Riders on the Storm

Juan J Dolado, Álvaro Jáñez and Felix Wellschmied*

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Abstract

In this paper we study the effects of the 2021 Riders Law regulating the working conditions of food delivery couriers (riders) in Spain. This Law established the presumption of dependent employment for riders who were previously hired as self-employed. We start by summarizing the main stylized facts of delivery platforms and their workers, as well as describe the results of a small online survey on their preferences for working conditions. We then develop a search and matching model with two-sided heterogeneity regarding firms and workers to evaluate the effect of that reform. Our main findings are...

Keywords: Riders, Food delivery platforms, Self-employed, Employees
JEL: J21, J60

1 Introduction

Like a dog without a bone, an actor out on loan, riders on the storm (**Riders on the Storm, The Doors**)

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The digital platform economy is expanding quickly with the European Union (EU) being hot on the heels of the US. Its rapid growth in the EU is illustrated by the fact that employment in this sector represented 14.5 percent of the its workforce in 2022 against 16 percent in the US. In parallel, revenues have grown almost sixfold (from an estimated €3 billion to around €18 billion) since 2016. These workers perform a whole variety of tasks, including on-site and off-site (remote) ones– which typically involve be food delivery, translation, data input, babysitting, elderly care, or taxi driving. Regarding online delivery platforms, their supporters argue that they generate value for consumers through access to a wide range of catering services and consumer goods, as well as saving travel time and purchase, among others. Conversely, opponents are concerned about working conditions in this sector. Thus, these divergent views have led to an ongoing debate on how governments should regulate these platforms.

Our specific focus in the paper lies on the food and grocery delivery sector which, together with taxi driving, has achieved the biggest revenue. In particular, this was the case during the COVID-19 pandemic episode as the use of these online platform services became widespread in many countries. Since then, delivery workers (commonly known as *riders*) have attracted growing attention in the media due to their visibility pedaling in the streets of the big cities with striking backpacks.[1] For several years, most online food companies have relied on self-employed workers to deliver these services with only a few platforms hiring couriers and owning those assets involved in the delivery process (e.g. bikes and scooters). As a result, an active debate has emerged on whether platform workers should be granted the same level of social protection as non-platform workers of the same category,[2] or, on the contrary, they should keep their status as independent contractors responsible for their own social insurance and with control over their labor income. On the one hand, those in favor of the status quo argue that digital platforms provide workers with flexible working hours and compatibility with other activities (e.g.

[1] Although rider means cyclist or motorcyclist, note that in several countries (e.g. Spain) this term also refers to any worker who performs food and grocery delivery tasks, regardless of the type of transport being used, including cars or vans.

[2] These include social security contributions, responsibility for health and safety and the right to engage in collective bargaining to negotiate fair terms and condition

formal education or part-time jobs); in addition, they facilitate lower barriers to market entry and open the possibility of labor participation to individuals with vulnerable profiles (e.g. less-educated youth, elderly people or migrants) who do not wish to have fixed working timetables like conventional employees; finally, they not only enhance business revenues for restaurants and retail establishments subject to physical restrictions of available space, but also facilitate digitalization in these establishments. Against this positive view, opponents claim that, despite the traditional consideration of workers in this sector as genuinely self-employed, a growing proportion is however incorrectly classified as such, since they fulfil all criteria to be classified as dependent workers (employees).

In line with this debate, over the last few years, EU authorities have sought to ease the access of people working through digital platforms to the legal employment status that corresponds to their actual working arrangements. Their objective has been to steer these goals along a path that better balances the interests of platforms and workers despite the heterogeneity of tasks in this sector. Consequently, in 2023 the EU Council made a proposal advocating two key improvements for digital platform workers: first, helping determine their correct employment status, and second establishing the first rules on the use of artificial intelligence (AI) in the workplace to ensure safer and fairer working conditions

This paper aims to analyze these issues in the context of the Spanish economy since this country has become a forerunner in approving legislation along the previous lines through the so-called "Riders' Law" (RL hereafter) passed in August 2021. This Law includes the above-mentioned EU objectives through two major contributions: (i) the presumption of dependent employment for riders whose working conditions are determined by digital platforms, and (ii) the algorithmic transparency requirements for digital platforms, paving the way for collective bargaining in the sector. Note, however, that since (i) is only a presumption of employment status, employers could provide evidence to the contrary by proving that they do not exercise powers of organization, direction and control over platform-based delivery workers. As regards (ii), it becomes a key request to ensure safer and fairer working conditions guaranteeing minimum rights such as regulation of working hours, paid vacations and compensation in case of unfair dismissals.

On the basis of this important reform and through the lens of search and matching model with heterogeneous firms and workers, we evaluate whether the new regulations have been effective in improving workers' rights while respecting their preferred employment status. To do so, the departure point in our model is to assume that delivery platforms can either offer regular jobs with predetermined hours of work or subcontract to self-employed workers (coined *casual* jobs hereinafter) with flexible hours Likewise, workers differ in their preferences about working conditions, with those who prefer flexibility (i.e. more volatile hours) opting for casual jobs while those who prefer stability choosing regular jobs. Consequently, both types of vacancies co-exist in the labor market and, under random matching and shocks to working time flexibility, there is some mismatch between workers and jobs, leading to labor transitions.[3]

In principle, it looks like firms would prefer to use self-employed, rather than hire employees, as a cost-minimizing device, but there is higher turnover among the former that may affect negatively the quality of services and customers' satisfaction (see Melián-Gonzalez, 2022). In contrast, firms that offer a casual job only pay the worker when being productive, while those offering regular jobs must pay the worker in all instances, and also face higher payroll taxes. Thus, this trade off implies the existence of preferences cut-off levels, the first one below which firms offer casual jobs and to workers with high flexibility, and a second one above which they offer an employee status to those with lower flexibility. We then solve the model numerically and calibrate it to moments of the Spanish food digital services before the approval of the RL. Next, we consider the banning casual jobs as established by the Law. Our main findings are as follows...

1.1 Related literature and outline

The literature on the characteristics of the online gig-economy workers is still at an early stage due to the difficulties of studying these work arrangement through

[3]Our focus is rather on homogeneous jobs except for hours flexibility (i.e. our setup is not one with very good jobs vs. very bad jobs) in a labor market where wages are not too dissimilar. Thus, random search is not such a restrictive assumption given that these workers are unlikely to direct search towards more attractive jobs.

conventional Labor Force Survey data. In effect, these standard data sources still do not provide enough detailed information on this kind of workers (see e.g. Abraham, 2021, and Katz and Krueger, 2019, for efforts to distill these data in the US). To overcome these limitations, other studies have either used specific administrative data (Collins et al. 2019), design specific surveys (Boeri et al, 2021) or conduct field experiments and RCTs (Mas and Pallais, 2017, Angrist et al., 2021). Finally, there is a small set of recent papers which embed casual jobs in structural search and matching equilibrium models, disciplined by the scant available data, to analyze theoretically the general equilibrium employment, wage and and welfare effects of these flexible work arrangements. Our paper falls into this last strand of research where the closest forerunners are Scarfe (2022) and Dolado et al.(2023). Scarfe (2022) builds a frictional labor- market model similar to ours, which is calibrated to Australia, where casual workers (not just riders) account for 10 percent of the labor force. In turn, Dolado et al (2023) model zero-hour contracts in the low-pay segment of the UK labor market, which represent about 3 percent of the overall workforce and 16 percent of the low-paid labor force. In their paper, agents are ex-ante heterogeneous in their time availability to work and they always receive the minimum wage whereas Scarfe (2022) deals with ex-ante homogeneous workers whose wages are Nash bargained. Our approach combines both modelling strategies by allowing for ex-ante heterogeneity while wages are considered to be endogenous.

