (Office for National Statistics, 2010). The most common multipliers used in economic analysis are "output multipliers, value-added multipliers, and

employment multipliers" (Gieryn, 2008, p. 9).

Figure 3: Summary of the direct, indirect, induced and sectorial effects of tourism.



Source: Adapted from Vellas (2011).

According to Gieryn (2008), the output multipliers are well suited for event economic impact studies given that the analysis is focused on the spending generated by the event. The author further contends that, when using output multipliers, it is relevant to consider that the total amount spent at a destination is not equal to the direct output used to calculate secondary effects and trade margins and that other costs must be accounted for, in order to determine the amount of spending remaining in a destination and thus generating secondary effects. The spending that does not remain in the area being studied is referred to as an economic leakage, and the ratio of spending that

remains in the community, generating secondary impacts to total spending is referred to as the “capture rate” (Gieryn, 2008, p. 10).

TSAs are, genertally, used to estimate direct effects, but to measure the total economic impact of tourism. Other methods are necessary. The International Recommendations for Tourism Statistics (IRTS 2008) identifies two other methods to estimate the total economic impact of tourism: I-O and CGE modelling, which aim at calculating multipliers, and the use of previously calculated multipliers from relevant studies (Office for National Statistics, 2010).

The use of previously calculated multipliers from relevant studies has been a frequent practice, given the complexities and heavy data requirements of both I-O and CGE approaches. However, this methodology may lead to overestimation or underestimation of the economic impact, when the size or structure of the regions are different, with consequent differences in the use of imported/domestically produced goods, being it, therefore, relevant to examine the structural composition of the economies (Office for National Statistics, 2010).

Moreover, if a study uses a multiplier calculated many years before the period of study, this can reduce the accuracy of the estimates as the time-period between the I-O tables being produced and the analysis being conducted increases. Economies are constantly evolving over time, with technology improvements, price fluctuations and demand changes and with the supply-side links that determine the indirect impact changing over time (Office for National Statistics, 2010).

Models for measuring tourism impacts

Tourism Satellite Accounts

Definition

TSAs have been largely used for the measurement of the direct economic contributions of tourism to a national or regional economy, by employing the principles and structure of the internationally adopted System of National Accounts (SNA) (Dwyer, Forsyth and Spurr, 2004; Ahlert, 2008; Frechtling, 2011). This instrument makes it

possible to obtain a realistic view of the role tourism plays in a particular economic structure and, having been standardized, permits easy comparisons (Fortuna and Maciel, 2017).

The purpose of TSAs is the analysis of all aspects of tourism demand for goods and services associated with tourism; the observation of the interface with the supply of such goods and services in the economy; and the description of how tourism supply interacts with other economic activities (Eurostat, 2008). A TSA reconciles demand data with information on the supply of goods and services generated by tourism industries (Office for National Statistics, 2010).

TSAs comprise a set of tables with data on Tourism Consumption (regarding the activities of tourists) in a country (or region) and the contributions to GDP, employment volume and other macroeconomic measures of the national economy, for a given year, giving a static 'snapshot' of the tourism sector with the rest of the economy as a backdrop (UNWTO, 1999). The data presented on these tables include the transactions, sources and uses of resources of institutional units and sectors (Frechtling, 2011, p. 2).

Policy making to simulate tourism demand or benefit certain types of households or businesses or push the national economy to a new equilibrium, requires analytical tools such as SAM, I-O or CGE models. It is possible to splice TSAs into those methods in order to extend macroeconomic analysis (Frechtling, 2011).

Implementation

TSAs are meant to reflect the tourism cluster, and therefore consider a large set of companies (the main producers of tourism products and the suppliers that provide complementary products and inputs to producers) and institutions. Producers include the private sector that supply products and services as core resources, such as theme parks, entertainment, shopping, and the public sector that supply and manages endowed resources, such as mountains, beaches and cultural heritage. Suppliers support and add value to core resources and attractions by providing complementary products such as accommodation, transportation and food from several industries (Kim and Wicks, 2010).

This tool is based on observed values of tourists' consumption of specific products produced by specified tourism industries, producing contributions to GDP and employment, which are among the direct or primary effects of tourism demand on the national economy (Frechtling, 2011, p. 3). The methodology for the construction of TSAs is based on the *2008 Tourism Satellite Account: Recommended Methodological Framework* (TSA: RMF 2008) and, for tourism statistics in general, on the *2008 International Recommendations for Tourism Statistics* (IRTS 2008) (Eurostat, 2013, p. 25).

Other relevant references are the World Tourism Organization (UNWTO) technical manuals on TSA and the Organization for Economic Cooperation and Development (OECD) recommendations, mainly referred to the estimation of tourism employment (*Measuring the role of tourism in OECD Economics,* OECD, Paris 2000). These guidelines have been translated into practical instructions for the European Union (EU) member states by merging principles and concepts with the European standards represented, first of all, by the European System of National and Regional Accounts (ESA95), the Council Directive, the Business Council Regulations, the EU classifications, as well as the experience gained within each country.

Eurostat (2008) presents an historical review about the evolution of the concept, delimitation and use of TSAs. The *2008 Tourism Satellite Account: Recommended Methodological Framework (TSA: RMF 2008)* presents the basic concepts regarding the construction of the 10 TSA Tables and the *European Implementation Manual on Tourism Satellite Accounts (TSA)", version 1.0.,* presents guidelines for the implementation of TSAs.

Advantages and disadvantages

According to Frechtling (2011), TSAs are the most valid method for measuring the size of the tourism economic contribution to a country, given that traditional national accounts (NSA) use a specific definition of activities that do not isolate what is associated to tourism and what is not. Indeed, TSAs, which now exist for most countries, provide accurate measures of the size of tourism sectors, the nature of demand for tourism, the

nature of supply in tourism sectors, and the direct contribution of tourism to GDP and employment (Blake et al., 2001).

Furthermore, TSAs provide detailed data on tourism activities that are not generally available in national accounts. This is because national accounts provide data classified according to production activities and commodities, and tourism spans many of these standard classifications (Rossouw and Saayman, 2011, p. 761).

Typically, the TSA provides cluster detail that is not obtained from a CGE model, even though the SAM, on which they are based, can be expanded to include more sector detail. Measures of tourism's direct contributions to the national economy, such as labour compensation, gross operating surplus of enterprises and government revenue directly generated by Tourism Consumption require extending the TSA through other macroeconomic analysis tools (Frechtling, 2011).

For instance, CGE models can be an improved method when compared to TSAs, given that they allow retrieval of the impact of tourism on the economy, specifically on variables such as the GDP or the employment, for example (Blake et al., 2001). Therefore, CGE models must be complemented and extended through integration with TSAs as a tool for the purpose of tourism policy analysis (Rossouw and Saayman, 2011).

The three most popular types of macroeconomic models used to explore the secondary effects of shocks to national economies (such as increased visitor spending or new macroeconomic policies) are the I-O Model; the SAM and the CGE Model (Frechtling, 2011, p. 4), presented in the following sub-sections.

Using TSAs in order to estimate tourism impacts

Frechtling (1999) presented the TSA foundations and analysed the progress of its use. After explaining the usefulness of the results obtained with a TSA he examined some important issues related to the conceptual framework and the methods used in its implementation, having concluded that, despite all the development problems it presents, the TSA is a "promising [...] tool", capable of providing relevant information that helps to understand the impacts of tourism on economic structures, though not in its entirety (Frechtling, 1999, p. 170).

In the same year, Crouch and Ritchie (1999) stated that there is a need for the tourism sector to be well managed, since it has a significant influence in the economy, having focused its study on the relationship between tourism, prosperity and social welfare, using a new approach, which aims to improve the competitiveness of tourist destinations.

Jones, Munday and Roberts (2003) discussed the usefulness of the regional TSAs as a policy tool, highlighting the methodological limitations associated to its construction and also the importance of the input-output matrices in this process.

Dwyer et al. (2004) presented several approaches used to estimate tourism economic impacts, including TSA. The authors refer to the constraints of each one, considering the CGE model the best method to be put into practice and providing tips for future research to be undertaken in the context of measuring the economic contribution of tourism.

Smeral (2006) presented a critical assessment of the TSAs and its applications for tourism, analysing issues related to the compilation and interpretation of the results obtained by this instrument.

Frechtling (2010) presented several considerations regarding the TSA as a primer, analysing its purposes and all its inherent conceptual framework.

Ragab (2016) presented best practices in implementing TSAs and their Ad Hoc Extensions, by performing a comparative study in three developed countries (Canada, Australia and Denmark) and in three developing countries (South Africa, Saudi Arabia and Egypt). This study concludes that the construction of TSAs depends greatly on the rules adopted by each country, as well as on the availability of the data. The author states that it is essential for the entities to cooperate with each other so that it is possible to ascertain as much information as possible, which is a complex and time-consuming process, which must be continuous.

