Platform-Based Food Delivery in Paris Before and During the Pandemic: Profile, Motivations and Mobility Patterns of Couriers

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Platform-based food delivery in Paris before and during the pandemic: profile, motivations and mobility patterns of couriers

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Abstract

Background: Platform-based fast delivery is developing rapidly in many cities across the world, especially in the food sector. Yet knowledge about the characteristics and the activity patterns of delivery couriers is scarce, especially in terms of their mobility behavior.

Methodology: Based on two questionnaire surveys conducted in 2020 and 2021 with 300 and 500 couriers respectively, this article analyses the profiles, motivations and mobility patterns of couriers working in Paris (France), with a focus on the impacts of the pandemic.

Results: First, the analysis of the profiles and motivations of couriers reveals that platform-based delivery is largely a temporary activity performed by young males of foreign origin, and undertaken as a student job or an entry to the labor market. Second, data on mobility patterns confirm that platform-based delivery is a dangerous activity with a high risk of road accidents. Moreover, many couriers break the law in order to increase their income by using motorized two-wheelers that are not legally permitted in France. We also show the use of shared bikes, which seems to be a great support tool for couriers who are starting work in this sector or have a problem with their own bikes. Third, the pandemic prompted many students to become platform-based delivery couriers in order to compensate for the lack of student jobs. It also worsened the working conditions of the majority of platform-based couriers. These findings raise new urban policy challenges and also new avenues for research in terms of topics and methods.

Keywords: Delivery, Platforms, Couriers, Bikes, Shared mobility, Accidents, Street survey

1 Introduction

New forms of urban delivery services and mobile work have been driven by both the omnipresence of the smartphone and the gig economy. Fast, platform-based delivery is developing in many cities across the world, especially in the food sector [15, 30, 39, 52]. Depending on the country, these new services either exacerbate existing consumption patterns or, on the contrary, seek to conquer a new market, as for instance in the case in France [9].

Most existing literature about these new forms of fast delivery falls in the areas of the gig economy and, more precisely, app-work [20], since on-demand delivery primarily involves independent contractors paid by delivery run [35]. Much of the literature looks at labor issues [59], such as labor law and employment protection [18, 56], algorithmic control of work by the platforms, for example by means of opaque rating systems [12, 17, 20, 28, 41, 62] and forms of individual or collective resistance, such as the analysis of recent strikes in several cities [54, 55, 57].

By contrast, little remains known about the characteristics (gender, age, education, etc.) and the activity patterns of delivery couriers, especially in terms of mobility

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behavior [5, 11, 19, 60]. We lack information on the number of delivery runs, hours and kilometers per day, the number of platforms for which the couriers work, their average income, the transportation modes used, etc. However, the rapid development of platform-based delivery raises new challenges for authorities concerning the impacts on safety and accidents, traffic growth, the carbon footprint of the transportation modes used [2, 3, 10, 38, 42, 48]. An area in which progress has recently been made is safety, with risk-taking on the road and accidents having been the subject of research in the last couple of years [24–26].

The lack of data is one of the major problems faced by researchers, since delivery platform data are not easily accessible, and national or local surveys on work or travel patterns not suitable. Consequently, current research relies heavily on qualitative interviews with couriers in different cities across the world. Another limitation is that existing studies on platform couriers generally do not consider alterations over time, in a sector characterized by rapid changes [15] and, in particular, sharply affected by the recent pandemic [7].

This article aims to analyze the profiles, motivations and mobility patterns of platform-based food delivery couriers working in the city of Paris, and the main changes that occurred between 2020 and 2021, with specific attention to the impacts of the pandemic. Data come from two original face-to-face questionnaire-based surveys with more than 300 couriers in 2020 and 500 couriers in 2021. The 2021 questionnaire includes specific questions about the impacts of the pandemic on the activity and working conditions.

The article is organized as follows. The background section (Sect. 2) is followed by the presentation of the data and methods (Sect. 3). The results are described in the next section (Sect. 4), which focuses in particular on the effects of the pandemic. it also looks at the profile and motivations of the couriers, then at the links between activity and mobility patterns, which have received little attention in previous literature. Section 5 discusses the results, and the concluding section (Sect. 6) highlights policy implications and proposes new avenues for research.

