The use of gis to study transport for disabled people

Article · January 2007

Source: OAI

1 author:

Verónica Cañal-Fernández
University of Oviedo
21 PUBLICATIONS **113** CITATIONS

SEE PROFILE

THE USE OF GIS TO STUDY TRANSPORT FOR DISABLED PEOPLE

Verónica Cañal Fernández

FUNDACIÓN DE LAS CAJAS DE AHORROS
DOCUMENTO DE TRABAJO
Nº 335/2007

De conformidad con la base quinta de la convocatoria del Programa de Estímulo a la Investigación, este trabajo ha sido sometido a evaluación externa anónima de especialistas cualificados a fin de contrastar su nivel técnico.

ISBN: 84-89116-07-5

La serie **DOCUMENTOS DE TRABAJO** incluye avances y resultados de investigaciones dentro de los programas de la Fundación de las Cajas de Ahorros.
Las opiniones son responsabilidad de los autores.

THE USE OF GIS TO STUDY TRANSPORT FOR DISABLED PEOPLE

Verónica Cañal Fernández

Department of Applied Economics
Oviedo University
Avda. del Cristo s/n 33006 Oviedo
vcanal@uniovi.es

Abstract. Disabled people are part of our society. However, the lack of information about the number of people involved and where they live makes it difficult to provide them with proper services. This study uses the Geographical Information System to locate the residences of the disabled people in Gijon, a town in Asturias in the North of Spain. ArcView is used to analyze the mismatch between the location of disabled people's residences and the proximity of any means of transport and where the highest number of people with disabilities is to be found. This study includes practices that would improve the availability of needed data, promote integration of technology, encourage collaboration among organizations and the public sector (two aspects have proved to be the key to the creation of a successful spatial data infrastructure: institutions that create data and institutions that coordinate and disseminate data) and extend access to geospatial technologies to organizations that would not otherwise benefit from them.

Key words: disabled people, spatial data infrastructure, mismatch, interoperability, INSPIRE.

Introduction

This paper concerns the potential of GIS in the field of disability policy. It suggests there are two distinct domains where GIS may empower disability groups. First, GIS is a method that may be used by policy analysts and researchers, to map whether public resources are accessible and appropriate given the size of catchments areas for populations and given the policy and program environment. Second, GIS is a method by which information may be consolidated and used by members of disability organizations and people with disabilities for their advocacy thus empowering people with disability. Furthermore, one should design GIS methodology so that it is usable by people with physical or intellectual disabilities, and has the potential for employment opportunities.

This paper is concerned primarily with the first domain and discusses how analysts from the public policy, governmental, and public utility may use GIS. Not only may

they use it as a method to map whether such resources as employment, schools, restaurants, recreational facilities and transport networks are appropriately accessible given the size and scale of the catchments areas for populations with disabilities.

The amount of information available in the different administrative registers managed by public administration is wide ranging and its value in improving social and economic research as well as its usefulness in conducting, assessing, judging and planning public policies is now recognised in Spain. This idea, often seen in the business world, is the main source for this study using information based on the inside pattern of the consumer's behaviour to create value – with an innovative approach to the problem of transport for disabled people with reduced mobility. A spatial data infrastructure is now commonly considered as an important economic resource and a critical base for the sustainable development of society. This information is a very important part of the country's Public Sector Information, which - in the knowledge-based economy - can have a strong and positive impact on citizens' quality of life and the development of businesses and administration. Many governments and the European Commission have recently introduced ambitious policies, guidelines and programmes to achieve a better quality of life for disabled people (e.g. INSPIRE, see Figure 1). The main objectives for those programs are to implement an information infrastructure that can provide the public sector with information for common use throughout the whole of society.

This analysis manages the relationship between three independent databases available in the public administration organization (Consejeria de Vivienda y Bienestar Social translated as English Regional Housing and Social Welfare Council, urban cartography in municipalities (local authorities) and the public transport offer available in the Consorcio de Transportes de Asturias, translated to English as Asturias Transport Consortium) to create a new and unique integrated base in an information geographical system with all the information (transport offer, disabled population needs of transportation, tracking down disabled people's residences). The main characteristic of this computer tool are its flexibility and consistency; the possibility of its low cost maintenance because each public administration performs operations naturally on its own, but with a common database. An advance in the standardization and coordination of computer science systems would allow the marginal cost of these operations to be reduced to the minimum expression. The application has used software ArcView GIS 3.2, a platform GIS that allows to one to integrate data from different origins, as well as to explore spatial data coming from other sources and its digitalization (see Figure 2). This way, the nature of their disabilities and locations of the handicapped people are analyzed. This analysis helps by providing the number of people involved and their location. So, the main purpose of this information system is to reduce the uncertainty for decision making, that is to say, to promote interest in the resolution of problems of mobility for disabled people from a cartographic perspective, an approach barely used at the moment.

This work is totally coherent with strategy 1003 defined by the National Plan of Accessibility 2004-2012 of the Ministerio de Asuntos Sociales-IMSERSO (Ministry of Social Affairs-IMSERSO) ("Fulfilment of statistical studies of accessibility in different environments"). Due to several reasons explained later, the investigation has been limited to Asturias; this will not detract from any general interest. The highest existing costs of transaction to coordinate a cross-sectional investigation affecting different administrations, endowing this research with the character of a pilot project,

that is expected from the guideline set down by the National Plan of Accessibility 2004-2012, in its first stages (2004-2006):

"Suitable control and information means should be created to carry out an efficient use of the resources from different Gobernment Administrations to promote facilities for disabled people. Although managing and sharing information is not a frequent habit among different Public Administrations, the increase shared specific obligations as those announced in the Law should be an incentive to generate new dynamics in this field"(p. 164).

Besides being used as a prototype and as a research tool, this analysis can offer private companies a mechanism of control about the number and distribution of disabled people through the accomplishment of consultations and the creation of certain informative thematic maps very useful for these companies to allow them to their adapt services to the existing demand.[1] In addition, with a model GIS, transport services planners can have a better tool to coordinate, to evaluate and to control transport services.[2] The improvement of communications, coordinating the efforts at the time of data collection and the interchange of information can lead, in the long term, to the reduction in costs and an increasing quality in decision making. These spatial relations between people, their activities and the territory in which they live, are those that allow, through the integration of data, a better administrative management and a better knowledge of our surrounding areas.

This paper is organized as follows. Section two describes the collective who is used to evaluate the importance of GIS in public transport. In the third section I briefly describe the major source of data used to analyze the information available on transport and disabled people. Section fourth and five present, respectively, the methodology used to study the relation between transport network and the distribution of disabled people in the territory and a description of the town used to analyze the mismatch between the location of disabled people's residences and the proximity of any means of public transport. In order to analyze the social and territorial impact of public transport, section sixth proposes a transport cover index to reconcile spatial data from different sources that allows the creation of new data sets.

[1] Every citizen, whether or not inhabitant, who has a relation with the corresponding local authority, has a geographic identification with that relation; for example, a boy with a certain degree of disability comprises a family unit, who lives as well in a certain flat that is located in a given street and goes to a school that is located in another street. In this case these exists a spatial relation between this boy and two streets of this local authority. If these relations are integrated in a geospatial database, it will be possible, if necessary, to establish how many young children in general or how many young children with disabilities are registered at a given school located in a given street and how close these children are to the mentioned school.

[2] A coordinated program to establish a model of integrated transport and a network of public and projection transport within the province, to allow future scenes of urban growth to be described and the necessities of transport generated or to consider the impact on the demand of different measures from traffic and transport (for example, the introduction of a new line of transport, the demand for buses with ramps on certain lines, services - or services door to door, etc.).

Finally, the two latest sections contain several problems such as a structural shortcoming in the statistics network in Spain and the main conclusions arising from the study.

Definition of a person with reduced mobility

The questions of the definition of "person with a disability" and how persons with disabilities perceive themselves are knotty and complex. It is no accident that these questions are emerging at the same time that the status of persons with disabilities in society is changing dramatically.

A person with reduced mobility is one whose mobility is reduced whether temporarily or permanently due to a physical inability (sensorial or driving force). This state could be the result of an intellectual deficiency, age or any other cause of manifest disability to use any means of transportation. These people would also need special attention and/or an adjustment in the available services used by other people.

- People in wheelchairs, with great difficulties in moving, travelling impediments, or with problems going up and down stairs or on pavements, or moving on uneven pavements, etc.
- People with sensorial difficulties (vision, hearing, communication, etc.) prevented from using conventional transport service (to get a travel ticket, to access to stops, boarding and leaving the vehicle, etc.).
- People with lack of functional mobility, amputation or arthritis of a limb who have problems moving, going up and down pavements, vehicles etc.
- People whose normal movement is affected by cardiac or respiratory problems.
- Older people who cannot move without help.
- People not permanently disabled, but with some type of temporary loss of mobility, for example pregnant women, people with a leg plaster on crutches.

From these definitions we deduce that the concept of a person with reduced mobility directly associates the term disability with mobility. Therefore, there is a group of people that, due to their disability have their physical, psychic or sensorial, ability to move temporarily or permanently decreased.

The concept of reduced mobility is wide an ambiguous. In order to carry out the study and respecting privacy and data protection rights, the database includes all disabled people who have a degree of disability over 33%.

Table 1. Reduced mobility people´s definition according to the source

European Parliament	All the people with difficulties in using public transport, for instance, handicapped (including people who have sensorial and intellectual disabilities and the people in wheelchairs), people with limited movement on a limb, short people, people burdened with shopping or luggage, pregnant women, old people, people with a pram and people with young children (including children in strollers).
IMSERSO	The group of people with reduced mobility includes all those who have a permanent or temporary physical, psychic or sensorial disability or those who in an exceptional circumstance have the normal development of their capacity of movement reduced. According to this definition within this group there would be included people with some type of disability, as well as those with a temporal hindrance derived from a natural processes (old people, pregnant women) or exceptional cases (victims of an accident, people with children), because their mobility is restricted.
Dependency Law[3]	According to this law permanent disability is the state of permanent dependency of people who, by reasons related to the lack or the loss of physical, intellectual or sensorial autonomy (understanding by autonomy the capacity to control, to confront and to make personal decisions about how to live in agreement with social standards and one's own preferences), need the assistance of other people or important aids to perform basic daily life activities, understanding by daily life activities the basic tasks any person performs to carry on a normal independent life, such as: personal care, basic domestic activities, essential mobility, to recognize people and objects, to orient themselves, to understand and to execute simple orders and tasks.

Sources and data

At the present time, the processes of planning, organizing, managing and evaluating transport demand efficient management systems and information analysis, in terms of processing speed, capacity of storage, versatility and reliability. In order to achieve this purpose it is indispensable to count on computer technology able to produce and to store input to make the system work. The geographical information system (GIS, see Figure 3) development has contributed to the demand for georeference spatial information of all kinds (characteristics relating to people, businesses, equipment, infrastructures and buildings, etc.).

