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## The Influence of Education on Work-Related Travel in Rural Metro-Adjacent Regions: The Case of Castilla-La Mancha (Spain)

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**Abstract:** This paper examines the spatial distribution of work related relationships in recently re-organized rural metro adjacent regions in order to understand their urban structure. Particularly, this research explores different travel purposes (commuting and business) and education levels (average working population and highly skilled professionals) in the Castilla-La Mancha rural region (Spain). The empirical results illustrate that: a) regardless of education level, regional cohesion was greater for commuting than for business travel and openness to other Spanish regions was greater for business trips than commuting; b) for highly-skilled professionals, metropolitan integration was greater for business travel than commuting; c) for the average working population, metropolitan integration was greater for commuting than for business purposes. Nonetheless, the outstanding level of interaction within the region (for both travel purposes and the overall working population), mainly among the main regional centralities, evidences an emerging intra-regional polycentric urban system. Finally, while it is concluded that the private car has a prevailing role in modal split both for commuting and business travel, differences are recorded in terms of travel purpose and education level. In this sense, findings reveal that high speed rail gets greater relevance among highly skilled professionals and for business trips.

**Keywords:** Average working population, business travel, commuting, highly-skilled professionals, modal split, rural metro-adjacent region, Spain.

### 1. INTRODUCTION

Since the 1970s, metropolitan externalities are no longer concentrated in only one city but shared among several interlinked intermediary centres resulting in the traditional monocentric model evolving towards a polycentric one [1 - 5]. In these emerging polycentric urban models, thanks to communication and transportation improvements (such as high-capacity road and high-speed rail networks), ‘temporary’ movements (commuting, short-term assignments, intra-company transfers, business trips or virtual contacts) have become more common and a new kind of contemporary professional has emerged: the mobile professional [6]. However, until now many scholars have traditionally focused on migration flows (particularly of skilled people, due to their capability for strengthening a region’s economic prosperity) [7].

Apart from increasing mobility levels, these polycentric systems (both housing and labour markets) have also led to significant changes regarding the direction of flows, travel distances and times as well as modal split [8 - 10]. First, in percentage terms, periphery-periphery and core-periphery relationships have increased, while travel to the central metropolitan core has been reduced [11 - 13]. Second, European studies have concluded that population dispersion, economic decentralization and polycentric urban structures have contributed to an increase in commuting distances and car dependency [14 - 17].

Much has been written about the nature of travel and the increasing functional interactions in the currently globalized economy [18 - 20] and several studies have already sought to disentangle the complex relationship between urban structure and mobility patterns (especially since the 1980’s, when the new polycentric urban spatial

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configurations started to emerge). However, largely because of the limited available data, debates generally focused on:

- a. Labour commuting flows [21, 22] as the major daily recurrent form of travel [23 - 25]. Nevertheless, apart from commuting, business mobility occupies a crucial role and constitutes a key factor in planning transport infrastructures in the globalization era. The growing number of multinationals/multiplant businesses with geographically distant units/offices, the increasing intra and inter-firm national/international relations, the improved/faster transport systems together with relative ease of movement or the growing need to attend conferences, trade shows and courses, make that business meetings progressively represent an important type of mobility and an essential component of working days [26 - 29]. Thus, in-depth explorations of the spatial organization of business flows in contrast to other forms of work-related interactions are necessary. Moreover, few studies have deepened in the education and/or professional level of travellers and none of them on the impact of high-speed rail (HSR) on functional relationships. The analysis of work related relationships of highly skilled workers become crucial to understand to what extent a region is immersed in globalization processes, and to what extent certain transportation modes have an influence on this integration.
- b. Specific geographical areas, mainly large global cities and urban regions [30 - 32] or international and cross border business relationships [26, 33]. However, since professional interactions are not only taking place at the international or national scales but also among an increasing number of smaller or regional firms [34], more emphasis should be placed on rural or sparsely populated territories [35 - 39].

Consequently, the aim of this paper is to analyse the spatial distribution of functional work-related relationships in rural regions highly influenced by metropolitan processes (what we call rural metro adjacent regions) and (recently) re-organized by state rescaling processes and the impact high speed rail connections have on them. As well, this paper examines the capabilities of mobility patterns for explaining these rural regions' urban structure. This is done by taking into account different travel purposes (called travel "multiplexity") and socio-economic profiles (called "individual heterogeneity") [40]. Particularly, commuting and business travel patterns are compared for average working population (hereinafter AWP) and highly-skilled professionals (hereinafter HSP). The analysis focused on central Spain, specifically on the Castilla-La Mancha region, adjacent to the Madrilénian region and towards which metropolitan processes have already begun to have a spillover effect [41, 42]. The data to support this research was provided by commuting and business travel collected from two original mobility surveys that were carried out during 2012. The first one was addressed to a sample of regional households and the second one, to three university graduate professions (Architecture, Civil Engineering and Legal professions).