2 Background

2.1 Profile and motivations

Platform-based food delivery couriers are mainly men [22, 47, 60, 64], as is also the case in traditional urban delivery services [19, 27]. In addition, they are on average younger than other couriers. In Belgium, for instance, the median age was 22 years [60], while in China a report by the largest platform revealed that 82% of couriers are aged between 23and 38 [64]. The main motivating factors for these couriers are the flexibility, autonomy and freedom offered by platform work, which does not require high level skills [34, 53].

Three categories of couriers emerge in the existing literature [23]. A first category consists of students looking for an easily accessible and flexible job, compatible with student schedules. A second category is made up of people who combine delivery work with another job and work to supplement their income. Full-time couriers, with no other (paid or non-paid) activity and who therefore rely on platform work for their livelihood, make up the third category [37]. Although this issue is only beginning to be documented, the distribution of these three categories (students, people with no other activity and full-time couriers) seems to vary across cities [2, 5, 19, 58, 60] and over time [2], as does also the proportion of migrants [36, 64]. Previous surveys in Paris noted a growing proportion of full-time couriers [2]. Moreover, a recent study shows that platform-based delivery work is primarily done by international students in Nijmegen (the Netherlands) and non-EU immigrants in Berlin (Germany) [58]. These findings confirm that platform work (in general) seems to accelerate entry by migrants into precarious, low-income, work because of low entry barriers and flexible forms of employment that can be combined with studying and searching for another position or another job [33, 61]. However, it is also associated with illegal practices such as app renting by undocumented migrants, where some couriers pay to use another courier's account [47].

2.2 Activity and mobility patterns

2.2.1 General working conditions

By contrast with traditional delivery services, platform-based food delivery couriers are mainly independent contractors [50, 58] paid per delivery run, and often in precarious situations [44]. They have very limited social protection (particularly unemployment benefits, while healthcare varies between countries). Many costs are not covered by the platforms, such as smartphones but also the costs associated with mobility (insurance, fuel, and maintenance), which erodes earnings [17]. In addition, people sometimes have to wait weeks or months to have their account activated, which fosters illegal app renting [47].

While couriers value the flexibility and freedom offered by platform work, they also report unpredictable and difficult working conditions, especially long working hours, low earnings, and algorithmic control by the platforms, which control not only orders but also space [12, 17, 28, 46, 62]. These working conditions create insecure situations [25], especially for people who are dependent on

platform income to pay basic expenses, compared with those working to supplement their earnings [37, 51]. As a result, platform-based delivery work is characterized by high personnel turnover rates [31].

2.2.2 Mobility patterns

Mobility is one specific aspect of courier working conditions that contributes to making the work difficult and insecure. Bicycles and motorized two-wheelers (mopeds and motorcycles) are the dominant modes, though there seem to be differences between cities depending on local regulations and traffic conditions: in Manaus City (Brazil), for instance, 55% of platform-mediated food delivery workers ride a motorcycle, 44% a bicycle and 1% drive cars [16], whereas in Perth and Melbourne (Australia) bicycles are used by 75% of couriers, motorcycles by only 20%, and cars by the remaining 5% [5]. Average distances traveled or speeds are poorly documented. Based on data from a major on-demand platform provider, Allen et al. [3] record that the mean one-way trip distance for meal delivery was 2 km at 5.5 km per hour in Greater London in 2017, and that meal deliveries by car and motorized two-wheelers were associated with higher emissions and curb occupancy than with bicycles.

