Understanding regional tourism impact when data is scarce: dealing with the absence of a regional Input-Output table[1]

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Abstract

There are many regional economies around the world which dependency on tourism as an economic source of income is vital. The study of how these economies are transformed by tourism, nevertheless, faces a big problem: Poor or inexistent data. We use the case of Salta province, in Argentina, to show how regardless of bad data problems, relevant insights can be found. Based on survey data and location quotients methodology we build a Social Accounting Matrix for Salta. This estimated matrix allows us to apply input-output and CGE models to understand the relevance of tourism in the region.

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1. Introduction

Tourism can play a crucial role behind the economic wealth of several countries around the globe. Given its importance, understanding the links that tie tourism with the rest of the economy as well as how policy-makers' decisions affect this industry has won a place on the agenda of both government agencies and researchers. Several tools are available to analysts for answering these questions, but Input-Output (I-O) models and more recently Computable General Equilibrium (CGE) models have gained popularity thanks to their analytical advantages. Numerous examples of their application can be found in the literature: CGE models have been used to study the relationship between tourism and megaevents (Allan, Lecca, and Swales 2017), the effects of a carbon tax on tourism (Dwyer, Forsyth, and Spurr 2012; Tol 2007), the impact of changes in oil prices on tourism (Becken and Lennox 2012), investment in infrastructure focused on tourism (Taylor et al. 2003; Taylor, Hardner, and Stewart 2009) and other tourism-focused policies (Meng, Siriwardana, and Pham 2013). More on the application of CGE on tourism can be seen in (Meng and Siriwardana 2016).

The role of the tourism industry can be even more relevant when we shift our focus from national to regional economies. The introduction of new policy can mean the destruction or creation of income for whole towns and cities which wealth rests on the money spent by visitors. There is no doubt that understanding how these policies affect tourism arrival should be behind the decisions of any regional and national government interested on the wellbeing of their citizens. Nevertheless, regional studies face an issue that is not frequent in national studies: lack of data, particularly, of an officially published input-output (I-O) table or social accounting matrix (SAM). This kind of matrices are usually elaborated from a survey-based approach, which means that their construction requires an expensive and complex process usually unattainable for regional statistical institutes.

The province of Salta, which rests between the Andes mountains in the North-West of Argentina, faces this issue. Systematically listed as one of the top touristic destinations of the south American country, the arrival of tourists means a fundamental source of income for many of its residents. The construction of new roads and infrastructure, tax modifications or the promotion of national parks are examples of policies that if carried on, could alter the inflow of tourists and therefor modify Salta's economy and the life of its citizens. Despite the relevance of understanding not only how the connection between tourism and the rest of the economy works but also how policies like the ones mentioned can modify this relationship, the inexistence of an input-output table or SAM can be a problem for giving a satisfactory analytical answer to these questions.

This issue can be avoided thanks to the development of a family of techniques based on non-survey methodology. The Location Quotients (LQ) methods can estimate a new input-output table working with relatively easily accessible data such as regional and national GDP values. Being an inexpensive alternative to survey-methods, while still providing with accurate results, has earned this methodology a growing literature, with studies dedicated to improvements on its estimation as well as empirical implementations. Location Quotients techniques have been applied in studies regarding Germany (Kowalewski 2013), Argentina (Flegg, Mastronardi and Romero 2015) and Greece (Kolokontes, Karafillis and Chatzitheodoridis 2008).

Sometimes surveys regarding the whole regional economy are not available, but industry or household specific surveys could be accessible. If this was the case, hybrid or semi-survey techniques can allow the researcher to improve the results obtained from LQ estimations by combining them with survey-based data. The usage of RAS and Cross-Entropy do the work of accomplishing said combination. Hybrid or semi-surveys techniques have also attracted many researchers and gained its share of participation in the literature with examples like Surugiu and Surugiu (2015) and Taylor, Hardner and Stewart (2009).

In this study, we present the construction of an Input-Output Table for the province of Salta, Argentina, using hybrid methodology. We create an estimated Input-Output table with the Flegg Location Quotient (Flegg and Webber 1997; Flegg, Webber, and Elliott 1995) technique and latter combine said results with data obtained from tourism industry firms and households surveys. Later, we combine the estimated hybrid I-O table with secondary data for creating a Regional Social Accounting Matrix containing the province of Salta and the rest of the country. Finally, the obtained matrices are implemented in an Input-Output Model and a Computable General Equilibrium Model with the objective of understanding the importance of the tourism industry in the regional economy of Salta.

This document is organized in the following way: Section 2 describes the economy of Salta and its tourism industry; Section 3 is purely methodological and its composed of a set of subsections regarding the construction of the input-output table and social accounting matrix, data sources and characteristics of the computable general equilibrium model; Section 4 reports the results of the estimations done for the input-output and computable general equilibrium models; Conclusions and discussion of the study are presented on Section 5.

2. A brief introduction to tourism in Salta

The province of Salta is located along the central Andes in north-eastern Argentina and shares borders with Chile, Bolivia and Paraguay as well as other 6 Argentinian provinces[2]. Salta has an extensive territory with an area similar to Nepal or Greece (155,488 square km) and covers a diverse geography that ranges from arid valleys to jungles. This natural diversity, together with a rich history, provides the province with a range of touristic attractions and experiences that position it as a top destination in the country for both national as well as overseas visitors. The capital city of the province attracts tourists with its colonial architecture and is commonly used as a base point for visiting the rest of the attractions the region offers, like the towns of Cachi and Cafayate. The

[2] The Argentine Republic is composed of 23 provinces and one autonomous city.

province of Salta also contains several protected areas, including 3 national parks that encompass its geographical diversity.

According to the National Institute of Statistics and Census from Argentina (INDEC), in 2016 Argentina was the fifth most visited country in the Americas with an inflow of 5.6 million overseas visitors representing an income of 3.8 billion dollars. This performance allowed the tourism sector to represent 30% of service exports (being the second biggest services exporter of the country) and 5.4% of total exports. The Domestic Tourism Survey of the Ministry of Tourism of Argentina shows that in terms of domestic tourism, in 2016 the industry generated 8.5 billion dollars.

