Forms of Work Organisation and Daily Mobility of Workers in Île-de-France

Laurent Proulhac*

Abstract – This article examines the effects of recent spatial and temporal changes in forms of work organisation on the daily mobility of working people in the Île-de-France region. On the basis of the 2010 Transport Global Survey (Île-de-France Mobilités-OMNIL-DRIEA), spatial ("sedentary", "mobile") and temporal ("standard", "shifted") categories are defined to describe forms of work organisation. The results show that these are associated with different daily mobility practices of workers in Île-de-France and their use of modes of transport. Mobile work organisation results in them travelling more and for greater distances, spending more time on transport and using automobiles more often. Shifted work organisation favours more intensive use of automobiles, but reduces personal daily mobility. Over the period 2001-2010, the results suggest that the decline in automobile use concerns all Île-de-France workers, regardless of the form of work organisation.

JEL Classification: R23 Keywords: daily mobility, workers, work organisation, Île-de-France

* Gustave Eiffel University, École des Ponts ParisTech, Laboratoire Ville Mobilité Transport (LVMT) (laurent.proulhac@enpc.fr)

The author warmly thanks two anonymous reviewers for their advice and suggestions, as well as Caroline Gallez, Emre Korsu and Anne Aguiléra (Gustave Eiffel University, LVMT) for their valuable assistance.

Received in June 2020, accepted in March 2021. Translated from "Formes d'organisation du travail et mobilité quotidienne des actifs franciliens" The opinions and analyses presented in this article are those of the author(s) and do not necessarily reflect their institutions' or Insee's views

Citation: Proulhac, L. (2022). Forms of Work Organisation and Daily Mobility of Workers in Île-de-France. *Economie et Statistique / Economics and Statistics*, 530-31, 83–102. doi: 10.24187/ecostat.2022.530.2067

The way in which the production of goods and services is organised has evolved in recent decades, influenced by fundamental trends such as globalisation and the tertiarisation of the economy, the specialisation and relocation of production sites, the outsourcing and subcontracting of business activities, the development of high-speed transport systems and the dissemination of information and communication technologies. These trends are contributing to changes in employment conditions (e.g. the increase in part-time, unpaid and precarious work) and to the emergence of new ways of organising work (more weekend work, the four-day week, etc.). The transformation in how working time is organised is reflected in the diversification of the working hours and schedules of employees. The working day is becoming more irregular and fragmented, with flexible, shifted and extended hours (Bué et al., 2002; Chenu, 2002; Lesnard, 2006; Algava & Vinck, 2015). As well as these temporal developments, there have also been changes in the locations where work is carried out. The workplace is thus increasingly far from home, reflecting urban sprawl and the functional specialisation of spaces (Massot & Roy, 2004). It is also becoming more variable and multiple, in terms of meetings, visits to customers or patients, business meals, conferences, teleworking, etc. (Crague, 2003; 2005; Boboc et al., 2006). Beyond the sphere of work alone, these temporal and spatial changes are influencing how the daily lives of employees are organised. In particular, they make it harder to separate work and personal life (Chenu & Herpin, 2002; Tremblay, 2003; Belton & de Coninck, 2007).

In this context, daily mobility, meaning all local journeys¹ by individuals on an average working weekday in order to perform routine activities in different timeframes and locations, is playing an increasingly important role in structuring the organisation of the daily lives of workers (Massot & Orfeuil, 2005; Gallez & Kaufmann, 2009). It has resulted in the adjustment of their work and personal activities in spatial and temporal terms. The daily mobility of workers has been evolving for several decades, influenced by new forms of work organisation, the dispersion of business spaces and lifestyle changes. The survey data show a decrease in the proportion of journeys between home and work, although these continue to dominate. The decrease in working hours, the gradual disappearance of the custom of going home in the lunch break, the growth of variable workplaces and the development of personal activities

explain the decrease in travel to a fixed workplace (Aguiléra et al., 2010; Hubert et al., 2013). These trends are leading to an increase in the complexity and individualisation of workers' daily mobility. They are thus travelling further and further away from their place of residence. The democratisation of the automobile and the development of transport networks have contributed since several decades to the increase in the distance between home and work locations and to the expansion of the catchment areas in which workers live (Orfeuil, 2000). In Île-de-France, the distance between home and work increased from 6.8 km on average in the 1970s to 10.6 km in the 2010s, while the daily distance travelled by workers increased from 18.8 km to 24.4 km.² Also, the average speed of travel of workers is increasing as a result of changes in the use of modes of transport. Île-de-France workers are using the car more than in the 1970s, making an average of 1.88 journeys per day compared with 1.64 in the 1970s, despite a recent decrease. They are also using public transport more – at least in absolute terms – with 0.90 journey on average compared with 0.85 in the 1970s (Courel, 2008; Grimal, 2012; Courel & Bouleau, 2013; Calvier & Jacquesson, 2015).

In the literature on the daily mobility of workers, few studies have looked at the effects of forms of work organisation. Daily mobility is most often studied using data on commuting drawn from the census surveys. Although these data are useful because of their comparability over time (Commenges & Fen-Chong, 2017), commuting figures only take account of regular practices and do not include the effects of the spatial and temporal dispersion of work on worker daily mobility. Based on the National Transport Survey 1993-94, Gallez et al. (1997) conclude, however, that types of employment (full-time or part-time permanent contracts, fixed-term contracts, apprenticeships and temporary contracts) have a significant influence on workers' daily mobility. Based on the 1983, 1991 and 2001 Global Transport Survey, Aguiléra et al. (2010) show that more and more Île-de-France workers are working exclusively in fixed locations and that their work-related daily mobility is less than that of those working in variable locations. Lejoux & Pochet (2019) construct categories of workers with atypical daily mobility based on the 2015 Rhône-Alpes

On the basis of surveys on the scale of large conurbations or urban areas, it is limited to travels within 80 km of home. This limitation excludes some long-distance journeys, even if they take place daily.

Author's calculations, based on Global Transport Survey 1976 (DREIF) and 2010 (IDFM-DRIEA).

Regional Transport Survey, including workers without fixed workplaces, workers arriving at work before 7.00 am and those ending work after 8.00 pm. The authors explain the contrasting effect of these situations on their daily mobility in terms of journeys, distances, durations and automobile use.

In line with this research, this paper focuses on the daily mobility of Île-de-France workers in different forms of work organisation. It assumes that the spatial and temporal constraints of work affect their daily mobility practices in different ways.

The rest of the paper is organised into four sections. The first section presents the data, sample and methodological choices. The second section sets out the forms of work organisation, the characteristics of the workers associated with them and their evolution. The third section examines the effects of forms of work organisation on the number of journeys, their distance and their duration, and the fourth section addresses the use of modes of transport. The conclusion sets out the limits and other avenues of research.

1. Data and Methods

1.1. The Global Transport Survey and the Measurement of Journeys

The quantitative analysis draws on the 2001 and 2010 Global Transport Survey (*Enquête globale transports*), carried out by the Regional directorate of equipment of Île-de-France (*Direction régionale de l'equipement d'Île-de-France*, DREIF) in 2001 and by *Île-de-France Mobilités* (IDFM) and the Regional and interdepartmental directorate of equipment and development (*Direction régionale et interdépartementale de l'équipement et de l'aménagement*, DRIEA) in 2010.

These surveys allow for monitoring the evolution of the local journey practices of people in Île-de-France in order to define daily mobility and transport policy. In 2010, the population sample consists of 14,885 households in the region, i.e. 32,241 individuals aged 5 years and over completing 124,262 journeys. An adjustment corrects the sample so that it can be representative of households. The household questionnaire collects information such as the town of residence, the type of property, income and car ownership. The individual questionnaire provides information on the gender, age, main occupation, socioprofessional category, the town of work and driving license possession of the individuals in the household. Lastly, the journey

questionnaire specifies the starting point, destination, mode of transport, reason, duration and distance of each journey of individuals on one working weekday.

Based on these data, the analysis is developed using four indicators: (*i*) the number of journeys per worker, (*ii*) the distance budget,³ (*iii*) the transport time budget and (*iv*) the division between modes of transport (Massot & Orfeuil, 2005). Each indicator is built around the concept of a "journey" defined as a movement between a starting point and a destination point, characterized by one or more modes of transport, and by a single motive (Commenges, 2015).

On the basis of the information in the journey questionnaire, we can identify the workplaces to which workers are travelling. Work related journeys are divided into a fixed and usual reported workplace where workers go at least three times a week, and variable and secondary workplaces⁴ (CERTU, 2013). In the analysis, the definition of the workplace is based on the actual journeys of the respondent on the day of observation and not on the location reported *a priori*, which is often at the address of the employer's establishment (Crague, 2003; Commenges & Fen-Chong, 2017).

For workers whose work includes professional tours or visits to patients, for example, only one workplace is retained, the furthest from the starting point. In addition, information related to travel that is inherent to the activity (bus driver, deliveryman, etc.) are not reported, since transport, and the succession of stops, is part of the working activity itself.