This research was motivated by the following five issues:

- a. the polycentric urban configurations that have emerged during the last three decades in the most highly urbanized parts of the world and that have started to absorb medium-sized cities of nearby rural territories.
- b. the increasing dynamism of rural regions, some of them evolving even more energetically than large metropolises [43 - 47]. Two sets of processes are crucial to the increasing dynamism in these rural areas: 1) metropolitan processes, which have started overflowing beyond their traditional boundaries, thanks to improvements in transportation networks [48], and integrating new sub centres in their catchment areas [49]; and 2) state re-scaling, that equip governments with appropriate political strategies to coordinate supra-national and intra-national scales while promoting territorial competitiveness in the current globalization era [50, 51]
- c. the increasing importance business meetings play in mobility patterns as an essential component of working days [26 - 29, 52] and their changing patterns in Europe and North America identified mainly in terms of origins, destinations and duration [18, 53]. Thus, while commuting has been traditionally explored as one of the major forces of change in rural areas<sup>1</sup> [54] and as an important component of daily travel [55], an in-depth exploration of other travel purposes is needed since they occupy a crucial role in mobility [56] and their spatial patterns could adopt various forms in contrast to those of commuting [57].
- d. the increasing dependence of travel behaviour on individual choice. Apart from the geographical mismatch between origin (home) and destination (workplace) and built-up area characteristics (density, diversity and design) [58 - 61], the workers' demographic-socioeconomic characteristics [9, 24, 62 - 69] have a relevant impact on mobility patterns. While greater attention has been given to gender compared to other socio-demographic variables, variations in the number of flows and the average commuting distances were shown to be greater by occupation than by gender [65]. Considerable differences in the labour-market geographical scopes regarding education levels have also been found: highly-educated workers are more willing to commute and are

more likely to engage in long-distance travel [70 - 72]

- e. the noteworthy dependence of transportation mode choice on travelling costs (in terms of time and money). Thus, unless the employer pays for the work-related trip, salary (and thus, education level and occupation) is decisive in choosing between transport modes and it should be enough to compensate for expensive travel fares (which are usually those associated with the faster transportation modes). Undoubtedly, the accessibility to train stations, bus stops or airports is also of crucial importance. Nevertheless, despite the speed and comfort advantages of airplanes, trains and express coaches (which can facilitate long-distance commutes), the car has been the fastest growing mode of transportation in the world and the most important one in explaining extended mobility [73]

The remainder of this paper is organized into the following four sections: a) the case study; b) data sources and methodological approach; c) findings comparing commuting and business travel patterns for different education levels (average and highly-skilled workers); e) summary of the paper conclusions.

## 2. STUDY AREA: CENTRAL SPAIN AS A CASE STUDY

The study area covers two adjacent administrative regions: Madrid and Castilla-La Mancha (CLM) (Fig. 1). While previous scholars have already analysed mobility in central Spain, most of them have focused on the Madrid Administrative Region [14, 74]. Recently, studies have analysed the CLM region, some in an isolated manner [37] and others combined with the Madrid region [49].

### 2.1. Madrid Administrative Region

Since the 1980s, transport investments have been transforming the traditional radial network toward the metropolitan centre into a radio-concentric one. In parallel, processes of population/economic decentralization have taken place, leading to the emergence of new metropolitan sub-centres and the integration of historic cities and to the expansion of the metropolitan region beyond the Madrid Administrative Region [75]. As a result, functional interrelations have developed in the neighbouring provinces of two different 'rural metro-adjacent regions' [49]: CLM and Castilla y León.

As a consequence of the aforementioned transport and urban networks transformations, commuting mobility patterns within the Madrid Administrative Region have changed over the last three decades<sup>2</sup> [76 - 78]:

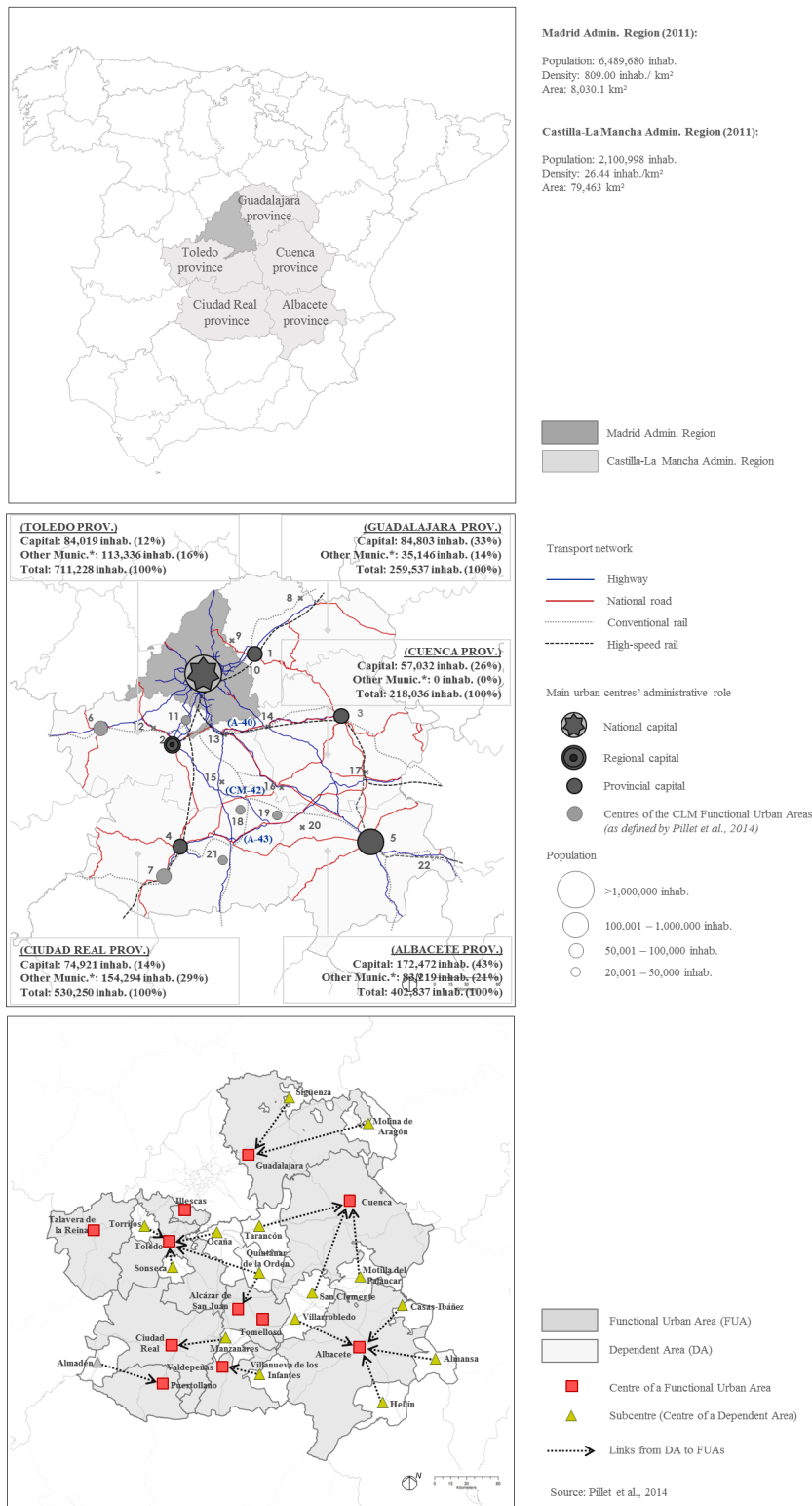
- a. The overall mobility increased from 299,668 in 1981 to 1,297,709 in 2011;
- b. The comparative importance of destinations changed:
  1. centripetal flows towards the municipality of Madrid substantially declined from 65.6% in 1981 to 44.2% in 2011,
  2. centrifugal flows from the municipality of Madrid to the rest of the Madrid region increased from 14.1% in 1981 to 18.5% in 2011.
  3. tangential (or periphery-periphery) flows between metropolitan sub-centres considerably increased from 20.3% in 1981 to 37.3% in 2011.