Taking an average of the total visits (domestic and international) throughout the country between 2012 and 2014, 3.6% were hosted by Salta, making the province recipient of 3.9% of the total touristic spending. Despite not showing an outstanding performance compared with the whole country, at regional level Salta seems to have a bigger relevance being the recipient of 33.2% (4.3 million visits) of the total number of tourists spending done though the northern provinces of Argentina[3].

The National Institute of Statistics and Census (INDEC) from Argentina develops a permanent survey across the whole country regarding hotels and tourism statistics, it contains interesting insights on the evolution of this industry across time. A resume of its content is shown along the rest of this section.

Figure 1 shows the evolution of tourists (domestic and international) that have visited the City of Salta, capital of the province of Salta, between 2008 and 2016. As said before, the City of Salta is usually used as a base point for visiting the rest of the region, so understanding the behavior of its tourism industry can help on the comprehension of the bigger picture. Tourism in the city of Salta seems to have had a dynamic growth, with an increase of 46% of visitors from 2008 to 2016. Its composition, is steady between national and overseas visitors: an average 22% of international tourists across the analyzed period.

These figures are in line with what have happened across the northern provinces of the country[4]. In this area, including the province of Salta, an increase of 27 % of visitors occurred between 2008 and 2016. As in the case of the city of Salta, the composition of tourism is steady in this period, with international visitors representing around 13 % of the total tourists.

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[3] Domestic visits were estimated using the Domestic Tourism Survey (Ministry of Tourism of Argentina). International visits were estimated using both, the national hotel survey and the local hotel survey (INDEC and Ministry of Tourism of Salta, respectively).

[4] The survey encompasses 7 cities of a total of 5 provinces.

Figure 1 Quantity of international and domestic tourists that visited the City of Salta between 2008 and 2016.

Source: National Institute of Statistics and Census from Argentina

Statistics of visitor quantities are also available nationwide but for a shorter period: between 2011 and 2016 the total number of tourists increased in almost 6%. This presents an interesting contrast with the reality of the tourism sector of the northern provinces and the City of Salta where the registered growth for the same period was of 10% and 13% respectively.

The growth of the touristic industry in the northern region of Argentina can also be seen on supply numbers: the quantity of hotels between 2008 and 2016 has grown 64% while the available rooms has risen a 36%. Apart from the increase in visitors, an expansion in infrastructure can also be seen, with growth of the amount of hotels and available rooms.

Even if the changes that Salta's tourism industry has overcome during the last years may not have had a big impact in the national economy because of its relatively small size, it could have a relevant regional importance. The growth of the sector could be significant enough to re-shape the way Salta's economy generates income, product and employment: there lies the relevance of understanding its nature.

3. Data and Models

3.1 The construction of the SAM

Argentina, as many other countries do, faces an obstacle when it comes to regional analysis: Poor data. In an ideal situation, we would like to have access to officially developed social accounting matrices or input-output tables, but when it comes to sub-national regions it's hard to find them. Nevertheless, regional and national statistical departments usually offer a set of different variables and datasets that can help us construct our own SAMs: regional gross domestic product values, government budgets, consumer and firm's surveys, taxation information and regional exports/imports, between others.

By combining secondary data with survey results, hybrid techniques can be used to estimate an input-output table and a regional social accounting matrix for the province of Salta. In Table 1 we present a resume of the information contained in the estimated SAM, particularly, GDP shares of every sector and participation of labor and capital per industry. Along this document, every time we refer to "touristic sectors" we'll be talking about hotels, restaurants, passenger transport and other touristic services such as entertainment.

Table 1. Descriptive variables taken from the estimated Social Accounting Matrix of Salta. GDP Values expressed in percentage and millions of Argentinian Pesos (at basic prices of 2014).

Sectors	GDP Shares	Share Labor	Share Capital
Primary	19.0%	22.8%	77.2%
Food and beverages	4.7%	38.5%	61.5%
Textile and leather	1.0%	35.8%	64.2%
Refinery	4.7%	3.9%	96.1%
Chemicals and plastics	1.4%	12.1%	87.9%
Rest of the industry	0.8%	30.4%	69.6%
Electricity, gas and water	2.7%	13.8%	86.2%
Construction	4.4%	39.4%	60.6%
Commerce	10.7%	20.2%	79.8%
Hotels	0.8%	40.9%	59.1%
Restaurants	0.8%	36.9%	63.1%
Land transport	5.2%	18.3%	81.7%
Airlines & tourism agencies	1.1%	16.0%	84.0%
Others (transport)	0.4%	18.3%	81.7%
Others (tourist services)	0.1%	34.5%	65.5%
Public sector and others	42.2%	56.7%	43.3%
Total	31,863	-	-

Source: Author's estimations and Statistics Department of the Province of Salta. Note: The total GDP is equivalent to 3,924 million US dollars.

The total tourism spending, which represents about 7% of Salta's GDP, is composed of two elements: the money spent by domestic visitors and the one spent by visitors from the rest of the world. Even if along this document, we refer with the term "touristic sectors" to hotels, restaurants, passenger transport, touristic agencies and other related services, the budget of tourists is distributed in a broader category of goods. Table 2 shows how domestic and international tourists spend their money across the different good and services categories. At benchmark values, the expenditure of tourists in Salta was calculated in $5,684 million of Argentine Pesos (i.e. 770 million US Dollars). From that amount 79 % were spent by Argentinian tourists and 21 % by visitors from the rest of the world.

Table 2. Composition of tourism spending.

Sectors	Domestic Tourism	International Tourism
Primary	0.0%	0.0%
Food and beverages	6.1%	3.2%
Textile and leather	2.0%	5.0%
Refinery	8.3%	1.9%
Chemicals and plastics	0.0%	0.0%
Rest of the industry	0.0%	0.0%
Electricity, gas and water	0.0%	0.0%
Construction	0.0%	0.0%
Commerce	12.9%	3.6%
Hotels	15.2%	13.9%
Restaurants	14.0%	28.7%
Land transport	10.2%	6.4%
Airlines & tourism agencies	23.7%	30.4%
Others (transport)	0.0%	0.0%
Others (tourist services)	0.1%	0.1%
Public sector and others	7.5%	6.8%
Total	$4,474	$1,210

Source: Author's estimations.

