An Analysis of Disabled Persons and the Labour Market in Mexico

Abstract

The aim of this work is to analyze the situation of disabled people in the labour market in Mexico, taking into account socio economic variables, and the spatial dimension. The results of our analysis provide guidelines for actions geared at improving the inclusion of disabled people in the labour market, and, as a consequence, in society. We apply cluster analysis to 32 Mexican Federal States using XII Census data for the year 2000, that allow us to identify spatial correlation processes and therefore spatial clusters. A dual structure emerges in the distribution of disabled people in the Mexican labour market, showing that effective economic policies to encourage the inclusion of disabled people into the labour market must take into account the socio-economic diversity of different geographical areas.

Keywords: *Disabled People, Public Policy, Non-Labour Market Discrimination, Cluster Analysis, Spatial Correlation.*

JEL: *J14, C61, J48, C21.*

1.Introduction

The twentieth century has shown an outstanding advance of the theme of disability that has kept on growing strongly during the first years of the twenty first century; in fact, it has gained importance among the professionals, the intellectuals and society in general. The problems of these people have been exposed unreservedly in the Mexican Congress as well as in educational, health and economic forums; the first article of the Mexican Constitution says that it is the responsibility of the State to watch for the maintenance of equality among Mexicans such that discrimination of any kind, in particular against disabled citizens, should not exist; also, there exists the ***Ley General de las Personas con Discapacidad (General Law for the Disabled Persons).*** Its main objective is to establish the basis that guarantees full inclusion of these citizens in a framework of equality all over the situations of life, and in particular in the right to work, as established in Article 9 of Chapter 2, under the responsibility of the Federal, Statal and Municipal levels of government.

The aim of our work is to analyze the situation of disabled people in the labour market in Mexico, with a view to provides guidelines in order to improve their inclusion in the labour market and in society. Analyzing the data of the XII Census of the Population in Mexico for the 32 Mexican Federal States, the latest available at the time of our writing, we investigate the territorial aspects of the labour market of disabled people. In the first part of the paper we provide a general, aggregate description of the labour market situation of disabled people. In the second part of the paper we provide a statistic analysis of the labour market situation of disabled people. Starting from the analysis of the correlation coefficient, we move on to cluster analysis that allows us to identify a possible dual structure in the labour market of disabled people; we then proceed to verify the presence of spatial correlation processes that enable us to identify spatial clusters. In this regard, we make reference to techniques of spatial statistics: Moran's I and LISA cluster map. The results of our investigation show a dual structure in the distribution of disabled people in the Mexican labour market, suggesting that effective economic policies for the inclusion of disabled people into the labour market must be differentiated in order to take into account the socio economic characteristics of different Federal States.

This paper is organized as follows: section 2 provides an overview of the situation of disabled people in the Mexican labour market; section 3 develops an empirical investigation on local labour markets of disabled people at the level of Mexican Federal States, in terms both of variables strictly related to the labour market, and also of variables related to the socio economic conditions of the various Federal States. In particular, subsection 3.1 outlines the steps and methods of the investigation and the data used; subsection 3.2 develops the analysis of the Participation Rate of Disabled People (PRDP) in terms of coefficients of correlation; subsection 3.3 develops cluster analysis; subsection 3.4 presents the analysis of spatial correlation; section 4 offers some conclusions and policy implications.

2. Disabled people and the labour market in Mexico

In this section we summarize information on the general working situation of disabled people in Mexico, according to the information contained in the XII General Census of Population and

Household 2000 (XII Censo de Poblacion y Vivienda 2000), the latest available at the time of our writing. The Census questionnaire has some very specific questions on disability in its section on the characteristics of people, Question 6 has the title "do you have limitations " and allows to identify people with disabilities, in the sense of people characterized by some physical or mental limitations; it contains a set of sub-questions on whether the interviewed person suffers from a list of limitations, i.e. walking, impediments on the upper limbs, deafness, speech impairment, blindness, mental deficiency, other physical or mental deficiencies; the final sub-question asks to confirm that there are no physical or mental limitations. Question 7 has the title "how have you been affected by this limitation" and it investigates the causes of the limitations, with a set of sub-questions asking whether the limitation derives from birth, from an illness, from an accident, from old age, from other causes. We concentrate on question 6[1], and we identify as disabled people those who suffer from some form of physical or mental limitation; from the replies to subsequent questions it is possible to identify the situation of disabled people with respect to work. In this respect it is necessary to recall that in Mexico persons with aptitude for work are those aged at least 12.

The data of the XII Census provide a detailed description of the situation of disabled people, with respect to participation, employment, wage, hours worked, and level of education as summarized in Table 1. Unfortunately, the available data do allow an analysis in terms of the gender or the age of disabled people.

TABLE 1 - Situation of disabled people over 12 year of age, and work

ECONOMICALLY ACTIVE POPULATION		ECONOMICALLY INACTIVE POPULATION	NOT SPECIFIED	TOTAL
402,237		1,188,615	15,038	1,605,890
Employed	Not employed			
397,183	5,054			
PARTICIPATION RATE of DISABLED PEOPLE (PRDP) = 402,237/1,605,890				
25.05				

Source: our calculation on the published data from the XII Censo de Poblacion y Vivienda 2000

Table 1 shows that out of 1,605,890 disabled persons aged at least 12, 402,237 were the "economically active population"; 397,183 of them were occupied and 5,054 did not have any job. 1,188,615 disabled people were registered as "economically inactive population" and the remaining 15,038 as "not specified". Disabled people have a much lower rate of participation[2] in the labour market (25%), compared with the one (49.3%) of the rest of the population. In Mexico 33% of citizens with incapacities obtain income by running their own small firm.

