

A Factor Analysis of the Tourism in the Mexican Province of Michoacan

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The tourism is a key branch in the world wide economy nowadays, and revenues account for one third of total income in the world. Many nations are trying to improve their tourism sector attracting more tourists every year in order to impact social welfare. This study addresses two research questions: (1) What are the factors that impact on tourism sector? and (2) Does the tourism really impact on social welfare of the communities? The objectives of this work are to analyze the variables that impact on the tourism in the Mexican providence of Michoacan and also to find out if the tourism sector is impacting on social welfare of the province, with the propose of answering this questions 41 variables were selected being 63 municipalities of Michoacan province in the case of study. Analysis Factorial of Correspondences (AFC) through the analysis of principal components methodology is employed in this article. The analysis is divided into five phases: (1) reliability testing; (2) the calculation of a matrix that expresses the joint variability of the variables; (3) extraction of the optimal number of factors; (4) the rotation of solutions for the ease of interpretation; and (5) the estimation of the scores graphically. The results showed that the variables that impact on tourism are several the most representative tourism infrastructure and complementary services restaurants, lodging with category five- and four- star travel, visitors foreign share of the Economic Active Population (EAP) in the tertiary sector, percentage of EAP women, percentage of economically active men and Gross Domestic Product (GDP) per capita among others. However the analysis of the Human Development Index (HDI) is not associated with the tourism variables.

Keywords: tourism, social welfare, factorial analysis, Mexico

Introduction

Tourism is a key branch of the services sector to the country's economy since 2009 ranks third among the leading foreign exchange earners (9.221 million dollars), oil exports rank first and remittances the second with 30.901 million dollars and 21.181 million dollars respectively (BANXICO, 2010). This represents higher incomes for workers in this sector, on average people with an activity related to tourism are paid wages 30% higher than other sectors of the economy (Carral, 2006).

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The objective of this study is to determine which variables impact on the tourism in the Mexican providence of Michoacan and also to find out if the tourism sector is impacting on social welfare of Michoacan province, Mexico.

In Michoacan, as in many provinces of Mexico, tourism represents a significant percentage of its GDP, being that for 2006 it was 17.2 percent (Secretaría de Turismo, 2006). The evolution of economic indicators, geographical location, diversity of attractions, the history and culture, cultural heritage and the magical towns, make the province of Michoacan fundamental importance object of study of where the competitiveness of this sector, constitute a priority to identify the advantages and disadvantages of this province in the national environment, in the national tourism and the international one (Gutiérrez, Rodríguez, & Vázquez, 2006).

Due to the diversity of variables that impact on tourism according to the literature review (Castillo & Rodríguez, 2002; Seoane et al., 2009; Guerrero & Ramirez, 2007), the different effects of tourism on the economy and to obtain a detailed study of competitiveness 41 variables were selected to show the degree of competitiveness of tourism sector in 63 most important municipal entities of Michoacan.

The 41 variables used to measure the competitiveness of the sector were grouped into six dimensions: cultural resources, tourism infrastructure, natural resources, people flow, additional services, economic indicators and social welfare this last one dimension with the objective of link tourism competitiveness with their impact on this essential part of any society. All the data collected was provided for the tourism office of the province and the Tourism Secretary of México, for the year 2010.

Dimensions with their corresponding variables are as follows:

- (1) Cultural resources. Library number, number of historical monuments, temples and shrines number with tourism potential, traditional festivals number, number of museums and houses of culture;
- (2) Tourism infrastructure. Lodging establishments including five-star, four-star and three-star, quarter total, total hotels, motels total, total units accommodation alternative total suites, inns total, total trailer park, other units accommodation, rooms for every 1,000 habitants and occupancy rate;
- (3) Natural resources. Jungle surface area per hectare and forest surface area per hectare;
- (4) Flow of people. Total visitors, domestic visitors and foreign visitors;
- (5) Additional services. Number of travel agencies and restaurants;
- (6) Economic indicators. Dollar GDP, GDP at current prices, GDP per capita in U.S. dollars, GDP per capita at current prices, percentage of the economically active in the tertiary sector, percentage of the economically active men in the tourism sector and percentage of the economically active women in the tourism sector;
- (7) Social welfare. Total population, men and women, PEA and the Human Development Index (HDI).

