

# Commuting times: Is there any penalty for immigrants?

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**Abstract:**

Studying the relation between workers' nationality and their commuting time has been of paramount importance in countries with high immigration rates and ethnical heterogeneity. Therefore, most of these studies focus on the spatial mismatch of racial minorities, and consider urban and social structures of the countries/cities where this segregation phenomenon may occur. Thus, extrapolating their conclusions to other countries with different urban and social structures may be uncertain. Currently, immigration is one of the main challenges of the Spanish society. The number of foreign residents in Madrid region increased 639 % between 1996 and 2004, with a sharp increase in the "third-world" component. As in other countries, immigrants' settlement patterns in Spain are characterized by spatial clustering. In this paper we aim to explore the connection between commuting flows, residential location and worker's nationality using an ordered logit model to identify the main determinants affecting the commuting time. Our findings reveal that immigrants coming from 'transition economies' and 'third world' countries are significantly more likely to suffer higher commuting times compared to natives. These differences can be attributed to both housing and labour market restrictions due to discrimination. This commuting penalty is in line with the spatial mismatch hypothesis and residential segregation.

## 1. Introducción

Commuting flows gives valuable information about the way in which companies and households take decisions about where to locate, or about the predisposal of individuals to migrate or support long trips to the workplace or to reach leisure facilities. It also offers priceless information to detect spatial mismatch between the labor supply and demand for different sectors and social groups (Crampton, 1999).

Studying the relation between workers' nationality, their residence and employment decisions, and their commuting time has been of paramount importance in countries with high immigration rates or ethnical heterogeneity. Therefore, most of these studies focus on the analysis of differences in the spatial mismatch of racial minorities, trying to identify evidences of discrimination derived from an unequal access to the housing and/or labour market (Kain, 1968; McCormick 1986; Preston, 1999; Crampton, 1999; Chung et al, 2001; Sultana 2005),

Moreover, a large number of these studies pay more attention to the problems of segregation of nationals from specific ethnical groups, instead of analyzing the differences between national workers and newcomers without any consideration about their race. Additionally, these studies usually consider the specific ethnical and urban structures of the countries/cities where this segregation phenomenon may occur, inducing some difficulties in the extrapolation of the results to other countries with different urban and social structures.

For example, within the large literature about spatial mismatch and commuting time differences by race in the United States, it is common to find studies trying to identify differences between white, blacks and Hispanics. These studies consider that the most deteriorated parts of metropolitan areas are located in the city center and the high wage employments concentrates in the suburbs. As a consequence, black workers living in the city-center may suffer disadvantages compare to other groups living close to the jobs offered in the suburbs (Chung et al, 2001; Sultana, 2005).

By contrast, if we focus on Southern European cities differences can be found in the urban and social structure, that may change some of the results obtained in the United States or other Northern European cities with similar urban structure. The urban sprawl process in Europe differs from the homonym in the US, since the evolution from mono-centric to pluri-centric cities in Europe have mainly derived from the interconnection of big cities with small pre-existent villages around (Goffette-Nagot, 2000). This difference, mixed with the existence of spatial-constrains for the urban growth and the presence of historic-city-

centers induce more complex and heterogeneous urban structures with a mix of high/low income areas and a more dispersed employment location. Moreover, in the case of Spain, there may be other peculiarities related to linguistic barriers that suggest revisiting the results obtained abroad. This will be the case of Latin-Americans, who are usually considered as a collective in risk of segregation in English-speaking countries but not in other host economies like Spain.

In the last years, immigration has become one of the main challenges faced by the Spanish society. The number of foreign residents in Spain has increased from 280,000, at the beginning of the nineties, to 2 million people in 2004. If trends in immigration are analyzed by country of origin, a sharp increase in the “third-world” component is revealed over the last few years.

As in other host European countries, immigrants’ settlement patterns in Spain are characterized by spatial clustering. Analyses have shown that minority ethnic groups remain spatially concentrated in particular parts of the urban and regional system, and that they are over-represented in areas of socioeconomic disadvantage.

This feature, combined with the increasing dispersion of metropolitan employment areas, and the concentration of these workers in certain branches of the economic activity (mainly domestic service, construction and hotels and restaurants) might have led to significant differences in commuting behaviour between nationals and immigrants.

Immigrants, as other disadvantaged groups, experience a weaker position in different aspects of their participation in the labour market compared to the average attainments of all individuals. This disadvantage position may be apparent across a range of indicators. For instance, unemployment rates of immigrants are found to be significantly higher. They also tend to be concentrated/ segregated within certain industries and occupations, and they seem to be more likely to be over-educated. Presumably this weaker position in the labour market could also affect the commuting time of immigrants, which could be explained by discrimination and/or spatial mismatch. The social discrimination faced by immigrants interacts with spatial concentration, restricting their choice set for job and residence location, potentially affecting the commuting behaviour in this collective. If discrimination does not exist, there would be no differences in commuting between nationals and immigrants other than those explained by factors distinct of nationality.

Spatial mismatch hypothesis states that the concentration of poverty and joblessness within predominantly non national neighbourhoods can be explained, in part, by the

geographic isolation of these neighbourhoods from job locations. If this hypotheses is complemented with residential segregation (Massey,1990) and transportation mismatch (Boardman and Field,2002, Taylor and Ong, 1995) it's reasonable to expect that immigrants commuting time is higher.

In principle, immigrants could experience either lower or higher commuting times with respect to their natives counterparts. On the one hand, commuting distances for ethnic groups could be shorter if these people have lack of access to a private vehicle (Blackaby et al., 1999). But on the other hand, if immigrants experience higher unemployment rates and lower wages in their local labour markets, they may be willing to accept more distant employment simply in order to gain employment and thereby raise earnings (McCormick, 1986).

Thus, an empirical analysis seems to be necessary in order to disentangle the puzzle on whether immigrants suffer lower or higher commuting times with respect to natives. We focus the analysis in the Madrid region because of two reasons. First, the significant increase in the migration phenomenon, and second the intense process of suburbanization experienced in this region.