[1] With this procedure, we use the concept of self reported disability. This choice is widely made in the literature, as for instance in all the article on disability which use European Union SILC data.

[2] As usual, the participation rate to the labour market of disabled people (PRDP*)* is defined as the ratio between the number of disabled people economically active, and the total number of disabled people in working age, i.e. above 12 years of age.

The distribution of employed disabled people among sectors of activity is shown in Table 2.

TABLE 2 - Distribution of employed disabled people by sector of activity (%)

SERVICE AND TRADE	INDUSTRY	AGRICULTURE (including animal breeding, silviculture, fishing and hunting)	UNSPECIFIED
48.5	24.4	23.4	3.7

Source: our calculation on the published data from the XII Censo de Poblacion y Vivienda 2000

This national level structure is also replicated in most of the Federal States; however in several Federal States, especially in those with agricultural and cattle raising vocation, the importance of the sectors changes, i.e. disabled people were mostly occupied in the agricultural sector in Chiapas and Ihdalgo; in other Federal entities the service sector was identified as the source of employment well above the national average, as in Campeche, Guerrero, Michoacán, Nayarit, San Luis Potosí and Sinaloa.

In following Table 3 we analyze the wage distribution of the salary received daily by the 397,183 employed disabled people, comparing it with the wage distribution of not disabled people.

TABLE 3 - Distribution of Wage received by disabled and not disabled people (%)

	W=0*	W <= Wm	Wm<W<=3Wm	W>3Wm	Wnot specified
Disabled People	12.9	21.9	37.4	14.9	6.7
Not disabled people	8.3	12.2	48.1	26.1	5.4

Source: our calculation on the published data from the XII Censo de Poblacion y Vivienda 2000

W= wage, Wm= minimum wage

***we interpret the situation of work for no wage as that in which workers, perhaps in agriculture, receive just board and lodging in exchange for work.*

Table 3 shows that the frequency of people receiving W <= Wm is higher for disabled people with respect to that of not disabled people: the percentage of people perceiving no wage at all is higher among disabled people in comparison with not disabled people, and so is the percentage of disabled people receiving a salary at most equal to the minimum wage, i.e. 21.9% for disabled people vs 12.2% for not disabled people. Above the minimum wage the relationship swaps direction, as the percentage of disabled people receiving a wage higher than the minimum one is lower than that of not disabled people, both for wages above and much above the minimum wage.

In Table 4 we analyze the distribution of hours worked by not disabled and disabled people.

TABLE 4 - Distribution of hours worked by not disabled and disabled people (%) *

Hours	< 32	33-40	41-48	>48	TOTAL Number of employed people
Not disabled people	18.93	19.44	28.21	30.23	33,221,464
Disabled people	27.83	16.02	22.36	28.98	397,183
Unspecified					111,563

Source: our calculation on the published data from the XII Censo de Poblacion y Vivienda 2000

**an astonishing 12.0% of disabled people declared to work more than 64 hours a week, but this can probably be interpreted in terms of people who receive board and lodging as part of their salary.*

The distribution of hours worked shows that relatively more disabled people work less than 32 hours a week when compared with not disabled people, and the reverse is true for people working more than 33 hours a week. However, only 16.0% of Employed disabled persons declared that they worked between 33 and 40 hours weekly, i.e. the prescribed weekly official time set by labor legislation in Mexico; 51.4% of disabled people worked more than 40 hours a week. Here comes up the following reflection: why does the law allow them to work more than 40 hours weekly? Is this not an attempt against their health? Would not it be better they spent this time in educational and training activities?

3. Empirical investigation on local labour market for disabled people: an empirical analysis on Mexican Federal States

3.1 Introduction, steps and methods of investigation, and data used.

After the macro description of the Mexican labour market for disabled people, we now proceed to a more disaggregate analysis, using published Census data at the level of Mexican Federal States; we develop spatial analysis, for the purpose of identifying Mexican areas which show similar characteristics in terms of the labour market for disabled persons and of socio economic variables. The purpose of this exercise is to identify similarities among areas which go well beyond administrative boundaries, and are likely to require similar instruments of economic policy geared at improving the employment situation of disabled people. In addition, identifying spatial correlation shows the possibility that contiguous areas influence each other, so that instruments of economic policy applied to one area within a cluster may produce results not only in the given area, but also in contiguous areas, because of invisible spatial links between contiguous areas. The analysis is developed in terms of variables strictly related to the labour market, i.e. participation rate of disabled people (PRDP) and employment rate of disabled people (ERDP) with various levels of education and wages; and also in terms of three general socio economic or environmental variables, i.e. the rate of growth of Gross National Product (GNP), the Human Development Index (HDI), and Population Density (PD). The analysis is organized in three subsections, according to the following steps and methods of investigation: in 3.2 we analyse the participation rate of disabled people (PRDP) by calculating the coefficient of correlation between PRDP and the other variables; in 3.3

we apply cluster analysis to identify groups of Federal States, heterogenous between the groups, but rather homogeneous within each group; in 3.4 we develop the analysis of spatial correlation, using tool of spatial statistics allowing to test for local spatial autocorrelation and to identify local clusters where contiguous areas show similar values. Among the various possible tools to be used for this purpose, we use here the Moran Index, and the **L**ocal **I**ndicators of **S**patial **A**utocorrelation (LISA) cluster map.