Meis (1999) presented the Canadian experience in developing and using the TSA, with Canada being one of the first countries to implement this tool (Couto, 2011). The author analyses the main results obtained, how the information obtained was used, the difficulties that had to be overcome and what methodological guidelines were used. In addition to the internationally defined and standardized methodology, the country

developed some "extensions" of TSA, known as National Tourism Indicators (NTIs), which consist of a "set of time series estimates" (Meis, 1999, p. 13), which fill the problem of the lack of regular results, since TSAs were only published every four years (Couto, 2011). Meis (1999) also looks at what those extensions were and what their results revealed and concludes by saying that the emergence of new "products" from TSA is a gain in knowledge about a country's tourism industry.

Tohamy and Swinscoe (2000) analyzed the economic impact of tourism in Egypt, and found relevant direct but also indirect effects of tourism on the economy, having used the economic impact analysis. This methodology allows us to assess the contribution of tourism to economic structures, using input-output databases, and is a simpler method than TSAs.

Yan and Wall (2001) used a traditional type I I-O model, excluding the impacts on domestic consumption expenditures, to study the impact of domestic and foreign tourism on the Chinese economy for 1992, using TSAs. They concluded that tourism only had a limited impact on the national level due to the size and diversity of the Chinese economy (Fan and Oosterhaven, 2005).

Oosterhaven and Fan (2006) determined the direct, indirect and induced impacts of international tourism on the Chinese economy with a type II I-O model, a SAM and a TSA approach.

Ivanov and Webster (2007) analysed the measurement of the impact of tourism on economic growth, presenting a methodology, for measuring the contribution of tourism to an economy’s growth, tested for Cyprus, Greece and Spain. The authors used the growth of real GDP per capita as a measure of economic growth and disaggregated it into economic growth generated by tourism and generated by other industries.

Parrilla, Font and Nadal (2007) explored whether specializing in tourism guarantees long-term growth using an accounting model in order to measure the contribution of different production factors and of productivity to economic development and found that for the Balearics and the Canary Islands of Spain tourism has enhanced economic development and contributed to shape society in a different way. However, the authors found a decreasing contribution over time of the output to result in a lower long-term

growth in production.

Diakomihalis (2007) analysed the impact of maritime tourism on the Greek economy via the TSAs. For the author, this tool can be seen as "an extension to the input-output framework" (Diakomihalis, 2007, p. 2), presenting several advantages. By following a standard methodology, when being adapted to the reality of maritime tourism, it can be compared with other industries.

Ahlert (2008) estimated the economic impact of an increase in inbound tourism on the German economy using TSA results. He concludes that information from this instrument proves to be very important for the formulation of policies, since it indicates how the economic structure reacts to changes in the tourism sector.

Diakomihalis and Lagos (2008) estimated the economic impacts of yachting in Greece via TSA results. The authors used this method to assess the effects of tourism on a specific tourism "subsector".

Munjal (2013) analyzed the economic impact of the tourism industry in India by using TSA and I-O Analysis. The combination of these models aimed to study the interconnections between tourism and other sectors of activity.

Baker (2013) studied the economic impact of tourism in the Asian Pacific region using TSA. In addition to analysing in detail the methodological procedure and the conceptual framework of this statistical tool, the article examines its implementation in different countries of the region, which present incomplete databases and large information gaps. Besides that, it draws attention to the importance of building TSAs, highlighting its advantages. Jovanović and Vukasović (2014) do the same, focusing on the case of Serbia, which does not have databases to build a TSA.

FrenŢt and Frechtling (2015) assessed TSAs with a program for ascertaining the consistency of a given TSA with the United Nations standards and applied it to a long-standing TSA, the United States Travel and TSA.

Jones and Li (2015) analyse the impact that meetings and conventions visitation (considered a tourism sub-sector, since it has a significant weight in the travel economy) causes in the British economy, using a TSA approach.

Chou and Huang (2016) discussed the framework of Taiwan TSA and evaluated the

system of Taiwan TSA, including a tourism expenditure model, a tourism I-O model, and a tourism CGE model, and also used the tourism I-O model to calculate the impacts of a tourism policy (opening up to Chinese tourism) on the economy.

Ragab (2016) presented a comparative study on the best practices in implementing TSAs and its ad hoc extensions.

Frenţ (2016) addressed the process of informing tourism policy with statistical data, by presenting the case of the Icelandic TSA. The author emphasizes the relevance of the estimates obtained with the TSAs, which are important sources of information for political decision-making.

Ivandić and Marušićś (2017) assessed the contribution of tourism to the Croatian economy, through the implementation of TSA. They outline an approach that adapts the internationally standardized TSAs framework to the reality of Croatia.

It is also possible to use TSAs to estimate the impact of different events on tourism or even the impact of tourism on the environment or in the energy sector. For example, Becken and Patterson (2006) showed how to measure national CO_2 emissions from tourism, in New Zealand, as a key step towards achieving sustainable tourism, since tourism's characteristic activities typically consume large amounts of fossil fuels. For that, they used two methodologies, a bottom-up and a top-down analysis, and environmental accounting data.

Jones and Munday (2007) explored the environmental consequences of tourism through a TSA approach.

Dwyer, Forsyth, Spurr and Hoque (2010) estimated the carbon footprint of Australian tourism, using two distinct approaches, namely a "production approach" and an "expenditure approach". One of the assumptions was that greenhouse gas emissions from tourism are equated with other industries in Australia's economic structure.

Perch-Nielsen, Sesartic and Stucki (2010) analysed the greenhouse gas intensity of the tourism sector, specifically for the case of Switzerland. It was calculated with the help of the information contained in the TSA.

Jones (2013) presented four scenarios for greenhouse gas emissions reduction from tourism. Using "an extended tourism environmental satellite account methodology"

(Jones, 2013, p. 458), this article studies the case of Wales, treated as a region of the United Kingdom.

Hadjikakou, Miller, Chenoweth, Druckman and Zoumides (2015) presented a comprehensive framework for comparing water use intensity across different tourist types. As in the other articles, the authors used information on tourism provided by TSAs to reach their survey objectives, namely to quantify the use of water in various tourism-related activities in eastern Cyprus.

Cadarso, Gómez, López, Tobarra and Zafrilla (2015) quantified the contributions of residents and visitors on the Spanish tourism's carbon footprint with a longitudinal study. With TSA data, they used an input-output model to analyse which are the largest carbon emitters in the economy of Spain.

Ragab and Meis (2016) developed environmental performance measures for tourism, using the TSA conceptual framework, and presented a pilot study of the accommodation industry in Egypt.

Robaina-Alves, Moutinho and Costa (2016) analysed the change in energy-related CO_2 (carbon dioxide) emissions in Portuguese tourism, for the period from 2000 to 2008. They studied which are the tourism related industries that contribute most to these emissions and their evolution.

Up to now, this review addressed the assessment of direct impacts of tourism on the economy, through TSAs. The next section addresses the study of the secondary impacts of shocks to the economy, specifically in order to estimate indirect and induced effects. For that, one can use existing multipliers from previous literature, I-O, SAM or CGE modelling (Office for National Statistics, 2010; Frechtling, 2011).

Input-output matrices

Definition and implementation

In its most basic form, an I-O model consists of a system of linear equations, each one describing the distribution of an industry's product throughout the economy (Rossouw and Saayman, 2011), which produces estimates of multipliers for the relevant year.

Specifically in the case of the tourism sector, the I-O table displays linkages between tourism industries producing for Tourism Demand and the industries supplying intermediate goods and services to those industries. Therefore, an I-O model computes, for any increase in consumption of tourism output, the total amount of intermediate output required. After that, these multipliers can be compared to other types of consumer expenditures (Frechtling, 2011).

The I-O model is based on an I-O Table constructed from the Use Table from a country's SNA, which has three quadrants. The northwest quadrant shows the products (rows) supplied to industries (columns), with the intermediate consumption of products by industries used to produce output for final demand, such as the demand of households, for business investment, for governments and for export. The northeast quadrant shows the consumption of each product (row) by the sectors of final demand. The southwest quadrant presents value added in terms of income earned by employees, gross operating surplus of firms, taxes less subsidies on production and imports and consumption of fixed capital (Frechtling, 2011).

In order to produce an I-O Table, we substitute industries for the rows in the northwest and northeast quadrants of the Use Table (SNA, 2008), also called the "interindustry matrix", presenting industries in the rows supplying output to industries in the columns (Frechtling, 2011).

Compensation of employees, direct operating surplus, and a measure of government tax revenue directly generated by Tourism Consumption in the country is obtained by comparing a TSA's measure of Tourism Direct Gross Value added by industry to the Total Gross Value Added in the southwest quadrant of the I-O Table, (Frechtling, 2011).

This I-O Table (which can be seen as an account, sometimes called the "direct requirements table") is then transformed into the I-O model. An account can be produced from the I-O Table by substituting for each cell in the Use Table, the ratio of the value in the cell in the I-O table to the total for the entire column. The direct requirements table, then, shows for each purchasing industry (in the column) the inputs directly required from different supplier industries (in the rows) to produce one unit of output. Through matrix algebra manipulation (called "matrix inversion") of this direct requirements table, the "total requirements table" can be derived (Frechtling, 2011).