The paper's structure is divided in three sections: the first section is the research method then briefly explaining the methodology of correspondence factor analysis; the second section is the research design where explains the different stages of the correspondence factor analysis and the results obtained in each stage; and finally the third section shows the conclusions from the results obtained.

Correspondence Factor Analysis

The study of the competitiveness of tourism sector was conducted through correspondence factor analysis—a multivariate statistical analysis that solves the problem of structure analysis of the interrelationships

(correlations) that exist in a large number of variables and cases, defining a number of common underlying dimensions, called components.

The objective of this technique is to represent the underlying structure that has a group of variables, through the analysis of dependence between variables, the association between attributes, leading to a revision of the intensity of attractions and repulsion, reaching a typing by factors or dimensions that express the behavior of these variables (Callealta, 2005; Kendall, 1990).

One of the advantages of correspondences analysis over other methods is the non-imposition of initial parameters, that is, not classified information in advance, whichever results in the formation factor is given by the information itself, so you get the maximum reliability of the information processed, as well as the conclusions that emerge from this (Kim & Muelles, 1978).

The analysis of similarity (proximity) between the modalities of an attribute (variable)—represented by the respective frequency distributions—conditioned by the distribution of forms of other attribute allows us to analyze the homogeneity of these two different spaces, one p dimension another dimension q , that what is introduced using Benzecri distance, which is a balancing of the points in inverse proportion to their frequencies. The analysis of the association between patterns of two different attributes will be the result of connecting these two spaces and, therefore, projecting a three-dimensional common space where proximity is interpreted as an attraction and repulsion away as applying for this Analysis Principal Components (Kruskal & Wish, 1981).

Research Design

Commonalities and Sedimentation Chart Variables

Within the next step in the Factorial Analysis of Correspondences is the table of commonality. This is a useful tool that shows the degree of dispersion of each of the variables to review, identifying the validity they have in the study (Perez, 2006).

If the level of extraction that shows the table of communalities is less than (0.500) which means that the variable to study is not explained well within the model, because it does not have a significant level of representation, the closer-to-one variable is best represented (Navarro & Zamora, 2010).

The present study shows in Table 1 that the extraction column has a significant degree of representation for each of the variables. The variable that has a lower level of representation is percentage of men pea with a value of (0683). While having a greater degree of representation is the occupancy rate with a number of (0997).

Sedimentation Chart

The second measure of reliability that allows performing the analysis is the number of components or dimensions to be considered. Each dimension shows a percentage of the variables, being that the first dimensions always will have a greater degree of representation, these is expressed in the screen plot as a greater distance on the vertical axis to zero. The screen plot—originally proposed by Cattell—shows if you are leaving out some important components (T. F. Cox & M. A. Cox, 1994).

Figure 1 shows the number of components that will be considered for this work is eight, because the sum represents a cumulative value of 90.39 percent of the total variance. The first dimensions has a value of 51.557 percent, the second dimension or factor the 15.86 percent, the third factor the 6.813 percent, the fourth dimension

4.223 percent, 3.523 percent the fifth, sixth 3.069 percent, seventh the 2.796 percent and finally the eighth dimension has a value of 2.548 percent.

