Heterogeneity Among Self-employed Digital Platform Workers. Evidence from Europe

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Abstract. This study examines the prevalence, types of activities, and characteristics of self-employment into digital platform work. Among others, we wonder if self-employment is the natural employment status to perform this type of work, or if this is the case but only for particular activities (i.e., on-location versus on-web), or for specific groups of the working population. Our analysis also addresses the initial motivation for becoming digital platform workers along with their working conditions in order to explore the differences between self-employed workers (workers who are self-employed in their main job), hybrid self-employed workers (workers who are self-employed in their secondary job) and paid-employees. We use data from two waves of the COLLEEM Survey (2017-2018) to estimate discrete choice models. Our results show that the probability of being a digital platform worker is higher for self-employed workers than for paid-employees, but that digital platform work is even more prevailing among hybrid self-employed workers. We also find that digital platform workers among the hybrid self-employed often have a precarious profile of necessity motivations and poor working conditions, whereas among the self-employed, digital platform work is much more associated with voluntary choices and pursuing aspirations related to work autonomy and a varied job.

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1. Introduction

Analysts and scholars have associated the resurgence of self-employment during the last decades with a number of new trends in the labour market, specifically with: i) the fragmentation of large firms and the propensity towards contracting out (Taylor, 2004), ii) deep changes in the industry composition (Blanchflower and Shadforth, 2007), iii) the stage of economic development (Acs, 2006), iv) the rise of necessity-driven entrepreneurs as a result of the lack of other options in the labour market (Fairlie and Fossen, 2020; Cowling and Wooden, 2021), v) the rise of dependent forms of self-employment, especially in countries where labour markets are highly regulated (Román, Congregado and Millán, 2011; Carrasco and Hernanz, 2022), vi) the emergence of the so-called atypical, non-standard or new forms of employment (Mandl, 2016; Malo, 2018; Giupponi and Xu, 2020), and, vii) the rise of digital labour platforms (Scholz, 2012; Sundararajan, 2016; Pesole et al., 2018; Congregado, de Andrés and Román, 2019; Urzi Brancati, Pesole and Fernández-Macías, 2020; Gómez and Hospido, 2022).

As a result, and despite differences across countries, self-employment[2] has risen significantly in many advanced economies.[3] The rapid growth of digital labour platforms has played a pivotal role in this process. The rise of digital labour platforms ran in parallel to a trend in which large companies outsourced various activities to contractors, freelancers and consultants on a demand-driven basis. For firms, digital platforms have allowed the fragmentation of tasks and the acceleration of contracting out — turning regular employment into tasks carried out by professional freelance workers and contractors —, thereby avoiding the most harmful costs associated with labour regulatory issues and turning employees into dependent self-employed workers (Boeri et al., 2020). For workers, digital platforms have become an additional source of income for involuntary part-time paid-employees (Valletta, Bengali and Van der List, 2020). These digital platforms offer potential alternatives for marginalized groups of workers, thus enhancing the employability of the most vulnerable groups (e.g. older workers, stay-at-home mothers, younger workers) who are not conventionally associated with self-employment (Williams and Horodnic, 2019).

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2. This rise has been mainly driven by solo self-employment, i.e. own-account workers without employees.
3. The numbers speak for themselves. In 2019, there were more than 5 million self-employed people in the UK, representing 15.3% of the labour force, up from 3.2 million (12%) in 2001 (source: Office for National Statistics, UK). The highest number of self-employed workers in the European Union was reached in 2019, when there were estimated to be 19.4 million, showing a major and common change in the European labour market composition by employment status (source: Eurostat).

Additionally, such digital platforms provide new opportunities and customers for professionals, contractors, and freelancers, creating an enabling framework for flexible working arrangements.[4]

The aim of this paper is to explore the heterogeneity among self-employed workers in digital platforms in a European context. In particular, in this paper we explore the heterogeneity of self-employed platform workers, suggesting that self-employment in digital platforms is not only associated with false forms of self-employment, with necessity entrepreneurs — pushed to self-employment in the digital labour market due to a lack of opportunities in traditional employment —, with precariousness (Codagnone, Abadie and Biagi, 2016), and with part-time self-employment (Petrova, 2012), but also with more lucrative forms of entrepreneurship — *true entrepreneurs, i.e. with entrepreneurial orientation* — who find in the digital platform sector the opportunity to expand their businesses, possibly as *hybrid entrepreneurs*.

