Journal of Transport Geography 88 (2020) 102856

Contents lists available at ScienceDirect

Journal of Transport Geography

journal homepage: www.elsevier.com/locate/jtrangeo

Commuting and self-employment in Western Europe

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ARTICLE INFO

Keywords:
Commuting time
European working conditions survey
Self-employed workers
Employees

JEL codes:
R40
O57

ABSTRACT

This paper explores the commuting behavior of workers in Western Europe, with a focus on the differences in commuting time between employees and the self-employed. Using data from the last wave of the European Working Conditions Survey (2015), we analyze the commuting behavior of workers, finding that male and female self-employed workers devote 18.6 and 24.7 fewer minutes per day to commuting than their employee counterparts, respectively. Furthermore, differences in commuting time between employee and self-employed females depend on the degree of urbanization of the worker's residential location, as the difference in commuting time between the two groups of female workers is greater in rural areas, in comparison to workers living in urban areas. By analyzing differences in commuting time between groups of European workers, our analysis may serve to guide future planning programs.

1. Introduction

This paper examines the commuting behavior of workers in seventeen European countries, focusing on differences in the time spent commuting to/from work between employed and self-employed workers. Commuting is a habitual activity for many, with millions of workers devoting time to the task, worldwide. For the specific commuting behavior of workers in Europe, in 2015 82% of workers lived in urban areas other than their respective workplaces (European Parliament Resolution 2014/2242 INI). Workers in Europe must cover the direct daily costs associated with commuting; costs in terms of time investments (time devoted to commuting, that cannot be devoted to other activities, such as leisure) and monetary costs (e.g., gasoline, fares on public transport), which may condition job and residence locations. In this sense, commuting has been found to have an impact on many aspects of worker daily lives, such as reduced well-being, increased sickness absenteeism, and other health outcomes.

Regarding those who are self-employed, prior research has found that these workers display different behaviors in comparison to employees. For instance, van Ommeren and van der Straaten (2008) consider that self-employed workers have better information about the job-search market than do employees, finding that self-employed workers commute around 40–60% less than their employee counterparts. More recently, Gimenez-Nadal et al. (2018a) studied differences in the time devoted to commuting by US employees and self-employed workers, finding a difference of about 17%. Furthermore, these authors report that differences between the two groups of workers vary with their geographical location (e.g., size of the city and the urban/rural status). Also, Albert et al. (2019) analyzed the case of Spain, using information about commuting time from the Quality of Life at Work Survey, and found a difference between employees and the self-employed ranging from 13% to 19.5%. Analyzing differences in commuting behavior between employees and self-employed workers is important in the case of Europe, since self-employed workers represent a significant proportion - between 7% and 29% – of the working-age population.

Within this framework, we analyze differences in the commuting behavior of the self-employed in comparison to employees, using the last wave (2015) of the European Working Conditions Survey (EWCS). In doing so, we empirically explore factors influencing commuting time of employed and self-employed workers, which represents a contribution to the literature. Factors such as gender, education, marital status, the presence of children in the household, employed partners, industry and occupation, and the geographical location (e.g., living in urban area) may differentially affect workers in their commuting behavior, helping to explain the difference in commuting time between the two groups.

We also contribute to the scarce literature on the differences in commuting behavior between employees and self-employed workers (Van Ommeren and Van der Straaten, 2008; Gimenez-Nadal et al.,

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https://doi.org/10.1016/j.jtrangeo.2020.102856
Received 13 April 2020; Received in revised form 28 July 2020; Accepted 28 August 2020

2018a; Albert et al., 2019). Prior research is based on the analysis of single countries, and their conclusions cannot be generalized to other countries. Our research extends the evidence to a set of countries that have, among other factors, different labour market structures and institutions, different social norms, and different welfare regimes. The fact that we find differences in commuting behavior in a set of countries with different characteristics points to such differences being motivated by workers' behavioral differences, rather than by labour market structures or institutions.

Gimenez-Nadal et al. (2017) develop a theoretical model for commuting, where self-employed workers behave differently than employees. Despite that we find a gap in the time devoted to commuting between employees and self-employed workers, our results show cross-country differences in the gap itself. Specifically, while the self-employed have shorter commutes in all the regions analyzed, the role played by urban characteristics seems to differ from one region to another. Limited sample sizes prevent us from doing a detailed analysis by country, and further research should investigate these potential differences using different sources of data (such as time use surveys, as done by Gimenez-Nadal et al., 2018a, for the US).

The remainder of the paper is organized as follows. Section 2 shows a literature review on commuting time and travel behavior. Section 3 describes the data and the variables. Section 4 describes the econometric strategy, and Section 5 shows the main results. Section 6 sets out our main conclusions.

2. Literature review

In recent decades, many studies have focused on commuting, and we present here some evidence that is related to our study. First, an historical relationship that has been considered in the literature is between commuting, on the one hand, and wages and labour supply, on the other. For instance, Leigh (1986) analyzes the payment of compensation wages for longer commutes, and the value of worker commuting time in the presence of such wage premiums. Rupert et al. (2009) develop a model where wages are positively related to commuting distance, depending on worker bargaining power, and empirically confirm that commuting has an impact on both wages and job acceptance decisions. Gershenson (2013) found that commuting time affects labor supply through accepted or rejected job offers, with the aversion to commuting being similar for US men and women. Mulalic et al. (2014) analyze the impact on wages of commuting due to firm relocation, in an experimental setting, finding that commuting has a long-run impact on worker earnings. Ross and Zenou (2008) find a positive correlation between commuting and wages, and a negative correlation between commuting and employment. Other recent studies of commuting, labor supply, and wages are, for instance, Gutiérrez-i-Puigarnau et al. (2016), Carta and De Philippis (2018), and Le Barbanchon et al. (2019).

Commuting behavior has also been found to have an impact on worker productivity. Gimenez-Nadal et al. (2018b) find negative correlations between commuting time and leisure time, and positive correlations between commuting and shirking at work, suggesting that commuting is a shock to time endowments that ultimately affect worker productivity. In a related paper, Van Ommeren and Gutiérrez-i-Puigarnau (2011) find that commuting has a positive impact on worker sickness absenteeism, hence reducing worker productivity in Germany, in line with the results of Grinza and Rycx (2020), who find that worker sickness absenteeism has a significant impact on firm productivity in Belgium. Furthermore, Ma and Ye (2019) use survey data collected from three major cities in Australia and find that commuting distance is positively associated with absenteeism, while active commuting (i.e., travel to work by walking or bicycling) is positively related to job performance in middle-aged employees.

Commuting behavior has also been found to have an impact on worker health and well-being, including psychological problems, increased stress, subjective health, and various measures of well-being.[1] These studies cover a range of disciplines, and use different measures for commuting, health outcomes, and well-being, relying on different empirical approaches. Nevertheless, there is consensus about the negative implication of longer commutes on worker health and well-being, dating back to Novaco et al. (1979) and Schaeffer et al. (1988). For example, Kahneman et al. (2004) and Kahneman and Krueger (2006), using detailed time-use data, report that commuting time ranks among the lowest activities in terms of “instant enjoyment” of workers in the US, and more recently Gimenez-Nadal and Molina (2019) find similar results using the American Time Use Survey. Wener et al. (2003) analyze commutes from New Jersey to New York City in an experimental setting, finding that new, faster, and more predictable commuting modes reduce the worker stress associated with commuting. Similarly, Stutzer and Frey (2008) report that workers with longer journeys to/from work are systematically more stressed, and Gottholmseder et al. (2009) find significant costs of commuting in perceived stress levels and stress-related health problems in Austria. Hansson et al. (2011) find that decreased worker health is a side-effect of longer commutes in Sweden, and Roberts et al. (2011) report a similar conclusion in terms of psychological health, despite compensation for commuting such as income or housing quality. Using the British Household Panel Survey, Kunn-Nelen (2016) finds that commuting is related to decreased subjective health, more visits to doctors, less regular exercise, and more calling in sick, but not to worker objective health. Recently, Simón et al. (2020) report that commuting has a negative impact on all areas of satisfaction for Spanish workers, with that impact being especially significant for females.