Table 1

Communalities

Variables	Initial	Extraction	Variables	Initial	Extraction
Library number	1.000	0.748	Guest houses	1.000	0.800
Monuments	1.000	0.765	Alternative accommodation	1.000	0.839
Temples and shrines	1.000	0.787	Suites	1.000	0.966
Traditional festivals	1.000	0.691	Inns total	1.000	0.877
Museums	1.000	0.783	Trailer park	1.000	0.899
Jungle	1.000	0.831	Other units accommodation	1.000	0.734
Forest	1.000	0.702	1,000 habitants	1.000	0.948
Total visitors	1.000	0.952	% Occupancy rate	1.000	0.997
Domestic visitors	1.000	0.948	Total population	1.000	0.983
Foreign visitors	1.000	0.956	Men	1.000	0.983
Agencies	1.000	0.979	Women	1.000	0.983
Restaurnts	1.000	0.988	PEA	1.000	0.985
Lodging	1.000	0.988	% PEA man	1.000	0.683
Lodging 5*	1.000	0.962	% PEA woman	1.000	0.817
Lodging 4*	1.000	0.987	HDI	1.000	0.996
Lodging 3*	1.000	0.952	GDP	1.000	0.991
Lodging uncat.	1.000	0.995	GDP per capita	1.000	0.996
Rooms total	1.000	0.985	GDP at current prices	1.000	0.991
Hotels	1.000	0.985	GDP per capita in u.s. dollars	1.000	0.862
Motels	1.000	0.832	% PEA in tertiary sector	1.000	0.936
Total units	1.000	0.977			

Notes. * Category according to the number of starts. Source: Authors' calculations based on the results of the factorial analysis of correspondences.

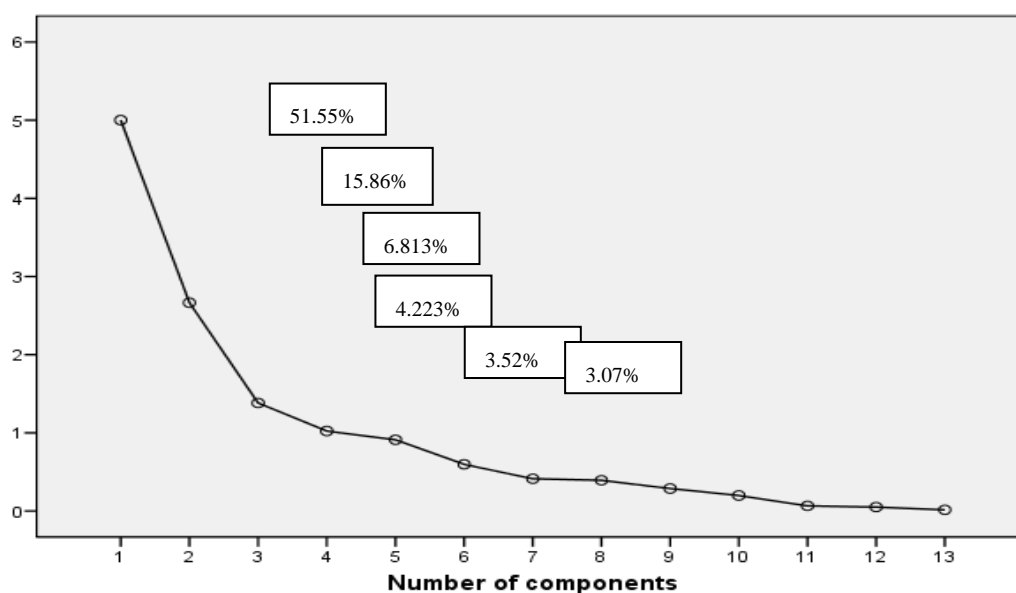


Figure 1. Sedimentation chart. Source: Authors' calculations based on the results of the factorial analysis of correspondences.

Rotated Component Matrix

The first results of correspondence factor analysis are in the matrix components and matrix of rotated components, which indicate the direction in space where the variables, the positive and negative signs show the space dimension where are positioned variables, as well as correlation levels (Navarro & Zamora, 2010).

In the rotated component matrix (see Table 2) it takes the data from the matrix of components and applies a process of standardization by the varimax method, which allows a better representation of variables. The effect of rotation is to redistribute the variance to obtain a pattern of factors or components of greater significance. Varimax rotation criterion focuses on simplifying the maximum column vector of factors (components), the maximum simplification is achieved by reaching values as +1 or -1 and other charges close to 0, which contributes to a better understanding of the variables. The values will show a positive or negative association between the variables and the component or a lack of association if the number thrown is zero number thrown is zero (Santos, Muñoz, Justice, & Curtis, 2003).

