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Measuring the impact of tourism on the economy through regional input-output modelling: The case of Campania

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Abstract

This paper discusses the most recent developments in the methodologies to regionalize national I-O tables. The final objective is to test whether different regional rescaling procedures deliver significant differences in the multipliers and, specifically, whether these lead to significant different results in the interpretation of how changes in the tourism industry impact on a local economy. To this extent we build multiple regional models using different techniques of regionalization (*non-survey methods*) using Italian input-output table provided by Eurostat for the year 2010. As a result, we investigate the effects of different shocks in the demand from tourists in an Italian region, Campania using national Tourist Satellite Account data for the year 2010. The results confirm the intuition that following a shock on tourism demand the predicted effects on main aggregate variables can significantly differ depending on the shock and on the rescaling procedure.

Keywords: input-output tables; non-survey methods; economic impact; regional tourism; Campania

Introduction

Tourism may provide very significant contribution to the economy overall (Wagner, 1997; Zhou et al., 1997). This is particularly true for underdeveloped regions for which tourism can represent a lever of growth and development (Holzner, 2011; Rosentraub and Joo, 2009). Hence, determining the channels through which changes in the tourism sector affects all other industries, and measuring the effects of these changes, is extremely important in order to design and implement the best growth enhancing policies. The literature has already provided some evidence of the effects of the changes in the tourism industry on the economy. The effects of changes in the tax system, in the transport provision, in the promotion and marketing of entire areas, among many others, have been extensively studied in different settings and frameworks. Yet, the debate on how to uncover and measure the multiple effects in the short and in the long run of tourism on the economy is still open (Dwyer et al., 2004). The reason is twofold. Firstly, by its own nature tourism is a multifaceted and articulated industry whose boundaries are very often difficult to set, secondly, changes in the sector and the consequent direct and indirect effects on the overall economy are difficult to measure. These difficulties are amplified when one wants to focus on local and regional effects. Indeed, the lack of data and specific aspects of the economy at this level makes it cumbersome to obtain reliable measures.

Traditionally, empirical investigations have employed input-output (I-O) analyses to study the effects of tourism on the economy. While, more recently, many investigations have started operating through richer models such as Computable General Equilibrium models (CGE). These studies are supported by the idea that CGE have the advantage of providing a richer picture of the interconnections between economic sectors taking into account income feedbacks, resource limitations and price adjustments. Despite these empirical and theoretical developments many empirical works continue to employ input-output analyses (Haddad et al., 2013; Orens and Seidl, 2009; Tian et al., 2013). The reason is the simplicity of the I-O model and the immediate interpretation of the multipliers. This is particularly true at regional or local levels because of the lack of data. The recent efforts of part of the literature in providing more reliable and significant methods to regionalize I-O tables can be read in this direction. By no chance many recent theoretical studies have deeply refined the techniques to reduce the scale of global I-O tables (Bonfiglio and Chelli, 2008; A. T. Flegg and Tohmo, 2013; Kronenberg, 2009; Lehtonen and Tykkyläinen, 2012; Nakano and Nishimura, 2013).

By departing from this literature, we discuss the most recent developments in the methodologies to regionalize national I-O tables. The final objective is to test whether different regional rescaling procedures deliver significant differences in the multipliers and, specifically, whether these lead to significant different results in the interpretation of how changes in the tourism industry impact on a local economy. To this extent we build multiple regional models using different techniques of regionalization (*non-survey methods*) using Italian input-output table provided by Eurostat for the year 2010. As a result, we investigate the effects of different shocks in the demand from tourists in an Italian region, Campania using national Tourist Satellite Account data for the year 2010. This region provide indeed a good framework to understand whether differences in multipliers due to different methodologies in regionalization lead to significant differences in the propagation of shocks. The results confirm the intuition and we find, for example, that following a shock on tourism demand the predicted effects on output on a local regional economy can almost double if instead of applying an FLQ one applies an SDP. Similar significant results holds for other aggregate macro variable such as employment and value added. The reason lies within the adjustment mechanisms of each regionalization techniques.

Depicting the working of regional economies is quite different from depicting the working of national economies. For example, imports and exports from one region towards another are not registered as such at a national level. Hence, interregional trade flows represent the most relevant obstacle in reducing national tables. Another problem concerns the structure of the economy. The production structure at national level may well be, and often is, very different from the production structure at regional level. And the efforts of the literature on the subject have indeed been directed to solve these problems.
Yet different regionalization techniques not only lead to different multipliers in absolute terms, they also delivers tables which are sensible to the very nature of the tourism shocks. And the effects on the economy strongly depend on which specific sectors the demand is impacting. In order to prove how the composition of tourism demand can affect the economy, we identify three kinds of demand shock: a symmetric shock, which hits the local economy with no specific sector biasedness, and two asymmetric shocks. The first asymmetric shocks strongly affects the consumption of consumable resources such as energy and water, as it occurs in mass tourism. The second asymmetric shock does not cause congestion but it affects more strongly the art and recreation sector, as it is in the cultural tourism. Our results indicate that the predicted effects on employment and output of the local economy strongly depend both on the type of shock and the nature of the table. This, of course, has strongly policy implications which are particularly relevant for a region such as Campania rich in cultural heritage and relatively poor in terms of average GDP per capita.
The paper is structured as follows. Section 2 contains a brief discussion of the related literature. Section 3 presents the methodology and it discusses the features of the most relevant regionalization techniques and the nature of the tourism demand shocks. Section 4 describes the data and section 5 presents the results. The last section contains some concluding remarks.