For the sake of clarity, we divide the construction of the SAM in subsections: first we introduce the usage of the FLQ technique for obtaining an estimated I-O table, then we present the application of hybrid techniques for improving the first estimation with survey data and finally we describe the construction of the regional social accounting matrix.

3.1.1 Applying FLQ techniques

As mentioned above, location quotients techniques are an affordable and effective way of obtaining input-output tables when survey-based techniques are not available. Their advantages have driven a growing literature that has been working on improving its estimations and testing them on an empirical basis. Even if different LQ estimator coexist in the literature, their essence is similar: on one hand, they work under the assumption that regional technologies are equal to the average national ones. On the other hand, they assume what's stablished in equation 1, which means that interregional coefficients (a_{ij}^{R}) differ from the national technical coefficient (a_{ij}^{M}) by a participation factor in the regional commerce (lq_{ij})

$$\mathrm{a}_{\mathrm{ij}}^{\mathrm{R}} = \mathrm{lq}_{\mathrm{ij}}\,\mathrm{a}_{\mathrm{ij}}^{\mathrm{N}} \quad (1)$$

where sub-indexes i and j reffer to the selling and buying sectors respectively, meaning that a_{ij}^{R} (also known as "regional input coefficient") shows the quantity of input i that is required for producing a unit of product j. Superscripts R and N refer to region and nation respectively.

The Flegg Location Quotient (FLQ) offers a variation of the LQ estimation by taking into consideration the relative size of the region (Flegg. and Webber 1997; Flegg et al. 1995). The FLQ proposes an inverse relationship between the size of the region and the propensity to import from the rest of the regions. Several studies in the literature show that the FLQ outperforms other LQ approaches such as the SLQ and CILQ. The usage of Monte Carlo simulation has shown evidence favoring the FLQ technique over its counterparts (Bonfiglio and Chelli 2008) and other studies applying data from Scotland (Flegg and Webber, 2000), Germany (Kowalewski, 2013) and Finland (Tohmo, 2004) have found similar results. In Argentina, (Flegg et al. 2015) tests these methods for Cordoba Province[5]. The calculation of the coefficient is introduced in equations 2 and 3.

$$FLQ_{ij} = \frac{GDP_{i,R} / GDP_{i,N}}{GDP_{j,R} / GDP_{j,N}} \times \lambda^* = CILQ_{ij} \times \lambda^* \quad (2)$$

$$\lambda^* = \left[log_2 \left(1 + {GDP_R}/{GDP_N} \right) \right]^{\delta}, 0 \leq \delta \leq 1 \quad (3)$$

where GDP represents the Gross Domestic Product, sub-indexes i and j industries and superscripts R and N regions.

The application of the FLQ needs two databases: The industry-disaggregated GDP levels of the region and the national ones. The data needs to be compatible to be able to work on it, this means that they must be updated to the same year and contemplate the same industry aggregation. In the case of Salta, even if our data matched in temporal terms, the aggregation of industries was not the same, so a work of compatibilization of both databases was applied. Finally, an input-output table containing inter and intra-regional information between Salta and the rest of the country was obtained.

3.1.2 Improving the estimation with hybrid techniques

As mentioned before, several studies have provided evidence on the accuracy of the FLQ technique. Nevertheless, the final estimations of the input-output table can be improved if reinforced with survey data. As explained in (Miller and Blair 2009), hybrid techniques allow the analyst to include information coming from small or focused surveys into the estimations obtained from non-survey techniques. The resulting product is a mix of survey and non-survey information hence it's nature of hybrid.

There are different hybrid techniques that allow the performance of this task, but the most popular ones are the RAS and Cross Entropy methods. RAS, also known as Biproportional Matrix Balancing, is an iterative process that given the total values of rows and columns can perform a re-adjustment of a matrix (Stone 1977). The Cross-Entropy method is an optimizing technique that minimizes a distance measure between an initial matrix and different calculated matrices conditioned to a set of constraints both technological as well as transactional.

The Cross-Entropy method is the most flexible between the two, as it allows for the inclusion of restrictions on regional technical coefficients in order to perform its estimations with the same or less amount of information that what would be needed if applying RAS (with the accuracy of the result depending on the available secondary information).

[5] They found that FLQ performs better for the region with delta near 0.1.

Both methods should not be seen as opposed to each other as it has been shown that RAS is a particular case of Cross-Entropy (McDougall 1999). Along this study both methods were applied.

For the case of Salta, we had access to a set of three different surveys that were designed and implemented under an impact-evaluation project done in the region for studying tourism policies. These surveys comprehended three groups: Households, firms related to the tourism industry and tourists. This data allows us to improve the results of our estimations particularly for those industries regarding tourism, hence supporting better answers to the questions raised by this study.

Between the most important data collected was the one regarding tourism-industry firms. The survey contemplated tourism agencies, campings, hotels, museums, restaurants, transport firms and casinos with restaurants and hotels representing almost 80% of the total observations. Several questions were asked to the surveyed firms allowing us to obtain useful information regarding costs, output, labor, tax payments and profit. The questions in relation to inputs and outputs where particularly detailed, which helped us to obtain the cost structures of this firms. The accessed data also informed if sales where used as intermediate of final consumption and examined whether the inputs were bought from other firms in the region, the rest of the country or overseas, as well as the geographical destination of the products that were sold.

The household survey was collected in different areas of the province of Salta contemplating a total of 277.905 observations. A set of diverse data was obtained from each surveyed individual including quantitative and qualitative characteristics of consumption and sources of income. Information about tax payments and money transfers was also available. The survey was detailed in its questions, so is known if a certain family member works on the private or public sector, the type of industry where she or he is employed and the amount of income perceived in terms of salary or share in revenues. A similar degree of detail was put into the consumption questions, allowing us to know the amount of money spent in goods and services with a minimum level of aggregation in their categories.