We use data from the 2000 Mexican Census (the most recent at the time of our writing) at the level of 32 Mexican Federal States. We use the aggregate data at the level of Federal States published by INEGI, XII Census General de Poblacion y Vivienda, 2000, at the web site:

http://www.inegi.org.mx/sistemas/olap/proyectos/bd/consulta.asp?c=10252&p=14048&s=est

3.2 Analysis of the PRDP, and first results

In this part of the investigation, we explain factors which may explain the distribution of PRDP across Mexican Federal States. The intuition behind our analysis is that disabled people decide to participate in the labour market both taking into account the general characteristics of their environment, and also the personal characteristics of disabled persons who are themselves already employed; the first group of variables indicates how favourable the environment appears to be with respect to the employment of disabled people; the second group of variables records the success of the employment of disabled people. As indicators of the environment we propose measurements connected with the rate of growth of Gross National Product (GNP), the Human Development Index[3] (HDI), and the Population Density (PD). As indicators of the labour histories of already employed disabled people the macro data illustrated in the first part of this work suggest to use the following variables: the employment rate of disabled people (ERDP)[4], the salary that employed disabled people receive, and the level of education of employed disabled people, in order to catch the effect of professional competence which education indicates. We express these variables in terms of the participation rate of disabled people[5], the % of employed disabled people without any education, with primary, or secondary, or higher or above higher education (masters, doctorate, etc), the % of employed disabled people who receive no salary, who receive a salary at least as large as the minimum wage[6], and who receive a salary larger than the minimum wage;

[3] The *Human Development Index* (HDI), measures the average results obtained in a country with respect to three basic aspect of human development:

a. **a long and healthy life,** measured in terms of expected life at birth;
b. **knowledge,** measured by a combination of adults' literacy rate **(**weight 2/3) and of the general gross schooling rate, considered at the level of primary, secondary and tertiary education (weight 1/3);
c. **dignified life style,** measured by per capita GNP expressed in PPA dollars.

[4] We consider the employment rate of disabled people with the following maximum achieved levels of education: without any education, with primary, or secondary, or higher or above higher education.

[5] The ratio between active disabled people over 12 and the total of disabled people over 12.

[6] All employment rates are calculated considering the number of employed disabled people with different levels of education and with different level of wages with respect to the total population of disabled people over 12.

We use as method of investigation the analysis of the correlation coefficient between the PRDP and the other variables above mentioned.

First we examine the correlation coefficients of PRDP and variables related to the labour histories of already employed disabled people.

Table 5 - relationship between the PRDP and ERDP with different levels of education

	PRDP	ERDP without any education	ERDP with just primary education	ERDP with just secondary education	ERDP with just higher education	ERDP with education above higher
PRDP	1.0000					
ERDP without any education	0.2387	1.0000				
ERDP with just primary education	-0.3447	-0.8596*	1.0000			
ERDP with just secondary education	-0.1992	-0.9384*	0.7828*	1.0000		
ERDP with just higher education	-0.0878	-0.9251*	0.6523*	0.8360*	1.0000	
ERDP with education above higher	-0.1697	-0.8425*	0.5305*	0.7017*	0.8858*	1.0000

*** Significant at 5%.**

Table 5 shows the value of the correlation coefficient between the Participation Rate of disabled people, and the employment rate of disabled people with various levels of education. The table shows that the correlation coefficient between PRDP and the ERDP with whatever level of education is never significant. A supply side interpretation is required to explain these results: disabled people do not have high expectations in terms of jobs, and therefore in order to decide whether to participate in the labour market do not use as a benchmark the educational level of already employed disabled people.

Table 6 - Relationship between the PRDP, ERDP with various level of wages, and socio economic variables

	PRDP	ERDP without salary	ERDP with wage up to minimum wage	ERDP with wage above minimum wage	Density of population	rate of growth of GNP	HDI
PRDP	1.0000						
ERDP without salary	0.2926	1.0000					
ERDP with wage up to minimum wage	0.4835*	0.7164*	1.0000				
ERDP with wage above minimum wage	-0.4035*	-0.9312*	-0.9157*	1.0000			
Population density	0.0214	-0.2524	-0.0625	0.1644	1.0000		
rate of growth of GNP	-0.1051	-0.2387	-0.3222	0.2986	-0.0813	1.0000	
HDI	-0.0960	-0.8111*	-0.6308*	0.7862*	0.4246*	0.1348	1.0000

*** Significant at 5%.**

Table 6 shows a positive and statistically significant value of the correlation coefficient between the PRDP and the % of employed disabled people who receive a salary at most equal to the minimum wage; however, the value of the correlation coefficient between the PRDP and the % of employed disabled people who receive a wage larger than the minimum wage appears to be

negative and significant. As before, these results can be explained from the supply side, i.e. disabled people have very low expectations in terms of jobs, and therefore in order to decide whether to participate in the labour market use as a benchmark the employment situation of disabled people with very low salaries, even though not the employment situation of disabled people who receive no salary at all. Finally, Table 6 also examines the correlation coefficient between RPDP and variables related to the environment: the sign of the correlation coefficient between the PRDP and PD, and the rate of growth of GNP, and the HDI is negative for the three variables, but not significant. Variables related to the socio economic situation appear to be irrelevant in attracting disabled people to participate to the labour market.

The results of this first analysis provide suggestions for economic policy: the participation of disabled persons in the labour market does not improve with the general well being of the areas, expressed in terms of environmental factors like HDI, and the rate of growth of GNP. Active and specific labour market policies, directly geared at disabled people, appear to be required in order to improve their participation in the labour market.

