Estimating the economic impact of tourism industry through the MM approach

Yousaf Ali, Maurizio Ciaschini, Rosita Pretaroli[1],

Francesca Severini and Claudio Socci

Department of Economics and Law

University of Macerata Italy

(The 22nd International Input-Output Conference, 13-18 July 2014 Lisbon, Portugal)

(Draft, Please do not cite)

Abstract:

Tourism is one of the fastest growing industry in Italy. It has proven a valuable financial part of the Italian economy. Businesses, public and private organizations are strongly interested in the economic impacts of tourism at national and regional levels. The main problem which arises when measuring the impact of tourism is that tourism is not only a single industry but its an amalgamation of different industries. In order to solve this problem we will identify the relationship among the synthetic tourism industry (cluster of tourism). The synthetic tourism industry has three primary components which are Transport, Hotel and Restaurants and Natural Resources. This study aims to present an input output analysis for Italy to portray the most important source of information for the investigation of the interrelations existing among different industries and to examine the economic costs and benefits associated with tourism in Italy. Further we will apply a new backward and forward dispersion approach, starting from the original Rasmussen definition, which can give further insight into the interactions between synthetic tourism industry and other industries. The method is based on identification of the Macro Multipliers and the related impact components of a model based on the input output matrix for Italian economy in year 2005. This model proposes an approach to look into the relation between tourism industry and the whole economic system, based on the quantification of the impact of tourism industry output on the total economic output. Further the strength of these techniques is evaluated in terms of interaction of the impact components within the industries and cross interaction between clusters of tourism and the rest of the industries. This study will further give a full picture of policies that aid policy makers in improving the country's tourism industry through identifying the key industries that are interrelated with cluster of tourism.

*Key Words***:** *Tourism, Input-Output Model, Linkages, Macro Multiplier analysis, Italy*

JEL Classification: C67, L83, E61, D31, R15

1. *Introduction:*

The economic benefits and cost of tourism reach directly or indirectly to everyone in the region. From the statistics of World Travel and Tourism Council (WTTC) tourism is the second largest industry in the world which generates 200 million jobs worldwide and holds 10% accounts of global GDP

[1] Corresponding author e-mail: rosita.pretaroli@unimc.it, University of Macerata, Dipartimento di Economia e Diritto, P.zza Strambi 1, 62100 Macerata (Italy). Phone +39 0733 258 2578.

(WTTC). The main problem which arises when measuring the impact of tourism is that tourism is not only a single industry but it's an amalgamation of different industries which cannot be incorporated into the national account framework. In the national account system there is no separate tourism industry exists in the list of industries because tourism is a typically demand driven activity. However we should consider this industry as a group of industrial industries which are associated with tourism at various levels. In order to know the potential economic contribution of tourism to a country economy we need to examine the role played by System of National Accounts in providing a consistent and reliable source of information on the economic dimensions of tourism.

The geographical location of Italy as well as its historic heritage offers a wealth of scenic views that attracts both locals and foreigners to participate in tourism related activities. Tourism is one of the fastest growing industry in Italy (WTTC). It has proven a valuable economic pillar of the Italian economy. This study, first of all, tries to measure the impact of tourism on Italian economy because an economic impact assessment is most useful when evaluating the effects of an economic policy. But once again to determine that what does belong to tourism is a complex process. According to (UNWTO) certain economic industries (where the main economic activities are tourism) are defined as tourism industries (UN/Eurostat/OECD/UNWTO, 2008). In order to solve this problem we will identify the relationship among the synthetic tourism industry (cluster of tourism). As mentioned earlier that tourism industry is implicitly included in the Input Output tables as part of the production of different industries such as Accommodation services for visitors, Hotel and Restaurant, Food and beverage industry, Land transport, Water transport, Rail transport, Air transport, supporting and auxiliary transport services, recreational, culture and sporting services, retailing industry and country specific tourism industry (Maresca et al., 2011).

The tourism literature (UN World Tourism Organization [UNWTO], 2007)) covered a number of studies through a variety of methods, ranging from pure guess work to complex mathematical models. Many economist have emphasized the importance of more accurate quantification of economic impacts of tourism (Madsen and Zhang, 2010) identified four different approaches to estimate the regional and local impacts of tourism based on national accounts and economic modelling. (Steenge and Van De Steeg, 2010) discussed the importance of tourism by using input output table and tourism satellite accounts for a small Caribbean island. (Manente and Zanette, 2010) conduct a study on the macroeconomic effects of a VAT reduction in the Italian hotels and restaurants industry. (Tantirigama and Singh, 2009) used an input output multiplier approach to measure the economic impacts of transport and tourism in New Zealand. According to (Fletcher, 1989) the input output analysis has been widely used in tourism economics impacts studies as it is more comprehensive in providing a holistic picture of economic structure, (Oosterhaven and Fan, 2005) investigated the impact of international tourism on the Chinese economy.

The mixed structure and the consistency of tourism industry strictly depend on the qualitative and quantitative elements performed on the demand side. In this scenario tourism refers that how will

the number of tourists increase or decrease in a particular area due to change in prices, competition, promotion, quality and quantity of facilities. The demand approach solves the problem in the industry approach by redirecting the focus toward tourist (Madsen & Zhang, 2010).

According to the structural definition of tourism industry we will perform the dispersion analysis (Rasmussen, 1956)[2]. In order to evaluate both the importance of tourism industry on the Italian economy and the weight of each synthetic tourism industry subsectorss, i.e., Hotel and Restaurant, Land transport, Air transport, Water transport, supporting and auxiliary transport services, recreational, culture and sporting services etc. Such analysis is made on the aggregated Italian I-O table for 2005 that has 57 industries and an industry by industry structure. I-O analysis has been the most sophisticated and traditional tool used to analyze tourism effects and quantify the impact of tourism in the economy (see Henry and Deane, 1997; Fletcher, 1994; Fletcher and Archer, 1996; Tyrrel and Johnston, 2001).

Further this study utilise the input output table data to compile an inter industry transaction table and Leontief matrix, and then using these to derive industry wise multipliers and linkages for the tourism industries. By following the results of multipliers and linkages analysis we will focus our attention on the subsector of tourism industry and will try to find that which one is the convenient composition of

---

[2] *Research on dispersion/linkage analysis dates back to the definitions elaborated by Rasmuseen (1956) of "summary measures for the inverse matrix". He noted that the sum, $r_{\cdot j}$, of column elements $(r_{\cdot j} = \sum_{i=1}^{m} r_{ij})$ Corresponds to the total increase in output from the whole system of industries needed to match an increase in the final demand for the product of industry j by one unit. Similarly the sum , $((r_{\cdot i})$, of row elements $(r_{\cdot i} = \sum_{j=1}^{m} r_{ij})$ gives the increase in output of industry i required to meet a unit increase in final demand for the product of each industry. We can take the average, $\frac{1}{m}\boldsymbol{r_{\cdot j}}$, and it will represent an estimate of the (direct and indirect) increase in output to be supplied by an industry chosen at random if final demand for the products of industry j expand by one unit. Similarly $\frac{1}{m}\boldsymbol{r_{\cdot i}}$ can be regarded as the average increase in output to be supplied by industry i if the final demand for the products of an industry chosen at random is increased by one unit.*

To carry out consistent inter industry comparisons, we need to normalize these averages by the overall average defined as $\frac{1}{m^2}\sum_{i=1}^{m}\boldsymbol{r_i}$ *and thus consider the indices*

$$\boldsymbol{\pi_j} = \frac{\frac{1}{m}\boldsymbol{r_{\cdot j}}}{\frac{1}{m^2}\sum_{j=1}^{m}\boldsymbol{r_{\cdot j}}}$$

And

$$\boldsymbol{\tau_i} = \frac{\frac{1}{m}\boldsymbol{r_{\cdot i}}}{\frac{1}{m^2}\sum_{i=1}^{m}\boldsymbol{r_{\cdot i}}}$$

The aim of the direct and indirect backward dispersion index $(\boldsymbol{\pi_j})$*, the power of dispersion in the Rasmuseen definition, is to measure the potential stimulus to other activities from a demand shock in any industry j. The forward dispersion* $(\boldsymbol{\tau_i})$*, the sensitivity of dispersion in the Rasmuseen definition, measures the degree to which one industry output is used by other industries as an input.*

the policy variable, namely the final demand change, to obtain a particular effect on the objective vector variable or (total output vector variable). Moreover we will also examine the contribution of each subsector of tourism industry to the total output change, which is generated by a change in final demand.

The analysis we propose in this study is based on a decomposition that allows for the identification and quantitative determination of aggregated Macro Multipliers (MM), which lead the economic interactions and the structure of macroeconomic variables that either activate or deactivate these forces (Ciaschini and Socci, 2007). The Macro Multiplier approach give a complete account of the effects of the changing structures of macro variable while the traditional tools like impact multipliers and linkages does not give the full shape. The analysis of Macro Multipliers (MM) identifies a different set of scalars extracted from the multi industry structural coefficients, which leads to the definition of new indices we define as backward and forward dispersions. It further develops along the lines of industry and industry grouping. The methodology of Macro Multiplier is based on the singular value decomposition (SVD). Singular value decomposition has singular values that can be easily interpreted as aggregated macroeconomic multipliers. This approach further evaluate that if the decomposition is applied on the standardized structural matrix then we can have the picture of the degree of interaction between each row and column of the matrix in terms of interactions. However the role of singular values identified as the aggregated Macro Multiplier and the role of the associated structures interpreted as compositions of two fundamental aggregated macroeconomic variables namely, final demand and total output. These tools are developed as tools of multi-sectoral analysis on the model parameters, rather than as tools of statistical multivariate analysis on the data base (Ciaschini, 1989, Ciaschini and Socci, 2006).

In this respect second section discuss the concept and definition of tourism, section 3 discusses the tourism and input output tables. Section 4 shows the input output model based on the input output table for Italian economy and Macro Multiplier Approach (MM). Section 5 shows hypothesis on tourism industry. Section 6 present the key structures of policy target and policy and section 7 conclusions.

2. Definition of Tourism

Now a day's tourism as an industry being studies by various economists from notable international institutions, such as Organization of Economic Cooperation and Development (OECD), the United Nations UN), the World Bank and the World Tourism Organization (WTO) etc. The important question studying tourism is: what is the definition of tourism or what exactly is tourism? .Usually tourism is associated with the fun and pleasure of visiting a place away from home. Different people have different ideas about the chemistry of tourism, although they may not all agree with the same definition. Henry and Deane (1997) express tourism as follows:

Tourism is referred to as an industry, but that is a misnomer. From the perspective of the tourist, he or she demands an extraordinary range of goods and services during the course of a holiday, or a visit to another country. The needs of tourists are not met by accommodation, transport, dining, and one or two other basics alone, but extend to such diverse areas as banking, medical and dental care, security, manufacturing, telecommunications, sewerage and hundreds of others. From the perspective of the supply side, some operators, such as a hotelier, see themselves as essentially in the tourism business. Others, such as a medical doctor or a postman, of course would not. But, nevertheless, for that period of time in which they are working to meet the needs of the tourist, they are, in fact, a part of the tourist 'industry'.