Other strands of the literature which our paper speaks to are those dealing with the introduction of short-time work arrangement or furlough (Cahuc et al, 2021, Carrillo-Tudela et al., 2021, Dolado et al., 2024), the imposition of restrictions on fixed-term contracts (Cahuc et al. 2022), and the effects of changing legal work-time regulations (Carry, 2023). Finally, we also rely on the literature that adds hour of work to search and matching models, like Cooper et al., (2017) and Frazier (2018). We depart from these models in allowing for two-sided heterogeneity regarding labor- demand decisions by firms and labor supply decisions by workers.

The rest of the paper is organized as follows. Section 2 provides an overview of how the food delivery digital platforms have evolved in Spain, involving a major legal reform in this sector, like the 2021 RL. Section 3 lays out the model. Section

4 describes its calibration before and after the reform. Section 5 discusses the main results. Finally Section 6 concludes.

2 An overview of food delivery services in Spain

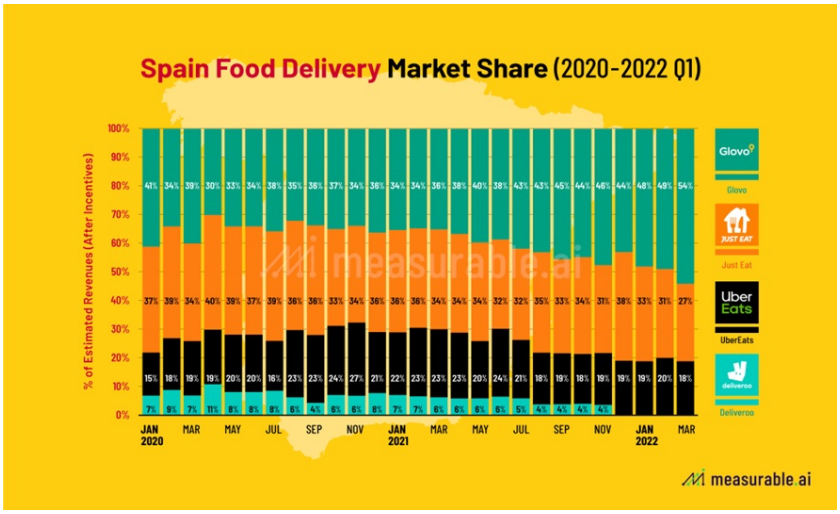
2.1 Historical Background

The first signs of activity in the food delivery sector in Spain date back to the early 2000s, when a startup launched the ComerComer.com website following the operating procedures that would become widespread a decade later. Restaurants began to create online branches (mainly specialized in delivering chinese food and pizzas) which charged them a commission fee of 12 percent and it was the establishments themselves that provided their fleets of delivery couriers. This early attempts to open a new market were followed by the entry of other small platform companies,[4] which relied on the use of improved technologies developed by bigger platforms, such as Just Eat in the UK or GrubHub in the US. Although some of these small companies had to exit the market following the dot.com bubble bust episode, the stronger platforms survived, being subsequently absorbed by the international bigger players (e.g. Delivery Hero, Just Eat, and Rocket Internet).

These acquisitions gave a great boost to the sector around 2015, following the recovery phase after the Great Recession plus the subsequent sovereign debt crisis. By 2019, this expansion resulted in: (i) 4.7 million end customer profiles from the digital delivery platforms in Spain, (ii) 36.2 million annual orders managed, (iii) above 64,500 collaboration agreements with restaurants and businesses (compared to less than 29,000 in 2018), and (iv) an annual overall employment growth of 2.4 percentage points (pp.) between 2009 and 2019. All this meant a direct contribution to GDP of €250 million which reaches about €700 million once indirect-induced effects are accounted for. At that time, total employment in the food and goods delivery sector amounted to 36,900 workers, out of which about 12,500 were riders with gross wages reaching on average between 1.2 and 1.4 times the national minimum wage (*Salario Mínimo Interprofesional*, SMI).

[4]The two most notable were Sin Delantal.com and La Nevera Roja

Figure 1: Market Shares in the Spanish Food Delivery Sector



Source:
Note: The graph displays the revenue market share in the Spanish food delivery sector between 2020 and 2022.

More recently, as in other countries, the activity of digital delivery platforms in Spain has grown considerably during the the COVID-19 lockdown, when it became one of the essential channels for food and goods delivery to households. Regarding the size of the big players, Figure 1 shows that, by the end of 2019, Glovo was the leading platform for riders (with 40 percent of market share), followed by Uber Eats (37 percent) and Just Eat (16 percent), while Deliveroo and other smaller companies accounted for the remaining 7 percent. Between 2020 and 2021, food deliveries increased by 40 to 50 percent as teleworking expanded during the pandemic. As a result, Glovo expanded its market share to close to 45-50 percent, at the expense of the other platforms. Consequently, the number of riders increased substantially, reaching 25,400 people by 2021, out of which 5,500 were employees (73 percent of them with open-ended contracts) while 19,900 were self-employed.

According to the results of a survey among 1850 riders carried out in 2019 by the consulting firm Adigital (2020), 81 percent positively value the flexible hours provided by platforms, while 65 percent appreciated the ability to combine platform collaboration with the development of other activities, both personal (studies, preparation of public sector competitions or others) and labour-related ones (part-time or temporary employment). According to this report, the follow-

ing socio-economic characteristics stand out among respondents: (i) 66 percent are aged below 29 years while 21 percent exceed 50 years; (ii) the dominant nationalities are Latin Americans (64 percent) followed by Spaniards (28 percent); (iii) their educational attainments are similar to average Spaniards' between 18 and 50 years of age, with 53 percent having achieved at most compulsory secondary education and 40 percent involved in college education; (v) 25 percent were unemployed and 5 percent inactive; and (v) they earn about €8 per hour and work on average 41.5 hours per week, leading to average annual gross earnings of €15,900 (the annual SMI in Spain was €14,700 in 2019)

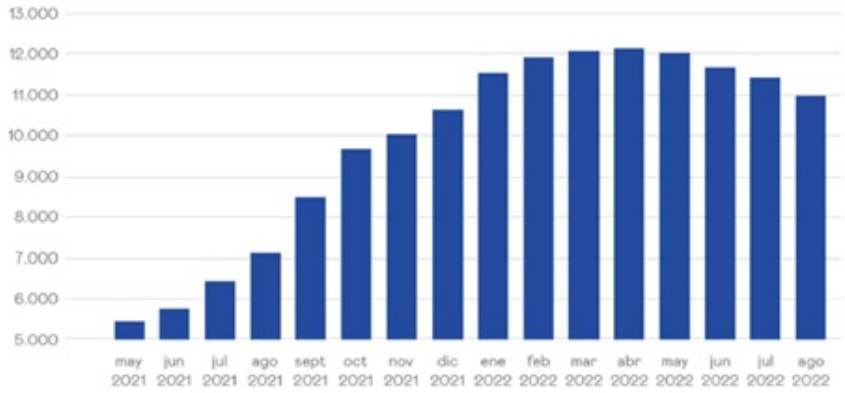
2.2 The Riders' Law

In 2023, two years after the approval of the RL´ , some big platforms have claimed that their labour costs increased by 30 percent regarding those workers who have been re-classified as employees. Importantly, Deliveroo, Glovo and Uber Eats have stood against this regulation, while Just Eat and a few other smaller companies (together with the employers' confederation and the trade unions) defended the new regulatory framework. By 2022, Deliveroo decided to leave Spain, after laying off 3,000 of its employees through a collective dismissal. In contrast, Just Eat and some new platforms, like Getir from Turkey and Gorillas from Germany (which also left Spain in 2023 and 2022, respectively) adopted the the new regulations since their arrival while committing to ultra-fast deliveries. As shown in Figure 2, the number of riders with employee contracts has doubled, rising from 5,500 in mid 2021 to about 11,000 in mid-2022.