For the purpose of this paper, we use data from the 2001 Census from the National Statistics Institute of Spain (*Censo 2001*), and we adopt an econometric approach based on ordered logit models. Our results suggest the existence of significant differences in commuting times between immigrants and natives that can be interpreted as a sign of discrimination.

The paper is organized as follows. In Section 2 we provide a short review of the literature. Section 3 highlights the localization patterns of individuals and jobs in the Madrid region, jointly with a descriptive analysis of the data set. Section 4 presents the econometric model and main results and Section 5 concludes.

## **2. Previous literature**

Commuting is intimately linked with decisions concerning residential location and workplace. Optimality in both dwelling and employment location choices also implies an

optimal commuting time<sup>1</sup> given the preferences, (possibly) labour and residential market rigidities, personal characteristics and restrictions faced by individuals.

In search models which simultaneously analyze labour and residence decisions (Van Ommeren et al. (1997, 2000) among others), workers search a combination of job and residence that maximizes their intertemporal utility. The individuals continuously search for better jobs and dwellings, maximizing the discounted future flow of wages, place utilities, minus commuting costs, taking into account the costs of changing jobs and residences. The commuting behaviour is the final product of a combination of labour and residential markets features and an individual decision-making process accepting or rejecting an offer.

From a theoretical point of view and in the context of search models, commuting time is affected by rigidities and imperfections affecting the housing and/or the labour market. In the model of Van Ommeren et al. (1997, 2000) these imperfections act in two ways. First, they impose higher cost on individuals when they decide to move to another residence or to change job. And second, they diminish the arrival rate of new dwelling and/or job offers.

Market imperfections and rigidities affect commuting behaviour since they restrict the ability of individuals to change residence and/or job. As a result, the job and/or dwelling decisions and the actual commuting time can be far away from the optimal ones.<sup>2</sup> In particular, Van Ommeren et al. (1997) demonstrate that, in general, the existence of higher costs of moving in the housing, or lower probabilities of receiving a new dwelling offer increase the commuting.

In spite of the absence of explicit estimates of these rigidities and onto the arrival of rate of new offers, it is plausible to think that these variables must be relevant. As suggested by the literature, these market imperfections are related to many factors, as individual and familiar characteristics, institutional and regulatory framework, housing tenure and capital market imperfections.

Regarding the influence of individual and familiar characteristics, Mac Auley and Nutty (1982) and Van Ommeren et al.(1999), indicate that residential mobility strongly depends on the stage in the life cycle of individuals. Dohmen (2005) presents a review of stylized facts about mobility, and he states that high-skilled workers migrate more than their low-skilled counterparts. Another example is provided by Van Ommeren et al. (1997), who

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<sup>1</sup> Optimal commuting time not means necessarily "minimum commuting time among the existing alternatives".

<sup>2</sup> Such suboptimality is reflected in terms of wasteful or excess commuting, in terminology of Hamilton( 1982) or Small and Song (1992).

point out that couple with both members employed commute more since it becomes more difficult to adapt their housing situation to job location.

The institutional features of housing markets impose restrictions to the ability of individuals to freely switch their residence location. There exists an enormous variety of forms and examples of institutional restrictions collected by the academic literature. An extreme case is the governmental refugee settlement policy pursued in the 80s in Sweden, which imposes to the individual the location where they can reside (Aslund, 2005). Van Ommeren et al. (1999) point out that many properties in the Dutch housing market are owned by housing associations that use waiting lists and do not supply the property to the highest bidder. In the Spanish case, municipal authorities use to subsidise housing through regulated prices for specific collective, requiring a previous period of residence in the municipalities.

Among others, Pinto (2002) argues that the existence of imperfect capital markets acts as a barrier preventing some people from changing their residence location since individuals must consider not only the cost and benefits from moving, but also the availability of housing finance. As result, people who cannot borrow will be restricted in terms of their capability of changing residence location, and therefore, they will be subject to excessive commuting.

The influence of housing tenure on the propensity to change residence, and indirectly on the commuting time, also has received great attention in the literature. Green and Hendershott (2001) suggest that home-ownership reduces mobility, owing to a variety of factors including the lump-sum costs associated with buying, financing and selling a house. Van Ommeren et al. (1999) point out the differences on moving costs as an explaining factor of the differences on residential mobility between renters and owners. Henley's (1998) findings also suggest that homeownership reduces mobility. His work supports the idea that migration flows are unresponsive to the state of labour market, since the owners-occupiers propensity to move is insensitive to the existence of high unemployment. In terms of commuting, Henley (1998) indicates that high transaction cost for owner-occupiers may deter commuters from seeking a better match between dwelling and job.

Focusing the analysis of residential and job location in the immigrant collective, some specific issues have been cited in the literature that must be additionally considered. Nationality is an individual characteristic that influences commuting times given their

relevance in determining the initial and subsequent residence location<sup>3</sup>. As pointed out by Zavodny (1999) and Bartel (1989), the most important factor determining the location choices of new immigrants is the presence of earlier ones. This clustering behaviour may be indicative of the existence of informal ethnic networks for new immigrants that provide them with information about jobs and housing, or serve as an indicator of the generosity of the local welfare system (see (Borjas, 1999))<sup>4</sup>. Immigrant's subsequent location choices, i.e., relocations within the host country, benefit from learning about location advantages that may alter the initial settlement pattern. However, there is no clear evidence on the literature about the immigrant's mobility, as Rephann and Vencatasawmy (1999) recognize, since the immigrant clusters may offer non-monetary benefits (or cost of moving in a wide sense) that erode the advantages to move.

Limited fluency in Spanish and lack of qualifications and skills may also create barriers to some minority immigrants' successful participation in the labour market. In particular, immigrants are unable to qualify for some jobs, reducing the arrival rate of job offers, and so limiting their ability to get a suitable combination of dwelling and job.

Finally, commuting time can also be influenced by access to transport. In particular if individuals have limited access to fasten transport modes their commuting times could be significantly higher.<sup>5</sup> As pointed out by Preston et al. (1998), those immigrants living in neighbourhoods distant from expanding employment centres are often dependent on slow public transport, and experience commuting times.