GIS constitutes, without any doubt, a powerful tool to collect, store, recover, analyse and unfold spatial data, for this reason it is an essential instrument to plan, design, construct, operate and maintain transport systems, a clear example of the advantages of GIS is shown in the applications carried out in town councils which include information from different sources, automated handling, graphical visualization and generation of maps, graphs and tables. One of the mayor problems at the beginning of GIS was information. The process of automatization of data is, perhaps, the critical component of the project, and a good recommendation in the process of file conversion is to have a good system of quality control. Thus, the success of the GIS depends on a good plan and strategies design, the procedures determine how to do tasks, such as how to introduce information in digital format, how to store and how to exit information format. This did not constitute a problem for the development of this project, since the need to count on cartographic and

[3] Draft Law for the promotion of personal autonomy and attention for people in situations of dependency. Ministry of Work and Social Affairs (MTAS).

alphanumeric georeference related to the spatial units with which we worked, was provided by Gijon Town Council

This chapter describes the inclusions and limitations data used in the analysis. A major problem to consider in this research is the access to updated, uniform, appropriate and complete statistical data to reach the objective proposed in the investigation. The suitable generation of data in the format, scale and map projection that is to say, the process of integration of the necessary information, is the one that takes most time and high cost. All GIS as an instrument of data processing requires two types of data sources: cartographic and alphanumeric.

The study consists of the quantitative and cartographic analysis of the information available on transport and disabled people in the town council of Gijon. Through the use of GIS (ArcView 3.2) the incorporation of the urban and interurban bus line has been carried out by the Consorcio de Transportes de Asturias (Asturias Transport Consortium) with the cartographic database of the town council. Together integrated in the same cartographic database the information related to disabled people provided by the Consejeria de Vivienda y Bienestar Social of the Principality of Asturias (Regional Housing and Social Welfare Ministry). In this case, the above mentioned government organization did not provide digital information therefore additional tasks were performed in order to adapt data to use in ArcView 3.2.

This thematic database[4] gathers people with a certain level of disability (according to the law this disability must always be above 33%) with additional information on each individual such as street address, postal code and degree of disability.

All this information is included in a new database called associated database, and is the result of the integration of cartographic bases and the alphanumeric data through GIS. This base physically does not exist, but we have created it from multiple surveys performed for this project.

The cartographic procedure is carried out through the relation of the cartographic and thematic databases (see Figure 4); next the application loaded for its integration, through the use of a common field which is the street number.

Methodology

In order to assess the social and territorial impact of public transport we are going to study the existing transport network and its distribution in the territory, so we can get an accurate perception about its spatial and population coverage. The analysis is carried out keeping in mind the proximity[5] of every handicapped individual address in the Gijon Town Council to the bus stops of the public transport.

[4] It is formed by the data of alphanumeric type and constitutes the fundamental part of this GIS. In a first stage of the work, the thematic database is constituted from primary data (the ones facilitated by the Council), but in a second phase has been created a set of databases generated from the cartographic treatment of first.

[5] In order to carry out this study a 25 metres distance from a bus stop to a residence has been taken as reference so the potential users within are considered able to use public transport without additional help. In order to simplify the study when the centre of the circle that represents each bus stop is within the influence area of 25 metres, we consider that all inhabitants who live in this area can accede to the public transport.

The used methodology only allows getting a rough result, since relevant aspects such as frequency, schedules, length of distance are not taken in consideration. We will only know how many districts (and consequently how many inhabitants) have access to the urban public transport and how many lack this basic service (according to the transport service coverage in the given quarter).

The first step consisted of purifying the database in the government department where the data were stored, this was one of the hardest tasks; it took a lot of time to clean the data files to eliminate the duplicated elements and obtain a good structure design to be used according to the alphanumeric[6] charts in the corresponding town council.

The administrative registrations are mainly used to gather information needed to fulfil their administrative purpose therefore their demographic use demands expensive previous tasks to allow the normalization and necessary purification of the data to lead to reliable and useful yields.[7] The next step is georeferenciation (see Figure 5); the geographic identification of alphanumerical data to classify cartographic and thematic information to use the previous gathered data to select the variables to be analyzed must be referred to the used spatial units. The geographical reference is carried out through information tabulation using as reference the street address and a specific code assigned to disabled people from our database and the city council. So we can overlap the disabled people cartography with the topographic one, this is to say we adapt the cartographic structure and the database associated to a new data model where all the information is divided in three groups: people, transport and area is geographically quoted in the cartography through the street address.

With regards to the means of transportation, the bus has been chosen, due to its bigger spatial incidence and permeability in the urban network. As a result the stops of existing lines will be adopted offering spatial transcription of desirable access.

Regarding to people with reduced mobility needing transport, only handicapped georefered residence by street address has been contemplated in the study.

On the other hand, the boundary of areas of influence with respect to the stops and the georefered population by buildings is the most exact possible since it tries to approach in detailed the origin of the journay (residence) of the personal displacements.

In the analysis the bus stops are included and they have the codification assigned by the Asturias Transport Consortium. As a boundary a 25 metre area has been chosen around each bus-stop, understanding that it is convenient and representative enough, since we are speaking about people who have mobility difficulties.

This information has been useful to make an approach to the accessibility of the transport based on a zone where people with reduced mobility live, in order to work out which areas have better communications.

On the other hand, should be emphasized a series of disadvantages at the time of doing this study:

[6] Gijon Local authority uses access as data manager because of its flexibility to import and export data, data manipulation and table definition.

[7] See Bermejo (2006).

- No standardized directions. This it is an important requirement to make reliable, useful codifications and operations.
- The concept of reduced mobility is wide and ambiguous, that is to say, it does not have defined limits due to the difference in each case in a group, and therefore, it is not possible to fit a concrete group of people in accurately. Thus, a group of people with reduced mobility will be defined by all the people who have a temporary or permanent physical, psychic or sensorial disability, preventing their normal development of mobility.
- Even when the database specifies the degree of disability for a person, the type of disability is not defined for each person in the same degree, and therefore every single person included in our data has been chosen to complete this survey.
- It is necessary to keep in mind that there is no evidence of the existence of disabled people who have never requested support because the family is usually in charge of their care.
- Another problem displayed in the database is that it was not updated, that is to say many registered people could be dead by now. In most cases relatives do not communicate their death.

Analysis of a study case: Gijon

In this chapter we start from the estimation of population included within an area next to a bus stop combining the metric distance by georeference streets with street address. If good digital street maps as well as a good postal address are available for georeference, the application cost turns out to be irrelevant so, this will be a good methodological option. Obviously to adopt a metric system and a georeferentiation method will result in a totally different final result from those obtained by using other old methods. If decision making must be supported by rigorous information, these georeference methods and the subsequent possible choice by researches would be conditioned by the public organizations in charge of producing and managing statistical data. The following calculations are made

- To carry out a description of the potential demand of transport from people with disabilities, contemplating exclusively the georeferential resident population according to the street number.
- Description of transport offer, centered on the city bus, due to its greater spatial presence.
- Purification and normalization of the database of people with disabilities respect to the official street guide of each city council.
- Georeferentiation of the population by buildings, through street number.
- Influence areas: boundary of the areas next to each bus-stop in ranks of 25 metres.
- Index of cover: surface or percentage of each district that has bus-stops in a distance that oscillates between 75 and 375 metres.
- Calculation of the potential demand (resident population with some type of disability) in the area next (each 25 metres) to each bus stop.

Gijon holds a privileged geographic position on the Asturian map, a few minutes away from Oviedo and Aviles. These cities are linked by the "Y" motorway, a large

highway of the Asturian metropolis. It takes half an hour to get to the airport or to the coal mining areas. The centre of Gijon has an amphitheatre shape, marked by the large beach of San Lorenzo, the main beach in the council.

With a surface of 187.7 and a density of approximately 1,460 inhabitants, the Council of Gijon is located in center of the Asturian coast (north of Spain), bordered by the councils of Carreño, Corvera, Llanera, Siero, Sariego and Villaviciosa.

The urban neighbourhoods, extend both sides of the primitive Roman quarters located in the hill of Santa Catalina, has a surface of 13.9 km2 - it is 7.6% of the surface of the Council in which 90% of the population is concentrated, total 274,000 inhabitants in 2005. 10% of the remaining population is distributed through the 25 parishes of the Council (see Figure 6).

The Regulation of Organization and Laws of the City council of Gijon divides the Territorial council in districts equipped with management organizations, Councils, without their own legal personality and presided over by a Councilman; the five first districts contain different neighbourhoods of the city of Gijon (see Figure 7), and in the last district the other parishes of the council are located.

As general information here are the names of the different parishes and neighbourhoods in Gijon.

- District called “Centro”. This includes the Central area, “Cimadevilla” and “Laviada” neighbourhoods.
- District East: includes “La Arena, El Coto, El Bibio, Las Mestas, Viesques and Ceares” neighbourhoods.
- District called “El Llano”.
- District South: includes “Pumarin, Montevil, La Braña, Nuevo Gijon, Santa Barbara and Roces” neighbourhoods.
- District West: includes “La Calzada, Jove, Tremañes, Natahoyo and Moreda” neighbourhoods.
- Rural district. This includes the following parishes: “Bernueces, Baldornón, Cabueñes, Caldones, Cenero, Deva, Fano, Fresno, Granda, Huerces, Lavandera, Leorio, La Pedrera, Porceyo, Poago, Ruedes, Santurio, Serín, Somió, Tacones, Vega and Veriña”.

The rural parishes have one double economic specialization; on the one hand, industrial specialization and, on the other hand we can find a set of parishes of clear residential nature that provide of space and leisure services.

In the first place, we showed the obtained results when analyzing the parishes and districts that compose the municipality of Gijon. It is possible to emphasize, that the parishes do not have an official boundary, but this parishes correspond partially with the urban area, so the sum of their surfaces does not correspond with the surface of the neighbourhoods.

In order to carry out the analysis with GIS it was necessary to georeference the population with disabilities through the only key that allowed us the database facilitated by the Consejeria de Vivienda y Bienestar Social (Council of House and Social Welfare), which is the street number. This street number was our identifier in the official street guide of the Gijon Town Council. So, we normalized this database according to the official street guide in order to locate disabled people geographically. The process has the following procedures:

- Out of the 30,579 disabled people registered in Gijon, 28,723 are registered with complete address. There is no way to identify the other 1,792 because they do not have a street address to allow their geographical identification.
- Next this purified database was overlapped with an alphanumeric table with the postal addresses according to its official street map. So an additional new database with 27,128 postal addresses of disabled people is obtained. After this procedure 1,595 postal addresses are lost, which could be due to mistakes in data entry.
- Finally the resulting database was exported in DBaseIII to Arcview so we could visualize geographically disabled people in Gijon.

Due to the database size (27,128 disabled people) and to simplify the calculations, “el Centro” neighbourhood was chosen to be studied because in this area there is the greatest number of bus stops and together with “El Llano” neighbourhood they have the highest number of disabled inhabitants (see Table 2 and 3).

On the other hand in “El Centro” we have counted 1,140 street addresses with several handicapped residents on each (see Table 3.4). In this table we can see not only each disabled person’s address but the distance between the address and the bus stop, this distance could be from 25 to 325 metres so the whole surface on the chosen studied neighbourhood is covered. After studying, these data allow us to figure out the bus stop location on any street and its distance from any random handicapped residence.