As mentioned above, not all companies have reacted in the same way to the new legislation. Strikingly, Glovo remains operative in Spain after its approval despite not having registered most of their riders (10,000 in a staff of 12,000) in the Social Security system, and the threat of a previous sentence by the Supreme Court confirming that its riders should become employees. Yet, these couriers remain as self-employed subcontractors, being this status particularly prominent among illegal migrants.[5] As a result of this refusal, so far this company accumulates more

[5]Indeed, Glovo's CEO has claimed that, if they were to convert their riders into employees, they would lose a large fraction of their workforce due to their lack of work permits for immigrants.

Figure 2: Number of Employees among Riders in the Food Delivery Sector



Source: Ministerio de Empleo y Seguridad Social, Spain.
Note: The Figure displays the number of employees in the Spanish food delivery sector between May 2021 and August 2022.

than €200 m. in administrative sanctions which have been appealed.[6]. However, as noted earlier, the reason why this platform remains still operative is because the dependency criteria in a labour relation does not preclude self-employed individuals to undertake such jobs whenever a platform proves in a labor court that it does not fix the working time of its riders but rather the latter is freely chosen by the worker. In particular, Glovo claims to have implemented a new online technology that does not impose any exclusivity clause on their riders as they can decline orders in their apps (smartphones) and instead choose to deliver food through other platforms which suit them better, given their location and time availability.[7] Similarly, Uber Eats is also keeping many self -employed riders as subcontractors through agreements with the restaurants they work with. In the meantime, some new players have entered this market, like GoDelivery, Deliverum or Stuart. [8]

[6]At any rate, it may pay Glovo to accept the fines, due to what they save on Social Security and the reduction in order prices (around €4-5 per order against €8 for those which comply with the RL, like Just Eat)

[7]´This legal strategy follows the European Court of Justice' s decision in the Yodel case when it did find that a parcel delivery driver with the discretion to subcontract, decline deliveries, provide services to third parties or fix her/his own hours could be considered self-employed in the context of the Working Time Directive.

[8]One of the new players is also Delitbee which aims to become the Skyscanner of the delivery sector by introducing an app where users can check all the available offers for food delivery and compare their prices in a simpler way.

There is scant evidence about the labor-market effects of the new regulations, mainly due to the lack of reliable publicly available statistics– besides those provided by the Public Employment Services (SEPE) in its registry of economically dependent self-employed workers. Yet, there are some reports pointing that riders' working conditions have improved after the 2021 RL. For example, as illustrated in Figure 2, Esade (2022) documents that the number of employees among riders in the food delivery sector has doubled between april 2021 and august 2022 (see Figure 2), out of which 98 percent (vs. 73 percent before the Law) hold open-ended contracts. Moreover, if just before the approval of the RL there were around 30,000 riders in total, currently there are no less than 35,000, given the larger number of platforms in the food delivery sector.

Yet, opponents claim that riders' (net) income has fallen as those becoming salaried workers have to pay now higher social security contributions. According to one of the workers' ´associations (Asociación Autónoma de Riders-AAR), which is against the RL, about 65 percent of the riders dislike the new regulation, despite getting better social protection, as illustrated by the growing market shares of the defiers (Glovo and Uber Eats) displayed in Figure 1. The main reason for this opposition to the Law is that their monthly income has been reduced, as employers shift part of their higher payroll tax burden onto wages.[9]. According to Esade (2022), assuming a salary contribution base of around €1000, the employers of the newly converted employees pay extra payroll taxes of €3,900 per year than when they were self-employed, an amount which has been partly shifted to lower delivery fees, especially once the pandemic boom in this sector slowed down. By 2019, a self-employed rider would have average monthly gross earnings of €1,330 with 8h workday six days a week whereas an employee needs to work 10 hours nowadays to get the same amount. In terms of paid fee per delivery, self-employed riders used to receive €5-6 (before taxes) before the Law was passed while, afterwards, employees get €4.5-5, to which other costs (like gasoline and bicycle expense) have to be deducted both for both types of workers.[10] Platforms in turn set a markup

[9] As self-employed, workers have a flat social security contribution of €249 for average monthly base earnings of about €1000, plus 15 percent in VAT,while the corresponding contributions for an employee are 4.7 percent (worker) and 30 percent (employer).

[10] A monthly rental of €135 for their bikes, plus €50 for the backpack and mobile phone when riders start working.

of 30 percent to clients for each delivery (about €290 per year for each rider). In addition, the closure of Deliveroo and other platforms, together with the increase in the number of riders after the Law, may have generated oversupply that lowers the price paid for each delivery.

2.3 Wages and turnover

According to Adigital (2020)'s survey, delivery drivers report average earnings of around €342 euros per week in 2020, which is equivalent to a gross hourly wages of €8 and just over €1,368 gross per month. With a monthly SMI of €1,108 in that year, this figure corresponds on average to 1.2 times the SMI. However, there is also a high degree of dispersion in terms of weekly income, resulting from large heterogeneity in hours worked. In general, hourly wages rise with longer working hours (see evidence in subsection 2.4 below). In effect, riders who work between 40 and 49 hours a week earn about €2.5 per hour tan those devoting less than 10 hours a week. This positive relationship between hours of work and hourly wages reveals that riders providing their services during a larger number of hours per week are possibly allowed by the platforms to select those periods with higher demand as well as those places with greater concentration of orders. On the contrary, those who work a smaller number of hours become less efficient, possibly because they endure greater waiting time which reduces their hourly pay.

The best statistical source for riders' ´wages is the Quarterly Survey of Labor Costs (Encuesta Trimestral de Coste Laboral) published by the Instituto Nacional de Estadística (INE), which is broken down by NACE sectors of activity at the 4-digit level. Riders are included in NACE 5320 H (Other postal services and courier activities), together with postmen and other couriers, etc. The average annual wage growth rate between 2020 and 2023 for these workers has been 2.5 percent which, if applied to riders, would imply a raw hourly wage close to €7 in 2019 (see Figure 3). However, once social security contributions plus, petrol and mobile phone maintenance costs are discounted, it drops to €5-6 per hour which, as shown below, is in the same ballpark of the average hourly wage reported in our sample of surveyed riders. After the RL, Just Eat signed a collective agreement with its employees in 2023 ensuring €15,200 a year with four weeks of holidays

and a maximum of 9 working hours per day.

An alternative survey made by Ranstad Research (2002) covering 5,000 firms shows that the turnover rate (dismissals and quits) in sector 532 is 13 percent, while it reaches 17 percent on average for all sectors. However, this figure may be inaccurate since other workers (like postmen) also included in that sector have much more stable (e.g. open-ended) contracts. Thus, to get a better estimate of wages and turnover rates, we have undertaken a small survey among riders which is described in the next section

2.4 Riders' survey

The small survey has been distributed in a completely anonymous format through the Google Forms platform during sept-oct 2023. It takes approximately 10 minutes to answer and questions are organized into three sections: (i) general information about the worker (age, gender, educational attainment, nationality and availability of a work permit); (ii) information about the job (current platform, tenure, number of platforms where (s)he has worked during 2023); and (iii) wages and turnover (net hourly wage, previous labor-market status– employed, unemployed and inactive–and dismissed/ quits over that year). In order to obtain a representative sample, we have established personal contacts with some riders who, through Facebook, Instagram, the Survey Swap website and street-level surveys, have distributed the questionnaire among several of their workmates. Overall 275 riders have been sent the questionnaire, out of which 162 replied.

Table 1 summarizes the main descriptive statistics of the survey sample which are not too different from the ones discussed above in the Adigital (2020) and Ranstad Research (2022) reports. So, the typical profile of the respondents corresponds to a foreign male rider working 4-5 hours a day for Glovo and Just Eat (72 percent) with a (net of costs) hourly wage of €5.6 and tenure of about 1.5 years. Interestingly, 18 percent of the respondents lack a work permit which agrees with the above-mentioned sub-contracting practices in those platforms which keep on using many self-employed couriers after the RL.