The United States Department of Commerce Office of Tourism Industries defines tourism as a industry made up of 'a diverse group of industries that supply goods and services purchased by business (Mak, 2004, p. 68). The main and complex problem which arises is to determine that what belong to the tourism industry, because tourism industry cannot be reduced to a single industry and it could not be incorporated into the national account structure. Since tourism should be regarded as being made up of many different industrial industries which in general not related to tourism. For example, let us consider the air transport industry. Airplane can be used both by tourists and non tourists, including professional and business people, etc. In addition some of the products related to tourism are intangible in which the output cannot be easily measured by volume or currency value. Therefore we will consider tourism industry as a group of industrial industries which associate directly or indirectly with tourists at various levels. From the perspective of different analyst it's concluded that tourism should be associated with visiting a place away from home, the visitor should be someone who is travelling under certain conditions, for pleasures, education, medical treatment, business or other purposes (Steenge and Van De Steeg, 2010). In this context tourism is not only related to fun and pleasures but also to encompass other purposes.

Now to understand the tourism phenomenon it is important to have both a conceptual basis to understand it and empirical tools to measure the impact of tourism activities. Thus which industries relate to tourism industry, and what percentage of their total sales should be attributed to tourism industry, so that we can compose all these fractions into larger pieces without altering the national accounts structure.

2.1 Economic Role of Tourism

As we already discussed that tourism is not only a single industry but it's an amalgamation of different industries. Almost all industries of an economy get benefit from the tourism industry given that the process of tourism involves several types of services. Among the industries those benefits from tourism are Transportation i.e. Land transport, water transport, Air transport, food and beverages, hotel and restaurant, agriculture, Fashion, recreation, sports and manufacturing industries etc. To explain this phenomenon briefly, more travellers means more use of transportation, more food and beverages consumption, more expenses on hotel and restaurant accommodation and precisely

more demand will generate for manufacturing goods as the industries that have been primarily affected demand more manufacturing goods for the maintenance of their services.

Tourism affects the economy of a country through different angles. Government and the institutional industries realize the contribution which tourism makes to the economy in terms of employment, profit margins, income generation, balance of payment and investment. Basically tourism is a labour intensive industry, the greatest proportion of this industry is likely to be derived from wages and salaries paid to those working in jobs either directly serving the needs of tourist or indirectly benefiting from the tourists expenditure. Through economic perspective tourism is also important for the economy because it generates employments for locals and increase profit margins for the country.

Another contribution of tourism industry is that it has a significant influence on a country balance of payments. Foreigner tourists are buying tourist services in the destination countries and the payment which they pay for these services are considered as "invisibles". The total value of international tourist receipts minus the total payments during a year represents a country balance of payments on the tourism account, which will include other services such as banking, insurance and transport (Holloway, 2006, p.572).

According the United Nation World Tourism Organization report that global tourism exports represents about 6% of overall exports of goods and services, while the contribution of tourism to economic activity worldwide is estimated at some 5% and it represents 6-7% of the overall number of jobs worldwide (direct and indirect) (UNWTO, 2010).

2.2 Tourism in the context of Italy

Italy is the 4th largest economy in Europe and the 7th largest economy in the world with a GDP per capita of $30 700 (CIA world Factbook, 2010). In the performance terms Italy Ranks 5th worldwide by the number of international tourist arrivals and place number 4th worldwide by the amount of international tourism receipts (UNWTO, 2010). Italy long history being a centre of the Roman Empire, endows it with a myriad of heritages and culture landmarks. More than 45 United Nations World Heritage sites are include in Italy which is the highest number of sites exit in a single country. It's also include 393 archaeological sites like Pompeii, the Greek ruins in Agrigento, its offer visitors7,300 churches, of which 750 are in Rome (Anne Babalola et al, May6, 2011). The total number of museums in Italy are 4100, 12 of which are include in 100 most visited museums in the world. Additionally Italy has the most moderate climate; its climate offers visitors an average of more than 282 days of Sun per year and 60 degrees Fahrenheit average temperature[3].

[3] Current results: http://www.currentresults.com.

The Italian hotel and restaurant industry is well developed that includes the second biggest hotel offering in the world with more than 36,000 hotels and 1.7 million beds. Compare to Hotel and restaurant industry the Italian logistical infrastructure is not so satisfactory, according to the Economic Forum Travel and Tourism Competitiveness Report of 2009 ranked its quality of air transport infrastructure 78th out of 133 countries which is so poor compared to France 5th and Spain 34th. Despite having high density of road and railway tracks the Italian land transport quality of networks was ranked 99th compared to Spain 20th and France 5th. Another important aspect of Italian tourism industry is the role of employment; this industry generates employment for locals and increase profit margins for the country. According to the Ministry of Foreign Affairs, 69 percent of Italy GDP is the services industry. The tourism industry is reflected incisively by the job market, with more than 2.6 million jobs created in 2013, equals to 11.6% of total Italian employment (WTTC, 2014). As we discuss earlier that tourism industry is the mixture of different industries, numerous industries support the tourism cluster and create additional incentives to visit Italy. Among these supporting industries the main cluster is the food cluster; Italian Cuisine is recognized as world class and one of the best internationally. With food industry wine is another cluster. Italy is the world largest wine producer, producing over 4.5 million tons compared to the 4.1 million tons of France and the 3.5 million tons of The Spain (FAO, 2008). Within the European Union, Italian wine is present with about 322 DOC (or controlled place name) wines (Ciaschini and Socci, 2005). Both food and wine cluster increase the positive perception of Italy and attract tourist. Agriculture tourism is expanding rapidly in several areas of Italy, among these areas Tuscany is the prime destination of this kind of tourism. Health cluster is another important industry which can play an important role to attract new tourist. Among the other supporting industries Italian fashion industry (footwear, clothing, Yacht and sporting cars) gaining increasing importance in directly attracting tourist.

Italy manages to attract many national and international tourists but in the last few year's due to the economic and financial crisis the consumer spending in each industry decline. Despite a wealth of culture, history, natural endowments and strong demand conditions, the context of tourism industry and its strategy remain challenging. Tourism contribution to the Italian economy in 2013 was slightly decrease (-1.6%) compared to 2012. In 2013 this contribution was amounted to 159.6 billion euro which was equivalent to 10.3% of GDP (WTTC). Over the last five years the tourism consumptions decline 6.7%. Italian national tourists have paid particular attention to save money for their daily life expenses (expenses made in supermarket and shops for the purchase of local products).

Recently some of the Italy supporting industries represent a burden to the growth of tourism industry. The first example of poor support is related to the hospitality industry, due to its poor performance catering fall 46.6% of the costs incurred by Italian and foreign tourist during their stay in Italy. Another most affected area is clothing, footwear and other products made in Italy, between 2008 and 2012 spending on this industry fell by -31.5% (ISNART, 2010).

3. Input Output Analysis and Tourism Industry

The input output analysis is the traditional tool for assessing and measuring the contribution of tourism activity to a region economy. This is one of the most useful technique to measure economic impacts, with the advantage being the ability to numerically measure indirect and induced impacts. The most important and best known results of I-O analysis is its ability to derive multipliers using supply and use sides of the national accounts. The main postulates and applications of I-O analysis have been discussed in (Miller & Blair, 2009), (Leontief, 1986), (Eurostat, 2008), (Thijs Ten Raa, 2006).

(Fletcher, 1989) discussed in great details the usefulness of input output analysis in studying the economic impact of tourism. In his paper he stated that I-O analysis is the most comprehensive method available for studying the economic impact of tourism, and that no other technique can offer the same flexibility and level of details. (Archer, 1982) discussed in great details the use of I-O models for Tourism industry, he also analyzed different policy choices to compare each for its implications on income, employment and wages, which would be valuable to policy makers and policy planners in the tourism industry.

In order to explore the full meaning of tourism it is necessary to have both a conceptual background to understand tourism and quantitative tools to analyze and measures the impacts of tourism activities. Information related to tourism such as theory and data must include both the tourism activities themselves as well as their relationship with other activities, within or outside the local and regional economic system. Generally we find both the data and theory on tourism in the national accounts and economic models. So it is important to look into both national accounts and associated models to learn more about how to examine the role and the impacts of tourism in local and regional economies.

3.1 I-O Model

An input output model is a model that describes the flows of income between industries within an economy, these flows represent that what each industry must buy from every other industry to produce a Euro or any other specific currency worth of output. By using the production function of each industry, input output models also determines the proportions of sales that go to wage and salary income and taxes.

The core of input output model is the input output table which shows the economy of destination in a matrix form.

I-O model provides useful information for studying the transactions among producers and consumers in national economy. The model represents that the total output (X) of n economic

industries is a function of the interdependencies among the industries, describe by the direct or technical coefficient matrix (A), and consumption of goods in each industry, denoted by the final use vector (c).

The original structure of the Leontief I-O model is shown in the below equation.

$$\mathbf{x} = \mathbf{A}\mathbf{x} + \mathbf{c} \tag{1}$$

Solving equation 1 to get the total output X can be in the form

$$\mathbf{x} = (\mathbf{I} - \mathbf{A})^{-1}\mathbf{c} \tag{2}$$

The equilibrium output vector can also be written as

$$\mathbf{x} = \mathbf{R}\mathbf{c} \tag{3}$$

Where $R = (I - A)^{-1}$ and A is the constant technical coefficient matrix which satisfies the Hawkins-Simon conditions. The *R* matrix is usually referred to as the Leontief multipliers matrix (Leontief, 1965) and its elements, l_{ij} shows the direct and indirect requirements of industry output i per unit of final demand of product at industry j. Extensive use is made of matrix *R* within the traditional multipliers analysis. The Leontief inverse matrix R provides in fact a set of disaggregated multipliers that are recognize to be the most precise and sensitive for studies of detailed economic impacts. These disaggregated multipliers recognize the evidence that total impact on output will alter depending on which industries are affected by changes in final demand. The ith total output multiplier measures the sum of direct and indirect input requirements needed to satisfy a unit final demand for goods produced by industry i (Bulmer-Thomas, 1982).

It has to be stressed, however, that all these measures, built starting from matrix *R*, are not independent of the structure of final demand. The column and row sums of the *R* matrix used in the linkage analysis procedures necessarily imply the consideration of a set of final demand vectors which has a predetermined structure.