Commuting has an impact not only on worker well-being and satisfaction while commuting, but also produces spill-over effects to other activities (Gimenez-Nadal and Molina, 2019; Chatterjee et al., 2020), such as distorted time use allocation decisions including socializing, leisure, and time with the family, producing work-family imbalances (Christian, 2012; Hilbrecht et al., 2014; Gimenez-Nadal et al., 2018b). Furthermore, longer commutes reduce the satisfaction experienced while doing these other activities (Kroesen, 2014; Wheatley, 2014; Denstadli et al., 2017; Gimenez-Nadal and Molina, 2019). These studies are tied to different theories, such as urban efficiency wages, where commutes are considered a shock to worker time endowments that ultimately produce reduced leisure and increased shirking and sickness absenteeism (Ross and Zenou, 2008).

Commuting is also related to urban structures and land use. For example, Manaugh et al. (2010) report that urban forms, job accessibility and home and work location are important predictors of commuting. Van Acker and Witlox (2011) find that commuting trips and land use are interrelated in complex ways, as land use patterns designed by planners do not always have the expected impact on commuting in Belgium. Burger et al. (2011) conclude that urban transformation is a heterogeneous process in the United Kingdom that can be explained by commuting trips. Hu and Schneider (2017) study the interrelations between workplace location, income, and commuting in Chicago, finding that commuting and, especially, commuting modes differ by income groups, generating imbalances in terms of employment cores. Ma et al. (2017) draw similar conclusions, using information from public transit use in Beijing. Guirao et al. (2018) study Spanish high-speed rail commuting trips, and find that the proximity of stations to residential and employment cores is crucial to favor this commuting mode and improve regional and local labor markets. Similarly, Cavallaro and Dianin (2019) find that the improvement of public transport modes in Central Europe may integrate rural areas and favor mobility. Jin (2019) estimates that labor market spatial structures and land use play a significant role in predicting commuting behaviors in

[1] See reviews of the literature in Dickerson et al. (2014) and Chatterjee et al. (2020).

Chicago, and Hu (2020) reports that commutes are related to race and ethnicity in the US, in line with prior research studying spatial segregation and employment (e.g., Kain, 1968; Cutler and Glaeser, 1997).

Commuting is also related to social and environmental issues, such as traffic congestion, pollution, and carbon emissions. Certain authors have recently analyzed the environmental impact of commuting, and studied the alternatives to traditional commutes by car, such as "green commuting" (see, for instance, Plaut, 2005, Shephard, 2008; Bopp et al., 2012; DeLoach and Tiemann, 2012; Ding et al., 2014; Fan et al., 2014; Cass and Faulconbridge, 2016; Kai and Haokai, 2016; Gimenez-Nadal and Molina, 2019). Teleworking has emerged as an alternative to balance work and family, reduce the negative costs of commuting for workers, and reduce the associated carbon emissions (e.g., Safirova, 2002; Golden, 2006; White et al., 2007; Rhee, 2008; Sardeshmukh et al., 2012; Duxbury and Halinski, 2014). Nevertheless, the benefits of telework are, as yet, unclear, as prior research has found contradictory results (see Bloom et al., 2015).

Finally, in the relationship between self-employment and commuting, prior research has found that the self-employed exhibit different behaviors in comparison to employees, with these differences being partially motivated by different job-search market structures (e.g., unemployed workers may search for job vacancies and thus become employees, or they look for places where they can establish their own business, and then become self-employed). For instance, Van Ommeren and Van der Straaten (2008) consider that self-employed workers have better information about the job-search market than do employees, finding that self-employed workers commute around 40–60% less than their employee counterparts in the Netherlands. More recently, Gimenez-Nadal et al. (2018a) study differences in the time devoted to commuting by US employees and self-employed workers, finding a difference of about 17%. Also, Albert et al. (2019) analyze the case of Spain, using information about commuting time from the Quality of Life at Work Survey, and find a difference between employees and the self-employed ranging from 13% to 19.5%. Analyzing differences in commuting behavior between employees and self-employed workers is important in the case of Europe, since the latter represent a significant proportion - between 7% and 29% - of the working-age population. This is the main purpose of our analysis and, to the best of our knowledge, represents the first cross-country comparison of differences in commuting time between employees and self-employed workers in European economies.

3. Data and variables

We use data from the European Working Conditions Survey (EWCS), for the year 2015. The EWCS is a cross-sectional micro-database conducted every five years by Eurofound, since 1990. The survey is based on stylized questionnaires and gathers information for the 27 European Union members, along with the five candidate countries, Switzerland, and Norway. The main purpose of the EWCS is to provide researchers and institutions with harmonized and cross-country information about the conditions of workers in their respective workplaces. Furthermore, the EWCS includes specific sociodemographic information for sampled individuals.

The sample used in our analysis is restricted to employees and self-employed workers in Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Norway, Portugal, Spain, Sweden, Switzerland, the Netherlands, and the United Kingdom (UK).[2] Since we are interested only in workers, we restrict the analysis to individuals between 16 and 65 years old (inclusive) who report being employed or self-employed. Workers with missing information on the relevant variables, namely commuting time, age, gender, occupation, education, household composition, and urban status, are omitted, which leaves 20,721 workers in the sample, of whom 10,386 are females and 10,335 are males. See Table A1 in the Appendix for a summary of sample sizes, by country.

The EWCS contains information about the employment status of individuals, and asks respondents the following question: "Are you working as an employee or are you self-employed?"; self-employed workers include "people who have their own business or are partners in a business as well as freelancers", "respondents who work as an employee for their own business", and "members of producers' cooperatives". Thus, the EWCS allows for a clear identification of self-employed workers. Based on this information, we define a dummy variable that takes value 1 for the self-employed, 0 otherwise (employees). In our sample, 14.0% (2904 individuals) are self-employed, while the remaining 17,817 individuals are employees.

Commuting time in the 2015 EWCS is measured in minutes per day, from the following question: "In total, how many minutes per day do you usually spend travelling from home to work and back?". It is important to acknowledge that time is, in general, a more accurate measure than distance, which leads to a reduced error term, and collects some aspects that distance alone cannot capture, such as traffic density, accessibility, or speed (Van Ommeren and Van der Straaten, 2008; Jara-Díaz and Rosales-Salas, 2015; Gimenez-Nadal et al., 2018a).

Fig. 1 shows the average commuting time in the analyzed countries, computed using the EWCS data.[3] This figure shows some degree of homogeneity, depending on the country. For instance, average commuting time in Mediterranean countries is below 30 min per day in Italy and Portugal, and between 30 and 37 in Greece and Spain, with this group of countries showing the shortest commutes. On the other hand, commuting time in both Ireland and the UK is between 43 and 50 min per day. In Nordic countries, average commutes are also high, with Denmark, Finland, and Sweden between 43 and 50 min, and Norway between 37 and 43 min per day, on average. In Belgium, Germany, and Luxembourg, average commutes are between 43 and 50 min per day, while in France and the Netherlands average commutes decrease to between 37 and 43 min. The average commuting time in Switzerland and Austria is between 30 and 37 min per day.