If we put together each address and each disabled person, we find out that the greater the bus stop distance the lower the number of disabled people’s residences. As a conclusion, we can figure out that under the hypothesis that every street in the neighbourhood “El Centro” is accessible for disabled people, most of the handicapped that live in this neighbourhood in Gijon have at least one bus stop within 300 metres of their street address.

We have to realise that the bus stop closest to a handicapped person’s dwelling may not be the one this person would need the most. However, once the person has ridden on an accessible bus he or she can always transfer.

We have extended our study 100 metres around the “El Centro” area in order to provide more accurate information, that is to say, users can move to another neighbourhood to get the bus if this bus stop is nearer their house.

In Figure 8 we can see the neighbourhood, the object of the study “El Centro”. The concentric circles are the 25 metre distance from the bus stop to a disabled person’s residence. The green dots are the bus stops in both direction within the neighbourhood and the blue dots represent disabled people.

On the other hand the light blue area around the studied neighbourhood represents the 100 metre extended studied area, and the yellow dots are the bus stops in this area.

Mismatch: Transport coverage index

This statement proposes the adjustment of transport availability and the distribution of the segment of population who use it. We calculate an index of transport covering whose value is determined next.

The first thing we did to measure the level of the offered service was to set a zone of influence around each bus stop within the studied area (593 bus stops in whole

municipality of Gijon). This influence area, like a market area (Lösch, 1954), describes the chosen area by the user as a minimum cost access area. Next the geoprocesing function “union two themes” is used to join the influence area layers representing the bus stops and the neighbourhood where they are located. As a result we got a new join layer to figure out where the bus stops are located and the distance, in this case from 75 to 375 metres. Finally we exported this chart to access and got the following results:

- First we looked at data showing the neighbourhoods and the surrounded areas.
- Next we search to discover what area in a neighborhood is within a specified distance. These are areas of influence around bus stops (see Table 5). For instance, in “El Bibio” all the bus stops are less than 375 metres distance from a disabled person’s home. On the other hand in “Tremañes” neighborhood all the bus stops are more than 375 metres away. In addition we can state that “La Arena” has the best transport network because almost all its surface is covered by bus stops located within 75 and 150 metres distance from located of handicapped people’s addresses in the area. On the other hand, “Tremañes” neighborhood has the worst transport network system with bus stops 375 metres away, “Jove” and “Veriña” neighborhoods are worse than “Tremañes”.
- Finally through a cross reference consultation over the two other ones previously done on the distance group in each neighbourhood we obtained the coverage index, that is to say, what percentage of the total area in each neighbourhood has a bus stop and on which rank of distance.

$$IC_i^d = (As_i^d / An_i) * 100$$

where:

IC_i^d : coverage index, areas with bus stops in neighbourhoods (i) on each rank of distance (d).

As_i^d : area section, share of area in a neighbourhood (i) for a rank of distance (d).

An_i : area neighbourhood, total area in any neighbourhood.

In Table 4 we can see “La Arena” neighbourhood which is the area with the best transport network because 98% of its total surface is within 0 to 150 metres average distance from a residence to a bus stop. In other words, any potential user can find a bus stop walking less than 150 metres. “El Coto” and “Laviada” neighbourhoods are in the second and third place transport wise with coverage of 94% and 91% of their surface.

According to this index the neighbourhood with the worst transport network is “Santa Barbara” with only 61% of transport coverage with a rank of distance to the closest bus stop of 375 metres distance followed by “Tremañes”, “Jove” and “Veriña”.

“El Centro” neighbourhood is reasonable because approximately in 83% of its surface the average distance to a bus stop is 150 metres.

In agreement with this index, the worst communicated neighbourhood is “Santa Barbara”, since 61.6% of its surface is within the rank of distance to the nearest bus

stop of more than 375 metres, followed the districts of “Tremañes”, “Jove” and “Veriña”. In the case of “El Centro”, it is not a badly communicated neighbourhood since approximately in 83% of its surface the bus stop is less than 150 metres away.

Table 5.4 shows the distribution of disabled people within Gijon neighbourhoods and according to the distance to the nearest bus stop in a 25 metres rank. “El Llano” neighbourhood has the greatest number of disabled people followed by “El Centro”. In both neighborhoods we can notice that disabled people are mostly located within 25 and 250 metres distance from the nearest bus stop. If we relate this table with the coverage index we will see the worst transport network is in “Santa Barbara” neighborhood, however, there are no disabled people registered in this area. The next with not such a good transport network are “Tremañes” and “Jove” neighbourhoods in which four disabled people were located more than 300 metres away from the closest bus stop.

This approach could be interesting for social services because a great segment of the population has insertion and autonomy difficulties inside society and need a certain kind of help to support their personal and economic and social development. This information analyzes social reality and new data can be added in order to store information about disabled people and other potential users and can also provide statistical data about the economic and social health in the studied neighbourhood. Additional studies on this segment of the population could be done to provide economic and/or social aid. The areas with a higher disabled population could receive more help than the ones with less disabled people.

On the other hand, the GIS give management and integration technical solutions about citizens. This data would be available to be used at a technical and political level in town councils to make decisions through the Consejeria de Vivienda y Bienestar Social (Regional Housing and Social Welfare Ministry) where people who get government aid are registered.

The geographic accessibility approach shows an offer which is worthwhile from the public transport user perspective. The increase in the number of bus stops available determines the quality of the service from the user point of view because it reduces the access time to the stops but the travel time may be longer due to the average speed reduction. This is the “opportunity cost” for the users if they wish to reduce the surface movement, especially people with reduced mobility. To provide this service to the handicapped increases the cross subsidy for all the users: a mayor accessibility desire will lead the transport planner to increase the bus stops in the network to benefit the handicapped and with certain loss in the average speed for the rest of the users.

Future research lines

In 2001 a new core of action was established –the Society of knowledge (Innovation, I+D, Information Society) – linked to FEDER was created. Measure 2.7 of the Information Society seeks to assign a new integrated function to the system to analyze and exchange information to coordinate territorial and cartographic information in the local, regional, national and European scope as a basic tool to

collect, broadcast and add new data, as well as to make it accessible to a great number of external users[8].

The work performed throughout this investigation shows a structural shortcoming in the statistics network in Spain, that is to say the lack of an administrative data georeference standard. This standard is the core information unit because it is the starting upward point or the foundation of the whole digital information. As different specialists highlight[9] there is a crack in the vault of the system and it can only be corrected with work, that is to say, hours of unproductive work due to data processing. When data is introduced in the system, these data should not be loaded again.

It is urgent to create the conditions for the standardization of information. All the organizations involved in the administrative bases management including local and regional authorities as well as national and international statistic organizations should commit themselves to this project. The main gains of productivity and efficiency lie in standardization we can take advantages from scale economies in fixed expenses in which all information collection and load are involved.

Without this standard many hours were invested in order to fit the source of information through purification of original data provided by Consejeria de Vivienda y Bienestar Social (Regional Housing and Social Welfare Ministry). As is known the administrative databases arise as a result of management needs therefore they could be incomplete. For this reason it is important for the administrative manager to recognize the statistical significance of his or her assignment because real standardization is finally present in every social issue. These standardizations can be used to improve the service if we learn to recognize them. In economic terms there are some scope economies, so managers must recognize and collect information wisely, information technologies make it easy to perform this task at low cost expanding qualification and productivity in the information management positions taking away routine operations and leading to creativity and problem resolution.

From the transport demand side we must consider the collecting information process within the affected community (disabled people). To recognize disabilities includes a wider study on characteristics in particular cases and handicapped people's residences. This opens up an interesting line of investigation in the information technology and spatial encryption field, such as the search for new ways to protect individual data privacy without sacrificing information.

Conclusions

GIS are widely used in business, government and a range of academic disciplines their application in economics has, to date, been more limited. The most frequent

[8] Recently, international organizations promote investment and research policies in spatial data infrastructure and their use by public institutions, groups, etc. The main conclusion is the necessity to create data infrastructure, standards and agreements between the spatial information creators to optimize its work. This is reflected through European Union directive, one of the most important is INSPIRE. INSPIRE aims at making available relevant, harmonised and quality geographic information with the purpose of formulation, implementation, monitoring and evaluation of Community policy-making.

[9] See Carcel, Marcos and Saralegui (2006).

application in economics is the use of GIS to visualise or map economic data with a spatial component. Less common is the use of GIS storage and management functions to generate additional data as inputs in to further statistical analysis. Many of these sources, for example sampling and census data, will be familiar to economists. Therefore, given that GIS data are spatial, a natural use is to measure the distance between observations or between observations and other features of interest. These distances could be physical distances, network distances (e.g. along a transport network) or involve some more general concept of social distance. Knowing the distance between observations is useful if we think that there may be interactions between them and that the strength of these interactions is mitigated by distance. According to this, the main purpose of this study is to show the importance of knowing the location of disabled people in order to improve public services, in this case, public transport for them. So, their distribution in the different parishes and neighbourhoods and their proximity to the bus stop provide an example of the use of GIS to implement such an instrumental variables strategy.

At present the success of the local administration is based on an excellent information management. The effectiveness of management requires a quick handling of great volumes of spatial (territorial) data related to different local tasks. As seen during this research the implementation of a geographical information system allowed us to store data from different administrations and to develop and analyze urban and social cartography with information statistics optimizing data flow to improve the yield and coordination in the daily tasks that different service departments provide and reducing marginal costs.

The major problem collecting information was the variety of data to be manipulated. We realized the urge to credit the data and its inconsistencies (wrong addresses, non existing streets, incomplete addresses, etc) to figure out the method to follow for normalization to be carried out. A fundamental issue to make the most of the disabled people database is to georeference information through the addresses. By experience we found out that this is an expensive procedure due to the lack of updates in mail address provided for this study. This is because Town Councils and local administration do not coordinate this task, so we had standardized this information before we began the research process. Interinstitutional relation is the key stone to complete any social task. The hierarchy creates an environment to create and keep data to be used at different levels according to topics, current affairs and covering information needed. These are the first steps to create coordinated relations and communication among the different agents in private companies and public administration.

An integrated perspective to interchange information and analysis to coordinate this local and cartographical information begins with this study and its purpose is to improve the collection, dissemination and broadcasting of data and the interchange of information among public organizations that produce information. In the current availability context of better and more quality data it is possible to reach a higher stage with regards to processed information as a result of investigation. Exacting data related to disabled people (privacy is always respected) sensible decisions to achieve more effectiveness in goal attainments among service providers of special means of transportation. The availability of sophisticated tools and particularly GIS makes data manipulation and analysis easy.

This work has tried to get a better yield in transport management in order to improve transport services for disabled people and increase effectiveness in related

agents so the utility of the information system is closely related to its capability to build real world representations from digital data. In this analysis we have tried to assess the degree of accessibility to public transportation among disabled people in Gijon measuring the public transport covering terms of accessibility in a simple way: whether or not a disabled person has access to public transport. With these functions we configured a geographical information system in order to get:

- Modernization of administrative public service with clear territorial implications. This will be carried out through spatial information technology. Data should be collected once and maintained at the level where this can be done more effectively.
- To assess the updated information availability as a support for decision making and its consideration as an instrument for territorial management.
- Information quality, during gathering process and in its processing
- Design of data model, organizational structure of territorial information to clarify, gather and help its process. An important condition to take different data files from different government organizations and make them useful from the information management point of view is to make them available to every government organization through a badge system on each registration; for instance county, municipality, if available, district, neighbourhood and the census tract. The standardization of postal addresses allows georeference information suitable for statistical information to be used for spatial required field.
- Spatial data specifications and harmonization. Data compatibility is fundamental (standardization) and interoperability with existing systems in regional administration.
- A loading protocol for information maintenance and upgrade in an integrated GIS platform. It should be possible to combine spatial data from different sources and share it between many levels, users and applications.
- To exchange information at regional level is an important cooperation support (through collaboration agreements) between government organizations to use GIS (regional administration, research institutions and private corporations) and with those boards of directors and institutions related to local management cartography data generation.