Several pre-packaged I-O models are available, such as the regional I-O models which include IMPLAN, REMI, and RIMS II (Rickman and Schwer, 1995), and have been used by several authors, as for example by Frechtling (1999). Gieryn (2008) refers to more than ten different academic studies targeting the economic impact of a wide variety of events, and reviews each one of them, following the three major methodological components to a tourism economic impact study: capturing visitation and spending data, defining the tourism industry, and I-O analysis. For more considerations about the evolution and construction of I-O models, refer to SNA 2008 and Dwyer et al. (2004).

Advantages and disadvantages

The advantages of using I-O models to estimate economic impacts are the following:

- ✓ I-O tables depict a comprehensive and detailed set of accounts of sales and purchases of goods and services among the producing industries, final consumers (residents, visitors, exports, and government), and resource owners (labour and capital) during a particular time-period (Pratt and Blake, 2009). Given an adequate amount of data, it is possible to calculate multipliers specific to the region and time of the event under analysis (Office for National Statistics, 2010).
- ✓ Given that I-O models take account of all transactions between industries, they capture the complexities of regional and national economies. Therefore, an I-O model can estimate the economic impact on any sector, or all sectors, given a change in the final demand of products produced by any other sector of an economy (Office for National Statistics, 2010).
- ✓ The interregional I-O table shows the value of goods and services flowing among the various sectors within each county as well as the relationship between sectors across counties. This is useful for analyzing different geographical distribution effects as a result of CGE simulations. The modified I-O table may be disaggregated into several counties and sectors (Pratt and Blake, 2009).
- ✓ The structure of, and data required for, I-O models are well-understood and widely accepted given that the guidelines for I-O models construction are well specified in SNA 2008 (Frechtling, 2011).

- ✓ A number of countries routinely produce Use Tables every 5 years or so. Data necessary to develop the I-O models for secondary impact analysis are available, albeit with a moderate lag (Frechtling, 2011).

However, these models also present limitations, namely:

- ✓ They only focus on the direct and indirect relationships of tourism within an economy (Frechtling, 2011).
- ✓ The main assumptions are that there are free and unrestricted flows of capital and labour, ignoring resource limitations and the mechanics of related markets, meaning that no supply constrains are built into the model (Frechtling, 2011). An I-O model assumes that an increase in tourism spending promotes an increase in tourism industries' outputs and hence on their suppliers' outputs, ignoring the fact that there are likely to be negative effects of decreased output in other industries, due to scarcity of resources (Office for National Statistics, 2010). In reality, as tourist expenditures rise, at some point there will be a shortage of input units available at the original price to service additional increases in tourist spending. When this occurs, wages and other prices must rise, constraining demand and affecting inter-industry relationships throughout the economy, which will not be captured in the I-O model (Frechtling, 2011).
- ✓ The vast amount of data required to construct an I-O table, as it requires the value of transactions between all industries, households and government. Besides, it needs to measure the amount of goods and services imported and exported, in order to gauge the extent of the leakages from the region (Office for National Statistics, 2010).
- ✓ The unrealistic assumption of a fixed input structure for each industry. It is known that the input structure of an operating economy is constantly varying, affecting output and incomes, given that, for example, a hotel will not require always the same ratio of expenditures on linens, labour and other items, as producers are constantly substituting inputs to reflect availability and prices. This most often shows up when a producer decides to import an input he formerly purchased from surrounding suppliers. This is not reflected in the I-O model (Frechtling, 2011).
- ✓ The unrealistic assumption of constant returns to scale. I-O models assume that to

produce one more unit of a good, the same volume of inputs will always be required. However, in the real world, there are increasing and decreasing returns to scale (Frechtling, 2011).

- ✓ On the demand side, I-O models do not consider that increased consumption at some touristic activities diverts consumption away from other goods and services. Therefore, in reality, this could lead to decreased production in those industries, and increased prices in the industries that have a greater demand (Office for National Statistics, 2010).
- ✓ I-O modelling assumes fixed output ratios among products produced by an industry. In reality the composition of one industry' mix of products today, may be different tomorrow, depending on prices, costs and the characteristics of consumer demand. However, the I-O model will consider the ratio to prevail as visitor spending increases or declines (Frechtling, 2011).
- ✓ Any increase in inbound visitors, holding other factors that affect the exchange rate constant, will lead to an appreciation of the domestic currency. This will harm export and import-competing industries. However, as I-O models do not consider these effects, it is possible that the estimated economic impacts are overestimated (Office for National Statistics, 2010).
- ✓ I-O models do not provide detail on producers below the industry level, or on different types of consumers. If we want to assess the effects of changing tourism demand on small/medium sized enterprises, or low-income workers, or various occupations, the I-O Model cannot help us. SAMs were created to produce such analyses (Frechtling, 2011).

Using I-O models in tourism studies

The first comprehensive exposition of I-O multipliers for tourism analysis was presented by Archer (1982) (quoted in Frechtling, 2013). Since then, many studies addressed I-O modelling techniques. Richardson (1985) addressed I-O models, in particular at the regional level, and economic base multipliers, highlighting some inherent issues and problems faced by these methods, such as the "identification of lags

and the possibility of extending the models to take account of labour market effects" (Richardson, 1985, p. 611). Bon (1986) performed a comparative stability analysis of demand-side and supply-side I-O models and concluded that, while the first one arrives at appropriate forecasts, the second one can provide "better forecasts for a larger number of sectors" (Bon, 1986, p. 231). Briassoulis (1991) addressed methodological issues on tourism I-O analysis and presented some proposals to overcome some of its associated disadvantages. West (1995) compared I-O, I-O+ econometric and CGE impact models at the regional level, in order to study the differences between them, using the same databases and assuming the same scenario. Frechtling and Horvath (1999) analysed the estimation of the multiplier effects of tourism expenditures on a local economy through a regional I-O model. Kweka, Morrissey and Blake (2001) addressed the analysis of I-O income, output employment and tax revenue in Tanzania, assessing the economic impacts of tourism in this country. Zengwen (2007) addressed the industrial correlation of China's tourism Industry, based on the I-O model. Sun (2007) analyzed the adjustment of I-O models for capacity utilization in service industries. Wiedmann (2009) performed a review of multi-region I-O models used for consumption-based emission and resource accounting. For the years between 2007 and 2009, he concludes that there is still much work to be done in this area, especially regarding the availability of data with quality and the precision of the modelling of the method used. Khoshkhoo, Alizadeh and Pratt (2017) approached the economic contribution of tourism in Iran with I-O modelling, that indicates that although this activity shows a great potential, with strong repercussions on economic growth and employment, it has not yet been efficiently promoted. Boero, Edwards and Rivera (2017) performed an integrated and interregional non-survey approach towards regional I-O tables and trade flows, and, in addition to presenting examples of other similar studies, they compared the methodology used with other approaches and numbered their main advantages.

Social Accounting Matrices

Description and structure

The SAM is an extension of I-O modelling, in which the I-O structure is completed with detailed transactions in the national economy. However, there is no single

structure universally recognized for the SAM, constructed with the goal of disaggregating relationships among suppliers, purchasers, and factors of production, according to each specific requirement. A SAM disaggregates the institutions purchasing or supplying goods and services (business firms, households and governments). The household sector might be disaggregated by race, income, and gender; the business sector might be broken down in size categories, and; the markets for factors of production might distinguish labour by occupations and capital by sources (Frechtling, 2011).

The actual distinction between extended I-O models and SAM models is not sharp (Fan and Oosterhaven, 2005). While extended I-O models tend to concentrate more on the inter-industry detail, at the expense of detailed modelling of the income redistribution process, SAM models concentrate more on a full description of the formation, distribution and re-distribution of income between different types of institutions, and thus normally provide a fuller coverage of all financial flows (Pyat and Round, 1985; Round, 2003; Fan and Oosterhaven, 2005).

A SAM can show how each component interacts with others in terms of products sold and income received, namely, regarding the flows between institutions and productive units, the flows between productive units and factors of production and the flows between factors of production and institutions (Frechtling, 2011).

Advantages and disadvantages

Arguments have been advanced in favour of using a SAM to generate multipliers (Wagner, 1997). A SAM can indicate the secondary effects in terms of transactions, employment and income for different types of households, different types of enterprises and different types of products purchased by tourists (Frechtling, 2011). For example, if one wants to understand what types of households (e.g., poor, female head, children) benefit from increased Tourism Expenditure, one can elaborate the sector through surveys to show households by the disaggregated categories. Besides, one can compare for instance government spending to attract more spending in order to alleviate poverty with spending the same amount to attract a new manufacturing plant

or improve energy and communication infrastructure in order to reduce poverty. Multipliers can be calculated, analogous to those from the I-O model, but including more demand and supply detail. This expands the information available to policymakers about who benefits from increased visitor spending, prospective public policies or other shocks (Frechtling, 2011).

However, a SAM is open to the same types of criticisms of the I-O approach, given that, even though providing a convenient framework to incorporate inter-sectoral linkages, it suffers from its inability to consider the behavioural responses of producers and consumers with respect to changes in prices (Alavalapati and Adamowicz, 2000; Rossouw and Saayman, 2011).