Finally, for the study of changes between 2001 and 2010, the modalities of the motives of work related journeys reported in the 2001 survey needed to be recoded: in this survey, workers with several places of work had to report one as fixed in the individual questionnaire, whereas in 2010 they declared only one variable place of work. As a result, in 2001 the journey questionnaire contained two motives (travel to a variable workplace and travel to a fixed location), whereas in 2010 it only contained one (travel to a variable location). The correction for the 2001 survey then consisted in recoding the journeys to the fixed workplace of workers

The calculation of distance is based on a grid of 100x100 metres in 2010 and 300x300 metres in 2001. A distance as the crow flies (range) is measured for each journey based on the starting point and destination squares (Courel, 2008).

^{4.} The 2010 survey distinguishes three reasons for a journey related to work in a variable location: work in another location, business outside the usual workplace (professional appointments, meetings, etc.) and professional tours.

reporting multiple workplaces as journeys to a variable workplace.

1.2. Categorization of Forms of Work Organisation

The analysis is restricted to only those workers who worked on the day to which the survey refers, and having made at least one work-related trip. We exclude workers who usually work at home (5%) as well as those who teleworked at home on the day surveyed. In addition to home-based teleworkers, workers travelling outside Île-de-France (2% of workers) are also left out because the distances and durations of these journeys are not reported. In 2010, 82% of workers with work outside the home work one day a week, a figure which stood at 86% in 2001. They represent 12,105 respondents in 2010, i.e. 3.9 million Île-de-France workers among the 5.1 million surveyed, and 8,789 surveyed in 2001.

Actual daily mobility practices enable the identification of the spatial and temporal organisation of the workers' work on one business day. As proposed by Crague (2003), the spatial dimension of work is built on the basis of the reasons for work journeys. Two forms of spatial organisation of work are distinguished. First, a "sedentary" work organisation when the work is carried out exclusively at a fixed location, as long as the reason for all the work journeys is "fixed and usual workplace". Second, a "mobile" organisation of work when the work is carried out in at least one variable workplace, as long as at least one reason for the work journeys is "variable workplace". In terms of the temporal dimension of work, two forms of work organisation are distinguished based on work journey times. First, a "standard" temporal organisation as long as work journey arrival times at the workplace (marking the start of work) are between 7.00 am and 8.00 pm, and work journey departure times (indicating the end of work) are also included in this time bracket.⁵ This temporal organisation is the most usual norm for working. It is consistent with an ordinary working day, lasting approximately eight hours and organised around the middle of the day (Lesnard, 2006; Bué et al., 2009; Sautory & Zilloniz, 2015). Second, work carried out between 8.00 pm and 7.00 am (even partially) is classed as a "shifted" temporal organisation. It corresponds to at least one work journey for which the time of arrival at work or departure from work is between 8.00 pm and 7.00 am. This organisation involves shifted working hours and includes night work (11.00 pm-5.00 am according to the Labour Code) and morning and evening work.

Combining these spatial and temporal dimensions, a categorisation of four forms of work organisation is retained: (*i*) "sedentary and standard", or *sedent_s* hereinafter, the most traditional form of work; (*ii*) "sedentary and shifted", *sedent_d*; (*iii*) "mobile and standard", *mobile_s*; and (*iv*) "mobile and shifted", ⁶ *mobile_d*. Note that this categorization is based on the observation of a weekday that does not capture the individual variation in work organisation from one day to the next (Commenges, 2015).

2. Evolution of the Forms of Work Organisation of Île-de-France Workers

2.1. Traditional Work Organisation Still Dominant but Decreasing

The sedentary form of work organisation is prevalent: it applies to 73% of Île-de-France workers (Table 1). In contrast, 27% have worked in at least one variable location (18% worked there without going to a fixed location). Between 2001 and 2010, the spatial organisation of work has changed: the sedentary form decreases (-4% of workers) while the mobile form increases (+36% of workers). This growth also appears in the average number of variable workplaces per worker: 0.40 in 2010 vs. 0.32 in 2001. These variable workplaces account for 33% of their total daily workplaces, compared with 27% in 2001. The literature suggests that the multiplicity of workplaces observed since the 1980s and 1990s by Crague (2003; 2005) and Boboc et al. (2006) is related to changes in the organisational and productive approach of companies which requires more contacts, changes in employment conditions - including the rise in the number of involuntary part-time workers with several jobs and self-employed workers - and the spread of remote working tools (Aguiléra et al., 2007; Bouleau & Leroi, 2016).

The majority of workers in Île-de-France (82%) work in a standard form of temporal organisation. In the period 2001-2010, the concentration of work in the 7.00 am-8.00 pm bracket increases (Table 2). While working times are closely connected to socioprofessional categories (Chenu, 2002), the reduction in shifted work organisation over the period mainly concerns

^{5.} However, the start of the journey to get to work might not be included in the bracket, and the same applies to the end of the journey from work. For example, the temporal organisation of a worker leaving home at 6.45 am and arriving at work at 7.30 am, and then leaving work at 7.30 pm to return home at 8.15 pm, is considered standard.

^{6.} The spatial and temporal dimensions are not necessarily simultaneous. For example, work at a variable location may be done during the day and work between 8.00 pm and 7.00 am at a fixed location.

	2001	2010
Forms of spatial organisation of work (%)		
Sedentary	79	73
Mobile	21	27
Number of different workplaces (mean and CI) ⁽¹⁾		
Total number of workplaces	1.19 [1.17; 1.20]	1.22 [1.21; 1.23]
Number of variable workplaces	0.32 [0.31; 0.34]	0.40 [0.39; 0.42]
Journeys between home and fixed workplace		
Average (median) distance in km	10.3 (7.2)	10.9 (7.7)
Average (median) time in minutes	37 (30)	43 (35)
Journeys between home and variable workplace (2)		
Average (median) distance in km	10.9 (7.6)	12.2 (8.1)
Average (median) time in minutes	41 (30)	48 (40)

Table 1 – Evolution of the spatial organisation of work (2001–2010)

⁽¹⁾The number of workplaces is defined with the grid: each square in which a working activity is carried out is considered a workplace. The lower and upper limits of the 95% confidence interval [CI] are specified. ⁽²⁾The distance is calculated using the coordinates of the home and variable workplace squares.

Sources and coverage: Enquête Globale Transport 2001 (DREIF) and 2010 (IDFM-DRIEA). Employed workers.

	2001	2010
Forms of temporal organisation of work (%)		
Standard	78	82
Shifted	22	18
Distribution of workers by working hours and times (%)		
At work before 7.00 am	9	8
At work after 8.00 pm	13	9
Working time more than 10 hours	19	14
Working time fewer than 4 hours	6	8
Average (and median) work schedule		
Time of arrival at work	9.00 am (8.40 am)	9.00 am (8.45 am)
Time of departure from work	5.20 pm (5.45 pm)	5.30 pm (5.35 pm)
Average (and median) working time		
Working time (hours)	8.15 am (8.35 am)	8.00 am (8.20 am)
Working time at fixed workplace (hours)	7.00 am (8.15 am)	6.30 am (7.55 am)
Working time at variable locations (hours)	1.15 am (0.00 am)	1.30 am (0.00 am)

Table 2 - Change in the tempora	I organisation of work	(2001-2010)
---------------------------------	------------------------	-------------

Notes: The reduction of the day to between 4.00 am and 4.00 pm results in a slight underestimation of the working time of workers. Sources and coverage: Enquête Globale Transport 2001 (DREIF) and 2010 (IDFM-DRIEA). Employed workers.

tradespeople, retailers and company heads (27% in 2010 vs. 33% in 2001), managers (14% vs. 19%) and employees (20% vs. 23%). In contrast, the proportion of manual workers in a shifted organisation is stable (34%).

The working day of Île-de-France workers starts at 9.10 am on average. For half of them, it starts before 8.45 am, for 8% before 7.00 am and for 1% after 8.00 pm. Between 2001 and 2010, the average time of arrival at work increased by 10 minutes. In 2001, more workers started work earlier: 50% of workers before 8.40 am, and 9% before 7.00 am. But the delay in the start of work does not mean any spreading of the time of arrival at work. For example, the times of arrival at work of managers in Île-de-France are increasingly synchronised between 9.00 am and 9.30 am despite greater flexibility in their choice of times (Munch, 2017). Also, the average time of departure from work is delayed by 10 minutes,

until 5.30 pm, so the length of the working day is stable. However, the later end of work does not mean a higher frequency of evening or night work - only 9% of Île-de-France workers end work after 8.00 pm in 2010, compared with 13% in 2001 - but again reflects a higher concentration at the end of the working day: 25% of workers end work between 5.30 pm and 6.29 pm in 2010, compared with 23% in 2001.

The average length of the working day for Île-de France workers is 8 hours, with 14% of them having a long working day (over 10 hours) and 8% a short day (under 4 hours). Over the period, the decrease in long working days and the growth in short working days resulted in a 15-minute decrease in average working time. Île-de-France workers spend less time (-30 minutes) in a fixed workplace -81% of active time in 2010 compared with 85% in 2001 - and more time (+15 minutes)

at variable locations. This decrease in working time is consistent with that observed in work based on the Time Use surveys, analysed as a consequence of the laws of 2002 on the reduction of working hours and the development of part-time work (Chenu & Herpin, 2002; Brousse, 2015).

The *sedent_s* (sedentary and standard) work organisation represents the day of six in ten Île-de-France workers, while the *mobile_d* (mobile and shifted) organisation represents the day of only one in twenty workers (Table 3). The change from 2001 to 2010 is characterized by the increase in *mobile_s* (mobile and standard) work, which represents more than one in five working days in 2010, the decrease in *sedent_d* (sedentary and shifted) work and the decrease in the *sedent_s* form.