We can expect that these measures hold for demand vectors of varying scale but with the same structures. However neither the demand vector nor its changes will ever assume this type of structure for this reason some authors go to the drastic conclusion that ‘linkage analysis should be never used’ (Skolka, 1986).

From another side it can be argued that the structure of final demand produces the most different effects on the level of total output (Ciaschini, 1989). Given a set of non-zero final demand vectors whose elements sum up to a predetermined level, but with varying structures, we will expect that the corresponding level of total output will also vary considerably (Ciaschini, 1993).

A genuine multisectoral solution, in fact cannot come from a methodology, as the Leontief multipliers that gives the effect of one single element of final demand on one single element of total output at a time. Neither can it reside in the linkage analysis for the reasons considered. A genuine multisectoral solution is a ‘general equilibrium’ solution where a configuration conveniently given, of all the elements of the final demand determines simultaneously all the elements of the total output.

For these reasons we cannot confine our knowledge of the system to the picture emerging from measures, which can only show what would happen if final demand assumed a predetermined and unlikely structure and refer to more innovative methodologies.

4. Methodology: Macro Multiplier Approach and Key Structures

In traditional analysis the main focus will be given to the effects of final demand shocks at the industry level on total output by industry and the reduced form of the model will be expressed as in equation (3). In our model the structural matrix R can be easily decomposed in a sum of m different matrices through the singular Value Decomposition (SVD) (Lancaster and Tismenetsky, 1985). Further policies for tourism industry will be design on the basis of characteristic structure obtained from the elements of inverse matrix of the extended model, R, through the Macro Multiplier (MM) approach (Ciaschini et al., 2006; Ciaschini et al., 2007; Ciaschini et al., 2013). The MM approach is based on the (SVD) of the Leontief inverse, can identify the most efficient structure that quantify the aggregate scale effects and the associated structures of the impact of a change in final demand on total output. Through the MM approach key structure of the exogenous variable (final demand change) can be identified in order to obtain the expected total output change (Ciaschini and Socci 2006). Avoiding the main criticism associated with the traditional multiplier analysis which are affected by the unrealistic structure of the exogenous shock (Ciaschini et al. 2009), the MM analysis overcomes this limit and identify the most convenient structure of the policy control (final demand for tourism industry) by which the shock on economy is modeled.

The singular value decomposition of the $n \times n$ matrix R can be written as the product of three matrices:

$$\mathrm{R} = \mathrm{USV^t} \tag{4}$$

The matrices U and V are two unitary or orthonormal basis matrices of dimension $n \times n$ in R. The columns of matrix U represent the structures of the objective variables (the total output) through which all the results are observed and evaluated. These structures are called the key structures of the policy objectives. The rows of unitary matrix V represent the structures of the policies control, these structures measure and establish the composition of all the possible policies control. The matrix $\boldsymbol{S}$ is a $n \times n$ diagonal matrix whose elements are positive scalars called singular values[4]. The elements along

[4] *From this consideration matrices* $\mathrm{U, S}$ *and* V *can be easily shown working on equation (4). Further premultiplying matrix* R *by its transpose* $\mathrm{R^t}$ *one obtain*

$$\mathrm{R^t.R} = [\mathrm{USV^t}]^{\mathrm{t}}.\mathrm{USV^t} = \mathrm{VS^2V^t}$$

The columns of matrix V *are the set of orthonormal eigenvectors of the real symmetric matrix* $\mathrm{R^t.R}$ *and that the elements of the diagonal matrix* S *are the square roots of the eigenvalues of matrix* $\mathrm{R^t.R}$*, that is* $\boldsymbol{s_i} = \sqrt{\lambda_{\mathrm{i}}(\mathrm{R^t.R})}$*. By post multiplying matrix* R *by its transpose one obtains* $\mathrm{R.R^t} = \mathrm{USV^t}\boldsymbol{.}\,[\mathrm{USV^t}]^{\mathrm{t}} = \mathrm{US^2U^t}$ *Where*

the diagonal represent aggregate multipliers, which are all real positive and ordered according their magnitude as: $s_1 \geq s_2 \geq \cdots \geq s_n \geq 0$.

The structure identified plays a fundamental role in determining the potential behaviour of the economic system. We can evaluate which will be the effect on total output of all possible final demand structures. In this respect, we note that matrix R hides the fundamental combinations of the policy variables (total output). Each of them is obtained multiplying the corresponding combination of final demand by a predetermined scalar, which has in fact the role of aggregated multiplier (Ciaschini et al. 2009,2010).

The SVD of the inverse matrix R can be express from equation (4) as a sum of n matrices

$$\mathrm{R} = s_1 \mathrm{u}_1 \mathrm{v}_1^{\mathrm{t}} + s_2 \mathrm{u}_2 \mathrm{v}_2^{\mathrm{t}} + \cdots + s_{\mathrm{n}} \mathrm{u}_{\mathrm{n}} \mathrm{v}_{\mathrm{n}}^{\mathrm{t}} = \sum_{\mathrm{i}=1}^{\mathrm{n}} s_{\mathrm{i}} \mathrm{u}_{\mathrm{i}} \mathrm{v}_{\mathrm{i}}^{\mathrm{t}} \tag{5}$$

Where u_i and v_i are the i-th columns of matrix U and V and s_i is the i-th singular value of matrix S. As the columns of matrix V are orthonormal therefore each operator $s_i \mathrm{u}_i \mathrm{v}_i^t$ acts as a filter**.** From this perspective component of the control vector $\boldsymbol{v_i}$ is transmitted along the axis which is scaled by a scalar $\boldsymbol{s_i}$ and reoriented along the axis identified by u_i.

Now we have all the elements to show how this decomposition correctly represents the MM that quantify the aggregate scale effects and the associated structures of the impact of a change in final demand on total output. Further we can also observed the actual vector C in terms of the structures identified by matrix V, we obtain a new final demand vector C°expressed in terms of the structures suggested by matrix R.

$$\mathrm{c}^{\circ} = \mathrm{V}.\,\mathrm{c} \tag{6}$$

Is the representation of the control vector. C, in the orthonormal basis defined by matrix V. While the representation of the target vector, X in the orthonormal basis defined by matrix U is

$$\mathrm{x}^{\circ} = \mathrm{U}^{\mathrm{t}}.\,\mathrm{x} \tag{7}$$

By premultiplying equation (3) by the transpose of U, U^t we get

$$\mathrm{x}^{\circ} = \mathrm{S}.\,\mathrm{c}^{\circ} \tag{8}$$

Which implies

$$\mathrm{x}_{\mathrm{i}}^{\circ} = \mathrm{s}_{\mathrm{i}}.\,\mathrm{c}_{\mathrm{i}}^{\circ} \tag{9}$$

---

the columns of matrix U *are the set of orthonormal eigenvectors of the real symmetric matrix* $\mathrm{R}.\mathrm{R}^{\mathrm{t}}$ *and the elements of the diagonal matrix* S *are the square roots of the eigenvalues of matrix*$\mathrm{R}.\mathrm{R}^{\mathrm{t}}$**.** *It is worthwhile to mention that the square matrices* $\mathrm{R}.\mathrm{R}^{\mathrm{t}}$*and* $\mathrm{R}^{\mathrm{t}}.\mathrm{R}$ *have the same set of eigenvalues.*

The equations of the reduce form in equation (9) are completely independent one from the other. This property expresses that when final demand assumes one of the characteristic structures defined by the orthonormal vector of matrix V, only one of the singular value is activated and the output coincides with the correspondent vector of matrix U scaled by the singular value. Singular values $\boldsymbol{s_i}$ then determine the aggregated effect of a final demand shock on output. For this reason we will call them Macro Multipliers (Ciaschini and Socci, 2007).

It is worthwhile to mention that the numbers of components of the key target structures are not necessarily equal to the number of the components of the key control structures, since matrix R is not necessarily a square matrix. In fact:

$$\mathrm{Rv}_1 = \mathrm{s}_1\mathrm{u}_1 \tag{10}$$

Where $\boldsymbol{v_1}$ corresponds to the most sensitive key control structure and $\boldsymbol{u_1}$ is the most sensitive key target structure.

With reference to the target and control key structure in matrix R let us build two types of indices with respect to key structures of both the target variable and the control variable (Ciaschini, et, al 2011). These indices, which can be focused on each single commodity, reveal the role of each commodity inside the set of key structures and quantify their relevance both in terms of target and control variable. For the key target structures, given matrix U, it is possible to define the index:

$$\mu_{\mathrm{ij}} = \frac{\frac{|s_i u_{ij}|}{1/n|s_i u_j|}}{1/n^2 \sum_{j=1}^{n}|s_i u_j|} \tag{11}$$

That quantifies the relevance of the ith commodity in all the n key target structures. In particular, the index can reveal the role played by the selected commodity inside the key target structures $\mathrm{u_i}$ when the corresponding Macro Multiplier $\mathrm{s_i}$ is activated[5]. Also for the key policy control structures, it is possible to define the index starting from matrix V:

$$\gamma_{\mathrm{ij}} = \frac{\frac{|v_{ij}|}{1/n|v_j|}}{1/n^2 \sum_{j=1}^{n}|v_j|} \tag{12}$$

The index quantifies the importance of the ith good in all the n key control structures. In particular, the index can reveal the role played by the selected good inside the key objective structures $\mathrm{v_i}$.

