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The region of Madrid: Effects of agglomeration vs. centralisation

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THE REGION OF MADRID: EFFECTS OF AGGLOMERATION VS. CENTRALISATION[1].

ABSTRACT

Madrid is an atypical territory among the Spanish regions. In comparison with other areas, this region presents high labour activity rates (63.68 percent) and employment (59.7 percent) alongside low rates of unemployment (6.25 percent). However, this aggregated labour dynamism is not generalized to the whole region of Madrid, as important territorial differences exist. This paper offers an analysis of the territorial characteristics of the regional labour market in Madrid. With this motive in mind, we have developed the following two types of analysis: firstly, we classified the municipalities of Madrid based on labour indicators using alternative methodologies (two-step cluster and k-means procedure) that mainly demonstrate the existence of a dichotomising structure of the labour market associated with the presence of centralisation and agglomeration patterns; secondly, we developed several probability models (logits) that define and determine the previous territorial clusters showing important centralisation effects. This work establishes an interesting methodology which could be applied to other regions facilitating comparisons between regions. In addition, territory differentiation is necessary in order to deal with the future regional labour policy. The Region of Madrid can be used as a typical example of regional labour market centralisation.

Key words: Madrid, labour market, cluster, logits, centralization.
JEL–Classification: J01, J10, R11, R121

RESUMEN:

Madrid se constituye como un espacio peculiar dentro de las regiones españolas. En comparación con otras áreas, esta región presenta una elevada tasa de actividad (63.68 por ciento) y empleo (59.7 por ciento) al mismo tiempo que una reducida tasa de desempleo (el 6.25 por ciento). Sin embargo, este dinamismo laboral que muestra a nivel agregado no es generalizable en el conjunto de la región persistiendo importantes diferencias territoriales. Este artículo pretende ofrecer un nuevo análisis territorial de las características regionales del mercado laboral de la Comunidad de Madrid. De acuerdo con este objetivo, se ha desarrollado dos tipos fundamentales de análisis: en primer lugar, hemos clasificado los municipios de Madrid en base a sus características laborales utilizando diferentes metodologías alternativas (two-step cluster and k-means procedure) que principalmente demuestran la existencia de una estructura laboral dicotómica asociada con la presencia de efectos de aglomeración y patrones de centralización; en segundo lugar, hemos estimado varios modelos de probabilidad (logias) que determinan la importancia de los efectos centralización en los cluster obtenidos previamente. Este trabajo desarrolla una interesante metodología de trabajo aplicable a otras regiones facilitando la comparación regional. Asimismo, el trabajo establece que la diferenciación del territorio es necesaria en el desarrollo futuro de la política laboral de carácter regional. Por último, la Comunidad de Madrid se constituye como el ejemplo típico de centralización en el mercado de trabajo.

Palabras clave: Madrid, mercado de trabajo, cluster, logits, centralización.

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[1] This article is based on the results reached in the Project Características territoriales del mercado de trabajo de la Comunidad de Madrid (Territorial characteristics of the labour market in the Region of Madrid), financed by the Dirección General de Empleo de la Consejería de Empleo y Mujer (Directorate-General of Employment of the Ministry of Employment and Women's Affairs) of the Region of Madrid and the European Social Fund.

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1. INTRODUCTION

The Region of Madrid covers an area of approximately 8,022 square kilometres, only 1.6 percent of the total area of Spain. Therefore, from a territorial perspective, it is not by any means a large region, and is only the twelfth largest of the 17 autonomous regions in Spain. However, in terms of inhabitants, there are over 6 million people residing in the Region of Madrid, 13.4 percent of the total population of Spain. This is why this region is a significant area to analyse.

The distribution of population throughout Madrid is uneven and an obvious trend exists towards concentration (cf. figure A.2 of the appendix). This determines to a large extent that the labour market in the Region of Madrid also presents an irregular territorial distribution of its parameters. The differences do not only affect the activity, employment and unemployment rates, but the distribution of industries and the employment characteristics are also affected by the dichotomy between the centre and the outskirts.

The aim of this article is to analyse the territorial characteristics of the labour market in the Region of Madrid, determining the foundation that this territorial structure is based on. To address this matter, we firstly offer a description of the labour market in Madrid, offering a special attention to its territorial distribution. Then, we have used several classifications of the municipalities of Madrid to highlight the territorial differences. Finally, different hypotheses are refused (agglomeration or centralisation effects) by developing several probability models.

The data sources used are basically two: the first is the Spanish Labour Force Survey (EPA) implemented by the Spanish National Statistics Institute (INE), which gathers information regarding the labour market in the Region of Madrid[2] between 1996 and 2007; secondly, the Census of Population for 2001 and 1991 are used, including data about the residents in each of the municipalities comprising the Region of Madrid.

Therefore, this source provides information regarding the labour supply of a specific municipality. It would be an advantage to have data regarding the labour demand, but unfortunately such detailed information is not available at a local level.

The reasons why studying the Region of Madrid is relevant are varied: firstly, its great economic importance, from a Spanish and European perspectives; secondly, it is a small region of limited geographical area with a high concentration of employment and productive activities;

[2] The EPA has been subject to a deep methodological reform during the year 2000 and this partly affects the data provided in this article. Generally speaking, the reform provokes an increase of employment and a decrease of unemployment. For further information, visit www.ine.es.

thirdly, it is the capital of Spain and this gives it relevant characteristics; finally, as we will see further on, there is an important diversity in its territorial configuration. As a whole, the region of Madrid is seen as a very interesting framework for the study of the territorial features of labour markets.

The spatial economic analysis is based on a wide theoretical trajectory. Krugman (1991a, 1991b) already used geographical interpretations for his economic researches, which are fundamental references. However, in the area of economic analysis, the study of the effects of centralisation and agglomeration on the labour market is a relatively new research field.

The centralisation hypothesis is used to study the economic effects derived from the concentration of resources in a specific area. Following this line of research, several studies have dealt with the economic effects related to the capital of a city or area. In the case of Madrid, the high concentration of existing productive resources, at least regarding public resources, is partly due to this effect (Region of Madrid, 2001)[3].

Nowadays, the analyses related to centralisation are mainly based on the measurement of distances, geographical positions or qualification of the environment[4]. Among these, it is worth highlighting those which focus on the analysis of travelling to the workplace, which measures the distance and time employed by the workers to travel from home to their workplaces as a key issue to explain not only the decisions of living in a specific place, but also of participation and position within the labour market. In the current study case, distances in Madrid are relatively short, although time needed to travel those distances are quite extensive.

Regarding these topics and the study of the labour market in Madrid, there are already many researches, among which those carried out by Del Castillo, F. and Casado, C. (1999); Martínez de Pisón, E. (2003); Cuadrado, J.R. et al (1999) and the Region of Madrid (2001 and 2007) are of great significance.

On the other hand, studies on agglomeration try to identify the effects derived from the concentration of resources after searching for scale economies. Thus, it is a matter of combining resources in order to surpass a critical mass or point from which positive externalities arise.

[3] Moreover, specialisation in the services sector registered in the Region of Madrid could be caused partly by this fact. See Puga, 2000 for more information about specialisation in cities and its implications.

[4] In this context, for a long time now, interesting advances have also been made related to the study of the effects derived from the existence of territorial dualities which differentiate between the centre and the outskirts (Seers, D. *et al* Ed. 1981). In the case of the City of Madrid, Gavira Martín, J. and Gavira Golpe, C. carried out a research on the geographical concentration and distribution of resources, specifying the key differences between the centre and the outskirts.

From this research perspective, studies focus on developing different lines of analysis: defining and identifying examples of agglomeration (when and where this occurs)[5]; quantifying the agglomeration; determining which the effects are derived from the agglomeration and its initiating factors; and finally, establishing which is the possible duration in time and its limits (Puga, D. 2000).

Although the idea of agglomeration has been traditionally studied in association with the urban environment, it is now being applied to regional matters. An example of this is the research performed by Rosenthal and Strange (2001), who state that the agglomeration effects could be extended from 1.5 to 15 miles around the urban centre or the origin of the agglomeration (approximately between 2 kilometres and a half and 24 kilometres). As Madrid is a small region, this could be the case, mainly in the area defined below as the "metropolitan ring".

Finally, it is worth mentioning that the last researches carried out regarding the matter at hand are defined by trying to differentiate between concentration, productive specialisation, centralisation and agglomeration, which are all much related but with different interpretations and implications (Duraton, G. and Puga, D. 2005 and Puga, D. 2000).

2. THE LABOUR CHARACTERISTICS OF MADRID

In the period under analysis, the labour market of the Region of Madrid has registered a particularly positive performance within the whole country:

a. Labour Activity rates of Spain and the Region of Madrid have experienced a sharp growth (figure 1). Moreover, the increasing trend is clearly more pronounced in the case of the Region as a whole. The labour activity rate for Spain has increased 8.07 percentage points, while the rise in Madrid was of 11.04 percentage points.

b. During the third quarter of the year 2007, the national employment rate amounted to 54.56 percent, while that corresponding to the Region of Madrid was 60.13 percent, that is to say, almost six percentage points more. Data show an outstanding growth in national employment, mainly in Madrid, which is a notably favourable performance within the Spanish framework.

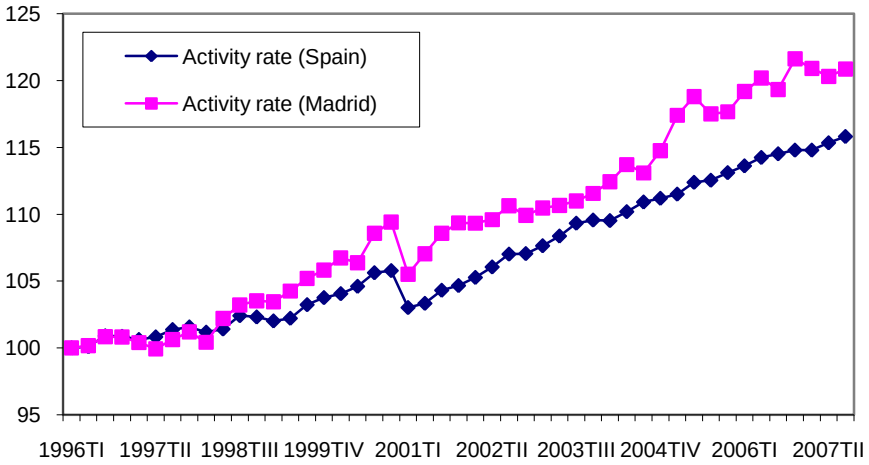
[5] The researches carried out by Glaeser and Maré (2001) or Wheton and Lewis (2002) are examples of the indirect measurement of agglomeration. And among studies regarding direct measurement we can find the studies by Sveikauskas (1975) and Henderson (1986).