At the same time, the spatial restructuring related to urban sprawl and the functional specialisation of spaces has increased the distance between workers and workplaces. In 2010, workers living and working in Île-de-France travel 10.9 km on average to reach their fixed workplace, compared with 10.3 km in 2001, and 12.2 km to reach variable locations, compared with 10.9 km in 2001. Variable workplaces are further from the place of residence than the fixed location. The difference in distance probably reflects the fact that workers take the distance to their fixed workplace into account in their choice of residential location - in addition to urban facilities, the neighbourhood and the price/surface area ratio of the property – which a multitude of variable workplaces does not allow for (Baccaïni, 1996; Massot & Roy, 2004). It also perhaps expresses more limits on the choice of location of some workers working at variable locations due to their socioeconomic characteristics. Increased spatial distance from workplaces is accompanied by temporal distance. Île-de-France workers take an average of 43 minutes to travel from their home to a fixed workplace in 2010, compared with 37 minutes in 2001, and 48 minutes to reach their variable workplaces, compared with 41 minutes in 2001.

2.2. Different Forms of Work Organisation by Socioprofessional Categories

The form of work organisation strongly correlates to the socioprofessional category (Table 4). Specifically, professional status is essential: the self-employed are always much more likely to work in an atypical form of work organisation. On the one hand, work outside their fixed location is common among company heads and tradespeople, and to a lesser extent, due to being based in a store or shop, among retailers (Crague, 2003). On the other hand, their work is often carried out during extended hours, in the morning and evening (Lesnard, 2006).

There is also a hierarchy between the socioprofessional categories. Less skilled workers, such as manual workers and personal service providers, are more likely to work in an atypical form of work organisation. These results are consistent with those of the literature (Chenu, 2002; Crague, 2003; 2005; Lesnard, 2006; Boulin & Lesnard, 2018). For example, Chenu (2002) observes that work in shifted schedules primarily concerns manual workers in industry, handling, warehouse work and transportation and, among personal service providers, childminders, cleaners and caterers.

Nevertheless, other socioprofessional categories regularly work in atypical forms of organisation too. Thus, the work of supervisors is often sedentary and shifted, and mobile and standard, in line with their supervisory role on site. Similarly, the *sedent* d organisation is common among sales staff and public sector employees due to demand from customers, patients and citizens (Chenu, 2002; Daniel, 2014; Sautory & Zilloniz, 2015). Moreover, as already noted by Crague (2003) and Boboc et al. (2006), management and intermediate professions correspond somewhat, particularly in the public sector, to a mobile work organisation, but not as much as company heads and professional occupations. Two explanations can be put forward. On the one hand, managers sometimes seek to reduce their local work journeys - viewed increasingly negatively - by

	2001		20	Change in	
	Population		Population		population
	in thousands	%	in thousands	%	(%)
Sedentary and standard	2,336	63	2,310	60	-1
Sedentary and shifted	612	16	508	13	-17
Mobile and standard	572	15	854	22	+49
Mobile and shifted	213	6	211	5	-1
Total	3,734	100	3,883	100	+4

Table 3 – Breakdown of forms of work organisation

Sources and coverage: Enquête Globale Transport 2001 (DREIF) and 2010 (IDFM-DRIEA). Employed workers.

	Proportion	Sedentary and shifted		Mobile and standard		Mobile and shifted	
	(70)	(/v-1	Odds ratio	(N-2	,002) Odde ratio	(/\-	Odde ratio
		COEII.	Ouus ralio	COEII.	Ouus Tallo	COEII.	Ouus Tallo
Brivete sector executives and angineers	17.6	Dof		Dof		Dof	
Tradespeed	17.0	TEI. 1 2002***	10	7 460	0.2	TEL.	11.0
	1.5	1.30UZ	4.0	2.409	9.2	2.4700	2.4
Retailers	1.4	0.9752	2.0	1.0110	2.7	1.2109	3.4
	0.8	0.3653	1.4	1.30/4"""	3.9	1./1//****	5.0
	1.4	1.5806****	4.9	1.4115"""	4.1	1.5968	4.9
Public sector executives	10.8	0.2206	1.2	0.4795***	1.6	0.5204***	1./
Public sector intermediate prof.	10.8	0.2658**	1.3	0.3376***	1.4	-0.0616	0.9
Public sector clerical staff	10.0	1.0892***	3.0	-0.2541**	0.8	0.2589	1.3
Private sector intermediate prof.	10.6	0.1357	1.1	-0.0853	0.9	-0.4765**	0.6
Technicians	4.5	-0.1822	0.8	0.1354	1.1	-0.7922***	0.5
Supervisors, overseers	1.7	1.0406***	2.8	0.5257***	1.7	0.4494	1.6
Clerical staff	8.1	-0.1556	0.9	-0.6210***	0.5	-1.4782***	0.2
Sales staff	2.5	1.6608***	5.3	-1.2969***	0.3	0.0503	1.1
Personal services workers	3.7	1.4927***	4.4	1.2133***	3.4	0.7443	2.1
Skilled manual workers, drivers	10.2	1.2536***	3.5	0.7726***	2.2	0.9489***	2.6
Unskilled and agricultural workers	4.4	1.4947***	4.5	0.3382**	1.4	1.2860***	3.6
Gender							
Male	53.8	Ref.		Ref.		Ref.	
Female	46.2	-0.6565***	0.5	-0.5869***	0.6	-1.0166***	0.4
Working time							
Full-time	91.3	Ref.		Ref.		Ref.	
Part-time	8.7	-0.1302	0.9	0.4255***	1.5	0.3023*	1.4
Property occupancy status							
Owner, homebuver	51.7	Ref.		Ref.		Ref.	
Tenant	45.5	0.0850	1.1	0.2366***	1.3	-0.0094	1.0
Housed free of charge	2.8	0.0693	11	0 4903***	1.6	-0 2978	0.7
Level of education	2.0	0.0000		0.1000		0.2010	
Higher	59 5	Ref		Ref		Ref	
Primany	3.0	0.8078***	22	0 3078***	15	0 /1870**	15
Secondary	37.5	0.0070	13	-0.0011	1.0	0.4075	1.0
Number of people in the bousehold	01.0	0.2010	1.0	0.0011	1.0	0.1700	1.2
Two or more people	81.0	Pof		Pof		Pof	
Single person	10.0	0.2056***	1 0	0 1350**	0.0	0 1122	1 1
	19.0	0.2030	1.2	-0.1330	0.9	0.1122	1.1
	15 7	Def		Def		Def	
30 10 44	40.7	Rel.	4.0	REI.	0.0	Rei.	0.0
	15.2	0.1401	1.2	-0.0852	0.9	-0.1019	0.9
40 IU 09	35.0	-0.0324	1.0	0.0093	1.1	-0.1055	0.9
60+	4.1	0.0943	1.1	0.3449^^^	1.4	0.4419**	1.6
	00.4	D (Б (D (
Urban centre (excluding Paris)	69.1	Ret.		Ret.		Ret.	
Paris	20.1	0.05/5	1.1	0.194/***	1.2	0.2743	1.3
Peri-urban	10.8	-0.0910	0.9	0.0323	1.0	-0.0224	1.0
Mc⊢adden's pseudo <i>R</i> ²				0.080			
IN				12,100			

Table 4 – Effects of individual characteristics on the probability of exercising a form of work organisation (Reference: Sedentary and standard, *N*=7,365)

^(a)Three categories of residence from the 2010 INSEE urban zoning (Floch & Levy, 2011) are defined: Paris, the urban centre excluding Paris and the peri-urban area. Because the urban area of Paris is larger than the region, peri-urban areas are under-represented.

Notes: The results derive from a multinomial logistic regression. The explanatory variables are age, gender, socioprofessional category, working hours, degree, place of residence, income per unit of consumption of the household, number of employed workers, number of people, number of young children and property occupancy status. The table gives the coefficient and odds ratio for each modality of the most significant variables. The selected variables are sorted in descending order of significance (stepwise procedure). Significance: * 10% threshold; ** 5% threshold; *** 1% threshold.

Sources and coverage: Enquête Globale Transport 2010 (IDFM-DRIEA). Employed workers.

using ICT and delegating to other employees (Aguiléra *et al.*, 2007). On the other hand, part of their work is beyond the local scale and involves long-distance travel that is more valued. This is less relevant to company heads and professional occupations (Aguiléra & Proulhac, 2015).

Since 2001, the growth of the *mobile* s organisation in Île-de-France relates more to tradespeople, retailers and company heads, manual workers, and managers and intermediate professions in the public sector.⁷ The decrease of the *mobile* dorganisation relates to all socioprofessional categories, with the exception of tradespeople, retailers, company heads and manual workers. The same is true of the *sedent* d organisation. Lastly, the proportion of the sedent s organisation is stable among managers, slightly decreasing among intermediate professions and employees, and decreasing more steeply among manual workers, tradespeople, retailers and company heads. These contrasting developments reinforce the opposition between the categories that mainly operate in a traditional organisation, in particular the intermediate professions and corporate employees, and those operating more often in an atypical organisation (Lesnard, 2006).