Table 1 shows the average time devoted to commuting, for both self-employed and employees in the pooled sample, along with the difference in average values, and the *p*-value of the difference based on a t-type test of equality of means. We observe that self-employed workers devote 26.8 min per day, on average, to commuting, while employees devote 42.8 min per day to this activity, with the difference of 16 min being statistically significant at standard levels.

We consider several socio-demographic characteristics that may be correlated with commuting time, among which is the age of respondents. The 2015 wave of the EWCS includes information about respondents household composition, and we use this information to compute the number of household members (including the respondent), the presence of a married or unmarried couple (a dummy that takes value 1 for individuals who cohabit in a couple, 0 otherwise), the employment status of this couple (1 for employed couples, 0 otherwise), the number of children under 5 years old, and the number of children between 5 and 17 years old (inclusive). It is important to consider these household composition variables when studying commuting behaviors, as prior research has documented a significant relationship between commuting time and workers' marital status and household responsibilities (see Roberts et al., 2011; McQuaid and Chen, 2012; Gimenez-Nadal and Molina, 2016).

[2] Countries are classified in terms of their social welfare regimes as: Nordic countries (Denmark, Finland, Sweden, Norway), Mediterranean countries (Greece, Italy, Portugal, Spain), Anglo-Saxon countries (Ireland, the UK), and Continental countries (Austria, Belgium, France, Germany, Luxembourg, Switzerland, the Netherlands). For this clustering of countries we follow the Esping-Andersen and Fenger classification. See: http://www.learneurope.eu/files/6713/7526/7222/Welfare_State_models_in_Europe_en.jpg

[3] For the computation of average commuting, we use the population weights included in the survey.

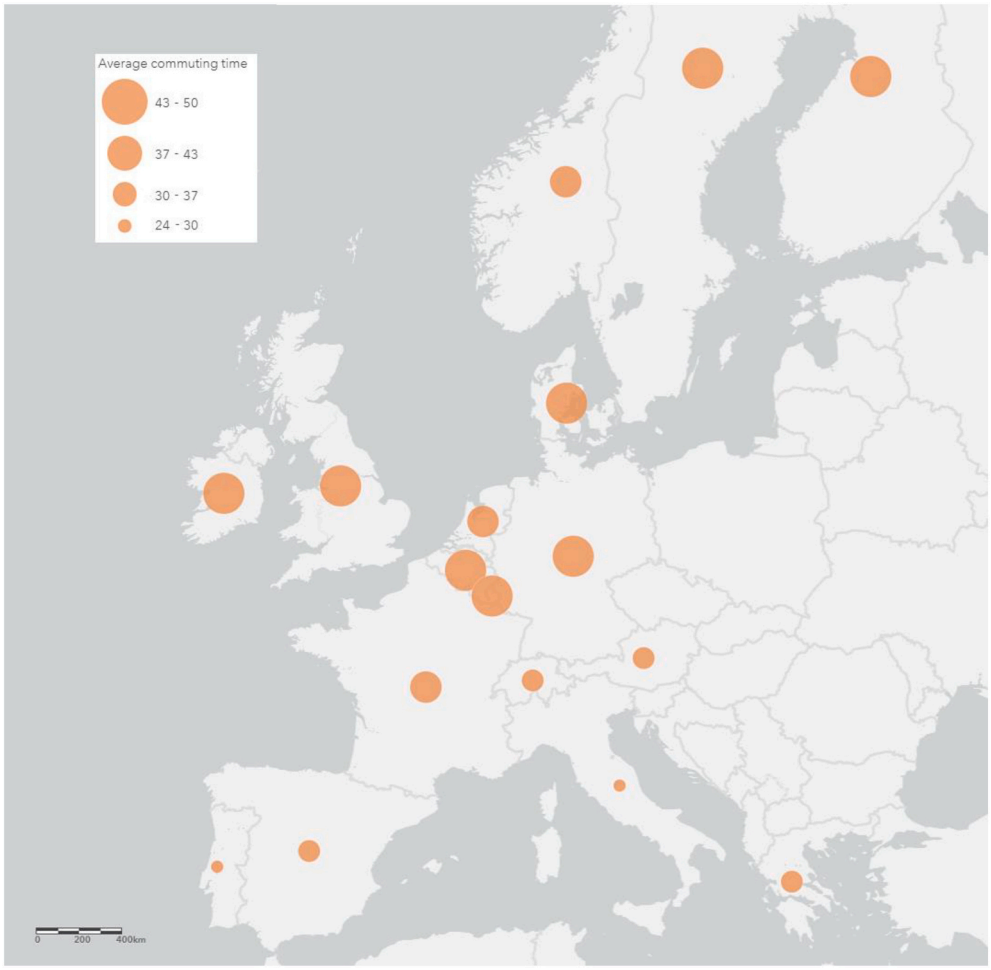

Fig. 1. Commuting time, by country.
Source: Authors computation, using the 2015 EWCS.

We also consider the maximum level of education achieved by individuals, as worker human capital has been found to be positively correlated to commuting times (Ross and Zenou, 2008). The EWCS defines education in terms of 7 codes, including: 0) "pre-primary education", 1) "primary education or first stage of basic education", 2) "lower secondary or second stage of basic education", 3) "(upper) secondary education", 4) "post-secondary non-university education" 5) "first stage of university education", and 6) "second stage of university education". We define three dummies to characterize the maximum level of formal education achieved by workers: primary education (value 1 for individuals whose education category is 0 or 1), secondary education (value 1 for individuals whose category is 2, 3 or 4), and University (value 1 for individuals whose education category is 5 or 6).

The 2015 EWCS includes information about the urban/rural status of the region where respondents live, which has been found to be a significant predictor of commuting time in general (Gordon et al., 1989; Cropper and Gordon, 1991; Small and Song, 1992; Mieszkowski and Mills, 1993; Kahn, 2000).[4] Furthermore, Gimenez-Nadal et al. (2018a) show, for the US, that the difference in commuting time between employees and the self-employed varies according to the population size of the area of residence. To that end, the EWCS identifies workers residing in "urban areas", "urban intermediate" areas, and "rural areas", so we define three dummy variables, in terms of the urbanization level, identifying these three categories.

Table 1 shows the proportion of workers living in rural areas, urban intermediate areas, and urban areas, by self-employment status. We observe differences between employees and self-employed workers' locations, and employees appear to live more in urban areas than in rural areas, relative to the self-employed. We observe that 37.8% of the self-employed reside in urban areas, and 32.4% in urban intermediate areas, vs 41.4% and 36.0% of employees, respectively, with these differences being significant at standard levels. This leaves 29.7% of the self-employed and 22.6% of employees living in rural areas, with these percentages also being statistically significant at standard levels. Table 2 shows the average time devoted to commuting by both employees and self-employed workers, by urban/rural status. We observe that employees in urban areas spend about 46.2 min per day commuting to/from work, while self-employed workers in urban areas commute about 34.5 min (i.e., a raw difference of about 12 min, which is statistically significant at standard levels). Similarly, the average employee residing in an urban intermediate area commutes 40.6 min, vs 24.9 min for the average self-employed worker. This difference, of about 16 min per day, is also highly significant. Differences between employees and self-employed workers increase more in rural areas, where employees commute on average 40.1 min, vs 18.9 min for the self-employed, with a significant difference of more than 21 min per day.