Table 1: Descriptive Statistics of Riders' Survey

	Mean	**s.e.**
Worker		
Age	27.3	7.4
Gender (Male)	0.86	
Education (Upper)	0.46	
Nationality (Foreign)	0.77	
Work Permit (Yes)	0.82	
Platform		
Glovo	0.48	
Uber Eats	0.20	
Just Eat	0.24	
Others	0.08	
No. of platforms (2023)	1.3	0.3
Tenure (years)	1.5	1.2
Wages/Turnover		
Net hourly wage (Euros)	5.6	2.3
Daily hours	7.8	1.3
Employee	0.4	
Self-employed	0.6	
Quit/Dismissed (Yes)	0.4	
Unemployed (previous status)	0.2	

Note: Sample size of 162 riders. Responses were collected during Sept.-Oct. 2023 through Google.form and Facebook platforms.

Table 2: OLS Estimates for Wages and Hours

Dep. Var	**ln(wage)**	**ln(hours)**
Age	0.050	0.027
	(0.033)	(0.018)
Gender (Male)	0.114*	0.063***
	(0.058)	(0.022)
Nationality (Foreign)	0.082	0.107***
	(0.069)	(0.034)
Work Permit (Yes)	0.065**	0.046**
	(0.033)	(0.021)
Tenure	0.035**	0.041**
	(0.016)	(0.019)
Glovo/Uber Eats	-0.024**	0.032**
	(0.012)	(0.016)
Education (Upper)	-0.007	0.028
	(0.013)	(0.022)
R-sq.	0.675	0.749
No. Obs.	162	162

Note: Reference categories are female, Spaniard, without work permit, Just Eat and others, employee. Robust standard errors in parentheses. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Figure 3: Distribution of Hours

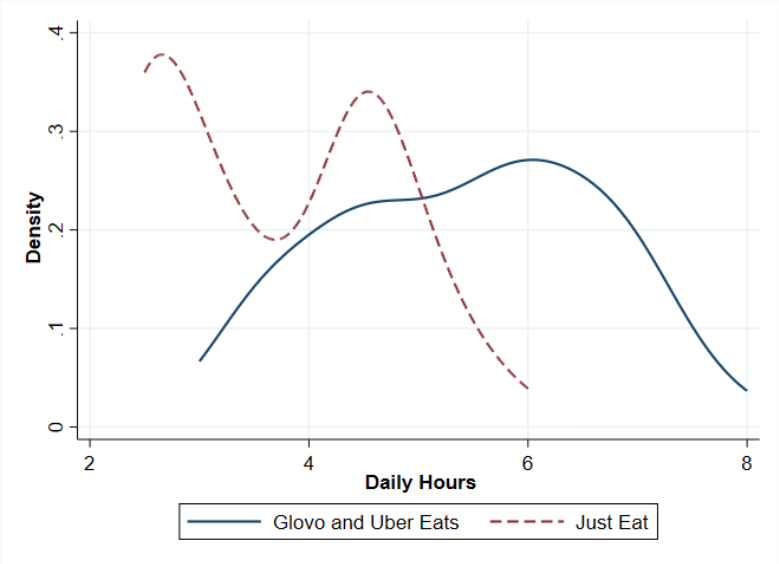


Figure 3 displays the wage densities of Glovo plus Uber Eats riders (the defiers to the RL) and Just Eat (the complier). As can be seen hourly wages in casual jobs are higher than in regular jobs. Interestingly, the latter distribution is bimodal in line with Just Eat offering typically 16 and 30 hours delivery contracts, besides weekends. Figure 4 in turn shows the hourly wage distributions for those two groups of riders, with higher wages (net of costs borne by the rider) in regular than in casual jobs. Thus, the survey data suggests that in both instances it is more profitable for platforms to have riders working long hours, possibly because it facilitates delivery planning. Hence, given workers' preferences on flexibility, firms know that to get long hours they have to pay higher hourly wages. This reasoning is supported by Figure 5 where the relationship between hourly wages and daily working hours is upward sloping, being steeper in regular jobs. These patterns will help discipline wage setting for each group in the calibration of the model discussed below in Section 3.

Next, some OLS regressions are ran to study the correlation between wages and hours of work with the survey covariates, including respondents´demographics (age, education, gender/male nationality/foreign, work permit), current platform

Figure 4: Distribution of Wages

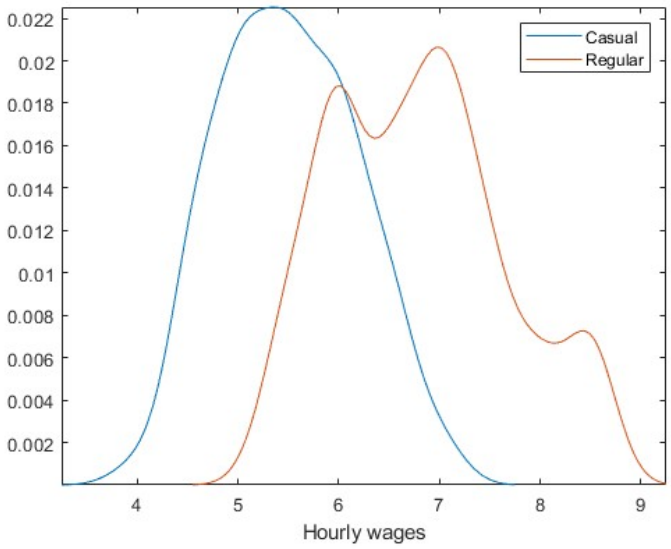
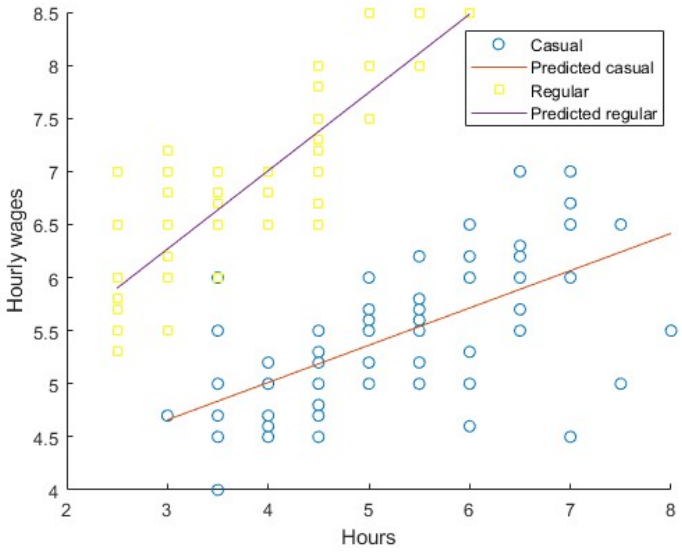


Figure 5: Correlation of Hourly Wages and Hours Worked



(Glovo and Uber Eats jointly), and tenure. Table 2 reports the corresponding OLS estimates. As can be seen in column 1 (wages), there are significant associations with gender (males earn 11.4 log points (lp.) higher wages than women), legal immigrants earn 6.5 lp. more than those without permits, higher tenure provides extra 3.5 lp., and Glovo/Uber Eats (most self-employed) earn 2.4 lp. less than the Just Eat employees, possibly because they have to pay Social Security contributions and face higher maintenance costs. As regards daily working hours, men (6.3 lp.), foreigners (10.7 lp.), legal immigrants (4.6 lp.), and the self-employed in Glovo/Uber Eats (3.2 lp.) work longer hours. Since the latter status is highly correlated with working for Glovo and Uber Eats, these platforms do not have significant associations with either outcome. Our interpretation of the gender wage gap is that platforms rank riders in terms of their availability, so that those who are high ranked are awarded shifts to locations with higher demand (e.g. downtown destinations during weekends and holidays) which entail extra pay. To the extent that women face larger time constraints than men, they get paid less per hour. The same logic would apply to immigrants vs. nationals. Finally, self-employed riders work more hours than employees because the later are subject to a 30-40 hours a week limit in most instances and they seem to receive lower wages (i.e. an income effect).