3. The Work and Personal Journeys of Workers in Île-de-France Relate to the Form of Work Organisation

3.1. Differences in Daily mobility According to Forms of Work Organisation

On a working day, the daily mobility of Île-de-France workers is, on average, 4.25 journeys covering 28.1 km and taking 123 minutes (Table 5). Work-related journeys account for 36% of journeys, 47% of journey distance and 45% of journey time. Since 2001, their share

in total daily mobility has been decreasing, except in terms of distance, but their number has increased (from 1.48 to 1.55 journeys, from 12.7 km to 13.2 km and from 48 to 55 minutes) in line with the increase in journeys to variable locations (from 0.38 to 0.47 journey, from 3.2 km to 4.0 km and from 13 to 18 minutes).

In fact, while work related journeys still primarily relate to fixed workplaces, they nevertheless relate increasingly to variable workplaces, which account for 30% of work related journeys in 2010, compared with 26% in 2001, i.e. 30% of distances travelled for work in 2010 vs. 25% in 2001, and 33% of time spent on work journeys vs. 27% in 2001. This change is due to the multiplicity of workplaces and, as pointed out by Hubert et al. (2013), to the higher proportion of continuous days without returning home in the lunch break. Also, work journeys, particularly those relating to variable workplaces, mainly take place at standard times⁸ – more than nine in ten journeys take place between 7.00 am and 8.00 pm. Since 2001, these journeys at standard times have been increased by the decline in the proportion of workers working shifts.

The work journeys of Île-de-France workers vary according to the form of work organisation. The differences reflect the increased daily mobility associated with mobile work organisation. In fact, daily mobility in its *mobile_d* form is more than twice as high as *sedent_d* daily mobility. In the latter category, work activity is more often carried out continuously, without a lunch break outside the workplace.

^{8.} For each work related journey, only the time of arrival is considered to define its time.

	Sedentary	Sedentary	Mobile	Mobile	Total
	and standard	and snifted	and standard	and snifted	
Journeys (number/day)	3.99	3.63	5.15	4.89	4.25
Return home	1.40	1.46	1.56	1.49	1.45
Work	1.30	1.19	2.23	2.44	1.55
Personal	1.29	0.98	1.36	0.96	1.25
Distance (kilometres/day)	25.6	24.1	34.2	40.1	28.1
Return home	10.0	10.6	11.2	13.6	10.5
Work	11.1	10.4	17.9	22.5	13.2
Personal	4.5	3.1	5.1	4.0	4.4
Duration (minutes/day)	112	94	159	163	123
Return home	43	41	51	50	45
Work	45	37	81	95	55
Personal	24	16	27	18	23

Table 5 – Mobility by motive by form of work organisation in 2010

Notes: The Student test shows that the means are significantly different, see Appendix 1, Table A1-1. Sources and coverage: Enquête Globale Transport 2010 (IDFM-DRIEA). Employed workers.

^{7.} The 2001 classification only enables the comparison of eight positions in socioprofessional categories, but nevertheless allows for a distinction to be made between the private and public sectors.

However, the differences in daily mobility between forms of work organisation narrow over the period. This trend can be explained by the increase in daily mobility in sedentary forms of work organisation and by the decrease in daily mobility in mobile forms of work organisation, reflecting the decrease in the proportion of workers having both fixed and variable workplaces (Aguiléra *et al.*, 2010). Lastly, regardless of the form of work organisation, the daily mobility of Île-de-France workers is less and less structured according to work activity.

3.2. Differences in Daily Mobility between Socioprofessional Categories: A Reflect of Different Forms of Work Organisation

Differences in daily mobility by forms of work organisation are also observed within each socioprofessional category. The high level of heterogeneity of daily mobility between these categories thus mainly reflects the unequal distribution of forms of work organisation. The high shares of mobile work among tradespeople, company heads, professional occupations, supervisors, personal service providers, workers and technicians explains their high level of daily mobility (see Figure). The nature of their activity causes them to make many journeys to variable locations.9 This is especially true for tradespeople (1.34 journeys, 12.6 km, 54 minutes), company heads (1.33 journeys, 12.0 km, 39 minutes) and supervisors (0.72 journey, 9.6 km, 40 minutes). This result is in line with that of Aguiléra et al. (2007), which shows that the high level of mobility in the work of some workers is essential for companies to function.

In contrast, the more frequently sedentary work of sales and clerical staff contributes to their low level of daily mobility.¹⁰ The number of their journeys to variable locations is much lower than that of other socioprofessional categories. It accounts for less than 10% of the work-related daily mobility of sales staff. For these categories, the fact that their workplace is fixed and close to home results in limited daily mobility (1.16 journeys, 9.5 km, 46 minutes of transport).

Similarly, differences in daily mobility in shifted schedules between socioprofessional categories cannot be interpreted independently of the mixed distribution of forms of temporal work organisation. For unskilled and skilled manual workers, tradespeople, supervisors, public sector employees, sales staff and personal service providers, work related mobility corresponds most often to shifted working hours. For example, 19% of unskilled workers' work related journeys start and end between 8.00 pm and 7.00 am.

By contrast, shifted daily mobility is marginal among company heads, professional occupations, public sector managers, corporate managers and corporate administrative staff: it accounts for between 1% and 3% of their overall work-related daily mobility.

3.3. The Form of Work Organisation Determines Personal Daily mobility

Personal activities encompass two different types of reasons for travel: the first, according to Tabaka (2009), relates to "leisure and social activities" (visits to friends, walks, entertainment, sports, etc.), and the other to "household logistics" (shopping, care, health, processes, etc.). These activities have a minimal role in structuring the daily mobility of Île-de-France workers, particularly in terms of transport distance and time, since they are often carried out in the immediate spatial and temporal vicinity of the home or the workplace (Robette, 2012). Another explanation is that certain personal activities are delayed until non-work days (Aguiléra et al., 2010). Nevertheless, the growth in journeys related to shopping and leisure activities¹¹ since 2001 results in a slight increase of the share of the total daily mobility of Île-de-France workers due to personal activities.

The results of a Student test indicate that personal daily mobility is significantly correlated to the form of work organisation (see Table A1-1 in Appendix 1). The *mobile_s* and *sedent_s* forms are associated to a higher level of personal daily mobility, owing to more leisure, social and household logistics activities. Conversely, personal daily mobility is lower in both the forms *nomad_d* and *sedent_d*. This reflects the constraints of morning, evening or night work on workers.

The *mobile_d* and *sedent_d* forms of organisation correspond to lower average personal daily mobility (Table 6). By contrast, the *mobile_s* form is not significantly related to personal daily mobility, indicating that the high work-related daily mobility associated with it does not take place at the expense of personal daily mobility.

^{9.} Company heads have the highest number of different daily workplaces (1.94 on average), ahead of tradespeople (1.52), professional occupations (1.39) and supervisors (1.39).

^{10.} Administrative and sales staff have the lowest number of different daily workplaces (1.06 and 1.07, respectively).

^{11.} This trend should be viewed with caution due to a methodological change in the 2010 survey, where greater attention is paid to local journeys (which are often related to personal activities).



Figure – Journeys by socioprofessional category

Note: The figure shows the means and confidence interval at 95%.

Reading Note: Tradespeople working in variable workplaces make an average of 1.34 business trips per day. Sources and coverage: Enquête Globale Transport 2010 (IDFM-DRIEA). Employed workers in the sample.

One explanation is that, by providing the opportunity to access urban resources and facilities, work journeys increase workers' personal daily mobility. Detailed analysis of the reasons for journeys shows that this increase in personal daily mobility is due to going to lunch, hence associated with work activity. As regards the influence of individual factors, the results are consistent with those already documented in the literature. In particular, personal daily mobility is positively associated with the presence of young children in connection with care activity (Grimal, 2012). Part-time work also has a significant positive effect through more time available for personal activities (Gallez *et al.*, 1997). Also, as observed by Coutras (1997) and Motte-Baumvol *et al.* (2011), women have a significantly higher level of personal daily mobility – despite engaging in fewer leisure activities – due to more care and shopping activities. Differences are also observed according to the place of residence. The concentration of businesses, services and equipment in the area of residence of Paris workers and often in that of their workplace – a majority of Parisians work in Paris or in the densely populated surrounding towns – favours higher levels of personal daily mobility (Vallée *et al.*, 2016). Lastly, personal daily mobility is significantly lower for workers in the lowest skilled categories of the socioprofessional hierarchy and for those with reduced cultural and financial resources. This may be partly due, as pointed out by Coulangeon *et al.* (2002), to less time spent in leisure activities.