Differences in workers' occupation and economic activity (industry)

[4] This information is not available in previous waves of the EWCS data. The urbanization information is based on the DEGURBA classification, that defines three degrees of urbanization in terms of the "Local Administrative Units" (NUTS 2 in the case of the EWCS), as: 1) urban areas (cities, densely populated areas), 2) urban intermediate (towns and suburbs, intermediate density areas), and 3) rural areas (thinly populated areas). See https://ec.europa.eu/eurostat/ramon/miscellaneous/index.cfm?TargetUrl=DSP_DEGURBA.

Table 1
Summary statistics.

Variables	Self-employed		Employees		Difference	
	Mean	S.D.	Mean	S.D.	Diff.	P-value
Commuting time	26.760	37.281	42.793	36.162	−16.033	(< .001)
Male	0.643	0.479	0.500	0.500	0.143	(< .001)
Age	46.388	10.682	41.935	11.601	4.454	(< .001)
Primary education	0.229	0.420	0.168	0.374	0.061	(< .001)
Secondary education	0.417	0.493	0.494	0.500	−0.078	(< .001)
University education	0.354	0.478	0.338	0.473	0.017	(.004)
Living in couple	0.742	0.438	0.692	0.462	0.050	(< .001)
Couple's employment status	0.748	0.434	0.785	0.411	−0.037	(< .001)
Family size	2.884	1.249	2.828	1.236	0.056	(.023)
N. children under 5	0.127	0.397	0.146	0.413	−0.019	(.003)
N. children between 5 and 17	0.479	0.821	0.471	0.811	0.007	(.919)
Full time worker	0.822	0.383	0.745	0.436	0.076	(< .001)
Public sector worker	0.034	0.181	0.250	0.433	−0.217	(< .001)
Urban area	0.378	0.485	0.414	0.493	−0.035	(< .001)
Urban intermediate area	0.324	0.468	0.360	0.480	−0.036	(< .001)
Rural area	0.297	0.457	0.226	0.418	0.071	(< .001)
Occupations						
Armed forces	0.000	0.000	0.004	0.060	−0.004	(< .001)
Managers	0.243	0.429	0.057	0.231	0.187	(.001)
Professionals	0.161	0.367	0.190	0.393	−0.030	(< .001)
Technicians	0.121	0.326	0.140	0.347	−0.020	(< .001)
Clerical support workers	0.016	0.125	0.128	0.334	−0.112	(< .044)
Service and sales	0.120	0.325	0.190	0.392	−0.070	(< .001)
Agric., forestry, fishery	0.089	0.285	0.011	0.106	0.078	(< .001)
Craft and trade	0.152	0.359	0.092	0.290	0.060	(< .001)
Operatos and assemblers	0.040	0.195	0.073	0.260	−0.033	(< .001)
Elementary occ.	0.059	0.235	0.115	0.319	−0.056	(< .001)
Economic activity						
Agric., hunting, forestry	0.124	0.329	0.018	0.133	0.105	(< .001)
Mining, quarrying, manuf.	0.094	0.291	0.135	0.341	−0.041	(< .001)
Electricity, gas, water supp.	0.002	0.045	0.009	0.093	−0.007	(< .001)
Construction	0.095	0.294	0.054	0.226	0.041	(< .001)
Trade	0.190	0.392	0.130	0.336	0.060	(< .001)
Hotels and restaurants	0.073	0.260	0.052	0.221	0.021	(< .001)
Transport, storage, comm.	0.043	0.203	0.071	0.257	−0.028	(< .001)
Financial	0.017	0.130	0.034	0.181	−0.017	(< .001)
Real estate	0.156	0.363	0.123	0.329	0.033	(< .001)
Public administration	0.003	0.056	0.073	0.259	−0.069	(< .001)
Other	0.203	0.402	0.302	0.459	−0.099	(< .001)
Observations	2904		10,335			

Note: The sample (2015 EWCS) is restricted to employed and self-employed workers. All statistics computed using sample weights. Differences measured as the average value for self-employed workers, minus the average value for employees. T-type test p-values for the differences in parentheses.

Table 2
Commuting time, by urbanization.

Variables	Self-employed		Employees		Difference	
	Mean	S.D.	Mean	S.D.	Diff.	P-value
General						
Urban area	34.525	42.997	46.165	36.586	−11.640	(< .001)
Urban intermediate	24.933	35.060	40.607	35.899	−15.674	(< .001)
Rural area	18.862	28.997	40.104	15.305	−21.242	(< .001)
Women						
Urban area	28.477	31.244	42.919	34.113	−14.442	(< .001)
Urban intermediate	17.748	25.586	38.033	32.146	−20.285	(< .001)
Rural area	14.635	26.612	38.972	34.095	−24.337	(< .001)
Men						
Urban area	37.686	47.726	49.227	38.529	−11.541	(< .001)
Urban intermediate	29.131	38.973	43.258	39.221	−14.127	(< .001)
Rural area	21.253	30.022	41.302	36.512	−20.049	(< .001)

Note: The sample (2015 EWCS) is restricted to employed and self-employed workers. All statistics computed using sample weights. Differences measured as the average value for self-employed workers, minus the average value for employees. T-type test p-values for the differences in parentheses.

have been found to be linked with commuting behavior (Hanson and Johnston, 1985; Gordon et al., 1989). Thus, we also define variables measuring occupation and economic activity of workers. The EWCS includes information about the occupation of workers, defined in terms of the International Standard Classification of Occupations, ISCO 88 (1 digit) codes, and about the economic activity of workers, in terms of the NACE 1 (the "statistical classification of economic activities in the European Community"). The ISCO 88 includes the following occupations: 0) "armed forces"; 1) "managers"; 2) "professionals"; 3) "technicians and associate professionals"; 4) "clerical support workers"; 5) "service and sales workers"; 6) "skilled agricultural, forestry and fishery workers"; 7) "craft and related trades workers"; 8) "plant and machine operators, and assemblers"; and 9) "elementary occupations". As only 65 employees are found to work in armed forces occupations, the combination of armed forces and elementary occupations is taken as reference category for our analysis. For the economic activity of workers, the EWCS collapses the NACE 1 into 11 categories: A-B) "agriculture, hunting, forestry, fishing"; C-D) "mining, quarrying, manufacturing"; E) "electricity, gas, and water supply"; F) "construction"; G) "wholesale and retail trade; repair"; H) "hotels and restaurants"; I) "transport, storage and communications"; J) "financial

intermediation"; K) "real estate activities"; L) "public administration and defence"; and M-N-O-P-Q) "other services", which is taken as reference activity for the analysis. Table 1 shows the rates of self-employed and employees in these occupations and economic activities.

4. Empirical strategy

We aim to analyze differences in commuting time between employed and self-employed workers, exploring factors contributing to such differences. To that end, we follow Van Ommeren and Van der Straaten (2008) and Gimenez-Nadal et al. (2018a), and analyze the differences in the commuting time between self-employed workers and employees, net of observed heterogeneity. In doing so, we estimate Tobit models on the time devoted to commuting, in terms of the self-employment status of workers, and a series of control variables (Tobin, 1958).[5] We estimate the following equation:

$$Y_i^* = \beta_0 + \beta_{SE} SE_i + \beta_X X_i + \varepsilon_i \quad (1)$$

where Y_i^* is a latent variable, defined as:

$$C_i = \begin{cases} 0 \text{ if } Y_i^* \leq 0, \\ Y_i^* \text{ if } Y_i^* > 0, \end{cases}$$

with C_i representing the daily minutes devoted to commuting to/from work for a given individual "i". The variable SE_i is a dummy indicating whether individual "i" is self-employed (value 1), or an employee (value 0). Let X_i be a vector of socio-demographic and job characteristics, and ε_i the error term, representing unmeasured factors.