Another potential of Singular value Decomposition of matrix R reveals the interaction of each commodity inside the set of key structure and quantify their interaction coefficient both in terms of

[5] When the index assumes a value lower than 1 the good has a low importance inside both the key objective and control structures i.e. $\mu_{\mathrm{ij}} < 1 \; and \; \gamma_{\mathrm{ij}} < 1$

policy target and policy control variables. The system of eigenvectors u_i for R^tR and v_i for RR^t are orthonormal bases which represent the interaction matrices of industry input and output respectively. This interaction or inter industrial interaction will be quantified by two macro multipliers. The angular distance between two dots will represent the interaction coefficient.

$$\Upsilon\left(s_i u_i, s_j u_j\right) = \frac{s_i u_i \prime\, s_j u_j}{\|s_i u_i\| \, \|s_j u_j\|} \tag{13}$$

and

$$\rho(v_i, v_j) = \frac{v_i \prime\, v_j}{\|v_i\| . \|v_j\|} \tag{14}$$

5. Hypothesis on Tourism Industry: Empirical Analysis

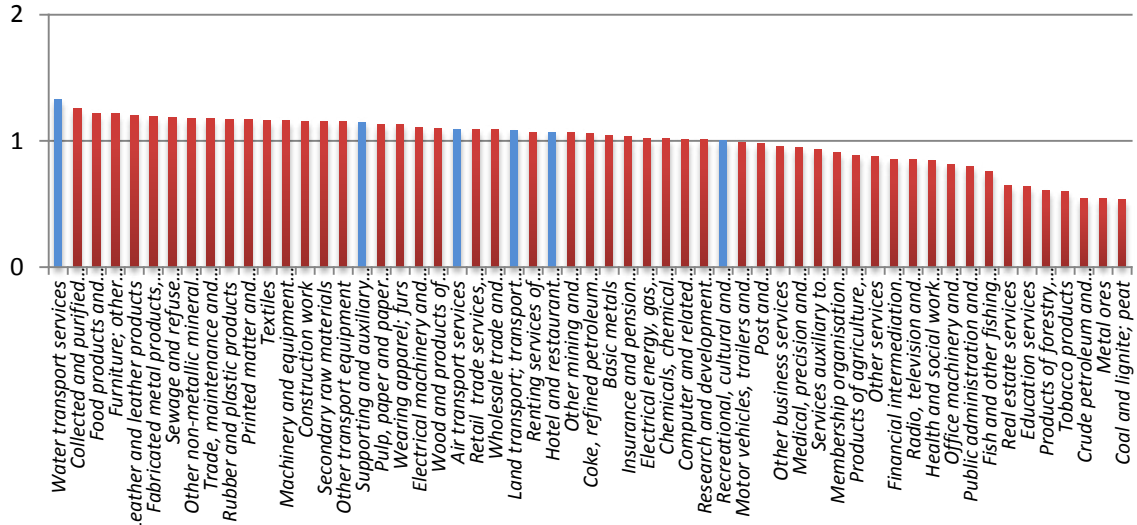
5.1 Power and Sensitivity dispersion for Tourism industry

The inverse matrix R has the potential to underline the direct and indirect effects on the disaggregated output generated. This is possible performing an exogenous shock through a predetermined final demand or through any other macroeconomic variables described in the model. Starting from matrix R the reduce form we can build two types of indexes of dispersion that are able to point out the role of any products in terms of power and sensitivity dispersion. The first type of index can appreciate the relevance of a good to activate the production chain or, to put it better, the index evaluate an increase of a unit final demand shock of the ith good in terms of a change of the output of the other commodities. The second type of index evaluates the relevance of a good when a unit final demand shock of all commodities is performed.

These indexes of dispersion determine those key commodities that play an important role in the tourism industry and give a rank to all commodities in term of power and sensitivity of dispersion. Results of the power of dispersion and sensitivity of dispersion indices are reported in the below figures 2 and 3. These figures show the results based on the Leontief inverse for the period of 2005.

Using the linkage analysis proposed by Rasmussen, an industry is considered as a key industry if $PD_j > 1$ and $SD_i > 1$.The second case If a industry $PD_j < 1$ and $SD_i > 1$then it is considered as a Sensitivity dispersion oriented industry. Third case is if $PD_j > 1$ and $SD_i < 1$ then it is considered as power dispersion oriented industry. Table A2 in the appendix present the full details of sensitivity and power dispersion indices for each of the tourism components within the 57 I-O industries. Table A2 shows that 16 industries have strong sensitivity and power dispersion, Land transport (x_{38}), transport via pipeline services and Supporting & auxiliary transport services; travel agency services are also among these industries. The results for power of dispersion are shown in figure 2.

Figure 2: Power of Dispersion (PD): Tourism Relevance



These results indicate that “water transport services” is the key and highest rank industry which plays an important role in the tourism industry. From figure 2 we also observe that 36 industries out of 57 for which the value of index is greater than 1 and they are the key industries which play an important role in the tourism industry.

Figure 3: Sensitivity Dispersion (SD): Tourism Relevance

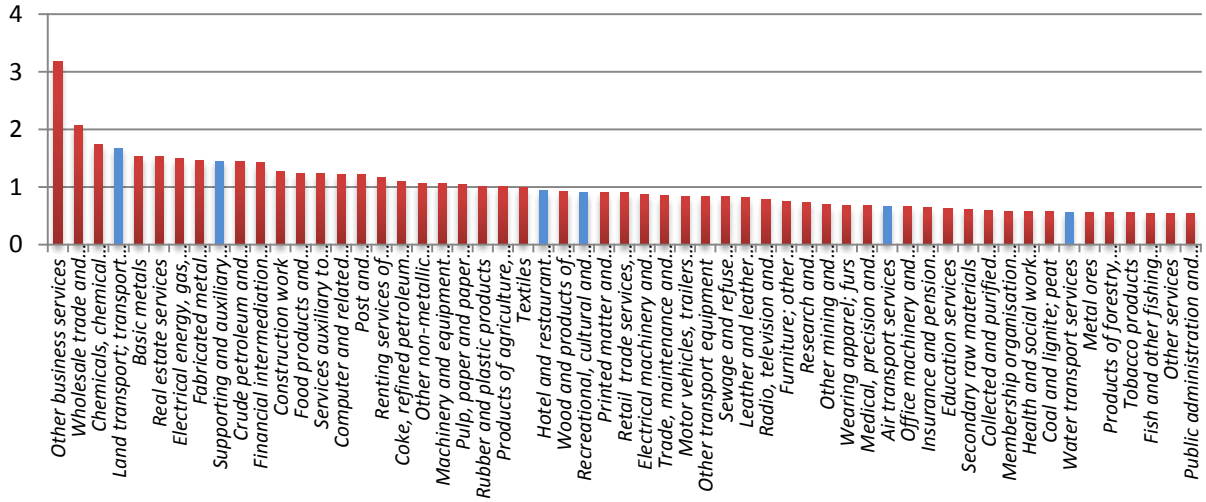


Figure 3 shows the sensitivity dispersion index. The results of the sensitivity dispersion indicate that “Other business services” is the key and highest rank industry among the 23 industries out of 57. The results support the importance of different industries in stimulating the economic growth of Italy tourism industry through both the power and sensitivity dispersion effects; they also show the importance of key industries that have higher potential to increase the output of tourism industry.

Tourism contributes directly and indirectly to gross domestic product (GDP), its make an indirect contribution through the flow on effect that changes in its output have on other industries output and hence output in general.

5.2 Backward and Forward Dispersion:

The matrix R also has the potential to reveal the role of each commodity inside the set of key structures and quantify their relevance both in terms of target and control variable. For this purpose we will use two types of indices with respect to key structures of both the target variable (Forward dispersion) and the control variable (Backward dispersion). These indexes of dispersion determine those key commodities that play an important role in the tourism industry and give a rank to all commodities in term of forward and backward dispersion. In order to calculate these indices we will use equation 11 and 12. The equation 11 reveals the role played by the selected commodity inside the target structures u_i when the corresponding Macro Multiplier s_i is activated. When the value of this index is lower than 1 (i.e. $\mu_{ij} < 1$) than the good has a low importance inside the target structure.

The results regarding the key objective structures or Forward Dispersion index for the Italian tourism industry are shown in the figure 4. We observe that 30 industries out of 57 for which the value of index is greater than 1 and they are the key industries which play an important role in the tourism industry. We can notice that the commodity 1"Products of agriculture, hunting and related services" get an important role into 30 key objective structures among 57. The other key objective structures are number. 6, 3, 17, 14, 2, 10, 32, 11, 7, 39, 18, 34, 22, 5, 15, 20, 4, 31, 29, 37, 24, 19, 21, 25, 36, 47, 28 and 26. From tourism cluster only 3 key structures are placed in the key objective structures which are 'Hotel & Restaurant services, Water Transport services and Air transport services.

Figure: 4 Forward Dispersion (FD)

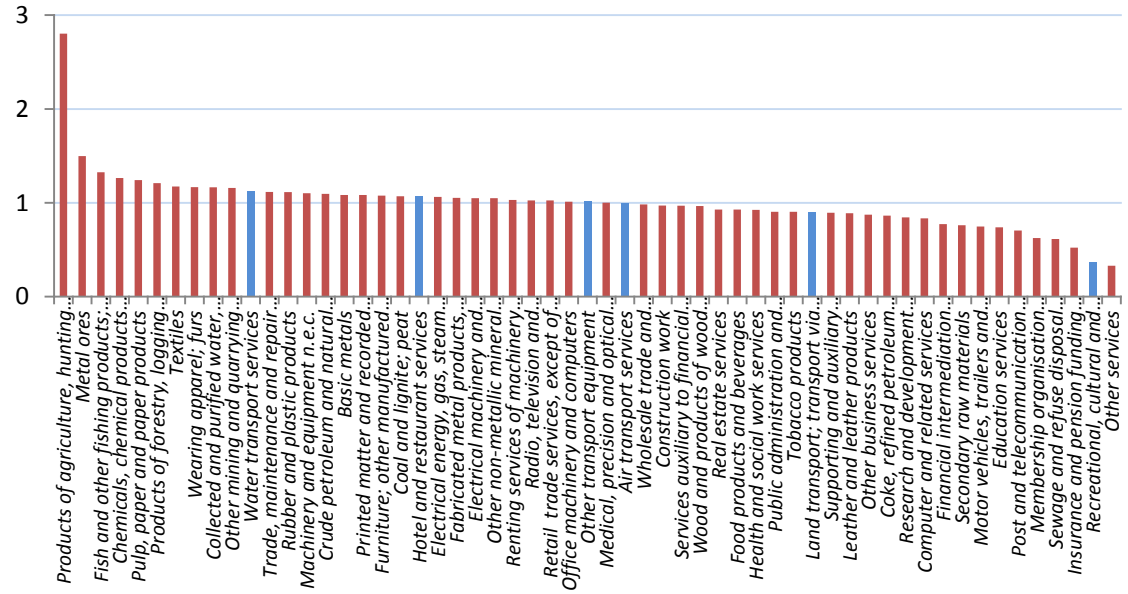
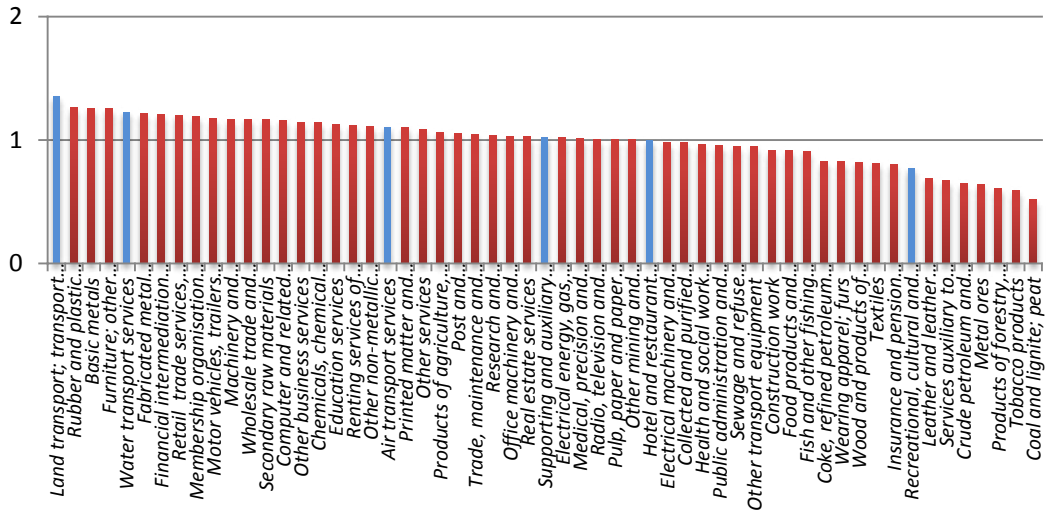


Table A3 in the appendix present the full details of forward and backward linkage indices and the ranking for each of the tourism components within the 57 I-O industries. From this table we can see that water transport get a highest rank 11 among the entire tourism cluster.