### 2.2. CLM Administrative Region

CLM, located between 40 km and 300 km from the municipality of Madrid, is an 'Objective 1 rural region' in European policies with low demographic density (26.4 inhab/km<sup>2</sup> in 2012) that predominantly comprises municipalities of less than 2,000 inhabitants (78.8% in 2012). However, half of the population (55.6% in 2012) is concentrated in 39 municipalities with more than 10,000 inhabitants. Only seven municipalities are between 50,000 and 175,000 inhabitants: the five provincial capitals, Talavera de la Reina and Puertollano (see Fig. 1).

<sup>1</sup> Commuting can be an alternative to migration, giving raise to the decrease of the depopulation of the most sparsely populated areas [38]. In order to achieve this, transport and road investments are crucial to make long-distance commuting feasible or tolerable as a daily journey

<sup>2</sup> It is important to mention that while the 1981, 2001 and 2011 Spanish Censuses asked for the municipalities of residence and work, each one made this information publicly available in a different way. The 1981 and 2001 censuses provide out-commuting information for all municipalities, although 1981 data are only disaggregated towards municipalities with more than 10,000 inhabitants or provincial capital cities. In the 2011 census, as an effect of the economic crisis, data were only collected for a sample from each municipality, and out-commuting statistics, which are not available for the smallest municipalities, are only published for workplace municipal type of location and size (and not by specific flow destinations).



NOTE. The numbers refer to the municipalities where the household mobility surveys were addressed (in bold, the eleven FUA centres identified by Pillet et al., 2014): (1) Guadalajara; (2) Toledo; (3) Cuenca; (4) Ciudad Real; (5) Albacete; (6) Talavera de la Reina; (7) Puertollano; (8) Sigüenza; (9) El Casar; (10) Azuqueca de Henares; (11) Illescas; (12) Torrijos; (13) Ocaña; (14) Tarancón; (15) Madridejos; (16) Mota del Cuervo; (17) Motilla del Palancar; (18) Alcázar de San Juan; (19) Tomelloso; (20) Villarrobledo; (21) Valdepeñas; (22) Almansa. Conversely, the surveys addressed to the highly-skilled professionals were emailed to all the members of each professional association.

Fig. (1). The Castilla-La Mancha Administrative region as case study: main urban and transport networks Source: CNIG, INE; authors.

Created in 1982 and comprising five provinces (see Fig. 1) with Toledo as the new regional capital, CLM has traditionally been defined as a disorganized, acephalic/leaderless region that lacks functional cohesion and is conspicuously influenced by Madrid [79]. Nevertheless, recent studies account for an incipient CLM polycentric urban structure: *i.e.* [37] identified 10 Functional Urban Areas (FUAs), organized by 11 FUA centres (which constitute the main CLM urban structure), and another 15 areas dependent on the 10 FUAs (due to the low regional population density).

The national ‘passing-through’ character of CLM transportation infrastructures has also shaped the regional urban dynamics. Recent transportation investments have predominantly improved radial road and high speed rail networks (connecting to the national capital), although a few tangential infrastructures have been established within the region (three tangential motorway stretches [CM-42, A-40] and a few low-frequency regional high-speed rail connections).

Mobility patterns within the CLM Administrative Region have also changed over the last three decades [76 - 78]: a) an outstanding increase in out-commuting, from 9.7% in 1981 to 31.6% in 2011, greater than other rural regions less influenced by metropolitan processes; b) an increase in commuting with the Madrid administrative region, from 20.5% in 1981 to 32.3% in 2011; and c) an intensified intra-regional cohesion derived from increasing out-commuting among FUA centres, from 4.6% in 1981 to 10.0% in 2011.