Eq. (1) is estimated separately by gender, given that female workers have, in general, shorter commutes than male workers (White, 1986; Crane, 2007; Gimenez-Nadal and Molina, 2016).[6] We also include country fixed effects, in order to partially capture potential differences among countries. Furthermore, robust standard errors are clustered at the country level, and estimates include sample weights.

Since variables measuring urban characteristics of worker residence may be important in explaining commuting time, we re-estimate the model including a vector U_i of urban variables of the municipality where individual "i" lives. The augmented equation is as follows:

$$Y_i^* = \beta_0 + \beta_{SE} SE_i + \beta_U U_i + \beta_{SEU} SE_i U_i + \beta_X X_i + \varepsilon_i \quad (2)$$

where the interaction between the self-employment status of workers and the vector of urban characteristics, SE_iU_i, is included to capture any potential correlation between commuting time and the self-employment status of workers, depending on the urbanization level of residence, beyond the raw conditional correlations between commuting and self-employment, and between commuting and urban characteristics.

5. Results

Table 3 shows the results of estimating Eq. (1) for male and female workers, respectively. These estimates include country fixed effects, in order to study the raw conditional correlation between commuting time and self-employment, net of country differences. All the estimates report marginal effects of the explanatory variables. Columns (1) and (2) show the results when only the dummy for self-employment status is included, and we observe a negative and highly significant correlation between self-employment and commuting time, for both female and male workers. Specifically, the female self-employed commute on average 23 fewer minutes per day than their employed counterparts, while male self-employed devote 18 fewer minutes per day to commuting than their employed counterparts. These differences reflect a relative difference in the time devoted to commuting between female and male self-employed workers, and their employee counterparts, of about 56.7% and 40.2%, respectively. Furthermore, the coefficients for male and female self-employed workers are not statistically different from each other at standard levels, according to a t-test ($p = .147$).[7]

Columns (3) and (4) of Table 3 show estimates of Eq. (1) for women and men, when we include workers' sociodemographic and family characteristics (age, education, and household composition), but not labor attributes. Estimates reveal that these variables barely change the conditional correlation between commuting time and self-employment, as the coefficients of interest are still negative and significant at standard levels, and remain quantitatively unchanged from estimates in Columns (1) and (2). Columns (5) and (6) include the complete set of sociodemographic and job characteristics (age, education, household composition, full-time status, a dummy for public sector workers, and occupation and economic activity fixed effects). Estimates of the main coefficients are again qualitatively and quantitatively unchanged from estimates in Columns (1) and (2). Results suggest that the female self-employed commute about 24.7 fewer minutes per day than their employee counterparts, while the male self-employed devote 18.6 fewer minutes to commuting than their employee counterparts. These results are in line with prior research for the Netherlands (Van Ommeren and Van der Straaten, 2008), the US (Gimenez-Nadal et al., 2018a), and Spain (Albert et al., 2019).

For the rest of the coefficients, estimates suggest that age is negatively related to commuting time for females, while the associated coefficient is negative and not significant for males. For education, females with secondary education commute about 2.7 fewer minutes than females who only have primary education, whereas the same coefficient for males is not significant at standard levels. However, both female and male workers with University education commute more (about 4.2 and 7.0 more minutes per day, respectively) than their counterparts with only primary education. Living in couple is not found to be correlated with commuting time at standard levels, while the couple's labor status is not significant for males, but working females in a couple commute 2.5 fewer minutes. Similarly, family size is only significant for females, suggesting that female workers in larger households have shorter commutes, in line with the "household responsibilities hypothesis" (Gimenez-Nadal and Molina, 2016). The number of children under 5 years old is estimated not to be significant for both males and females, while the number of children between 5 and 17 years is positively correlated to males' commuting time. Regarding job characteristics, full time female (male) workers spend 4.5 (2.9) more minutes commuting than their non-full-time worker counterparts, while working in the public sector is negatively correlated with commuting time, but is only significant among males, where public sector male workers spend about 2.5 fewer minutes commuting than their female counterparts.

[5] Given that commuting time may take value 0 for home-based workers (i.e., telecommuters), Tobit models are the preferred tool to take into account censorship of the variable. However, prior research has compared Tobit and OLS when studying time use, and results are similar (Frazis and Stewart, 2012; Gershuny, 2012; Foster and Kalenkoski, 2013).

[6] The average commuting times of female and male workers are 38.3 and 42.8 min per day to/from work, respectively, with the difference being statistically significant at standard levels. When we focus on differences in commuting time between employees and the self-employed, by gender, female self-employed commute about 20.7 min per day vs 40.2 min per day for their employee counterparts, while self-employed males commute, on average, 30.1 min, vs 45.4 min per day for their employee counterparts. The differences between employees and self-employed workers are statistically significant at standard levels.

[7] The pseudo R-Squared is very low in all the regressions shown in this paper. Unfortunately, this is a feature in all the research analyzing commuting time (van Ommeren and van der Straaten, 2008; Gimenez-Nadal and Molina, 2016, 2019; Gimenez-Nadal et al., 2018a, 2018b) and is explained by the fact that commuting is a process that depends on stochastic or non-observable factors, such as the weather, traffic congestion, or communication infrastructures.

Table 3
Baseline tobit estimates.

Variables	(1)	(2)	(3)	(4)	(5)	(6)
	Women	Men	Women	Men	Women	Men
Self-employed	−22.940 (2.493)***	−17.722 (2.594)***	−23.071 (2.722)***	−17.661 (2.938)***	−24.653 (2.988)***	−18.590 (2.983)***
Age	–	–	−0.066 (0.026)**	−0.006 (0.032)	−0.084 (0.018)***	−0.009 (0.037)
Secondary education	–	–	−1.253 (1.304)	5.914 (2.943)**	−2.748 (1.365)**	4.585 (3.110)
University education	–	–	8.798 (1.146)***	10.949(3.234) ***	4.173 (1.355)***	6.956 (3.647)*
Living in couple	–	–	1.257 (1.652)	0.652 (2.088)	1.510 (1.453)	0.145 (2.112)
Couple's employment	–	–	−1.927 (1.616)	−0.676 (1.003)	−2.455 (1.472)*	−0.595 (1.115)
Family size	–	–	−1.566 (0.497)***	−0.057 (0.829)	−1.062 (0.417)**	0.069 (0.842)
N. children under 5	–	–	3.832 (2.587)	−0.565 (1.700)	3.971 (2.527)	−0.746 (1.687)
N. children 5–17	–	–	−0.764 (0.639)	1.577 (0.581)***	−0.899 (0.566)	1.480 (0.614)**
Full time worker	–	–	–	–	4.495 (1.318)***	2.945 (1.226)**
Public sector worker	–	–	–	–	−0.207 (0.972)	−2.534 (0.879)***
Occupation FE	No	No	No	No	Yes	Yes
Activity FE	No	No	No	No	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Constant	36.156 (0.532)***	35.219 (1.050)***	41.554 (2.048)***	28.077 (4.122)***	35.837 (2.576)***	24.458 (3.292)***
Observations	10,386	10,335	10,386	10,335	10,386	10,335

Note: Robust standard errors in parentheses, clustered at the country level. The sample (2015 EWCS) is restricted to employed and self-employed workers.
*** p < .01.
** p < .05.
* p < .1.