### **3. Descriptive analysis**

#### **3.1. The spatial concentration of population, employment and commuting flows by nationality in the Madrid region**

Between 1996 and 2004 foreign population living in Madrid region increased by 639 %, growing from 95,141 immigrants to 703,343 (12 % of the whole population). According to the 2001 Census, the main origin of immigrants was South America (45%), Africa (14%), UE (12%) and the non-UE countries (12%). Most of Latin-American immigrants come from

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<sup>3</sup> This assertion may be mediated by several variables, as level of education, country of origin, language and occupation or legal restrictions (Aslun, 2005).

<sup>4</sup> Others alternative and complementing explanations for this behaviour are the ethnic goods theory proposed by Chiswick and Miller (2001) and the herd effect theory by Epstein (2002).

<sup>5</sup> As suggested in Taylor and Ong (1995), despite increasing commuting distances over time, the average commuting time remains unchanged between 1977 and 1985. They argued that this fact can be explained by the increasing use of private vehicles.

Ecuador (18,5%) and Colombia (11,6%), while the most prevalent origin for Africans is Morocco (72%).

In 2004, 64% of immigrants were located in Madrid municipality, where they represented 13 % of the population. In spite of this concentration, the use of location coefficients reveals that the highest concentration takes place in municipalities relatively far away from Madrid centre (Figure 1). The analysis of the data reveals two contrary tendencies in the location of immigrants. On the one hand, a significant proportion of them are found to reside in Madrid municipality, taking advantage of deteriorated neighborhoods and house-sharing formulas. And, on the other hand, other groups are located in municipalities with a long distance with respect to Madrid city center.

The data also reveal interesting spatial concentration patterns of immigrants by country of origin. In Table 1 we show the concentration coefficients of foreign people using the official names of spatial areas (Vinuesa, 2004). The coefficients are calculated by dividing the number of immigrants from origin,  $o$ , in spatial area,  $s$ , by the number of immigrants with the same origin in the whole region,  $R$ :  $p_{s/r}^o = \frac{P_s^o}{P_R^o}$ . Thus, coefficients larger than one indicate higher levels of concentration in a specific area compared to the relative weight of this group in the region.

The corresponding coefficients using data from the 2001 Census, show that the most clear concentration of low income groups corresponds to Non-EU European countries in the East-crown (along road N-II), and Moroccans in the South-crown and non-metropolitan municipalities. Caribbeans and Asiatics are clustered in the city center, while South Americans do not exhibit a clear pattern of spatial concentration. In contrast, it is also interesting to highlight the strong concentration of high income groups of non-nationals (people from EU and North American countries) in the North and West-Crown (areas with the highest prices of housing in the region).

Based on the information provided by the 2001 Census, we built two origin and destination matrices (OD) of inter-municipal flows (intra-municipal flows excluded). Thus, we capture the most important commuting flows for the whole amount of workers (Figure 2A) and immigrants (Figure 2B), showing different commuting patterns in both groups.<sup>6</sup>

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<sup>6</sup> For simplicity, the municipalities in both figures are sorted in the same way..

Figure 2A shows that the most intensive inter-municipal flows correspond to the Madrid municipality, showing the mono-central model of urban development that Madrid metropolitan followed in the past (less clear in the last 30 years). On the other hand, it is easy to find difference in the spatial structure of OD commuting flows of immigrants compare to the total population (Figure A and B). In Llano (2006), these two commuting OD matrix of nationals and immigrants from the 2001 Census were compared using a Le Masne Similarity Index (De Mesnard, 2004 )<sup>7</sup>. The index of similarity obtained for total workers of nationals/immigrants was 81,36%. Then, the same index was computed to compare one by one the commuting structures of national/immigrant working in the 4 main sectors. The similarity index obtained was 70,24% per Agriculture, 75,96% per Industry, 75,54% per Construction, and 81,28 per Service employees. Then, the statistical significance of intra and inter-group differences was proved by means of Anova with post-hoc multiple comparison analysis.

Figure 3 shows the spatial concentration of national and immigrant working in a hypothetical Central Business District (CBD) located in Madrid center, but living in other municipalities. As in previous studies (Llano, 2006), the municipalities of origin are ordered according to their proximity in kilometres to the CBD, and aggregated in two groups depending on the direction of the flow (from the Southern-East or the North-West axis to the CBD).

As can be observed in Figure 3 the concentration of commuters in both collectives is similar in the municipalities more distant to the Madrid CBD. However, the relative concentration of national commuters is always higher in the nearest municipalities (less than 25 Km from Madrid municipality). This fact is in line with the positive correlation of housing prices and the distance to the CBD, as well as the lower income levels of immigrants compared to nationals. Furthermore, it is expected that the different location choices of nationals and immigrants were conditioned by the sector of activity, the proportion of immigrants with the same nationality living in the municipality, the housing tenure and the household characteristics. Moreover, according to the international literature, it could be expected that commuting structures are conditioned by rigidities and imperfections both, in the housing and the labor market.

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<sup>7</sup> 
$$S_I(F^{n_1s_1a_1} - F^{n_2s_2a_2}) = 100 * \left( 1 - 0,5 * \sum_{i=1}^N \sum_{j=1}^N \left| p_{ij}^{n_1s_1a_1} - p_{ij}^{n_2s_2a_2} \right| \right)$$
; being  $p_{ij}^{nsa} = \frac{f_{ij}^{nsa}}{P^{nsa}}$  the intensity of inter-municipal flow between every pair of the 179 municipalities in the Madrid region. The index takes values between 0-100, being similarity index equal 100 when both matrix share the same structure.

In order to address this question we explore the difference in the commuting times between nationals and immigrants, using data extracted from the 2001 Census.