### 3. DATA SOURCES AND METHODOLOGICAL APPROACH

#### 3.1. Sampling and Data Collection

Due to the poor quality of official commuting statistics and the lack of official CLM statistics for travel purposes other than commuting, particularly business trips, the data in which this research is supported were based on two original surveys:

##### a) *A Mailed Paper-and-Pencil Survey of CLM Households*

Own-elaborated mobility questionnaires were addressed to a sample of regional households during April-May 2012. The methodology, previously shown to have revealing conclusions regarding mobility patterns [80], consisted of organizing a tree-shape distribution and collection method with a set of key individuals (direct contacts) who distributed the leaflets to the whole sample. Respondents (households) were selected from last-grade students at a set of selected high-schools (eighty-three centres distributed among twenty-two regional municipalities<sup>3</sup> including the FUA centres identified by [37]). Despite the bias generated by only considering part of the regional population, this sector has noteworthy mobility levels [81] thus making its analysis more interesting.

A total of 25,400 leaflets were distributed to students and questionnaires were filled out at their household during April and May 2012. Although 7,332 responses were received (29% response rate), after a debugging process, 6,901 valid answers (27% response rate) comprised the final data. The sample had less than a 1.5% margin of error and a confidence level of 95%, constituting a representative sample of all regional households (785,907 in 2012). The questionnaire was organized in two sections:

- a. Questions about the household and its head (place of residence, gender, age, number of children in the household, education level, occupation);
- b. Questions about work-related travel (commuting and business) to other municipalities, including the transportation mode used in undertaking them.

##### b) *An Internet Based Survey of Different Types of Highly-Skilled Professionals Residing in CLM*

Since during the last two decades the number of workers independent of a formal organization has considerably increased [6], instead of focusing on specific corporations, this survey was addressed to three professional sectors (Architects - ARCH, Civil Engineers - CE, and Lawyers - LAW, residing in CLM). These professional sectors were chosen for two reasons: a) due to the already assessed outstanding intermunicipal mobility levels for ARCH and Engineers in other Spanish regions [82]; and b) in order to collect information from professionals working both for

<sup>3</sup> The twenty-two municipalities were selected by: a) their geographical location in order to characterize key regional municipalities homogeneously distributed throughout CLM; b) their population “size” and the presence of, at least, one high-school; c) their positive 1981-2011 demographic dynamics; d) By their intermediary role and capability for organizing/articulating adjacent territories;

public and private sectors (CE have a traditionally strong tie with the public sector, while the other two types of professionals are usually more related with the private one).

Following a similar methodology to others used in previous studies [6, 83 - 85], the internet based questionnaire was emailed to all the members of the CLM Architecture, Civil Engineering and Legal Professional Associations in May 2012. Table 1 collects the number of valid responses received by the end of the month.

This questionnaire included questions about:

- a. The surveyed professional gender, age, municipality of residence and company they worked for (freelance or contractual basis, public and/or private sector, size in terms of the number of offices, location of the headquarters);
- b. The regular workplace municipality and the transportation mode used to access it;
- c. The business travel destinations during the previous complete working week. Each relation was characterized as intra or inter-firm, by the transportation mode used and by its frequency (annual, monthly, weekly, twice or more per week).

**Table 1. Response rates of the internet base survey.**

Professional sector	Members of CLM professional association (in 2012)	Responses received (percentage of response rate)	Valid responses received (percentage of response rate)	Error of the sample	Confidence level of the sample
<b>Total CLM HSP<sup>4</sup></b>	7,172	479 (6.7%)	417 (5.8%)	5 %	95 %

Source: authors

### 3.2. Collected Data Processing Methodology

Due to the recent diversification and complexity of workplaces (as a consequence of, among others, the emerging polycentric urban structures and the rapid development of ICT) [85 - 87] this paper distinguishes between different types of mobility:

- a. Commuting travel, which comprises daily travel between the place of residence and place of work. This paper considers only out-commuters (workers traveling daily for working purposes to a different municipality than that of residence);
- b. Business travel, which comprises work-related trips to an irregular place of work. Business travel provides a very flexible form of corporate mobility [88]. This paper considers only business trips to a municipality other than the place of residence;

Despite the fact that in both surveys (regional households and HSP) individuals were the sample units, their work trips were the basic unit of our analysis. Consequently, in order to determine the capabilities of the main cities in the study area (FUA centres) for attracting professionals (both frequent - residence or regular workplace locations - and sporadic - as business travel locations), these work trips were classified according to their respective destinations:

- a. Madrid Administrative Region, distinguishing between those directed towards the metropolitan centre (Madrid municipality) and those oriented to the remaining region;
- b. CLM municipalities, distinguishing between those directed towards the main regional cities (FUA centres) and the rest of the CLM region;
- c. Other Spanish regions (except Madrid) or countries.

These relations were compared between average households and overall HSP (all surveyed workers were weighted by the population of each professional association). This comparison was done by assessing: a) the total share of workers engages in out-commuting/business travel; b) the covered distances<sup>5</sup>; c) the working/business destinations; and d) modal split.

<sup>4</sup> The margin of error and level of confidence were, in each individual case (for each of the three surveyed professional sectors), lower than 10% and 95% respectively.

<sup>5</sup> While euclidian distance has been widely used in travel behaviour analyses they are shorter than network ones. Since in Spain car-dependency has considerably increased as a result of population dispersion, economic decentralization and emerging polycentric urban structures [14] and in 2011 more than 70% of the commute trips were done by car [78], travel distances along the road network were assessed in this study

## 4. FINDINGS: A COMPARISON OF THE CLM RURAL METRO-ADJACENT REGION HOUSEHOLDS AND HIGHLY-SKILLED PROFESSIONALS

### 4.1. Residential Concentration

Significant patterns of residence concentrations were found with regard to education levels, being the share of HSP residing in the eleven CLM FUA centres (73%) higher than the one of the average regional working population (54%).

Thus, in accordance with existing literature [11, 89], differences in residence location were also found in rural metro-adjacent regions when considering education levels: greater proportions of university educated workers' residences were concentrated in the main (central) cities. As some scholars have already pointed out, despite the possibility of decentralization offered by new technologies (in the case of CLM, the improved road network and the four HSR lines connecting with Madrid), this concentration of HSP in main cities (business centres) could be justified by the key importance given by these talented professionals to urban amenities and quality life or by the need for F2F contact [90 - 92].