Finally those people in charge of decision making need to discover the economic and environmental benefits in this procedure. For instance reducing duplication and resource expenses or improving urban environment management. It is paramount to get local administration involved in this project since they are the main spatial information providers and this information is socially relevant because it includes local water service, rubbish service, health service, education, post office and public transportation.

References

Bermejo, A.: La estadística municipal y su esperanza en el aprovechamiento de los registros administrativos. Instituto de Estudios Fiscales, Madrid (2006). http://www.ief.es/Investigacion/Recursos/Seminarios/Estadistica/RegistrosAdministrativos.htm

Carcel, C.: "La producción estadística pública. Un punto de vista municipal", Instituto de Estudios Fiscales, Madrid (2006). http://www.ief.es/Investigacion/Recursos/Seminarios/Estadistica/RegistrosAdministrativos.htm

European Commission: Green Paper: The citizen´s network. Fulfilling the potential of public passenger transport in Europe. The Office for Official Publications of the European Communities. COM(95) 601 (1995). http://europa.eu/documents/comm/green_papers/index_en.htm

European Commission: White Paper: European Transport policy for 2010: time to decide. The Office for Official Publications of the European Communities. COM(2001) 370 (2001). http://europa.eu/documents/comm/white_papers/index_en.htm

DPTAC: Re-statement of recommended specifications for buses used to operate local services. Disabled persons transport advisory Committee, London (1993).

ECMT: Public transport by bus. European Conference of Ministers of Transport, OECD publication services, Paris, France (1989).

ECMT: Access to Coaches. European Conference of Ministers of Transport, OECD publication services, Paris, France (1990b).

ECMT: Improving Transport for people with mobility handicaps. A guide to good practice. European Conference of Ministers of Transport, OECD publication services, Paris, France (1999).

INE: Nacional Disability, Deficiency and Health condition survey. Instituto Nacional de Estadística, Madrid (2001).

Longley, P. A., Goodchild, M. F., Maguire, D. J., Rhind, D. W.: Geographic Information Systems and Science. 2nd edition, Wiley, England (2006).

Marcos, C.: Ventajas e inconvenientes, oportunidades y algunas propuestas para el desarrollo de la estadística de base administrativa. Instituto de Estudios Fiscales, Madrid (2006). http://www.ief.es/Investigacion/Recursos/Seminarios/Estadistica/RegistrosAdministrativos.htm

Millar, H. J., Shaw, S-L.: Geographic information systems for transportation. Principles and applications. Oxford University Press, Oxford (2001).

Ministry of Work and Social Affairs: II Action plan for people with disabilities (2003-2007). Institute of the Elderly and Social Services (IMSERSO), Madrid (2003).

Ministry of Work and Social Affairs: I National Accessibility Plan 2004-2012. Achieving equal opportunities and full participation through design for all. Institute of the Elderly and Social Services (IMSERSO), Madrid (2003). http://www.mtas.es/uafse/equaluk/documentacion.htm

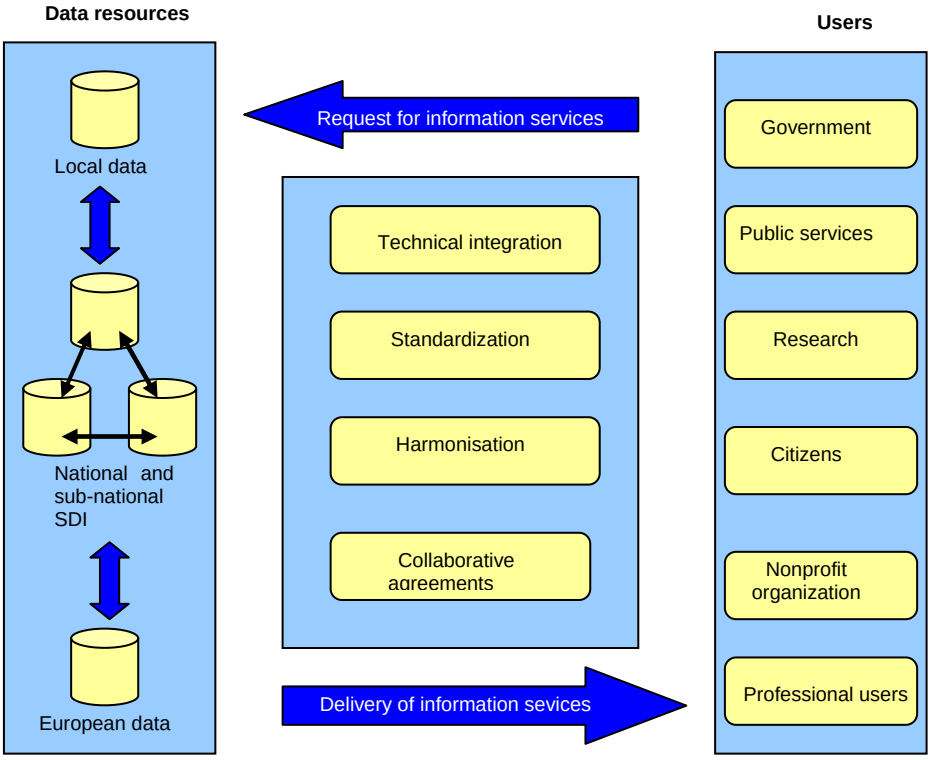
Ministry of Work and Social Affairs: "Draft law for the promotion of personal autonomy and attention for people in situations of dependency". Madrid (2006) www.mtas.es/inicioas/dependency/proyecto_law_dependency.pdf

Nogueras-Iso, J, Zarazaga-Soria, F. J., Muro-Medrano, P. R.: Geographic Information Metadata for Spatial Data Infrastructures. Resources, Interoperability and Information Retrieval. Springer-Verlag Berlin Heidelberg, New York (2005).

United Nations: The Standard rules on the equalization of opportunities for persons with disabilities. Adopted by the United Nations General Assembly. Forty-eight session, resolution 48/96, annex (1993), http://www.un.org/esa/socdev/enable/dissres0.htm

Saralegui, J.: El uso estadístico de las fuentes administrativas como factor de cohesión territorial. Instituto de Estudios Fiscales, Madrid (2006).