5.1. Results by country groups

Table 4 shows estimates of Eq. (1) by country groups, that is to say, for Nordic countries (Denmark, Finland, Sweden, Norway) in Columns (1) and (2), Mediterranean countries (Greece, Italy, Portugal, Spain) in Columns (3) and (4), Continental countries (Austria, Belgium, France, Germany, Luxembourg, Switzerland, the Netherlands) in Columns (5) and (6), and Anglo-Saxon countries (Ireland, the UK) in Columns (7) and (8). Estimates show some quantitative differences among country groups, although qualitatively the correlation between self-employment and commuting is negative and highly significant in all the countries. Specifically, in Nordic countries, female and male self-employed workers commute 35.6 and 20.9 fewer minutes per day than their employed counterparts, while in Mediterranean countries the differences are 14.8 and 15.3 min, for females and males, and 32.6 and 27.3 min for females and males in Continental countries. In Anglo-Saxon countries, the female self-employed commute about 24.1 fewer minutes per day than female employees, while the difference between self-employed and employee male workers is the smallest among all the countries, being about 10.0 daily minutes, but still significant at standard levels.

5.2. Differences in commuting, by urbanization characteristics

Results in Tables 3 and 4 suggest a negative correlation between commuting time and self-employment, indicating that self-employed female and male workers commute about 24.7 and 18.6 fewer minutes than their employed counterparts. However, these differences may be due to different urban characteristics of residence, as found by Gimenez-Nadal et al. (2018a) for the US. For instance, Table 2 shows the average commuting time of female and male self-employed and employed workers, depending on the degree of urbanization of their residence location (urban areas, urban intermediate areas, and rural areas). The female self-employed and employed workers in urban areas devote 28.5 and 42.9 min to commuting, 17.7 and 38.0 min in urban intermediate areas, and 14.6 and 34.1 min in rural areas, respectively. The differences in commuting time between female self-employed and employed workers indicate that the former devote less time to commuting in urban areas (14.42 min), urban intermediate areas (20.29 min) and rural areas (24.33), with these differences being statistically significant at standard levels (Column (4)).

For males, results are similar. Male self-employed workers commute, on average, 37.7, 29.1, and 21.3 min in urban areas, urban intermediate areas and rural areas, respectively, while male employees devote 49.2, 43.3, and 41.3 min in the same areas, respectively. This leads to differences in commuting time between male self-employed and employed workers of 11.51, 14.13, and 20.05 min in urban areas, urban intermediate areas and rural areas, respectively, with these differences being statistically significant at standard levels. These magnitudes suggest that the differences arise from urban characteristics, as the difference in commuting time between self-employed and employed workers seems to be larger in rural areas in comparison to urban (intermediate) areas.

Table 5 shows estimates of Eq. (2). Columns (1) and (2) show estimates for women and men, respectively, where all the countries are considered and country fixed effects are included.[8] Results show a statistically significant negative correlation between the self-employment status of female and male workers and commuting time, showing that female and male self-employed workers devote 31.1 and 23.1 fewer minutes to commuting than their employed counterparts. Regarding the location of worker's residence in urban or rural areas, and considering that living in rural areas is the category of reference, there are no statistically significant differences for female workers between the degree of urbanization and their commuting time. In the case of male workers, those living in urban areas devote 4.65 more minutes to commuting than workers living in rural areas.

When we analyze differences between self-employed and employed workers according to the degree of urbanization, the interaction terms between commuting time and degree of urbanization are significant at standard levels only for female workers. Specifically, despite the negative correlation between commuting and self-employment in general terms, differences between the self-employed and employees are smaller for female workers in urban and urban intermediate areas. While female self-employed workers living in rural areas devote 31.15 fewer minutes to commuting than their employed counterparts, those living in urban areas devote 18.96 fewer minutes to commuting than their employed counterparts. In the case of male workers, the interactions between self-employment and urban characteristics are not

[8] Table 5 shows only the main coefficients of interest, but estimates also include the same control variables as Columns (5) and (6) of Table 3. Additional coefficients are available upon request.

Table 4
Tobit estimates, by region.

Variables	Nordic		Mediterranean		Continental		Anglo-Saxon	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Women	Men	Women	Men	Women	Men	Women	Men
Self-employed	−35.622 (6.315)***	−20.894 (3.443)***	−14.784 (1.660)***	−15.294 (1.547)***	−32.623 (2.947)***	−27.333 (2.687)***	−24.120 (1.414)***	−10.025 (3.462)***
Age	0.035 (0.066)	−0.142 (0.053)***	−0.141 (0.051)***	0.018 (0.048)	−0.068 (0.021)***	0.014 (0.053)	−0.158 (0.022)***	−0.019 (0.017)
Secondary education	3.520 (3.362)	−0.180 (2.235)	−1.555 (2.213)	1.347 (1.302)	−0.898 (1.775)	1.091 (0.579)*	−8.339 (1.055)***	13.492 (2.325)***
University education	8.782 (4.309)**	6.968 (1.544)***	4.137 (3.394)	4.864 (1.994)**	6.738 (1.446)***	0.293 (3.394)	1.280 (0.139)***	13.710 (0.060)***
Living in couple	1.459 (3.082)	3.047 (3.226)	1.753 (1.311)	0.328 (1.264)	1.709 (3.282)	3.310 (0.719)***	2.399 (1.193)**	−10.912 (0.911)***
Couple's employment	−3.642 (3.126)	0.261 (1.669)	−2.143 (2.268)	0.583 (1.317)	−1.329 (3.057)	0.292 (0.995)	−5.705 (1.354)***	−2.276 (2.693)
Family size	−0.248 (1.277)	−0.105 (2.925)	−0.424 (0.724)	−0.552 (0.385)	−1.310 (0.864)	−1.073 (1.325)	−2.238 (0.918)**	1.393 (0.261)***
N. children under 5	2.155 (1.791)	−1.218 (3.087)	3.568 (1.291)***	1.695 (2.703)	5.851 (4.065)	1.393 (1.532)	0.700 (0.752)	−3.445 (1.672)**
N. children 5–17	−0.867 (1.002)	−1.607 (4.001)	−0.960 (0.686)	2.646 (1.307)**	−1.137 (0.956)	1.887 (0.763)**	0.495 (0.347)	3.309 (0.565)***
Full time worker	0.092 (3.582)	8.640 (2.387)***	0.725 (2.501)	1.412 (0.630)**	7.114 (1.335)***	4.687 (1.300)***	3.788 (0.953)***	−2.534 (0.338)***
Public sector worker	−2.373 (1.132)**	−0.462 (4.628)	3.154 (1.805)*	−3.935 (0.945)***	−1.635 (1.042)	−1.876 (1.495)	1.151 (0.606)*	−2.567 (0.092)***
Occupation FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Activity FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	25.127 (5.376)***	35.850 (3.952)***	30.939 (3.343)***	19.676 (1.293)***	29.746 (3.336)***	26.115 (4.890)***	52.704 (5.703)***	49.832 (0.522)***
Observations	1795	1736	2869	2926	4591	4430	1131	1243

Note: Robust standard errors in parentheses, clustered at the country level. The sample (2015 EWCS) is restricted to employed and self-employed workers.
*** $p < .01$.
** $p < .05$.
* $p < .1$.

Table 5
Tobit estimates including urbanization characteristics.