The tourists survey focused on tourists visiting different areas of the province and asked several questions regarding not only the origin of this visitors but also their plans while on the area, the type of accommodation where they were staying and the goods and services consumed. The information this survey provided played a useful role on the construction of cost structures of those sectors related to the tourism industry of Salta.

3.1.3 Concluding the construction of the SAM

A Social Accounting Matrix, or SAM, is a fundamental element of any Computable General Equilibrium model. The objective of a SAM is to capture all the different transactions that occur in an economy during an established time frame, creating a detailed picture of it. A social accounting matrix will describe the transactions occurring in the production and resources markets (Miller and Blair 2009) while contemplating and accounting for interaction between government, firms, households and the rest of the world. Social Accounting Matrices are closely related to the structure that can be found in national accounts databases representing an overall balance between the income and outflows of each of the participants in the economy. Moreover, SAMs could be thought of as a way of representing national accounts data in an expanded and more detailed way. These matrices can also be approached as an extension to input-output tables, including not only information on transactions between industries but also a more detailed view on final consumption and value added production.

Reading and interpreting a SAM can be a simple and intuitive process once its organization is understood. As their name indicates, SAMs are matrices where rows and columns represent markets and institutions while its elements the transactions that happen between them. As a general rule, rows represent incomes and columns outflows. Table 3 presents a Macro-SAM (i.e. a SAM for which markets and institutions are aggregated) with the goal of providing a clearer understanding of the introduced concepts. For getting familiar with the SAM-logic take as an example the point where row “Government” intercepts column “Households”, that point, “direct taxes” will represent an income for the government and an outflow for the households.

The estimated input-output table will be an important element of the SAM, but still other data sources were needed for finishing its construction. Notice that I-O tables contain information on final consumption but in an aggregated way, so secondary data sources are necessary to distinguish the share belonging to government, households and exports. Different sources of information were used to accomplish this division: household surveys provided us with data on household consumption, government spending was obtained from government budgets and regional exports databases published by the National Institute of Statistics and Census of Argentina contained the data for firm’s exports to overseas destinations.

Table 3 Simplified Macro-SAM

	Activities	Commodities	Factors	Households	Government	Investment	ROW	Total
Activities		Domestic offer						Production
Commodities	Intermediate demand			Private consumption	Public consumption	Investment	Exports	Total Demand
Factors	Value added						ROW factors payments	Factors income
Households			Factor payments		Government transfers		ROW transfers	Households income
Government		Indirect taxes		Direct taxes			ROW transfers	Government Income
Investment				Private saving	Fiscal result		Current Account	Total savings
ROW		Imports						ROW income
Total	Production	Total offer	Total factor payments	Households Income	Government Income	Investment spending	Income from ROW	

Source: Author’s own elaboration.

The value of exports (imports) that firms residing on Salta sold (bought) to the rest of the country was obtained from the estimation of the input-output table and survey results. On the other hand, imports that Salta's firms obtained from international providers were calculated based on the imports technical coefficients of Argentina under the assumption that the technologies regarding international imports of Salta were equal to those of Argentina.

The data regarding added value was constructed by adding to the estimated input-output table the information provided by the household survey. On the other hand, information on government expenses, transfers and tax payments was obtained from government budgets, tax agencies databases and household and firms surveys.

Data about investment was scattered along different sources. Public investment can be deducted from the information provided by government budgets, but there is no single source of data regarding private investment. This last information was constructed by using data from the construction sector GDP, results of the FLQ estimation (in terms of capital goods demand) and firms' surveys. This information was then combined with data on savings reported on the household survey.

3.2 The I-O and CGE models

Input-Output tables and Social Accounting Matrices are a primary element of input-output and computable general equilibrium models respectively, a set of analytical techniques that have gained popularity along the last two decades. Input-Output models offer relatively simpler and more intuitive mechanics than computable general equilibrium models but at the cost of relying in heavier assumptions. CGE models provide the analyst with more comprehensive and accurate results, considering the limit to the usage of resources and the effects of price changes, but at the cost of larger data needs and analytic complexity. Which model fits best the analyst preferences will depend primarily on the scope of her objective: the literature on tourism analysis offers several examples on the empirical application of both options. In the case of the present study, both models were applied. The main purpose of the current section is to familiarize the reader with the technical characteristics and capabilities of the computable general equilibrium model, further detail on the application of the I-O model is presented later.

The CGE model used contains all the properties of a Walrasian general equilibrium and is numerically solved though the MPSGE interface in the GAMS software following (Brooke, Kendrick, and Meeraus 1992; Rutherford 1999).

The regional general equilibrium model comprehends two regions: Salta and Argentina. The model includes 4 households[6], 2 governments (national and regional[7]), the rest of

[6] Two households for Salta (one residing in its capital city and other in the rest of the province) and two "touristic households", one from the rest of the country and the other from the rest of the world.

[7] The national government is composed of the central national government and a sum of the rest of regional governments that form the country (excluding Salta).

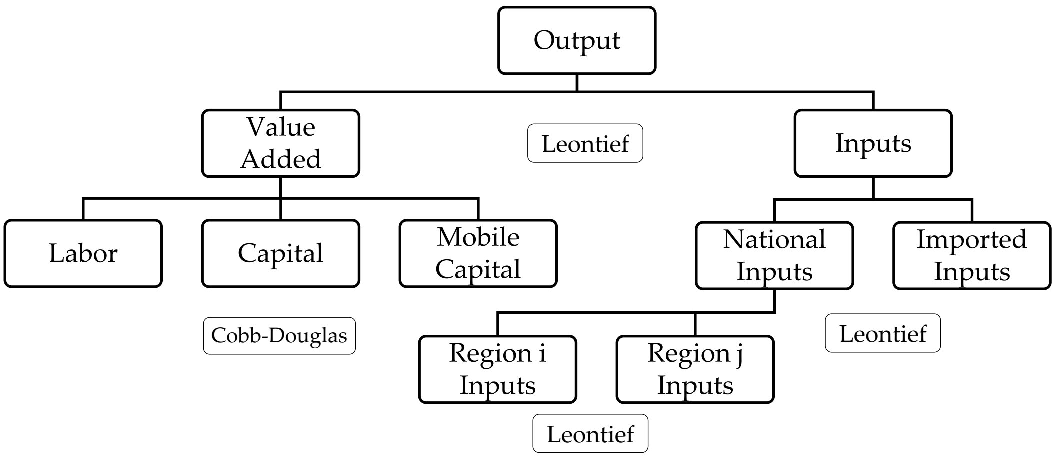
the world and 16 industries. Production sectors of both regions produce a homogenous good. Said good is produced with intermediate inputs (acquired both in the region where the firm produces as well as in the other region) and production factors. The model allows us to estimate regional differences in terms of welfare and activity levels when simulations occur.