Table 6 - Effects of individual characteristics on the probability of making journeys for personal motives

	Proportion (%)	Coefficient	Odds ratio
Socioprofessional category			
Private sector executives and engineers	17.6	Ref.	
Tradespeople	1.5	-0.1335	0.9
Retailers	1.4	0.0663	1.1
Company managers	0.8	-0.0498	1.0
Liberal occupations	1.4	0.0401	1.0
Public sector executives	10.8	0.0229	1.0
Public sector intermediate staff	10.8	-0.0165	1.0
Public sector clerical staff	10.0	-0.1052	0.9
Private sector intermediate staff	10.6	0.0340	1.0
Technicians	4.5	0.1595	1.2
Supervisors, overseers	1.7	-0.0820	0.9
Private sector clerical staff	8.1	0.0727	1.1
Sales staff	2.5	-0.4467***	0.6
Personal service workers	3.7	-0.3914***	0.7
Skilled manual workers, drivers	10.2	-0.2202**	0.8
Unskilled and agricultural workers	4.4	-0.2389**	0.8
Gender			
Male	53.8	Ref.	
Female	46.2	0.2301***	1.3
Working time			
Full-time	91.3	Ref.	
Part-time	8.7	0.3927***	1.5
Age			
30 to 44	45.7	Ref.	
Under 30	15.2	-0.1062*	0.9
45 to 59	35.0	-0.2040***	0.8
60+	4.1	-0.3379***	0.7
Level of education			
Higher	59.5	Ref.	
Primary	3.0	-0.4734***	0.6
Secondary	37.5	-0.1073**	0.9
Form of work organisation			
Sedentary and standard (sedent_s)	59.5	Ref.	
Sedentary and shifted (sedent_d)	13.1	-0.3297***	0.7
Mobile and standard (mobile_s)	22.0	-0.0160	1.0
Mobile and shifted (mobile_d)	5.4	-0.5007***	0.6
Number of people in the household			
Two or more people	81.0	Ref.	
Single person	19.0	0.2528***	1.3
Child under 10			
No children	62.1	Ref.	
With child(ren)	37.9	0.6670***	1.9
Place of residence			
Urban centre (excluding Paris)	69.1	Ref.	
Paris	20.1	0.3840***	1.5
Peri-urban	10.8	-0.1685***	0.8 →

Table 6 – (contd.)

	Proportion (%)	Coefficient	Odds ratio
Income quintile ^(a)			
Fifth	20.4	Ref.	
First	19.2	-0.1728**	0.8
Second	19.8	0.0111	1.0
Third	20.2	0.0163	1.0
Fourth	20.4	0.0606	1.1
Property occupancy status			
Owner, homebuyer	51.7	Ref.	
Tenant	45.5	-0.1208***	0.9
Housed free of charge	2.8	0.0649	1.1
Ν		12,105	

^(a)The thresholds of the monthly income quintiles per consumption unit (CU) are €1,250/CU, €1,800/CU, €2,200/CU and €2,850/CU. Notes: The results derive from a binomial logistic regression. Significance: * 10% threshold; ** 5% threshold; *** 1% threshold. Sources and coverage: Enquête Globale Transport 2010 (IDFM-DRIEA). Employed workers.

4. Forms of Work Organisation and the Mode of Transport

4.1. A Reduction in Automobile Use Regardless of the Form of Work Organisation

In Île-de-France, the daily mobility of workers is essentially motorised.¹² The automobile is the main mode of transport in terms of number of journeys (47%) and distance (55%), while public transport is the main mode in terms of duration (46%). Active modes (walking, cycling) occupy a more secondary position, except in terms of number of journeys (28%) (Table 7).

Beyond these averages, there are nevertheless differences in the distribution of the modes of transport between the forms of work organisation, and a Student test indicates that the average numbers of journeys by automobile, public transport and active modes are significantly different (see Table A1-2 in Appendix 1).¹³ The traditional form of work organisation is more favourable to modes other than the automobile.¹⁴ In line with the work of Zilloniz (2015) and Lejoux & Pochet (2019), the results indicate that shifted and mobile work organisations are increasing the use of automobiles. Their use is the most intensive in the *mobile_d* form (2.98 journeys, 30.5 km and 104 minutes). This can be explained by the greater ease of movement and parking and

^{14.} Regarding the link between work activity and mode of transport, it should be borne in mind that two-way causality is credible. Although the choice of mode of transport derives from the activity, the activity doubtless also derives from the choice of mode of transport.

Table 7 – N	/lobility by I	mode of transport	according to for	orms of work	organisation
-------------	----------------	-------------------	------------------	--------------	--------------

	Sedentary		Sedentary		Mobile		Mobile		Total	
	and st	andard	and s	shifted	and standard		and shifted			
	2001	2010	2001	2010	2001	2010	2001	2010	2001	2010
Journeys (number/day)	3.54	3.99	3.30	3.63	5.00	5.15	5.01	4.89	3.81	4.25
Public transport	0.95	1.10	0.64	0.78	0.95	1.13	0.82	0.95	0.90	1.06
Individual motorized modes	1.83	1.69	2.04	1.97	3.04	2.63	3.38	2.98	2.14	2.00
Active modes	0.75	1.19	0.61	0.87	0.99	1.37	0.78	0.93	0.76	1.18
Other modes	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.01	0.01
Distance (kilometres/day)	24.8	25.6	23.4	24.1	35.2	34.2	37.3	40.1	26.9	28.1
Public transport	11.2	13.3	6.3	7.7	8.6	11.2	6.7	8.7	9.8	11.8
Individual motorized modes	13.0	11.6	16.6	15.8	25.7	22.2	29.8	30.5	16.5	15.5
Active modes	0.6	0.7	0.5	0.5	0.7	0.7	0.5	0.5	0.5	0.7
Other modes	0.0	0.0	0.0	0.1	0.2	0.1	0.3	0.4	0.1	0.1
Duration (minutes/day)	99	112	85	94	145	159	151	163	107	123
Public transport	48	60	30	39	44	58	37	47	44	56
Individual motorized modes	43	39	48	45	84	84	104	104	55	53
Active modes	8	13	7	10	16	16	9	11	8	13
Other modes	0	0	0	0	1	1	1	1	0	1

Notes: The Student test shows that the means are significantly different, see Appendix 1, Table A1-2.

Sources and coverage: Enquête Globale Transport 2001 (DREIF) and 2010 (IDFM-DRIEA). Employed workers.

^{12.} The modes of transport are the individual motorised modes, comprising cars and two-wheeled motorised vehicles (for the sake of simplification the term "automobile" is used in the text), public transport, active modes combining walking and cycling, and other modes.

^{13.} Only the averages of journeys by public transport between the "sedentary and standard" and "mobile and standard" work organisations, and in active modes between the "sedentary and shifted" and "mobile and shifted" work organisations do not differ at the 10% threshold.

the lower frequency of public transport supply before 7.00 am and after 8.00 pm. Lastly, the highest daily mobility in the mobile form of work organisation is also accompanied by more journeys by public transport and active modes.

Considering only work-related daily mobility, the results are the same: automobile daily mobility is the most limited in the *sedent_s* form (38% of journeys, 41% of distance) and the most developed in the *mobile_d* form (64% of journeys, 77% of distance). In this form of work organisation, Île-de-France workers make more than three times more journeys and travel nearly four times more in terms of distance by automobile for work than workers in the *sedent_s* form. But they also have high levels of work-related daily mobility, in absolute terms, by public transport and in active modes.

The recent changes in the use of modes of transport in Île-de-France has benefited alternatives to the automobile. Active modes and public transport increase as a proportion of total daily mobility between 2001 and 2010, from 20% to 28% for the former and 24% to 25% for the latter, while the proportion of automobile use decreases from 56% to 47%. The trend is the same in work-related daily mobility alone, with strong growth in active modes, from 18% to 24%, and public transport, from 29% to 32%, and a sharp decrease in automobile use, from 53% to 44%. This decrease concerns both journeys to a fixed workplace (Calvier & Jacquesson, 2015) and to variable workplaces. The main reasons for this include the increased supply of public transport, the decrease in the average speed of automobiles – partly due to higher traffic levels and parking constraints - and the increase in their cost (Grimal, 2012).

While these shifts in the use of various modes of transport can be observed regardless of the form of work organisation, they are uneven in terms of extent. The growth in the proportion of active modes is more associated with Ile-de-France workers in the *sedent* s form, with an increase from 21% to 30%. This reflects in particular the increase in bicycle use, due to the roll-out of self-service bicycles available since 2007 in Paris and later in the surrounding towns. Workers in the *sedent* d form are also using public transport more. The increase in public transport supply in the morning and evening, particularly of buses, and rising fuel costs - the workers in this form of organisation being among the most financially vulnerable - explain this. Also, automobile use has decreased significantly in favour of public transport in the *mobile* s form. These

trends doubtless reflect the increased difficulties relating to traffic levels and parking in the urban centres where the variable workplaces are concentrated.

4.2. The Mode of Transport Used to Travel to Work Depends on the Form of Work Organisation

In Île-de-France, the place of residence also has a major structuring effect on the use of modes of transport by workers, due to the organisation of the city and the transport system, with differences between socioprofessional categories (Sari, 2011; Proulhac, 2019). We provide an illustration of how wide these differences can be with the example of two socioprofessional categories in three different areas of residence in 2010: Parisian executives¹⁵ and intermediate professions living in urban centres (except Paris) or peri-urban areas – which are the most numerous socioprofessional category in these areas (see Tables A2-1 and A2-2 in Appendix 2). Within each category, the differences remain notable in the use of modes of transport according to forms of work organization, not so much in terms of numbers of journeys, but by the relative share of use of automobile. This mode of transport is much higher among peri-urban workers of intermediate professions than among Parisian executives: whether in terms of number of journeys, distance or time, the hierarchy of the use of automobile or public transport appears completely reversed.