Variables	Pooled sample		Nordic		Mediterranean		Continental		Anglo-Saxon	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men
Self-employed	−31.154 (5.267)***	−23.136 (3.387)***	−46.042 (5.424)***	−23.126 (6.167)***	−14.897 (3.536)***	−14.900 (1.331)***	−44.031 (4.879)***	−31.662 (5.623)***	−34.963 (2.042)***	−34.021 (4.314)***
Urban area	1.452 (2.356)	4.646 (1.441)***	4.442 (5.621)	12.432 (3.003)***	5.483 (1.317)***	7.620 (2.078)***	1.417 (3.814)	3.526 (2.942)	−7.177 (2.338)***	1.753 (1.836)
Urban intermediate	−1.312 (2.028)	0.907 (1.039)	−3.072 (1.899)	5.783 (3.940)	5.432 (1.574)***	0.309 (2.339)	−1.694 (1.044)	1.162 (1.068)	−12.857 (1.905)***	−0.813 (1.874)
Self-employed*										
Urban area	12.192 (3.426)***	6.923 (6.301)	17.042 (3.505)***	3.213 (4.214)	5.637 (2.521)**	−4.544 (2.720)*	21.787 (3.846)***	7.727 (6.318)	8.872 (0.699)***	31.201 (4.437)***
Urban intermediate	5.316 (4.166)	5.780 (3.417)	11.904 (7.020)*	0.506 (8.115)	−3.319 (5.681)	4.518 (2.931)	6.476 (4.941)	3.707 (6.760)	24.202 (2.382)***	24.704 (3.776)***
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Occupation FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Activity FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	35.515 (2.987)***	21.730 (3.419)***	21.592 (1.326)***	23.155 (2.391)***	26.679 (3.188)***	14.924 (1.856)***	29.085 (2.815)***	24.069 (4.252)***	61.656 (7.808)***	45.766 (1.641)***
Observations	10,386	10,335	1795	1736	2869	2926	4591	4430	1131	1243

Note: Robust standard errors in parentheses, clustered at the country level. The sample (2015 EWCS) is restricted to employed and self-employed workers.
*** $p < .01$.
** $p < .05$.
* $p < .1$.

statistically significant at standard levels, indicating that differences between male self-employed and employed workers do not depend on the degree of urbanization.

These results contrast with the findings reported in Gimenez-Nadal et al. (2018a) for the US, who find that while self-employed workers in non-metropolitan and fringe-metropolitan areas commute 24% and 9% less than their employed counterparts living in similar areas, differences in commuting time between self-employed and employed workers in metropolitan center areas (densely populated areas) are not significant. The results reported here may indicate that European workers have a different commuting behavior regarding urban characteristics, despite that the relationship between self-employment status and commuting is similar when the degree of urbanization is not explored. On the contrary, differences between the US and Europe in the relationship between commuting time, self-employment, and urban structure may be due to a range of factors, including differences in the definition of variables (e.g., urbanization characteristics in the EWCS, and metropolitan information in the ATUS), different urban structures between the US and European countries, such as the location of urban and employment cores (Brueckner et al., 1999; Brueckner and Rosenthal, 2009) or unmeasured factors (e.g., the EWCS does not allow us to control for the commuting mode, such as commuting by car, commuting by public transport, or active commuting) among others. If anything, these results are in line with prior research suggesting the existence of a complex relationship between commuting behaviors and urban structure (Manning, 2003; Rodríguez, 2004; Gimenez-Nadal et al., 2018a).

Columns (3) to (10) show estimates of Eq. (2) by country groups, analogously to Table 3. Results show that estimates are, in general terms, similar to those in Columns (1) and (2) for the whole sample. The conditional correlation between commuting time and the self-employment status of workers is negative and significant at standard levels for all Columns. However, the conditional correlations between commuting time and urban characteristics are not the same across groups of countries, which may be due to real differences in urban characteristics that impact commuting time, but also to the limited sample sizes of some of the country groups included in the analysis. Results for Nordic and Continental countries are mostly analogous to the general case (Columns (1) and (2) of Table 5), as coefficients are qualitatively unchanged.

In the Mediterranean countries, while female self-employed workers living in rural areas devote 14.90 fewer minutes to commuting than their employed counterparts, those living in urban areas devote 9.26 fewer minutes to commuting than their employed counterparts; this difference between rural and urban status is statistically significant at the 95% level. Males in Mediterranean countries exhibit different travel behaviors, as self-employed workers in rural areas spend 14.90 fewer minutes commuting than their employee counterparts, but differences increase in urban areas, as self-employed males in urban areas commute about 19.44 more minutes than employees in urban areas. Anglo-Saxon countries show some differences in the estimated relationship between commuting time and self-employment.[9] While female and male self-employed workers living in rural areas commute 35 and 34 fewer minutes than their employed counterparts, female and male self-employed workers living in urban intermediate areas devote 10.76 and 9.32 fewer minutes to commuting, while female and male self-employed workers living in urban areas devote 26.09 and 2.82 more minutes to commuting than do their employed counterparts.

5.3. Robustness tests

We have computed several robustness checks. Columns (1) and (2) in Table A2 in Appendix A show estimates of Eq. (1), restricted to private sector workers, and results are qualitatively similar, although differences between employees and self-employed increase to 24.5 and 18.5 min for women and men, respectively. Columns (3) and (4) show estimates

[9] It must be remarked that this group of countries shows the most limited sample size, so these results should be interpreted cautiously.

controlling for some additional regressors, namely weekly working hours, the level of responsibility in the current occupation (measured with two dummies that identify workers who are in charge of between 1 and 9 workers, and workers who are in charge of 10 or more workers), and monthly earnings. As these explanatory variables may lead to endogeneity issues, they have not been included in the main analysis. Results are, however, similar to estimates in Table 3. We have additionally re-estimated the models, excluding workers who report zero commuting time, using OLS estimates. The distribution of zero commuters, by occupation, is shown in Table A3 in the Appendix, and estimates are shown in Table A4. Results are similar to those estimated in Table 5. Finally, we have estimated all the equations using OLS, and the results are equivalent to the Tobit estimates. For the sake of brevity, we do not show these OLS estimates, but they are available upon request.

6. Conclusions

This paper analyzes the relationship between self-employment and the commuting behavior of male and female workers in seventeen Western European countries, using the 2015 European Working Conditions Survey. We show a negative and significant correlation between commuting time and the self-employment status of workers, relative to employees, with differences ranging between 10 and 46 min per day. Specifically, female self-employed workers are found to commute, on average, 24.7 fewer minutes per day than their employee counterparts, while male self-employed workers commute 18.6 fewer minutes per day than employees. These results are in line with prior research analyzing the Netherlands, the US, and Spain. Furthermore, results suggest that urban characteristics are important in such differences in commuting time, which seem to be smaller in urban areas than in rural areas, especially among female workers.

The results found in this paper may be relevant for researchers and policy makers. Results should encourage further research on the relationship between commuting behaviors, occupational choices, and urban structures and communication infrastructures, which appear to be interconnected in a complex way. The use of different data sources, such as detailed time use diaries, panel databases, or specific regional surveys, with detailed information at the urban level, may be enlightening. Furthermore, the results suggest that the commuting gap between the self-employed and employees is smaller in rural areas, so policy makers should target densely populated regions, as workers in those areas appear to be subject to longer commutes, with a corresponding impact on their daily lives. For instance, reduction of housing costs or policies favoring housing rentals may help to improve workers' residence location and, consequently, reduce their commuting trips. Similarly, improvements in communication infrastructure and public transport services may also reduce worker commuting costs and help workers to re-orient their residence and/or workplace choices. Besides that, shorter commutes would be beneficial for the whole society through their impact on traffic congestion, agglomeration, and air pollution, which is a matter of current concern for policy makers, especially in several urban areas of Europe such as London ("LEZ" and "ULEZ"), Paris ("clean air" stickers and "Paris breathes" campaign), Berlin ("Environmental Zone"), Madrid ("Madrid Central"), Lisbon, Amsterdam, and several Italian cities ("Traffico Limitato" zones).