Next, as regards the relationship between reported hourly wages (net of costs) and daily hours of work, Figure ?? shows that wages are positively correlated with hours in both regular and casual jobs, while Figures ?? and ?? depict the histograms of wages and hours in the survey .....

Questions: Are there workers who prefer to be self-employed? How do people sort into regular and casual jobs? Effects of banning casual jobs? Effects of a MW rise?

2.5 Labor market transitions

We turn to the Muestra Contínua de Vidas Laborales (MCVL) to compute workers' labor market transitions. The MCVL is a Spanish administrative panel dataset that provides daily information on individuals' employment histories for a 4 percent representative sample of the contributors to Spain's Social Security during the

Table 3: Labor Market Flows by Employment Status

	$\mathbf{E}_{t+1}$	$\mathbf{S}_{t+1}$	$\mathbf{U}_{t+1}$
$\mathbf{E}_t$	95.6	0.1	4.3
$\mathbf{S}_t$	0.4	96.2	3.4
$\mathbf{U}_t$	4.5	2.0	93.5

Source: Own elaboration based on MCVL data from Jan 2019 to Aug 2021.
Note: The table reports the monthly labor market flows of Salaried employees (E), Self-employed (S), and Non-employed (U) individuals. We restrict the sample to individuals that work two consecutively months in the NACE sector 532 "Other postal and courier activities".

reference year. We restrict the sample to working-age individuals who have been employed for at least one month in the NACE Sector 532, "Other Postal and Courier Activities", during the period from 2019 to 2022.

Table 3 reports workers' average monthly transition probabilities computed for the period before the 2021 RL. Table 3 shows high persistence in each of the three states (employees, E, self-employed, S, and non-employment, U). However, the most salient finding is that transitions from S to E are larger than from E to S, despite both being small. Moreover, non-employed workers are twice as likely to transition to E as to S. Lastly, given the difficulty of identifying riders in this sector, Table 4 reports the corresponding flows for workers with tenure below one year, who are expected to be riders, as other workers included in this sector typically have longer tenures (e.g., postmen). The results are similar to those shown above except that flow rates to unemployment are a bit higher.

3 Model

In this section, we set out a simple and tractable search and matching model which will be later calibrated to ascertain the effects of the 2021 RL. In the model, firms decide whether to offer casual (C) jobs where individuals are subcontracted as self-employed or regular (R) jobs where they become employees. Its main ingredients are: (i) both types of jobs coexist in equilibrium, with casual workers concentrated in jobs requiring more volatile hours than regular workers, (ii) transitions take place between these jobs, and (iii) workers differ in their availability to work with those who prefer flexibility being concentrated in C- jobs. Indeed, the only random

variable is a preference by potential riders for the number of hours worked ϵ (i.e. other time commitments, like caring tasks or studying), where $\epsilon \sim N(\mu_\epsilon, \sigma_\epsilon^2) \in [0, \infty]$, i.e., a left-truncated normal distribution. Higher (lower) ϵ implies less (more) preference for work. Every period, i.i.d. shocks from a c.d.f. $G(\epsilon)$ arrive at Poisson rate λ. Consider a standard labor supply model of hours of work (h) and leisure (l), given available time ($T = 1$) subject to the budget constraint $c = w(1 - \tau_w)h$ (c is consumption and τ_w are possible payroll taxes paid by the worker):

$$\max u(c, l) = \ln c + \epsilon \ln l = \ln(w(1 - \tau)h) + \epsilon \ln(1 - h) \tag{1}$$

In the R-sector, workers always work $h = \bar{h}$. In the C-sector, they choose their hours optimally. Regarding firms, the production function in both sectors is $y = A(h)h$ where $A(h)$ is an efficiency parameter that depends on the number of hours worked. This is motivated by the above finding that firms pay higher hourly wages to workers working long hours. Firms in each sector x post a wage schedule that is increasing in hours worked

$$w_x = \eta_x^0 + \eta^1 h. \tag{2}$$

Finally, firms may pay payroll taxes τ_f in the R-sector, while the self-employed pay their own social security contributions τ_w in the C-sector.

Thus, workers can be in one of the three states: (i) unemployed, (ii) subcontracted self-employed in C, or (iii) employees in R. Unemployed workers receive income $b < w$ with associated utility $\ln b$. In the C-sector, job opportunities arrive at the exogenous rate α, while in the R-sector job opportunities arrive at the endogenous rate $\theta q(\theta)$. There are two cut-off values of ϵ. First, for a job in the R-sector, working preferences below or equal to the cut-off value ϵ^*, imply a disutility of working so low that the worker prefers unemployment to then look for a job in the C-sector, $U(\epsilon^*) \geq W_r(\epsilon^*)\ \forall \epsilon \leq \epsilon^*$. Second, for a job in the C-sector, working preferences above or equal to the cut-off value ϵ^{**} imply a disutility of working so high that the worker prefers unemployment to look for a job in the R-sector, $U(\epsilon^{**}) \geq W_c(\epsilon^{**})\ \forall \epsilon \geq \epsilon^{**}$. Lastly, in the interval $[\epsilon^*, \epsilon^{**}]$, the worker accepts both types of jobs.

Firm values Let $J_x(\epsilon)$ be the value of the firm in sector x and $W_x(\epsilon)$ be the value of being employed in sector x. Moreover, let $U(\epsilon)$ be the value of unemployment. Define the policies of workers and firms as

$$\mathbb{I}^w_{x=1}(\epsilon) \quad \text{if} \quad W_x(\epsilon) \geq U(\epsilon) \tag{3}$$

$$\mathbb{I}^f_{x=1}(\epsilon) \quad \text{if} \quad J_x(\epsilon) \geq 0. \tag{4}$$

Hence, we can compute the expected values for a firm in case no preference shock arrives, and when a preference shock arrives:

$$\mathbb{J}^{\lambda=0}_x(\epsilon) = \mathbb{I}^w_{x=1}(\epsilon)\mathbb{I}^f_{x=1}(\epsilon)J_x(\epsilon) \tag{5}$$

$$\mathbb{J}^{\lambda=1}_x = \int_{\underline{\epsilon}}^{\bar{\epsilon}} \mathbb{I}^w_{x=1}(\epsilon')\mathbb{I}^f_{x=1}(\epsilon')J_x(\epsilon')dG(\epsilon'). \tag{6}$$

Hence, the value of a job in sector x is

$$J_x(\epsilon) = \pi_x(\epsilon) + (1-\delta)\beta\left[\lambda\mathbb{J}^{\lambda=1}_x + (1-\lambda)\mathbb{J}^{\lambda=0}_x(\epsilon)\right]. \tag{7}$$

The value of posting a vacancy in the R-sector is given by

$$V_r = -\kappa + \beta q(\theta)\int_{\underline{\epsilon}}^{\bar{\epsilon}} \mathbb{I}^w_{x=1}(\epsilon)\mathbb{I}^f_{x=1}(\epsilon)J_R(\epsilon)dG^u(\epsilon), \tag{8}$$

where $G^u(\epsilon)$ is the CDF of in the distribution of the unemployed which is an endogenous object.