Once located each one of the variables in dimensional space, we can appreciate the degree of correlation of each of these in relation to other variables. So that in the first component variables that best explained are: number of temples and shrines, many museums, total visitors, national visitors, foreign visitors, agencies, restaurants, lodging establishments (category: five star lodging establishments, four star lodging establishments, and three star total rooms), number of hotels, total units alternative accommodation, guest houses, suites, total population, men, women, PEA, GDP and GDP at current prices.

For the second component variables are better explained uncategorized lodging establishments, rooms for every 1,000 habitants, occupancy rate, percentage of the economically active men in the tourism sector and percentage of the economically active women in the tourism sector, Human Development Index (HDI) and GDP per capita.

Scoring Charts: By Municipalities and Variables

The Factorial Analysis of Correspondences is interdependent, i.e., all variables are considered simultaneously. The variables are interrelated and form factors that maximize the explanation of all the variables, identifying the structure that exists between them (Santesmases, 1998).

The scores plot shows (in a plane with two axes) is precisely the space where each case is at a point given by coordinates (X , Y) of the two dimensions represented. These coordinates are influenced by the proximity or remoteness to the variables, so this figure expresses the correlation of the cases (municipalities) with the variables, if the cases are affected or benefited by these variables, or if the variables are opposed, juxtaposed etc..

Tourism Sector Competitiveness and Social Welfare in Michoacan

From the scores, plot can be seen as each of the municipalities which are projected into a multidimensional space as a point given by the coordinates of the X , Y . Figure 2 projected along the analyzed variables and cases municipalities, in order to understand more the position of the municipalities for each of the variables.

The X axis shows the variables corresponding to the dimensions of tourism infrastructure, flow of people and complementary services. While in the Y axis, the dimensions considered are the economic indicators and the dimension of social welfare.

Municipalities with more tourist infrastructure, an influx of visitors and a greater number of complementary

services are positioned to the right of the axis of *X*. While the municipalities that account for the economic indicators and improved social welfare in tourism will be located at the bottom of the *Y* axis (see Figure 2).