The flexibility of the model allows for different modifications on its structure. By imputing changes in parameters and elasticities one can modify production and utility functions. At the same time, these parametric changes can be used on both intermediate and final consumption as well as for modifications in factor mobility. For more details on the structure of the model please view its simplified description in the appendix or refer to (Mastronardi 2013; Mastronardi, Romero, and Chisari 2014).

Nested production functions were modeled a la Leontief between added value and intermediate inputs. The same technology is used to regulate the production of inputs. On the other hand, in the value-added function, the relationship between production factors (work, capital and mobile capital) is modeled as a Cobb-Douglas. Intermediate consumption is also a nested function a la Leontief between good and services. These relationships are presented in a schematic way in Figure 2.

The factor market is modeled in a way such that capital is used at its fullest. There are in total five different factor endowments: capital and labor from each region (Salta and Argentina) and mobile capital. Even if we assume that labor endowments can only be used in a single region (i.e. Salta labor can't be used in the rest of the country) we do allow for a certain degree of mobility of the capital. Mobile capital is modeled as a proportion of total capital and is assigned between the industries of both regions according to variation in rates of return.

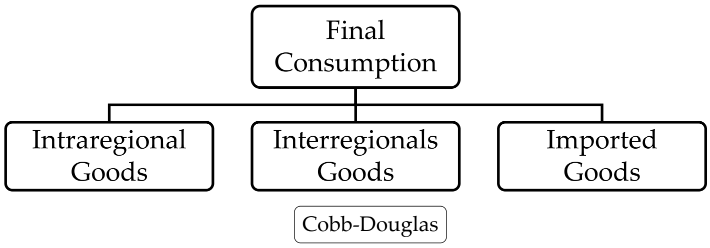
Figure 2. Schematic representation of the production function of the CGE Model.



Source: Own author's elaboration

Households utility is modeled as a Cobb-Douglas function where the substitution elasticity between domestic and imported goods is one. Households decide their levels of consumption by maximizing a utility function given factors income and transfers. There is no restriction imposed to the regional origin of the consumed goods, so a household in Salta can consume goods produced in its region or somewhere else in the country. The relationships expressed above are presented in Figure 3.

Figure 3. Schematic representation of the household utility function for the CGE Model.



Source: Author's own elaboration.

The different governments that compose the model invest, consume and send transfers to households and other governments. The size of their budget is restricted not only by the taxes and other government monetary transfers that they have received but also by acceding to the bond market.

Finally, the rest of the world interacts commercially with both regions by buying as well as selling goods and services. They also participate in the regions factor markets and in the bonds market. As the modeling doesn't contemplate a commerce balance, the closure of the CGE resides in the financial market (i.e. bond market). In terms of prices, except for wages (since there is a disequilibrium in the labor market for the benchmark year of 2014), they are computed simultaneously to clear all markets.

4 Simulations and results

4.1 Simulation strategy

There are different strategies that are used in the literature for understanding the tourism industry under a general equilibrium or input-output approach. Sometimes the nature of the question that dominates the study shapes the simulation strategy. In Allan et al. (2017), the interest of understanding how the announcement of the realization of the Commonwealth Games in Glasgow (as well as the games themselves) modified the economy requires the simulation of forward looking agents. Another example can be found in (Becken and Lennox 2012), where understanding the implications of oil price changes in tourism shapes a particular simulation strategy with attention paid to oil production.

As opposed to studies which questions rest on the occurrence of a particular phenomenon, be it existent or hypothetical, our study does not have such a ground to fund its simulation strategy. In other words, even if we intend to understand how the tourism industry in Salta could be transforming its economy, we are not interested in understanding how this is affected by a particular shock. These conditions give the simulation strategy flexibility, as it doesn't have to respond to particular simulation requirements, but at the same time makes the induced shocks arbitrary. We decided to simulate a 10 %

increase in tourism demand in order to see how changes in this industry can modify the state of the rest of the economy. The increase in tourism demand is modeled by increasing the total number of visitors while keeping constant the previous per-capita tourism spending. Said tourism demand will be divided in two components: domestic and international tourism. The presented simulations will test results to sensibility in terms of capital mobility and type of tourism (national or international).

The results that can be obtained from this type of technique do not only give answers to questions regarding the responses of certain variables of interests but can also work as a useful input for other applications. One of those applications are cost-benefit analysis. If we think the shock as a result of a particular policy we could compare the benefits that said policy generated under the simulation conditions with the financial costs of its implementation to obtain a conclusion on its potential net benefit. For more information regarding the implementation of cost-benefit analysis in CGE environments refer to (Taylor 2010). Along the main results, we present a simple example of their usage for cost-benefit analysis.

4.2 Input-Output Model Results

The results that are obtained from an input-output model are not as comprehensive as those that a CGE model provides, but their understanding is intuitive and straightforward. All the variations that an exogenous change can generate under a simulation are captured by the input-output multipliers. These multipliers register variations of different aspects of the simulated economy, from production and value added, to industry specific and regional indicators. A set of 4 models were simulated:

- Model 1: Open Input-Output Model.
- Model 2: Close model, including Salta households.
- Model 3: Close model, including households from Argentina.
- Model 4: SAM Based model, including households and activities from Argentina.