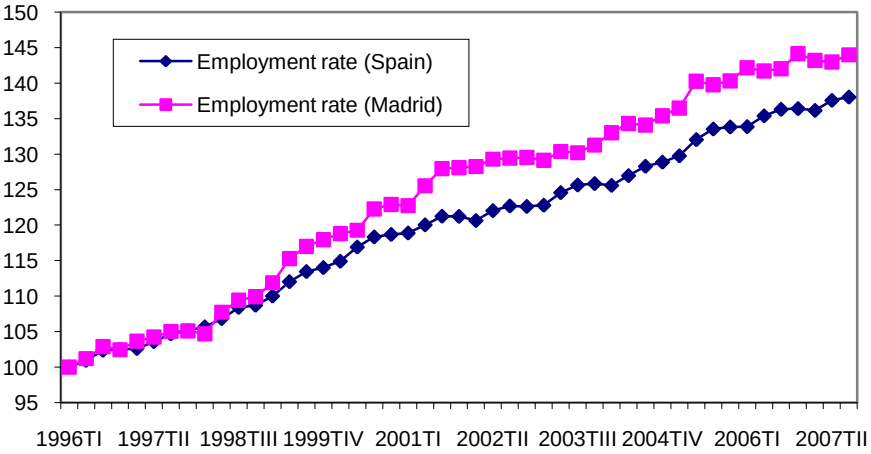
c. Recent data also show that, within the whole Spanish economy, 8.03 percent of labour force was unemployed, against the Region of Madrid, where just 6 percent were seeking employment to no avail. The evolution of Spanish unemployment, and particularly in Madrid, has meant the end of a very negative period for the labour market, as the unemployment rates in the mid-90's meant 22.83 and 21.1 percent at a national and regional level respectively. This implies a decrease of over 15 percentage points, which has caused current unemployment rates to approach what it is considered to be technically full employment[6].

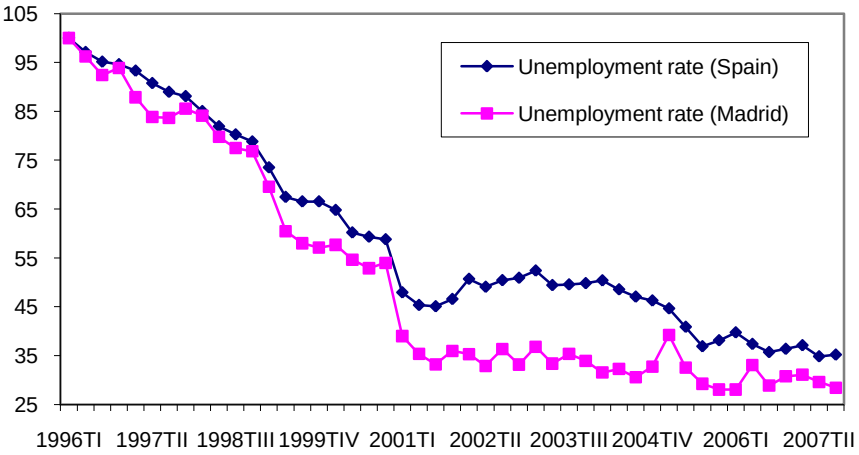
Generally speaking, the labour market in Madrid is in a better situation and emphasizes the positive trend registered since 1996 in the labour market. Nevertheless, this situation has very important nuances and differences when carrying out a regional analysis of Madrid.

[6] Which would correspond exclusively with frictional unemployment, just explained by the dynamic performance of the labour market itself.

FIGURE 1.
Evolution of activity, employment and unemployment rates in the Region of Madrid and Spain. Base 100 = first quarter of 1996.







Source: Own elaboration from EPA´s data. INE.

In the whole Region of Madrid, the activity rate is 52.65 percent, the employment rate is 46.22 percent and the unemployment rate is 12.21 percent. The activity rate is proven to be particularly high in the Metropolitan North and North-East of the region. On the other hand, the City of Madrid and mainly the South Sierra register activity rates lower than the rest. Regarding the employment rate, the highest values are registered by the Metropolitan North and Metropolitan West, the South Sierra being the area with the lowest index. Finally, the unemployment rate is high in the South Sierra and it is quite low in the Metropolitan North. In general, the Metropolitan North is an area with a high level of labour dynamism (high activity and employment rates and low unemployment rates) while in the South Sierra the opposite occurs (low activity and employment rates and a high unemployment rate). As a conclusion, we could state that the population of the Region of Madrid demonstrates very different labour rates, particularly in terms of employment rate, depending on the place of residence.

Marked differences can also be observed from a temporal perspective. According to table 1, the activity and employment rates have increased intensely in the South-East of the Region and in the South Sierra; the unemployment rate has deeply decreased in the Metropolitan East and North. Therefore, the uneven geographical situation shown by the labour market in Madrid is not based on the ten years under study, but on a previous structural change or it is a characteristic of the constitution of this region itself.

TABLE 1.
Labour rates in the Region of Madrid and incidence by areas.

	2001						Growth rates (1991-2001)		
				Incidence					
	Activity rate	Employment rate	Unemployment rate	Activity rate	Employment rate	Unemployment rate	Activity rate	Employment rate	Unemployment rate
Madrid (City)	49.66	43.51	12.40	0.94	0.94	1.02	-2.80	-0.83	-12.33
Metropolitan North	57.93	51.98	10.28	1.10	1.12	0.84	1.44	3.86	-16.87
Metropolitan East	57.36	50.27	12.37	1.09	1.09	1.01	-2.11	1.24	-18.97
Metropolitan South	55.81	48.39	13.29	1.06	1.05	1.09	-0.45	2.42	-15.47
Metropolitan West	57.36	51.93	9.47	1.09	1.12	0.78	4.21	5.84	-12.83
North-East of the Region	57.79	50.94	11.85	1.10	1.10	0.97	9.03	10.89	-11.09
South-East of the Region	51.34	45.81	10.78	0.98	0.99	0.88	9.08	9.08	0.05
South-West of the Region	57.63	51.34	10.91	1.09	1.11	0.89	11.35	13.05	-10.96
North Sierra	51.27	45.48	11.29	0.97	0.98	0.92	5.50	5.53	-0.20
South Sierra	49.07	42.09	14.23	0.93	0.91	1.17	10.51	11.37	-4.47
Central Sierra	57.24	51.26	10.44	1.09	1.11	0.85	8.09	9.08	-7.19
Total	**52.65**	**46.22**	**12.21**	**1.00**	**1.00**	**1.00**	**-0.38**	**1.98**	**-14.27**
Max-Min	**8.86**	**9.89**	**4.76**						
Var.	**13.05**	**13.11**	**1.99**						

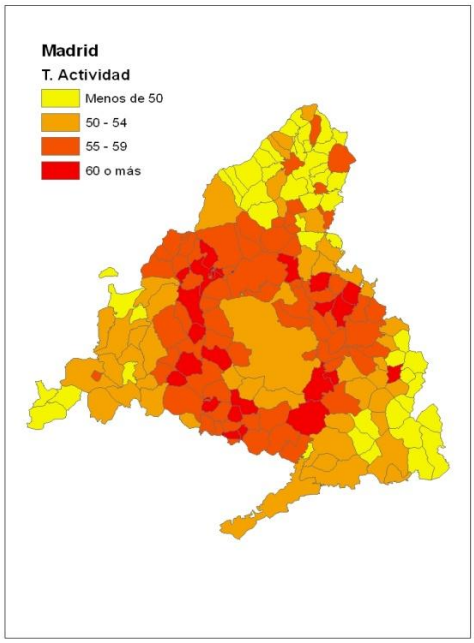
Source: Own elaboration from data of the Census of Population of the Region of Madrid, 1991-2001. INE.

In order to carry out a more in-depth research into the knowledge of the geographical distribution of labour markets comprising the Region of Madrid, the analysis will use even more detailed data at a local level (figure 27). Therefore, the labour activity of Madrid is demonstrated to be concentrated in the municipalities of the metropolitan ring.

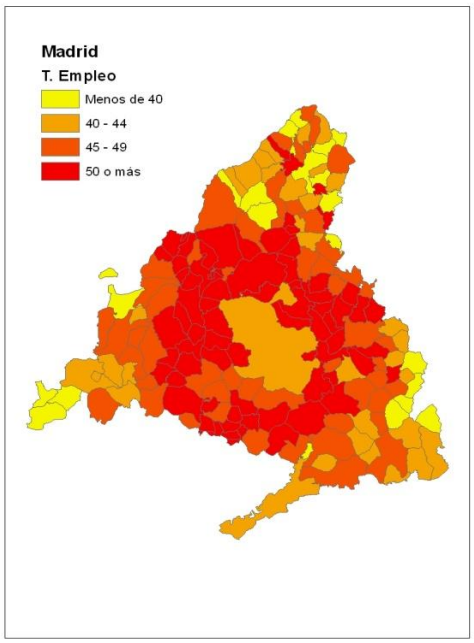
[7] The elaboration of figures has been carried out by establishing similar quartiles between the range of the variable analysed. This methodology is used in all the distribution figures included in the present article.

FIGURE 2.
Labour rates in Madrid.