Risks and safety issues, and their connection with poor working conditions, such as the intense time pressure inherent in on-demand delivery, are gradually being documented. The findings underline that the use of bicycles and motorized two-wheelers, coupled with fatigue due to long hours on the road, the need to refer frequently to smartphones, and also the pressure to break traffic regulations to gain time and make more deliveries [10, 24, 25, 64], make on-demand couriers particularly vulnerable to road accidents such as collisions with cars. In China, Fuxiang et al. [24] show how road traffic injuries are affected by daily travel distances and bad cycling behavior. Qin et al. [48], in a study based on observations at urban intersections, highlight that running red lights and riding in motor vehicle lanes are the most frequent risky traffic behaviors, with no difference across platforms [48]. In the Montreal metropolitan area, Lachapelle et al. [32] demonstrate that risk-taking behaviors and accidents among commercial cyclists (i.e. bike messengers and food delivery bike couriers) depend on various work-related factors, such as travel distances, accumulation of multiple short trips, type of bicycle used, experience of the work, knowledge of the city, but also the type of working arrangements: full-time, seasonal or part-time. A detailed observation of a large intersection in Paris, France in 2018 showed that while 50% of "civilian cyclists" would run a red light, the rate was 75% for delivery cyclists [8], demonstrating a significant difference in risk-taking. Finally, while the design of the streets and the cycle network seem to have a big influence on the level of danger in delivery activity, these factors remain poorly documented [21, 58].

2.3 Impacts of the pandemic

Although conducted in various contexts in terms of countries and cities, several recent studies mostly report the negative impacts of the pandemic on couriers working in on-demand food delivery. A notable exception is the research done by Polkowska (2021) in Poland, which identifies some benefits in terms of customer recognition, and an increase in the number of orders and in earnings. They also underline that on-demand delivery is a solution for people who lost their jobs as a result of the pandemic. The study by Apouey et al. [4] in France also shows both positive and negative impacts on financial insecurity and well-being, but their work does not exclusively look at food delivery workers.

Other studies present a more negative picture of the working conditions for delivery workers during the pandemic. They emphasize increased health risks [44], and the high prevalence of infection among couriers in Ecuador [43]. They also report a global worsening of working conditions such as the intensification of precarious working conditions [6, 40, 63] due to greater financial insecurity [29] and reduced earnings per hour for the same number of working hours [1, 44]. Finally, the pandemic helped to expose some of the vulnerability these workers were facing [49].

3 Data and methods

Our study is based on a quantitative questionnaire survey, conducted face-to-face in winter in 2020 and 2021 by a survey institute (MV2). It should be noted that during the 2021 survey, a curfew was in force from 6 pm onwards, but delivery (and survey) activity was still permitted. In addition, except for takeaway and delivery, restaurants were closed.

For both surveys, we used a convenience sample, which means that the respondents were chosen for convenience and availability. Platform-based delivery couriers were chosen in the street in the north and east of Paris during their working hours [13, 14]. It was not possible to control the representativeness of the sample because of the absence of a public database on the population of delivery workers in France or Paris and the refusal of the platforms to share their data with us.

Table 1 General characteristics of the couriers in 2020 and 2021. *Source*: Author's surveys

	Male (%)	Under 25 (%)	No diploma (%)	Foreign nationals (%)	Students (%)	People with another job (%)	Full-timers (%)	Under one year in the business (%)
2021	97	66	38	86	18	12	70	67
2020	93	88	40	90	9	24	64	79

517 people were interviewed in 2021, and 300 in 2020, with very similar questionnaires in both years, composed mainly of closed-ended questions.[1] These two surveys follow two other surveys made in 2016 and 2018 in most of the same spots [2, 15]. The method chosen since 2016 is the "random" but systematic meeting (each person met, ideally, must answer: the investigator is invited not to give up too quickly if a respondent is reluctant) in the field. This method avoids the biases of online surveys, which are distributed in particular on social networks, which only get responses from delivery workers who are motivated to testify. However, it is not without limitations. In particular, there is a risk of selection bias regarding the transportation mode used, as car using delivery drivers may be left out because they spend less time in public space (outside their car) waiting for an assignment and the equipment they use for delivery may not be identifiable if it remains inside the vehicle. Moreover, our methodology makes it difficult to guarantee the representativeness of the courier sample, as well as the comparability between the two surveys.