### **3.2. Data description: *Census 2001***

Empirical results are based on data from *Census 2001* conducted, every 10 years, by the National Statistics Institute of Spain (*INE*). The questionnaire collects both household and personal information, and it allows us to distinguish between Spanish and non-Spanish citizens. Furthermore, amongst those non-Spanish citizens we can observe the corresponding nationality. For the purpose of this paper, we select a sample of wage and salary workers aged between 16 and 64 years old, living in the region of Madrid in municipalities with more than 20,000 inhabitants.<sup>8</sup>

Table 2 describes the main characteristics of the selected sample. The variables, used later as explanatory variables to study the determinants of the commuting time, relate to personal, household and job characteristics: nationality, gender, age, marital status, household type, education, type of contract, housing tenure, transport mode and a set of activity dummies. As can be observed in Figure 4, the majority (almost 60%) of immigrants living in the region of Madrid comes from Latin-American countries. The second most common nationality corresponds to people coming from Other European countries (different from the EU15) and African people. The descriptive statistics also reveals significant differences between immigrants and natives with respect to different aspects. As shown in Figure 5 renting is significantly more likely amongst immigrants compared to natives. More than 70 percent of immigrants are renters, while the corresponding percentage amongst natives is less than 10 percent. This difference can be explained by differences in the access to the housing market. Taking into account the increasing trends in housing prices in Spain, and since the majority of immigrants tend to be occupied in less skilled jobs, with lower wages, it is not surprising that renting was the most common form of housing tenure among them.

Significant differences can also be appreciated regarding the transport mode. As can be observed in Figure 6, most immigrants take public transport to commute to their workplace (almost 70 percent) whereas no significant differences can be observed in the use of private and public transports amongst natives. This result would be due to the fact that, in general, immigrant people do not have access to a private vehicle, either due to legal (driving licence provided by Spanish authorities is compulsory) or economic motives.

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<sup>8</sup> Census 2001 does not provide disaggregated information on municipalities with less than 20,000 inhabitants.

The descriptive statistics also reveals that immigrants tend to be concentrated in certain activities. As reported in Figure 7, the presence of immigrants is significantly high in construction; hotels and restaurants; and other community, social and personal service activities, private households with employed persons, extra-territorial organizations and bodies.

Finally, different patterns in terms of commuting time can be observed between natives and immigrants. As shown in Figure 8, immigrants experience higher commuting times compared to natives.

#### 4. Econometric model and main results

In this section we aim to a more-in-depth analysis of the main factors determining the commuting time, where special attention will be given to the effect of nationality. In particular, we try to address the question whether immigrants experience higher commuting times than their native counterparts.

As the variable to be explained is an ordered and discrete variable, we have to rely on ordered regressions. In particular, we estimate an ordered logit model to study the determinants of commuting time. Consider the following dependent variable:

$$y_{ij} = \begin{cases} 1 & \text{if individual } i \text{ belongs to category } j \\ 0 & \text{otherwise} \end{cases} \quad (1)$$

where  $i = 1, \dots, N$ ;  $j = 1, \dots, m$ , and where  $j$  can be thought of a commuting time profile, such that:

Categories	Commuting times
$j=1$	<10 min.
$j=2$	10-20 min.
$j=3$	21-30 min.
$j=4$	31-45 min.
$j=5$	46-60 min.
$j=6$	61-90 min.
$j=7$	>90 min.

Assume that there is a latent variable  $y^*$ , which can be modelled as:

$$y_i^* = \beta' x_i + \varepsilon_i ; \varepsilon_i \sim Logistic(\theta=1) \quad (2)$$

that is,  $y^*$  can be explained by  $k$  explanatory variables contained in  $x$ . The logistic distribution with mean 0 has the following probability density function:

$$f(x) = \frac{1}{\theta} \frac{\exp(x/\theta)}{(1 + \exp(x/\theta))^2} \quad (3)$$

The individuals are classified into the  $m=7$  categories by the following rule:

$$\begin{aligned} y_{i,1} &= 1 \text{ if } y_i^* \leq \alpha_1 \\ y_{i,j} &= 1 \text{ if } \alpha_{j-1} < y_i^* \leq \alpha_j \text{ for } j = 2, \dots, m-1 \\ y_{i,m} &= 1 \text{ if } \alpha_{m-1} < y_i^* \end{aligned} \quad (4)$$

Combining (1), (2) and (3), we obtain that:

$$\begin{aligned} P(\text{individual } i \text{ belongs to category } j) &= P(y_{ij} = 1) \\ &= P(\alpha_{j-1} < y_i^* \leq \alpha_j) = P(\alpha_{j-1} < \beta'x_i + \varepsilon_i \leq \alpha_j) \\ &= P(\alpha_{j-1} - \beta'x_i < \varepsilon_i \leq \alpha_j - \beta'x_i) \\ &= F(\alpha_j - \beta'x_i) - F(\alpha_{j-1} - \beta'x_i) \end{aligned} \quad (5)$$

where  $F$  denotes the cumulative density function of the logistic distribution. The parameters of the model can be estimated using maximum likelihood technique. The likelihood function has the following expression:

$$\begin{aligned} L(\alpha, \beta) &= \prod_{i,j} P(y_{ij} = 1) = \prod_{i=1}^n \prod_{j=1}^m P(y_{ij} = 1)^{y_{ij}} = \\ &= \prod_{i=1}^n \prod_{j=1}^m [F(\alpha_j - \beta'x_i) - F(\alpha_{j-1} - \beta'x_i)]^{y_{ij}} \end{aligned} \quad (6)$$

And the parameters are estimated by maximizing the log-likelihood function given by:

$$\ln L = \sum_i \sum_j y_{ij} \ln [F(\alpha_j - \beta'x_i) - F(\alpha_{j-1} - \beta'x_i)] \quad (7)$$

Table 3 presents the estimation results of the ordered logit model. To better understand the result we present them in terms of marginal effects instead of coefficients. Our main interest is on the dummy variables identifying the nationality. As can be observed, immigrants coming from European countries different than EU15, and Africa are significantly more likely to suffer higher commuting times compared to natives. In particular, we find that an individual who only differs from the reference in that he/she is an immigrant from a European country different from EU15 has 1.67 times the probability of having higher commuting time. For the case of immigrants coming from Latin-American countries, the results reveal no significant differences with respect to natives, since they benefit from cultural and linguistic similarities with natives that are absent in the rest of collectives.