This relevant concentration of residential locations in FUA centres (either of the average regional household or of HSP) points to the consolidation of the CLM main urban structure as a set of centralities distributed across the territory.

### 4.2. Labour Commuting Patterns

The scarce literature on rural or low density areas has already concluded that mobility levels are greater than those of urban regions and long distance commuting has been associated with living and working in these areas. Besides, previous scholars have already found that having access to fast and comfortable transport modes can facilitate commuting longer distances [93]. However, travelling costs (both time and money) are one of the most important factors in explaining the choice of transportation mode. Consequently, sensitivity to distance in general decreases as education level increases. Nevertheless, the extent to which HSP residing in rural regions are as well much more willing to travel further for work-related purposes is still a remaining question.

Collected data for CLM showed that, contrary to what it could be expected and to previous literature for urban regions, a lower percentage of HSP than average ones commuted daily to a different municipality (*i.e.* while 17.4% of university educated professionals were out-commuters, this was 26.0% for the AWP). This outcome, together with the noteworthy residential concentration of university educated workers, indicates that large numbers of high skilled jobs must be concentrated in these main CLM centralities.

Regarding travelled distances, despite the important residential concentration in the main CLM urban centres, its low demographic density (the lowest for all Spanish regions) resulted, in average, in long-distance<sup>6</sup> commuting for the AWP (51.7 km) and more so for HSP (75.1 km) (see Table 2).

**Table 2. Average commuting distance of CLM average working population and highly-skilled professionals.**

	Distance	
	(km)	(min)
CLM average working pop.	51.7	37.0
Highly-skilled prof. (residing in CLM)	75.1	50.9

Source: 2012 authors' surveys and Google Maps

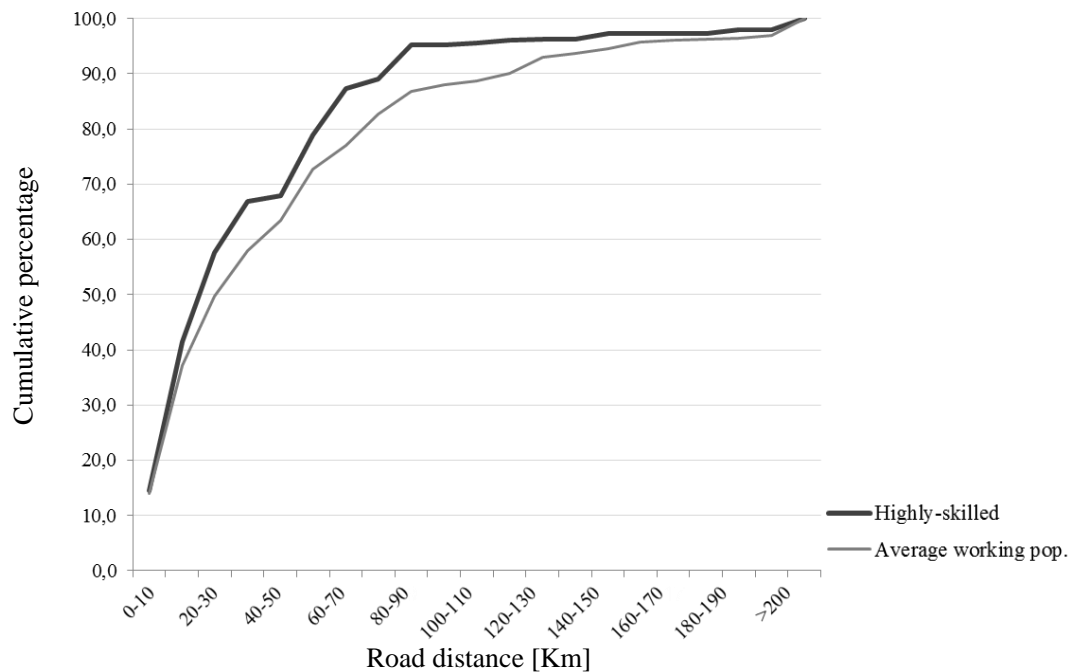
Nevertheless, while on average, commutes could be characterized as long-distance trips, Fig. (2) clearly depicts that important proportions of commutes were short-distance: 63.5% of AWP and 68.0% of HSP commuted distances under the 50km threshold.

Apart from the influence of education on travel distances, attraction capabilities should also be explored to grasp the complexity of CLM urban network and its regional openness to Madrid and other Spanish regions.

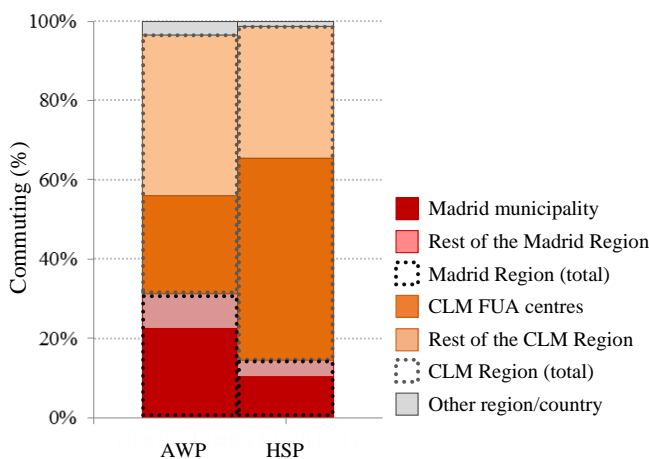
As Fig. (3) illustrates, a significant proportion of commuting took place within CLM itself (more than 60%) regardless of education level. Nevertheless, higher rates of commuting within the regional territory were found among university graduates (84.3%) than among the AWP (65.4%), which significantly interacted with the Madrid region

<sup>6</sup> Long-distance trips have been defined in literature, although without any consensus on the threshold used. Recently, [95] chose 50 km for the characterization of trips in regards to the travel distance. In Spain, according to the MOVILIA 2006/2007 survey 64% of work-related travel covered distances less than 50 km and only 13% are trips longer than 100 km. Thus, in this study long-distance trips are defined as those greater than 50km (one-way).