We now seek to examine in a more systematic way the determining factors of the mode of transport used by Île-de-France workers to travel to work. The analysis takes into account the specific effects of the individual characteristics, as already done by Sari (2011), and of the form of work organisation. A multinomial logistic regression models, all other things being equal, the probability of using one mode of transport, with individual motorized modes as the modality of reference. A main mode of transport is assigned to each worker from the first work journey of the day.¹⁶ Individual motorized modes, the reference, account for 47% of the work journeys considered, compared with 43% for public transport and 10% for the active modes. In addition to the form of work organisation, the explanatory variables include the workers' age, gender, socioprofessional category, working hours, education level, place of residence, a control

^{15.} Public and private sector workers are aggregated in order to have sub-populations of adequate size.

^{16.} The mode of transport for the first work journey of the day is most often the one used for subsequent work journeys.

variable for the employment coverage rate,¹⁷ and their household's property occupancy status, household's income, number of people, number of active workers and presence of a young child or children.¹⁸ The results are presented in Table 8.

The odds ratio suggest that the place of residence is the most important variable. Parisian workers are much more likely to use public transport and active transport modes than urban and peri-urban workers (a result also obtained by Sari, 2011). This result is hardly surprising, given the urban structure and the organisation of the transport supply in Paris and the urban centres, which make alternative modes more competitive than automobiles. Another spatial variable, the rate of employment coverage in nearby towns, also has a significant positive effect on the use of alternative modes. The effect is particularly positive on cycling and walking, as workers have shorter journeys between home and work when the density of same socioprofessional jobs around the home is high.

Among the individual variables, the results demonstrate the variation in the choice of mode

of transport associated to the socioprofessional category. Compared to executives in the private sector (the reference), the use of public transport is lower for the self-employed, especially company heads and tradespeople, skilled manual workers, intermediate public sector occupations and supervisors, while the use of active modes is lower for supervisors, corporate employees, skilled manual workers and technicians. Conversely, the use of active modes is higher for personal service providers (as is the use of public transport), professional occupations, sales staff and public sector employees. These differences doubtless partly reflect the more decentralized workplace of manual workers, supervisors and technicians, in locations where the availability of alternative modes is lower. As Coulangeon & Petev (2012) point out, they probably also illustrate the social dimension associated with

^{18.} We do not introduce variables of holding a public transport season ticket or having an automobile since they are very likely of being bidirectional (Orfeuil, 2000).

			,	, ,	
		Public transpo	ort (N=4,935)	Active mode	s (<i>N</i> =1,119)
	Proportion (%)	Coefficient	Odds ratio	Coefficient	Odds ratio
Place of residence					
Urban centre (excluding Paris)	69.1	Ref.		Ref.	
Paris	20.1	1.4191***	4.1	1.6448***	5.2
Peri-urban	10.8	-0.9015***	0.4	-0.5600***	0.6
Socioprofessional category					
Private sector executives and engineers	17.6	Ref.		Ref.	
Tradespeople	1.5	-1.6376***	0.2	-0.3198	0.7
Retailers	1.4	-1.2243***	0.3	-0.3382	0.7
Company managers	0.8	-2.0308***	0.1	-0.2059	0.8
Liberal occupations	1.4	-0.5127***	0.6	0.6722***	2.0
Public sector executives	10.8	-0.0065	1.0	0.4165***	1.5
Public sector intermediate staff	10.8	-0.5313***	0.6	0.3716***	1.4
Public sector clerical staff	10.0	-0.0808	0.9	0.5560***	1.7
Private sector intermediate staff	10.6	-0.0290	1.0	-0.4305***	0.6
Technicians	4.5	-0.3387***	0.7	-0.4615**	0.6
Supervisors, overseers	1.7	-0.4965***	0.6	-1.2946***	0.3
Private sector clerical staff	8.1	0.0358	1.0	-0.4673***	0.6
Sales staff	2.5	0.0735	1.1	0.6008***	1.8
Personal service workers	3.7	0.5805***	1.8	1.1163***	3.1
Skilled manual workers, drivers	10.2	-0.5737***	0.6	-0.4663***	0.6
Unskilled and agricultural workers	4.4	-0.2573**	0.8	-0.1190	1.1
Form of work organisation					
Sedentary and standard (sedent_s)	59.5	Ref.		Ref.	
Sedentary and shifted (sedent_d)	13.1	-0.7557***	0.5	-0.8431***	0.4
Mobile and standard (mobile_s)	22.0	-0.4647***	0.6	-0.4306***	0.6
Mobile and shifted (mobile_d)	5.4	-0.9230***	0.4	-1.0111***	0.4
Employment coverage rate within 10 km radius	3	0.6826***	2.0	1.0555***	2.9 →

Table 8 – Effects of individual characteristics on the probability of using a mode of transport to travel to work (Reference: Individual motorized modes, *N*=6,051)

^{17.} The coverage rate corresponds to the ratio of the number of jobs in a socioprofessional category (8 positions) to the number of workers in this socioprofessional category in the area (Baccaïni, 1996).

Table 8 –	(contd.)
-----------	----------

		Public transport (N=4,935)		Active modes (N=1,119)	
	Proportion (%)	Coefficient	Odds ratio	Coefficient	Odds ratio
Property occupancy status					
Owner, homebuyer	51.7	Ref.		Ref.	
Tenant	45.5	0.2712***	1.3	0.3607***	1.4
Housed free of charge	2.8	-0.0039	1.0	0.6379***	1.9
Gender					
Male	53.8	Ref.		Ref.	
Female	46.2	0.2925***	1.3	0.3785***	1.5
Income quintile					
Fifth	20.4	Ref.		Ref.	
First	19.2	0.5883***	1.8	0.6002***	1.8
Second	19.8	0.1197	1.1	0.1963	1.2
Third	20.2	0.1632**	1.2	0.1013	1.1
Fourth	20.4	0.0619	1.1	0.0017	1.0
Age					
30 to 44	45.7	Ref.		Ref.	
Under 30	15.2	0.3037***	1.4	0.2892***	1.4
45 to 59	35.0	-0.0963	0.9	0.1285	1.1
60+	4.1	-0.3165***	0.7	0.1777	1.2
Level of education					
Higher	59.5	Ref.		Ref.	
Primary	3.0	0.5259***	1.7	0.3370	1.4
Secondary	37.5	-0.1544***	0.9	0.0731	1.1
Number of people in the household					
Two or more people	81.0	Ref.		Ref.	
Single person	19.0	0.2189***	1.2	0.1030	1.1
Child(ren) under 10					
No children	62.1	Ref.		Ref.	
With child(ren)	37.9	-0.1442***	0.9	0.0874	1.1
Employment coverage rate in the municipality					
of residence		-0.0617**	0.9	0.0351	1.0
McFadden's pseudo R ²			0.123		
Ν			12,105		

Notes: The results derive from a multinomial logistic regression. The selected variables are sorted in descending order of significance (stepwise procedure). The unretained variables are the number of workers in the household and working hours. Significance: * 10% threshold; ** 5% threshold; *** 1% threshold.

Sources and coverage: Enquête Globale Transport 2010 (IDFM-DRIEA) and 2012 Census (INSEE). Employed workers.

car use, particularly among the self-employed. Lastly, another significant difference is that of gender, with women traveling more by modes of transport other than individual motorized ones (as already shown by Coutras, 1997).

As regards household characteristics, the transport mode appears associated with the occupancy status of the property: tenants make significantly more use of public transport and active modes than homeowners or people in free of charge accommodation. This reflects tenants' greater proximity to employment as a result of a more central location – homeownership comes at the expense of proximity to employment. As could be expected, the use of alternative modes also differs according to income: workers with the lowest incomes travel significantly more by

public transport and active modes, with the cost of automobiles being an obstacle to their use (Jouffe *et al.*, 2015).

Finally, the estimation confirms that the form of work organisation contributes to the choice of mode of transport to travel to work. Any form of work organisation other than *sedent_s* has a significant negative effect on the use of alternative modes, with the highest negative coefficients for those implying a shifted temporal organisation of work. This reflects the competitiveness of the automobile in these forms of work organisation.

* *

This paper shows that the form of work organisation is a differentiating factor in the daily mobility practices of Île-de-France workers. It highlights the interest of addressing worker daily mobility not only on the basis of the two-way commute, but in all its complexity and daily variations. For the Île-de-France region, the results indicate that mobile forms of work organisation results in workers making more journeys, travelling longer distances, spending more time on transport and making more use of automobiles. The daily mobility of those working in variable workplaces is all the more intense because their high work-related daily mobility is accompanied by high personal daily mobility. Tradespeople, retailers, company heads, professional occupations, personal service providers and manual workers are particularly concerned by this spatial organisation of work. Over the period under review, the increase in work at variable locations within the 7.00 am to 8.00 pm time bracket is one of the drivers of growth in the daily mobility of workers. The development of mobile workplaces does not seem to affect trends in the use of modes of transport. The decrease in automobile daily mobility and the increase in public and active transport modes in Île-de-France concern workers working only in one fixed location just as much as those working in variable locations. Thus, the spatial reconfiguration of work, while encouraging heavy use of automobiles for workers working at variable locations, does not seem likely to impede the modal shift from the car to alternative modes.