A first set of questions sought to obtain the profile and motivations of the respondents, with the usual characteristics such as age, gender, nationality, educational qualifications, and place of residence. In addition, couriers were asked how long they had worked in the platform-based delivery business, and how they entered it: advice from relatives or friends; response to a job advertisement; advice by an employment agency; other means. Finally, they were asked if they thought they would still be delivering in three months and in one year. A second set of questions focused on the characteristics of the working conditions, such as occupational status (self-employed, salaried employee, etc.), earnings, number of working days, number of working hours per day, average number of deliveries per day, etc. Finally, a third set of questions was about mobility patterns. Couriers were asked about the modes of transportation used for delivery on the day of the survey and provided an estimate of the length of the previous delivery. Another set of questions concerned accidents and fear of accidents. Both in 2020 and 2021, respondents were asked whether they had already had an accident in the course of their work (yes or no). Regarding the fear of accidents, in 2020 couriers were asked to indicate if they agreed with the following statement: "I don't like the lack of road safety and risks of accidents" (agree, disagree or neutral). In 2021, the statement was: "The risk of accidents is high" (agree, disagree or neutral). Finally, the respondents were also asked if they had ever had an accident while doing delivery work (yes or no or "prefer not to answer"). This question was the same in 2020 and 2021.

4 Results

4.1 Profile and motivations

In line with previous literature, our sample is predominantly male and young (Table 1). Men accounted for 97% of delivery workers in 2020 and 93% in 2021. Couriers working in Paris are young, however there is a difference between the two years: in 2021, 66% were less than 25 years old, and 88% in 2020 (Table 1).

Our data in both years also indicate that most couriers have little or no qualifications. In 2021, 38% had no educational qualifications and only 26% had a higher education degree. In the 2020 survey, these figures were 40% and 21%, respectively (Table 1).

Foreign nationals are in the majority: French people represented 14% of the sample in 2021, and 10% in 2020. North-Africans and Africans account for the vast majority of workers (85% in 2021). Finally, respondents mainly live in the municipality of Paris (58% in 2021) or in the adjacent Seine Saint Denis district (23%), which is also the poorest district in the region and the one with the highest proportion of foreigners in the population.

In Paris, as is also the case in in other cities [47], platform-based on-demand delivery has primarily become a way for young people with an immigrant background and often few qualifications to enter the labor market. It is the first job in France for more than a fourth (27%) of the sample. 70% of the sample (the so-called full-timers) declared no other paid or unpaid activity in 2021 (Table 1). This group is on average less qualified than the rest of the sample, which consists, on the one hand, of

[1] Both questionnaires are available online (in French). The 2020 questionnaire is available at: https://www.lvmt.fr/wp-content/uploads/2022/08/Enquete-2020-version-finale-avec-Annexe-questionnaire.pdf (pp. 76–86), and the 2021 questionnaire: https://www.lvmt.fr/wp-content/uploads/2021/04/Livreurs-2021.pdf (pp. 88–94).

Table 2 Working conditions of the couriers in 2021. *Source*: Author's survey

	Self-employed (%)	Salaried employees (%)	Other status (%)	5 days of delivery a week (%)	6 days of delivery a week (%)	7 days of delivery a week (%)	10–20 deliveries a day (%)
Students	37	42	21	29	20	19	40
People with another job	47	27	26	20	22	22	36
Full-timers	58	25	17	32	52	16	41

students (18% in 2021), and on the other hand of people with another paid (and generally part-time) occupation (12%). French nationals are (slightly) over-represented in these second and third categories. Respondents mostly became couriers on the advice of friends and colleagues (this is the case for 57% of the respondents), while only 20% responded to a job advertisement.

Because of low barriers to entry, easy exit and poor working conditions, platform-based delivery is mostly a temporary job, with high personnel turnover. In 2021, most respondents (67%) had been working in the on-demand platform-based delivery sector for less than one year. 54% thought that they would no longer be working in the sector in a year's time, and 35% in three months. However, finding another job can be difficult, especially for people with few qualifications. In 2021, while 37% of all the respondents said that they could not find another job, this figure reached 51% of those with no high school or university degree.