(31.2%). Differences were also found regarding the capabilities of the main urban centres for attracting commuting flows. On the one hand, noteworthy concentrations of high skilled jobs at FUA centres may explain the outstanding percentage of university educated professionals (50.9%) commuting towards them compared to the AWP (24.8%). On the other hand, the national capital (Madrid) exerted a greater influence on the AWP (22.6%, similar to the FUA centres), than on qualified professionals (10.4%). Consequently, the attraction capabilities of FUA centres in comparison to those of the metropolitan centre were more noticeable with increasing education.



**Fig. (2).** Average working population’s and highly-skilled professionals’ commuting distances, cumulative distribution. Source: 2012 authors’ surveys



	AWP.	HSP
<b>Out-commuting</b>	26.0%	17.4%
<b>Madrid region (total)</b>	31.2%	14.4%
<b>CLM region (total)</b>	65.4%	84.3%
<b>Other region/country</b>	3.4%	1.3%
<b>Madrid munic.</b>	22.6%	10.4%
<b>FUA centres</b>	24.8%	50.9%

**Fig. (3).** Commuting linkages of Castilla-La Mancha average working population and highly-skilled professionals. Source: 2012 authors’ surveys.

In conclusion, compared to the AWP, regional HSP were less influenced by Madrid municipality and had greater relations with CLM FUA centres. Thus, considering the total share of commutes attracted by the main centres of the



CLM urban network, it could be concluded that intra-regional commuting polycentricity is positively correlated with education.

Finally, in regards to modal split, literature gathers a wide range of factors (from individual to urban structure characteristics) which influence it. There seems to be a positive link between income and car use, although the link between income and other modes (such as public transport) differs among studies [94]. Regarding population density, scholars have concluded its importance for the viability of public transport [96 - 98] and in workers' mode choice for work-related trips [99]: [100] found a negative association between higher population density and commuting by car and [101] found a positive association between population density and commuting by public transport.

According to the authors' surveys, regardless education level, an outstanding percentage (more than 80%) of commuting trips were done by private car (see Table 3). The low share of the other transportation modes could be justified first, because of the poor quality/low frequencies of intercity bus and conventional train services/timetables in the region (which have been decreased during the last years) and second, because average commuting distances ([102] and Table 3). Nevertheless, differences were observed in public transport shares in regards to education: while AWP used intercity buses or conventional trains (6.4%) more than HSRs (2.1%) for commuting purposes, the opposite took place by HSP (1.2% and 4.7%, respectively). It is important to notice that an important number of HSP recorded the use of different<sup>7</sup> transport modes for commuting (mainly car and HSR). Thus, although it is difficult to assign them to only one transportation mode, this means that the use of HSR for commuting purposes maybe greater than the registered in (Table 3). In any case, the mobility surveys revealed that the higher the education level, the higher the use of HSR.

To sum up, the following can be concluded regarding commuting flows:

- a. an important regional cohesion (more than interactions towards other territories including the metropolitan region) which is especially significant for university graduates. In this regional cohesion, the role FUA centres play is notorious, with a more noticeable intra-regional polycentrism for university graduates than for the AWP. Partly because of the CLM HSR network configuration, which facilitates radial flows to/from the national capital and has very few services between regional territories (such as the provincial capital cities) and partly because the HSR is still very recent (built between 1992 and 2010), the high-capacity road network has played an hegemonic role in this regional cohesion (which is reflected in the prevailing use of private car in commuting in contrast to HSR).
- b. a considerable integration in the metropolitan processes, but to a greater extent for the CLM AWP. This could mean that while average regional workers employed in the Madrid region decide to locate/maintain their residences in CLM taking advantage of lower land/housing prices, as education level (and consequently, salary) increases, those HSP working in Madrid decide to locate/relocate within the metro region and only those ones that work in CLM reside there. A supra-regional scale monocentric spatial structure of commuting is observed regardless of education levels: the attraction of Madrid municipality represent more than 70% of the overall commuting flows from the Madrid region. Nevertheless, it is important to bear in mind that FUA centres consist of a total of eleven municipalities, when comparing their attraction role with that of Madrid municipality. In this noteworthy metropolitan integration, the radial character of the CLM transport system (connecting with Madrid) has played a significant role. In this case, the impact of HSR is more relevant since all the connections where built to connect with the national capital and since almost all commuting trips made by HSR where directed towards Madrid (according to the author's surveys).
- c. a low regional openness towards other national international regions.

**Table 3. Modal split for commuting journeys.**

	Transportation mode				
	Car	Intercity bus/ conventional train	High-speed rail	Airplane	Other/ various
CLM average working pop.	90.5	6.4	2.1	0.0	1.0
Highly-skilled prof. (residing in CLM)	88.3	1.2	4.7	0.0	5.8

Source: authors' 2012 surveys

<sup>7</sup> This refers not to the different modes of transport used in the same trip (for instance in most cases, public transport travel require another transportation mode to get to and from the station) but to different choices during the week.

### 4.3. Business Travel Patterns

The third step of this paper compares business travel of average regional households with those of HSP in an attempt to understand whether spatial organizations of commuting and business travel are different and consequently the regional urban network has different attraction roles with regard to the type of functional linkage and education level.