Worker values Similarly, for workers, we can compute the following expected values

$$\mathbb{U}^{\lambda=1}_x = \int_{\underline{\epsilon}}^{\bar{\epsilon}} U(\epsilon')dG(\epsilon') \tag{9}$$

$$\mathbb{W}^{\lambda=0}_x(\epsilon) = \mathbb{I}^w_{x=1}(\epsilon)\mathbb{I}^f_{x=1}(\epsilon)W_x(\epsilon) + (1 - \mathbb{I}^w_{x=1}(\epsilon)\mathbb{I}^f_{x=1}(\epsilon))U(\epsilon) \tag{10}$$

$$\mathbb{W}^{\lambda=1}_x = \int_{\underline{\epsilon}}^{\bar{\epsilon}} \mathbb{I}^w_{x=1}(\epsilon')\mathbb{I}^f_{x=1}(\epsilon')W_x(\epsilon') + (1 - \mathbb{I}^w_{x=1}(\epsilon')\mathbb{I}^f_{x=1}(\epsilon'))U(\epsilon')dG(\epsilon'). \tag{11}$$

The value of unemployment is given by

$$U(\epsilon) = \ln b + \beta \left[\lambda \Omega_u^{\lambda=1} + (1-\lambda)\Omega_u^{\lambda=0}(\epsilon)\right] \tag{12}$$

$$\Omega_u^{\lambda=1} = v_c \mathbb{W}_c^{\lambda=1} + v_r \theta q(\theta) \mathbb{W}_r^{\lambda=1} + (1 - v_c - v_r \theta q(\theta)) \mathbb{U}_x^{\lambda=1} \tag{13}$$

$$\Omega_u^{\lambda=0}(\epsilon) = v_c \mathbb{W}_c^{\lambda=0}(\epsilon) + v_r \theta q(\theta) \mathbb{W}_r^{\lambda=0}(\epsilon) + (1 - v_c - v_r \theta q(\theta)) U(\epsilon). \tag{14}$$

Finally, the values of employment are given by

$$W_r(\epsilon) = \ln\left(\bar{h} w_r(\bar{h})(1-\tau_w^r)\right) + \epsilon \ln(1-\bar{h}) + \beta \left[\lambda \Xi_r^{\lambda=1} + (1-\lambda)\Xi_r^{\lambda=0}(\epsilon)\right] \tag{15}$$

$$W_c(\epsilon) = \max_h \{\ln\left(h w_c(h)(1-\tau_w^c)\right) + \epsilon \ln(1-h)\} + \beta \left[\lambda \Xi_c^{\lambda=1} + (1-\lambda)\Xi_c^{\lambda=0}(\epsilon)\right] \tag{16}$$

$$\Xi_x^{\lambda=1} = (1-\delta)\mathbb{W}_x^{\lambda=1} + \delta \mathbb{U}_x^{\lambda=1} \tag{17}$$

$$\Xi_x^{\lambda=0}(\epsilon) = (1-\delta)\mathbb{W}_x^{\lambda=0}(\epsilon) + \delta \mathbb{U}_x^{\lambda=0}(\epsilon). \tag{18}$$

$$\tag{19}$$

4 Intuition from a non-stochastic model

To get an insight of how the model works, we make several simplifying assumptions that allow us to highlight the mechanisms of the model analytically. To that end, we assume that labor supply in the C-sector is $h_c(\epsilon) = \frac{1}{1+\epsilon}$ which approximates well the solution from the model above. As before, we assume that hours worked in the R-sector are $\bar{h}$, and wages in the C-sector are $w_c = \nu_0 + \nu_1 h$. Further, we simplify the utility function as follows:

$$u = c - \epsilon h \tag{20}$$

$$u_r(\epsilon) = \bar{h} w_r - \epsilon \bar{h} = \bar{h}(w_r - \epsilon) \tag{21}$$

$$u_c(\epsilon) = \frac{1}{1+\epsilon} w_c(h)(1-\tau_w) - \frac{\epsilon}{1+\epsilon} = \frac{1}{1+\epsilon}(w_c(h)(1-\tau_w) - \epsilon) \tag{22}$$

$$u_u = b. \tag{23}$$

Finally, we assume that ϵ is deterministic, and that time is continuous. First, we derive workers' optimal policy in the R-sector, i.e., the cut-off value of ϵ that

makes her indifferent between a job and unemployment, ϵ^*:

$$U(\epsilon^*) = W_r(\epsilon^*) \tag{24}$$

The asset value of working in a C job evaluated at ϵ^* is given by

$$rW_c(\epsilon^*) = u_c(\epsilon^*) + \delta[U(\epsilon^*) - W_c(\epsilon^*)] \tag{25}$$

$$W_c(\epsilon^*) = \frac{u_c(\epsilon^*) + \delta U(\epsilon^*)}{r+\delta}. \tag{26}$$

Combining it with the asset value of unemployment yields

$$rU(\epsilon^*) = b + v_c\left[W_c(\epsilon^*) - U(\epsilon^*)\right] \tag{27}$$

$$rU(\epsilon^*) = \frac{v_c \frac{w_c(h^*)(1-\tau_w)-\epsilon^*}{1+\epsilon^*} + (r+\delta)b}{r+\delta+v_c} \tag{28}$$

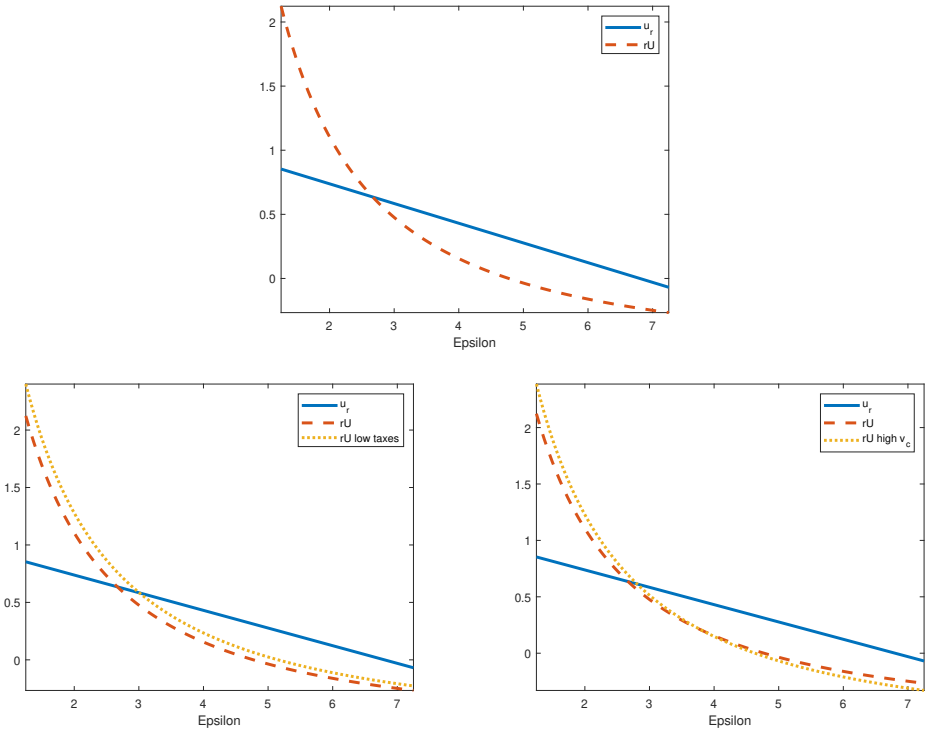
The asset value of working in R evaluated at ϵ^* is simply $u_r(\epsilon^*)$ and, hence, we have

$$\frac{v_c \frac{(\nu_0+\nu_1\frac{1}{1+\epsilon^*})(1-\tau_w)-\epsilon^*}{1+\epsilon^*}}{r+\delta+v_c} + \bar{h}\epsilon^* = \bar{h}w_r - \frac{(r+\delta)b}{r+\delta+v_c}. \tag{29}$$

which yields an implicit solution for ϵ^*. The first term on the left-hand side has the slope $\frac{\partial rU}{\partial \epsilon^*}$ which is negative. The second term is simply $-\frac{\partial w_r}{\partial \epsilon^*}$. For ϵ^* to be positive, the slope of the first term needs to be steeper initially than $-\bar{h}$. The top left panel of Section 4 displays this equilibrium. At low levels of ϵ, the worker has a comparative advantage to work in the C-sector, thus increasing her value to stay in unemployment relatively to accepting a job in R. As ϵ increases, her comparative advantage becomes smaller.