The following constraints can be pointed out to SAMs (Frechtling, 2011):

- ✓ Given that SAMs are expansions of the I-O model, they are subject to the boundaries identified for the I-O model.
- ✓ The required input data, matrix structure, and characteristics of the outputs are not standardized, and therefore it is difficult to compare SAMs for different countries with one another.
- ✓ The data requirements for the SAM are significantly greater than for I-O tables and models.
- ✓ It is likely that the research required for disaggregating households is not updated very often due to the high costs of conducting the required studies.
- ✓ SAMs do not require all markets to clear: that is, to reach equilibrium where all prices, wages and output produced and sold are consistent. Therefore, estimates are not in line with reality, as this is a feature of an actual national economy. CGE models overcome these problems.

Applying SAMs to tourism

Several authors used SAM models in order to estimate the economic impacts of tourism.

West (1993) used a SAM model to analyse the economic impacts of tourism on the

economy of Queensland, Australia, combining a regional SAM with econometric time series. Wagner (1997) used a SAM model for Guaraqueçaba, Brasil. Polo and Valle (2004) for the Balearic Islands, Spain. Jones (2010) for Mozambique; Karimsakov and Karadag (2017) for Kyrgyzstan for 2010; Emonts-Holley, Ross and Swales (2014) for Scotland. Bhatt and Munjal (2013) used SAM modelling to study the Socio-Economic Linkages of Tourism Sector in India. Seung (2014) measured spill over effects of shocks to the Alaska economy with an inter-regional social accounting matrix (IRSAM) model approach. Alikaj and Alexopoulos (2014) analyzed the regional economy of Western Greece using SAM modelling. Al-mulali, Fereidouni, Lee and Mohammed (2014) analyzed the tourism-led growth hypothesis with a case study of the Middle East countries. Zhong and Hara (2014) quantified the impacts of the recent economic crisis on a regional tourism industry and economy. Incera and Fernandez (2015) analysed tourism and income distribution through a SAM model of Galicia for the year 2008. Pratt (2015a) estimated the potential economic contribution of Regional Tourism Development in China, while performing a comparative analysis. Banerjee, Cicowiez and Gachot (2015) performed a quantitative framework for assessing public investment in tourism, with an application to Haiti. Polo and Valle (2016) analysed tourism interactions and redistribution effects in the Balearic Islands with a SAM analysis. Subanti, Mulyanto and Hakim (2016) analysed the economic impact of tourism in Central Java province, through the use of SAM modelling. Croes and Rivera (2017) analysed the tourism's potential to benefit the poor, with a SAM model applied to Ecuador. Campoy-Muñoz, Cardenete and Delgado (2017) accessed the economic impact of a cultural heritage site using SAM with the case of the Mosque-Cathedral of Cordoba. Amador, Campoy-Muñoz, Cardenete and Delgado (2017) studied the economic impact of small sport events in the Spanish Football League with SAMs. Maria Raya, Martínez-Garcia and Celma (2017) studied the economic and social yield of investing in hiking tourism with the case of Berguedà, Spain. Burfisher (2017) made recommendations about a generous list of publications regarding introductory treatments concerning SAM.

The SAM structure can be different according to different studies. Polo and Valle (2007) made a review of several studies, which considered different structures for the SAM, referring to the study of West (1993) and Wagner (1997). They compared the

effects of exogenous injections in three scenarios: the first one considers that only the 54 production accounts are endogenous; in the second case, factors accounts and the resident household account are also endogenous; and in the third scenario, the savings investment account is endogenous too.

Polo, Ramos, Rey-Maqueira, Tugores and Valle (2006 and 2008) also analysed the impact on employment and added value of a hypothetical change in the expenditure distribution of the non-resident consumer, using I-O and SAM models. They calculated the increase in demand for 4-5 star hotels services needed to offset a decline in the demand of the 1-2-3 star hotel category, so that neither employment nor the added value would be affected. With this, they came to the conclusion that a reduction of 1,000 beds in 1-2-3 star hotel segment would require nearly 500 extra beds in the 4-5 star category using the I-O (SAM) model (Kozak and Kozak, 2015).

Incera and Fernandez (2015) SAM model of Galicia had a special design for the evaluation of tourism policies, incorporating data for households (eight different types disaggregated by level of income), two governments (regional and central), four types of taxes, four wage earners (classified by education skill) and 29 sectors, among other figures. The authors also presented the traditional multiplicative and additive SAM multiplier decompositions in order to account with distributive effects. The authors' results showed positive effects on all income groups. High-income households benefited more than low income ones, contributing to increase income inequality within the region.

SAM modelling can also be used to evaluate areas that are correlated with tourism. For example, Gallardo and Mardones (2013) developed an environmentally extended social accounting matrix for Chile. Morton, Winter and Grote (2016) accessed natural resource management through integrated environmental and social-economic accounting, specifically in the case of a Namibian conservancy.

Computable General Equilibrium Models

Description and structure

CGE models are better suited to analyse the total impacts of tourism on the economy,

given that they are able to describe the efficiency-maximizing behaviour of firms and the utility maximizing behaviour of consumers, with changes in the GDP, government tax revenue and spending, aggregate savings and investment and the balance of trade (Burfisher, 2017). To do so, CGE models expand a SAM by linking industries, other institutions, purchasers and markets in a general equilibrium context (Frechtling, 2011).

In economic terms, general equilibrium analysis aims at understanding how households, firms and markets interact in order to determine what is produced in a national or regional economy, how it is produced and for whom. Genral assumptions of the model are that:

- ✓ Markets are competitive (Frechtling, 2011), supply equals demand in the market for each product and supply equals demand in the labour and capital factor markets (Kehoe, 1996);
- ✓ Prices for inputs and products move freely to equilibrate supply and demand (Frechtling, 2011);
- ✓ Producers minimize costs subject to feasibility constraints and zero after-tax- profits, so firms maximize profits (Kehoe, 1996; Frechtling, 2011);
- ✓ Households as consumers maximize the utility of the range of products purchased, so households consume their preferred products (Kehoe, 1996; Frechtling, 2011);
- ✓ Each product is produced under constant or decreasing returns to scale (Frechtling, 2011);
- ✓ Government does not interfere to restrict these conditions; government tax receipts equal taxes paid by all producers and consumers, Government expenditures are fixed (Kehoe, 1996; Frechtling, 2011);
- ✓ Exports are fixed (Frechtling, 2011).

CGE models are programmed using packages such as General Algebraic Modelling Software, also called GAMS; General Equilibrium Modelling Package, also called GEMPACK; MATLAB and E-Views (refer to Ahmed and Donoghue, 2007, for more details on the literature sources referring to each package).

CGE models extend the SAM structure to address how a national or regional economy

adjusts to a shock, such as increased Tourism Expenditure or higher tax rates, and reaches a new equilibrium with the above features (Frechtling, 2011).

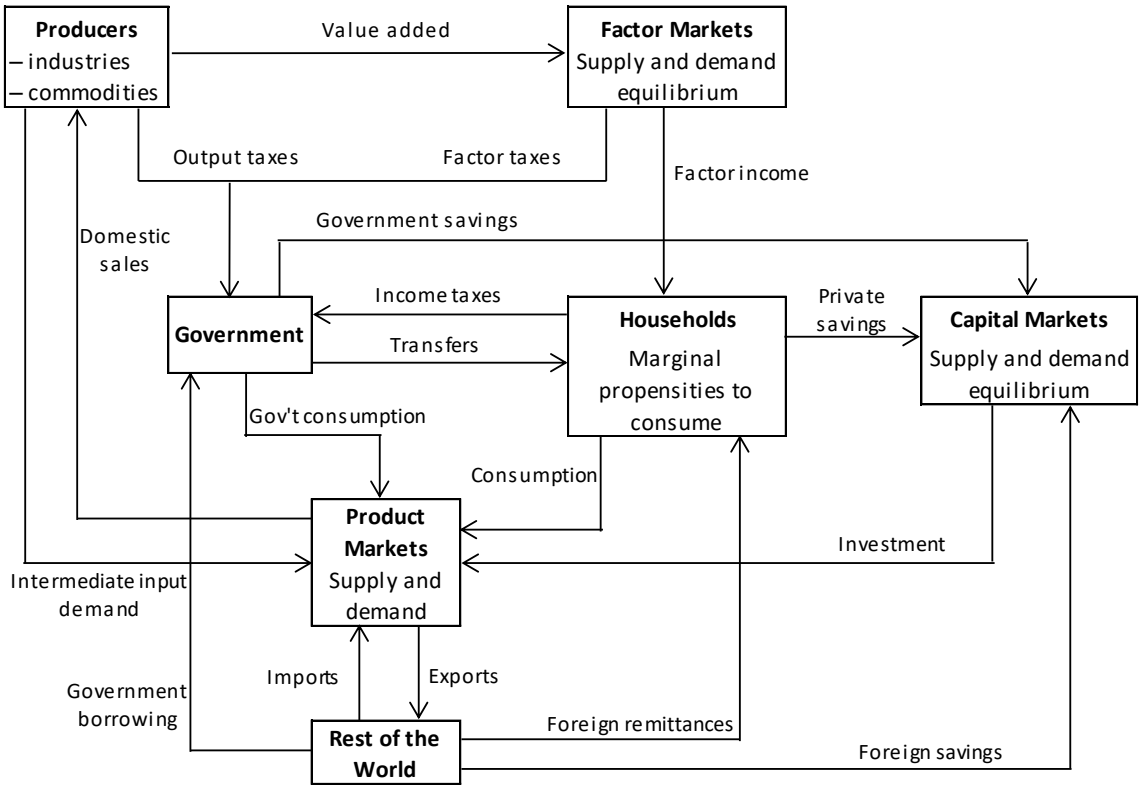
A CGE model is "an economy-wide model that includes the feedback between demand, income and production structure and where all prices adjust until decisions made in production are consistent with decisions made in demand" (Dervis, De Melo and Robinson, 1982, p. 132, quoted in Rossow and Saayman, 2011).