Figure: 5 Backward Dispersion (BD)



The index for the key control structures or backward dispersion is represent in equation 12, which quantifies the importance of the ith good in all n key control structures. In particular this index reveals the role played by the selected good inside the key objective structure (v_i). When the index assumes a value lower than 1 (i.e. $\gamma_{ij} < 1$) than the good has a low importance inside the key control structure. Further these indexes identify the key structure of final demand in which the tourism industry play an important role. From the figure 5 we can identify 35 key structures of final demand that have an index more than or equal to one ($\gamma_{ij} \geq 1$). On the basis of these key structures of final demand we can identify the goods that get the major change in terms of output.

From figure 5 we can see that the commodity 38 “Land transport; transport via pipeline services” get an important role into 35 key control structures among 57. The other key control structures are number.18, 20, 29, 39, 21, 43, 36, 55, 27, 22, 35, 30, 48, 50, 17, 52, 47, 19, 40,15, 57, 1, 42, 34, 49, 23, 46, 41, 31, 26, 25, 14,7 and 37 . From tourism cluster 5 key structures are placed in the key objective structures which are ‘Land transport; transport via pipeline services, Hotel & Restaurant services, Water Transport services, Air transport services and Supporting and auxiliary transport services; travel agency services. From table A3 we can see that “Land transport; transport via pipeline services” get a highest rank 1 among the entire economic industry and tourism cluster. Another influential tourism industry is “water transport services” which have ranked 5.

6 Policy target and Policy control Key structures

In this section we will identify the demand control policies (policy variable) that promote the tourism cluster (i.e. Hotel and restaurant, Land transport, Water transport, Air transport, Supporting & auxiliary transport services and recreational, culture & sporting services) within the realized total output (Objective variable). By using the Macro Multiplier approach we will identify the convenient final demand and output vectors, operating on the whole structures. We determine than a particular structure of final demand, which has a positive effect on the growth of tourism cluster as a whole taking into consideration also the effects on the remaining industries output. By using the concept of Singular value Decomposition (SVD) we obtain a set of 57 MM (s_i), a set of 57 structures of demand control matrix V and a set of 57 structures of matrix U. The structures identified by matrix V and U play an important role to determine the potential behavior of the economic system.

From the set of structures of the objective variable, $\boldsymbol{s_i.u_i}$ ($i = 1 \dots 57$), it is possible to choose the most effective policies for the tourism cluster (i.e. 37 Hotel & Restaurant, 38 Land transport, 39 water transport, 40 Air transport, 41 Supporting & auxiliary transport services and 56 recreational, culture & sporting services). Table1 shows the most effective policies that give the highest push to at least one of the industries composing the tourism cluster set.

Policy 1 has a modulus multiplier $\boldsymbol{s_1}$, a demand control structure $\boldsymbol{v_1}$ and an overall policy effect on the objective, $\boldsymbol{s_1.u_1}$, which is shown in the second column of the table1. We can notice the most relevant component is 0.50 at row 38, which express that a demand control tend to have the greatest impact on industry 38 the 'Land transport services'.

Policy 11 has an impact, 0.49 on industry 41 'supporting and auxiliary transport services' and a greater impact on industry 56 'Recreational, culture & sporting services' -0.77. However the impact is in opposite direction. Policy 46 can be seen from the 4th column of table1. This policy has an impact -0.50 on industry 40 'Air transport', the impact is in opposite direction. Policy 52 has a greater impact, 0.60 on industry 37 'Hotel and restaurant' and finally the impact of policy 55 on industry 39 'Water transport services' is -0.49.

Since policy 1 is a dominating policy, which is a demand driven policy that has the highest multiplier effect on output and being an expensive one on all industries. The policy control structure v_1 of all positive final demand changes generates a vector of all positive (objective variable) total output changes $s_1.u_1$. The policy control structure $v_1$is shown in the figure 6.

Among the 57 industries a hierarchy of industries to be stimulated to get the result of policy 1, can be established. From figure 6 we see that four industries must stimulated at a very high degree, i.e. 50 Other businesses service, 35 Wholesale trade and commission trade services, except of motor

vehicles and motorcycles, 21 Fabricated metal products, except machinery and equipment and 41 Supporting and auxiliary transport services; travel agency services.