Equation (29) also allows us to think about how workers' decisions change when they no longer have to pay social security taxes. Setting $\tau_w = 0$ increases the first term, i.e., shifts $rU(\epsilon^*)$ to the right. As a result, ϵ^* needs to rise, i.e., fewer workers accept jobs from R. The bottom left panel of Section 4 shows this partial effect.

As more workers work in the C-sector, and the sector grows, it is more likely



that workers receive offers from that sector, i.e., v_c increases. This leads to an amplification effect as Equation (27) highlights. A increase in v_c will shift rU to the right at ϵ^* whenever $W_c(\epsilon^*) > U(\epsilon^*)$ which holds by definition. The bottom panel of Section 4 shows this effect.

Next, we derive workers' optimal policy in the C-sector, i.e., the cut-off value of ϵ that makes her indifferent between a job and unemployment, ϵ^{**}:

$$U(\epsilon^{**}) = W_c(\epsilon^{**}) = \frac{1}{1+\epsilon^{**}} w_c(h)(1-\tau_w) - \frac{\epsilon^{**}}{1+\epsilon^{**}}. \tag{30}$$

The asset value of working in a R job evaluated at ϵ^{**} is given by

$$rW_r(\epsilon^{**}) = u_r(\epsilon^{**}) + \delta[U(\epsilon^{**}) - W_r(\epsilon^{**})] \tag{31}$$

$$W_r(\epsilon^{**}) = \frac{u_r(\epsilon^{**}) + \delta U(\epsilon^{**})}{r+\delta}. \tag{32}$$

Combining it with the asset value of unemployment yields

$$rU(\epsilon^{**}) = b + v_r \left[W_r(\epsilon^{**}) - U(\epsilon^{**})\right] \tag{33}$$

$$rU(\epsilon^{**}) = \frac{v_r \bar{h}(w_r - \epsilon^{**}) + (r+\delta)b}{r + \delta + v_c} \tag{34}$$

The asset value of working in C evaluated at ϵ^{**} is simply $u_c(\epsilon^{**})$ and, hence, we have

$$\frac{v_r \bar{h}(w_r - \epsilon^{**}) + (r+\delta)b}{r + \delta + v_c} = \frac{1}{1+\epsilon^{**}} w_c(h)(1-\tau_w) - \frac{\epsilon^{**}}{1+\epsilon^{**}} \tag{35}$$

which yields an implicit solution for ϵ^{**}. Equation (34) is decreasing in ϵ. Hence, a decline in τ_w, which will increase $u_c(\epsilon^{**})$, will lead to a rise in ϵ^{**}, i.e., fewer workers only preferring R jobs.

Let κ be the vacancy creation costs. Vacancy creation in R occurs according to

$$\kappa = p(\theta) \int_{\epsilon^*}^{\bar{\epsilon}} J_R(\epsilon) dG^u(\epsilon) \tag{36}$$

$$\kappa = p(\theta) \int_{\epsilon^*}^{\bar{\epsilon}} \frac{\pi_R}{\delta + r} dG^u(\epsilon) \tag{37}$$

Hence, a higher ϵ^* reduces vacancy creation.

5 Calibration

The length of a period is one month and people discount the future at a 4% annual discount rate. We set the hours worked in the R sector to $3.73/24 = 0.15$ consistent with a mean daily hours of 3.73 in that sector. We chose the mean and standard deviation of the distribution for work preferences to match the mean daily hours worked in the C sector (5.4) and their standard deviation (1.2).

To compute the wage schedules, we use the predicted wages from the following regression using the survey data:

$$w_i = \beta_0 + \beta_1 \mathbb{I}_{R=1} + \beta_2 h_i + \varepsilon_i \tag{38}$$

where $\mathbb{I}_{R=1}$ is a dummy if a worker is employed in the regular sector. Consistent with the survey, these are net wages for workers. We assume that firms in the R sector pay workers a constant fraction, ψ, of output:

$$w_R^{gross}(h) = \frac{\psi y_r(h)}{1+\tau_f}. \tag{39}$$

we set $\kappa = 0.9$ and assume that $y_c(h) = y_f(h)$. Hence, given that wages are lower in the C sector, firm profits are higher in that sector.

As in Hagedorn and Manovski, we set vacancy posting costs to 3.7% of wages and 4.5% of output in the R sector. As in Shimer, we set $\alpha = 0.74$. We then adjust the matching efficiency such that 4.5% of the unemployed that have worked in the Postal sector for at least one month during the sample period transition to the R sector. Similarly, we adjust the job offer rate v_c such that 2% move to the C sector. We set the exogenous job destruction rate such that around 4% of employed become unemployed. What is not calibrated yet is the probability that I get a new ϵ, λ.

6 Old Model (IGNORE)

This section provides a search and matching model of the food-delivery labor market where firms can offer regular (employees) and casual (self-employed) jobs. Its main ingredients are: (i) both types of jobs coexist in equilibrium, with casual workers concentrated in jobs requiring more volatile hours than regular workers, (ii) transitions take place from casual to regular jobs, and (iii) workers differ in their availability to work with those who prefer flexibility being concentrated in casual jobs.

Job productivity depends on the type of work. Both regular and casual jobs are characterized by a stochastic match productivity (z) and drawn from a distribution $F(z)$. "low demand"). In a casual job, the firm and the worker can decide whether it is better not to produce, implying that the worker receives unemployment benefits, b.

Workers are of a type, ϵ, that determines how much they like working in each

respective type of job, i.e. how much they value flexibility. The type distribution, $H(\epsilon)$, is assumed to be normal with zero mean. For simplicity, we take tastes to be perfectly negatively correlated, such that when the utility flow of working in a regular job is ϵ, the utility flow of working in a casual job is $-\epsilon$. (You had only two types, and I am fine with either. I think a continuous distribution may bring more stability. We could also make workers ex-ante homogeneous, and the type realizes only when meeting a vacancy which would make the model a little simpler, but not much). Given this setup, it is easy to see that the decision in a casual job to not produce in a period is given by $\mathbb{I}_p(\epsilon, z, x) = b > zx - \epsilon$.(This is not quite right. The firm would like to pay the worker to discourage him from searching. I think this will depend on the wage determination, specifically, what the outside option of the worker is in the wage bargaining.)

Labor market search is frictional and characterized by random search. Firms post vacancies, v, to meet workers. A firm decides whether to post a regular or a casual vacancy. The latter has a flow cost κ. Alternatively, when opening a regular vacancy, the cost is $\kappa + \xi$, where ξ is redrawn every period from an exponential distribution $I(\xi)$. This way of modelling vacancy costs ensures that regular vacancies and casual vacancies co-exist (The alternative is to do it as in your zero-hours paper where the type of vacancy is just a random realization. That case is significantly simpler but firms cannot post more vacancies when demand is high, only the job filling rate would increase. We have to decide how important this feature is to us).

Two types of workers are searching: the unemployed, u, and those in casual jobs who have not been called to produce, u_c. There is a CRS matching function bringing together all job seekers, $s = u + u_c$, and vacancies. Labor market tightness is denoted by $\theta = \frac{v}{s}$. Hence, given the random search assumption, the probability of a searching worker to contact any job is $p(\theta)$, and to contact a regular job is $\phi_r p(\theta)$, where ϕ_r is the share of vacancies of regular jobs: $\phi_r = \frac{v_r}{v_r + v_c}$. Similarly, the probability of a vacant job to contact any worker is $q(\theta)$, and the probability to contact an unemployed worker is $\phi_u q(\theta)$, where ϕ_u is the share of unemployed searchers: $\phi_u = \frac{u}{s}$.