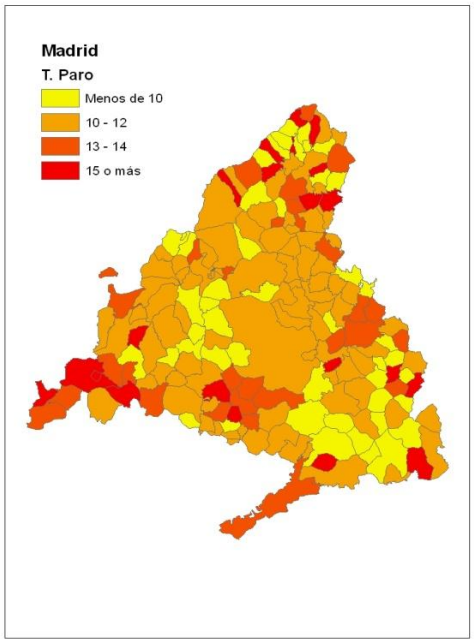
Activity rate



Employment rate



Unemployment rate



Source: Census of Population of the Region of Madrid, 2001. INE.

The employment rate presents a similar geographical distribution, although higher values are registered by the municipalities of the metropolitan ring. Therefore, there is a high concentration of the activity and employment concentration in the surroundings of the City of Madrid, in the metropolitan ring. However, the unemployment rates of the municipalities of Madrid are unevenly distributed. Some municipalities of the North Sierra, South Sierra and South-East of the Region register an employment rate above the total.

3. DIFFERENTIATION OF THE TERRITORY: CLUSTER ANALYSIS

On the basis of the previous descriptive analysis, we aim to establish whether there are characterising criteria at a geographical level in order to validate the existence of territorial labour differences, particularly between the centre and the outskirts.

The methodology employed is based on the development of different spatial classifications of the labour market of Madrid by using two different aggregation methods (two-step cluster and k-means). The spatial aggregation of municipalities of Madrid is performed according to the next main labour variables: activity rate, employment rate, unemployment rate both aggregated and differentiated by gender, percentage of employment in agriculture, construction, industry and services, percentage of employment in WCHS occupations, in BCHS, in WCLS and in BCLS, paid employees rate, self-employment rate and part-time employment rate. In order to analyse, two different perspectives will be used: firstly, the characteristics observed in 2001 in the Region of Madrid (static cluster) will be used; then, the criteria used will be those of labour transformation registered by the different municipal units between 1992 and 2001 (dynamic cluster). From the first approach, the municipalities will be aggregated according to their labour characteristics in 2001. On the basis of the second approach, the aggregation of municipalities will be carried out according to their sharing of similar labour transformation from 1991 to 2001.

3.1 Territorial groups according to their labour characteristics.

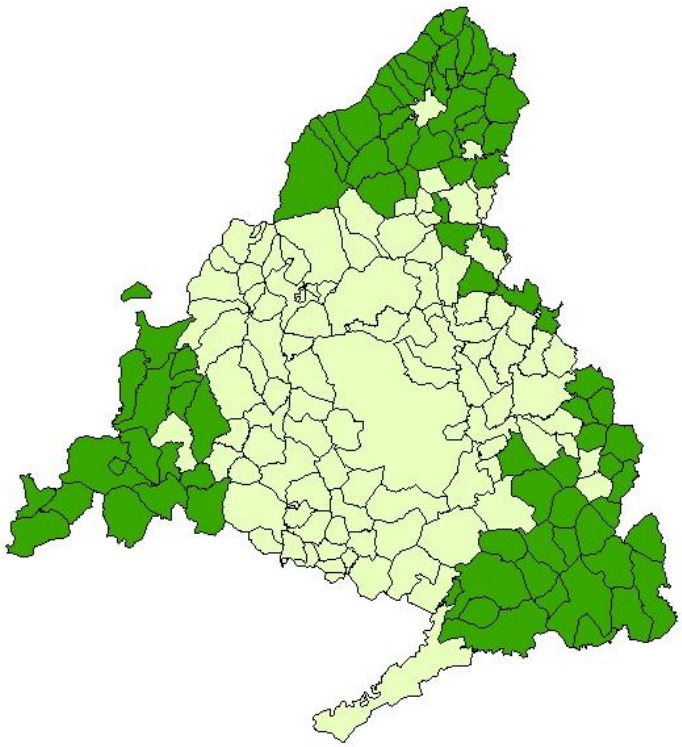
The identification of homogenous groups of municipalities according to their current labour parameters will be carried out sequentially: first through the two-step cluster analysis; then, using the k-means method.

The two-step method determines the number of groups to be created by maximising the differences between them. The main advantage of this procedure is the automatic determination of the number of groups to be created according to the variables included in the analysis. Another advantage is that this method does not suffer from the subjectivity of other methods of spatial analysis, where the results obtained are

conditioned by certain decisions which must be adopted by the researcher. However, the method has some disadvantages, one of which affects our analysis directly: the need for independence of the classification variables or the factors determining the groups. Evidently, the variables defining the labour market are correlated, although not in a direct way. For this reason, this classification is used to set up the efficient number of groups, rather than to establish definitely which municipalities comprise each of the groups. Therefore, this is just a first approach to this issue. The classification of municipalities of Madrid carried out through this methodology is illustrated in figure 3 below.

The municipalities of Madrid are divided in two groups, where the centre and the outskirts are clearly differentiated. This result highlights the existence of two opposed realities in the Region of Madrid and clarifies which are the areas to be considered for analysing the labour market of Madrid. The distribution in groups is quite equitable: while the group of the centre and the metropolitan ring includes 96 municipalities (53.6 percent of the total), the group of the outskirts is comprised of 83 municipalities (46.4 percent).

FIGURE 3.
Classification of Madrid´s municipalities by main characteristics of their labour markets using the two-step cluster method.



Source: Census of Population of the Region of Madrid, 2001. INE.

Table 2 shows the average and the standard deviation of the variables used in the analysis. Moreover, the appendix includes the confidence intervals and their significance using the Bonferroni´s statistics (figure A.3). All the variables used are significant except for the unemployment rate (aggregated and for men and women) and the employment rate in industry. This data allows us to identify the foundations on which the differences between both groups are based:

1. The first group includes municipalities in the outskirts and registers:
    a. A higher unemployment rate at an aggregated level and for men and women.
    b. A higher percentage of employment in agriculture, construction and industry, and a lower level in services.
    c. A higher predominance of blue-collar workers among its population.
    d. And a higher self-employment rate.

2. Group 2, comprising municipalities from the centre and the metropolitan ring, demonstrates a more dynamic labour market:
    a. With higher activity and employment rates and lower unemployment rates.
    b. The dynamism of the labour market in these municipalities is also repeated when disaggregating by gender. Men and women register a better labour position in this field.
    c. Higher presence of tertiary employment.
    d. A higher percentage of white-collar workers.
    e. And a high rate of paid employment and part-time work.

TABLE 2.
Definitions of groups obtained by the two-step cluster method.

		Total	Centre	Periphery
Activity rate	Average	47.16	57.44	52.67
	Standard deviation	4.87	2.91	6.47
Employment rate	Average	41.88	51.11	46.83
	Standard deviation	4.54	2.99	5.97
Unemployment rate	Average	11.19	11.06	11.12
	Standard deviation	4.63	1.79	3.40
Activity rate (Men)	Average	61,34	69,57	65,75
	Standard deviation	6,31	3,41	6,44
Activity rate (Women)	Average	32,65	45,61	39,60
	Standard deviation	5,51	4,02	8,04
Employment rate (Men)	Average	56,30	64,04	60,45
	Standard deviation	6,46	3,45	6,37
Employment rate (Women)	Average	27,11	38,53	33,23
	Standard deviation	4,61	4,02	7,15
Unemployment rate (Men)	Average	8,33	7,96	8,13
	Standard deviation	4,77	1,60	3,45
Unemployment rate (Women)	Average	16,65	15,76	16,17
	Standard deviation	7.30	3.40	5.56
Percentage of employment in agriculture	Average	8.07	1.93	4.78
	Standard deviation	6.26	1.45	5.35
Percentage of employment in construction	Average	19.51	12.32	15.65
	Standard deviation	6.64	3.82	6.40
Percentage of employment in industry	Average	16.72	15.88	16.27
	Standard deviation	8.33	5.96	7.15
Percentage of employment in services	Average	55.81	70.06	63.45
	Standard deviation	10.38	7.45	11.40
Percentage of WCHS	Average	43.95	32.43	37.77
	Standard deviation	7.89	7.83	9.73
Percentage of WCLS	Average	24.02	18.69	21.16
	Standard deviation	6.81	5.85	6.84
Percentage of BCHS	Average	14.40	23.74	19.41
	Standard deviation	4.84	10.60	9.62
Percentage of BCLS	Average	17.67	25.26	21.74
	Standard deviation	5.15	3.81	5.86
Paid employment rate	Average	76.55	82.48	79.73
	Standard deviation	6.53	4.97	6.45
Self-employment rate	Average	22.46	17.08	19.58
	Standard deviation	6.52	4.80	6.25
Part-time employment rate	Average	6.27	7.57	6.97
	Standard deviation	2.58	1.19	2.06

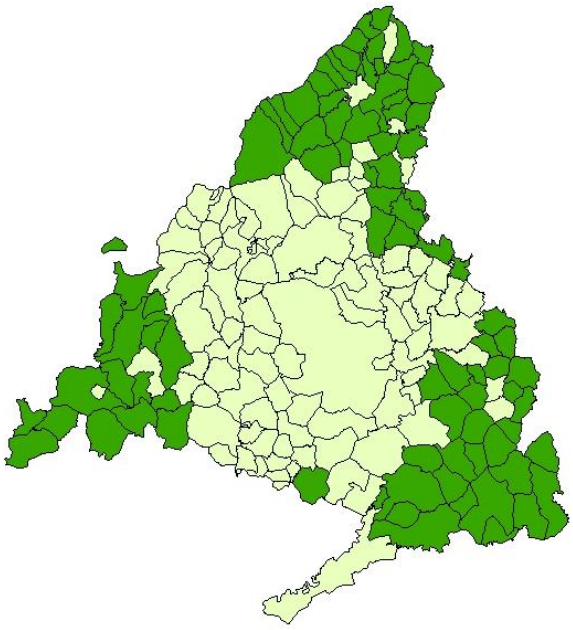
Source: Census of Population of the Region of Madrid, 2001. INE.