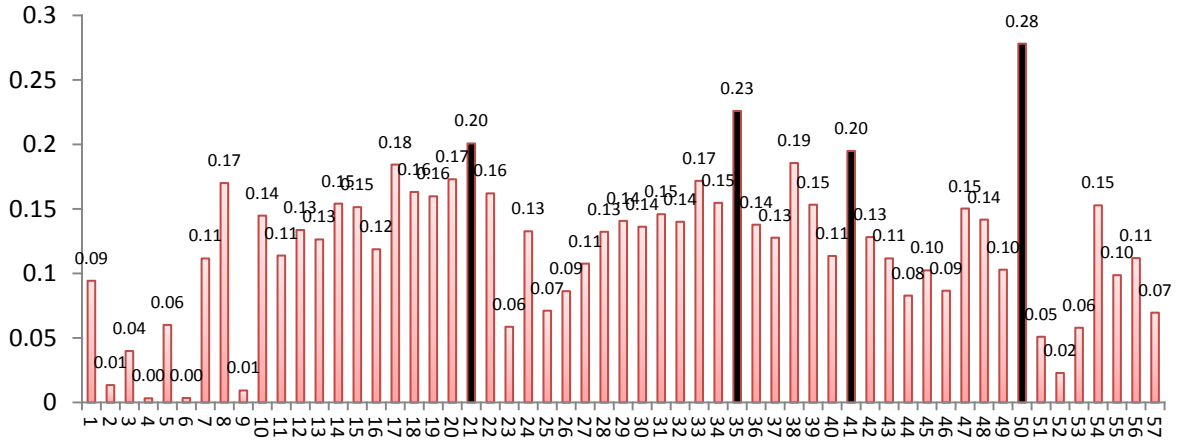
Table1: Key Policies structure

Key Objective policy structures: 1, 11, 46, 52, 55						Key policies control Structures: 13, 29, 46, 52, 55					
ID	$S_1.U_1$	$S_{11}.U_{11}$	$S_{46}.U_{46}$	$S_{52}.U_{52}$	$S_{55}.U_{55}$	ID	V_{13}	V_{29}	V_{46}	V_{52}	V_{55}
x_1	0.22	-0.08	-0.05	0.32	-0.02	f_1	-0.05	-0.10	-0.05	0.37	-0.03
x_2	0.02	-0.01	-0.04	0.00	0.00	f_2	0.00	0.00	-0.04	0.00	0.00
x_3	0.04	0.00	-0.31	0.06	0.01	f_3	0.01	-0.03	-0.31	0.06	0.01
x_4	0.01	-0.01	0.10	0.00	0.00	f_4	0.00	0.01	0.10	0.00	0.01
x_5	0.29	-0.14	0.06	0.01	0.04	f_5	-0.04	0.01	0.06	0.01	0.05
x_6	0.01	-0.01	0.12	-0.01	0.00	f_6	0.00	0.01	0.13	-0.01	0.00
x_7	0.15	0.13	-0.01	-0.03	0.01	f_7	0.04	-0.02	0.00	-0.02	0.00
x_8	0.35	-0.09	0.00	-0.46	0.08	f_8	-0.04	0.02	0.00	-0.53	0.11
x_9	0.01	0.00	-0.02	-0.02	0.01	f_9	0.00	-0.02	-0.02	-0.01	0.01
x_{10}	0.26	0.01	-0.01	-0.02	0.01	f_{10}	0.03	-0.12	0.01	-0.01	0.01
x_{11}	0.15	-0.02	-0.03	-0.02	0.01	f_{11}	-0.01	0.18	-0.03	-0.02	0.01
x_{12}	0.21	0.11	-0.01	0.05	-0.01	f_{12}	0.05	0.01	-0.01	0.04	-0.01
x_{13}	0.23	-0.11	-0.05	0.00	0.01	f_{13}	-0.06	0.13	-0.04	0.00	0.01
x_{14}	0.30	-0.28	0.00	0.01	0.01	f_{14}	-0.01	-0.07	0.01	0.02	0.00
x_{15}	0.25	-0.21	-0.05	-0.05	0.02	f_{15}	0.01	0.02	-0.05	-0.04	0.01
x_{16}	0.26	-0.06	0.01	0.00	0.01	f_{16}	-0.07	-0.01	0.04	0.01	0.04
x_{17}	0.50	0.21	0.02	0.04	-0.03	f_{17}	0.08	0.21	0.03	0.05	-0.05
x_{18}	0.29	0.11	-0.05	-0.05	0.03	f_{18}	0.05	-0.41	-0.04	-0.04	0.03
x_{19}	0.31	0.28	-0.05	-0.01	0.07	f_{19}	0.09	-0.03	-0.04	0.00	0.08
x_{20}	0.46	-0.15	-0.09	0.05	-0.01	f_{20}	0.06	-0.02	-0.10	0.07	-0.02
x_{21}	0.45	-0.07	0.16	-0.02	0.02	f_{21}	0.05	0.01	0.18	0.00	0.02
x_{22}	0.30	-0.04	-0.17	-0.02	0.00	f_{22}	0.00	-0.01	-0.16	-0.01	-0.01
x_{23}	0.09	0.00	-0.25	-0.03	0.00	f_{23}	-0.03	-0.02	-0.25	-0.02	0.00
x_{24}	0.22	-0.03	0.04	-0.05	0.02	f_{24}	0.03	0.09	0.05	-0.04	0.02
x_{25}	0.12	-0.01	0.09	-0.01	0.01	f_{25}	-0.02	-0.06	0.10	-0.01	0.00
x_{26}	0.12	0.00	-0.07	-0.04	0.00	f_{26}	0.00	-0.24	-0.07	-0.03	0.00
x_{27}	0.19	-0.02	-0.14	0.02	0.00	f_{27}	-0.08	0.04	-0.14	0.03	0.00
x_{28}	0.21	0.17	0.07	0.02	0.09	f_{28}	0.13	-0.07	0.09	0.04	0.13
x_{29}	0.20	-0.05	0.04	-0.03	0.04	f_{29}	0.00	-0.30	0.05	-0.03	0.05
x_{30}	0.16	-0.06	0.00	-0.16	0.03	f_{30}	-0.05	0.20	0.01	-0.16	0.03
x_{31}	0.39	-0.08	-0.02	-0.01	-0.08	f_{31}	0.04	0.07	-0.01	-0.01	-0.12
x_{32}	0.15	0.19	0.02	-0.02	0.39	f_{32}	0.08	0.03	0.02	-0.02	0.40
x_{33}	0.37	0.33	-0.01	-0.02	-0.25	f_{33}	0.12	-0.04	0.00	-0.02	-0.36
x_{34}	0.24	-0.01	0.05	-0.12	0.03	f_{34}	-0.09	0.16	0.05	-0.12	0.03
x_{35}	0.63	-0.01	0.12	0.02	-0.02	f_{35}	-0.06	0.35	0.14	0.05	-0.03
x_{36}	0.23	-0.07	-0.08	0.07	0.01	f_{36}	-0.05	-0.15	-0.07	0.07	0.01
x_{37}	0.24	-0.05	-0.01	0.60	-0.05	f_{37}	-0.02	0.04	-0.01	0.60	-0.05
x_{38}	0.50	0.20	0.16	-0.05	-0.15	f_{38}	0.08	-0.38	0.17	-0.04	-0.17
x_{39}	0.16	0.27	0.20	-0.05	-0.49	f_{39}	0.16	0.15	0.20	-0.05	-0.49
x_{40}	0.15	0.14	-0.51	-0.17	-0.24	f_{40}	0.07	0.01	-0.51	-0.17	-0.24
x_{41}	0.45	0.49	-0.03	0.06	0.40	f_{41}	0.17	0.08	-0.03	0.11	0.56
x_{42}	0.30	0.00	-0.38	0.00	0.04	f_{42}	0.00	0.01	-0.38	0.01	0.04
x_{43}	0.33	0.00	-0.06	0.07	-0.02	f_{43}	-0.02	0.13	-0.06	0.09	-0.03
x_{44}	0.11	0.03	0.03	-0.05	-0.03	f_{44}	0.04	-0.03	0.03	-0.05	-0.03
x_{45}	0.24	0.05	0.01	0.01	0.03	f_{45}	0.04	0.00	0.00	0.02	0.04
x_{46}	0.33	-0.10	0.00	-0.15	-0.01	f_{46}	0.01	-0.07	0.00	-0.17	-0.02
x_{47}	0.32	0.03	-0.02	-0.01	-0.04	f_{47}	-0.02	0.04	-0.01	0.01	-0.04
x_{48}	0.32	-0.03	0.18	-0.04	0.01	f_{48}	-0.10	-0.15	0.20	-0.04	0.01
x_{49}	0.16	0.01	-0.01	-0.02	0.01	f_{49}	-0.02	0.26	0.00	-0.02	0.01
x_{50}	0.98	-0.15	0.06	0.12	-0.03	f_{50}	-0.21	-0.02	0.06	0.17	-0.06
x_{51}	0.05	-0.02	0.36	-0.04	0.03	f_{51}	-0.03	-0.01	0.36	-0.04	0.03
x_{52}	0.04	-0.02	0.09	0.06	0.01	f_{52}	0.00	-0.13	0.09	0.06	0.02
x_{53}	0.06	0.00	0.00	-0.01	0.02	f_{53}	-0.03	-0.06	0.00	-0.01	0.02
x_{54}	0.23	-0.13	-0.01	-0.04	0.00	f_{54}	-0.65	-0.04	-0.01	-0.03	-0.01
x_{55}	0.11	-0.05	0.00	-0.15	0.04	f_{55}	-0.12	-0.05	0.00	-0.15	0.04
x_{56}	0.20	-0.77	0.01	-0.02	0.01	f_{56}	0.57	0.01	0.00	-0.01	0.01
x_{57}	0.07	-0.02	-0.01	-0.03	0.02	f_{57}	-0.02	0.07	-0.01	-0.03	0.02

Eight industries are part of a second set highly stimulated: 38 Land transport; transport via pipeline services, 17 Chemicals, chemical products and man-made fibers, 20 basic metals, 33 Construction work, 8 Food products and beverages, 18 rubber and plastic products, 22 Machinery and equipment n.e.c. and 19 Other non-metallic mineral products. 29 industries are activated at an intermediate degree the numbers are: 34, 14, 39, 54, 15, 47, 31, 10, 48, 29, 32, 36, 30, 12, 24, 28, 42, 37, 13, 16, 11, 40, 56, 43, 7, 27, 49, 45 and 55. The remaining industries are activated at a low level or very low level.

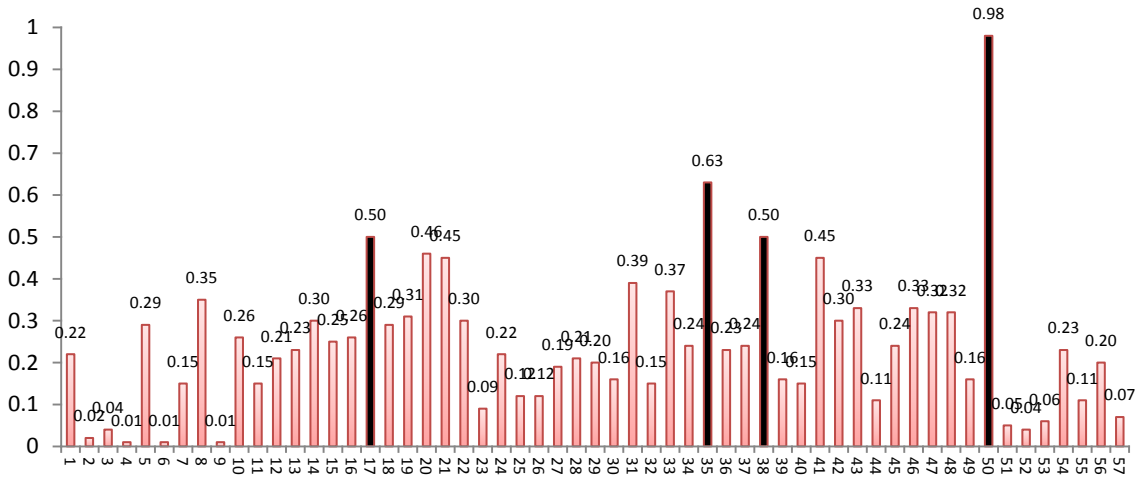
From the set of policy control structures, v_i $(i = 1 \dots 57)$, it is possible to choose the most effective policies for the tourism cluster (i.e. 37 Hotel & Restaurant, 38 Land transport, 39 water transport, 40 Air transport, 41 Supporting & auxiliary transport services and 56 recreational, culture & sporting services). Table1 shows the most effective policies that give the highest push to at least one of the industries composing the tourism cluster set. From table 1 Policy 13 has an impact, 0.57 on industry 56 “Recreational, cultural and sporting services”. Policy 29 can be seen from the third column of table 2, this policy has an impact -0.38 on industry 38 “Land transport; transport via pipeline services”. Policy 46 has an -0.51 impact on the industry 40 “Air Transport Service”. Policy 52 has a greater impact, 0.60 on industry 37 “Hotel and restaurant services”. Policy 55 has an impact 0.56 on industry 41 “Supporting and auxiliary transport services; travel agency services” and another impact -0.49 on industry 39 “Water transport services” however the impact is in opposite direction.

Figure: 6 Structure of the policy control 1 (dominating policy)



The $s_1\|u_1\|$ is the aggregated policy control effect on the total output (Objective variable) and its value is 2.22. Such effect will be observed along the policy structure u_1 and will be equal to $s_1 u_1$ as can see in the figure 7.

Figure 7: Multisectoral effect output of policy 1 (dominating policy)



From figure 7 we can see that the highest impact is borne by a group of four industries: 50 other business services, 35 wholesale trade and commission trade services, except of motor vehicles and motorcycles, 17 chemicals, chemical products and man-made fibres and 38 Land transport; transport via pipeline services. Three industries are part of a second group with highest impact: 20 basic metals, 21 fabricated metal products, except machinery and equipment and 41 supporting and auxiliary transport services; travel agency services. Third group of 46 industries bears an impact of intermediate intensity and a set of four industries is under an impact of low intensity.

6.1 Interaction Analysis

Further we will extend our analysis and perform a consistent comparison in the terms of interaction analysis. Table 2 represent an interaction table that represent the interaction coefficients between the most effective policies objective that give the highest push to at least one of the industries composing the tourism industries (i.e. 37 Hotel & Restaurant, 38 Land transport, 39 water transport, 40 Air transport, 41 Supporting & auxiliary transport services and 56 recreational, culture & sporting services). From table 2 we can see that policy 1 has a low positive interaction with respect to policy 11 and policy 52, however it have a low negative interaction with respect to policy 46 and policy 55. Policy 11 has only a positive interaction with policy 55, its interaction with respect to policy 46 and policy 55 is negative. Policy 46 positively interacted with respect to policy 52 and policy 55. A negative interaction is observed between policy 52 and policy 55.

Since policy 1 is the dominating policy, which has the highest multiplier effect on output. Table 3 represents the interaction coefficients table of dominating policy 1 with respect to other key objective policies.

Table 2: Interaction coefficient between tourism sectors

	u_1s_1	$u_{11}s_{11}$	$u_{46}s_{46}$	$u_{52}s_{52}$	$u_{55}s_{55}$
u_1s_1	1				
$u_{11}s_{11}$	0.001	1			
$u_{46}s_{46}$	-0.005	-0.009	1		
$u_{52}s_{52}$	0.002	-0.002	0.012	1	
$u_{55}s_{55}$	-0.001	0.001	0.004	-0.003	1

Table 3: Interaction between dominating policy and tourism sector

	$u_{11}s_{11}$	$u_{46}s_{46}$	$u_{52}s_{52}$	$u_{55}s_{55}$
u_1s_1	0.001	-0.005	0.002	-0.001

From Table 3 we can see that dominating policy 1 (u1s1) has a low positive interaction with respect to policy 11 and policy 52, however it has a low negative interaction with policy 46 and policy 55.

Following equation 14 it is possible to calculate the interaction coefficient between the key control structures policies for the tourism cluster (i.e. 37 Hotel & Restaurant, 38 Land transport, 39 water transport, 40 Air transport, 41 Supporting & auxiliary transport services and 56 recreational, culture & sporting services).