The results also show that shifted temporal work organisations result in lower personal daily mobility and increased automobile use in Île-de-France. This form of work organisation is typical of manual workers, tradespeople, sales staff, retailers, professional occupations, public sector employees and supervisors. The decrease in automobile daily mobility, which is evolving, affects workers in both standard and shifted working hours. It highlights the need to improve public transport supply, particularly at peak times, in order to cope with the growth of daytime work and to support targets for a modal shift from the car to alternative modes of transport. The analysis proposed here should nevertheless be further refined. Firstly, the definition of forms of work organisation only partially takes into account the diversity of professional situations. A more granular approach is needed to deepen the knowledge of the daily mobility practices associated with certain specific forms of work organisation. In particular, the spatial organisation of work only in variable locations, the dispersion of which raises questions about distance and duration, deserves special attention. Similarly, a detailed analysis of the daily mobility practices of Île-de-France workers working only at night would be interesting. For these workers, who are often less financially well-off, getting to work is all the more difficult because they are less likely to own a car, the absence of a driving licence is more widespread, and public transport provision in their places of residence and work is lower, more often outside well-served centres. Similarly, fragmented forms of work organisation, which are more likely to lead to high work-related daily mobility, might require specific analysis.

Finally, the profound changes in work organisation over the past few years, such as the emergence of new private or shared workplaces (Bouleau & Leroi, 2016) and the accelerated development of teleworking due to the COVID-19 health crisis, are likely to disrupt the daily mobility of workers. Such spatial developments open up new research opportunities and increase the interest of future work. While the first results of the new Global Transport Survey (H2020) for the period 2018-2019 seemed to confirm the trends of the previous decade – decrease in travel to fixed workplace, increase in travel to variable locations, increased use of alternative modes to travel to work – (Omnil, Île-de-France Mobilités, 2019), the post-COVID period could see the use of teleworking, for a long time limited, more frequent in the next few years, at least for certain categories of workers, with major implications for individual worker daily mobility and transport. Lastly, and more generally, the question of the links between work organisation and worker daily mobility should be analysed in urban areas other than Île-de-France which are less specific, particularly in terms of public transport supply.

BIBLIOGRAPHY

Aguiléra, A., de Coninck, F. & Hauchard, P. (2007). Le rôle des déplacements professionnels dans les entreprises industrielles multi-établissements. Le cas d'un fournisseur de l'automobile. *Recherche Transport Sécurité*, 24, 29–49. https://doi.org/10.3166/rts.96.195-209

Aguiléra, A., Massot, M.-H. & Proulhac, L. (2010). Travailler et se déplacer au quotidien dans une métropole. Contraintes, ressources et arbitrages des actifs franciliens. *Sociétés contemporaines*, 80, 29–45. https://doi.org/10.3917/soco.080.0029

Aguiléra, A. & Proulhac, L. (2015). Socio-occupational and geographical determinants of the frequency of long-distance business travel in France. *Journal of Transport Geography*, 43, 28–35. https://doi.org/10.1016/j.jtrangeo.2015.01.004

Algava, E. & Vinck, L. (2015). L'organisation du temps de travail. DARES, *Synthèse Stat* 'N° 12. https://dares.travail-emploi.gouv.fr/sites/default/files/pdf/synthese_stat_no_12_-_conditions_de_travail_vol.2_.pdf

Baccaïni, B. (1996). Les trajets domicile-travail en Île-de-France. Contrastes entre catégories socioprofessionnelles. *Économie et Statistique*, 294-295, 109–126. https://doi.org/10.3406/estat.1996.6088

Belton, L. & de Coninck, F. (2007). Des frontières et des liens. Les topologies du privé et du professionnel pour les travailleurs mobiles. *Réseaux*, 140, 67–100.

https://www.cairn.info/revue-reseaux1-2007-1-page-67.htm

Boboc, A., Dhaleine, L. & Maillard, A. (2006). Travailler, se déplacer et communiquer : premiers résultats d'enquête. *Réseaux*, 140, 133–158. https://www.cairn.info/revue-reseaux1-2007-1-page-133.htm

Bouleau, M. & Leroi, P. (2016). Nouveaux modes de travail et enjeux de mobilité. Rapport IAU Île-de-France. https://www.iau-idf.fr/fileadmin/NewEtudes/Etude_1284/ModesTravail_enjeuxMobilite.pdf

Boulin, J.-Y. & Lesnard, L. (2018). Les usages du temps des Français. *Futuribles*, 423, 39–58. https://www.futuribles.com/fr/revue/423/les-usages-du-temps-des-francais-evolution-sur-un-/

Bué, J., Guignon, N., Hamon-Cholet, S. & Vinck, L. (2002). Vingt ans de conditions de travail. Insee, *Données Sociales 2002-2003*, pp. 273–279.

Brousse, C. (2015). La vie quotidienne en France depuis 1974. Les enseignements de l'enquête Emploi du temps. *Économie et Statistique*, 478-479-480, 79–117. https://doi.org/10.3406/estat.2015.10559

Calvier, C. & Jacquesson, F. (2015). En Île-de-France, l'usage de la voiture pour aller travailler diminue. *Insee Analyses* N° 11. https://www.insee.fr/fr/statistiques/1285604

Certu (2013). L'enquête ménages déplacements « standard Certu ». Manuel d'instruction aux enquêteurs. Ministère de l'Écologie, du Développement Durable et de l'Énergie.

Chenu, A. (2002). Les horaires et l'organisation du temps de travail. *Économie et Statistique*, 352-353, 151–167. https://doi.org/10.3406/estat.2002.7397

Chenu, A. & Herpin, N. (2002). Une pause dans la marche vers la civilisation des loisirs? Économie et Statistique, 352-353, 15–37. https://doi.org/10.3406/estat.2002.7391

Commenges, H. (2015). Mesurer les pratiques modales et la dépendance automobile : à la recherche de congruence entre mesure et interprétation. *Espace, populations, sociétés*, 1-2, 1–15. https://doi.org/10.4000/eps.6037

Commenges, H. & Fen-Chong, J. (2017). Navettes domicile-travail : naissance et développement d'un objet statistique structurant. *Annales de géographie*, 715, 333–355. https://doi.org/10.3917/ag.715.0333

Coulangeon, P., Menger, P.-M. & Roharik, I. (2002). Les loisirs des actifs : un reflet de la stratification sociale. *Économie et Statistique*, 352-353, 39–55. https://doi.org/10.3406/ahess.1993.279232

Coulangeon, P. & Petev, I. D. (2012). L'équipement automobile, entre contrainte et distinction sociale. *Économie et Statistique*, 457-458, 97–121. https://doi.org/10.3406/estat.2002.7392

Courel, J. (2008). 170 millions de kilomètres par jour. Un autre regard sur la mobilité des Franciliens par une approche fondée sur les distances parcourues par les individus au cours de leurs déplacements. Rapport IAU Île-de-France.https://www.institutparisregion.fr/nos-travaux/publications/170-millions-de-kilometres-par-jour/

Courel, J. & Bouleau, M. (2013). « Peak car » : la baisse de la mobilité automobile est-elle durable ? *Note Rapide de l'IAU Île-de-France* N° 620. https://omnil.fr/IMG/pdf/nr 620-peakcar iau.pdf

Coutras, J. (1997). La mobilité quotidienne et les inégalités de sexe à travers le prisme des statistiques. *Recherches féministes*, 10(2), 77–90. https://doi.org/10.7202/057936ar

Crague, G. (2003). Des lieux de travail de plus en plus variables et temporaires. *Économie et Statistique*, 369-370, 191–212. https://www.insee.fr/fr/statistiques/1376021?sommaire=1376023

Crague, G. (2005). Le travail industriel hors les murs. Enquête sur les nouvelles figures de l'entreprise. *Réseaux*, 134, 65–89. https://www.cairn.info/revue-reseaux1-2005-6-page-65.htm

Daniel, C. (2014). Le travail en horaires atypiques en Île-de-France. BREF Thématique N° 43.

https://idf.drieets.gouv.fr/sites/idf.drieets.gouv.fr/IMG/pdf/Bref_Thematique_no_43_-_Fevrier_2014.pdf

Floch, J.-M. & Levy, D. (2011). Le nouveau zonage en aires urbaines de 2010. Poursuite de la périurbanisation et croissance des grandes aires urbaines. *Insee Première* N° 1375. https://www.insee.fr/fr/statistiques/1281046

Gallez, C., Orfeuil, J.-P. & Polacchini, A. (1997). L'évolution de la mobilité quotidienne. Croissance ou réduction des disparités ? *Recherche Transports Sécurité*, 56, 27–42. https://halshs.archives-ouvertes.fr/halshs-01109441

Gallez, C. & Kaufmann, V. (2009). Aux racines de la mobilité en sciences sociales : contribution au cadre d'analyse sociohistorique de la mobilité urbaine. In: Guigueno V., Flonneau M. (dir.), *De l'histoire des transports à l'histoire de la mobilité*, pp. 41–55. Rennes : Presses Universitaires de Rennes. https://halshs.archives-ouvertes.fr/halshs-00570341v2

Grimal, R. (2012). Des mobilités plus homogènes ou plus diversifiées ? Économie et Statistique, 457-458, 13–34. https://doi.org/10.3406/estat.2012.9962

Hubert, J.-P., Meissonnier, J., Madre, J.-L. & Roux, S. (2013). La pause méridienne : un facteur clé de l'évolution de la mobilité en France depuis 35 ans. *Économie et Statistique*, 457-458, 35–56. https://doi.org/10.3406/estat.2012.99623

Jouffe, Y., Caubel, D., Fol, S. & Motte-Baumvol, B. (2015). Faire face aux inégalités de mobilité. Tactiques, stratégies et projets des ménages pauvres en périphérie parisienne. *Cybergéo : European Journal of Geography.* https://doi.org/10.4000/cybergeo.26697

Lejoux, P. & Pochet, P. (2019). Désynchronisations des temps et dissociation des lieux de travail. Les actifs à mobilité atypiques en Rhône-Alpes. *Espace Populations Sociétés*, 1. https://doi.org/10.4000/eps.8420

Lesnard, L. (2006). Flexibilité des horaires de travail et inégalités sociales. In: Insee, *Données sociales- La société française*, pp. 371–378. https://www.hal.inserm.fr/CREST/halshs-00092421

Massot, M.-H. & Roy, E. (2004). Lieu de vie - Lieu de travail. 25 années d'évolution de la distance au travail. Rapport Inrets.