Fig. 1. INSPIRE specifications



GEOGRAPHICAL INFORMATION SYSTEM

Fig. 2. Geographical Information System

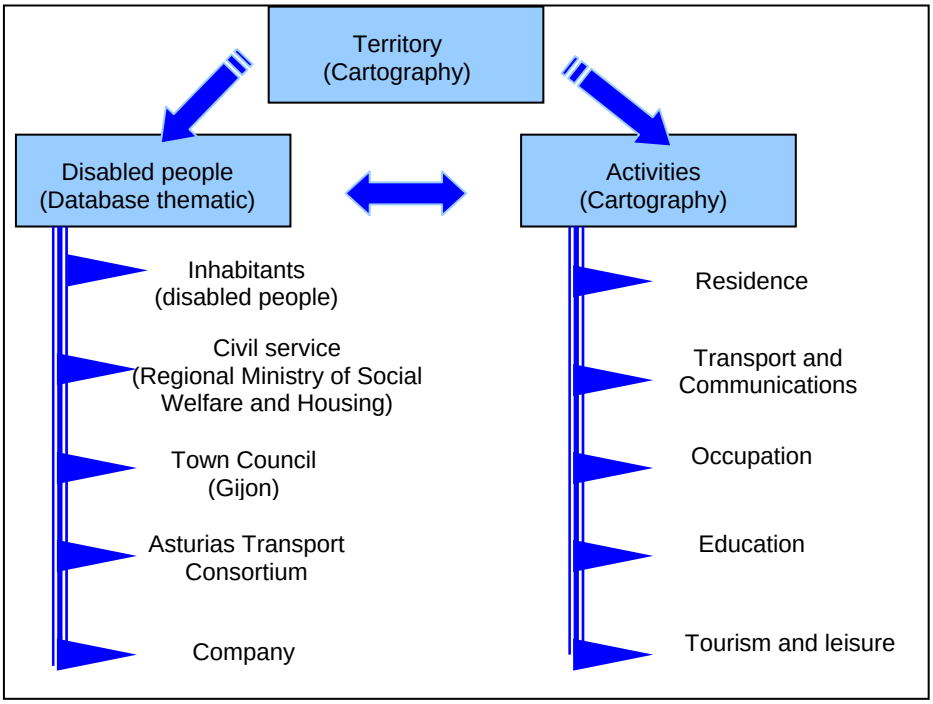


Fig. 3. Georelational data model

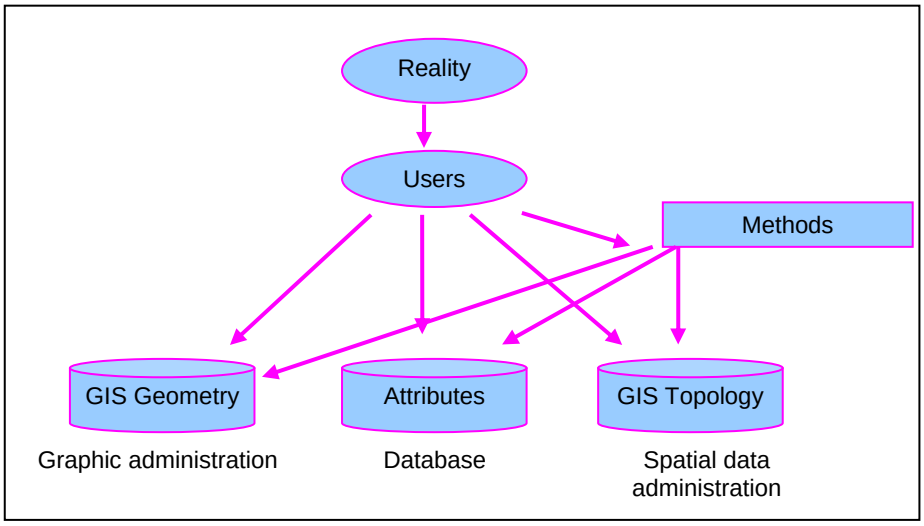


Fig. 4. Relationship between cartography and thematic database

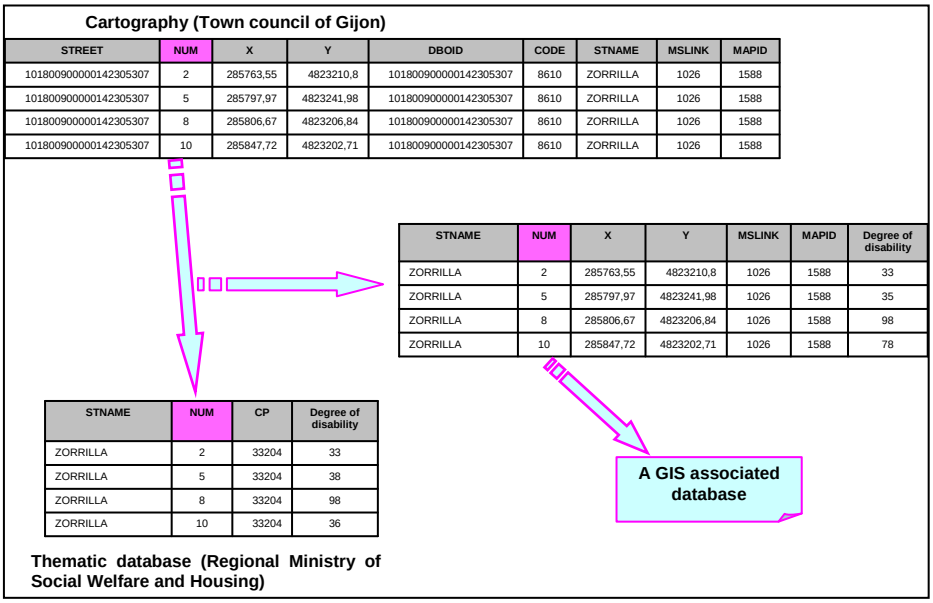
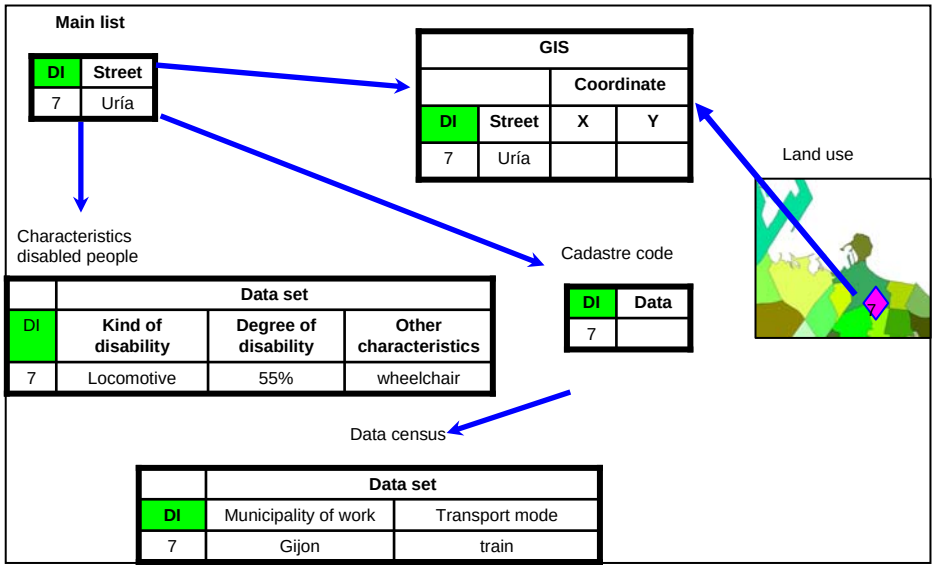


Fig. 5. Relational database model and attribute data structures



GEOGRAPHICAL INFORMATION SYSTEM

Fig. 6. Gijon parishes

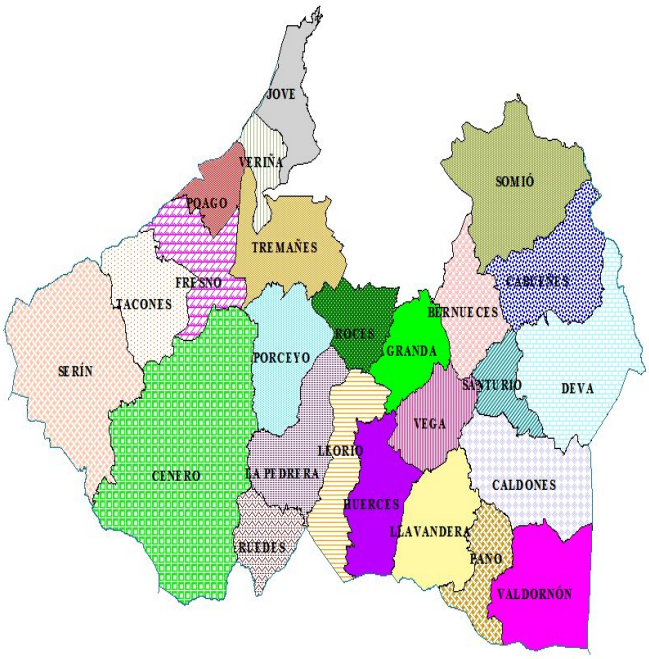


Fig. 7. Gijon neighborhoods

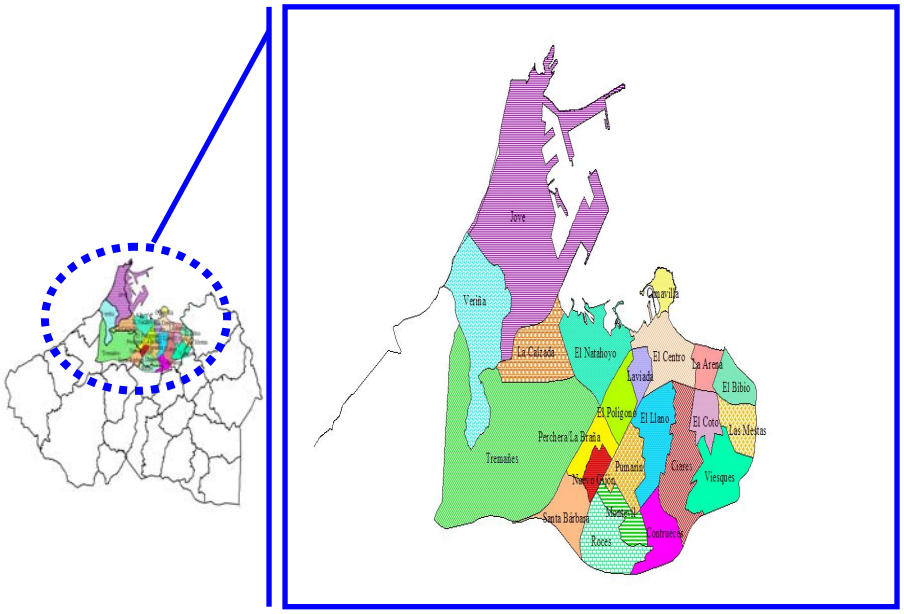


Table 2. Parishes and neighborhood´s surface

Parish	Hectare	Disabled people	Neighborhood	Hectare	Disabled people	Bus stop (number)
Veriña	215,03	2	Ciares	120,98	2.031	10
Poago	257,10		Cimavilla	25,16	282	4
Santurio	280,86		Contrueces	70,10	464	6
Ruedes	342,45		El Bibio	46,69	418	8
Fano	361,62		El Centro	99,53	4.016	35
Jove	382,72	65	El Coto	43,44	1.220	17
Roces	383,40	42	El Llano	100,97	4.918	28
Granda	415,71		El Natahoyo	135,26	1.572	17
Vega	454,43		El Polígono	57,81	1.381	10
Bernueces	481,28	1	Jove	575,16	1	23
Leorio	531,55		La Arena	32,92	2.297	11
Fresno	532,19		La Calzada	115,79	2.553	30
Huerces	584,33		Las Mestas	51,15	92	6
Tacones	599,16		Laviada	30,29	2.007	11
La Pedrera	633,38		Montevil	44,23	281	13
Porceyo	637,47		Nuevo Gijon	28,07	518	6
Llavandera	656,94		Perchera	44,70	245	3
Tremañes	689,77	46	Pumarín	67,60	2.256	18
Cabueñes	737,50	6	Roces	99,31	211	11
Valdornón	787,37		Sta. Bárbara	72,11	0	2
Caldones	847,39		Tremañes	586,10	4	23
Somió	1.044,69	136	Veriña	215,02	0	10
Deva	1.052,69		Viesques	106,66	63	13
Serín	1.445,69					
Cenero	2.385,44					
TOTAL	**16.740,16**	**298**	**TOTAL**	**2.769,06**	**26.830**	**320**

Table 3. Number of bus stop in “El Centro“ neighbourhood

NAME
MUSEO DEL FERROCARRIL
PEDRO DURO
F.E.V.E.
GOTA DE LECHE (LADO MAGNUS BLIKSTAD)
BEGOÑA
LOS CAMPOS
BEGOÑA
GOTA DE LECHE (LADO LLANES)
HUMEDAL (LADO SEMÁFORO)
FOMENTÍN
PEDRO DURO
PLAYA DE PONIENTE
MANUEL LLANEZA
PRENDES PANDO
HUMEDAL (LADO CABINA)
PLAZA DEL CARMEN
PLAZA DEL INSTITUTO
CAPUA
CURA SAMA
LA PLAYA
LUCIANO CASTAÑÓN
CRUZ ROJA
PLAZA DE SAN MIGUEL
PLAZA DEL INSTITUTO
ÁLVAREZ GARAYA
AVDA. SCHULZ (PUERTA LA VILLA)
PLAZA EUROPA
JARDINES DE LA REINA
INSTITUTO
PUERTA LA VILLA
CAPUCHINOS
MIERES
AVDA. CONSTITUCIÓN (PUERTA LA VILLA)
PLAZA DEL CARMEN (BLANCA RÍOS)
ALVARÉZ GARAYA

Table 4. A part of the table shows by ArcView: distance between postal addresses and bus stop

STREET	POSTAL ADDRESS	NAME BUS STOP	DISTANCE (metres)
ADOSINDA	13	CRUZ ROJA	75
ADOSINDA	14	CRUZ ROJA	100
ADOSINDA	15	CRUZ ROJA	100
ADOSINDA	17	CRUZ ROJA	100
AGUA	27	PLAZA DEL CARMEN	125
ALARCON	1	LOS CAMPOS	200
ALARCON	2	LOS CAMPOS	200
ALARCON	3	LOS CAMPOS	175
ALARCON	4	LOS CAMPOS	200
ALARCON	5	LOS CAMPOS	175
ALARCON	6	LOS CAMPOS	200
ALARCON	8	LOS CAMPOS	200
ALARCON	9	LOS CAMPOS	175
ALARCON	10	LOS CAMPOS	200
ALARCON	11	LOS CAMPOS	175
ALARCON	12	LOS CAMPOS	200
ALARCON	14	LOS CAMPOS	200
ALARCON	16	LOS CAMPOS	200
ALARCON	18	LOS CAMPOS	200
ALFONSO I	1	LOS CAMPOS	150
ALFONSO I	2	CRUZ ROJA	150
ALFONSO I	3	LOS CAMPOS	175
ALFONSO I	4	CRUZ ROJA	175
ALFONSO I	6	CRUZ ROJA	175
ALFONSO I	7	LOS CAMPOS	200
ALFONSO I	8	LOS CAMPOS	200
ALFONSO I	9	LOS CAMPOS	225
ALFONSO I	10	LOS CAMPOS	200
ALFONSO I	12	LOS CAMPOS	225
ALFONSO I	13	LOS CAMPOS	250
ALFONSO I	14	LOS CAMPOS	225
ALFONSO I	16	LOS CAMPOS	225
ALFONSO I	18	LOS CAMPOS	250
ALFONSO I	20	LOS CAMPOS	250
ALFONSO I	22	LOS CAMPOS	250
ALFREDO TRUAN	4	BEGOÑA	100
ALFREDO TRUAN	6	BEGOÑA	100
ALFREDO TRUAN	7	BEGOÑA	75
ALFREDO TRUAN	8	BEGOÑA	75
ALFREDO TRUAN	9	BEGOÑA	50
ALFREDO TRUAN	11	BEGOÑA	50
ALMACENES	2	F.E.V.E.	75
ALMACENES	4	F.E.V.E.	75
ALMACENES	9	PEDRO DURO	75
ALLER	2	BEGOÑA	75
ALLER	7	BEGOÑA	100
ANSELMO CIFUENTES	2	BEGOÑA	175
ANSELMO CIFUENTES	6	BEGOÑA	175
ANSELMO CIFUENTES	8	BEGOÑA	175
ANSELMO CIFUENTES	10	BEGOÑA	175
ANSELMO CIFUENTES	11	BEGOÑA	150
ANSELMO CIFUENTES	12	BEGOÑA	175
ANSELMO CIFUENTES	16	PUERTA LA VILLA	175
ARGANDONA	2	MIERES	50
ARGANDONA	2	MIERES	50