This analysis has certain limitations. First, the data used throughout is cross-sectional, and therefore estimates must be interpreted as conditional correlations, and no causal results can be derived from the analysis. Similarly, we cannot control for individual unobserved factors, nor for selection into employment, as the data used in this research has no longitudinal dimension. Further research should focus on the use of databases with panel structure to overcome these issues. Third, despite the use of a harmonized database, limited sample sizes at the country level prevent us from pursuing a detailed analysis for each of the countries in the sample. Data limitations also prevent us from conducting a more in-depth exploration of how factors such as gender roles related to household responsibilities (Gimenez-Nadal and Molina, 2016; Craig and van Tienoven, 2019; Reuschke and Houston, 2020), psychological factors (Collins and Chambers, 2005; Silva et al., 2014; Idris et al., 2015; Lorenz, 2019) and home-based work (Helminen and Ristimäki, 2020; Budnitz et al., 2020; Elldér, 2020) interrelate with the commuting behavior of employed and self-employed workers, and with the difference in commuting time between the two groups of workers. These issues must be left for future research.

Acknowledgement

This paper has benefitted from funding from the Government of Aragón (Project S32_17R, co-financed by FEDER 2014–2020). J. Velilla gratefully acknowledges funding from the Government of Aragón Doctoral Grants (Program FSE Aragón 2014–2020).

Table A1
Sample sizes, by country.

Country	Observations	
	Females	Males
Nordic countries		
Denmark	402	439
Finland	453	430
Norway	483	419
Sweden	457	448
Mediterranean countries		
Greece	395	528
Italy	540	554
Portugal	448	316
Spain	1486	1528
Continental countries		
Austria	498	411
Belgium	1153	1124
France	740	684
Germany	869	846
Luxembourg	463	466
Netherlands	448	447
Switzerland	420	452
Anglo-Saxon countries		
Ireland	445	464
United Kingdom	686	779

Note: The sample (2015 EWCS) is restricted to employed and self-employed workers.

Table A2
Robustness checks.

Variables	Private sector workers		Additional controls	
	(1)	(2)	(3)	(4)
	Women	Men	Women	Men
Self-employed	−24.458 (2.796)***	−18.533 (3.229)***	−27.132 (3.393)***	−18.429 (3.967)***
Age	−0.118 (0.033)***	−0.001 (0.055)	−0.113 (0.032)***	−0.033 (0.033)
Secondary education	−1.952 (1.409)	5.245 (3.655)	−3.117 (1.590)**	4.524 (3.075)
University education	5.529 (1.863)***	7.699 (4.318)*	1.837 (1.742)	6.096 (3.600)*
Living in couple	0.683 (1.733)	−0.679 (2.049)	1.347 (1.558)	0.366 (1.832)
Couple's employment	−3.413(1.670) **	−0.304 (1.136)	−2.742 (1.384)**	−1.315 (0.821)
Family size	−0.995 (0.416)**	0.198 (0.779)	−1.328 (0.361)***	0.255 (0.877)
N. children under 5	3.754 (3.671)	−0.966 (1.538)	4.728 (2.321)**	−1.183 (1.645)
N. children 5–17	−0.263 (0.954)	1.998 (0.672)***	−0.491 (0.596)	1.040 (0.561)*
Full time worker	3.935 (0.895)***	1.694 (1.768)	2.800 (1.295)**	0.762 (0.775)
Public sector worker	–	–	0.185 (1.392)	−2.274 (0.917)**
Weekly working hours	–	–	0.003 (0.073)	0.103 (0.071)
Supervisor (1–9 workers)	–	–	4.567 (0.929)***	1.349 (4.295)
Supervisor (10+ workers)	–	–	−3.247 (2.139)	−3.952 (3.312)
Monthly earnings	–	–	0.003 (0.001)**	0.002 (0.001)***
Occupation FE	Yes	Yes	Yes	Yes
Activity FE	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes
Constant	37.830 (4.391)***	25.063 (3.445)***	32.004 (2.272)***	19.926 (2.746)***
Observations	7324	8382	9118	8926

Note: Robust standard errors in parentheses, clustered at the country level. The sample (2015 EWCS) is restricted to employed and self-employed workers. Columns (1–2) are restricted to workers in the private sector.

*** p < .01.
** p < .05.
* p < .1.

Table A3
Zero commuters, by occupation.

Occupations (ISCO 88–1)	Employees			Self-employed		
	Commuters	Zero comm.	% Zero comm.	Commuters	Zero comm.	% Zero comm.
Armed forces occupations	63	2	3.077	0	0	0.000
Managers	978	29	2.880	559	147	20.822
Professionals	3334	60	1.768	334	133	28.480
Technicians and associated	2405	92	3.684	234	116	33.143
Clerical support workers	2230	47	2.064	34	12	26.087
Service and sales workers	3242	139	4.111	245	104	29.799
Skilled agricultural workers	198	3	1.493	185	74	28.571
Craft and related trade	1594	54	3.277	334	108	24.434
Plant and machine operators	1258	43	3.305	84	31	26.957
Elementary occupations	1972	74	3.617	136	34	20.000
Total	17,274	543	3.048	2145	759	26.136

Note: The sample (2015 EWCS) is restricted to employed and self-employed workers.

Table A4
OLS estimates for commuters.

Variables	Pooled sample		Nordic		Mediterranean		Continental		Anglo-Saxon	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men
Self-employed	−18.328 (3.082)***	−12.321 (1.841)***	−34.873 (4.500)***	−3.731 (4.425)	−11.579 (3.768)*	−10.989 (1.690)***	−24.003 (3.991)***	−16.056 (6.083)**	−2.233 (3.913)	−12.431 (0.931)**
Urban area	0.983 (2.209)	4.606 (1.679)**	4.030 (5.982)	12.471 (3.358)**	5.405 (0.757)***	9.186 (3.725)*	0.144 (3.774)	3.331 (2.718)	−5.932 (1.905)	0.731 (2.170)
Urban intermediate	−1.971 (1.881)	1.750 (0.910)*	−3.905 (2.490)	5.479 (4.501)	4.904 (1.525)**	1.571 (1.116)	−2.728 (0.911)**	2.111 (1.521)	−11.306 (1.143)*	−0.416 (2.072)
Self-employed* Urban area	10.540 (3.534)***	12.519 (7.630)	26.820 (6.135)**	−2.640 (6.001)	6.375 (1.264)**	0.268 (2.864)	17.345 (2.638)***	8.089 (3.376)*	−12.258 (2.041)	37.134 (4.336)*

(continued on next page)

Table A4 (*continued*)

Variables	Pooled sample		Nordic		Mediterranean		Continental		Anglo-Saxon	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men
Urban intermediate	4.887 (3.083)	4.747 (3.579)	17.658 (12.654)	−9.881 (6.784)	−0.186 (5.502)	4.128 (4.620)	2.261 (2.077)	5.096 (7.733)	11.759 (3.001)	12.648 (2.757)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Occupation FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Activity FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	33.809 (2.415)***	21.065 (4.003)***	34.306 (4.474)***	28.379 (5.762)**	37.078 (2.647)***	14.313 (3.612)**	28.221 (2.498)***	22.004 (6.016)**	47.123 (4.339)*	38.495 (2.015)**
Observations	9804	9615	1727	1630	2731	2743	4277	4112	1069	1130
R-squared	0.097	0.100	0.088	0.059	0.094	0.082	0.093	0.055	0.114	0.132

Note: Robust standard errors in parentheses, clustered at the country level. The sample (2015 EWCS) is restricted to employed and self-employed workers who report positive commuting time.

*** $p < .01$.

** $p < .05$.

* $p < .1$.

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