3.3 Cluster analysis

We carry on our analysis by applying cluster analysis (CA) to Federal States, in order to identify groups of States which show characteristics heterogenous between one another, but similar within each group (cfr. for instance Nosvelli, 2006, and also Cerioli and Zani, 2007).

Before applying cluster analysis, the usual analysis of principal components is applied to the original variables, (see for instance Friedman and Meulman, 2004) in order to identify the variables to be used in the cluster analysis; in other words, we apply cluster analysis to a subset of the original variables, i.e. to those variables which have the highest correlation with the first k principal component, given that the remaining ones turn out to be scarcely connected with the basic aspects of our investigation. The choice of the proper number of principal components takes place on the basis of three criteria which take into account their explanatory power[7].

On the basis of the results of the analysis, we choose only two principal components that we define as follows: a synthetic indicator of the level of education of employed disabled people, and a synthetic indicator of the socio environmental variables. The matrix of correlation of the initial variables with the two selected principal components, here not shown for brevity, shows that the only variable left out from the analysis is the rate of growth of GNP[8].

We now proceed to cluster analysis. We present the results for the hierarchical method of classification with complete linkage. This method assumes as distance between two groups G_1 and

[7] First we consider a number of principal components which take into account at least 95% of the variance of each of the k initial variables, which imposes a minimal threshold; second, we keep all the principal components whose eigen value is larger than 1; third, we observe the screen plot of the eigen values as a function of the number of principal components; as eigen values are obtained in decreasing order, the graph will show a decreasing curve, with a kink in correspondence to the proper number of principal components

[8] Standardized deviations are taken into account, given that HDI and population density are expressed in a unit of measure different from the other variables.

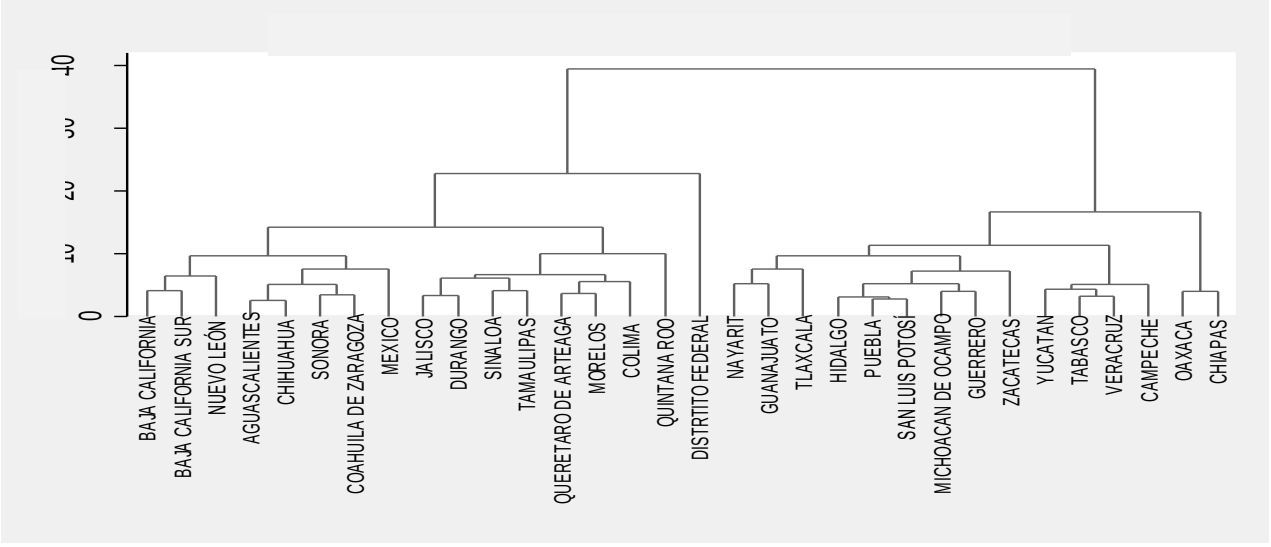
G_2 the maximum distance between pairs of elements each belonging to group G_1 and to group G_2. In this case we have:

$$d(G_1, G_2) = \max d(x_i, x_j) \quad \forall x_i \in G_1 \text{ e } \forall x_j \in G_2$$

This method tends to produce compact clusters without any chain effect and it is invariant with respect to monotonic transformations of distance (Cerioli and Zani, 2007)[9]. This algorithm of aggregation clearly shows the differences among elements: it highlights homogeneity among the elements of a group, rather than the differences between groups.

Fig 1 shows some results of the cluster analysis: two clusters clearly emerge, if one cuts the dendogram at the height 15 of the indicator of dissimilarity (vertical axis) where the only anomalous values refer to the Federal States of Oxaca and Chapas. The clustergram (Schonlau, 2002) as well identifies two clusters (Fig 2), and so does the Calinski/Harabasaz index that allows us to choose the suitable number of groups in terms of which the analysis should be developed (Table 7); in particular, we choose the number of clusters at which the Calinski / Harabasz pseudo-F assumes the highest value; in our case the highest value of the test (27.34) is obtained in correspondence to a number of clusters equal to two.

Fig. 1 – Dendogram: method of complete linkage



[9]We developed several other methods of cluster analysis, i.e. the one with the hierarchical method of classification (in particular, the method of single linkage, and the method of complete linkage); and the one with not hierarchical method of classification (method of the k averages). The method of single linkage confirms the robustness of our results; the method of k averages does not provide additional findings to the investigation, but mainly confirms the results already obtained. For brevity these results are not reported here.