As a peculiar result, an individual who only differs from the reference in that he/she is non-Spanish citizen coming from Asia or Oceania, has a probability of suffering higher commuting 1.123 (=1/0809) times lower than a Spanish citizen counterpart. This apparently misleading result could be attributed to the high specialization of these collectives in activities which imply lower commuting times.

The larger commuting times experienced by certain types of immigrants can be explained by both housing and labour market imperfections. On the one hand if immigrants, due to discrimination, have lower probabilities of receiving a residential offer, the probability that residential location was close to their workplace would be lower. This is consistent with the common view that persons with a lower ability to adapt their housing situation to their work locations will have larger commuting distances (see Rouwendal and Rietveld, 1994). On the other hand, as predicted by the search theory, those individuals who receive more job offers tend to commute less. The fact that immigrants tend to be spatially concentrated in areas of socioeconomic disadvantage, obviously reduces the arrival rate of job offers, so that they may be willing to accept more distant employment simply in order to gain employment and thereby raise earnings.

Regarding the effects of other variables, several points are worth of mentioning. Males, older workers, and workers being the reference person in the household experience higher commuting times. The household type seems to affect commuting times too. In particular, taking those individuals who are single and without children as the reference group, we find that those living in a couple with children experience higher commuting times. They type of contract is found to be another important factor in determining the commuting time. The results reveal that those workers holding a temporary contract are 1.115 times more likely to experience higher commuting times than those with a permanent contract. Housing tenure is also found to be of paramount importance in explaining commuting times. Taking owners without mortgage as the reference category, we find that renters and those workers living in free housing experience lower commuting. Finally, transport mode is found to be a key factor in explaining commuting times. The estimation results reveal that using public transport significantly increases commuting times.

## **5. Concluding remarks**

In this paper we aim to explore the connection between commuting flows, residential location and worker's nationality using an ordered logit model to dilucidate the main determinants affecting the commuting time. Our findings reveal that, after controlling for residence

location, housing tenure, educational level and demographic variables, immigrants coming from European countries different than EU15, Africa, and South and Central America are significantly more likely to suffer higher commuting times compared to natives. These differences can be attributed to both housing and labour market restrictions due to discrimination. This is consistent with the common view that persons with a lower ability to adapt their housing situation to their work locations will have larger commuting distances. This commuting penalty is in line with the spatial mismatch hypothesis and residential segregation. Several reasons yield this conclusion. First, immigrants are usually more restricted in the housing market. Second, they tend to be located in areas of socio-economic disadvantage where ethnic network operates. Third, they tend to be concentrated within certain industries and occupations. All these factors restrict the job and dwelling choice set, so that immigrants may be willing to accept a combination of job and residence location associated to larger commuting times.

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**APPENDIX**

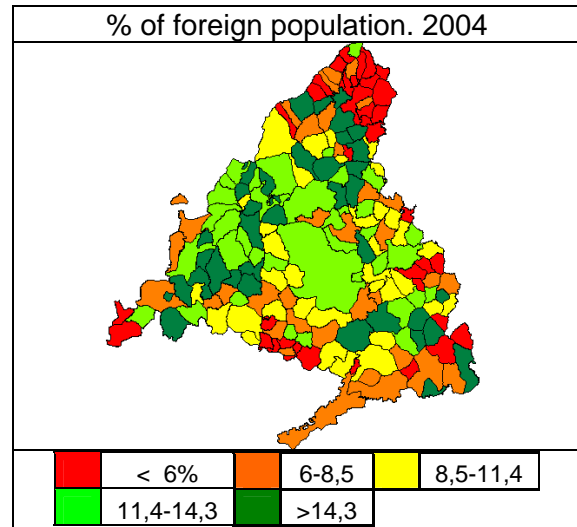
**A) Figures**

**Figure 1: Origin and spatial distribution of immigrant in the Madrid region.**

**Origin of non-national residents.**

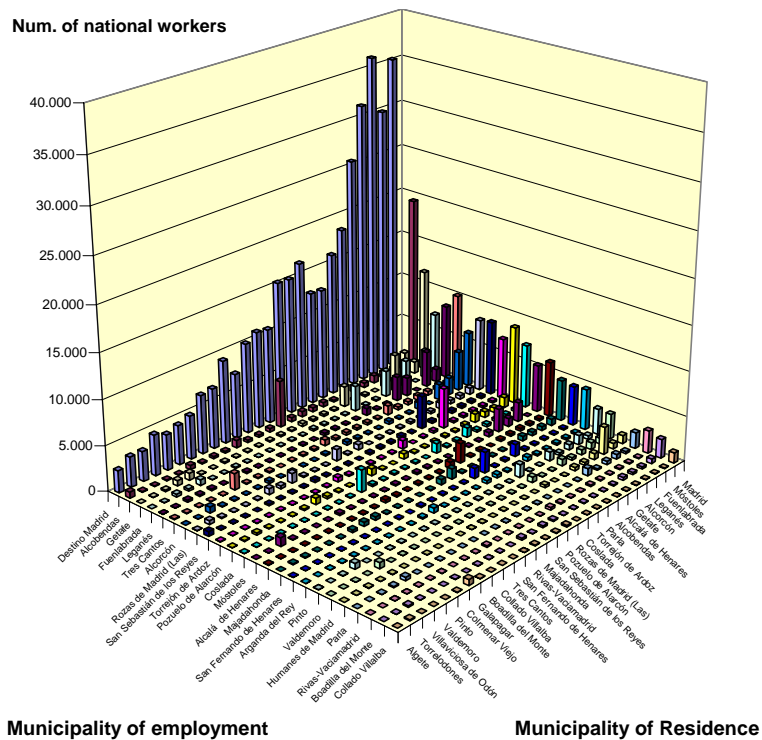
	People	%
South America	215.303	45,8
Africa	67.271	14,3
UE-15	58.600	12,5
Rest of Europe	55.791	11,9
Central Am.-		
Caribbean	34.893	7,4
Asia	24.107	5,1
North America	12.855	2,7
Oceania	1.080	0,2
<b>Total</b>	<b>469.900</b>	<b>100,0</b>