The lockdowns and further health measures implemented in 2020, which reduced the number of jobs and especially student jobs in sectors such as hospitality and catering, prompted 34% of the respondents to become couriers for a delivery platform in 2021. This figure stands at 61% among the students in our sample. As a result, 83% of the students had been working as delivery workers for less than a year in 2021, compared to 67% for the whole sample. In the first year (2020), the pandemic also probably made it more difficult to find another job.

4.2 Activity patterns and working conditions

By contrast with the existing literature, which claims that the majority of platform-based delivery couriers are independent contractors, our data show a greater diversity of occupational status in Paris (Table 2). Only 53% of our respondents were self-employed in 2021: 37% among students, 47% among people with another job, and 58% among full-timers. On the one hand, 28% of the respondents were salaried employees: 42% of the students, 27% of the people with another job, and 25% of the full-timers. On the other hand, 19% of the respondents declared a different occupational status. Among the latter, most (75%) belonged to a courier cooperative. Cooperatives are independent companies that belong to their members and that were created by couriers in response to the many pitfalls and flaws of the gig economy model described in the literature section. Couriers become partners by buying shares of the company. In our surveys, most cooperative members belong to the full-timer category.

In line with the literature section, our data confirm that on-demand delivery is a very intense and rather low-paid activit. In 2021, almost 80% of the couriers earned less than the minimum wage per month (about 1,500 Euros net in France in 2021) and per hour, despite high numbers of deliveries and working days. On average, almost half (48%) of the respondents make between 10 and 20 deliveries a day, and more than the third (38%) more than 20 deliveries (Table 2). 28% of the respondents work 5 days a week, 40% 6 days a week, and 17% 7 days a week. Couriers with no other paid activity were those who worked the most: on average, almost half of them work 6 days a week, compared to only 20% for the students (Table 2).

78% of the couriers work for one of the two main delivery platforms on the French market (Deliveroo and UberEats). Only 11% work for more than one platform. Interestingly, as mentioned in the literature review section, 8% sometimes or regularly use another courier's account. Our data show that app-renting is more frequent among people with another job (20%) and among students (15%). Moreover, it is probably under-estimated (masking bias) since the main reason for using someone else's account is the incapacity to register in the absence of legal documentation or for being a minor. This latter finding suggests that there is a risk of age misrepresentation by any minors surveyed in our data (Table 3).

Table 3 Number of platforms by courier and practice of app-renting. *Source*: Author's survey

	One platform (%)	Two platforms or more (%)	App-renting (%)
All couriers	78	11	8

Table 4 Working conditions of the couriers in 2020. *Source*: Author's survey

	Self-employed (%)	Salaried employees (%)	Other status (%)	5 days of delivery work a week (%)	6 days of delivery work a week (%)	7 days of delivery work a week (%)
Students	14	14	72	14	3	4
People with another job	55	O	45	39	8	4
Full-timers	50	14	36	18	37	35

Table 5 Kilometers per day and accidents in 2021 and 2020. *Source*: Author's surveys

	Deliveries under 5 km (%)	20–40 km a day (%)	40–60 km a day (%)	Fear of accidents (%)	Already had an accident (%)
2021	84	34	40	73	25
2020	66	Not available	Not available	79	29

In the 2020 survey, the proportion of people working 6 days a week was 20%, and 37% for the full-timers. On average, 35% of the respondents worked between 5 and 8 h a day (Table 4).

Finally, a majority (58%) of the respondents reported a deterioration in their working conditions between 2020 and 2021 in the 2021 survey, as well as a loss of income (55%) and a decrease in the number of delivery runs (52%) due to the pandemic.

4.3 Mobility patterns

Each delivery is quite short: 84% are under 5 km in 2021, and 66% in 2020. In Paris, 34% of the respondents estimated riding between 20 and 40 km a day, and 40% between 40 and 60 km a day (Table 5). Salaried and self-employed full-timers show the highest figures, with respectively 54% and 51% covering between 40 and 60 km in a working day. As a result, more than 57% of the respondents think that platform-based food delivery is too physical a job.