To conclude, the first analysis demonstrates the existence of two completely different labour realities in the Region of Madrid which are clearly defined by two geographical locations: the centre and the outskirts.

On the basis of these results and taking into consideration the same labour variables as in the previous section, we will classify the municipalities of Madrid through the k-means procedure. Using this methodology, the elements are classified by an algorithm that reduces the existing averages between the classification variables and, therefore, groups together the most similar elements. The weakness of this method is that it does not determine the number of optimal groups to classify the elements of analysis, but this is left for the researcher. Nevertheless, using the afore-mentioned method, we know that the number of groups registering the highest difference and the most efficient is the disaggregation of two clusters.

Again (figure 4), the municipalities in the centre and the periphery of the region are differentiated, highlighting the important dichotomy existing in the labour market of Madrid.

FIGURE 4.
Classification of the municipalities of Madrid by the main characteristics of their labour markets using the k-means procedure.



Source: Census of Population of the Region of Madrid, 2001. INE.

This aggregation is quite similar to the previous one. In this case, the group of the outskirts is made up of 87 municipalities (48.2 percent) and

the centre and metropolitan ring group aggregates 92 municipalities (51.8 percent). Demonstrated by the statistics obtained[8], all labour variables used are significant except for the global, male and female unemployment rates and the percentage of employment in industry. The peripheral municipalities show (table 3) a less dynamic labour market which registers a lower activity rate not only at a global level, but also for men and women, as well as a lower employment rate in all the groups being considered and a higher female unemployment rate. Thus, within the municipalities of the outskirts, the unfavourable labour position of women is highlighted, presenting deep differences in comparison with the central municipalities as regards to participation, employment and unemployment. As far as the productive structure is concerned, the periphery registers as an average a higher percentage of employment in agriculture, construction and industry. Due to this, the presence of white-collar high-skill and low-skill workers is significant. Finally, it is worth mentioning that the self-employment rate in the periphery is higher and the part-time employment rate is lower than in the rest of municipalities. Generally speaking, the differences previously obtained are further emphasized from this new methodological point of view. The differences between the centre and the outskirts are based not only on the varied results regarding participation and employment of their residing population.

TABLE 3.
Definitions of groups obtained by the k-means procedure.

	Average	
	Group 1 (Periphery)	Group 2 (Centre)
Activity rate	47.40	57.65
Employment rate	42.23	51.18
Unemployment rate	10.97	11.27
Activity rate (Men)	61,68	69,61
Activity rate (Women)	32,79	46,04
Employment rate (Men)	56,86	63,85
Employment rate (Women)	27,30	38,85
Unemployment rate (Men)	7,98	8,27
Unemployment rate (Women)	16,52	15,85
Percentage of employment in agriculture	7.82	1.90
Percentage of employment in construction	19.33	12.17
Percentage of employment in industry	17.08	15.50
Percentage of employment in services	55.87	70.62
Percentage of WCHS	43.64	32.22
Percentage of WCLS	24.36	18.14
Percentage of BCHS	14.33	24.21
Percentage of BCLS	17.71	25.55
Paid employment rate	76.80	82.50
Self-employment rate	22.21	17.09
Part-time employment rate	6.28	7.62

Source: Census of Population of the Region of Madrid, 2001. INE.

[8] See table A.1 of the appendixes.

3.2 Territorial groups relative to the evolution of the regional labour market.

Once concluded that, relative to their territorial labour characteristics, the municipalities of Madrid differ depending on whether they are located in the centre or the periphery, the matter now is to find out how this situation has occurred and which has been the evolution of the different local labour markets comprising the Region of Madrid[9].

To address this issue, we will classify in this section the municipalities of Madrid depending on the evolution of their labour markets characteristics between 1991 and 2001. But, this data for all municipalities is not available so the classification is developed with 120 municipalities (over a total to 179 possible municipalities) . The purpose is to establish those areas which have been subject to similar labour changes. Similarly as in the previous section, consecutive classifications are developed through the application of the two-step cluster and the k-means methods.

The variables considered in order to carry out the analyses included the following: the growth of activity, employment and unemployment rates for the whole population and distinguishing between men and women; the increase of the employment rate in 8 activity sectors ("Agriculture, Stockbreeding, Hunting and Forestry", "Manufacturing Industry", "Other Industries", "Construction", "Trade, Catering and Hotel and Repair Services", "Transport and Communications", "Financial Institutions, Insurance and Services" y "Other Services"); the growth of employment percentage in 7 labour skills ("Professional, Technicians y similar", "Directors and Managers", "Administrative Employees", "Retailers and Salespeople", "Hotel, Personal and Security Services Employees", "Employees in Agriculture and Stockbreeding sectors", "Employees in Mining, Construction and Transport sectors"); the growth of paid employment rate and of the self-employment rate.

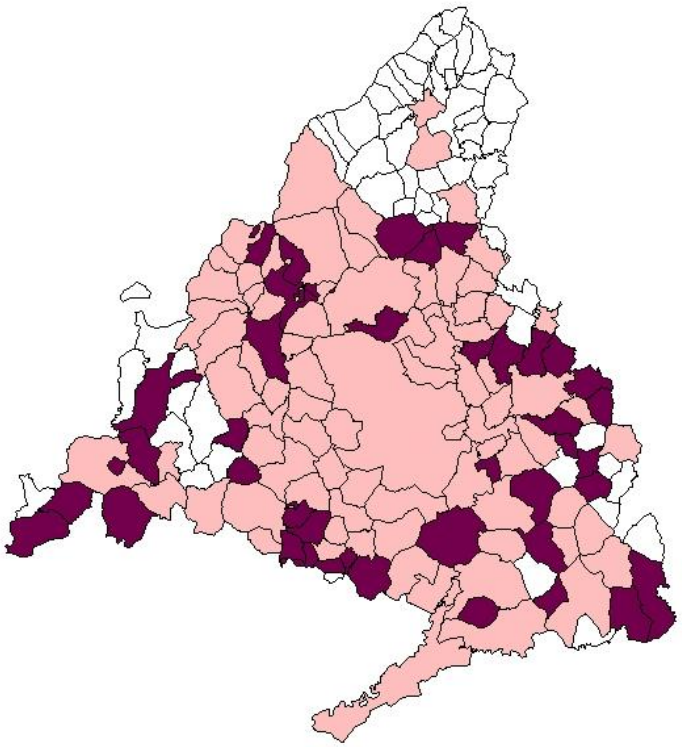
The classification registering the most differences, according to the first methodology (figure 5), results from the following two groups, one including 80 municipalities and an alternative group of 40 municipalities, characterised by being in the outskirts of the Region, near the metropolitan ring. The municipalities around the metropolitan ring are those that register the largest transformations in their labour markets. Taking into consideration only the significant variables (see the appendix on the Bonferroni statistics, figure A.4), the table below shows that the periphery demonstrates the following:

[9] Only an individual analysis could be carried out including the final situation of local labour markets of the Region of Madrid and their evolution towards this situation. However, we have opted for performing different analyses in order to offer more information, and not give a false idea of the different realities existing within the Region of Madrid. However, in Germany there are examples of this type of methodology, such as the research developed by Blien, U., Hirschenauruer, F. and Hong Van, P. (2005).

a. A stronger growth in the activity and the employment rates. Hence, this includes municipalities with a higher development of the labour market.

b. A larger growth in female labour rates. This is an area where the female population has considerably improved their labour situation.

FIGURE 5.
Classification of the municipalities of Madrid in relation to the evolution of labour markets using the two-step cluster method.



Source: Census of Population of the Region of Madrid, 1991-2001. INE[10].

[10] The municipalities without data are in white.

TABLE 4.
Definitions of groups obtained using the two-step cluster method related to the evolution of the labour market

		Total	Metropolitan Periphery	Rest
Growth of activity rate	Average	27.98	54.49	36.96
	St. Dev.	16.76	31.68	26.04
Growth of employment rate	Average	39.68	68.49	49.44
	St. Dev.	20.42	42.00	32.40
Growth of unemployment rate	Average	-27.06	-13.20	-22.36
	St. Dev.	16.15	43.82	29.25
Growth of activity rate (Men)	Average	-6.44	-1.03	-4.61
	St. Dev.	5.60	11.10	8.27
Growth of activity rate (Women)	Average	29.07	54.88	37.82
	St. Dev.	17.21	31.93	26.18
Growth of employment rate (Men)	Average	-5.97	-1.17	-4.34
	St. Dev.	6.62	13.22	9.60
Growth of employment rate (Women)	Average	41.04	68.27	50.27
	St. Dev.	21.42	42.22	32.62
Growth of unemployment rate (Men)	Average	-1.28	16.57	4.76
	St. Dev.	24.65	65.06	43.39
Growth of unemployment rate (Women)	Average	-26.91	-12.91	-22.17
	St. Dev.	17.04	43.33	29.35
Growth of employment percentage in agriculture	Average	35.04	16.12	28.63
	St. Dev.	65.91	69.65	67.51
Growth of employment percentage in manufacturing industries	Average	27.23	98.76	51.46
	St. Dev.	42.08	134.84	91.56
Growth of employment percentage in other industries	Average	-67.91	-39.24	-58.20
	St. Dev.	20.63	51.55	36.76
Growth of employment percentage in construction	Average	126.68	303.71	186.66
	St. Dev.	85.30	404.85	257.89
Growth of employment percentage in trqde, catering and hotel and repair services	Average	132.71	276.34	181.38
	St. Dev.	75.68	227.69	160.35
Growth of employment percentage in transport and communications	Average	181.89	363.54	243.44
	St. Dev.	115.22	277.17	204.45
Growth of employment percentage in business services	Average	261.73	452.76	326.45
	St. Dev.	133.39	296.82	222.09
Growth of employment percentage in other services	Average	107.40	287.73	168.50
	St. Dev.	74.55	243.72	175.51
Growth of employment percentage of professionals and similar	Average	250.49	451.29	318.53
	St. Dev.	166.01	496.07	330.58
Growth of employment percentage of directors and managers	Average	-24.59	-4.29	-17.71
	St. Dev.	21.06	37.34	29.15
Growth of employment percentage of administrative employees	Average	-40.56	-42.00	-41.05
	St. Dev.	20.42	20.41	20.34
Growth of employment percentage of retailers and salespeople	Average	20.21	39.44	26.73
	St. Dev.	24.96	52.24	37.46