Background Literature

This paper is closely related to two strands of literature. One is the strand of literature discussing which methodology to deploy in order to study the impact of a shock in tourism demand on local economies, the other is the strand of literature studying the methodologies and the processes to rescale and regionalize I-O tables.
Tourism is a peculiar sector since it does not fall within the system of national accounts because of its demand driven nature. For this reason it is difficult to fully depict the overall effect of a shock in tourism demand on the economy and to identify the channels through which this shock penetrate other production sectors. The production structure of the economy, the degree of interconnection between sectors, the level of capital utilization in each sector and even the nature of the shock, among others, are all factors which can influence the overall effect of tourism demand.
This implies that the choice of the methodology employed to investigate the effects of tourism on local economies requires a careful consideration of the objectives of the analysis and of the main features of the economic system. Hence, modelling macro and micro-level tourism expenditure

entails the cautious choice of the independent variables to include into the analysis, the functional forms of the process involved and the right choice of estimation technique (Thrane, 2014). A number of studies have indeed focused on this issue and have highlight the relative strength of some methodologies in specific contexts. Cummings and Epley (2014) have recently shown, for example, that "local quotients" which are based on employment ratios produce misleading results while a better approach would be to use total expenditure combined with absolute levels of employment. In order to determine the effect of tourism on Indian economy, Munjal (2013) employs I-O transaction tables and focuses on the inter-linkages between sectors. The importance of the inter-industry linkages in tourism analysis is also the focus of other works such as Cai et al. (2006), Beynon et al. (2009) and more recently by Khanal et al. (2014) who analyse the impact of tourism in the Lao PDR economy. As well as being influenced by the "physical" structure of the economy, the effects of a change in tourism demand depend also on the time horizon one considers. Indeed the capacity to capture and describe regional economic impact of short-term tourism demand depends on the stability of multiplier through time and on the proximity of short term multiplier to long run I-O technical coefficients (Sun and Wong, 2014).

The other strand of literature related to the paper includes the studies on regionalization of I-O tables. In most instances I-O tables contains data collected at national level and hence these tables cannot be used to obtain multiplier at local level and in general on a smaller scale. Rescaling an I-O table is not a straightforward process and it requires the cautious adaptation of data which refer to a wider economic system to a more restrict local one which, usually, displays very different features. For example, imports and exports from one region towards another are not registered as such at a national level. Hence, interregional trade flows represent the most relevant obstacle in reducing national tables. Another problem concerns the structure of the economy. The production structure at national level may well be, and often is, very different from the production structure at regional level. And the efforts of the literature on the subject have indeed been directed to solve these problems (Bonfiglio and Chelli, 2008; A. T. Flegg and Tohmo, 2013; Kronenberg, 2009; Lehtonen and Tykkyläinen, 2012; Nakano and Nishimura, 2013). The application of different processes of reduction may lead to significantly different regional tables and multipliers. By pivoting on this literature we investigate the insights of different regionalized I-O tables on the effects of tourism on a local economy. The investigation relies on non-survey methods of regionalization classified in three different approaches: a) the quotient approach; b) the commodity-balance approach; c) the iterative approach (Hewings and Jensen, 1986).

The most simple process for regionalizing a national input-output table is to apply production-based location quotients (LQ). In its simpler form the *Simple location Quotient* (SLQ) is obtained by dividing the proportion of regional production in each supplying sector *i* by the corresponding proportion of national production in that sector. The first modification comes by the *purchase-only location quotients*. This process applies adjustment and rescaling factors in each sector but only to those sectors which actually use as input the production of sector *i*. The objective is to reduce the amplified effect arising from the straightforward application of SQL (size effect). A further modification to SQL has been introduced by the cross-industry quotients (CIQ). This takes into account the ratio between the selling sector *i* and the buying sector *j* at national and regional level. More recently, Flegg and Tohmo (2013) modify the CIQ by adjusting the ratio between the selling sector and the buying sector by the proportion of the regional output on national output (*Flegg Location Quotient*, FLQ).

Regionalization techniques of commodity-balance approach are based on Isard (1953). Using national production coefficients and local output estimates, is possible to derive regional input requirements table. "This procedure allocates local production, where adequate, to meet local needs. Where the local output is inadequate, however, the procedure allocates to each purchasing industry *j* its share of regional output *i*, based on the needs of the purchasing industry itself relative to total needs for output *i*" (Schaffer and Chu, 1969).

The iterative approach, instead, operates by means of the *RAS method*. This method is an iterative method of biproportional matrix adjustment of rows and columns that has been independently developed by various researchers. Stone (1961), for the first time, adapted this technique for updating input-output tables. RAS is basically an iterative scaling method whereby a non-negative matrix is adjusted until its column sums and row sums equal given vectors (Schneider and Zenios, 1990). This adjustment is achieved by multiplying each row by a positive constant so that the row total equals the target row total. This operation would alter the column totals. The columns would then be multiplied by constants to make their totals correspond to the target column totals. This sequence of row and column multiplication would continue until both the column and row totals converge to the target vectors (Ahmed and Preckel, 2007).

Methodology

The input-output analysis provides a useful description of the working of an economic system through the measurement of the interexchange of resource flows between all sectors in the economy. In its simple formulation, each sector is considered to be a producer that supplies goods to all other remaining sectors, and, at same time, it is considered to be a consumer demanding goods from other sectors. The intersectoral flows can be quantified in both physical and monetary terms. This approach seeks to build a bridge between economic theory, that often ignore economic facts, and a series of empirical evidences, which go beyond the theory. Hence, input-output analysis is ultimately a compromise between a pure theoretical model and a pure empirical model.

I-O tables are usually composed by three main matrices (please see Figure 1). The principal table is the symmetric matrix, called *Interindustry matrix* (the *Qs* data), reporting the same set of industries on both axes and registering money flows between all the industrial sectors that comprise a specific economic system in a given period of time. More specifically, each element of this matrix indicates the flow of financial resources coming from a row-sector and directed to another column-sector.