Fig. 2 – Clustergram: method of complete linkage

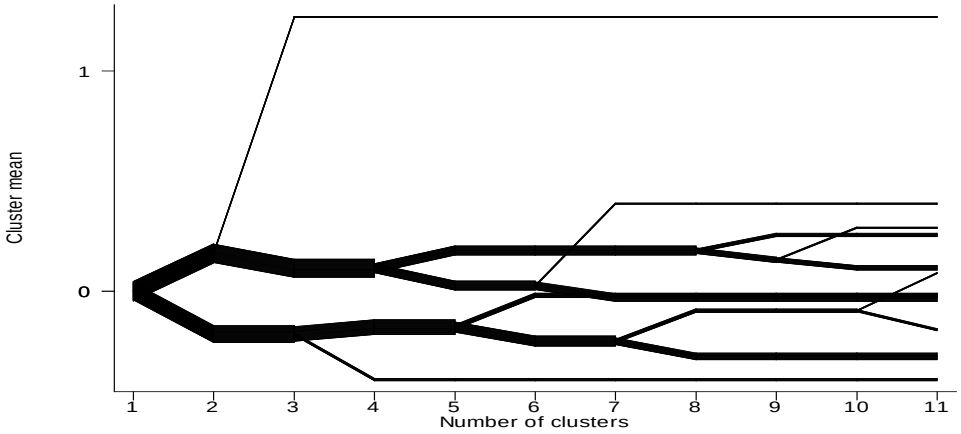


Table 7 – Calinski/Harabasz pseudo-F: method of complete linkage

number of clusters	Calinski/Harabasz pseudo-F
2	27.34
3	24.48
4	21
5	20.78
6	19.93

Table 8– Average values of the indicator in each cluster: method of complete linkage

Cluster	**1**	**2**
PRDP	-1.69E-01	0.190971
ERDP without any education	-7.31E-01	0.828852
ERDP with just primary education	0.6305689	-0.7146447
ERDP with just secondary education	0.689632	-0.78158
ERDP with just higher education	0.695997	-0.7888
ERDP with education above higher	0.582779	-0.66048
ERDP without salary	-0.75246	0.852791
ERDP with wage up to minimum wage	-0.71426	0.809491
ERDP with wage above minimum wage	0.794897	-0.90088
Population density	0.165428	-0.18748
HDI	0.697799	-0.79084

The values in Table 8 are standardized, therefore when positive or negative indicate values respectively above or below the average. The values in this table, which are the numerical result of cluster analysis, suggest that Federal States where environmental conditions are above average (i.e. HDI and Population Density) show also above the average employment conditions of disabled people, both in terms of level of salary received, and in terms of professional qualifications. In the first cluster, charachterized by a high HDI and a high PD, the level of education of employed disabled people is above average, and so is their level of wage, while below average is the percentage of disabled people with no salary, or with a salary at most equal to the minimum wage. On the opposite, the second cluster identifies Federal States with below average environmental variables, and employed disabled people with very low qualifications: high levels of employed disabled people without any education, below the average percentage of disabled people with any other educationals level, but above the average work for no salary, or for a salary below the minimum wage, and below the average for other levels of wage. These findings suggest that general well being goes together with general above the average conditions of employment of disabled people. General policies geared at improving the general well being of an area appear therefore suitable to improve the employment situation of disable people.

A second finding of the analysis concerns the PRDP. With respect to the participation rate of disabled people, the first cluster characterized by high general well being shows a below the average PRDP, while the second cluster shows an above the average PRDP. The cluster analysis seems to confirm the findings of the correlation analysis in subsectin 3.2 above, showing that PRDP does not appears to respond to the variabled considered, so that participation can only be affected by active and specific policies towards disabled people.

3.4. Analysis of spatial correlation for the Mexican labour market of disabled people

Our previous results have shown two rather remarkable clusters in terms of variables connected with the local labour markets of disabled people. We now investigate whether there are processes of spatial correlation; spatial interdependence appears in terms of spatial concentration of similar or different values (respectively, positive or negative interdependence). A proper indicator of spatial interdependence is necessary in order to measure its intensity, and allow for comparisons across countries or over time. Among the many indicators developed by the literature we choose the I Moran Index, i.e. the most traditional among the indicators of spatial correlation, which has the following definition[10].

[10] The I Moran Index is similar to the correlation coefficient: it varies between zero and one, -1 and +1. When I equals zero, there is no spatial auto correlation; when I is close to -1 or to +1 there is high spatial correlation, respectively negative or positive.
The I index has the following main characteristics when compared to the coefficient of correlation:

a. it takes one, and not two, variable into account;
b. it incorporates the weights (w_{ij}) which index the relative areas;
c. it is appropriate to think of it as :"the correlation between neighbouring values on a variable" (O'Sullivan and Unwin 2003).

$$I = \frac{\sum_i \sum_j W_{ij}(X_i - \mu)(X_j - \mu)}{\sum_j (X_j - \mu)^2}$$

Xi and *Xj* indicate the variable describing the phenomenon under investigation respectively observed in region *i* and in region *j*, μ is the average value in the sample, and W_{ij} is the standardized matrix of spatial contiguity, which specifies the criteria for defining contiguity. (For a discussion of this matrix see Appendix A). This index allows us to establish the relationship existing between a phenomenon observed in a given Federal State j and the same phenomenon observed in contiguous Federal States. In our analysis we have included all the variables so far used, except for the rate of growth of GNP, consistently with the results of the analysis of principal components.