Source: 2001 Census. Nacional Statistic Institute

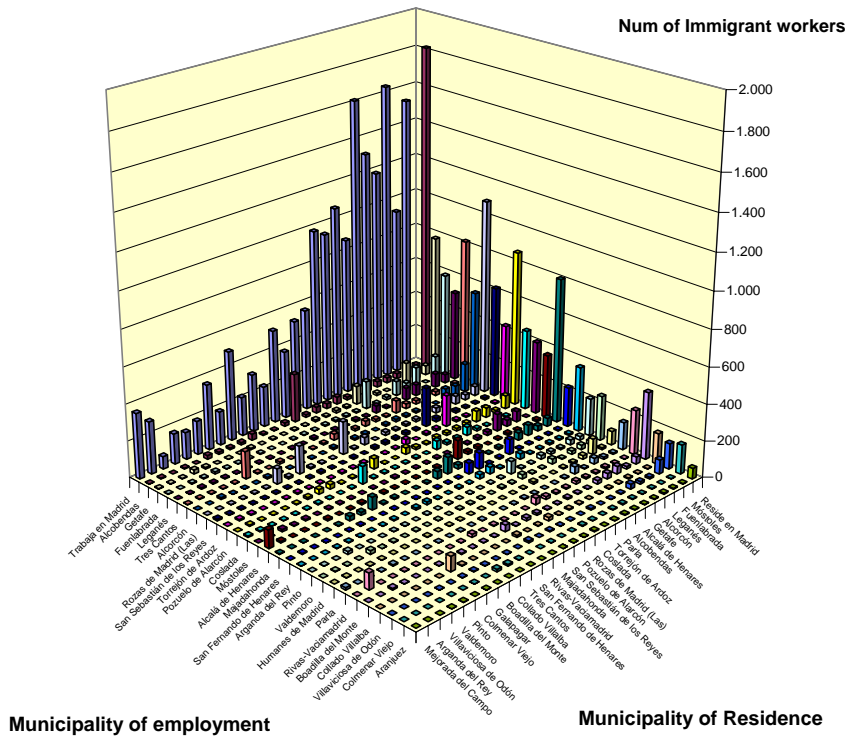


**Figure 2: Inter-municipal flows of workers in Madrid region. Census 2001.**

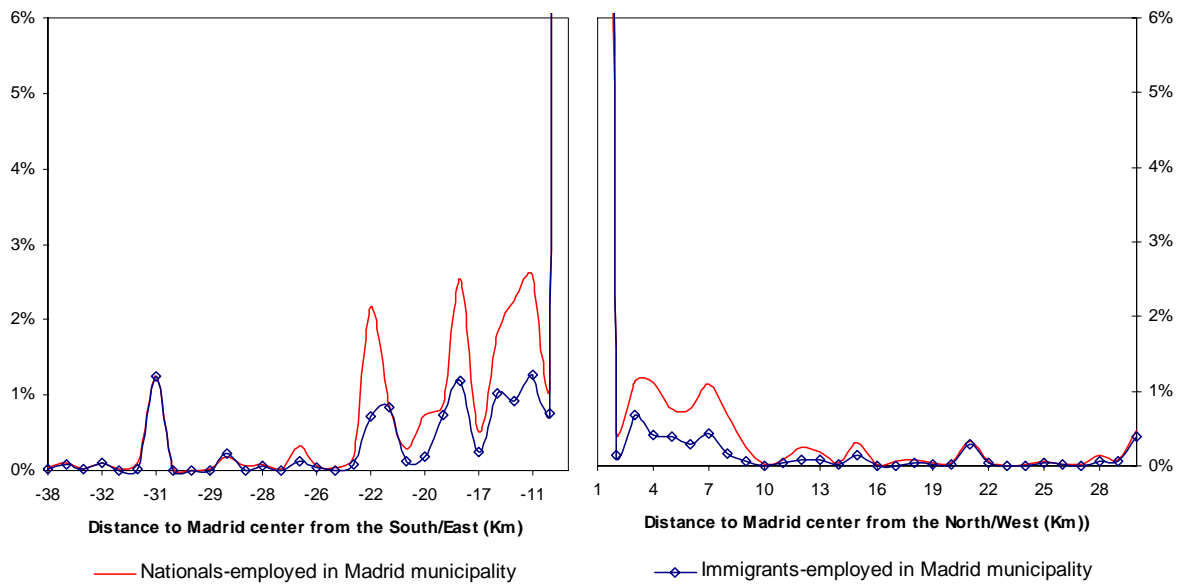
**a) Total workers**



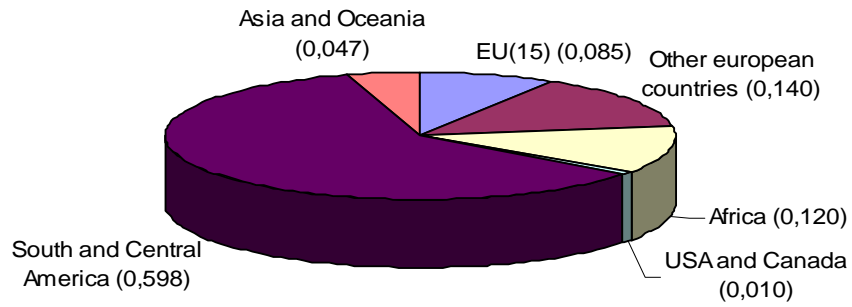
**b) Immigrants**



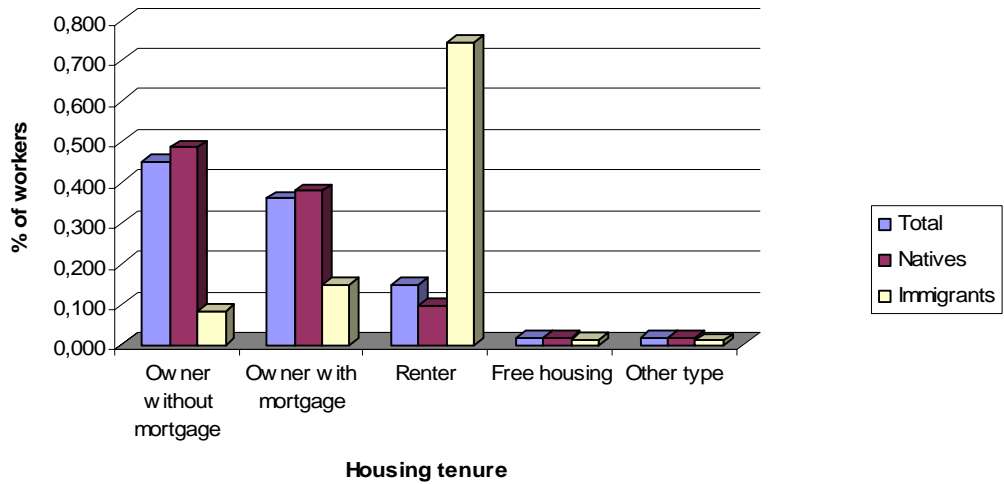
**Figure 3: Concentration of national and immigrant commuters to Madrid CBD by distance.**