Figure 1. Framework of the input-output table

Industries		Interindustry Demand					Final Demand				
		1	2	3	é	n	1	2	3	Export	t
Domestic Production	1	$Qint_{11}$	$Qint_{12}$	$Qint_{13}$	é	$Qint_{1n}$	$Fint_{11}$	$Fint_{12}$	$Fint_{13}$	$Expint_{1}$	$Fint_{1t}$
	2	$Qint_{21}$	$Qint_{22}$	$Qint_{23}$	é	$Qint_{2n}$	$Fint_{21}$	$Fint_{22}$	$Fint_{23}$	$Expint_{2}$	$Fint_{2t}$
	3	$Qint_{31}$	$Qint_{32}$	$Qint_{33}$	é	$Qint_{3n}$	$Fint_{31}$	$Fint_{32}$	$Fint_{33}$	$Expint_{3}$	$Fint_{3t}$
	é	é	é	é	é	é	é	é	é	é	é
	n	$Qint_{n1}$	$Qint_{n2}$	$Qint_{n3}$	é	$Qint_{nn}$	$Fint_{n1}$	$Fint_{n2}$	$Fint_{n3}$	$Expint_{n}$	$Fint_{nt}$
Imports	1	$Qimp_{11}$	$Qimp_{12}$	$Qimp_{13}$	é	$Qimp_{1n}$	$Fimp_{11}$	$Fimp_{12}$	$Fimp_{13}$	$Expimp_{1}$	$Fimp_{1t}$
	2	$Qimp_{21}$	$Qimp_{22}$	$Qimp_{23}$	é	$Qimp_{2n}$	$Fimp_{21}$	$Fimp_{22}$	$Fimp_{23}$	$Expimp_{2}$	$Fimp_{2t}$
	3	$Qimp_{31}$	$Qimp_{32}$	$Qimp_{33}$	é	$Qimp_{3n}$	$Fimp_{31}$	$Fimp_{22}$	$Fimp_{33}$	$Expimp_{3}$	$Fimp_{3t}$
	é	é	é	é	é	é	é	é	é	é	é
	n	$Qimp_{n1}$	$Qimp_{n2}$	$Qimp_{n3}$	é	$Qimp_{nn}$	$Fimp_{n1}$	$Fimp_{n2}$	$Fimp_{n3}$	$Expimp_{n}$	$Fimp_{nt}$
Production factors	1	H_{11}	H_{12}	H_{13}	é	H_{1n}					
	2	H_{21}	H_{22}	H_{23}	é	H_{2n}					
	3	H_{31}	H_{32}	H_{33}	é	H_{3n}					
		é	é	é	é	é					
	m	H_{m1}	H_{m2}	H_{m3}	é	H_{mn}					

Source: own elaboration

A second table is linked to the principal table in the form of additional rows. This is known as *Value Added matrix* (the *Hmn* data) and it registers the monetary flows directed to the main production factors, capital and labor, employed in the production processes. The third table is linked to the interindustry matrix as additional columns and it is known as *Demand Final matrix* (the *Fnt* data). This table registers the monetary flows coming from the demand of the main actors in the economic system: households, non-profit institutions, government and foreign demand. As a matter of fact, a fully representative I-O table also takes into account the origin and the destination of the goods circulating within the economy.

For accountable reasons, it is interesting to notice that the total of each row, which identifies a specific industry, and consequently a given output (X_i), is equal to the total of the respective column. This implies that the amount of a particular good *demanded* by all industries and by all different categories of final consumers, must be equal to the amount of the same good *produced* (plus the imports) in the economy. If we indicate with Q_{ij} the amount of output *i* demanded by industry *j* and with F_{ij} the amount of output *i* demanded by the final consumer *j*, total output *i* in the economy is given by

$$\sum_{j=1}^{n} Q_{ij} + \sum_{s=1}^{t} F_{ij} = X_i \quad (i=1,\cdots n) \tag{1}$$

By employing the complete input-output matrix with absolute values, one can calculate three different sets of *matrices of coefficients: 1) the matrix of technical coefficients; 2) the matrix of input or direct coefficients and 3) the matrix of import coefficients.*

Technical Coefficients measure the amount of required input (Q_{ij}) to achieve a unit of output (X_i). More formally, if we denote with a_{ij} a generic element of the matrix of the technical coefficient, we can write

$$a_{ij} = \frac{Q_{ij}}{X_i} \quad (i=1,\cdots n) \tag{2}$$

For our purposes, it is important to notice that this ratio does not distinguish the geographical origin of the input (internal or external to the region under investigation). In order to take into account the internal or external origin of production input, one has to refer to the matrix of *Input or Direct Coefficient*, which are determined by dividing the amount of required input ($Qint_{ij}$), coming from inside the economic system, by the total output X_i. *Import Coefficients*, instead, distinguish the geographical origin of the input (external to the region under investigation) and are determined by dividing the amount of required input ($Qimp_{ij}$), coming from outside the economic system by total output (X_i).

Finding the correct technical, input and import coefficients is the most important step in the process of geographically rescaling I-O tables.

In fact, any local economic system is characterized by a specific allocation of the production factors, both in quantitative (demographic structure, availability of raw materials) and qualitative (human and social capital) terms. Regional input-output analysis seeks to measure the specificity of territorial economic systems allowing the coefficients matrix to capture this "singularity" (Miller and Blair, 2009). Yet determining this specificity of local economies is not a simple process because of different reasons. First of all data and statistics very often are not detailed and hence it is difficult to determine the geographical distribution of an aggregate variable. Secondly, the higher is the level of aggregation of a production sector, the larger is the loss of information when one attempts to identify the contributions of this specific sector to local economies (*product-mix problem*). If one fails in finding this singularity local economies may appear similar in the analysis despite great real differences.

Input-output rescaling may occur through four main approaches (Hewings and Jensen, 1986): the Commodity-based approach; the Survey approach; the Non-survey approach; the Hybrid approach.

The *commodity- based* approach is preferable when it is possible to obtain detailed data on commodity supply at regional level. These tables allow to distinguish between commodities and industries. Through the *survey approach* is possible to build regional I-O tables by collecting primary data by a variety of methods, including formal surveys. The *non-survey approach* employs specific techniques to build regional tables from national data or from other regional tables. The *hybrid approach* incorporates explicit and formal attempt to integrate the properties of both the survey and non-survey approaches. The hybrid approach seeks to capture the advantage of the higher level of accuracy of the survey method and some of the speed of the non-survey approach.

In this paper we build a regional input-output matrix by employing different non-survey techniques in order to correct the national coefficients and identify the regional coefficients which better represent the specificity of the regional economy. More specifically, in the absence of regional data for the Campania region, we rescale national Italian input-output data and compare different scaling techniques by performing empirical experiments on the effects of a change in tourism demand on the local economy.