Table 5. People´s distribution according to the distance

Distance to the nearest bus stop (metres)	Postal addresses number	Disabled people´s number
25	67	224
50	149	604
75	181	624
100	178	611
125	171	612
150	134	440
175	99	316
200	65	272
225	39	122
250	30	86
275	15	52
300	7	36
325	5	17
Total	**1.140**	**4.016**

Fig. 8. Bus stop buffers: “El Centro” district

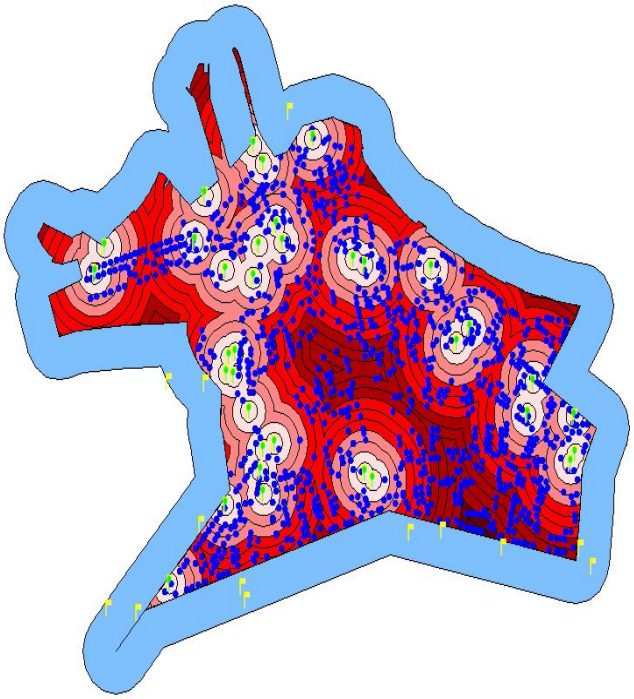


Table 6. Coverage rates for transport (%)

	Distance to the bus stop (metres)					
Neighborhood	**[0,75)**	**[75,150)**	**[150,225)**	**[225,300)**	**[300,375)**	**>375**
Ciares	15,47	29,89	22,82	14,40	11,55	5,86
Cimavilla	22,87	42,58	23,50	8,98	0,96	1,12
Contrueces	15,71	22,56	19,07	19,22	12,85	10,58
El Bibio	26,71	45,43	20,46	7,37	0,02	
El Centro	38,47	44,66	15,64	1,23		
El Coto	49,70	44,41	5,89			
El Llano	34,55	44,68	16,04	3,71	0,98	0,04
El Natahoyo	16,37	27,09	22,99	16,24	10,07	7,24
El Polígono	22,93	40,94	22,58	8,97	3,72	0,86
Jove	4,81	11,49	15,85	15,96	12,64	39,25
La Arena	47,86	50,29	1,86			
La Calzada	32,07	42,17	19,39	5,49	0,87	
Las Mestas	13,41	26,74	23,08	16,61	13,75	6,41
Laviada	44,14	47,31	8,55			
Montevil	33,54	49,88	16,00	0,59		
Nuevo Gijon	30,66	36,80	21,24	8,92	2,33	0,06
Perchera/La Braña	10,32	15,16	12,84	16,67	18,76	26,25
Pumarín	32,24	44,79	22,96	0,01		
Roces	13,29	25,15	27,64	21,42	8,80	3,69
Santa Bárbara	2,60	6,37	7,92	9,81	11,73	61,58
Tremañes	5,11	11,34	13,37	12,07	11,86	46,24
Veriña	6,19	14,83	21,84	14,19	11,18	31,77
Viesques	14,23	18,37	12,48	16,45	14,31	24,16

Table 7. Disabled people distributed by neighborhood and distance to the bus stop

	Distance to the bus stop (metres)											
Neighbor.	**25**	**50**	**75**	**100**	**125**	**150**	**175**	**200**	**225**	**250**	**>275**	**Total disabled / Neighbor**
Ciares	113	278	350	451	333	304	158	40	4			2.031
Cimavilla	1	40	51	42	66	48	29	5				282
Contrueces	29	103	84	111	95	22	16	3		1		464
El Bibio	12	75	81	111	74	48	17					418
El Centro	247	653	766	806	630	385	260	174	74	21		4.016
El Coto	131	306	377	253	118	18	9	8				1.220
El Llano	229	635	763	960	949	613	414	216	110	21	8	4.918
El Natahoyo	136	287	209	228	244	135	90	89	54	64	36	1.572
El Polígono	94	141	368	351	215	122	33	24	18	15		1.381
Jove											1	1
La Arena	176	458	583	500	342	205	33					2.297
La Calzada	182	440	498	606	438	230	99	51	9			2.553
Las Mestas	2	2	2	20	21	14	12	7	11		1	92
Laviada	199	303	609	367	317	186	20	6				2.007
Montevil	56	88	30	44	37	14	4	7	1			281
Nuevo Gijon	40	94	140	131	73	33	2			3	2	518
Perchera	8	38	75	79	23	5	1		6	4	6	245
Pumarín	82	287	323	305	329	385	267	166	100		12	2.256
Roces	4	24	49	39	44	39	12					211
Tremañes											4	4
Viesques	8	8	21	11	12	1	1				1	63
TOTAL	1.749	4.260	5.379	5.415	4.360	2.807	1.477	796	387	129	71	**26.830**

FUNDACIÓN DE LAS CAJAS DE AHORROS

DOCUMENTOS DE TRABAJO

Últimos números publicados

159/2000 Participación privada en la construcción y explotación de carreteras de peaje
Ginés de Rus, Manuel Romero y Lourdes Trujillo

160/2000 Errores y posibles soluciones en la aplicación del *Value at Risk*
Mariano González Sánchez

161/2000 Tax neutrality on saving assets. The spahish case before and after the tax reform
Cristina Ruza y de Paz-Curbera

162/2000 Private rates of return to human capital in Spain: new evidence
F. Barceinas, J. Oliver-Alonso, J.L. Raymond y J.L. Roig-Sabaté

163/2000 El control interno del riesgo. Una propuesta de sistema de límites
riesgo neutral
Mariano González Sánchez

164/2001 La evolución de las políticas de gasto de las Administraciones Públicas en los años 90
Alfonso Utrilla de la Hoz y Carmen Pérez Esparrells

165/2001 Bank cost efficiency and output specification
Emili Tortosa-Ausina

166/2001 Recent trends in Spanish income distribution: A robust picture of falling income inequality
Josep Oliver-Alonso, Xavier Ramos y José Luis Raymond-Bara

167/2001 Efectos redistributivos y sobre el bienestar social del tratamiento de las cargas familiares en el nuevo IRPF
Nuria Badenes Plá, Julio López Laborda, Jorge Onrubia Fernández

168/2001 The Effects of Bank Debt on Financial Structure of Small and Medium Firms in some European Countries
Mónica Melle-Hernández

169/2001 La política de cohesión de la UE ampliada: la perspectiva de España
Ismael Sanz Labrador

170/2002 Riesgo de liquidez de Mercado
Mariano González Sánchez

171/2002 Los costes de administración para el afiliado en los sistemas de pensiones basados en cuentas de capitalización individual: medida y comparación internacional.
José Enrique Devesa Carpio, Rosa Rodríguez Barrera, Carlos Vidal Meliá

172/2002 La encuesta continua de presupuestos familiares (1985-1996): descripción, representatividad y propuestas de metodología para la explotación de la información de los ingresos y el gasto.
Llorenc Pou, Joaquín Alegre

173/2002 Modelos paramétricos y no paramétricos en problemas de concesión de tarjetas de credito.
Rosa Puertas, María Bonilla, Ignacio Olmeda

174/2002 Mercado único, comercio intra-industrial y costes de ajuste en las manufacturas españolas.
José Vicente Blanes Cristóbal

175/2003 La Administración tributaria en España. Un análisis de la gestión a través de los ingresos y de los gastos.
Juan de Dios Jiménez Aguilera, Pedro Enrique Barrilao González

176/2003 The Falling Share of Cash Payments in Spain.
Santiago Carbó Valverde, Rafael López del Paso, David B. Humphrey
Publicado en "Moneda y Crédito" nº 217, pags. 167-189.