As expected, being involved in business travel is positively correlated with level of education: while the percentage of AWP undertaking business trips was only 4.0%, this figure rose up to 81.2% for HSP.

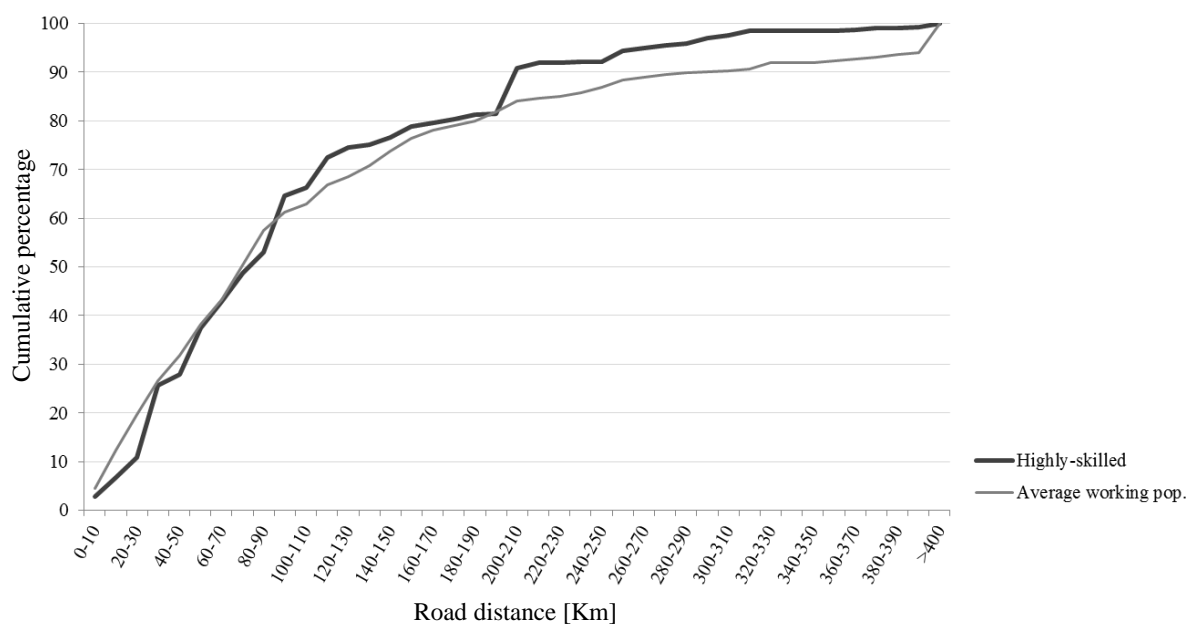
In regards to travelled distances and conversely to commuting, business travel take place over longer distances (see Table 4), although in this case they were not significantly affected by education level (being approximately 120 km). This means that differences between both types of work related travel are greater for lower education levels: *i.e.*, whereas for AWP average business travel distance was approximately 2.5 times that of commuting, for HSP, it was approximately 1.6 times.

**Table 4. Modal split for commuting journeys.**

	Distance	
	(km)	(min)
CLM average working pop.	126.8	79
Highly-skilled prof. (residing in CLM)	120.8	72

Source: authors' 2012 surveys

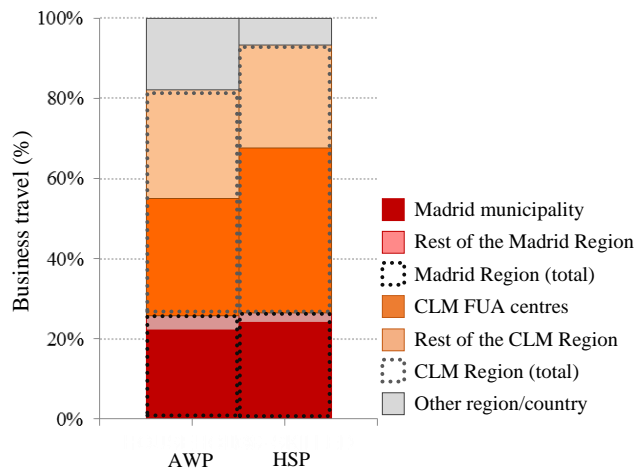
Thus, business travel could be characterized as long-distance (as Fig. 4 also depicts): only 31.8% of AWP and 28.0% of HSP travelled business distances under the 50km threshold. Nonetheless, in both cases, only more than 10% of business trips were over 200km. As concluded from the average business distance comparison, the cumulative distribution of business distances illustrates a similar behaviour for the AWP and HSP.



**Fig. (4).** Average working population's and highly-skilled professionals' business travel distances, cumulative distribution. Source: 2012 authors' surveys

Similarly to commuting, a significant proportion of business travel took place within CLM and was positively influenced by education level (Fig. 5): higher rates of business trips within the regional territory were found among university graduates (66.8%) rather than among the AWP (56.4%). Differences were also found regarding the capabilities of the main CLM urban centres for attracting commuting flows: relevant concentrations of specialized services/activities at FUA centres may explain the outstanding percentage of university educated professionals (41.1%)

traveling for business purposes towards them compared to the AWP (29.2%). Thus, for an intra-regional scale, this greater attraction of FUA centres would mean a more polycentric spatial organization of qualified workers' business travel. Interactions with both the Madrid region and the metropolitan centre were similar, regardless of education (see Fig. 5).