In line with the literature section, couriers complain about risks and accidents (Table 5). 73% of the sample complained about the high risk of accidents. This figure rises as high as 85% among self-employed full-timers, whose work patterns are particularly intense, as shown above. The fear of accidents is consistent with the fact that a quarter of the respondents had already suffered an accident (the severity of which is not recorded in the survey) in the course of their delivery work. This proportion rises to 30% for the self-employed full-timers. The 2020 data indicate that a very similar proportion (29%) of the couriers declared that they had already experienced an accident. Moreover, 79% of the respondents mentioned road safety and accident risk as major threats in 2020.

Mobility patterns appear as a means of adapting to poor working conditions such as payment per delivery run, algorithmic control of the platforms, and insecurity. On the one hand, more than a third of the respondents (36% in 2021 and 31% in 2020) ride a moped (Table 6). Car use reaches 7% in 2021, and only 1% in 2020. In France the use of motorized vehicles (including two- or three-wheelers) to carry merchandise requires a Domestic Transportation License (based on financial capacity, specific training, and no record of previous offences) for any freight transport company owner, to which self-employed delivery workers belong. However, while 66% of car users in the 2021 survey said they had a Domestic Transportation License, this was true for only 15% of motorcycle users. In detail, the (mostly illegal) use of motorcycles is the highest among self-employed full-timers, while the use of a private car is higher than the average among salaried full-timers with employee status and among couriers with another job. The use of motorcycles is associated with more deliveries per day, which suggests that the use of illegal transport modes comes from the need to travel fast in order to make more deliveries and earn more money, especially for those who have no other source of income.

Table 6 Transportation modes used by the couriers in 2020 and 2021. *Source*: Author's surveys

	Private bicycle (%)	Shared bicycle (%)	Bicycle (private + shared) (%)	Private scooter (%)	Shared scooter (%)	Scooter (private + shared) (%)	Motorcycle (%)	Car (%)
2021	29	18	47	9	1	10	36	7
2020	46	16	62	0	0	0	31	1

On the other hand, the two surveys shows a high proportion of people using shared bikes, though this is prohibited by the operator and Paris City Council (Table 6). In 2021, of the 47% of people using a bike for their deliveries, 39% used the Parisian bike-sharing scheme (called Velib). In 2020, 25% of the bike users used shared bikes. Shared bike schemes meet the specific needs of platform-based couriers, who otherwise have to buy and maintain their vehicle, and to replace it when it is stolen. Respondents report that their use of shared transportation modes is generally a temporary solution, before buying a bike or a new bike when their bike has been stolen, or while their bike is under repair.

5 Discussion

Firstly, our findings indicate greater diversity among couriers than suggested by current literature [50, 58], both in terms of profile and occupational status. Almost half of the respondents in Paris are salaried workers or cooperators, which suggests the need for a specific analysis of their motivations and working conditions compared with self-employed people. The impacts of the pandemic, which seems to have globally worsened working conditions, at least in early 2021, also need further investigations for each category of couriers.

Secondly, our work calls for more attention to be paid to courier mobility patterns in transportation research. In particular, we need a better understanding of (legal but also illegal) practices in terms of the transportation modes used, and their contribution to building forms of vulnerability (for instance on the road, as shown by our data) but also resistance to gig and algorithmic work [45]. Additionally, what appears to be an important use of shared transportation modes in Paris, and especially shared bikes, which seem to be a significant support tool for couriers who are starting out in the business or have a problem with their own bike, also calls for closer attention in research and among the different stakeholders (public and private). A recent study in Brazil also highlighted that some couriers used shared bikes in Manaus city [16]. Moreover, our findings show that platform-based couriers do not only belong to the so-called cycle work category. This finding must be even more salient in suburban areas, where platform-based delivery is currently developing in France and were the transportation infrastructure and distances are not suitable for bicycles use. However, research has primarily considered bicycle couriers working in city centers.