The model time line is as follows:

1. Wages are paid, and production takes place.
2. Next period productivity is realized.
3. At the end of the period, jobs are destroyed at rate δ.
4. Firms decide whether to pay the flow cost required to post a vacancy.
5. Firms and workers meet subject to the above-mentioned random matching function.
6. Upon meeting a worker, both parties learn about match productivity z. Firms observe the type of worker, ϵ, and workers observe the type of vacancy. The match is created when its surplus is positive.

Asset values of workers The value of unemployment is given by

$$U(\epsilon) = b + \beta\Big[(1 - p(\theta))U(\epsilon) + p(\theta)[\phi_r \int_z \Xi_r(\epsilon, z')dF(z') \\ (1 - \phi_r) \int_z \Xi_c(\epsilon, z')dF(z')]\Big], \tag{40}$$

where recall ϕ_r is the share of vacancies of regular jobs, and Ξ_r and Ξ_c are the decisions to accept offers for a regular and causal job offer, respectively, namely:

$$\Xi_r(\epsilon, z') = \max\{U(\epsilon), W_r(\epsilon, z')\} \tag{41}$$

$$\Xi_c(\epsilon, z') = \max\{U(\epsilon), W_c(\epsilon, z')\}. \tag{42}$$

Next, we denote by $\mathbb{I}_{ur}(\epsilon, z')$ the resulting policy to accept a regular job offer and by $\mathbb{I}_{uc}(\epsilon, z')$ the decision to accept a casual job offer. The desire for hours, ϵ is a key determinant for these acceptance decisions. We assume that workers in a regular job always work 40 hours per week and their resulting utility from hours worked is:

$$u_\epsilon = -\left(\epsilon - 40\right)^2. \tag{43}$$

As for the value of employment in a regular job, it is given by

$$W_r(\epsilon, z) = w(z, r) + u_\epsilon + \beta \mathbb{E}_{z'|z} \Big[\delta U(\epsilon) + (1-\delta)[(1-\lambda p(\theta)) \Xi_r(\epsilon, z') + \lambda p(\theta)(\phi_r \int_{z''} \Lambda_r(\epsilon, z', z'') dF(z'') + (1-\phi_r) \int_{z''} \Lambda_c(\epsilon, z', z'') dF(z''))] \Big], \tag{44}$$

where $\Lambda(\epsilon, z', z'')$ is the value of receiving an outside offer given that the worker has the option to stay with her current regular job:

$$\Lambda_r(\epsilon, z', z'') = \max\{U(\epsilon), W_r(\epsilon, z'), W_r(\epsilon, z'')\} \tag{45}$$

$$\Lambda_c(\epsilon, z', z'') = \max\{U(\epsilon), W_r(\epsilon, z'), W_c(\epsilon, z'')\}. \tag{46}$$

When holding a casual job, the corresponding value is

$$W_c(\epsilon, z) = w(z, c) + u_\epsilon + \beta \mathbb{E}_{z'|z} \Big[\delta U(\epsilon) + (1-\delta)[(1-\lambda p(\theta)) \Xi_c(\epsilon, z') + \lambda p(\theta)(\phi_r \int_{z''} \Omega_r(\epsilon, z', z'') dF(z'') + (1-\phi_r) \int_{z''} \Omega_c(\epsilon, z', z'') dF(z''))] \Big], \tag{47}$$

with

$$\Omega_r(\epsilon, z', z'') = \max\{U(\epsilon), W_c(\epsilon, z'), W_r(\epsilon, z'')\} \tag{48}$$

$$\Omega_c(\epsilon, z', z'') = \max\{U(\epsilon), W_c(\epsilon, z'), W_c(\epsilon, z'')\}. \tag{49}$$

Asset values of firms The value of opening a regular vacancy is:

$$\begin{aligned} V_r = \kappa_r + \beta \Big[& (1-q(\theta)) V_r \\ & + q(\theta)[\phi_u^f \int_\epsilon \int_{z'} \mathbb{I}_{ur}(\epsilon, z') \max\{V_r, J_r(\epsilon, z')\} dF(z') d\Gamma_u(\epsilon) \\ & \phi_r^f \int_\epsilon \int_z \int_{z'} \mathbb{I}_{rr}(\epsilon, z, z') \max\{V_r, J_r(\epsilon, z')\} dF(z') d\Gamma_r(\epsilon, z) \\ & \phi_c^f \int_\epsilon \int_z \int_{z'} \mathbb{I}_{cr}(\epsilon, z, z') \max\{V_r, J_r(\epsilon, z')\} dF(z') d\Gamma_c(\epsilon, z)] \Big], \end{aligned} \tag{50}$$

where $\Gamma_u(\epsilon)$ is the density of the unemployed over ϵ, $\Gamma_c(\epsilon, z)$ is the joint density of casual job searchers over ϵ and z, and ϕ_u^f is the probability that a firm meets an unemployed worker. Further, the indicator variables $\mathbb{I}_{ur}(\epsilon, z, z')$ and $\mathbb{I}_{cr}(\epsilon, z, z')$ capture the decisions by the unemployed and casual workers, respectively, on whether to accept a regular job offer.

The value of a casual vacancy is

$$\begin{aligned} V_c = \kappa_r + \beta\Big[&(1 - q(\theta))V_c \\ &+ q(\theta)[\phi_u^f \int_\epsilon \int_{z'} \mathbb{I}_{uc}(\epsilon, z') \max\{V_c, J_c(\epsilon, z')\} dF(z') d\Gamma_u(\epsilon) \\ &\phi_r^f \int_\epsilon \int_z \int_{z'} \mathbb{I}_{rc}(\epsilon, z, z') \max\{V_c, J_c(\epsilon, z')\} dF(z') d\Gamma_r(\epsilon, z) \\ &\phi_c^f \int_\epsilon \int_z \int_{z'} \mathbb{I}_{cc}(\epsilon, z, z') \max\{V_c, J_c(\epsilon, z')\} dF(z') d\Gamma_c(\epsilon, z)]\Big]. \end{aligned} \tag{51}$$

The value of having a filled regular job is

$$J_r(\epsilon, z, x) = z - w(\epsilon, z, x, r) + \beta \mathbb{E}_{x'|x}\Big[(1 - \delta)J_r(\epsilon, z, x') + \delta V(x')\Big]. \tag{52}$$

And the value of a filled casual job is

$$\begin{aligned} J_c(\epsilon, z, x) = \mathbb{I}_p(zx - w(\epsilon, z, x, c)) + \beta \mathbb{E}_{x'|x}\Big[&\delta V(x') \\ + (1 - \delta)[\mathbb{I}_p J_c(\epsilon, z, x') + (1 - \mathbb{I}_p)p(\theta)[\phi_w \int (1 - \mathbb{I}_{cr}(\epsilon, z, z', x'))dF(z')J_c(\epsilon, z, x') \\ &(1 - \phi_w) \int (1 - \mathbb{I}_{cc}(\epsilon, z, z', x'))dF(z')J_c(\epsilon, z, x')]]\Big], \end{aligned} \tag{53}$$

Wages Before thinking about this, let us agree on what we have so far.

$$w = \max\{\eta z + (1 - \eta)b, w_{min}\} \tag{54}$$

Note: we need to specify how wages are set for riders in casual jobs and possibly take into account that regular and casual employers and workers pay (different) payroll taxes.

Worker stocks in steady state

Table 4: Labor Market Flows by Employment Status (Tenure $\leq$ one year)

	$\mathbf{E}_{t+1}$	$\mathbf{S}_{t+1}$	$\mathbf{U}_{t+1}$
$\mathbf{E}_t$	91.9	0.1	8.0
$\mathbf{S}_t$	0.4	94.4	5.2
$\mathbf{U}_t$	4.3	0.6	95.1

Source: Own elaboration based on MCVL data from Jan 2019 to Aug 2021.
Note: The table reports the monthly labor market flows of Salaried employees (E), Self-employed (S), and Non-employed (U) individuals. We restrict the sample to individuals that work two consecutively months in the NACE sector 532 "Other postal and courier activities".