Typically, CGE models are calibrated around a single year's SAM derived from a country's documented I-O tables and institutional accounts, and therefore there is no need for a time-series record for each and every variable under consideration (Ahmed and Donoghue, 2007).

After specifying equations and variables, time series of SAMs allow the calibration of the parameters of the model so that its equilibrium states reproduce the values observed in the most recent SAM. Once the model is calibrated, effects of shocks such as increased visitor spending, higher petroleum prices, higher wage ranges, or an increase in tax rates can be studied (Frechtling, 2011).

Figure 4 presents an example of the flows in the CGE model and the equilibrium conditions.

Figure 4: Flows in the CGE model and the equilibrium conditions.



Source: Frechtling, 2011.

CGE models come in all shapes and sizes and share the same core approaches to depict supply and demand, factor markets, savings and investment, trade, taxation, and regulations (Burfisher, 2017).

CGE models can be static and dynamic. A static CGE model provides a before and after comparison of an economy when a shock, such as a tax, causes it to reallocate its productive resources in more or less efficient ways. However, in spite of being able to indicate the "winners" of a shock, these are not able to describe the adjustment pathway. The adjustment process could include periods of unemployment for example. Moreover, CGE models can be single-country or multi-country. The economies in multi-countries may be connected with each other through trade and sometimes through capital or labour flows (Burfisher, 2017).

The dynamic models are further sub-grouped into (Ahmed and O' Donoghue, 2007):

✓ Models that allow adaptive expectations;

- ✓ Models that allow rational expectations.

Fully integrated dynamic general equilibrium models (rational expectations) can also be divided into two types (Ahmed and O' Donoghue, 2007):

- ✓ Ramsey model;
- ✓ Overlapping-generations models (OLG).

The OLG models traditionally can be further grouped into (Ahmed and O' Donoghue, 2007):

- ✓ Blanchard-Cass-Yaari model;
- ✓ Auerbach and Kotlikoff model.

The primary advantage of working with fully integrated dynamic general equilibrium models is that these models can accommodate uncertainty and idiosyncratic risk.

CGE models may be either short-run or long-run models. In a short-run model, the factors of production are sector specific, whereas in the long-run model, the factors of production are mobile (Pratt and Blake, 2009).

A CGE model database provides all exogenous variables and parameters and the initial equilibrium values of all endogenous variables, and incorporates the SAM (Burfisher, 2017).

CGE endogenous variables are prices and quantities of goods that are produced and consumed, prices and quantities of imports and exports, tax revenue, and aggregate savings. A CGE model usually has the same number of endogenous variables as independent equations. This is necessary (but not sufficient) to guarantee that the system has a unique equilibrium solution (Burfisher, 2017).

Exogenous variables have values that are fixed at their initial levels and do not change when the model is solved. Therefore, the modellers will decide which variables are endogenous and exogenous (called model closure). CGE models contain also three types of exogenous parameters: tax and tariff rates, elasticities of supply and demand, and the shift and share coefficients used in supply and demand equations (Burfisher, 2017).

Elasticities are exogenous parameters in a CGE model that describe the

responsiveness of producers and consumers to changes in relative prices and income. These elasticities can be of several types, according to the types of production and utility functions assumed in the model (Burfisher, 2017).

In order to assess the impact of simulations on the economy, one measures the change in welfare from the simulated change, by comparing the existing equilibrium with the counterfactual equilibrium. The equivalent variation (EV) takes the initial equilibrium income and prices and computes the change needed to achieve new equilibrium utilities. EV in welfare will be used to assess the economic benefits of the simulations. With sector specific factors of production in the short-run model, prices vary to a larger degree than in the long-run model; hence, the welfare impacts are larger in the short- run model (Pratt and Blake, 2009).

Recently, Meng and Siriwardana (2017c) briefly reviewed CGE modelling and included its history, its main elements, the types of CGE models, and the acceptance and evaluation of CGE modelling. In order to have a better insight on the developments on CGE, refer to the work of Burfisher (2017), which addresses a generous list of publications regarding intermediate and advanced level CGE case studies.

Advantages and disadvantages

According to Laffargue (2009), the advantages of a CGE model are associated to the fact that it describes a Walrasian equilibrium of an economy with many details, given that it is based on a SAM that can include a large set of industries, classes of households, and considers a very detailed fiscal policy of the Government. CGE simulations can provide precise and detailed information on the changes in the allocation of resources and distribution of income.

For Laffargue (2009), the limitations of CGE modelling are as follows:

- ✓ A CGE is essentially static. A CGE model includes almost none of the dynamic behaviour and nominal and real rigidities based on inter-temporal optimization and the assumption of rational expectations. Besides, a CGE model is fit on a base year, but is not econometrically estimated.
- ✓ The second limit of CGE models comes from their Walrasian features. The effects of

a big reform can have many major implications besides a change in the allocation of scarce resources between industries. For instance, a policy to developing tourism will encourage domestic residents to learn foreign languages and to invest in education, will develop international business networks, will encourage the diffusion of international knowledge and technology, will increase efficiency in the service industry, etc.

- ✓ The third limit of CGE models comes from their calibration, especially from the discretionary choice by the model-builders of the values of the elasticity parameters.

In addition, as stated in Dwyer et al. (2004), this method is often considered time-consuming, complex and expensive to implement, requiring a large amount of information, which must come from reliable sources. Concomitantly, it admits assumptions of the researchers themselves, which are usually not substantiated or explained throughout the work done, which makes it difficult to understand the models (Dwyer et al., 2004; Frechtling, 2011).

General applications of CGE models

There are already many studies using CGE modelling to estimate the impact of specific policies in the economy. In the eighties, Norrie and Percy (1983) addressed the freight rate reform and regional burden with a CGE analysis of Western freight rate proposals; and Kimbell and Harrison (1986) proposed an algorithm to solve a wide class of CGE models.

In the nineties, Breuss and Tesche (1991) presented the first non-linear CGE model of 7 sectors of the Austrian economy, making a detailed description of it and solving the model using data from a SAM. Sayan and Hushak (1992) presented a CGE interpretation for the US Economy, in the period 1982-1986, concerning the twin-deficits hypothesis; Hanson, Robinson and Tokarick (1993) investigated the implications for the structures of the USA economy of a reduction in their trade deficit, through two alternative adjustment scenarios, using a 30-sector CGE model. Kilkenny and Otto (1994) presented a general equilibrium perspective on structural change in the rural economy. Pasha and Aisha Ghaus (1995) analysed the general equilibrium effects of local taxes. Hanson and

Rose (1997) presented a general equilibrium analysis focusing on the factor productivity and income inequality. Boyd and Chermak (1999) presented a dynamic CGE model concerning the impacts of current US oil policy.

More recently, Rose, Hanson and Li (2001) addressed income distribution effects of government transfers and sensitivity to closure rules in I-O and CGE approaches. Honerkamp, Moog and Raffelhüschen (2002) presented the analysis of the case of a tax reform proposal through CGE-models. Blake and Sinclair (2003) presented a CGE Analysis of September 11 focusing on managing tourism shocks. Koopman, Arce, Balistreri and Fox (2003) addressed large scale CGE modelling at the United States International Trade Commission. Treyz and Treyz (2003) evaluated the regional economic effects of structural funds programs using the REMI Policy Insight Model. Schwarm and Cutler (2003) addressed the thematic of building small city and town SAMs and CGE models. Blake, Sinclair and Sugiyarto (2003) quantified, through a CGE model, the impact of foot and mouth disease on tourism and the UK economy. Jensen (2004) discussed Pareto efficiency, relative prices, and solutions to CGE models. Lima and Cardenete (2005) used a CGE model to identify the policy trade-off between unemployment and inflation. Park (2006) presented the simulation results from the Chicago CGE model, focusing on the retirement exodus and its impacts on regional economies. Bayar, Fortuna, Sisik, Mohora and Silva (2006) performed a simple approach with international trade with a CGE Modelling Platform for the Azorean Economy. Menezes, Fortuna, Silva and Vieira (2006) performed a review on CGE; Park and Hewings (2007) presented simulation results from the Chicago CGE model regarding aging and the regional economy; Park (2007) presented simulation results from the Chicago CGE model regarding immigration benefits to a regional economy with an aging population.