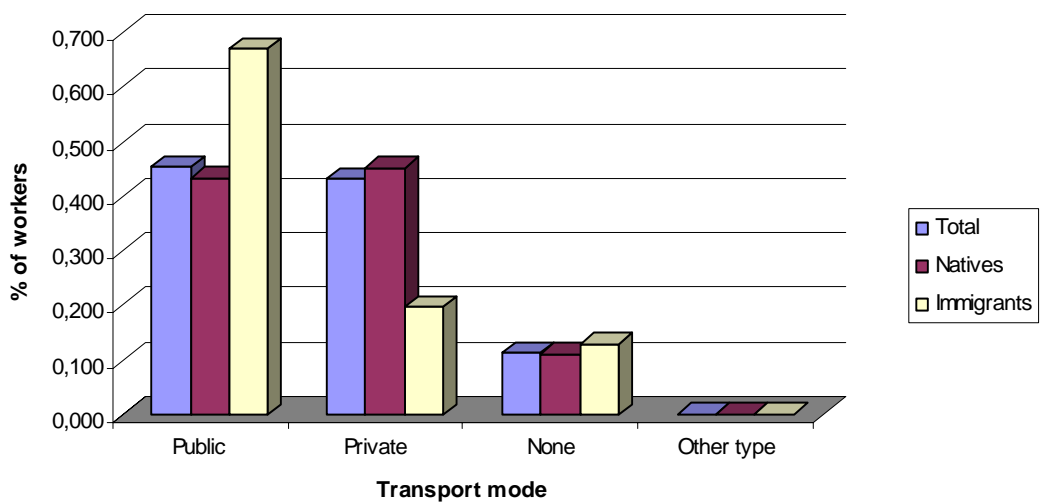
**Figure 4: Immigrants**



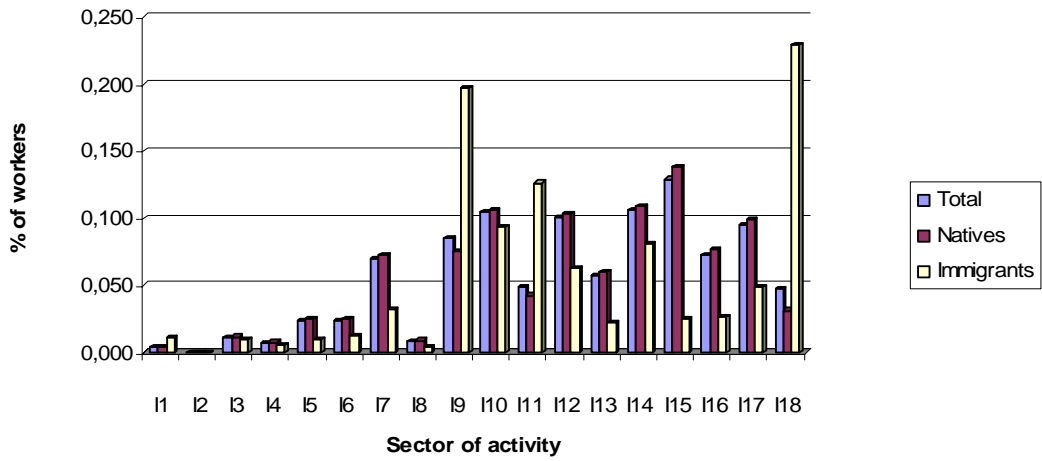
**Figure 5: Housing tenure**



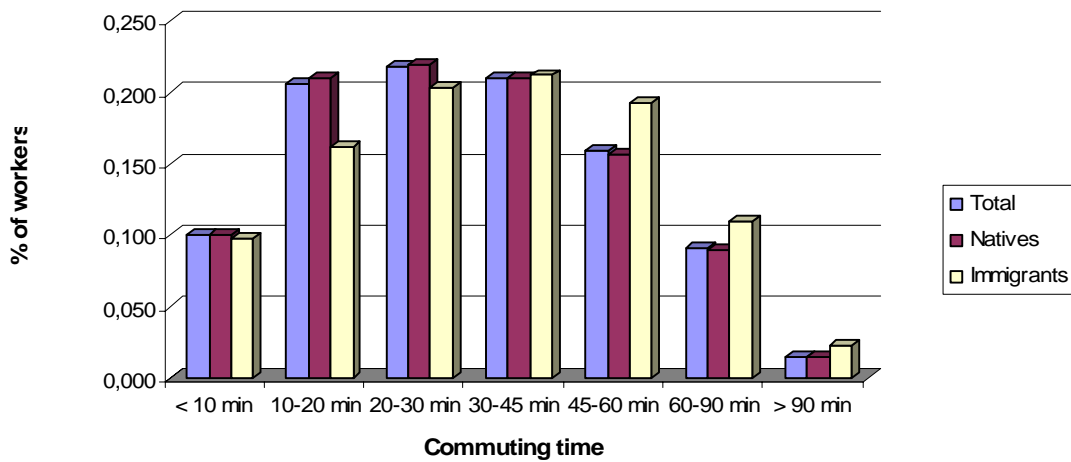
**Figure 6: Transport mode**



**Figure 7: Sector of activity**



**Figure 8: Commuting time**



## B) Tables

Table 1: Spatial concentration of foreign population. Census 2001									
2001 Census.	Total	EU 15	Rest of Europe	Africa	North America	Central A. Caribe	South America	Asia	Oceania
<b>Madrid Region</b>	<b>1,0</b>	<b>1,0</b>	<b>1,0</b>	<b>1,0</b>	<b>1,0</b>	<b>1,0</b>	<b>1,0</b>	<b>1,0</b>	<b>1,0</b>
Madrid center	1,0	0,9	0,4	0,6	1,4	1,4	1,2	1,6	0,6
North-West periphery	1,0	1,2	0,6	0,7	1,4	1,0	1,1	1,2	0,9
East periphery	1,0	1,0	1,4	0,9	0,6	0,9	1,0	0,7	1,1
South periphery	1,0	0,6	0,9	1,0	0,3	1,0	1,2	0,9	0,7
North-crown	1,0	1,7	0,6	0,8	1,7	1,1	0,9	1,0	1,2
East-crown	1,0	0,9	3,1	1,0	0,7	0,8	0,6	0,6	1,4
South-crown	1,0	1,1	1,3	1,9	0,3	0,8	0,7	0,8	1,6
West-crown	1,0	1,4	0,6	0,9	2,4	0,9	1,0	1,0	0,9
Non-metropolitan m.	1,0	1,1	1,6	1,6	1,0	0,6	0,8	0,5	1,4

Source: (Vinuesa, 2004)

<b>Table 2: Descriptive Statistics (Mean)</b>			
	Total sample (N=86120)	Natives(N=79038)	Immigrants(7082)
<i>Commuting time</i>			
< 10 minutes	0,100	0,100	0,098
10 - 20 minutes	0,207	0,211	0,162
20 - 30 minutes	0,218	0,220	0,203
30 - 45 minutes	0,211	0,210	0,212
45 - 60 minutes	0,159	0,156	0,192
60 - 90 minutes	0,091	0,089	0,109
> 90 minutes	0,015	0,014	0,023
<i>Nationality</i>			
EU(15)	0,007		0,085
Other european countries	0,011		0,140
Africa	0,010		0,120
USA and Canada	0,001		0,010
South and Central America	0,049		0,598
Asia and Oceania	0,004		0,047
Male	0,638	0,644	0,567
Reference person	0,482	0,492	0,364
<i>Age</i>			
16-24	0,020	0,014	0,091
25-39	0,338	0,315	0,603
40-54	0,446	0,464	0,241
55-64	0,169	0,181	0,029
Married	0,756	0,773	0,568
<i>Household type</i>			
Single without children	0,405	0,395	0,519
Couple without children	0,142	0,136	0,211
Single with children	0,047	0,046	0,063