		Total	Metropolitan Periphery	Rest
Growth of employment percentage of hotels, security and personal services employees	Average	-45.28	-61.51	-50.78
	Syt. Dev.	18.85	17.30	19.83
Growth of employment percentage of employees in agriculture and similar sectors	Average	-22.78	-22.24	-22.60
	St. Dev.	12.23	15.01	13.18
Growth of employment percentage of employees in mining, trade, construction and transport sectors	Average	-23.21	38.20	-2.41
	St. Dev.	65.21	154.53	107.76
Growth of paid employment rate	Average	76.86	54.75	69.37
	St. Dev.	72.66	38.74	63.93
Growth of self-employment rate	Average	-2.77	7.94	0.86
	St. Dev.	22.17	49.78	34.29

Source: Census of Population of the Region of Madrid, 1991-2001. INE.

a. It is also worth highlighting the large increase in employment in industry, trade, transport, financial and similar services and other services [11].

b. Compared to labour occupations, this group of municipalities is characterised by a high growth in the percentage of "Directors and Managers" and "Hotel, Security and Personal Services Employees" over total employment.

c. Those residing in these municipalities demonstrate a tendency for higher development in white-collar activities generally associated with the services sector and this tends to coincide with their productive specialisation.

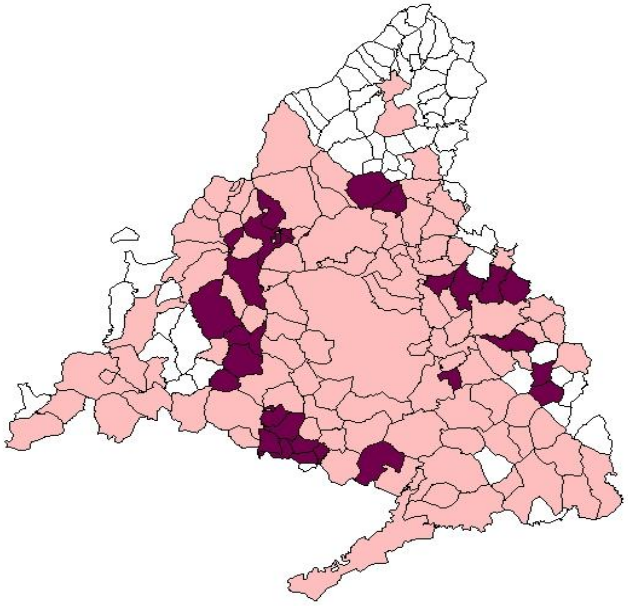
The afore-mentioned features could be due to the changes in residency trends shown among the new generations in the Region of Madrid. Among other factors, the difficulties faced by young people trying to enter the housing market is seen to be a protagonist for the main changes in the labour market as these tend to reside in the metropolitan ring rather than in the centre. This new residency trend establishes a "spin" effect for the population subject to labour changes, which is the main reason for such areas to be associated to the principal transformation during the decade under analysis.

Considering that the most effective number of clusters is two, the Madrid municipalities have been classified again through the k-means method by the evolution of their labour markets. The results (figure 6) lead to a first group which includes the majority of municipalities (96 municipalities), while a second group is composed of some municipalities in the metropolitan ring (26 municipalities). In this latter case the group

[11] For further information on the different productive specialisation at a European level, see Aumayr, .M. (2006), who validates the high tertiarisation in the Region of Madrid and the existence of important agglomeration effects in association with the distribution of productive activities.

is smaller but geographically more compact. The difficulty to find out similar evolution patterns between all these municipalities is reflected in the lack of significance of the variables used to carry out the classification (see table A.2 of the appendixes). However, the results show the existence of limited but significant differences, which are based on the fact that the population residing in the peripheral municipalities register, according to table 5, the following differential features:

FIGURE 6.
Classification of municipalities of Madrid in relation to the evolution of labour markets using the k-means procedure



Source: Census of Population of the Region of Madrid, 1991-2001. INE)[12].

- A higher growth of activity, employment and unemployment rates for the whole population.
- A better position of women in the labour market based on a higher growth of their activity and employment rates, and also on a higher unemployment rate.
- A larger sectoral development of industry and mainly of services, the wide growth of the sectors labelled "Financial Institutions, Insurances and Services" and "Transport and Communications" being highlighted.

[12] The municipalities without data are in white.

- A larger increase in occupations named "Professionals, Technicians and similar".

- And finally these municipalities also show stronger growth in the paid employment rate and self-employment rate, with the decade analysed being highly dynamic.

To sum up, the Region of Madrid presents marked territorial differences, more specifically between the centre and the periphery. The labour market of the central area is more dynamic and the metropolitan ring has experienced deeper transformations.

TABLE 5.
Definitions of groups obtained by the cluster method through the k-means procedure related to the evolution of the labour market.

	Metropolitan Periphery	Rest
Growth of activity rate	44.31	34.95
Growth of employment rate	57.19	47.32
Growth of unemployment rate	-26.77	-21.16
Growth of activity rate (Men)	-3.18	-5.00
Growth of activity rate (Women)	44.84	35.89
Growth of employment rate (Men)	-2.53	-4.84
Growth of employment rate (Women)	56.85	48.47
Growth of unemployment rate (Men)	-1.64	6.52
Growth of unemployment rate (Women)	-26.28	-21.04
Growth of employment percentage in agriculture	60.42	19.93
Growth of employment percentage in manufacturing industries	149.69	24.58
Growth of employment percentage in other industries	-30.69	-65.73
Growth of employment percentage in construction	449.00	114.86
Growth of employment percentage in trade hostel and repair services	408.15	119.32
Growth of employment percentage in transport and communications	517.27	168.49
Growth of employment percentage in business services	624.38	244.92
Growth of employment percentage in other services	386.85	108.75
Growth of employment percentage of professionals and similar	194.46	352.48
Growth of employment percentage of directors and managers	-23.85	-16.03
Growth of employment percentage of administrative employees	-45.15	-39.93
Growth of employment percentage of retailers and salespeople	20.96	28.31
Growth of employment percentage of hotels, security and personal services employees	-64.19	-47.11
Growth of employment percentage of employees in agriculture and similar sectors	-28.42	-21.00
Growth of employment percentage of employees in mining, industries, construction and transport sectors	62.08	-20.05
Growth of paid employment rate	54.18	73.53
Growth of self-employment rate	14.55	-2.88

Source: Census of Population of the Region of Madrid, 1991-2001. INE.

4. THE CENTRALISATION VERSUS THE AGGLOMERATION EFFECT.

As we have repeatedly seen in this article, the population residing in the different municipalities of Madrid present differing labour features, or alternatively, the labour parameters analysed are not homogeneously distributed throughout the area of the Region of Madrid. For example, the population residing in some of the municipalities have a higher possibility of employment than others. In this section, we aim to establish the key variables that account for the resulting labour situation of the population of Madrid. In order to do so, a model is created to show the probability of being employed against the other possible labour situations. This model also shows the effect of residing in the different geographical areas comprising the Region of Madrid. Generally speaking, it is a matter of explaining the marked territorial differences previously concluded, identifying the reasons on which these are based.

We have opted to develop a logit model, taking a dichotomised variable as a dependent variable which takes value one if the individual is employed and value zero if he/she is not (unemployed or inactive). The independent or explanatory variables used for this analysis are: sex, age, marital status, level of studies, geographical area (a particularly interesting variable for our objective) and type of household.

Table 6 shows the results estimated. The signs and coefficients obtained for the personal variables (sex, age, level of studies…) are coherent with those predicted. Further interest is focused on the results regarding the territorial categories. Using the City of Madrid as a category for comparison, we can conclude that in the South-East, Metropolitan North and Metropolitan North-East areas of the Region, their residing population is more likely to be employed. On the contrary, this is less likely in the Metropolitan West and South Sierra municipalities compared to Madrid (City). Regarding the Metropolitan East and South-East of the Region, nothing can be established, as the values obtained are not significant. Again, there exists a certain dichotomy in the area of Madrid: the metropolitan areas are more likely than the peripheral areas of the Region to find employment.

TABLE 6.
Probability of the residents of Madrid of being employed (logit).

	B	Sig.	Exp (B)
SEX			
Female	-1.480	0.000	0.228
AGE			
15 to 19 years old	-2.849	0.000	0.058
20 to 24 years old	-0.913	0.000	0.401
25 to 29 years old	0.598	0.000	1.818
30 to 34 years old	0.839	0.000	2.315
35 to 39 years old	0.636	0.000	1.888
40 to 44 years old	0.562	0.000	1.754
45 to 49 years old	0.409	0.000	1.506
55 to 59 years old	-0.553	0.000	0.575
60 to 64 years old	-1.545	0.000	0.213
65 and over	-4.318	0.000	0.013
MARITAL STATUS			
Single	0.307	0.000	1.360
Separated, divorced or widower	0.347	0.000	1.414
LEVEL OF STUDIES			
No studies	-0.784	0.000	0.456
Primary Education	-0.515	0.000	0.598
University Studies	0.523	0.000	1.687
TYPE OF HOUSEHOLD			
Household with one person	0.319	0.000	1.376
One adult and at least one child	0.236	0.000	1.266
Three adults	-0.157	0.000	0.855
Four adults and over	-0.141	0.000	0.868
GEOGRAPHICAL AREA			
North Sierra	0.065	0.001	1.067
Central Sierra	0.066	0.000	1.069
South Sierra	-0.088	0.000	0.916
Metropolitan North	0.089	0.000	1.094
Metropolitan East	-0.005	0.762**	0.995
North-East of the Region	0.087	0.000	1.091
South-West of the Region	-0.001	0.941**	0.999
Metropolitan South	0.014	0.000	1.014
South-East of the Region	0.102	0.000	1.108
Metropolitan West	-0.091	0.000	0.913
Constant	1.765	0.000	5.844

** No significant with a probability of 95%.
Reference: Men between 50 and 54 years old, married, with Secondary Education and living in the City of Madrid in a household constituted by two adults.