Massot, M.-H. & Orfeuil, J.-P. (2005). La mobilité au quotidien, entre choix individuel et production sociale. *Cahiers internationaux de sociologie*, 118(1), 81–100. https://doi.org/10.3917/cis.118.0081

Motte-Baumvol, B., Belton-Chevallier, L. & Shearmur, R. G. (2011). Différences de genre et formes de dépendances des conjoints biactifs dans l'accompagnement des enfants. *Géographie, Économie, Société*, 13, 189–206. https://doi.org/10.3166/ges.13.189-206

Munch, E. (2017). *Mais pourquoi arrivent-ils tous à la même heure ? Le paradoxe de l'heure de pointe et des horaires de travail flexibles.* Thèse de doctorat, Université Paris Est.

https://tel.archives-ouvertes.fr/tel-01699034/document

Omnil, Île-de-France Mobilités (2019). La nouvelle enquête globale transport. Présentation des premiers résultats 2018. *Assises de la mobilité en Île-de-France*, 24 septembre. https://omnil.fr/IMG/pdf/presentation egt v publique vf.pdf

nups.//onnini.n/nwo/pui/presentation_egt_v_puonque_vi.pu

Orfeuil, J.-P. (2000). L'évolution de la mobilité quotidienne. Synthèse Inrets.

 $https://www.lavoisier.fr/livre/transports/l-evolution-de-la-mobilite-quotidienne-comprendre-les-dynamiques-eclairer-les-controverses-synthese-inrets-n-37/orfeuil/descriptif_2200781$

Proulhac, L. (2019). Qui se cache derrière la baisse de la mobilité automobile en Île-de-France ? Une analyse typologique des pratiques modales des actifs occupés franciliens. *Cybergéo : European Journal of Geography.* https://doi.org/10.4000/cybergeo.32010

Robette, **N. (2012).** Les espaces de vie individuels : de la géographie à une application empirique en démographie. *Cybergéo : European Journal of Geography.* https://doi.org/10.4000/cybergeo.25332

Sari, F. (2011). Expliquer les déplacements domicile-travail en Île-de-France : le rôle de la structure urbaine et des caractéristiques socio-économiques. *Les Cahiers Scientifiques du Transport*, 60, 123–156. https://afitl.msh-lse.fr/tl_files/documents/CST/N60/Sari60.pdf

Sautory, O. & Zilloniz, S. (2015). De l'organisation des journées à l'organisation de la semaine : des rythmes de travail socialement différenciés. *Économie et Statistique*, 478-479, 155–188. https://doi.org/10.3406/estat.2015.10561

Tabaka, K. (2009). Vers une nouvelle socio-géographie de la mobilité quotidienne. Étude des mobilités quotidiennes des habitants de la région urbaine de Grenoble. Thèse de doctorat, Université Joseph Fourier. https://tel.archives-ouvertes.fr/tel-00420343

Tremblay, D.-G. (2003). La difficile articulation des temps sociaux : concilier la vie familiale et la vie professionnelle. *Interventions économiques.* https://doi.org/10.4000/interventionseconomiques.904

Vallée, J., Le Roux, G. & Chauvin, P. (2016). Quartiers et effets de quartiers. Analyse de la variabilité de la taille des quartiers perçus dans l'agglomération parisienne. *Annales de géographie*, 708, 119–142. https://doi.org/10.3917/ag.708.0119

Zilloniz, S. (2015). Le temps de déplacement entre domicile et travail. Des disparités selon l'organisation des horaires de travail. *Dares Analyses* N° 081.

https://dares.travail-emploi.gouv.fr/sites/default/files/pdf/2015-081.pdf

APPENDIX 1_

STUDENT TESTS

	Number of journeys/day	Distance (km/day)	Duration (minutes/day)				
Work related motives							
Sedent_s vs. Sedent_d	***	**	***				
Sedent_s vs. Nomad_s	***	***	***				
Sedent_s vs. Nomad_d	***	***	***				
Sedent_d vs. Nomad_s	***	***	***				
Sedent_d vs. Nomad_d	***	***	***				
Nomad_s vs. Nomad_d	***	***	***				
Personal motives							
Sedent_s vs. Sedent_d	***	***	***				
Sedent_s vs. Nomad_s	**	***	***				
Sedent_s vs. Nomad_d	***	ns.	***				
Sedent_d vs. Nomad_s	***	***	***				
Sedent_d vs. Nomad_d	ns.	**	*				
Nomad_s vs. Nomad_d	***	**	***				

Table A1-1 – Differences in means of journeys by motive

Note: The null hypothesis is rejected at the threshold of *** 1%, ** 5%; *10% ; ns: not significant. Sources and coverage: Enquête Globale Transport 2010 (IDFM-DRIEA). Employed workers.

	Number of journeys/day	Distance (km/day)	Duration (minutes/day)	
Public transport				
Sedent_s vs. Sedent_d	***	***	***	
Sedent_s vs. Nomad_s	ns.	***	ns.	
Sedent_s vs. Nomad_d	***	***	***	
Sedent_d vs. Nomad_s	***	***	***	
Sedent_d vs. Nomad_d	***	ns.	**	
Nomad_s vs. Nomad_d	***	***	***	
Motorized individual modes				
Sedent_s vs. Sedent_d	***	***	***	
Sedent_s vs. Nomad_s	***	***	***	
Sedent_s vs. Nomad_d	***	***	***	
Sedent_d vs. Nomad_s	***	***	***	
Sedent_d vs. Nomad_d	***	***	***	
Nomad_s vs. Nomad_d	***	***	***	
Active modes				
Sedent_s vs. Sedent_d	***	***	***	
Sedent_s vs. Nomad_s	***	ns.	***	
Sedent_s vs. Nomad_d	***	**	*	
Sedent_d vs. Nomad_s	***	***	***	
Sedent_d vs. Nomad_d	ns.	ns.	ns.	
Nomad_s vs. Nomad_d	***	***	***	

Table A1-2 – Differences in means of journeys by transport mode

Note: The null hypothesis is rejected at the threshold of *** 1%, ** 5%; *10%; ns: not significant. Sources and coverage: Enquête Globale Transport 2010 (IDFM-DRIEA). Employed workers.

TWO EXAMPLES OF MOBILITY BY TRANSPORT MODE AND FORM OF WORK ORGANIZATION

	Sedentary	Sedentary	Mobile	Mobile	Total
	and standard	and shifted	and standard	and shifted	
Journeys (number/day)	4.12	3.82	5.20	5.41	4.45
Public transport	1.76	1.33	1.98	1.70	1.77
Individual motorized modes	0.49	0.75	1.02	1.69	0.73
Active modes	1.86	1.64	2.17	1.95	1.92
Other modes	0.02	0.09	0.04	0.07	0.03
Distance (kilometres/day)	17.3	13.4	21.1	25.1	18.4
Public transport	12.5	7.8	12.6	10.8	11.9
Individual motorized modes	3.5	4.3	7.0	13.1	5.1
Active modes	1.2	0.9	1.3	1.0	1.2
Other modes	0.1	0.4	0.2	0.2	0.2
Duration (minutes/day)	107	92	135	141	115
Public transport	72	54	78	64	72
Individual motorized modes	15	19	31	52	22
Active modes	20	17	25	24	21
Other modes	0	2	1	1	1

Table A2-1 – Parisian executives

Sources and coverage: Enquête Globale Transport 2010 (IDFM-DRIEA). Employed workers.

	Sedentary and standard	Sedentary and shifted	Mobile and standard	Mobile and shifted	Total
Journeys (number/day)	4.06	3.55	5.66	6.02	4.42
Public transport	0.54	0.14	0.31	0.26	0.45
Individual motorized modes	2.87	3.22	4.70	4.76	3.35
Active modes	0.65	0.19	0.65	1.00	0.62
Other modes	0.00	0.00	0.00	0.00	0.00
Distance (kilometres/day)	53.2	43.9	66.5	96.2	56.7
Public transport	23.8	5.3	10.8	5.4	18.9
Individual motorized modes	29.1	38.5	55.5	90.6	37.7
Active modes	0.2	0.1	0.2	0.3	0.2
Other modes	0.0	0.0	0.0	0.0	0.0
Duration (minutes/day)	121	87	183	199	134
Public transport	50	13	28	16	41
Individual motorized modes	65	72	150	175	88
Active modes	6	2	5	8	5
Other modes	0	0	0	0	0

Table A2-2 - Peri-urban intermediate professions

Sources and coverage: Enquête Globale Transport 2010 (IDFM-DRIEA). Employed workers.