Table 4: Interaction Table of key control structures for Tourism cluster

	v_{13}	v_{29}	v_{46}	v_{52}	v_{55}
v_{13}	1				
v_{29}	-0.007	1			
v_{46}	-0.012	-0.007	1		
v_{52}	0.000	0.001	0.003	1	
v_{55}	0.001	0.004	0.002	0.009	1

Table 4 represents an interaction table between the key control structures policies for tourism industries. From table 4 we can see that policy 13 has a negative interaction with respect to policy 46

and policy 29, however its interaction with policy 52 and 55 is low positive. Policy 29 has only interacted negatively with policy 46; however its interaction with policy 52 and policy 55 is positive. Policy 46 interaction with both policy 52 and 55 is positive. The interaction between policy 52 and policy 55 is low positive.

Further we will concentrate on the policy control structure V_1, its aggregated value is 1 and it's determined in terms of its modulus $\|\mathbf{v}_1\|$. Table 5 represents the interaction coefficients table of dominating policy $V_1$with respect to other key control policies for tourism industries (.i.e. 37 Hotel & Restaurant, 38 Land transport, 39 water transports, 40 Air transports, 41 supporting & auxiliary transport services and 56 recreational, culture & sporting services).

Table 5: Correlation B/W Dominating policy 1 and Tourism Sectors

	v_{13}	v_{29}	v_{46}	v_{52}	v_{55}
v_1	0.002	-0.001	-0.003	0.002	0.005

From Table 5 we can see that dominating policy (v_1) has a negative interaction with respect to policy 29 and policy 46, however it has a positive interaction with respect to policy 52 and policy 55.

7. Conclusion

The economic importance of tourism has been subject to considerable debate. In order to solve this debate it requires reliable and authentic information on the precise nature of tourism spending and its impact on different industries of the economy. One common issue which always create hurdle, is to analyze the economic contribution of tourism because tourism is not a distinct industry in the systems of national accounts. In this paper we introduce some different analysis to provide a better understanding of tourism cluster. The evidence of this analysis is provided by the results of traditional dispersion analysis (linkage analysis) that has been preliminarily performed. This approach starts from the assessment of the intensity of economic flows implied in the output of the tourism cluster i.e. 37 Hotel & Restaurant, 38 Land transport, 39 water transport, 40 Air transport, 41 Supporting & auxiliary transport services and 56 recreational, culture & sporting services. Then the linkage analysis has been applied to the inverse matrix of the multisectoral model, the results support the importance of different industries in stimulating the economic growth of Italy tourism industry through both the backward and forward linkage effects; they also show the importance of key industries that have higher potential to increase the output of tourism industry. In particular the backward dispersion reveals a high potential stimulus to other industries from a demand shock in tourism cluster. The

backward linkage results indicate that “water transport services” is the key and highest rank industry which plays an important role in the tourism industry.

In order to get a wider picture of the actual and potential impacts of tourism cluster, the analysis has been focused on the role played by the sectoral composition, i.e. the structure of macroeconomic variables. Each macroeconomic variable is decomposed into an aggregated scale component and a disaggregated structure component through a rigorously consistent procedure. Further the analysis has been refined through the implementation of our approach of Macro Multipliers (MM), this approach checks the relevance of tourism industries from a policy perspective in a two way fashion: as a part of final demand and as a total output, which within a scheme of economic policy can be considered respectively as the policy control and the policy objective. A dispersion analysis performed on the basis of these two types of policy indices i.e. the target variable (Forward dispersion) and the control variable (Backward dispersion). The results regarding the key objective structures or Forward Dispersion index reveals that only three industries of tourism cluster are placed in the key objective structures which are ‘Hotel & Restaurant services, Water Transport services and Air transport services. On contrary the backward dispersion reveals a high potential stimulus to other industries, 5 key structures from tourism cluster are placed in the key objective structures which are ‘Land transport; transport via pipeline services, Hotel & Restaurant services, Water Transport services, Air transport services and Supporting and auxiliary transport services; travel agency services. The industry 38 “Land transport; transport via pipeline services” get a highest rank 1 among the entire economic industry and tourism cluster.

The policy problem is then transformed into the choice of a convenient structure for the policy control, each of the 57 MM is associated with a structure of a policy control that activate each multiplier effect. This multiplier effect is directed towards specific industry component of the policy target according the target key structures. Focus on the dominant policy mean a positive effect on the system as a whole. Both the target and control key structures associated with the dominant policy have all positive components thus the policy control increases both the scale of total output and each industrial component. In particular, the results of the analysis performed on key structures show that tourism cluster plays a relevant role in the composition both of the policy target and the policy control variable. Further the analysis shows that which are the policies of final demand, in terms of composition of the policy variable, that must allocate resources directly to tourism cluster in order to generate a general increase in total output. The analysis also reveals the policy targets where the tourism industries i.e. i.e. 37 Hotel & Restaurant, 38 Land transport, 39 water transport, 40 Air transport, 41 Supporting & auxiliary transport services and 56 recreational, culture & sporting services are more stimulated and examined that tourism cluster is as much effective as other key industries in generating changes in output if it is stimulated conveniently and it also present an important role within all industries when the final demand policy tends to privilege tourism cluster demand compared to other industries. An extension of the method has also been provided in terms of

interaction analysis, which presents an interpretation of the strength of the mutual links among and between the tourism cluster in terms of disaggregated components of total output and final demand.

Further development with more extensive and authentic policy outcomes can be expected when the application is broadened to data from more complete framework as the Social Accounting Matrix.

Appendix

Table:A1 I-O industries classification

Activities	ID	Activities	ID
Products of agriculture, hunting	x_1	Secondary raw materials	x_{30}
Product forestry, logging and related services	x_2	Electrical energy, gas, steam and hot water	x_{31}
Fish and other fishing products	x_3	Collected &purified water, services of water	x_{32}
Coal and lignite; peat	x_4	Construction work	x_{33}
Crude petroleum and natural gas	x_5	Trade, maintenance and repair services	x_{34}
Metal ores	x_6	Wholesale trade & commission trade services	x_{35}
Other mining and quarrying products	x_7	Retail trade services	x_{36}
Food products and beverages	x_8	Hotel and restaurant services	x_{37}
Tobacco products	x_9	Land transport; transport via pipeline services	x_{38}
Textiles	x_{10}	Water transport services	x_{39}
Wearing apparel; furs	x_{11}	Air transport services	x_{40}
Leather and leather products	x_{12}	Supporting and auxiliary transport services	x_{41}
Wood and products of wood and cork	x_{13}	Post and telecommunication services	x_{42}
Pulp, paper and paper products	x_{14}	Financial intermediation services	x_{43}
Printed matter & recorded media	x_{15}	Insurance and pension funding services	x_{44}
Coke, refined petroleum nuclear fuels	x_{16}	Services auxiliary to financial intermediation	x_{45}
Chemicals, chemical &man-made fibers	x_{17}	Real estate services	x_{46}
Rubber and plastic products	x_{18}	Renting services of machinery and equipment	x_{47}
Other non-metallic mineral products	x_{19}	Computer and related services	x_{48}
Basic metals	x_{20}	Research and development services	x_{49}
Fabricated metal products	x_{21}	Other business services	x_{50}
Machinery and equipment	x_{22}	Public administration and defense services	x_{51}
Office machinery and computers	x_{23}	Education services	x_{52}
Electrical machinery and apparatus	x_{24}	Health and social work services	x_{53}
Radio, television &communication equipment	x_{25}	Sewage and refuse disposal services	x_{54}
Medical, precision &optical instruments	x_{26}	Membership organization services	x_{55}
Motor vehicles, trailers and semi-trailers	x_{27}	Recreational, cultural and sporting services	x_{56}
Other transport equipment	x_{28}	Other services	x_{57}
Furniture; other manufactured goods	x_{29}		

Table A2 Power and Sensitivity Dispersion of Tourism components

ID	PD πj	Rank	SD τi	Rank	PD>1 SD>1
Products of agriculture, hunting and related services	0.887	43	1.016	23	
Products of forestry, logging and related services	0.609	53	0.559	53	
Fish and other fishing products;	0.762	50	0.549	55	
Coal and lignite; peat	0.537	57	0.572	50	
Crude petroleum and natural gas;	0.544	55	1.451	10	
Metal ores	0.542	56	0.562	52	
Other mining and quarrying products	1.069	28	0.69	39	
Food products and beverages	1.217	3	1.24	13	X
Tobacco products	0.598	54	0.555	33	
Textiles	1.159	12	0.993	24	
Wearing apparel; furs	1.128	19	0.682	40	
Leather and leather products	1.201	5	0.822	35	
Wood and products of wood and cork	1.103	21	0.932	26	
Pulp, paper and paper products	1.131	18	1.054	21	X
Printed matter and recorded media	1.17	11	0.905	28	
Coke, refined petroleum products and nuclear fuels	1.059	29	1.092	18	X
Chemicals, chemical products and man-made fibers	1.021	33	1.736	3	X
Rubber and plastic products	1.17	10	1.018	22	X
Other non-metallic mineral products	1.177	8	1.063	19	X
Basic metals	1.041	30	1.535	5	X
Fabricated metal products,	1.191	6	1.464	8	X
Machinery and equipment n.e.c.	1.158	13	1.06	20	X
Office machinery and computers	0.815	48	0.661	43	
Electrical machinery and apparatus n.e.c.	1.105	20	0.873	30	
Radio, television and communication equipment	0.851	46	0.79	36	
Medical, precision and optical instrument, watches and clocks	0.95	40	0.678	41	
Motor vehicles, trailers and semi-trailers	0.985	37	0.842	32	
Other transport equipment	1.153	16	0.838	33	
Furniture; other manufactured goods n.e.c.	1.215	4	0.756	37	
Secondary raw materials	1.158	15	0.612	46	
Electrical energy, gas, steam and hot water	1.023	32	1.492	7	X
Collected and purified water, distribution services of water	1.257	2	0.586	47	
Construction work	1.158	14	1.278	12	X
Trade, maintenance and repair services of motor vehicles	1.176	9	0.846	31	
Wholesale trade and commission trade services,	1.09	24	2.064	2	X
Retail trade services, except of motor vehicle and motorcycle;	1.092	23	0.9	29	
Hotel and restaurant services	1.07	27	0.938	25	
Land transport; transport via pipeline services	1.082	25	1.68	4	X
Water transport services	1.33	1	0.566	51	
Air transport services	1.092	22	0.664	42	
Supporting and auxiliary transport services; travel agency services	1.152	17	1.454	9	X
Post and telecommunication services	0.981	38	1.212	16	
Financial intermediation services, except insurance	0.854	45	1.418	11	
Insurance and pension funding services,	1.039	31	0.641	44	
Services auxiliary to financial intermediation	0.929	41	1.233	14	
Real estate services	0.65	51	1.526	6	
Renting services of machinery and equipment	1.071	26	1.16	17	X
Computer and related services	1.012	34	1.22	15	X
Research and development services	1.01	35	0.738	38	
Other business services	0.96	39	3.179	1	
Public administration and defence services;	0.796	49	0.541	57	
Education services	0.638	52	0.627	45	
Health and social work services	0.843	47	0.577	49	
Sewage and refuse disposal services, sanitation and similar	1.187	7	0.834	34	
Membership organisation services n.e.c.	0.911	42	0.579	48	
Recreational, cultural and sporting services	1.009	36	0.908	27	
Other services	0.879	44	0.542	56	