In the last decade, Spinelli (2010) addressed water reallocation policies in a CGE framework focusing on the impact of drought on the Kenyan economy. Monge (2012) presented a CGE approach for the long-run implications of a forest-based carbon sequestration policy on the United States economy. Punt (2013) addressed the modelling process of multi-product industries with CGE models. Cardenete, Delgado and Lima (2013) estimated the economic impact on Andalusian economy of European funds, by using a dynamic general equilibrium model. Monrobel, Camara and Marcos (2013)

constructed a CGE model for the economy of Madrid, with the aim of estimating the impact of the 2007-2013 Structural Funds applied to the region. Hannum (2014) presented three applications of regional CGE models. Álvarez Martínez (2014) analysed the effects of European structural funds in the Spanish regions using CGE models. Fortuna, Silva and Medeiros (2016) used a CGE approach in order to measure the impacts of EU structural funds in a small open economy. This CGE model, named AzorMod, previously developed in Fortuna, Bayar, Mohora, Opese and Sisik (2009), incorporated the economic behaviour of six agents: firms, households, the regional government, the central government, the European Commission and an external sector. The authors found that by eliminating EU funds from the Azorean economy public consumption and consumer well-being would be reduced, investment would increase, and GDP and employment would decrease in the first year, only being recovered at the end of ten years.

Cardenete, Lima and Sancho (2017) addressed the validation of policy-induced economic change using sequential general equilibrium SAMs. Burfisher (2017) presented a list of CGE models applications; Madden (2017) addressed fiscal accounts in regional CGE modelling. Ko (2017) presented a CGE approach to analyse migration in Europe and its economic Impacts. Wittwer (2017) addressed the development and applications of the multi-regional dynamic general equilibrium modelling of the US Economy: USAGE-TERM.

Applying CGE models to tourism

Applying CGE models in order to analyse the ex-ante or ex-post impacts of tourism has occurred in many regions and countries, since the eighties.

Copeland (1991) used a CGE model in order to examine the impact of tourism in a small open economy, demonstrating that the host country benefits when the price of non-tradeable or the real exchange rate increases and that the larger the immigration of households, the smaller is the net benefits to the host country (Burnett, Cutler and Thresher, 2007).

Adams and Parmenter (1995) and Dwyer, Forsyth and Spurr (2003) used a CGE model

to examine tourism in a quite small and open economy in Australia, finding that significant crowding out will occur in the face of a tourism expansion (Burnett et al., 2007).

Zhou, Yanagida, Chakravorty and Leung (1997) used a CGE model for Hawaii to estimate the impact of a 10% reduction in tourist expenditures, and compared this with the outcomes of a standard I-O model. They find that the CGE income multipliers are much smaller than the I-O income multipliers, as the CGE model allows for a downward price-reaction as well as the subsequent employment of some of the laid off tourism-related resources (Fan and Oosterhaven, 2005).

Gooroochurn (2004) used a CGE model to examine the impact of taxing tourism-related products on the Mauritius economy and found taxation of such products to be relatively efficient and equitable, as most of them are luxury products, with a relatively inelastic demand, and domestically mainly consumed by high-income people (Fan and Oosterhaven, 2005).

Dwyer, Forsyth, Spurr and Van Ho (2006) used a CGE model to explore the economic effects of the world tourism crisis on Australia, from the Iraq War and SARS, and found the events to promote less inbound tourism and a reduction of outbound tourism. However, they found that the net effects are not as severe as might have been perceived by tourism stakeholders (Dwyer et al., 2006).

Forsyth, Dwyer, Spurr and Pham (2014) estimated the flow and expenditure effects of the recent increase in Australia's Passenger Movement Charge (PMC), as well as the economic impacts on the Australian economy and the tourism industry. The authors applied a CGE model combined with collected information, in order to estimate the economic impacts of the increased charge on different Australian tourism markets (inbound, outbound and domestic) and discussed the implications of the modelling results for the validity of the industry criticisms of the PMC. Results indicated a negative impact in the tourism industry. However, it was estimated that the Australian economy would gain, pointing to the existence of a clash between the industry and wider economic interests (Forsyth et al., 2014).

Burnett et al. (2007) used a CGE model with a large set of data, applied to a small city

level, in order to determine whether tourism should be seen as an opportunity to stimulate economic growth or to change the structure of the economy in order to increase the efficiency of collecting tax revenue (Burnett et al., 2007).

Fernando, Bandara, Smith and Pham (2015) used a tourism focused CGE model in order to analyse the effects of tourism on the economy of Sri Lankan, showing that tourism can play a wide effect on the economy in the post-war phase, and referred to several past studies on the use of CGE modelling techniques applied to Sri Lankan.

Meng and Siriwardana (2017a) discussed the suitability of applying CGE modelling to tourism studies and reviewed the application of CGE modelling to different tourism topics. The same authors provided a detailed illustration about data requirements for CGE models, where to obtain data and how data is related to the CGE model structure. They used the tourism CGE model for Singapore, illustrating in detail the procedures and skills to construct a database for a tourism CGE model, including I-O updating, aggregation and disaggregation, mapping, and new matrix derivation (Meng and Siriwardana, 2017b). The researchers also discussed the issues related to generating reliable modelling results, focusing on three aspects: the integrity of model implementation, the simulation design, and the sensitivity tests (Meng and Siriwardana, 2017e). In another paper, they demonstrate how to consider tourism demand in a CGE model, how tourism demand is linked to industries and discuss CGE models in detail, including functions and solutions, the TABLO codes, and the structure of nested functions (Meng and Siriwardana, 2017d).

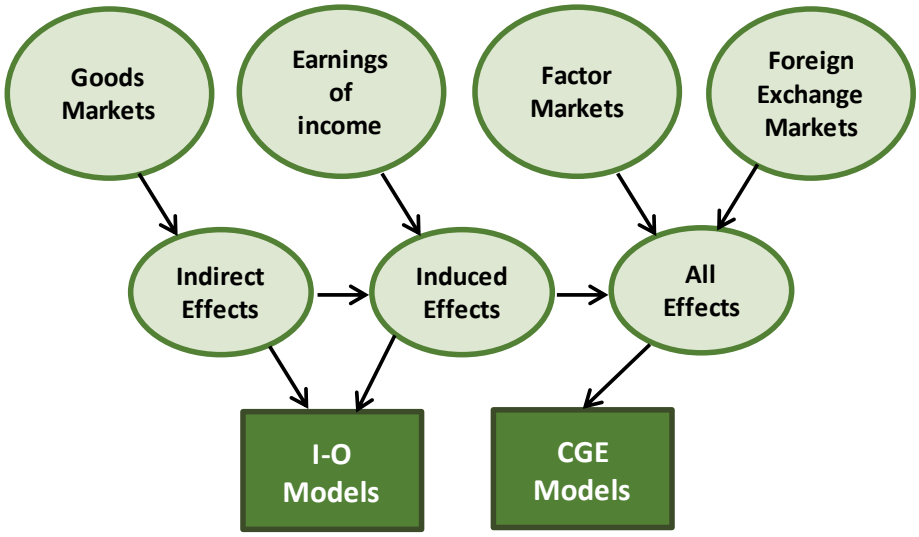
TSAs vs. I-O matrices vs. SAMs vs. CGE models

A TSA is based on the I-O/SAM structure and gives information on the direct effects on the economy. I-O analysis is used to analyse the interdependence of industries in an economy and records economic transactions irrespective of the social background of the transactors. A SAM comes from I-O tables, national income statistics, and household income and expenditure statistics, and is thus broader than an I-O table and typical national accounts, showing more detail about all kinds of transactions within an economy. A CGE model comes from a SAM, and is coupled with a conceptual framework

of the behavioural and technical relationships among variables within and among sets of accounts, and is used to convert the abstract representation of an economy into realistic and solvable models of actual economies. Therefore, CGE models can be used for more detailed and realistic evaluations of the economy-wide effects of policy changes or other economic impacts than neither I-O analysis nor SAM can (Rossouw and Saayman, 2011).

Figure 5 presents a comparison of I-O and CGE models regarding the effects captured by each one of them.

Figure 5: Comparison of I-O and CGE models.



Source: Blake et al., 2001.

Table 1 summarizes the usual assumptions made for an I-O and for a CGE model.

Table 1: Assumptions made for an I-O model and for a CGE model.

Assumptions of an I-O model	Assumptions of a CGE model
All components of final demand (consumption, private investment, government purchases and exports) are determined outside the model.	All "main" final demand components are determined within the model.
There are no price-induced substitution effects; real wages and real foreign exchange rates are fixed.	Price-induced substitution effects may occur; real wages and exchange rates are allowed to vary with demand.
Government expenditure is exogenous.	Government budget deficits are exogenous, but expenditures may vary against revenue.
Employment supply is perfectly elastic; wages do not rise as employment demand rises.	Employment supply is somewhat elastic but may not be high enough to produce all the products; wages rise as employment demand rises.
Product inputs per unit of product output to final demand are fixed.	Product inputs may vary per unit of output to final demand.
Industry mix of products for final demand is fixed as percent distributions.	Industry product mixes may vary in response to changing demand and prices.