The main non-survey regionalization techniques can be reconducted to three different categories: a) the quotient approach; b) the commodity-balance approach; c) the iterative approach (Hewings and Jensen, 1986). *Quotient Approach* refers to methods based on production-based location quotients (LQ), while *Commodity-balance Approach* refers to methods based on local demand-based balancing procedures (CB). Finally, *Iterative Approach* refers to iterative methods based on scaling algorithms (RAS).

Simple Location Quotients (SLQ)

The most simple technique for regionalizing a national I-O table is to apply production-based location quotients (LQ). In its simpler form the *Simple location Quotient* (SLQ) is obtained by dividing the proportion of regional production in each supplying sector *i* by the corresponding proportion of national production in that sector.

Let x_i^r and x^r denote, respectively, output of sector *i* in region *r* and total output in that region, and let x_i^n and x^n denote the same values at national level. The Simple Location Quotient for a generic sector *i* is calculated as follows:

$$SLQ_i^r = \left(\frac{x_i^r / x^r}{x_i^n / x^n} \right) \qquad (3)$$

In order to rescale a table and obtain regional coefficients, a_{ij}^r, the production-based location quotients require to correct national coefficients, a_{ij}^n, in the following way:

$$a_{ij}^r = \begin{Bmatrix} (SLQ_i^r) a_{ij}^n & if\ SLQ_i^r < 1 \\ a_{ij}^n & if\ SLQ_i^r \geq 1 \end{Bmatrix} \qquad (4)$$

That is, if the SQL of a sector *i* is greater than unity this implies that the sector is overrepresented at regional level and it does not need any transfer of resources from other regions. The opposite occurs if SQL<1. In the first case one reports with no change at regional level the national coefficient, in the second case the national coefficient is reported at regional level only after being scaled down. Evidently this asymmetric adjustment represents the first limit of this methodology which has been further modified in different directions.

Cross Industry Location Quotient (CIQ)

The first modification comes from the *purchase-only location quotients*. This process applies adjustment and rescaling factors in each sector but only to those sectors which actually use as input the production of sector *i*. The objective is to reduce the amplified effect arising from the straightforward application of the SQL (size effect). Instead of considering the size of the region, this approach takes into account the ratio between *the selling sector i* and the *buying sector j* at national and regional level. The quotient is

$$CIQ_{ij}^r = \left(\frac{x_i^r / x_i^n}{x_i^n / x_j^n} \right) \qquad (5)$$

while the regional coefficient is now

$$a_{ij}^r = \begin{Bmatrix} (CIQ_i^r) a_{ij}^n & if\ CIQ_{ij}^r < 1 \\ a_{ij}^n & if\ CIQ_{ij}^r \geq 1 \end{Bmatrix} \qquad (6)$$

Flegg Location Quotient (FLQ)

More recently, Flagg and Thomo (2013) modify the CIQ by adjusting the ratio between the selling sector and the buying sector by the proportion of the regional output on national output (*Flagg Location Quotient*, FLQ). More precisely, in order to obtain the new quotient, the CIQ is multiplied by a factor which is a function of the proportion of the regional output on national output, λ, (A. Flegg et al., 1995). The quotient is

$$FLQ_{ij}^{r} = (\lambda) CIQ_{ij}^{r} \tag{7}$$

while the regional coefficient is

$$a_{ij}^{r} = \begin{cases} (FLQ_{i}^{r}) a_{ij}^{n} & if\ FLQ_{ij}^{r} < 1 \\ a_{ij}^{n} & if\ FLQ_{ij}^{r} \geq 1 \end{cases} \tag{8}$$

Adjusted Flegg Location Quotient (AFLQ)

AFLQ modifies the FLQ by adding specialization terms. These specialization terms identify regional coefficients which are larger than their national counterparts when a regional sector is more concentrated. The AFLQ quotient is

$$AFLQ_{ij}^{r} = \begin{cases} \log_2 (1 + SLQ_{j}^{r}) FLQ_{ij}^{r} & if\ SLQ_{j}^{r} > 1 \\ FLQ_{ij}^{r} & if\ SLQ_{j}^{r} \leq 1 \end{cases} \tag{9}$$

while the regional coefficient is now

$$a_{ij}^{r} = \begin{cases} (AFLQ_{ij}^{r}) a_{ij}^{n} & if\ SLQ_{j}^{r} > 1 \\ (FLQ_{ij}^{r}) a_{ij}^{n} & if\ SLQ_{j}^{r} \leq 1 \end{cases} \tag{10}$$

Supply-Demand Pool (SDP)

The SDP identifies regional input coefficients balancing the regional size of the economic sectors with the regional size of the components of the final demand (Schaffer and Chu, 1969).
For each industry, i, SDP is based on the calculation of the regional *commodity balance*, b_{i}^{r}, which is given by the difference between the value of the production at regional level and the value of demand for good i (both from other industries from final consumers),

$$b_{i}^{r} = x_{i}^{r} - \tilde{x}_{i} \tag{11}$$

where

$$\tilde{x}_{i} = \sum_{j} a_{ij}^{n} x_{j}^{r} + \sum_{f} c_{if}^{n} f_{f}^{r} \tag{12}$$

Then the corrected regional coefficient is

$$a_{ij}^{r} = \begin{cases} (x_{i}^{r} / \tilde{x}_{i}) a_{ij}^{n} & if\ b_{i}^{r} < 0 \\ a_{ij}^{n} & if\ b_{i}^{r} \geq 0 \end{cases} \tag{13}$$

The last two methods require additional statistical information which are not included in the national input-output tables.

Regional Purchase Coefficients (RPC)

Regional Purchase Coefficients (RPC) are defined as the proportions of regional demand for each sector that is satisfied only from regional production. To use this method one needs additional information on the amount of imports in the region. Let z_i^{rr} represents the shipments of good i from producers in *r* to all buyers in *r* while z_i^{sr} represents imports of *i* from outside *r* to buyers in r. The quotient is calculated as

$$RPC_i^r = 1/\left[1+1/(z_i^{rr}/z_i^{sr})\right] \tag{14}$$

Biproportional matrix balancing (RAS)

Adopted for the first time by Stone (1961), this method is a scaling algorithm based on an iterative method employing bi-proportional matrix adjustment of rows and columns. It is basically an iterative scaling method whereby a non-negative matrix is adjusted until its column sums and row sums equal given vectors (Schneider and Zenios, 1990). This adjustment is achieved by multiplying each row by a positive constant so that the row of totals equals the target row of totals. This sequence of row and column multiplication continues until both the column and row totals converge to the target vectors (Ahmed and Preckel, 2007).