Table 9 show the results of the analysis: the I Moran index is constantly significant, and a process of positive spatial correlation emerges for all the variables considered.

Table 9 – Moran I index with matrix of contiguity of Rook and Queen type[11]

Variabili	I_Moran (queen matrix)	I_Moran (rook matrix)
PRDP	0.63***	0.6156***
ERDP without any education	0.3731***	0.4029***
ERDP with just primary education	0.3872***	0.4108***
ERDP with just secondary education	0.2834**	0.3151**
ERDP with just higher education	0.3981***	0.4222***
ERDP with education above higher	0.2086**	0.2316**
ERDP without salary	0.4159***	0.4499***
ERDP with wage up to minimum wage	0.5763***	0.5896***
ERDP with wage above minimum wage	0.5507***	0.5804***
Population density	0.0765**	0.0765**
HDI	0.3415***	0.3668**

***, **, *: 1%, 5%, 10%.

[10] Cfr. Anselin 1988. For a discussion of the matrix of contiguity see Appendix A.

Table 9 shows that the signs of the Moran Index are the same whether calculated with the Queen or the Rook matrix of contiguity, and so are almost always the values of the I index; these results for both matrixes confirm the robustness of our estimates. The signs of the I Moran index are all positive: this indicates positive spatial correlation for all the variables considered in the analysis. As an example, we illustrate the implications of these results for PRDP: a high level of PRDP observed in a particular Federal State is associated to high levels of PRDP in contiguous Federal States. This interpretation is valid for all the variables considered, as they all show positive spatial correlation. However, the intensity of the spatial correlation varies among variables: PRDP shows the strongest spatial correlation, with a value of the I Moran Index above 0.60, while PD shows the weakest, almost not existing, correlation, with a value of 0.08.

These results have implications for economic policy, as positive spatial correlation suggests that policy applied in one Federal State has effects on contiguous Federal States as well.

We now apply the **L**ocal **I**ndicators of **S**patial **A**utocorrelation (LISA), a tool of spatial statistics allowing us to test for local spatial autocorrelation and to identify local clusters where contiguous areas show similar values. LISA provides information about the position of the spatial clusters and about the types of spatial correlation. The LISA statistic is described by the following expression:

$$LISA = \frac{(X_i - \mu)}{\sum (X_i - \mu)} \sum_j W_{ij} (X_j - \mu)$$

where the symbols have the same meaning as in the I Moran Index.

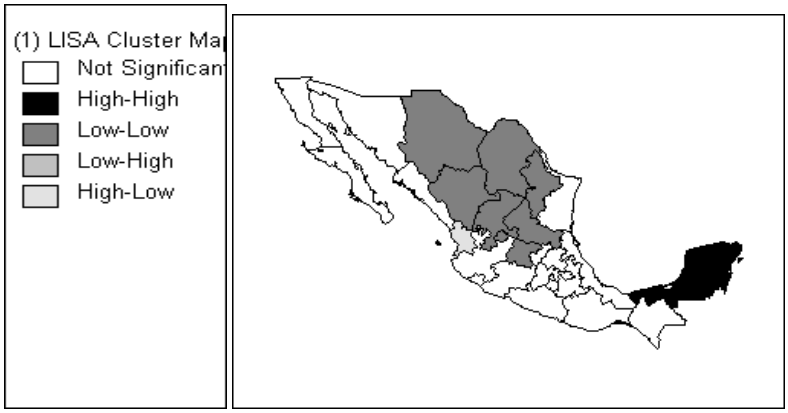
In the LISA cluster maps grouped as Fig. 3 we associate black to a spatial correlation High - High, dark grey to spatial correlation Low-Low, grey to Low-High and light grey to High-Low. Areas with a High-High and Low-Low correlation suggest spatial clusters, while areas High-Low and Low-High indicate spatial outliers (see Appendix B to this article). As before, we identify clusters with respect to the variables used throughout the analysis, i.e. a first group of variables related to the labour market situation of disabled people, i.e. PRDP, ERDP receiving various levels of wage, and with various educational level; and also with respect to environmental variables, i.e. HDI, and population density. We find two clusters for the PRDP (Fig. 3, I): a cluster in the South of Mexico (Tabasco, Chiapas, Campeche, Yucatan, Quintano Roo) with high participations rate of disabled people, and one in the North of Mexico (Chihuahua, Coahuila, Nuevo Leon, Durango, Zucatecas, Auascalientes, San Luis Potosì) with a low PRDP. Similar clusters appear with respect to wages: there is a cluster of Federal States in the North of Mexico (Baja California, Baja California Sud, Sonora e Chihuahua) characterized by a large number of employed disabled people obtaining high salaries (Fig. 3, IX), and a cluster in the South of Mexico (Puebla, Veracruz, Oaxaca, Tabasco e Chiapas) characterized by a large number of employed disabled people who at most receive the minimum wage (Fig.3, VIII). Variables connected with education show only one cluster of disabled people occupied without education (Fig.3, II), mainly concentrated in the South of Mexico (Veracruz, Oaxaca, Tabasco e Chiapas). HDI (Fig.3, XI) shows a cluster of poorer Federal States in the South of Mexico (Guerrero, Veracruz, Oaxaca e Chiapas) while the variable linked to

population density (Fig.3, X) shows a cluster of less populated Federal States in the North of Mexico (Chihuahua, Coahuila, Sinaloa, Durango and Nuovo Leon) .