Sample size: 4,648,314

Source: Own elaboration from data of the Census of Population of Madrid, 2001. INE.

It is therefore clearly contrasted that there is a dual labour market in the Region of Madrid divided between the centre and the periphery. This marked dichotomy is an interesting case of study that allows us to address certain hypotheses regarding the geographical distribution of employment. The first hypothesis implies the existence of "agglomeration effects" in the Region of Madrid. According to this, the size of the municipalities would favour the employability of their resident population, which would be higher in the centre and the metropolitan ring. An alternative hypothesis, although related to the previous one, regards the existence of a "distance effect" in the Region of Madrid. Given the fact that the Region of Madrid is not very vast, this hypothesis implies that the municipalities nearer the centre favour employability of people residing there in comparison with the peripheral municipalities. This hypothesis is based on the idea that when people choose their place of residence they try to minimise the travelling time required to get to their place of work. For this reason, they tend to reside as near as possible to the centre, where the highest concentration of labour demand exists. However, large enterprises seem to undertake a recent decentralisation towards the metropolitan periphery (Region of Madrid, 2001).

By comparing both hypotheses, we try to determine the bases of the dichotomy observed in the geographical distribution of employment in Madrid. For the purpose of validating this, a new probability model (logit) has been carried out on the possibility of being employed against being unemployed, taking into consideration the previous variables and two new variables: the size of the municipality where the individual resides and the geographical location of such municipality, distinguishing between the City of Madrid, the metropolitan ring and the periphery (this differentiation being obtained from the previous analyses). The first variable will be used to contrast the "agglomeration effect" hypothesis and the second variable to demonstrate the possible existence of "distance effects".[13] Also, it is included some variable of control as the geographical distance to the centre of the Madrid (city), the existence of a highway, the price of public housing (that could be a indirect measure about the personal income of people[14]) and the average time of commuting (the average time of travelling to regular work place for employed people in this municipality).

Table 7 shows the results obtained. The size of the municipality is not a relevant variable for the probability of being employed or unemployed.

[13] Regarding this issue, within the geographical economic models, the distance to the centre or the distance squared are normally used. Such an indicator has not been used due to the short distances within the Region of Madrid and due to the fact that previous analyses lead us to believe that it is more determining to be in a nearer or further area than the real distance to the centre.

[14] The public prices of housing are the base of private price of housing. The difference between both is high but this index could be a measure of the differences existing by areas. To determinate the average price of housing in the region of Madrid is very difficult due to the high heterogeneity.

Although it is significant, its coefficient is null. Therefore, the dichotomy existing in the labour market of Madrid can be stated to be due to the existence of an agglomeration effect. Or at least, the effect of the agglomeration is distributed throughout the area of Madrid but is not determining. However, the geographical area is significant and shows valid values in determining the probability of being employed and unemployed. According to the results obtained, the probability of being employed decreases as the individual establishes his residence in municipalities further from the centre. However, this is also applicable to the probability of being unemployed. Therefore, the labour market of Madrid is mainly divided by the labour participation (activity rate), this being determined by the existence of "distance effects" rather than "agglomeration effects". The further away an individual resides from the centre of the Region, the more probable he/she is to not participate actively in the labour market. The large distance from companies generally located in the centre or the metropolitan ring, as well as the concentration of the older workforce which are less likely to be employed or the decline in important productive activities such as agriculture or industrial sectors could be some of the reasons behind this matter. The variables of control establish the same conclusion an exception to the probability of being unemployed. In this case, a high distance to centre increases the probability to be unemployed. Again, a main result could be established in terms of the labour participation (activity rate); a high distance to centre reduces the probability to be active.

The coefficients of the price of public housing are not important. Maybe, it could be better to test the model with data about the private price of housing or the average of wages in every municipality. Unfortunately, these data are not available.

An important issue of this analysis lies in determining whether employability is determined by the place of residence or vice versa (direction of causality). For this reason, new studies must be developed with new methodologies in order to differentiate these questions. Moreover, we have taken the first step towards determining important centralisation effects in Madrid, but establishing the reasons for such effects remain pending for future researches.

TABLA 7.
Probability of the residents of Madrid of being employed, unemployed or including in active population (in labour market) (logit)

	B	*Sig.*
Probability of being employed		
Sex	-0,215	0,000
Age	-0,206	0,000
Marital Status	0,504	0,000
Level of studies	0,806	0,000
Type of household	-0,086	0,000
Side of the municipality	**0,000**	**0,000**
Geographical area	**-0,080**	**0,000**
Distance to the centre	-0,050	0,000
Highway	0,028	0,000
Price of public housing	-0,001	0,000
Time of commuting	-0,008	0,000
Constant	1,471	0,000
Probability of being unemployed		
Sex	-0,048	0,000
Age	0,031	0,000
Marital Status	-0,579	0,000
Level of studies	-0,351	0,000
Type of household	0,112	0,000
Side of the municipality	**0,000**	**0,000**
Geographical area (distance)	**-0,167**	**0,000**
Distance to the centre	0,041	0,000
Highway	0,085	0,000
Price of public housing	-0,001	0,000
Time of commuting	0,006	0,000
Constant	-1,549	0,000
Probability of being active (in the labour market)		
Sex	-0,226	0,000
Age	-0,202	0,000
Marital Status	0,411	0,000
Level of studies	0,738	0,000
Type of household	-0,074	0,000
Side of the municipality	**0,000**	**0,000**
Geographical area (distance)	**-0,104**	**0,000**
Distance to the centre	-0,044	0,000
Highway	0,038	0,000
Price of public housing	-0,001	0,000
Time of commuting	-0,007	0,000
Constant	1,990	0,000
Sample size: 4,648,314 (to every model)		

Source: Own elaboration from data of the Census of Population of Madrid, 2001. INE.

5. CONCLUSIONS

The labour market in the Region of Madrid is characterised by being more dynamic (higher activity rates) and having better labour results (higher employment and lower unemployment rates) than the rest of the country. However, the Region of Madrid, despite being a single province, is quite far off from having a uniform and homogeneous labour market. On the contrary, the analyses carried out clearly highlight the existence of marked labour differences in its territory. These basically imply the distinction between the centre of the Region and the outskirts, that is to say, the City of Madrid and the peripheral municipalities against the rest of municipalities. In this sense, the results obtained indicate that the municipalities of the periphery present worse labour features when analysing the current configuration of their labour markets. More specifically, we have observed the following:

a. The participation and occupation of the residing workforce are lower, while the unemployment rate is higher.

b. Women show a less favourable labour position.

c. In contrast with the central municipalities, the percentage of population working in activities related to agriculture, construction and industry is higher, and lower in services.

d. All this leads to higher percentages of employees undertaking blue-collar work.

This territorial differentiation is not only observed in terms of the labour characteristics of the municipalities, but it is also based on the way in which the area of Madrid is related to the different ongoing processes of labour transformation. In this case however, the peripheral municipalities are those reflecting the most intense changes.

Finally, we can conclude that the distance rather than the size of the municipality is the most important explanatory factor supporting the labour distinction between the centre and the periphery. In this respect, the analyses carried out give a higher explanatory relevance to the "distance effect" than to the "agglomeration effect". The distance to the centre of the place of residence chosen affects, to a larger extent, to the labour results of the individuals rather than the size of the municipality where it is integrated.

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ANNEX

FIGURE A.1.
Location of Madrid within Spain and main geographical areas.