	AWP.	HSP
<b>Engagement in business travel</b>	4.0%	81.2%
<b>Madrid region (total)</b>	25.7%	26.5%
<b>CLM region (total)</b>	56.4%	66.8%
<b>Other region/country</b>	17.9%	6.8%
<b>Madrid munic.</b>	22.1%	24.1%
<b>FUA centres</b>	29.2%	41.1%

Fig. (5). Business linkages of Castilla-La Mancha average working population and highly-skilled professionals. Source: 2012 authors' surveys

Not surprisingly in both cases, almost all business trips directed to that region were attracted by the metropolitan centre (approximately 90%). This could mean a monocentric supra-regional spatial organization of business travel where the traditional centre exerts a key role. Differences between the attractor roles of Madrid municipality and CLM FUA centres were greater with increasing education level: 22.1% and 29.2%, respectively for AWP and 24.1% and 41.1% respectively for HSP. Finally, there was a greater engagement with other Spanish regions or countries for the AWP (17.9%) than for qualified workers (6.8%).

Finally, in regards to modal split, private car was concluded to be the main mode of transportation for commuting regardless education level (see section 3.3.4). Some scholars have already pointed out that having access to fast, flexible, comfortable and affordable transport modes can facilitate commuting longer distances [93]. Hence, does the greater distances covered for business purposes have an implication on transportation mode choice? That is to say, is the car also prevailing for business travel or conversely, since further territories need to be reached, public transport start exerting a more relevant role?

According to the authors' surveys, regardless education level and similarly to commuting travel, an outstanding percentage (more than 80%) of business trips was done by private car (see Table 5). Nevertheless, for HSP, public transport modes, in particular HSR, acquires greater relevance for this travel purpose. This is in relation with distance covered for business meeting in parallel to higher incomes which allow professionals to have access to faster transport modes.

Table 5. Modal split for commuting journeys.

	Transportation mode			
	Car	Intercity bus/ conventional train	High-speed rail	Airplane
CLM average working pop.	90.8	2.7	5.2	0.1
Highly-skilled prof. (residing in CLM)	85.6	1.9	8.1	0.5

Source: authors' 2012 surveys

To sum up, the following can be concluded in regards to business flows:

- a. a significant proportion of business travel took place within CLM, and was positively influenced by education level. In this relevant regional cohesion, the attractor role FUA centres played was noteworthy and greater for HSP than for the average regional working population. It is remarkable that this role of FUA centres was greater

than that exerted by the municipality of Madrid and is more noticeable for highly skilled than for the regional population. This two facts show an intra-regional polycentric spatial structure of business flows and consequently the consolidation of FUA centres as business destinations.

- b. an outstanding monocentric integration in the metropolitan processes, where most of the trips directed to the Madrid region were attracted by the metropolitan centre (approximately 90%) regardless education levels.
- c. a lower regional openness towards other national or international regions, more significant for the AWP than for university graduates.

## CONCLUSION

While much has been written regarding commuting or business meetings/travel, two main gaps are found in the existing literature. First, most studies analysed commuting independent of business travel behaviour. Second, they mainly focused on large global cities, urban regions and international relations paying little attention to rural or sparsely populated areas. In an attempt to fill these gaps, the aim of this paper is to analyse commuting and business travel spatial organizations for workers residing within a low density region influenced by metropolitan processes, paying special attention to differences in workers' education level and economic sector. These analyses are of relevant importance due to the recent increasing dynamism of these rural regions, which is partly influenced by the funds received from the European Union in order to promote their development and structural adjustment (f.e. improving their transport systems).

The first general (and predictable) conclusion extracted from the analyses is the outstanding residential concentration in the main (central) cities with increasing education levels.

Not surprisingly, education level impacts on commuting travel behaviour. However, contrary to what it could be expected, in rural metro-adjacent regions, a lower percentage of HSP commute daily to a different municipality than the AWP. This lower out-commuting for HSP together with their significant concentration in central cities would show: on the one hand, that large proportions of high-skilled jobs must be concentrated in these cities; and on the other, that these HSP's preferences for residential location in rural metro-adjacent regions are strongly dependent on the features of the city/neighbourhood, the amenities provided and that pollution, noise, congestion or land price issues were less relevant for these professionals. In contrast, engagement in business travel is positively correlated with education level (*i.e.* for CLM, the percentage of HSP undertaking business trips was twenty times larger than the one of the regional working population). Moreover, the share of HSP traveling for business purposes is much greater than for commuting, and the opposite occurs for the average population. However, distances covered for business purposes are not significantly affected by education level.

But while fewer HSP travel daily from home to work compared to the regional working population, on average they are more willing to commute longer distances. Nevertheless, noteworthy proportions of commutes take place over short-distances regardless of education. Comparatively, business travel take place over longer distances than commuting for all workers residing in rural metro-adjacent regions (being HSP more willing to undertake longer business trips). This is in accordance with [57] who found a much more local geographical scope of commuting than business travel. These longer distances covered for business trips derives in a greater use of HSR for this travel purpose (although private car has been concluded to be the main mode of transportation for commuting and business regardless education level), which is more outstanding as education level increases (as a consequence of their higher incomes).

To summarize, the comparison between CLM commuting and business travel patterns reveals that regardless of education level, regional cohesion is greater for commuting than for business travel and openness to other Spanish regions (different to the Madrilenian one) is greater for business trips than commuting. For both travel purposes, the consolidation of an intra-regional polycentric urban structure (comprised by a set of main centralities which organize the regional territory) is more noticeable for HSP than for AWP. Besides, in regards to metropolitan integration, for HSP, it is greater for business travel than commuting while for the AWP it is greater for commuting than for business purposes. Finally, while it has been concluded that the private car has a prevailing role in modal split both for commuting and business travel, differences have been recorded in terms of travel purpose and education level: HSR gets greater relevance among HSP and for business trips.

## CONFLICT OF INTEREST

The authors confirm that this article content has no conflict of interest.

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