Table 2

Rotated Component Matrix

	Component							
	1	2	3	4	5	6	7	8
Library number	0.355	-0.044	0.150	0.029	0.731	-0.030	0.189	-0.160
Monuments	0.462	0.020	0.348	0.098	-0.089	0.004	0.642	0.024
Temples and shrines	0.739	-0.016	0.047	0.035	-0.185	-0.101	0.422	0.117
Traditional festivals	0.205	-0.066	-0.063	0.003	0.159	-0.040	0.783	0.026
Museums	0.730	-0.037	0.297	0.184	-0.128	0.041	0.322	-0.070
Jungle	-0.049	-0.038	0.020	0.028	-0.114	-0.110	0.052	0.894
Forest	0.228	0.054	-0.146	-0.085	0.469	0.320	-0.048	0.542
Total visitors	0.896	0.047	0.169	0.131	0.266	0.038	0.170	-0.019
Domestic visitors	0.891	-0.043	0.168	0.116	0.275	0.036	0.183	-0.021
Foreign visitors	0.864	-0.046	0.083	0.425	0.101	0.055	0.076	-0.030
Agencies	0.974	0.032	0.051	-0.127	-0.012	-0.027	0.099	-0.015
Restaurants	0.967	0.215	-0.014	0.017	0.035	0.022	0.063	0.000
Lodging	0.894	-0.080	0.107	0.315	0.215	0.143	0.072	0.006
Lodging 5*	0.945	0.040	-0.030	0.140	-0.216	0.015	-0.018	0.007
Lodging 4*	0.959	0.133	0.040	0.217	0.025	0.006	0.008	0.004
Lodging 3*	0.729	0.200	0.121	0.564	0.126	0.152	0.094	-0.013
Lodging uncat.	0.059	0.986	-0.138	0.009	0.013	0.007	-0.018	0.004
Rooms total	0.948	0.043	0.136	0.149	0.190	-0.005	0.089	-0.013
Hotels	0.946	-0.054	0.150	0.164	0.175	-0.003	0.081	-0.012
Motels	0.759	0.019	0.150	-0.116	0.411	0.005	0.225	-0.011
Total units	0.904	-0.073	-0.025	0.225	0.099	0.303	-0.005	0.026
Guest houses	0.833	-0.059	-0.001	0.013	0.204	0.180	0.161	0.047
Alternative accommodation	0.075	-0.040	-0.028	0.362	0.139	0.823	-0.019	-0.053
Suites	0.952	0.002	-0.069	-0.091	-0.209	-0.053	-0.035	0.011
Inns total	-0.008	-0.027	-0.018	0.020	-0.088	0.931	-0.036	0.000
Trailer park	0.089	-0.013	0.029	0.904	-0.012	0.257	0.076	-0.019
Other units accommodation	0.124	-0.032	0.064	0.566	0.615	0.002	-0.100	0.076
1,000 habitants	0.022	0.967	0.044	-0.008	-0.026	0.010	-0.093	0.032
% Occupancy rate	0.021	0.987	-0.148	-0.003	-0.012	-0.018	-0.012	-0.001
Total population	0.962	0.011	0.159	-0.044	0.147	-0.020	0.089	0.013
Men	0.956	0.127	0.140	-0.044	0.151	-0.025	0.085	0.014
Women	0.962	0.035	0.157	-0.045	0.142	-0.019	0.090	0.012
PEA	0.958	-0.075	0.176	-0.043	0.147	-0.029	0.086	0.004
% PEA man	-0.131	-0.624	0.336	-0.052	-0.048	0.100	-0.324	0.208
% PEA woman	0.198	-0.500	0.713	0.050	0.035	0.023	0.011	-0.122
HDI	0.021	0.991	-0.112	-0.005	-0.015	-0.013	-0.030	0.006
GDP	0.982	-0.064	0.115	-0.065	0.022	-0.052	0.046	0.001
GDP per capita	0.021	0.991	-0.112	-0.005	-0.015	-0.013	-0.030	0.006
GDP at current prices	0.982	-0.064	0.115	-0.065	0.022	-0.052	0.046	0.001
GDP per capita in u.s. dollars	0.440	-0.398	0.696	-0.015	0.086	-0.130	-0.021	0.035
% PEA in tertiary sector	0.397	-0.370	0.765	0.106	0.160	-0.029	0.137	0.027

Notes. * Category according to the number of stars. Source: Authors' calculations based on the results of the Factorial Analysis of Correspondences.