Thirdly, this work highlights some connection between mobility practices, platform-work (especially the payment per delivery run), but also public policies (such as policies in favor of bicycle use), that have not yet been well addressed in the literature [21, 58]. Mobility seems appears as one key parameter that couriers can control to optimize their activity and increase their earnings. In response to the payment per delivery run, algorithmic control, and the non-reimbursement of transportation costs by the platforms, on the one hand, and French law that requires the use of non-motorized vehicles, on the other hand, some couriers use illegal transport modes (motorcyles and shared bikes). This result is probably also linked to the pressure to be as quick as possible in order to increase earnings and meet the requirement of the platforms (which evaluate their couriers in terms of reliability of participation), otherwise there is a risk of penalty and loss of opportunities [45]. The consequence is an increase of the vulnerability of the couriers on the road, and therefore their insecurity in the absence of social protection. Moreover, the mandatory use of bicycles in poorly suited environments seems to worsen this situation, as does also the prohibition on using shared mobility services for professional use. Full-timers are particularly concerned by these issues, which present public authorities with new challenges in terms of both the transport modes allowed and the design of cycling spaces. The use of bikes to deliver food or small parcels, which is seen by the public authorities as a way to make urban deliveries more sustainable [38, 42], is not without consequences in terms of vulnerability and accidents.

6 Conclusion

Platform-based fast delivery is a recent but growing subject of interest to researchers in the transportation field. This work, based on two quantitative surveys in Paris of approximately 300 and 500 couriers in 2020 and 2021 respectively, confirms some previous findings regarding the profile, motivations, and poor working conditions of couriers in European cities. It also underlines the mostly negative impacts of the pandemic in terms of earnings. Finally, our work raises new academic and urban policy issues in the areas of the impacts of platform work on cities and transportation systems.

Regarding policy implications, our results call for more attention to the mobility behaviors and needs of delivery workers in the design of transportation and city logistics policies. For researchers as well as local administrations, this means collecting data about travel behaviors, such as average distance traveled, the transport modes used, the geography of trips, and also accidents involving couriers, in relationship with local contexts: public policies, and urban form (such as the design of the streets, etc.) In particular, if urban authorities wish to increase deliveries by bicycle, there is a need to identify the most dangerous areas – signalized intersections that pose threats to the safety of delivery cyclists – and to install roadway equipment (such as dedicated space for bicycles at the traffic

lights) to improve bicycle safety. It also demands better design of cycle lanes, in line with the specific needs of the on-demand delivery industry, which is developing very fast in cities. The significant use of shared transportation modes, and especially shared bikes which seem to be a great support tool for couriers starting out in the business or who have a problem with their own bike, also calls for greater attention in research and on the part of the different stakeholders, both public authorities and private operators who did not design micro-mobility services for such professional uses. However, our surveys show that shared-bikes services adapted to the needs of couriers should contribute to increase bicycle use in urban areas.

From an academic point of view, this article raises important methodological issues. To our knowledge, this study is one of the first based on a large sample of couriers and on quantitative data, where previous research is mainly based on interviews of 20 to 50 couriers. In a context where it is very difficult to get representative data, since the platforms do not want to share their data with researchers, and many couriers are undocumented migrants not recorded by the platforms, our work highlights the value and of course the limitations of street surveys. Our surveys demonstrate that even if people are in a hurry, most are not reluctant to talk in detail about their work practices, even when they are illegal (such as the use of motorized two-wheelers). However, it is difficult to guarantee the representativeness of the courier sample, including the transportation modes used. There is also a risk of misrepresentation of age (since minors are not allowed by the platforms). The comparability between the different surveys is another difficulty. Nonetheless, regular surveys are necessary since changes are occurring fast, as shown by our results. Moreover, qualitative surveys are needed in order to better explain many of our findings, such as the use of illegal or shared transport modes, and the links between mobility patterns and working conditions in general. Methodological issues are a complex but key aspect for future research in this field.

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Author contributions
AA has made the literature review and has written the larger part of the text. CK and NL have supervised the data collection and made the statistical analysis. LD has supervised the research, contributed to the structure, conceptualization, and reviewed the text. All authors have read and approved the new version of the final manuscript. All authors read and approved the final manuscript.

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Availability of data and materials
Data are available from the authors on request.

Declarations

Competing interests
The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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