The results of our spatial analysis on the labour market of disabled people confirms the results of our cluster analysis, identifying two well defined areas: a "center" of the country (North Mexico) and a "periphery" of the country (South of Mexico) (Krugman, 1991 and 1999).

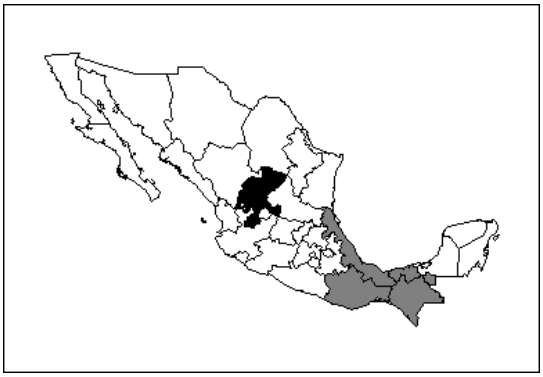
Fig. 3 –LISA cluster map

I. Participation rate of disabled people



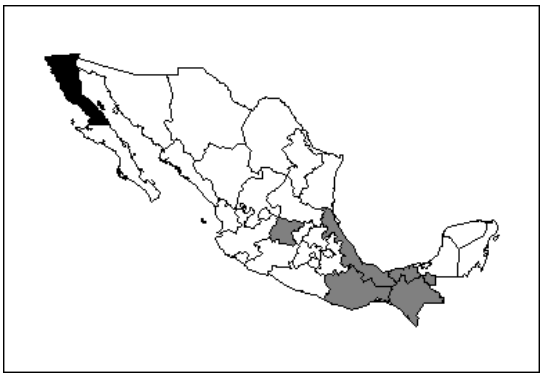
II. ***ERDP*** *without any education*

III. ***ERDP*** *with just primary education*

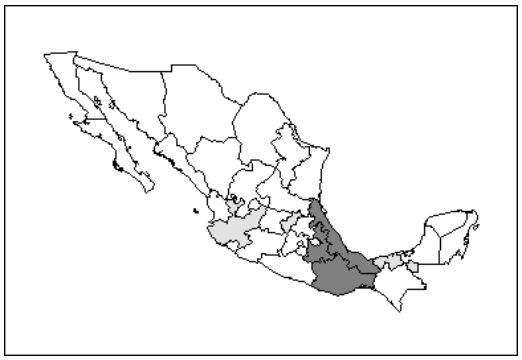


IV. ***ERDP*** *with just secondary education*

V. ***ERDP*** *with just higher education*



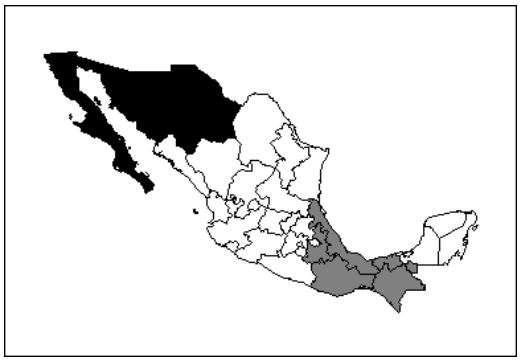
VI. ***ERDP*** *with education above higher*



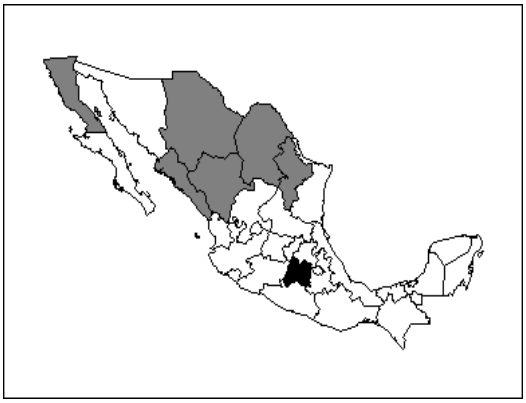
VII. ***ERDP*** *without salary*

VIII. ***ERDP*** *with wage up to minimum wage*

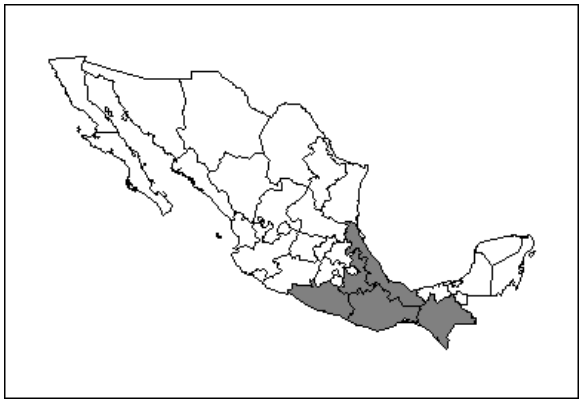
IX. ***ERDP*** *with wage above minimum wage*



X. Density of the population



XI. ***HDI***



4. Conclusions

Several conclusions emerge from our investigation:

From the correlation analysis we learn two important lessons. First, we have shown that "environmental" variables play no role in the decision of disabled people to actively take part in the labour market, as variables like the rate of growth of GNP and the HDI are not significantly correlated to PRDP. We have the first implication of economic policy: the participation of disabled persons in the labour market does not improve even if the general well being of the areas is comparatively high in terms of environmental factors like HDI, and the rate of growth of GNP. Active labour market policies, directly geared at disabled people, are required in order to improve their situation in the labour market. Second, we have shown that there is no statistically significant correlation bertween the PRDP and the rate of employment of already employed disabled people with various levels of education; also, we note that the PRDP is significantly and positive correlated to the rate of employment of disabled people who receive a very low salary, but not to that of employed disabled people who work for no salary. This suggests that the expectations of Mexican disabled people in terms of work and payment, are, probably realistically, extremely low, but that employment without payment does not persuade them to take part in the labour market. These findings provide suggestions in terms of policies: it appears that raising the level of education of disabled people would not trigger off the indirect effect of making them to want to take part in the labour market, and therefore would not contribute to the improvement of their general well being in terms of financial autonomy. However, protecting the employment of disabled people by guaranteing them at least some wage, in other words removing the situation of employment for no wage, would encourage the labour market participation of disabled people.