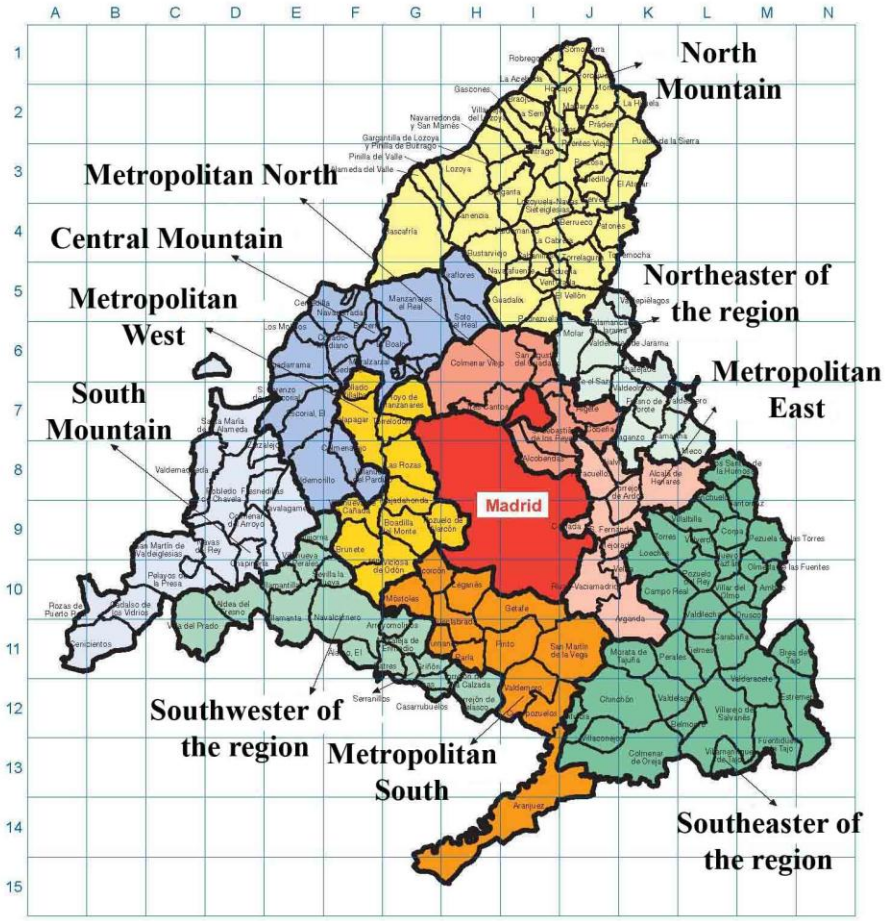
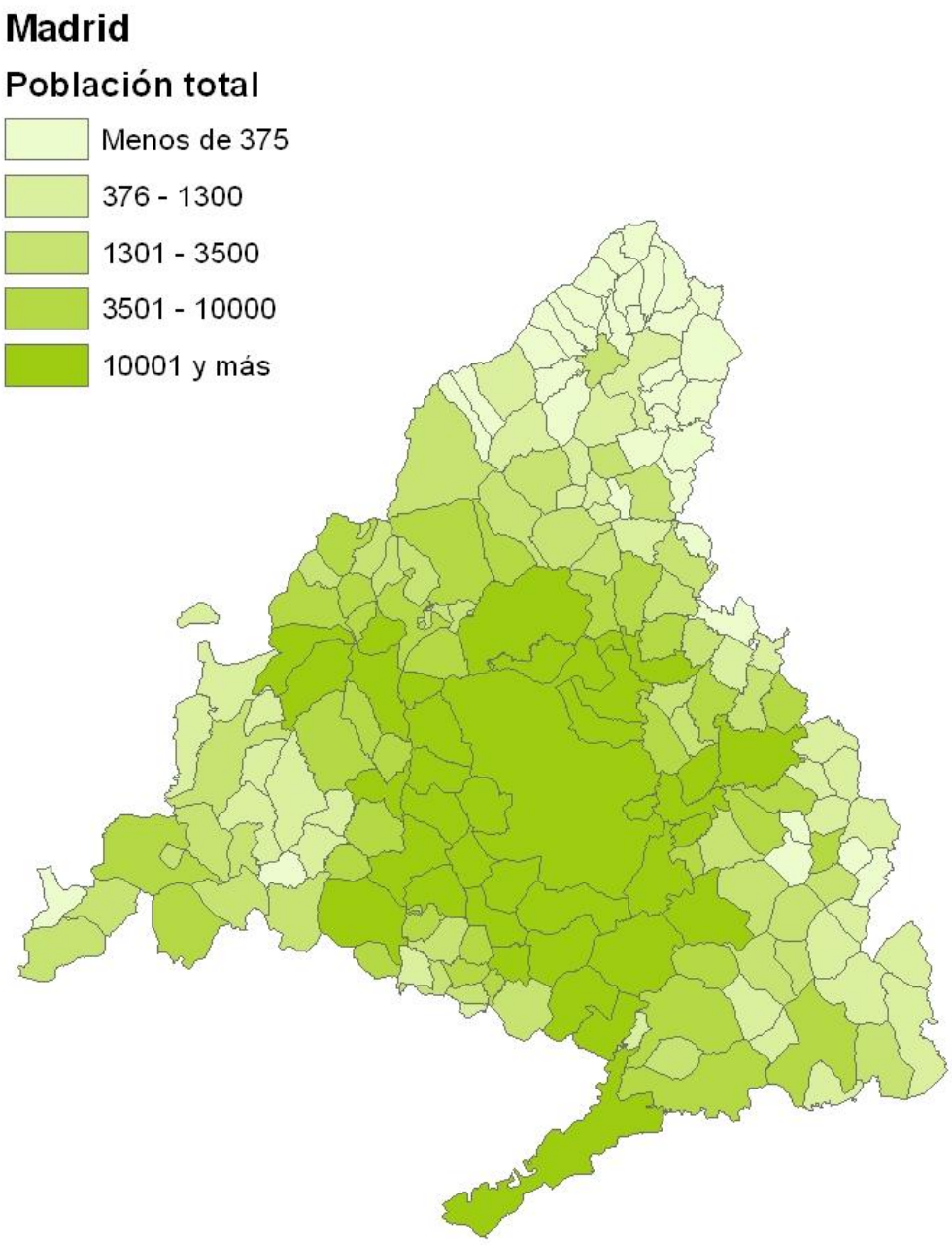
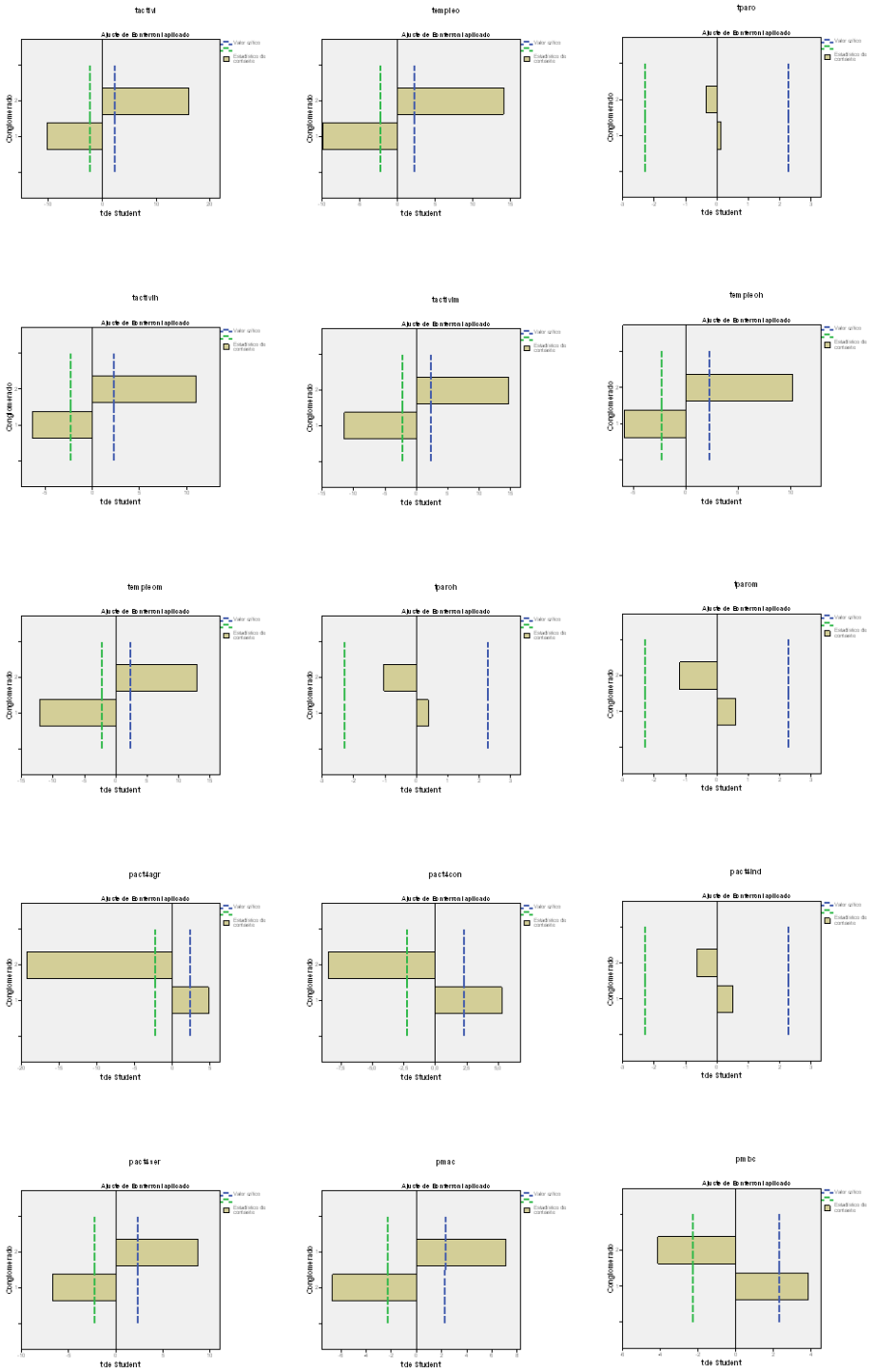


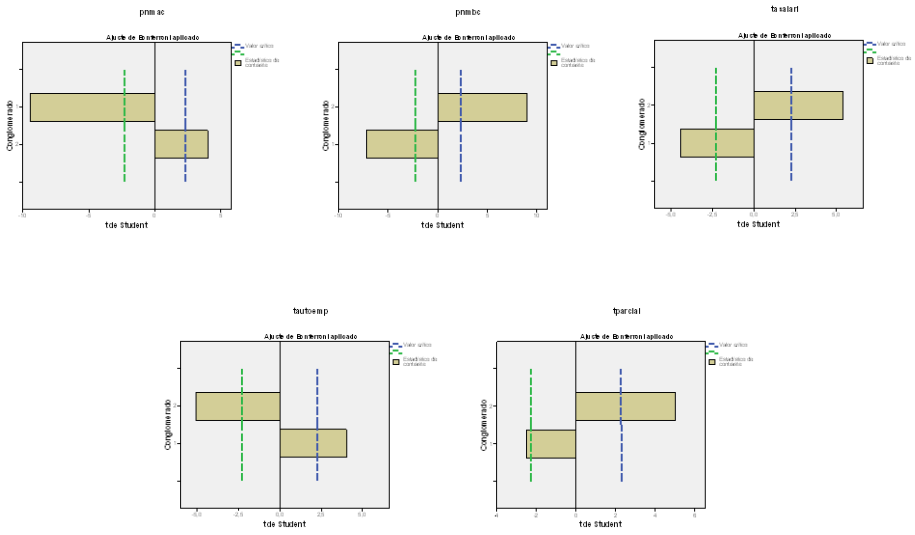
FIGURE A.2.
Distribution of population in the Region of Madrid.