For our empirical analysis we make use of two waves of microdata on digital platform workers in 16 European Countries conducted by the European Commission. This panel allows us to explore the role of the work situation or employment status as focus variable (paid-employment, self-employment (main job), and self-employment as secondary job, i.e. *hybrid self-employment*) on the probability of being a digital platform worker. The exploratory analysis is further extended in two directions: (i) distinguishing four categories of digital platform workers, depending on the intensity of digital platform work — sporadic, marginal, secondary and main — and (ii) including three types of activities — on location, on web or both, i.e. on location and on web —. We complete the analysis with consideration of two additional elements. First, we study the determinants of different types of motivations to perform digital platform work. And second, we analyze the determinants of different working conditions of digital platform workers.

Our research contributes to the controversial debate on negative work characteristics associated with non-standard forms of employment in the digital labour market, by focusing on the heterogeneity among self-employed platform workers. In contrast to previous research surrounding digital labour markets, which has mostly concentrated on issues related to precariousness and the emergence of dependent forms of self-employment associated to the work mediated by digital platforms (Maselli and Fabo, 2015; De Groen, Maselli and Fabo, 2016; De Stefano, 2016; Hall and Krueger, 2018; Melián and Bulchand, 2021), our study highlights that these negative work characteristics may be associated only to certain activities and industries, and to some groups of workers (Congregado, de Andrés and Román, 2019). This highlights that the reality of the digital labour market is more complex than it might seem at first.

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4. For some of them, digital platforms have been the driver to become self-employed or hybrid self-employed workers.

Our findings show that identifying digital platform work with the triangle of vertices consisting of precariousness, loss of social protection, and self-employment is an excessively simplistic view. Our results are important for rethinking the impact of particular regulations and/or macro policies on self-employment entry and its potential collisions with employment and social protection. The remainder of the paper is organized as follows. In Section 2, we conduct a brief literature review. In Section 3, we present a description of the data and the methodology that we employed within the study. In Section 4 we describe the empirical results, and finally, in Section 5 we discuss the findings and conclude.

2. Literature Review

The present paper contributes to the literature on the rise of self-employment due to the rapid penetration of digital platform work. Although there is a growing body of related literature, research to date typically focuses on the characteristics of digital platform workers and issues related to social protection and precariousness. These studies typically focus on the question whether precarious platform workers should have the status of wage-employed or (dependent) self-employed (e.g. De Stefano, 2016). However, studies focusing on the full spectrum of self-employed platform workers (including both necessity and opportunity types of entrepreneurs, both dependent and independent self-employed, and both self-employed in their main job and hybrid self-employed) are scarce. We start the review of literature by defining the sharing economy and digital labour platforms.

2.1. The Sharing Economy and Digital Labour Platforms

The dramatic growth of the sharing economy has brought with it new forms of employment and employment practices (Ahsan, 2020). Subsequently, its emergence has become a focal point of interest for scholars, practitioners, and policy makers alike (Laffey, 2021). When reviewing past literature, the sharing economy can be referred to as gig, collaborative or on-demand economy (Ferreira et al., 2021). The heterogeneity and vastness of the sharing economy, in terms of the numbers of businesses and markets, means that limited consensus exists surrounding its definition (Demary, 2015; Ferreira et al., 2021). Past literature (e.g., Ahsan, 2020; Frenken and Schor, 2017) provides various definitions of the term sharing economy with limited agreement. Bergh et al. (2021) note that there is no "commonly accepted way" to define the term sharing economy (p. 73), while Feng et al. (2021) indicate that past definitions are sometimes ambiguous and lack consensus. In an attempt to conceptualize the term sharing economy,

Schlagwein et al. (2020) drew from a detailed review of previous studies and defined the sharing economy as "an IT-facilitated peer-to-peer model for commercial or noncommercial sharing of underutilized goods and service capacity through an intermediary without a transfer of ownership" (p. 827). Similar to Feng et al. (2021), we adopt Schlagwein et al.'s (2020) definition of the sharing economy in the present study.