Source: Frechtling (2011).

Table 2 summarizes the characteristics of the four macroeconomic policy analysis tools discussed in this paper, presenting the levels of effects on a macro economy, chocks that can be analysed, results, strengths and boundaries.

Table 2: Comparison of the TSA, the I-O model, the SAM, and the CGE model.

Macroeconomic policy analysis tool	Macroeconomic effects	Shocks that can be analysed	Results	Strengths	Boundaries
TSA	Direct	Changes in visitor consumption by product	Tourism's contribution to GDP and employment by industry for a given year	Explicitly incorporates visitor demand by product and industry; TSA is an account that is often updated annually and benchmarked every 5 years	Certain elements of direct impact only; cannot present details for different types of firms, households or other institutions
Input-Output	Direct, indirect and induced effects on output, income and employment	Changes in consumption by product or industry	National output, income, employment, value added	Well- understood, standard methodology; standardized construction and presentation	Assumes no constraints on availability of factors of production; prices and wages do not vary; distribution of factor inputs required by outputs does not vary
Social Accounting Matrix	Indirect and induced effects on output, income and employment, by disaggregated households, firms and other institutions, products, types of demand and other elements of the macroeconomy	Changes in consumption by product or industry; changes in policy: tax rates, government spending, price inflation	National output, income, employment, value added; product prices, wage rates; broken down by type of household, labor and capital source	Disaggregates households, firms and other institutions, products, types of demand and other elements of the macroeconomy according to analytical needs and data resources	No standard methodology or presentation; same boundaries as I-O model
Computable General Equilibrium models	Indirect and induced effects on output, income and employment; prices and wage rates by industry	Changes in consumption by product or industry; changes in policy: tax rates, government spending, price inflation	National output, income, employment, value added; product prices, wage rates; broken down by type of household, labor and capital source	Allows factor of production prices to vary; effects of resource constraints covered; all markets clear	No standard methodology or presentation; posited relationship equations, parameters, elasticities seldom made public; heavily dependent on assumptions; requires massive input data that is seldom current; require validation against the actual economic

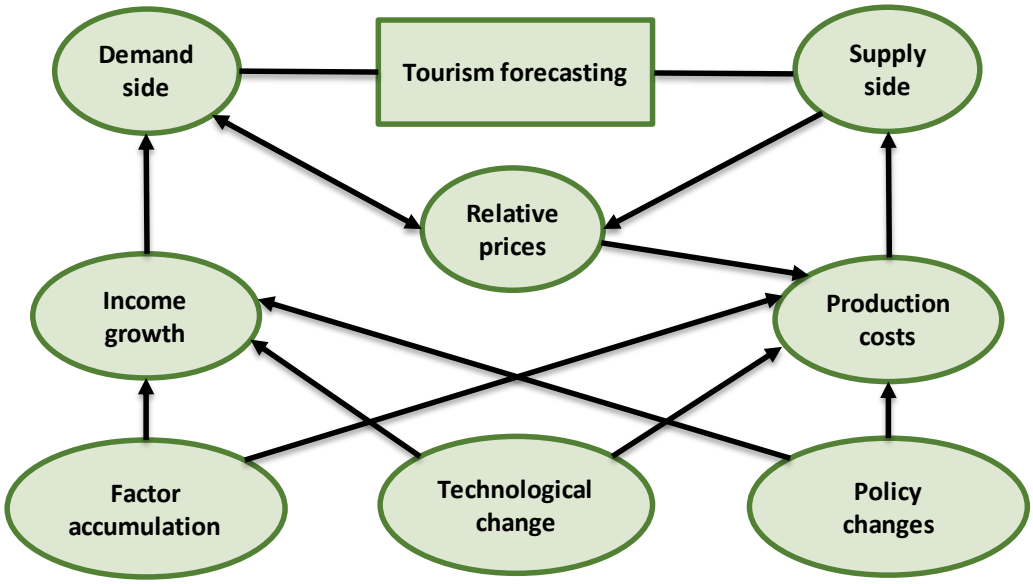
Source: Frechtling (2011).

Combining CGE models and TSAs

How to combine CGE models and TSAs

The combined use of CGE models and conventional TSAs to analyse the effect of certain events or policy changes in the economy embody complementarities between both models, resulting in the production of more accurate information than by conducting the analyses with each type of model in isolation (Rossouw and Saayman, 2011). Figure 6 presents the conceptual model for the tourism forecasting with the integrated use of TSAs and CGE models.

Figure 6: Tourism forecasting with integrated (TSA and CGE) models.

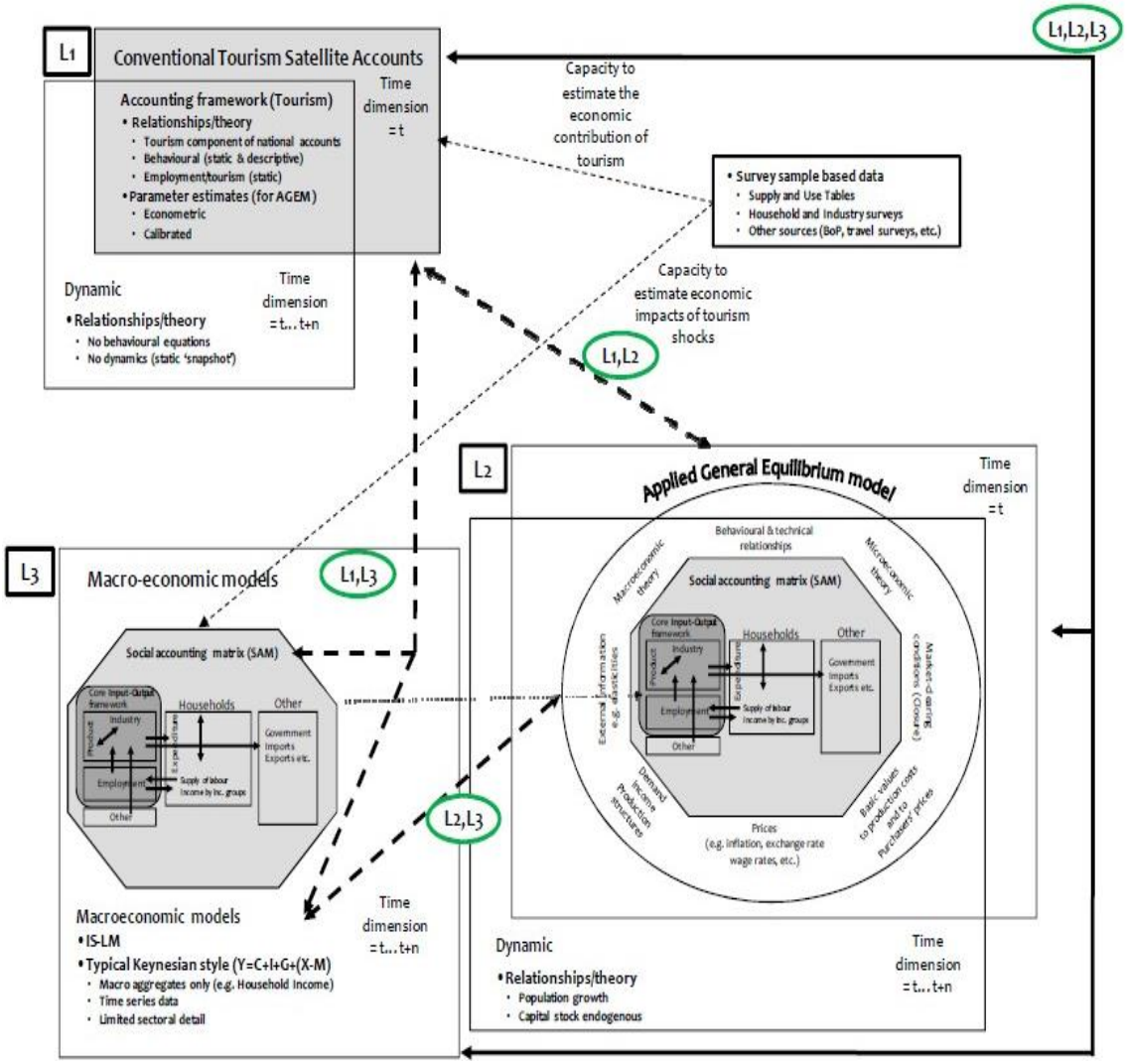


Source: Blake et al., 2001.

Rossouw and Saayman (2011) presented an approach to integrate both techniques, this implying the construction of a single model comprising several elements and layers. Figure 7 presents a stylized representation of interaction between TSAs and other (CGE and macro) models. Moreover, the authors also presented several reasons (based on a literature review) to support the preference given to integrated models (TSAs and CGE models and TSAs/econometric models). Even though some (a few) applications use the integration of TSAs with econometric models, the most widely used approach is the

integration of TSAs with CGE models (see Rossouw and Saayman, 2011).