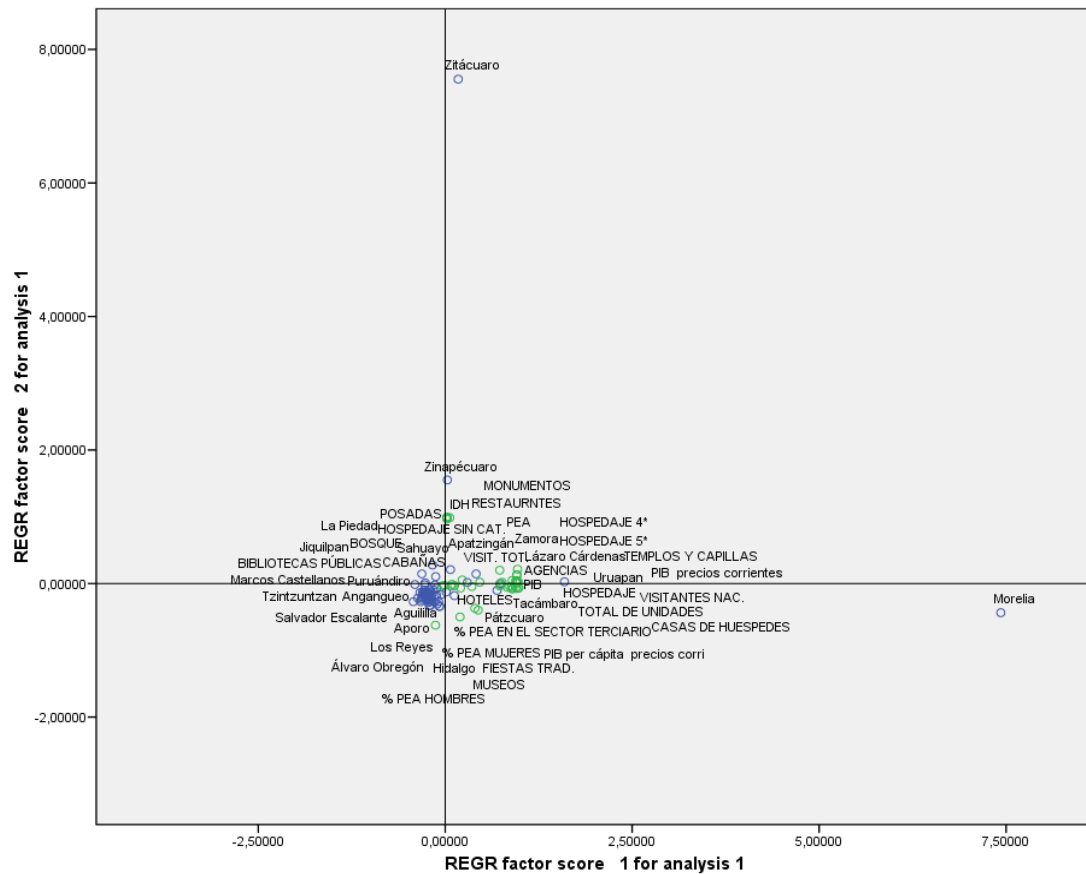


Figure 2. Variables and provinces scoring charts. Source: Authors' calculations based on the results of the factorial analysis of correspondences.

Disaggregated so we can see more clearly the location of the variables of each of the respective dimensions and position of the municipalities under study, for which we look at Figure 3.

Within municipalities associated with tourism competitiveness are Morelia, Uruapan, Patzcuaro, Lazaro Cardenas, Anganguero and Zamora. These municipalities are placed them on the right side of the axis of X. While the towns associated with social welfare product of tourism sector are Morelia, Patzcuaro, Anganguero, Hidalgo, Uruapan, Lazaro Cardenas—Cartesian plane quadrant IV (see Figure 2). Therefore, the dimensions that account for tourism competitiveness are associated with the dimensions of social welfare, where the occupation that is generated in this sector is an expression of it.

Conclusion

Factor analysis is a multivariate statistical technique whose goal is the definition of an underlying structure in a data matrix. Factor analysis can solve the problem of analyzing the structure of interrelationships in a large number of variables and cases, defining a number of common underlying dimensions, called components.

One advantage of this approach is that the researcher does not present the relationships expected but on the contrary, the variables and cases converge consistent with the attributes of each case—municipalities.

The results of these correlations are reflected in the rotated component matrix, which shows us in what dimension each variable is represented and the direction in space that is projected.