From the cluster analysis, both using the tools of analysis of the classical cluster analysis, and of the spatial one. we have found evidence of two clusters, allowing us to identify two different areas: a North and a South Mexico. The two areas differ dramatically in terms of their general well being (HDI, PD), and so do the characteristics of the labour market situation of disabled people. This suggests that specific policies taking into account the socio economic characteristics of the two areas are needed in order to improve the situation of disabled people in the labour market. The limitation of the data does not allow any inference about the speed which the adjustment may require.

The overall impression generated by our results suggests that there is scope for improving the situation of disabled people in the labour market in Mexico, both with general and with specific policies, and that research has much to say in this direction, as our results, however limited, suggest. The wealth of data on the socio economic situation of disabled people available in the Mexican 2000 Census clearly shows great interest for these problems, and further research seems possible. Two directions for further research emerge from our investigation: our results and policy recommendations are based on the XII Census data of the year 2000, the most recent ones available at the time of our writing, and are aggregated at Federal State level; it is therefore essential a follow up investigation, to compare our results with the recently published Census data for the year 2010; also, the analysis should be developed at a more local level shoul suitable data become available.

APPENDIX A

The contiguity matrix [12]

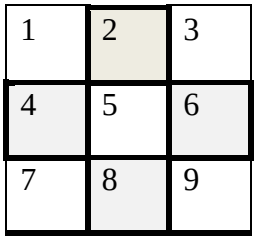
Central to spatial statistics/econometrics is the problem of formally expressing the structure of geographic dependence. This problem has been solved by introducing a matrix W, of spatial weights or spatial lags. This is the most general shape of the matrix:

$$W = \begin{bmatrix} 0 & w_{12} & \dots & w_{1N} \\ w_{21} & 0 & \dots & w_{2N} \\ \dots & \dots & \dots & \dots \\ w_{N1} & w_{N2} & \dots & 0 \end{bmatrix}$$

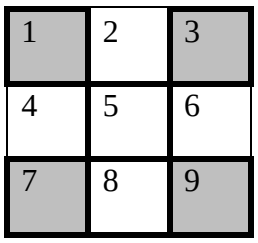
The Matrix is square, and not stochastic; the elements w_{ij} express the intensity of the connection between each pair of regions *i,j*. There can be various measures of this intensity, which must be not negative and finite. Various indicators are used to construct the matrix of weights, as various types of distances, such as for instance cultural, linguistic, and administrative ones can be considered in addition to the classic matrix of contiguity.

Each of these indicators has pros and cons, therefore there is not a single rule universally accepted; the choice depends on the objective of the investigation, so that the weights are always exogenous with respect to the subject of investigation

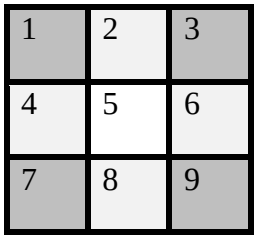
We show some examples of contiguity matrixes well established in the literature. (Anselin, 1988).



Rook contiguity



Bishop contiguity



Queen contiguity

If we consider the central element, here identified with number 5, it is possible to identify three different matrixes of spatial contiguity. In the *rook contiguity matrix* we only consider elements which border with the central element, i.e. elements 2, 4, 6 and 8; the *bishop contiguity matrix* is characterized by elements which share corners with the central element, i.e. elements 1, 3, 7 and 9;

[12] The names rook, bishop, and queen refer to chess pieces , and the three types of matrix are built according to the rules governing the possible moves of these pieces on the chess board.

in the *queen contiguity matrix* the central element shares with the other elements both borders and corners, and therefore in our example all the elements are considered.

In the analysis in the text we have used a *rook* and a *queen contiguity matrix*.

APPENDIX B

Spatial autocorrelation: further considerations

The Moran Scatterplot is drawn in a cartesian graph where the normalized variable x is on the horizontal axis, and the normalized spatial lag of this variable (Wx) is on the vertical axis.

If the dots are scatered across the quadrants, there is no correlation. If there is a clear relationship, the *Moran Scatterplot* can be used to identify various types of spatial correlation.

If most of the dots are in the North-East and South-West quadrants the correlation is positive, with the following specification: dots in the North-East quadrant identify a High-High relationship, as they mark high values both of x (region *i)* and of Wx (regions contiguous to *i*); dots in the South-West quadrant identify a Low-Low relationship, as the values of both variabless are low.

If the concentration of the dots is high in the other two quadrants, the correlation is negative. In particular, dots in the North-West quadrant are associated with low values of x and high values of Wx (Low-High relationship), and viceversa in the South-East quadrant (High-Low relationship).

The results of the *Moran Scatterplot* can be shown in the LISA cluster map so that geographic areas with different types of correlation can be identified (High-High, Low-Low, High-Low, Low-High). In this way it is possible to verify whether regions sharing a specific type of correlation are contiguous, and form a *cluster*.

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