Source: Census of Population of the Region of Madrid, 2001. INE.

FIGURE A.3.
Significant variables included in the classification of municipalities of Madrid using the two-step cluster analysis. Bonferroni Statistics





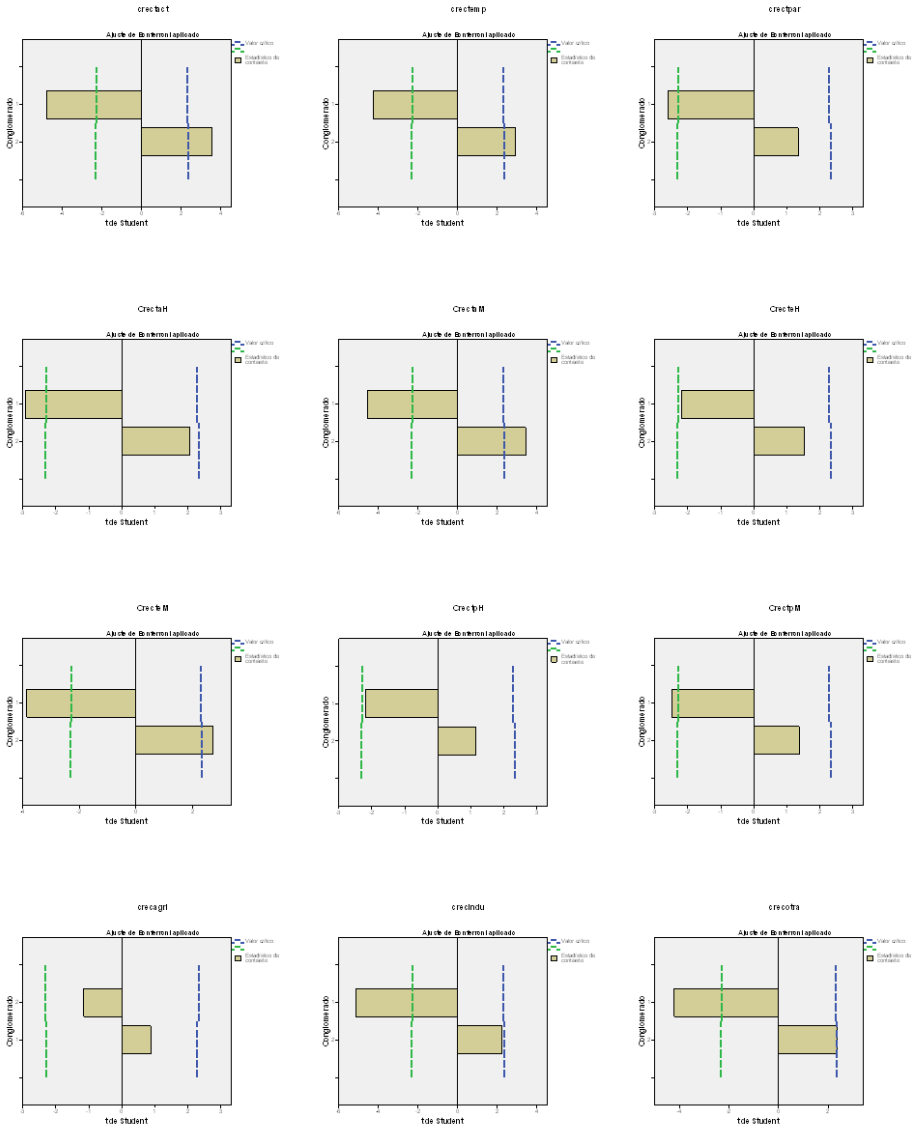
Source: Census of Population of the Region of Madrid, 2001. INE.

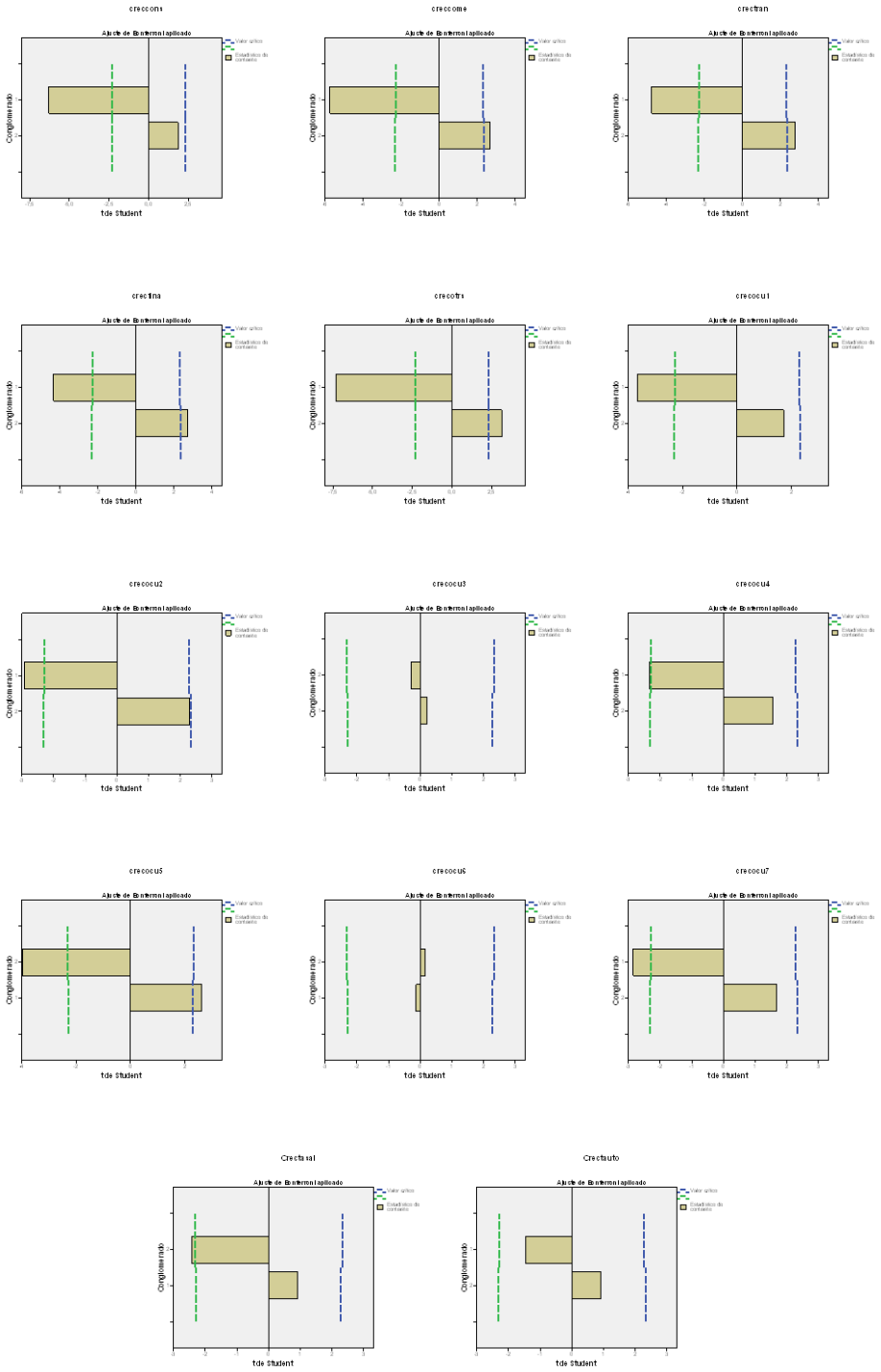
TABLE A.1.
Significant variables (ANOVA) in the classification of municipalities of Madrid by the k-means procedure.

	Sig. gl
Activity rate	.000
Employment rate	.000
Unemployment rate	.549
Activity rate (Men)	.000
Activity rate (Women)	.000
Employment rate (Men)	.000
Employment rate (Women)	.000
Unemployment rate (Men)	.569
Unemployment rate (Women)	.422
Percentage of employment in agriculture	.000
Percentage of employment in construction	.000
Percentage of employment in industry	.140
Percentage of employment in services	.000
Percentage of WCHS	.000
Percentage of WCLS	.000
Percentage of BCHS	.000
Percentage of BCLS	.000
Paid employment rate	.000
Self-employment rate	.000
Part-time rate	.000

Source: Census of Population of the Region of Madrid, 2001. INE.

FIGURE A.4.
Significant variables included in the classification of municipalities of Madrid using the two-step cluster analysis compared to the evolution of the labour market. Bonferroni Statistics





Source: Census of Population of the Region of Madrid, 2001. INE.

TABLE A.2.
Significant variables (ANOVA) in the classification of municipalities of Madrid by the k-means procedure compared to the evolution of the labour market.

	Sig. gl
Growth of activity rate	.105
Growth of employment rate	.169
Growth of unemployment rate	.388
Growth of activity rate (Men)	.322
Growth of activity rate (Women)	.123
Growth of employment rate (Men)	.280
Growth of employment rate (Women)	.247
Growth of unemployment rate (Men)	.398
Growth of unemployment rate (Women)	.422
Growth of employment percentage in agriculture	.006
Growth of employment percentage in manufacturing industries	.000
Growth of employment percentage in other industries	.000
Growth of employment percentage in construction	.000
Growth of employment percentage in trade hostel and repair services	.000
Growth of employment percentage in transport and communications	.000
Growth of employment percentage in business services	.000
Growth of employment percentage in other services	.000
Growth of employment percentage of professionals and similar	.030
Growth of employment percentage of directors and managers	.227
Growth of employment percentage of administrative employees	.247
Growth of employment percentage of retailers and salespeople	.378
Growth of employment percentage of hotels, security and personal services employees	.000
Growth of employment percentage of employees in agriculture and similar sectors	.010
Growth of employment percentage of employees in mining, industries, construction and transport sectors	.000
Growth of paid employment rate	.172
Growth of self-employment rate	.021

Source: Census of Population of the Region of Madrid, 2001. INE.

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