We simulated a change in tourism spending of 10% (from both national as well as overseas visitors) which results are shown in Table 4. When comparing the results of the different models it can be seen that independently on the addition of new households and sectors, the total effect on Salta remains almost constant. This could indicate that there exists space for an improvement in the productivity connectivity of Salta.

When turning to how each sector participates on the total growth, tourism-related sectors are those with the biggest share, an intuitive result. In other words, this means that tourism sectors are the ones with the biggest growth under the simulation. On the other hand, the participation that each sector has on the total growth doesn’t seem to depend on the considered model.

Table 4. Input-Output Models results for models 1-4 (Millions of $ of 2014)

Effect	Model 1		Model 2		Model 3		Model 4	
	$	Var. %	$	Var. %	$	Var. %	$	Var. %
Direct	568,0	0,9%	568,0	0,9%	568,0	0,9%	568,0	0,9%
Indirect	175,9	0,3%	634,2	1,0%	944,3	1,5%	2970,9	4,6%
Total	744,0	1,2%	1202,3	1,9%	1512,3	2,3%	3539,0	5,5%
Impact on Salta activity sectors								
Primary	12,6	0,1%	12,7	0,1%	12,7	0,1%	13,0	0,1%
Industry	49,2	0,3%	49,4	0,3%	49,5	0,3%	49,9	0,4%
Tourist Sect.	318,5	3,6%	318,5	3,6%	318,7	3,6%	319,2	3,6%
Services	129,7	0,4%	130,0	0,4%	130,1	0,4%	130,9	0,4%
Total effect on Salta	510,0	0,8%	510,7	0,8%	511,0	0,8%	513,0	0,8%

Source: Author's estimates. Note: The variations are calculated respect to the production values.

The tourism multiplier represents the increase on production generated by each dollar spent by tourists. The multiplier values for each model are presented in Table 5. The results show an interesting occurrence: After an increase in tourism consumption, the benefit on Salta is smaller than the observed direct effect. Take as an example the results for model 4, where the multiplier states that for each dollar spent in tourism, 0,958 $ stay in the province.

Table 5. Input-Output tourism multipliers for models 1-4

	Model 1	Model 2	Model 3	Model 4
Tourism Multiplier Salta	0,898	0,943	0,944	0,958
Only domestic	0,874	0,921	0,922	0,936
Only Foreign	0,984	1,025	1,026	1,040
Tourism Multiplier Total	1,310	2,117	2,662	6,230

Source: Author's estimates.

When separating domestic from foreign tourism, we observe that tourism multiplier of foreign visitors leaves a higher regional return in the region than that of domestic visitors. For example, the foreign tourism multiplier in the SAM based model (model 4) is 1,04, a 4% more that the direct increase in consumption.

From the point of view of local productive development, sectorial analysis and, particularly, the regional spillovers that follows tourism growth, an interesting observation regarding value chains arises. The limited results that the tourism multipliers show in terms of regional impact seem to indicate that there is space for improving them. It would be worth analyzing if the development of local value chains that allow to extend the impact of tourism growth in the region is possible or not.

4.2 CGE Model results

A CGE model was also built to analyze the impact of an increase of tourism demand in Salta. We consider a 10 % increase in tourism spending focusing first on the composition of that increase between national and international visitors and secondly on how the obtained results are modified when the mobility of capital is modified.

Table 6 presents the results of a set of simulations: The first one, “Argentina” depicts the outcomes of modifying only the total demand of Argentinian visitors, the second one, “ROW”, only the one of rest of the world visitors and finally, “Total”, the whole effect of the previous two. All the simulations done assumed that all capital is perfect mobile.

The results of the model show that under an increase of 10 % of both national and overseas tourism the GDP of the province of Salta grows around 1.32%. The observed growth is driven mainly by the dynamics of touristic sectors (such as hotels, restaurants, tourism agencies and other tourist services) and the impact of backward linkages to commerce and industries like food and beverages or textile and leather.

Table 6. CGE model results by type of tourism expenditure

Variables	Origin of tourists		
	Argentina	ROW	Total
Salta GDP	1.08%	0.34%	1.32%
Activity level			
Primary	0.19%	0.00%	0.20%
Food and beverages	0.66%	0.11%	0.78%
Textile and leather	1.39%	0.86%	2.25%
Refinery	0.74%	0.03%	0.78%
Chemicals and plastics	0.34%	0.13%	0.47%
Rest of the industry	0.12%	0.05%	0.17%
Electricity, gas and water	0.04%	0.02%	0.06%
Construction	0.40%	0.15%	0.55%
Commerce	1.68%	0.20%	1.88%
Hotels	7.40%	1.84%	9.25%
Restaurants	4.28%	2.28%	6.56%
Land transport	1.26%	0.22%	1.48%
Airlines & tourism agencies	7.02%	2.41%	9.43%
Others (transport)	1.05%	0.22%	1.27%
Others (tourist services)	6.43%	1.95%	8.38%
Public sector and others	0.63%	0.19%	0.82%

Source: Author’s estimates.

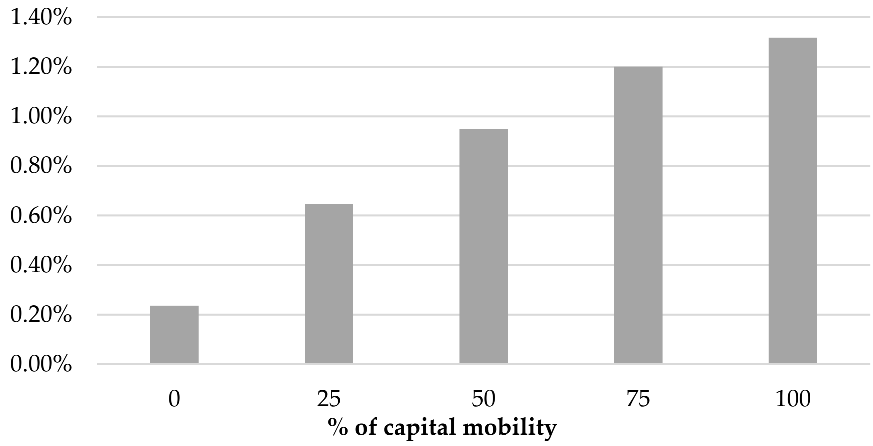
The results of the model depend not only on who are those tourists that drive the increase in tourism demand but how can capital react to the occurring changes, that is, its grade of flexibility for moving from one geographical area to the other. Table 7 and Figure 4 presents the sensibility of the model results to the modification of capital mobility.