The sharing economy is an innovative approach that enables individuals to collaborate and share resources, goods, and services with each other, often facilitated through digital platforms. Such digital platforms offer a novel and promising environment for entrepreneurial activity (Nambisan and Baron, 2021) and consequently, there has been an increasing trend of solo self-employment in digital platform work (Burke, 2019). Online platform workers are considered to be independent contractors who, through the use of technology, provide a service, remotely or in-person, to fill the immediate short-term service labour needs of a firm (Kuhn and Maleki, 2017). In order to understand this cohort of workers we outline the types of digital platform workers and their motivations to become solo self-employed in the following section.

2.2. Solo Self-employed Workers in Digital Platforms

A general consensus in occupational choice theories indicates that individuals decide on their occupational group, be it paid employment or entrepreneurship, based on expected utilities (Fossen and Sorgner, 2021). The choice to become a solo self-employed worker in digital platforms is driven by several factors. First, low employability groups, which are usually determined by lack of educational attainment, lack of experience, age, and gender, may become self-employed workers in digital platforms due to the lack of standard work available to them. These (non-genuine) solo self-employed workers (Kösters and Smits, 2022) are generally involved in temporary on-demand work (gig economy) and their work arrangements are often associated with different forms of precariousness, such as dependency (Román et al., 2011),[5] vulnerability (Pollert and Charlwood, 2009; Schor et al., 2020), uncertainty (Heery and Salmon, 2000), underemployment (Bell and Blanchflower, 2013), and self-employment (Pantea, 2022). These are five characteristics of a substantial part of this type of nonstandard jobs mediated by digital platforms (Pesole et al., 2018; Congregado et al., 2019; Urzi Brancati et al., 2020), and thus the common association between precariousness and gig work.

Second, there are also professionals, contractors and self-employed skilled workers, who use digital platforms to expand their customer base, enhance their

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5. This group epitomizes the litigations against the larger digital platforms of work regarding the (mis)classification of workers as self-employed, linked to on-location, low skilled work activities, that is, to the "uberised" workforce.

reputation, and increase their opportunities (Nambisan and Baron, 2021). These self-employed digital platform workers belong to the category of true or opportunity entrepreneurs (Reynolds et al., 2001). These workers are likely to have higher bargaining power over the price, terms, and conditions under which their services are provided, compared to necessity entrepreneurs and dependent self-employed workers included in the first group[6], who may have limited control when choosing the task, setting pay rates, or determining working arrangements.

Third, there are individuals who decide to engage in entrepreneurial activity while simultaneously holding salaried-work (hybrid entrepreneurs), which allows them to transition from full-time paid employment to freelance employment in the digital platform arena (Folta, Delmar and Wennberg, 2010; Luc et al., 2018; Kurczewska et al., 2020; Demir et al., 2022). This can be viewed as a stepping stone to full-time solo self-employment (Thorgren et al., 2016), and to potentially becoming an employer (Congregado, Millán and Román, 2010; Cowling and Wooden, 2021). However, hybrid self-employment may also reflect that an individual needs more than one job to make ends meet (moonlighting), see Bögenhold (2019).

Finally, there are individuals who become self-employed in digital platform work because it offers them flexibility, family conciliation and self-organisation (Drahokoupil and Jepsen, 2017).

2.3. Regulations Surrounding Digital Workers

The rapid emergence of digital workers has attracted the interest of scholarly research surrounding the areas of ethics, governance, and law (Ahsan, 2020; Schor, 2016; Friedman, 2014). Self-employed workers in the digital platform economy are diverse in nature. Differences are evident between those who are professional self-employed workers in skilled occupations, whose services are highly demanded in digital platforms, and indeed those who perform so-called gig work. In the former case, the platformization of work opens up a new range of possibilities including flexibility, independence, and a potential correction of the labour productivity compensation gap. In the latter, the transition to self-employment in tech-enabled work results in a loss of protection and potential benefits given that these social instruments are intended primarily for the traditional and regular employer-employee relationship.[7] As such, criticism has arisen in recent years surrounding the lack of regulations and increased levels of inequality in such an economy (Kuhn and Maleki, 2017; Sundararajan, 2016). Additionally, the European Commission has recently devised a Directive Proposal (European Commission, 2021) for establishing the real employment