Tourism demand shock

Each regionalisation technique leads to different technical coefficients and hence to different multipliers. This in turn implies that the effects of an exogenous shock on a local economy will be measured differently by an input-output analysis depending on how the table has been regionalised.
In order to detect such differences we will focus on a specific demand shock: an exogenous shift in the tourism demand.
The demand for tourism goods is by itself peculiar since it is not one sector-specific but it involves an array of sectors. Hence, prior to execute the analysis, one needs to fully specify the linkages between the tourism demand and the regional I-O table. By using the information on tourism demand extrapolated by the data in the TSA (*Tourism Satellite Account*), we will conjecture the distribution of final tourism demand among different industrial sectors. We will keep that the same distribution holds at national and regional level. The following table (Table 1) describes the shares of industrial sectors in the tourism demand for Italy in the year 2010 (Istat, 2010).
Moreover, also the features of the tourism demand may vary considerably across the shocks. For example, the same variation in the demand may be caused by different variables: average expenditure of tourists in a year; number of tourists' night spent in a year; average expenditure of the excursionists in a year; number of excursionists in a year; and may affect asymmetrically the economic system: some industrial sectors may be affected more than others and also the

consumption/income ratio in the economy may change differently depending on the kind of shock on tourism. These effects are also relevant in terms of dynamics of propagation. For example the consumption/income ratio is relevant in determining the induced effects since this influences the amount of the increased income that will turn into additional consumption.

Table 1 – Shares of the industrial sectors influenced by the final tourism demand for Italy in the year 2010

Shares of the industrial sectors of the final tourism demand	*tourists*		*excursionists*	
	domestic	foreign	domestic	foreign
A - Agriculture, forestry and fishing				
B - Mining and quarrying				
C - Manufacturing				
D - Electricity, gas, steam and air conditioning supply				
E - Water supply; sewerage, waste management and remediation activities				
F - Construction				
G - Wholesale and retail trade; repair of motor vehicles and motorcycles	18,9%	20,9%	42,4%	62,0%
H - Transportation and storage	16,6%	5,7%	11,8%	24,3%
I - Accommodation and food service activities	53,6%	67,9%	42,4%	11,5%
J - Information and communication				
K - Financial and insurance activities				
L - Real estate activities				
M - Professional, scientific and technical activities				
N - Administrative and support service activities	7,1%	1,4%	0,5%	0,4%
O - Public administration and defence; compulsory social security				
P - Education				
Q - Human health and social work activities				
R - Arts, entertainment and recreation	3,9%	4,1%	2,9%	1,8%
S - Other service activities				
T - Activities of households as employers				

Source: own elaboration from TSA data Istat, 2010

Data

In this paper we build a *single* region input-output table. The region is Campania and the objective is to use this table in order to quantify the impact on the regional industrial sectors of a specific change in the final demand for goods produced in this region. Starting from existing data collected by different sources, the whole process entails the merging and combining of these data to finally identify two sets of information: 1) information on the economic structure of the local economy; 2) information on regional tourism demand.

The first step of the process is to build Campania region's input-output table by reducing the scale of the symmetrical *supply and use* table provided by the National Institute of Statistics (ISTAT) for Italy for the year 2010. This table is composed by 63 industrial sectors and its values are expressed in millions of euros. In rescaling we reduce the number of sectors from 63 to 20 and we use additional regional data, such as the number of employees and the value added

for each industrial sector, in order to implement different regionalization techniques and to obtain different balanced input-output matrices (one matrix for each specific technique).
The variables describing the features of the economic system of Campania region come from the *Regional Economic Accounts* provided by ISTAT.
The second step of the process is to simulate tourism demand shocks on the regional economic system. Data on regional tourism demand are drawn from the Italian Tourism Satellite Account (TSA). These data provide information on the expenditure flows towards all industrial sectors coming from the domestic, inbound and outbound tourism. Other statistical tables which are not included in the TSA but which are also produced by ISTAT, provide measurements of the capacity of collective accommodation and the number of nights spent in tourist accommodation.

Results and Discussion

Regionalization techniques: implications for tourism analysis

Rescaling an I-O table causes not only loss of information but also distortions in the parameters and in the multipliers. These distortions strongly influence the predictive power of the table and may cause the results of the simulations to be significantly biased and misleading. This is particularly true when one wants to predict the impact on the economy of possible changes in the tourism demand. In fact, since tourism by its own nature cannot be strictly identified with a specific production sector in the economy, a change in tourism expenditure influences a number of different sectors. Hence, the structure of the table and the nature of the linkages between sectors are even more relevant when one analyses the tourism effects on the economy.
In order to verify how large the differences in the predicted effects of a specific shock in tourism expenditure on a local economy can be, we rescale the national I-O table by means of a number of methodologies and then we compare the resulting multipliers. Moreover, since the results are not immune by the way one models tourism, we subsequently identify three types of tourism and we compare the changes in the multipliers under each of these types in turn.

Table 2 - Regionalization techniques comparison from a tourism perspective

	sectoral aggregation problem	relative size of the region	relative size of the selling sector	relative size of the buying sector	import-export orientation	specialization of regional sectors
SLQ	✓	✓	✓		*import*	
CIQ	✓		✓	✓	*import*	
FLQ	✓	✓	✓	✓	*import*	
AFLQ	✓	✓	✓	✓	*export*	✓
SDP	✓				*import*	
RPC*	✓				✓	
RAS*	✓				✓	✓

source: own elaboration

In grey the features which may be more relevant for tourism analyses

As one can intuitively understand, all rescaling methodology involve high costs in terms of biases due to approximations on data reconstruction and lack of information on the structure of local economies. As a matter of fact, these costs are strictly linked to sectoral aggregation problems: because of the lack of specific information, simplifying aggregations lead to product-mix problems which arise when production processes are assumed to be similar when in fact they are not. This problem is particularly relevant in the analysis of the impact of tourism on the economy since by its own nature tourism is not an independent clearly identified sector. Table 2 summarises these findings and provides a general overview of the problems and the main features of each rescaling technique. The columns in grey identify the features that are particularly relevant for tourism analyses.