177/2003 Effects of ATMs and Electronic Payments on Banking Costs: The Spanish Case.
Santiago Carbó Valverde, Rafael López del Paso, David B. Humphrey

178/2003 Factors explaining the interest margin in the banking sectors of the European Union.
Joaquín Maudos y Juan Fernández Guevara

179/2003 Los planes de stock options para directivos y consejeros y su valoración por el mercado de valores en España.
Mónica Melle Hernández

180/2003 Ownership and Performance in Europe and US Banking – A comparison of Commercial, Co-operative & Savings Banks.
Yener Altunbas, Santiago Carbó y Phil Molyneux

181/2003 The Euro effect on the integration of the European stock markets.
Mónica Melle Hernández

182/2004 In search of complementarity in the innovation strategy: international R&D and external knowledge acquisition.
Bruno Cassiman, Reinhilde Veugelers

183/2004 Fijación de precios en el sector público: una aplicación para el servicio municipal de suministro de agua.
Mª Ángeles García Valiñas

184/2004 Estimación de la economía sumergida es España: un modelo estructural de variables latentes.
Ángel Alañón Pardo, Miguel Gómez de Antonio

185/2004 Causas políticas y consecuencias sociales de la corrupción.
Joan Oriol Prats Cabrera

186/2004 Loan bankers' decisions and sensitivity to the audit report using the belief revision model.
Andrés Guiral Contreras and José A. Gonzalo Angulo

187/2004 El modelo de Black, Derman y Toy en la práctica. Aplicación al mercado español.
Marta Tolentino García-Abadillo y Antonio Díaz Pérez

188/2004 Does market competition make banks perform well?.
Mónica Melle

189/2004 Efficiency differences among banks: external, technical, internal, and managerial
Santiago Carbó Valverde, David B. Humphrey y Rafael López del Paso

190/2004 Una aproximación al análisis de los costes de la esquizofrenia en españa: los modelos jerárquicos bayesianos
F. J. Vázquez-Polo, M. A. Negrín, J. M. Cavasés, E. Sánchez y grupo RIRAG

191/2004 Environmental proactivity and business performance: an empirical analysis
Javier González-Benito y Óscar González-Benito

192/2004 Economic risk to beneficiaries in notional defined contribution accounts (NDCs)
Carlos Vidal-Meliá, Inmaculada Domínguez-Fabian y José Enrique Devesa-Carpio

193/2004 Sources of efficiency gains in port reform: non parametric malmquist decomposition tfp index for Mexico
Antonio Estache, Beatriz Tovar de la Fé y Lourdes Trujillo

194/2004 Persistencia de resultados en los fondos de inversión españoles
Alfredo Ciriaco Fernández y Rafael Santamaría Aquilué

195/2005 El modelo de revisión de creencias como aproximación psicológica a la formación del juicio del auditor sobre la gestión continuada
Andrés Guiral Contreras y Francisco Esteso Sánchez

196/2005 La nueva financiación sanitaria en España: descentralización y prospectiva
David Cantarero Prieto

197/2005 A cointegration analysis of the Long-Run supply response of Spanish agriculture to the common agricultural policy
José A. Mendez, Ricardo Mora y Carlos San Juan

198/2005 ¿Refleja la estructura temporal de los tipos de interés del mercado español preferencia por la liquidez?
Magdalena Massot Perelló y Juan M. Nave

199/2005 Análisis de impacto de los Fondos Estructurales Europeos recibidos por una economía regional: Un enfoque a través de Matrices de Contabilidad Social
M. Carmen Lima y M. Alejandro Cardenete

200/2005 Does the development of non-cash payments affect monetary policy transmission?
Santiago Carbó Valverde y Rafael López del Paso

201/2005 Firm and time varying technical and allocative efficiency: an application for port cargo handling firms
Ana Rodríguez-Álvarez, Beatriz Tovar de la Fe y Lourdes Trujillo

202/2005 Contractual complexity in strategic alliances
Jeffrey J. Reuer y Africa Ariño

203/2005 Factores determinantes de la evolución del empleo en las empresas adquiridas por opa
Nuria Alcalde Fradejas y Inés Pérez-Soba Aguilar

204/2005 Nonlinear Forecasting in Economics: a comparison between Comprehension Approach versus Learning Approach. An Application to Spanish Time Series
Elena Olmedo, Juan M. Valderas, Ricardo Gimeno and Lorenzo Escot

205/2005 Precio de la tierra con presión urbana: un modelo para España
Esther Decimavilla, Carlos San Juan y Stefan Sperlich

206/2005 Interregional migration in Spain: a semiparametric analysis
Adolfo Maza y José Villaverde

207/2005 Productivity growth in European banking
Carmen Murillo-Melchor, José Manuel Pastor y Emili Tortosa-Ausina

208/2005 Explaining Bank Cost Efficiency in Europe: Environmental and Productivity Influences.
Santiago Carbó Valverde, David B. Humphrey y Rafael López del Paso

209/2005 La elasticidad de sustitución intertemporal con preferencias no separables intratemporalmente: los casos de Alemania, España y Francia.
Elena Márquez de la Cruz, Ana R. Martínez Cañete y Inés Pérez-Soba Aguilar

210/2005 Contribución de los efectos tamaño, book-to-market y momentum a la valoración de activos: el caso español.
Begoña Font-Belaire y Alfredo Juan Grau-Grau

211/2005 Permanent income, convergence and inequality among countries
José M. Pastor and Lorenzo Serrano

212/2005 The Latin Model of Welfare: Do 'Insertion Contracts' Reduce Long-Term Dependence?
Luis Ayala and Magdalena Rodríguez

213/2005 The effect of geographic expansion on the productivity of Spanish savings banks
Manuel Illueca, José M. Pastor and Emili Tortosa-Ausina

214/2005 Dynamic network interconnection under consumer switching costs
Ángel Luis López Rodríguez

215/2005 La influencia del entorno socioeconómico en la realización de estudios universitarios: una aproximación al caso español en la década de los noventa
Marta Rahona López

216/2005 The valuation of spanish ipos: efficiency analysis
Susana Álvarez Otero

217/2005 On the generation of a regular multi-input multi-output technology using parametric output distance functions
Sergio Perelman and Daniel Santin

218/2005 La gobernanza de los procesos parlamentarios: la organización industrial del congreso de los diputados en España
Gonzalo Caballero Miguez

219/2005 Determinants of bank market structure: Efficiency and political economy variables
Francisco González

220/2005 Agresividad de las órdenes introducidas en el mercado español: estrategias, determinantes y medidas de performance
David Abad Díaz

221/2005 Tendencia post-anuncio de resultados contables: evidencia para el mercado español
Carlos Forner Rodríguez, Joaquín Marhuenda Fructuoso y Sonia Sanabria García

222/2005 Human capital accumulation and geography: empirical evidence in the European Union
Jesús López-Rodríguez, J. Andrés Faíña y Jose Lopez Rodríguez

223/2005 Auditors' Forecasting in Going Concern Decisions: Framing, Confidence and Information Processing
Waymond Rodgers and Andrés Guiral

224/2005 The effect of Structural Fund spending on the Galician region: an assessment of the 1994-1999 and 2000-2006 Galician CSFs
José Ramón Cancelo de la Torre, J. Andrés Faíña and Jesús López-Rodríguez

225/2005 The effects of ownership structure and board composition on the audit committee activity: Spanish evidence
Carlos Fernández Méndez and Rubén Arrondo García

226/2005 Cross-country determinants of bank income smoothing by managing loan loss provisions
Ana Rosa Fonseca and Francisco González

227/2005 Incumplimiento fiscal en el irpf (1993-2000): un análisis de sus factores determinantes
Alejandro Estellér Moré

228/2005 Region versus Industry effects: volatility transmission
Pilar Soriano Felipe and Francisco J. Climent Diranzo

229/2005 Concurrent Engineering: The Moderating Effect Of Uncertainty On New Product Development Success
Daniel Vázquez-Bustelo and Sandra Valle

230/2005 On zero lower bound traps: a framework for the analysis of monetary policy in the 'age' of central banks
Alfonso Palacio-Vera

231/2005 Reconciling Sustainability and Discounting in Cost Benefit Analysis: a methodological proposal
M. Carmen Almansa Sáez and Javier Calatrava Requena

232/2005 Can The Excess Of Liquidity Affect The Effectiveness Of The European Monetary Policy?
Santiago Carbó Valverde and Rafael López del Paso

233/2005 Inheritance Taxes In The Eu Fiscal Systems: The Present Situation And Future Perspectives.
Miguel Angel Barberán Lahuerta

234/2006 Bank Ownership And Informativeness Of Earnings.
Víctor M. González

235/2006 Developing A Predictive Method: A Comparative Study Of The Partial Least Squares Vs Maximum Likelihood Techniques.
Waymond Rodgers, Paul Pavlou and Andres Guiral.

236/2006 Using Compromise Programming for Macroeconomic Policy Making in a General Equilibrium Framework: Theory and Application to the Spanish Economy.
Francisco J. André, M. Alejandro Cardenete y Carlos Romero.

237/2006 Bank Market Power And Sme Financing Constraints.
Santiago Carbó-Valverde, Francisco Rodríguez-Fernández y Gregory F. Udell.

238/2006 Trade Effects Of Monetary Agreements: Evidence For Oecd Countries.
Salvador Gil-Pareja, Rafael Llorca-Vivero y José Antonio Martínez-Serrano.

239/2006 The Quality Of Institutions: A Genetic Programming Approach.
Marcos Álvarez-Díaz y Gonzalo Caballero Miguez.

240/2006 La interacción entre el éxito competitivo y las condiciones del mercado doméstico como determinantes de la decisión de exportación en las Pymes.
Francisco García Pérez.

241/2006 Una estimación de la depreciación del capital humano por sectores, por ocupación y en el tiempo.
Inés P. Murillo.

242/2006 Consumption And Leisure Externalities, Economic Growth And Equilibrium Efficiency.
Manuel A. Gómez.

243/2006 Measuring efficiency in education: an analysis of different approaches for incorporating non-discretionary inputs.
Jose Manuel Cordero-Ferrera, Francisco Pedraja-Chaparro y Javier Salinas-Jiménez

244/2006 Did The European Exchange-Rate Mechanism Contribute To The Integration Of Peripheral Countries?.
Salvador Gil-Pareja, Rafael Llorca-Vivero y José Antonio Martínez-Serrano

245/2006 Intergenerational Health Mobility: An Empirical Approach Based On The Echp.
Marta Pascual and David Cantarero

246/2006 Measurement and analysis of the Spanish Stock Exchange using the Lyapunov exponent with digital technology.
Salvador Rojí Ferrari and Ana Gonzalez Marcos

247/2006 Testing For Structural Breaks In Variance Withadditive Outliers And Measurement Errors.
Paulo M.M. Rodrigues and Antonio Rubia

248/2006 The Cost Of Market Power In Banking: Social Welfare Loss Vs. Cost Inefficiency.
Joaquín Maudos and Juan Fernández de Guevara

249/2006 Elasticidades de largo plazo de la demanda de vivienda: evidencia para España (1885-2000).
Desiderio Romero Jordán, José Félix Sanz Sanz y César Pérez López

250/2006 Regional Income Disparities in Europe: What role for location?.
Jesús López-Rodríguez and J. Andrés Faíña

251/2006 Funciones abreviadas de bienestar social: Una forma sencilla de simultanear la medición de la eficiencia y la equidad de las políticas de gasto público.
Nuria Badenes Plá y Daniel Santín González

252/2006 "The momentum effect in the Spanish stock market: Omitted risk factors or investor behaviour?".
Luis Muga and Rafael Santamaría

253/2006 Dinámica de precios en el mercado español de gasolina: un equilibrio de colusión tácita.
Jordi Perdiguero García

254/2006 Desigualdad regional en España: renta permanente versus renta corriente.
José M.Pastor, Empar Pons y Lorenzo Serrano

255/2006 Environmental implications of organic food preferences: an application of the impure public goods model.
Ana Maria Aldanondo-Ochoa y Carmen Almansa-Sáez

256/2006 Family tax credits versus family allowances when labour supply matters: Evidence for Spain.
José Felix Sanz-Sanz, Desiderio Romero-Jordán y Santiago Álvarez-García

257/2006 La internacionalización de la empresa manufacturera española: efectos del capital humano genérico y específico.
José López Rodríguez

258/2006 Evaluación de las migraciones interregionales en España, 1996-2004.
María Martínez Torres

259/2006 Efficiency and market power in Spanish banking.
Rolf Färe, Shawna Grosskopf y Emili Tortosa-Ausina.