Table 7 Model results depending on capital mobility

Variables	% of Capital Mobility				
	0	25	50	75	100
% Salta GDP	0.24%	0.65%	0.95%	1.20%	1.32%
Activity level					
Primary	0.02%	0.07%	0.12%	0.16%	0.20%
Food and beverages	0.41%	0.52%	0.62%	0.70%	0.78%
Textile and leather	1.26%	1.60%	1.86%	2.08%	2.25%
Refinery	0.17%	0.55%	0.67%	0.73%	0.78%
Chemicals and plastics	0.02%	0.13%	0.25%	0.37%	0.47%
Rest of the industry	-0.06%	-0.01%	0.05%	0.11%	0.17%
Electricity, gas and water	0.01%	0.03%	0.04%	0.05%	0.06%
Construction	0.07%	0.19%	0.31%	0.44%	0.55%
Commerce	0.64%	1.08%	1.40%	1.66%	1.88%
Hotels	4.25%	5.62%	6.91%	8.12%	9.25%
Restaurants	2.84%	3.90%	4.87%	5.75%	6.56%
Land transport	1.02%	1.26%	1.37%	1.43%	1.48%
Airlines & tourism agencies	2.53%	5.00%	6.85%	8.28%	9.43%
Others (transport)	0.48%	0.79%	0.99%	1.15%	1.27%
Others (tourist services)	2.97%	4.65%	6.09%	7.32%	8.38%
Public sector and others	0.33%	0.47%	0.59%	0.71%	0.82%

Source: Authors' own estimations

Figure 4: GDP sensitivity to capital mobility (% change with respect to benchmark).



Source: Authors' own estimations

A sensitivity analysis of the results to capital mobility allows us to see what could happen in extreme situations (when capital is perfectly mobile and when is completely fixed) and between them. Under a situation of immobile capital, where it is not endogenously assigned between industries and regions according to return rates, the observed GDP growth is notoriously smaller than in the case of perfect capital mobility.

4.3 A cost-benefit application

In this section we present an hypothetical cost-benefit exercise and use the results obtained from the CGE model as input. The usage of cost-benefit analysis for measuring public investment (including tourism infrastructure) has gained momentum lately and is common to see it in impact evaluation documents from institutions like the World Bank and the Interamerican Development Bank (Taylor, 2010).

We can suppose that the reason behind the increase of tourism spending comes from a pro-tourism policy: let's imagine that a national and world-wide tourism publicity campaign that shows the touristic highlights of Salta was carried on. Filming the campaign and showcasing it around the globe would have a cost, but it would increase the arrival of tourists (and tourism spending) in 10%. The application of a cost-benefit analysis requires knowing the characteristics of the future flow of income that the project will generate. Due to our model is static, we assume that the publicity campaign is produced and showcased on period cero and generates from period one on, an increase in the amount of arrivals (ergo of tourism spending) that does not decrease with time. In other words, starting from period one, a new fixed amount of arrivals (larger than the one before) is registered. This assumption could be more complex and realistic but it's enough for our example.

Next, we have to choose a variable that will be use as a contrast to the cost invested in the campaign: in this case it will be the regional gross domestic product. Thanks to the results of our CGE model[8] we can know how the regional GDP changes after a 10% increase in tourism spending, so that value will be used as the "income"[9]. Finally, we assume the interest to be 10%.

Given the fact that our exercise is purely hypothetical we don't have any kind of information on the costs of filming and broadcasting this publicity campaign (neither the authors have experience in the marketing industry) so we decided to shift our focus from the one of a normal cost-benefit analysis. We calculate the amount of investment or publicity campaign that results in a null NPV (i.e. the flow of visitors' expenditure is not big enough to compensate for the costs it took to create it).

The results of this exercise are shown in

Table *8*. As the intuition would indicate, an increase in domestic tourism of 10% would finance a higher cost for publicity campaign than the increase in international tourism would independently of the model we use.

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[8] For this example we work with the CGE results but the Input-Output model results are also valid for this application.

[9] Particularly we use the results obtained from the simulation where all capital is mobile.

Table 8 Hypothetical investment cost for obtaining an NPV of zero.

	Domestic tourism	International tourism	All tourism
CGE Model	2,930	922	3,581
SAM based model (model 4)	2,204	657	2,861

Source: Author's estimations.

Taking the CGE model as an example, if only domestic tourism increased, the campaign should cost 2,930 million Argentinian pesos or less for the Net Present Value to be equal or greater than cero. On the other hand, if only international tourism increased, the campaign development should be cheaper (922 million pesos or less) for the NPV to be cero. This makes sense: an increase of 10% in domestic tourism supports a bigger GDP growth than an increase of the same proportion in international tourism, which means that a bigger cost can be supported to finance the campaign.

5. Conclusion

For some regional economies, the money that comes with tourism can represent their main source of income. Its relevance implies that understanding how certain policies affect the tourism industry should be in the interest of the policy makers behind these decisions. Carrying on research on tourism at regional level, though, may face a problem: Poor or inexistent data. Computable general equilibrium models and Input-Output models are familiar tools in the literature of tourism research, but the development of their main elements, input-output tables and SAMs, requires more resources than those available to most regional statistical institutes.

If officially developed input-output tables are not available, then constructing a self-made one can be a solution. Government agencies usually develop this matrices from data recorded in surveys, but easier and cheaper options are available as substitutes of this methodology. Semi-survey and non-survey techniques do not require as many resources as survey techniques do and nevertheless provide trustable and quality results. In the case of non-survey techniques Location Quotient methodology can be used as the foundation of the construction of the input-output table. The estimations archived by applying LQ techniques can be later reinforced with focused surveys on certain industries or markets under an hybrid approach.