In order to obtain reasonable rescaling factors each of these techniques employ different relative measurements. SLQ, FLQ and AFLQ build on the comparison of the *Relative size of the region* for each sector with respect to the size of the nation; Location Quotient, instead, focus on the *Relative size of the selling sectors* with respect to other sectors, while CIQ, FLQ and AFLQ focus instead on the *Relative size of the buying sectors* (please see table 2). These features, however, despite influencing the process of reduction of national I-O table, cannot be considered to be particularly relevant for the implementation of tourism analyses, while other features can be considered to be more relevant. These are the inclusions of import-export measurements since the tourism industry is an economic sector which is particularly affected by the final demand from foreign countries, and by the degree of specialisation of regional sectors. For this reason, input-output tables can provide rather different results when they are built through the Location Quotient and the Commodity Balance techniques which promote import-oriented sectors and penalize export-oriented sectors. *Import-oriented methods*, such as SLQ, may underestimate the impact of tourism on the economy. As a matter of fact, only RPC takes into account in more details the level of imports corresponding to each sectors.

On the contrary, techniques that take into account the specialization of the regional sectors, such as AFLQ, can better quantify the economic impact of the tourism on the economy whenever the region is characterized by a relatively high tourism specialization with respect to the nation.

The effects of an exogenous shock in tourism demand

It is quite common to assume that the effects of a change in tourism expenditure by sectors resembles the distribution of tourism expenditure by sector as determined by national account. Hence, working on TSA data for Italy and by applying this rule of thumb, we should assume that the change in tourism demand will directly affect the local economy with a proportion equal to the share by sector of final tourism demand in Italy in the year 2010 (see Table 1).

Table 3 - Distribution among the economic sectors of tourism demand in three scenarios

Sectors distribution of tourism demand	Scenario 1			Scenario 2			Scenario 3		
	dom	ext dom	foreign	dom	ext dom	foreign	dom	ext dom	foreign
A - Agriculture, forestry and fishing									
B - Mining and quarrying									
C - Manufacturing									
D - Electricity, gas, steam and air conditioning supply				6,3%	7,0%	7,0%			
E - Water supply; sewerage, waste management and remediation activities				6,3%	7,0%	7,0%			
F - Construction									
G - Wholesale and retail trade; repair of motor vehicles and motorcycles	18,9%	20,9%	20,9%	6,3%	7,0%	7,0%	9,4%	10,4%	10,4%
H - Transportation and storage	16,6%	5,7%	5,7%	16,6%	5,7%	5,7%	16,6%	5,7%	5,7%
I - Accommodation and food service activities	53,6%	67,9%	67,9%	53,6%	67,9%	67,9%	53,6%	67,9%	67,9%
J - Information and communication									
K - Financial and insurance activities									
L - Real estate activities									
M - Professional, scientific and technical activities									
N - Administrative and support service activities	7,1%	1,4%	1,4%	7,1%	1,4%	1,4%	7,1%	1,4%	1,4%
O - Public administration and defence; compulsory social security									
P - Education									
Q - Human health and social work activities									
R - Arts, entertainment and recreation	3,9%	4,1%	4,1%	3,9%	4,1%	4,1%	13,4%	14,5%	14,5%
S - Other service activities									
T - Activities of households as employers									

Source: own elaboration

We will call this "Scenario 1". Yet, this is a simplifying assumption and may be misleading for two reasons. The first is that the shock may be asymmetric and affecting differently each sector, the second is that national accounts do not attribute uniquely all tourism expenditure to the sectors in the economy. There is indeed a share of expenditure which is attributed residually to the wholesale sector (sector D in table 1) and this residual may be quite relevant. In Italy for example this is 18.9% of total tourism expenditure. In order to take into account asymmetric shocks and to reassign more reasonably the residual, we proceed in assuming two alternative features of possible shocks. In the first we assume that the change in tourism demand causes congestion effects as it happens in mass tourism. Under this assumption tourism expenditure causes mainly an increase in the demand of electricity, gas, water and other consumable resources. We will call this "scenario 2" (please see table 3) and we specifically design it by distributing equally the residual between the wholesale sector, the electricity and gas sector (sector D) and the water supply and waste management sector (sector E). In the second we assume that the change in tourism demand does not cause significant congestion effects and it is mainly directed towards the arts and recreation sector as it occurs when tourism is of high profile (cultural tourism). We will call this "scenario 3" and we specifically design this shock by attributing part of the residual to the wholesale sector and to the arts, entertainment and recreation sector (sector R in table 3).
More specifically, under each assumption, we distribute the residual in the following way (table 3):

Scenario 1: all residual attributed to Wholesale sector (G);

Scenario 2 (mass tourism): 33% of residual attributed to Electricity, gas, steam and air conditioning supply (sector D); 33% of residual attributed to Water supply, sewerage, waste management and remediation activities (sector E); 33% of residual attributed to Wholesale sector (G);

Scenario 3 (cultural tourism): 50% of residual attributed to Arts, entertainment and recreation (sector R); 50% of residual attributed to Wholesale sector (G);

Table 4 - Results of the three tourism demand shock simulations (*total effects*)

	Scenario_1	Scenario_2	Scenario_3
Output			
SLQ	2,180	2,199	2,166
CIQ	2,093	2,085	2,093
FLQ	1,298	1,305	1,302
AFLQ	1,308	1,321	1,311
SDP	2,274	2,321	2,271
RPC	1,622	1,630	1,620
RAS	1,702	1,713	1,700
Value Added			
SLQ	1,023	0,962	1,019
CIQ	0,999	0,928	1,001
FLQ	0,634	0,579	0,637
AFLQ	0,638	0,586	0,641
SDP	1,067	1,017	1,067
RPC	0,782	0,724	0,783
RAS	0,814	0,757	0,815
Income			
SLQ	0,425	0,421	0,423
CIQ	0,412	0,405	0,413
FLQ	0,267	0,262	0,268
AFLQ	0,269	0,265	0,270
SDP	0,442	0,444	0,443
RPC	0,326	0,321	0,326
RAS	0,340	0,335	0,340
Employment			
SLQ	1,393	1,243	1,356
CIQ	1,363	1,200	1,332
FLQ	0,952	0,801	0,921
AFLQ	0,957	0,808	0,925
SDP	1,446	1,309	1,414
RPC	1,116	0,965	1,083
RAS	1,155	1,005	1,123