260/2006 Asimetrías en volatilidad, beta y contagios entre las empresas grandes y pequeñas cotizadas en la bolsa española.
Helena Chuliá y Hipòlit Torró.

261/2006 Birth Replacement Ratios: New Measures of Period Population Replacement.
José Antonio Ortega.

262/2006 Accidentes de tráfico, víctimas mortales y consumo de alcohol.
José Mª Arranz y Ana I. Gil.

263/2006 Análisis de la Presencia de la Mujer en los Consejos de Administración de las Mil Mayores Empresas Españolas.
Ruth Mateos de Cabo, Lorenzo Escot Mangas y Ricardo Gimeno Nogués.

264/2006 Crisis y Reforma del Pacto de Estabilidad y Crecimiento. Las Limitaciones de la Política Económica en Europa.
Ignacio Álvarez Peralta.

265/2006 Have Child Tax Allowances Affected Family Size? A Microdata Study For Spain (1996-2000).
Jaime Vallés-Giménez y Anabel Zárate-Marco.

266/2006 Health Human Capital And The Shift From Foraging To Farming.
Paolo Rungo.

267/2006 Financiación Autonómica y Política de la Competencia: El Mercado de Gasolina en Canarias.
Juan Luis Jiménez y Jordi Perdiguero.

268/2006 El cumplimiento del Protocolo de Kyoto para los hogares españoles: el papel de la imposición sobre la energía.
Desiderio Romero-Jordán y José Félix Sanz-Sanz.

269/2006 Banking competition, financial dependence and economic growth
Joaquín Maudos y Juan Fernández de Guevara

270/2006 Efficiency, subsidies and environmental adaptation of animal farming under CAP
Werner Kleinhanß, Carmen Murillo, Carlos San Juan y Stefan Sperlich

271/2006 Interest Groups, Incentives to Cooperation and Decision-Making Process in the European Union
A. Garcia-Lorenzo y Jesús López-Rodríguez

272/2006 Riesgo asimétrico y estrategias de momentum en el mercado de valores español
Luis Muga y Rafael Santamaría

273/2006 Valoración de capital-riesgo en proyectos de base tecnológica e innovadora a través de la teoría de opciones reales
Gracia Rubio Martín

274/2006 Capital stock and unemployment: searching for the missing link
Ana Rosa Martínez-Cañete, Elena Márquez de la Cruz, Alfonso Palacio-Vera and Inés Pérez-Soba Aguilar

275/2006 Study of the influence of the voters' political culture on vote decision through the simulation of a political competition problem in Spain
Sagrario Lantarón, Isabel Lillo, Mª Dolores López and Javier Rodrigo

276/2006 Investment and growth in Europe during the Golden Age
Antonio Cubel and Mª Teresa Sanchis

277/2006 Efectos de vincular la pensión pública a la inversión en cantidad y calidad de hijos en un modelo de equilibrio general
Robert Meneu Gaya

278/2006 El consumo y la valoración de activos
Elena Márquez y Belén Nieto

279/2006 Economic growth and currency crisis: A real exchange rate entropic approach
David Matesanz Gómez y Guillermo J. Ortega

280/2006 Three measures of returns to education: An illustration for the case of Spain
María Arrazola y José de Hevia

281/2006 Composition of Firms versus Composition of Jobs
Antoni Cunyat

282/2006 La vocación internacional de un holding tranviario belga: la Compagnie Mutuelle de Tram-ways, 1895-1918
Alberte Martínez López

283/2006 Una visión panorámica de las entidades de crédito en España en la última década.
Constantino García Ramos

284/2006 Foreign Capital and Business Strategies: a comparative analysis of urban transport in Madrid and Barcelona, 1871-1925
Alberte Martínez López

285/2006 Los intereses belgas en la red ferroviaria catalana, 1890-1936
Alberte Martínez López

286/2006 The Governance of Quality: The Case of the Agrifood Brand Names
Marta Fernández Barcala, Manuel González-Díaz y Emmanuel Raynaud

287/2006 Modelling the role of health status in the transition out of malthusian equilibrium
Paolo Rungo, Luis Currais and Berta Rivera

288/2006 Industrial Effects of Climate Change Policies through the EU Emissions Trading Scheme
Xavier Labandeira and Miguel Rodríguez

289/2006 Globalisation and the Composition of Government Spending: An analysis for OECD countries
Norman Gemmell, Richard Kneller and Ismael Sanz

290/2006 La producción de energía eléctrica en España: Análisis económico de la actividad tras la liberalización del Sector Eléctrico
Fernando Hernández Martínez

291/2006 Further considerations on the link between adjustment costs and the productivity of R&D investment: evidence for Spain
Desiderio Romero-Jordán, José Félix Sanz-Sanz and Inmaculada Álvarez-Ayuso

292/2006 Una teoría sobre la contribución de la función de compras al rendimiento empresarial
Javier González Benito

293/2006 Agility drivers, enablers and outcomes: empirical test of an integrated agile manufacturing model
Daniel Vázquez-Bustelo, Lucía Avella and Esteban Fernández

294/2006 Testing the parametric vs the semiparametric generalized mixed effects models
María José Lombardía and Stefan Sperlich

295/2006 Nonlinear dynamics in energy futures
Mariano Matilla-García

296/2006 Estimating Spatial Models By Generalized Maximum Entropy Or How To Get Rid Of W
Esteban Fernández Vázquez, Matías Mayor Fernández and Jorge Rodriguez-Valez

297/2006 Optimización fiscal en las transmisiones lucrativas: análisis metodológico
Félix Domínguez Barrero

298/2006 La situación actual de la banca online en España
Francisco José Climent Diranzo y Alexandre Momparler Pechuán

299/2006 Estrategia competitiva y rendimiento del negocio: el papel mediador de la estrategia y las capacidades productivas
Javier González Benito y Isabel Suárez González

300/2006 A Parametric Model to Estimate Risk in a Fixed Income Portfolio
Pilar Abad and Sonia Benito

301/2007 Análisis Empírico de las Preferencias Sociales Respecto del Gasto en Obra Social de las Cajas de Ahorros
Alejandro Esteller-Moré, Jonathan Jorba Jiménez y Albert Solé-Ollé

302/2007 Assessing the enlargement and deepening of regional trading blocs: The European Union case
Salvador Gil-Pareja, Rafael Llorca-Vivero y José Antonio Martínez-Serrano

303/2007 ¿Es la Franquicia un Medio de Financiación?: Evidencia para el Caso Español
Vanesa Solís Rodríguez y Manuel González Díaz

304/2007 On the Finite-Sample Biases in Nonparametric Testing for Variance Constancy
Paulo M.M. Rodrigues and Antonio Rubia

305/2007 Spain is Different: Relative Wages 1989-98
José Antonio Carrasco Gallego

306/2007 Poverty reduction and SAM multipliers: An evaluation of public policies in a regional framework
Francisco Javier De Miguel-Vélez y Jesús Pérez-Mayo

307/2007 La Eficiencia en la Gestión del Riesgo de Crédito en las Cajas de Ahorro
Marcelino Martínez Cabrera

308/2007 Optimal environmental policy in transport: unintended effects on consumers' generalized price
M. Pilar Socorro and Ofelia Betancor

309/2007 Agricultural Productivity in the European Regions: Trends and Explanatory Factors
Roberto Ezcurra, Belen Iráizoz, Pedro Pascual and Manuel Rapún

310/2007 Long-run Regional Population Divergence and Modern Economic Growth in Europe: a Case Study of Spain
María Isabel Ayuda, Fernando Collantes and Vicente Pinilla

311/2007 Financial Information effects on the measurement of Commercial Banks' Efficiency
Borja Amor, María T. Tascón and José L. Fanjul

312/2007 Neutralidad e incentivos de las inversiones financieras en el nuevo IRPF
Félix Domínguez Barrero

313/2007 The Effects of Corporate Social Responsibility Perceptions on The Valuation of Common Stock
Waymond Rodgers , Helen Choy and Andres Guiral-Contreras

314/2007 Country Creditor Rights, Information Sharing and Commercial Banks' Profitability Persistence across the world
Borja Amor, María T. Tascón and José L. Fanjul

315/2007 ¿Es Relevante el Déficit Corriente en una Unión Monetaria? El Caso Español
Javier Blanco González y Ignacio del Rosal Fernández

316/2007 The Impact of Credit Rating Announcements on Spanish Corporate Fixed Income Performance: Returns, Yields and Liquidity
Pilar Abad, Antonio Díaz and M. Dolores Robles

317/2007 Indicadores de Lealtad al Establecimiento y Formato Comercial Basados en la Distribución del Presupuesto
Cesar Augusto Bustos Reyes y Óscar González Benito

318/2007 Migrants and Market Potential in Spain over The XXth Century: A Test Of The New Economic Geography
Daniel A. Tirado, Jordi Pons, Elisenda Paluzie and Javier Silvestre

319/2007 El Impacto del Coste de Oportunidad de la Actividad Emprendedora en la Intención de los Ciudadanos Europeos de Crear Empresas
Luis Miguel Zapico Aldeano

320/2007 Los belgas y los ferrocarriles de vía estrecha en España, 1887-1936
Alberte Martínez López

321/2007 Competición política bipartidista. Estudio geométrico del equilibrio en un caso ponderado
Isabel Lillo, Mª Dolores López y Javier Rodrigo

322/2007 Human resource management and environment management systems: an empirical study
Mª Concepción López Fernández, Ana Mª Serrano Bedia and Gema García Piqueres

323/2007 Wood and industrialization. evidence and hypotheses from the case of Spain, 1860-1935.
Iñaki Iriarte-Goñi and María Isabel Ayuda Bosque

324/2007 New evidence on long-run monetary neutrality.
J. Cunado, L.A. Gil-Alana and F. Perez de Gracia

325/2007 Monetary policy and structural changes in the volatility of us interest rates.
Juncal Cuñado, Javier Gomez Biscarri and Fernando Perez de Gracia

326/2007 The productivity effects of intrafirm diffusion.
Lucio Fuentelsaz, Jaime Gómez and Sergio Palomas

327/2007 Unemployment duration, layoffs and competing risks.
J.M. Arranz, C. García-Serrano and L. Toharia

328/2007 El grado de cobertura del gasto público en España respecto a la UE-15
Nuria Rueda, Begoña Barruso, Carmen Calderón y Mª del Mar Herrador

329/2007 The Impact of Direct Subsidies in Spain before and after the CAP'92 Reform
Carmen Murillo, Carlos San Juan and Stefan Sperlich

330/2007 Determinants of post-privatisation performance of Spanish divested firms
Laura Cabeza García and Silvia Gómez Ansón

331/2007 ¿Por qué deciden diversificar las empresas españolas? Razones oportunistas versus razones económicas
Almudena Martínez Campillo

332/2007 Dynamical Hierarchical Tree in Currency Markets
Juan Gabriel Brida, David Matesanz Gómez and Wiston Adrián Risso

333/2007 Los determinantes sociodemográficos del gasto sanitario. Análisis con microdatos individuales
Ana María Angulo, Ramón Barberán, Pilar Egea y Jesús Mur

334/2007 Why do companies go private? The Spanish case
Inés Pérez-Soba Aguilar

335/2007 The use of gis to study transport for disabled people
Verónica Cañal Fernández