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6.   This group may include the most part of the so-called marginal platform workers (Pesole et al., 2018), that is, those who use the platform sporadically, as a way to supplement other sources of income from their main activity.

status of digital platform workers in order to prevent the use of dependent forms of self-employment as a way to evade employment protection legislation.

3. Data and Methods

3.1. Data and Sample

It is well-recognized that there are several difficulties associated with measuring non-standard employment forms by using Labour Force Statistics and the lack of a satellite account for measuring the digital economy (Ahmad and Ribarsky, 2018). This has triggered the emergence of new statistical operations carried out by different institutions and statistical agencies, for inventorying, identifying and monitoring the digital platform economy, and in particular the work mediated by these platforms — see O'Farrell and Montagnier (2020). In Europe, after a first attempt to provide an inventory of existing digital platforms (Fabo et al., 2017), the European Commission conducted two panel surveys (2017 and 2018) for estimating the prevalence of digital platform work, while characterizing digital platform workers and their working conditions (Urzi Brancati et al., 2020). This survey, the *Collaborative Economy and Employment* Survey (COLLEEM, hereafter) has enabled analyses surrounding the expansion of the digital labour market in Europe, which has become the basis of recent empirical work (Pesole et al., 2018; Congregado, de Andrés and Román, 2019; Urzi Brancati et al., 2020).

The first wave (COLLEEM I, hereafter), completed in 2017, contained information on a total of 32,409 internet users aged between 16 and 74 years old in 14 European countries[8], including 19,811 employees and self-employed workers, collecting socio-demographic and labour market data. The second wave (COLLEEM II, hereafter) collected a total of 38,022 responses from 16 EU Member States, out of which 26,222 correspond to workers.[9] In both samples, respondents working in digital labor platforms are questioned about characteristics and conditions of such platform work. Our final sample includes men and women aged 18 to 65 merging data of the two waves, whenever possible.

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7. The controversies around the hiring of workers as (dependent) self-employed-workers — with negative consequences on workers' rights — has been decided by National Courts. The forthcoming European legislation (https://ec.europa.eu/commission/presscorner/detail/en/qanda_21_6606) will consider that when a digital platform exercises a certain degree of control over the independent contractor performing work through it, the platform will be presumed to be an employer and the dependent self-employed will be presumed a worker or regular employee.
8. Germany, Netherlands, Spain, Finland, Slovakia, Hungary, Sweden, United Kingdom, Croatia, France, Romania, Lithuania, Italy, Portugal.
9. In the second wave data from Czech Republic and Ireland was also collected.

Depending on the empirical exercise, the final dataset yields between 41,747 and 2,246 observations.

3.2. Dependent Variables

As our main objective is to study whether being self-employed plays a decisive role in the decision to become digital platform workers, taking into consideration the degree of intensity in this employment, we generate the following two discrete variables:

• a dummy variable equalling 1 for digital platform workers and 0 otherwise — model I.[10]

• a discrete non-ordered variable equalling 1 for sporadic digital platform workers; 2 for marginal digital platform workers; 3 for secondary digital platform workers and 4 for main digital platform workers — model II.[11]

Furthermore, we explore both motivations and working conditions, generating the following dependent variables:

• a dummy variable equalling 1 for individuals who declare having become digital platform workers due to having difficulties in finding standard employment and 0 otherwise — model III.

• a dummy variable equalling 1 for individuals who declare having become digital platform workers as a way to find more clients and 0 otherwise — model IV.

• a dummy variable equalling 1 for individuals who declare having become digital platform workers for being their own boss and 0 otherwise — model V.

• a dummy variable equalling 1 for individuals who declare having become digital platform workers since they wish to be voluntary part-time workers and 0 otherwise — model VI.