Figure 7: Stylized representation of interaction between TSAs and other (CGE and macro) models.



Source: Cameron (2003); Rossouw and Saayman (2011).

TSAs are primarily based on data from Supply and Use Tables, as well as large representative survey-based samples. These same tables and surveys also inform certain parameters and assumptions when constructing SAMs for CGE models (Rossouw and Saayman, 2011).

The TSA will provide the valid detail on output generated by Tourism Expenditure and

the CGE will extend this to detailed impact measures based upon its assumptions (Frechtling, 2011).

If one wants to construct an integrated model with a TSA embedded within it, the integrated combination (L1,L2) in Figure 7 would be considered, with full capabilities with regards to industries, households, taxes and transfers (Rossouw and Saayman, 2011).

The advantages of using integrated models with TSAs and CGE models are the following:

- ✓ Cleaner and more transparent method (Rossouw and Saayman, 2011);
- ✓ Flexibility (Rossouw and Saayman, 2011);
- ✓ More suited when the aim of the study is to understand the direction and relative magnitude of distributional and other effects in the context of a full microeconomic analysis within an economy-wide framework (Rossouw and Saayman, 2011);
- ✓ Usually contain certain core components of the model structure, and can be expanded by extending the scope of the model to suit the circumstances of the tourist origin/destination country or region (Rossouw and Saayman, 2011);
- ✓ TSAs take no account of possible factor constraints or the impacts that changing prices and wages might have on other (non-tourism) industries, nor do they contain any behavioural equations specifying how each sector responds to external shocks including shocks normally affecting the sector directly and shocks transmitted through intersectoral linkages, via change in prices, wages, exchange rates and other variables. As such, TSAs are of partial equilibrium nature only. SAMs and CGE models in turn track inter-industry relationships, which are ideally based on realistic behavioural assumptions, and allow for resource constraints and prices. Moreover, they can provide fully simulated economic impacts and welfare estimates. It is therefore apparent that these approaches can complement each other in the quest to understand these issues better in the context of economy-wide as well as macro and micro level analysis for less developed and transitional economies (Rossouw and Saayman, 2011);
- ✓ Given that CGE models do not incorporate detailed information on the tourism sector

(economic size of tourism), and TSAs are sets of accounts providing exactly such detail (but do not assess the whole impact of tourism), with consensual definitions and data, the complementarity of both models is an advantage. Besides, when a TSA does not exist, CGE models can provide information on input and output relationships, to be used in the construction of a TSA (Rossouw and Saayman, 2011);

- ✓ Include many economic impacts that are not captured in I-O models, avoiding unreliable and heavily biased results (Rossouw and Saayman, 2011);
- ✓ CGE models allow prices to vary and resources to be reallocated between production sectors. Integrated models build upon this framework by including tourism data from TSAs to provide a consistent means of modelling tourism in the entire economy (Rossouw and Saayman, 2011);
- ✓ Allow the assessment of potential long-term growth of tourism in response to predictable changes in the economy (e.g. population growth and changing education levels), as well as the short-term impact of macroeconomic changes such as currency market crises and natural disasters (Rossouw and Saayman, 2011);
- ✓ Is able to trace the effects of changes in non-tourism activities on tourism related sectors, as well as the effects of changes in tourism on the rest of the economy (Rossouw and Saayman, 2011);
- ✓ Quantifies the macroeconomic impacts of alternative scenarios on income, employment, welfare, the balance of trade and government revenue, as well as on individual sectors of the economy (Rossouw and Saayman, 2011).

However, data requirements and rapid structural change in transitional economies pose a challenge to the application of both CGE models and TSAs in these types of economies (Rossouw and Saayman, 2011).

Examples of CGE and TSAs combined models

Until a few years ago, the use of CGE modelling to analyse tourism economic impacts was limited, given the sparse number of TSAs available worldwide. However, recently TSAs have been produced in larger numbers and the construction of CGE models has

also been boosted. Based on this availability of data and on the advantages of integrating TSAs with CGE models, integrated methodologies (TSAs and CGE modelling) have become more frequent in the research outputs.

Blake et al. (2001) addressed the modelling of tourism and travel using a Tourism Policy and Forecasting (TPF) model, which integrates TSAs in CGE modelling. The authors presented a summary of the TPF model for the USA and examined three illustrative cases (namely a rise in foreign tourist expenditure, removal of indirect taxation, and an increase in air transport productivity). In the first case, the indirect effects of an I-O model were also presented for comparison with the integrated approach results.

Blake et al. (2006) presented an integrated model combining CGE, and structural equations forecasts obtained from data collected regarding tourism indicators, and analysed, among other things, the impact of a 10% increase in tourism spending in the economy of Scotland, in the short, medium and long-run. The authors showed the model's ability to take account of the multiple events that affect tourism destinations.

Ahmed and O' Donoghue (2007) addressed an integrated modelling analysis, referring to the linkage between a macro framework with reduced form estimations; a macro framework with representative households; and a CGE model with micro-simulation, and reviewed relevant literature on this subject.

Laffargue (2009) presented a survey of the CGE while analysing the economic and social effects of tourism activities and tourism policies, using an integrated model that extends the TSA into a CGE model. The authors reviewed literature on this topic and examined a series of studies which used CGE modelling to analyse the impact of tourism in the economy.

Rossouw and Saayman (2011) presented a case study with the use of an integrated approach (with the extension of TSA and consequent integration with an applied general equilibrium - CGE model), in order to analyse the economy-wide effects of a decline in tourism demand, identifying which industries would suffer the most and which would be unaffected in the South African economy. The same authors also analysed the effects of hosting a world-class sports event on reducing unemployment and poverty in the country. The authors found that the I-O model overestimates the total GDP effect,

underestimates the total effect on tourism sectors and misses the negative effects on non-tourism sectors. The authors modelled a sustained 10% growth in tourism and found that the overall GDP of the country could increase by 0.31%, while employment could increase by as much as 0.56% (results in line with similar studies in Thailand, Australia and the USA, according to the authors). The conclusion was that a coherent and systematic integrated approach gives policy makers greater variety and accuracy of information, than by using independent models (Rossouw and Saayman, 2011).

Fernando (2015), at an early stage, analyzed tourism performance in Sri Lanka in a comprehensive way, through the preparation of a literature review and the use of historical data. Of particular note are the changes in the sector's development, due to the country's economic policies and the long-term internal conflicts (civil war) that lasted almost three decades. Given the enormous information gap in this sense, the author decided to measure these impacts using systematic econometric models and a CGE model, which he called SLCGE-Tourism, that follows the ORANI-G model applied to the Australian economy. The SLCGE-Tourism represents the economic structure of Sri Lanka through a series of linear equations, derived from microeconomic theory, that incorporate percentage changes in the variables, implemented through GEMPACK software. Sixty-five industries were included, following the Horridge (2014) index, divided into five groups of equations. Through the creation of a dummy tourism sector, the model includes international tourism as an industry. For the construction of this vector, the author used data from TSAs, referring to the consumption of visitors. The results showed that tourism in Sri Lanka is influenced by political violence, changes in exchange rates and seasonality, and that the number of tourists visiting the country would increase by 26% per year if the social and political environment remained peaceful. In addition, tourism can be a major driver of economic growth and job creation, although it is also associated with some negative aspects, such as a decline in exports, due to the appreciation of the real exchange rate.

Pratt (2015b) analysed the Borat effect, while focusing on the film-induced tourism, through an integrated comparative static model, comprising the integration of TSA with CGE modelling, in order to estimate its impact in the economy of Kazakhstan. The author discusses the interesting results of the impact of the film on the economy of the country.

Dwyer, Forsyth, Spurr and Van Ho (2016) refer the importance of developing an integrated suite of regional TSAs to apply to Australia, and present an overview of the development of a set of TSA for each of the six Australian states and two territories. They also discuss the nature of TSAs, their importance, as well as the particular challenges of developing regional TSA (including data limitations, treatment of interstate trade, taxes/subsidies and reconciliation with the national TSA).

Discussion and Conclusions

The main purpose of the current work was to review the literature on the main methods that have been used to quantify the economic impacts of tourism activities, focusing on Tourism Satellite Accounts (TSAs), Input-Output (I-O) matrices, Social Accounting Matrices (SAMs) and Computable General Equilibrium (CGE) models.

The review focused on the papers that help our understanding of a set of methodologies that have been used but stress the importance of TSAs, as elements that are essential to quantify a concept of tourism cluster. A brief review of this concept is also included since it is not a closed matter. The building of TSAs incorporates a specific understanding of the limits of the tourism cluster, which does not eliminate the interest of discussing such an assumption.

The main focus of the review is, however, on the models that have been built to improve our understanding of the tourism cluster and how it can be modelled as such with particular attention devoted to the models that provide a comprehensive view the sector, highlighting advantages and disadvantages. The final purpose was to identify how the specificities of tourism can be directly integrated in CGE models.

The final purpose of the literature review is to set the background of a wider study of tourism cluster in the Azores, an insular region of Portugal, for the implementation of a combined TSA/CGE model of this economy.

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