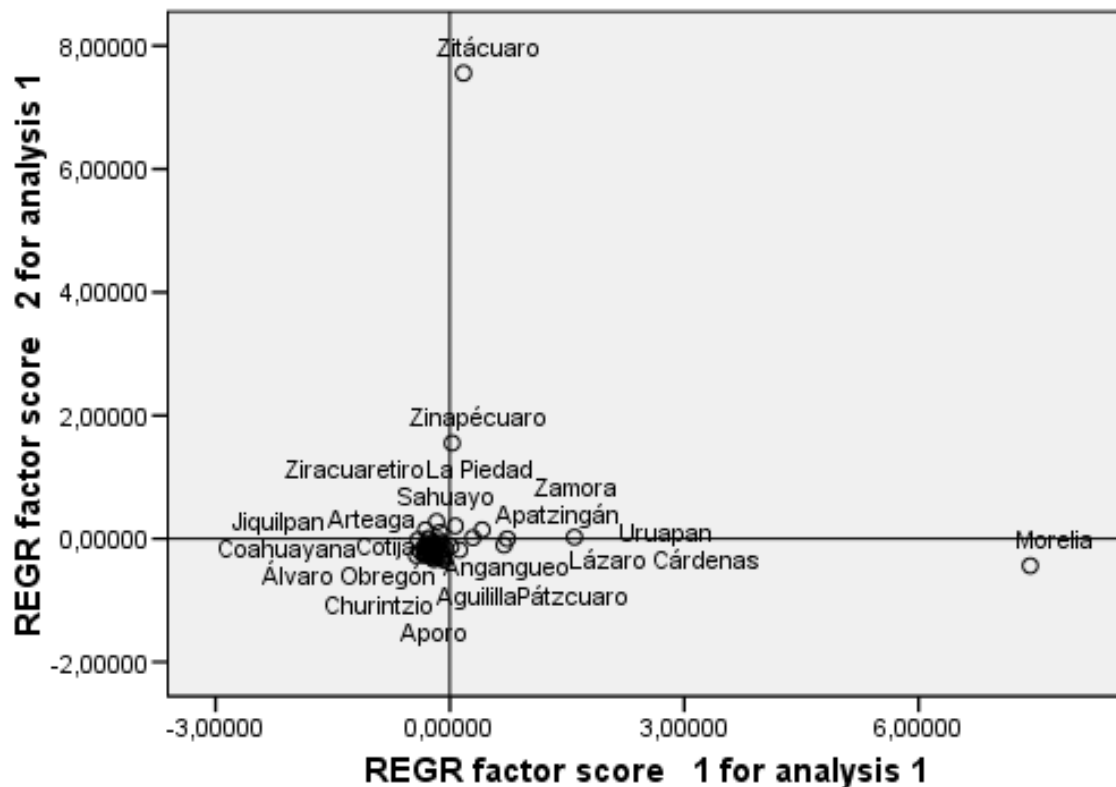


Figure 3. Provinces scoring charts. Source: Authors' calculations based on the results of the factorial analysis of correspondences.

Finally the scores plot shows in the two-dimensional analysis of the axes (X, Y) the position of the municipalities in one of four quadrants, showing that:

The variable located within the tourism infrastructure, flow of people and complementary services are directly correlated, because all these are located in factor 1.

Dimensions and economic indicators of social welfare also interrelate with each other, as it is expressed by the factor 2.

In the Cartesian plane, competitiveness of the tourism sector is explained by the aforementioned dimensions and is given by those cases—municipalities, which are located in this space, where the variables that stand out are: restaurants, lodging with category five and four star travel, visitors foreign share of the EAP in the tertiary sector, percentage of EAP women, percentage of economically active men and GDP per capita.

The analysis of the Human Development Index (HDI) is not associated with the tourism variables, because even though the sector accounts for variables referenced in this case, the HDI is that of all economic sectors.

Within municipalities associated with tourism competitiveness are Morelia, Uruapan, Patzcuaro, Lazaro Cardenas, Angangueo, and Zamora (place them on the right side of the axis of X). While in the towns associated with social welfare are products of tourism sector to Morelia, Patzcuaro, Angangueo, Hidalgo, Uruapan to Lazaro Cardenas (at the bottom of the axis Y).

The study reflects the importance of tourism in the state sector since the spills generated by the concept of job are outstanding; in addition to that there are several municipalities that have a substantial infrastructure around it and thus are benefiting from it.

The Economically Active Population (EAP) dedicated to the tourism sector points out that women are more dedicated to this area than men.

Although tourism is an important economic source for many municipalities the lack of tourism infrastructure is obvious, because while Morelia is the municipality with the highest level of infrastructure indicators, municipalities as Angangueo despite having a strong sector of the population working in this area do not count on with these variables.

The tourism competitiveness asymmetries reflect that the municipalities in the province of Michoacan such as tourism infrastructure, flow of people and complementary services contrasted with the dimensions of social indicators and welfare through correspondences analysis, lead to the immediate need to move around more effective public policies to enhance the province in tourism.

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