Couple with children	0,406	0,423	0,207
<i>Education</i>			
Primary or less	0,164	0,160	0,205
Secondary	0,512	0,506	0,582
Tertiary	0,324	0,334	0,213
Temporary contract	0,167	0,140	0,464
<i>Housing tenure</i>			
Owner without mortgage	0,453	0,486	0,082
Owner with mortgage	0,360	0,379	0,149
Renter	0,150	0,096	0,745
Free housing	0,018	0,019	0,013
Other type	0,019	0,020	0,011
<i>Type of transport</i>			
Public	0,454	0,435	0,671
Private	0,432	0,453	0,197
None	0,113	0,111	0,129
Other type	0,001	0,001	0,002
<i>Sector of activity</i>			
I1	0,005	0,004	0,012
I2	0,000	0,000	0,000
I3	0,012	0,012	0,010
I4	0,008	0,008	0,006
I5	0,024	0,026	0,009
I6	0,024	0,025	0,012
I7	0,069	0,073	0,033
I8	0,009	0,009	0,005
I9	0,085	0,075	0,197
I10	0,105	0,106	0,093
I11	0,050	0,043	0,126
I12	0,101	0,104	0,063
I13	0,057	0,060	0,022
I14	0,106	0,109	0,081
I15	0,129	0,139	0,025
I16	0,072	0,077	0,027
I17	0,095	0,099	0,049
I18	0,048	0,032	0,229

<b>Table 3: Ordered logit for commuting times<sup>9</sup></b>	
<i>Nationality</i>	Odds Ratio t

<sup>9</sup> A set of activity and *municipi* dummy variables have been included in the estimation.

EU(15)	0,941	-0,82
Other european countries	1,671	8,33
Africa	1,175	2,43
USA and Canada	1,043	0,2
South and Central America	1,060	1,73
Asia and Oceania	0,809	-2,12
Male	1,028	1,93
Reference person	1,093	6,22
Age		
16-24		
25-39	1,080	2,51
40-54	1,088	2,73
55-64	1,188	5,09
Married	1,016	0,88
<i>Household type</i>		
Single without children		
Couple without children	1,112	5,07
Single with children	0,980	-0,63
Couple with children	1,003	0,17
<i>Education</i>		
Primary or less		
Secondary	0,985	-0,82
Tertiary	1,052	2,32
Temporary contract	1,115	6,06
<i>Housing tenure</i>		
Owner without mortgage		
Owner with mortgage	1,006	0,4
Renter	0,906	-4,5
Free housing	0,785	-5,14
Other type	0,932	-1,54
<i>Type of transport</i>		
Public		
Private	0,240	-98,5
None	0,020	-155,9
Other type	0,122	-12,46
N	86120	
Log Likelihood	-137104	