Source: own elaboration

Given the above distribution of tourism demand among sectors, the effects of an exogenous shock on the local economy are measured by the multipliers (Table 4). As anticipated, both the nature of tourism (the scenario) and the kind of technique employed to reduce the national input-output table affect the size of the multipliers, and the combined effects may produce quite large differences. More interestingly, such differences are not the same across the aggregate macro variables. For example, while output seems to be more sensible to shocks in tourism demand when tourism is mainly mass tourism, i.e. scenario 2, employment reacts more significantly to shocks in cultural tourism, i.e. scenario 3, and when the shock is not asymmetric (scenario 1). In fact, with the exception of the CIQ, the multipliers on output are systematically higher for scenario 2 (table 4). The opposite occurs for employment which registers the highest multipliers under the assumption of scenario 1 and 3. These results can be explained by the fact that when shocks are concentrated on very few sectors, as it occurs in scenario 3 and more significantly in scenario 1, the impact on total output is relatively lower since this produces lower indirect and induced effects. On the other hand, when the shocks are concentrated, they have a larger impact on employment.

As well as delivering different multipliers, each input-output reduction technique entails a different propagation of the shock in terms of direct, indirect and induced effects. For example FLQ and AFLQ imply that almost 80% of the total shock comes through the direct effects while 19 per cent is due to induced effects and only less than 1 per cent comes through the indirect effects (see Table 5). And these proportions are substantially invariant to the kind of scenario we are considering. On the contrary if the reduced table is obtained through the SDP methodology, almost 55 per cent of total effect is due to direct effects, while 20 per cent comes through indirect effects and 25 per cent through induced effects.

Table 5 - Shares of the output results between direct, indirect, induced effects

	Scenario 1	Scenario 2	Scenario 3
		direct effects	
SLQ	56,4%	59,1%	56,7%
CIQ	58,5%	61,7%	58,5%
FLQ	80,0%	80,5%	80,0%
AFLQ	80,0%	80,4%	80,0%
SDP	54,9%	57,4%	55,0%
RPC	68,4%	70,3%	68,5%
RAS	66,1%	68,0%	66,1%
		indirect effects	
SLQ	19,9%	17,6%	19,6%
CIQ	17,1%	14,2%	17,0%
FLQ	0,6%	0,6%	0,6%
AFLQ	0,6%	0,7%	0,6%
SDP	20,7%	18,7%	20,5%
RPC	10,0%	8,6%	9,9%
RAS	11,9%	10,4%	11,8%
		induced effects	
SLQ	23,7%	23,3%	23,8%
CIQ	24,4%	24,0%	24,5%
FLQ	19,3%	18,8%	19,3%
AFLQ	19,4%	18,9%	19,4%
SDP	24,3%	23,9%	24,4%
RPC	21,5%	21,1%	21,6%
RAS	22,0%	21,6%	22,1%

Source: own elaboration

Table 6 – Results of the *Scenario 1* simulation among industrial sectors

Output	Scenario 1						
	SLQ	CIQ	FLQ	AFLQ	SDP	RPC	RAS
A - Agriculture, forestry and fishing	0,025	0,027	0,004	0,005	0,030	0,013	0,016
B - Mining and quarrying	0,001	0,001	0,000	0,000	0,001	0,000	0,000
C - Manufacturing	0,280	0,204	0,054	0,054	0,299	0,117	0,149
D - Electricity, gas, steam and air conditioning supply	0,051	0,048	0,008	0,008	0,053	0,026	0,028
E - Water supply; sewerage, waste management and remediation activities	0,021	0,022	0,004	0,004	0,023	0,012	0,014
F - Construction	0,025	0,025	0,003	0,003	0,028	0,014	0,015
G - Wholesale and retail trade; repair of motor vehicles and motorcycles	0,530	0,523	0,434	0,435	0,538	0,467	0,475
H - Transportation and storage	0,291	0,295	0,189	0,196	0,305	0,231	0,240
I - Accommodation and food service activities	0,472	0,471	0,451	0,451	0,474	0,457	0,459
J - Information and communication	0,068	0,067	0,009	0,009	0,076	0,031	0,036
K - Financial and insurance activities	0,054	0,050	0,012	0,012	0,056	0,029	0,032
L - Real estate activities	0,111	0,110	0,047	0,047	0,117	0,075	0,078
M - Professional, scientific and technical activities	0,094	0,095	0,004	0,004	0,107	0,041	0,046
N - Administrative and support service activities	0,078	0,078	0,022	0,023	0,085	0,045	0,048
O - Public administration and defence; compulsory social security	0,001	0,001	0,000	0,000	0,001	0,001	0,001
P - Education	0,008	0,008	0,004	0,004	0,009	0,006	0,006
Q - Human health and social work activities	0,008	0,008	0,005	0,005	0,008	0,006	0,006
R - Arts, entertainment and recreation	0,044	0,044	0,037	0,037	0,045	0,039	0,040
S - Other service activities	0,011	0,011	0,006	0,006	0,012	0,008	0,008
T - Activities of households as employers	0,008	0,007	0,005	0,005	0,008	0,006	0,006

Source: own elaboration

We also study the effects of a shock in tourism demand on the different sectors of a local economy. Following the initial impact, the shock propagates to all sectors through indirect and induced effects. Under the hypothesis of scenario 1, more than 50 per cent of the shock will benefit the wholesale sector (sector G in table 6). This is clearly the result of the starting assumption that the "residual" is completely attributed to this sector. Yet it is somewhat surprising that the next sector which most benefit of the shock in the tourism demand is the manufacturing sector which absorbs 17% of the shock. Unexpectedly also the administrative and support service activities (sector N) benefit by an average of 6%. While the impact on and Real estate activities (sector L) is on average 8%.