Table A3: Macro Multiplier Backward & Forward Dispersion

ID	*Forward Dispersion*	*Rank*	*Backward Dispersion*	*Rank*	*FD>1, BD>1*
Products of agriculture, hunting and related services	2.80	1	1.06	23	x
Products of forestry, logging and related services	1.21	6	0.61	55	
Fish and other fishing products; services incidental of fishing	1.33	3	0.91	44	
Coal and lignite; peat	1.07	18	0.51	57	
Crude petroleum and natural gas; services incidental to oil and gas	1.10	15	0.65	53	
Metal ores	1.50	2	0.64	54	
Other mining and quarrying products	1.16	10	1.00	34	x
Food products and beverages	0.93	36	0.91	43	
Tobacco products	0.90	39	0.59	56	
Textiles	1.17	7	0.81	48	
Wearing apparel; furs	1.17	9	0.82	46	
Leather and leather products	0.89	43	0.69	51	
Wood and products of wood and cork (except furniture);	0.96	35	0.82	47	
Pulp, paper and paper products	1.24	5	1.01	33	x
Printed matter and recorded media	1.08	16	1.10	21	x
Coke, refined petroleum products and nuclear fuels	0.86	45	0.83	45	
Chemicals, chemical products and man-made fibres	1.26	4	1.14	16	x
Rubber and plastic products	1.11	12	1.27	2	x
Other non-metallic mineral products	1.05	23	1.11	19	x
Basic metals	1.08	17	1.25	3	x
Fabricated metal products, except machinery and equipment	1.05	24	1.22	6	x
Machinery and equipment n.e.c.	1.10	14	1.17	11	x
Office machinery and computers	1.01	29	1.03	27	x
Electrical machinery and apparatus n.e.c.	1.05	22	0.98	36	
Radio, television and communication equipment and apparatus	1.03	25	1.01	32	x
Medical, precision and optical instruments, watches and clocks	1.00	30	1.01	31	x
Motor vehicles, trailers and semi-trailers	0.75	50	1.17	10	
Other transport equipment	1.01	28	0.95	41	
Furniture; other manufactured goods n.e.c.	1.08	20	1.25	4	x
Secondary raw materials	0.76	49	1.16	13	
Electrical energy, gas, steam and hot water	1.06	19	1.02	30	x
Collected and purified water, distribution services of water	1.16	8	0.98	37	
Construction work	0.97	34	0.91	42	
Trade, maintenance and repair services of motor vehicles and	1.12	13	1.05	25	x
Wholesale trade and commission trade services, except	0.98	32	1.17	12	
Retail trade services, except of motor vehicles and motorcycles;	1.03	26	1.20	8	x
Hotel and restaurant services	1.07	21	1.00	35	x
Land transport; transport via pipeline services	0.90	40	1.35	1	
Water transport services	1.12	11	1.23	5	x
Air transport services	1.00	31	1.11	20	x
Supporting and auxiliary transport services; travel agency serv	0.89	42	1.02	29	
Post and telecommunication services	0.70	52	1.05	24	
Financial intermediation services, except insurance and pension	0.77	48	1.21	7	
Insurance and pension funding services, except compulsory social	0.52	55	0.80	49	
Services auxiliary to financial intermediation	0.97	33	0.67	52	
Real estate services	0.93	37	1.03	28	
Renting services of machinery and equipment without operator	1.03	27	1.12	18	x
Computer and related services	0.83	47	1.16	14	
Research and development services	0.84	46	1.04	26	
Other business services	0.87	44	1.14	15	
Public administration and defence services; compulsory social	0.90	41	0.96	39	
Education services	0.74	51	1.12	17	
Health and social work services	0.92	38	0.97	38	
Sewage and refuse disposal services, sanitation and similar	0.61	54	0.95	40	
Membership organisation services n.e.c.	0.62	53	1.19	9	
Recreational, cultural and sporting services	0.37	56	0.78	50	
Other services	0.33	57	1.09	22	

References:

WTTC. Travel and Tourism: A World of Opportunity.– 2003 (available at http://www.wttc.org/measure/PDF/Executive%20Summary.pdf).

United Nations World Tourism Organization. *UNWTO Tourism Highlights 2010 Edition*. September 2010.

Ciaschini, M. and Socci, C. 2007. Final demand impact on Output: A Macro Multiplier Approach. Journal of Policy Modelling 29(1), 115-132.

Ciaschini, M. 1989. Scale and structure in Economic modeling. Economic modeling 6(4), 355-373.

Ciaschini, M., Socci, C.(2006): `*Income distribution and output change:* macro multiplier approach, in Salvadori, N. ed: Economic growth and distribution: on the nature and cause of wealth of nations. Edward Elgar, Cheltenham.

Ciaschini, M.(1993), Modelling the structure of the Economy, London: Chapman and Hall.

Ciaschini, M., Pretaroli, R., Severini, F., Socci, C., 2013. Policies for electricity production from renewable sources: the Italian case. Journal of Policy Modeling.

Ciaschini, M., Socci, C.(2005): Multiplier impact of wine activity on inter-industry interactions.

Ciaschini, M., Pretaroli, R., Socci, C.(2011): Convenient policy for Health care expenditure in a multiindustryal extended model. (The 19th International Input-output Conference in Alexandria, USA, July 13-17, 2011)

2010 estimate (CIA World Factbook) https://www.cia.gov/library/publications/the-world-factbook/fields/2004.html

Lancaster, p., Tismenetsky, M (1985): The thory of Matrices, 2nd edn, Academic press, New York.

Ciaschini, M., Pretaroli, R., and Socci, C, (2009), "A convenient multi industryal policy control for the ICT in the USA economy" Metroeconomica, 60(4), 660-685.

Ciaschini, M., Pretaroli, R., and Socci, C, (2010), "Multiindustryal structure and policy design," International Journal of Control, 83, 281-296.

Henry, E.W., and Deane, B. (1997), 'The contribution of tourism to the economy of Ireland in 1990 and 1995', *Tourism Management*, Vol 18, No 8, pp 535–553.

Fletcher, J. (1994), 'Input–output analysis', in Witt, S., and Moutinho, L., eds, *Tourism Marketing and Management Handbook*, second edition, Prentice-Hall International, pp 480–484.

Archer, B., and Fletcher, J. (1996), 'The economic impact of tourism in the Seychelles', *Annals of Tourism Research*, Vol 23, No 1, pp 32–47.

Tyrrell, T., and Johnston, R. (2001), 'A framework for assessing direct economic impacts of tourist events: distinguishing origins, destinations, and causes of expenditures', *Journal of Travel Research*, Vol 40, No 1, pp 94–100.

UN World Tourism Organization. (2007, October). *Climate change and tourism: Responding to global challenges. Advanced summary.* Davos, Switzerland.

Madsen, B., and Zhang, J. (2010) "Toward a new framework for accounting and modeling the regional and local impacts of tourism" Economic System research, 2010, Vol.22(4), December, pp. 313-340.

Steenge, A.E and Van De Steeg, A.M. (2010) " Tourism Multipliers for a small Caribbean island State; The case of Aruba" Economic System research, 2010, Vol.22(4), December, pp. 359-384.

Henry, E.W. and B. Deane (1997) The Contribution of Tourism to the Economy of Ireland in 1990 and 1995.Tourism Management, 18, 535–553.

Manete, M. and Zanette, M. (2010) "Macroeconomic Effects of a VAT reduction in the Italian Hotels and Retaurants Industry" Economic System research, 2010, Vol.22(4), December, pp. 407-425.

Fletcher, J. (1989). Input-Output analysis and tourism impacts studies. Annals of Tourism Research, 16(4), 514-529.

Tantirigama, T. and Singh, M.T. (2009) "Economic impacts of transport & tourism in New Zealand: An input output multiplier approach" Paper presented at NZAE conference 2009.

Oosterhaven, J. and Fan, T. (2005) " The impact of international tourism on the Chinese economy" Paper presented at the 15th international input output conference, Beijing, June 2005.

UN/Eurostat/OECD/UNWTO. (2008) Tourism Satellite Account: Recommended Methodological Framework. Madrid, Spain.

UN and UNWTO. (2007) 2008 International Recommendations for Tourism Statistics (IRTS 2008). New York, Madrid.

United Nations World Tourism Organization. *UNWTO Tourism Highlights 2010 Edition*. September 2010.

Maresca, S. Anzalone, M., Piscitelli, I. (2011) "Versus the first Italian Tourism Satellite account: The Production Approach" Italian national institute of statistics.

Rasmussen, P. (1956): Studies in Interindustryal Relations, North Holland, Amsterdam.

Leontief, W. (1986) *Input-Output Economics*. Oxford University Press.

Blair, R. and Miller, P. (2009). Input-Output Analysis Foundations and Extensions. Second Edition. Cambridge University Press.

Eurostat (2008), *Eurostat Manual of Supply, Use and Input-Output Tables*, Collection: Methodologies and Working Papers, Luxembourg.

Thijs Ten Raa, 2006. The Economics of Input-Output Analysis, Cambridge University Press (February 6, 2006).

Archer , B. (1982) The value of multipliers and their policy implications . Tour Manage December , 236 – 241

Fletcher , J.E. (1989) Input-output analysis and tourism impact studies . Ann. Tour. Res. 16 , 514 – 529

Lee, K. C. (1986). Input output multipliers with backward and forward and total linkages. In paper presented at the 8th international conference on input output technique.

Bulmer-Thomas, V. (1982), Input-Output analysis in developing countries, USA: John Wiley and sons Ltd.

Skolka, J., (1986), Input Output Multipliers and Linkages, paper presented at the 8th international conference on input output technique, Sapporo.

Anne Babalola et al, May6, 2011. Tourism Cluster In Italy. Microeconomics of Competitiveness final report.

Food and Agriculture Organization (FAO), 2008 report. United Nation.

ISNART, 2012. : L'impatto economico del turismo in Italia

http://epp.eurostat.ec.europa.eu/portal/page/portal/tourism/data/database

Holloway, J.C. (2006). *The Business of Tourism*. UK: Longman.

Mak, James (2004). *Tourism and the Economy, Understanding the Economics of Tourism, Honolulu: University of Hawaii Press.*