The province of Salta, in northern Argentina, is a good example of the problems that bad data can raise. Despite being one of the main tourist destinations in the country, with increasing numbers of visitors each year, the inexistence of an input-output table could be a potential problem for understanding how the growth of the tourism industry is changing this regional economy.

In this study we constructed a input-output table and social accounting matrix for the province of Salta using an hybrid approach. The application of this methodology was based on the combined use of Flegg Location Quotients and regional surveys done to households, tourism-related industries and tourists. We are not aware that hybrid techniques have been used before for understanding tourism by published studies. The estimated results were then imputed in both an Input-Output model and a Computable General Equilibrium model. For both cases an increase in tourism spending was simulated under different scenarios. An example of how these results can be used for cost-benefit analysis was also presented.

By applying the Input-Output model we found that an expansion in tourism is correlated with regional GDP and wealth growth. Nevertheless, it seems that an improvement in local value chains could allow Salta's economy to take a bigger advantage of its tourism industry. On the other hand, CGE results are not as optimistic, and show that a positive relationship between tourism growth and wealth expansion is conditioned to a high level of regional and sectoral capital mobility. In terms of GDP, even if under low capital mobility GDP grows, a high capital mobility drives better results.

Understanding how policies or events affect the economy is a matter of interest for both policy makers and researchers. For some regional economies, a certain policy that results in damages to its tourism industry could mean a major loss of income for several families and business. CGE models are a well-known and useful tool for avoiding this kind of situations, but SAM are not usually available at regional level. Despite this problem, their implementation should not be discouraged, as techniques for creating new SAMs without the need of expensive and resource intensive surveys exist and are available.

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Annex: Model Structure

In this section we introduce a simplified version of the general equilibrium model used in this paper. Let's start by considering an economy with H domestic agents. The utility function of said agents will depend on the consumption of goods and services of the j regions (c_j)[10], imported goods (m), bonds held by the households (b), and labor supply (L_j^s).

Each of the households will maximize their utility function [$u_H(c_1, c_2, m, b, L_j^s)$] subject to a budget constraint. Assuming optimal conditions, the agents will equalize the marginal rate of substitution to relative prices. The mentioned budget constrain of the domestic agents will be:

$$\sum_{J=1}^{2}(1 + t_n + t_j)\, p_j\, c_j + p_m\, m + p_b\, b$$
$$= \sum_{J=1}^{2} w_j\, L_j^s + \sum_{J=1}^{2} \pi_j\, w_j + \eta_j + \sum_{J=1}^{2} r_j\, K_j \varphi_j + p_b b_0 \quad (4)$$

where w_j are salaries earned, L_j^s the offer of labor and π_j the firm's profits, all of these corresponding to region j. Parameters η_j and φ_j represent the participation of domestic agents on profit and capital ($0 < \eta_j,\ \varphi_j < 1$). Equation 4 assumes that consumers only pay regional and national taxes when buying domestic goods. This is a simplification, as households in the model as well as in the economy pay taxes that are not necessarily national or regional. The last term of the equation represents the initial amount of bonds in the households' portfolio. The general model allows households to take decisions on private investment.

The equilibrium condition in the market of good j comes from equation 5:

$$x_j + \sum_{i=1}^{2} c_{j,i} = F\,(L_j, K_j) \quad (5)$$

Where F is a production function of domestic goods ($c_{j,i}$) and exports to the rest of the world x_i. Benefits of industry are:

$$\pi_j = p_j \left(x_j + \sum_{i=1}^{2} c_{j,i} \right) - w_j\, L_j^d - r_j\, K_j^d \quad (6)$$

where r_j represents capital payments in region j (if capital is region-sector specific) and w_j salaries in region j. The first order conditions imply[11]:

[10] Let's call Salta region 1 and Argentina (i.e. the rest of the country) region 2, so consumption would of those regions would be written as c_1 and c_2 respectively.

[11] It's assumed that F has a less than 1 degree of homogeneity and there is complementarity in the production function at input level.

$$p_j F_{K_i} - r_j = 0 \quad (7)$$

$$p_j F_{L_i} - w_j = 0 \quad (8)$$

where capital and labor levels are determined optimally. In equilibrium demand and offer of factors is equalized, i.e. labor demand of region j matches labor offer of both regions combined.

$$L_j^d = \sum_{i=1}^{2} L_i^s \quad (9)$$

$$K_j^d = \sum_{i=1}^{2} K_i^s \quad (10)$$

In models with unemployment, as the one we use in this paper, equation 9 is replaced by a salary indexation rule, such as $w > 1$ as an example, with minimal nominal salaries or some price index used to fix constant real salary. The governments of the several provinces that compose the country face the following budget restriction:

$$t_j p_j c_j + p_b b_0^{G_i} + T = w_j L_j^{G_i} + p_b b^{G_i}, with\ j = 1{,}2 \quad (11)$$

The left side of equation 11 represents the sum of provincial tax incomes, bond selling and revenue sharing of the federal government. On the other side of the equation are represented labor costs and bonds buying. Notice that even if in this simplified version, the government does not participate in the good and services market, in the general model the government also buys and invests in goods and services.

The national government faces a different budget restriction than its sub-national counterparts:

$$\sum_{J=1}^{2} t_n\, p_j\, c_j + \sum_{J=1}^{2} t_x x_j + p_b b_0^G - T = \sum_{j=1}^{2} w_j\, L_j^G + p_b b^G\, , with\ j = 1{,}2 \quad (12)$$

where the left side of the equation represents the financial sources of the government: national taxes and bond selling (net of revenue sharing). These financial sources are, in this simplified version of the model, used only to cover labor costs, while in the general version of it, also cover consumption and investment costs.

Finally, trade balance can be expressed as:

$$p^x x = p_m + \sum_{j=1}^{2} (1 - \varphi_j) r_j K_j + \sum_{j=1}^{2} (1 - \eta_j)\, \pi_j \quad (13)$$

Notice that this simplified model counts with a strong assumption that is left aside in its general version: the rest of the world does participate in the bond market.