Table 7 – Results of the *Scenario 2* simulation among industrial sectors

Output	Scenario 2						
	SLQ	CIQ	FLQ	AFLQ	SDP	RPC	RAS
A - Agriculture, forestry and fishing	0,023	0,025	0,004	0,004	0,028	0,012	0,015
B - Mining and quarrying	0,002	0,002	0,000	0,000	0,002	0,000	0,001
C - Manufacturing	0,301	0,211	0,054	0,055	0,326	0,124	0,159
D - Electricity, gas, steam and air conditioning supply	0,187	0,182	0,139	0,139	0,192	0,158	0,160
E - Water supply; sewerage, waste management and remediation activities	0,166	0,168	0,143	0,149	0,170	0,149	0,153
F - Construction	0,025	0,024	0,003	0,003	0,028	0,014	0,015
G - Wholesale and retail trade; repair of motor vehicles and motorcycles	0,271	0,262	0,174	0,175	0,283	0,211	0,218
H - Transportation and storage	0,291	0,297	0,189	0,196	0,310	0,232	0,241
I - Accommodation and food service activities	0,471	0,469	0,450	0,450	0,474	0,456	0,458
J - Information and communication	0,067	0,065	0,009	0,009	0,077	0,031	0,035
K - Financial and insurance activities	0,050	0,046	0,012	0,012	0,053	0,027	0,030
L - Real estate activities	0,102	0,100	0,046	0,047	0,109	0,070	0,073
M - Professional, scientific and technical activities	0,083	0,080	0,003	0,003	0,097	0,035	0,039
N - Administrative and support service activities	0,081	0,077	0,023	0,023	0,089	0,046	0,050
O - Public administration and defence; compulsory social security	0,001	0,001	0,000	0,000	0,001	0,001	0,001
P - Education	0,008	0,008	0,003	0,004	0,009	0,005	0,006
Q - Human health and social work activities	0,008	0,008	0,005	0,005	0,008	0,006	0,006
R - Arts, entertainment and recreation	0,043	0,043	0,037	0,037	0,045	0,039	0,039
S - Other service activities	0,011	0,011	0,006	0,006	0,012	0,008	0,008
T - Activities of households as employers	0,008	0,007	0,005	0,005	0,008	0,006	0,006

Source: own elaboration

Under the hypothesis of scenario 2, the proportion of the shock that goes to the wholesale sector (sector G in table 7) decreases to 23%. The manufacturing sector still absorbs on average of 18% while the congestion effects are reflected in a larger share of the shock on Electricity and water supply (sector D and G).

Table 8 – Results of the *Scenario 3* simulation among industrial sectors

Output	Scenario 3						
	SLQ	CIQ	FLQ	AFLQ	SDP	RPC	RAS
A - Agriculture, forestry and fishing	0,024	0,025	0,004	0,005	0,028	0,013	0,015
B - Mining and quarrying	0,001	0,001	0,000	0,000	0,001	0,000	0,000
C - Manufacturing	0,272	0,200	0,054	0,054	0,293	0,115	0,146
D - Electricity, gas, steam and air conditioning supply	0,049	0,047	0,008	0,008	0,051	0,025	0,028
E - Water supply; sewerage, waste management and remediation activities	0,020	0,021	0,004	0,004	0,023	0,012	0,013
F - Construction	0,026	0,026	0,003	0,003	0,029	0,015	0,016
G - Wholesale and retail trade; repair of motor vehicles and motorcycles	0,333	0,327	0,240	0,240	0,342	0,274	0,281
H - Transportation and storage	0,281	0,285	0,189	0,196	0,295	0,225	0,233
I - Accommodation and food service activities	0,472	0,471	0,451	0,451	0,475	0,457	0,459
J - Information and communication	0,076	0,076	0,010	0,010	0,085	0,035	0,041
K - Financial and insurance activities	0,051	0,048	0,012	0,012	0,054	0,028	0,031
L - Real estate activities	0,106	0,106	0,047	0,047	0,113	0,073	0,076
M - Professional, scientific and technical activities	0,092	0,095	0,004	0,004	0,107	0,040	0,046
N - Administrative and support service activities	0,080	0,080	0,023	0,023	0,088	0,046	0,050
O - Public administration and defence; compulsory social security	0,001	0,001	0,000	0,000	0,001	0,001	0,001
P - Education	0,008	0,008	0,004	0,004	0,009	0,005	0,006
Q - Human health and social work activities	0,008	0,008	0,005	0,005	0,008	0,006	0,006
R - Arts, entertainment and recreation	0,247	0,247	0,234	0,234	0,249	0,236	0,237
S - Other service activities	0,011	0,011	0,006	0,006	0,012	0,008	0,008
T - Activities of households as employers	0,008	0,007	0,005	0,005	0,008	0,006	0,006

Source: own elaboration

In case we consider a shock in the tourism demand of cultural type, a larger share, an average of 24%, of the total shock goes to Art and entertainment (sector R). Manufacturing sector instead will capture an average of 16% of total shock.

Conclusions

The efficient management of the tourism sector can be very important for the development of local economies. This is particularly true when one is considering small underdeveloped local economies rich in cultural heritage. In this economies, in fact, the full scale of a shock in tourism can be particularly relevant for economic growth. Implementing the right policies in order to boost tourism requires however the full knowledge of how the demand for tourism goods impact the economy. And this is not an easy task to accomplish. It is not easy both because it is not easy to correctly define the limits of the influence of tourism as a sector in the economy and because it is difficult to measure the overall extent of the influence in the economy of a change in demand for tourism.

We have attempted to measure the relevance of tourism on local economies by intersecting changes in tourism demand in different direction and we found that an external shock can influence very differently aggregate variables, such as employment and output. The regionalized I-O table can deliver very dissimilar result depending on the technique employed to derive the table, and so would be the suggested policy implication. The reason is that each rescaling technique is correcting for a specific factor and hence is implicitly biasing the I-O table. One should carefully trade-offs the benefits of using a specific reduction technique, with these implicit costs.

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