• a dummy variable equalling 1 for individuals who declare suffering risks as digital platform workers and 0 otherwise — model VII.

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10. If the answer to the survey question "have you ever gained income from any of these two online sources?" is yes and the respondent also declares that the source is from providing services via online platforms, where you and the client are matched digitally, payment is conducted digitally via the platform, regardless of whether the work is location-independent (web-based) or performed on-location, the respondent is classified as digital platform worker.

11. Sporadic digital platform workers are those individuals who work in platforms with a frequency smaller than monthly. Those who work in digital platforms with a higher frequency (monthly, weekly or daily), are classified in terms of their number of weekly working hours in this type of work (lower than 10, between 10 and 19, and at least 20) and the percentage of their income that is gained from digital platform work (less than 25%, between 25 and 50%, and at least 50%) as marginal digital platform workers, secondary digital platform workers and main digital platform workers, respectively. See Urzi Brancati et al. (2020) for more details about the classification.

• a dummy variable equalling 1 for individuals who consider that their work at the digital platform is monotonous and 0 otherwise — model VIII.

• a dummy variable equalling 1 for individuals who consider that their work at the digital platform is stressful and 0 otherwise — model IX.

• a dummy variable equalling 1 for individuals who are not able to control the pace of their work and 0 otherwise — model X.

3.3. Focus Variable

Our empirical research aims to explore the role of the occupational status on the decision to become a digital platform worker, the motivational reasons, along with working conditions. Conditional on self-classification, the COLLEEM 2017 and 2018 allow us to identify the following work situations: i) Employee; ii) Self-employed (with and without employees[12]); iii) Unemployed; iv) Student; v) Retired; vi) Full-time homemaker; and vii) other not in the labour force (including inactive and in compulsory military service). In addition, respondents are questioned about whether besides their main activity, they are also self-employed. Based on this information, we classify digital platform workers within our dataset as (1) self-employed; (2) paid-employed; and iii) hybrid self-employed (i.e., paid-employees answering positively to the question referred to above whether they are also self-employed).

3.4. Control Variables

In order to isolate the effect of an individual's work situation, our empirical models include a set of explanatory variables related to socio-demographic characteristics (gender, age, cohabitation status, number of dependent children), to educational attainment, the type of digital platform work (on location vs. on web)[13] and the intensity in digital platform work (main, secondary, marginal, and sporadic).

In order to control idiosyncratic effects, potentially due to structural differences between countries, the empirical models also include country dummies and a year dummy to detect differences between the two waves.

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12. It is possible to identify different types of self-employed workers. However, this classification reports an insufficient number of observations for statistical inference.
13. The questionnaire allows distinguishing between digitally provided services "on web" and services provided in person "on location".

3.5. Methodology

We use non-ordered discrete choice models (binomial and multinomial logit models) in this research. To explore whether the work situation (employment status) affects the probability of being a digital platform worker, and for explaining the motivations and working conditions of the digital platform workers, we run logit models. We run a multinomial model for exploring the determinants of digital platform work by intensity.

4. Results

First, we analyze the probability of being a digital platform worker as compared with being a standard worker (Table 1, model I). Our focus independent variable is the work situation (employment status), that classified the individuals as paid employees, self-employed workers and paid employees who declare to be also self-employed workers (hybrid self-employed workers). The marginal effects of being a self-employed or hybrid self-employed worker are associated with a higher probability to become a digital platform worker as compared to paid employment. Controls are statistically significant showing that a higher probability of being a digital platform worker is associated with younger age, and with higher educational attainment. The country dummies indicate that the probability of becoming a digital platform worker is higher in Spain than in all other countries included in the analysis.

Following this initial analysis, we look for differentiated effects of work situation and of gender, age and educational attainment. With respect to gender issues (Table 2 and Figure 1), our main findings show that being female is associated with lower probabilities of being a digital platform worker, independently of the work situation. Furthermore, being a self-employed or hybrid self-employed worker is associated with a higher probability of being a digital platform worker (compared to paid employees), but the marginal effect is bigger for hybrid self-employed.

Table 1. Determinants of the probability of being a digital platform worker – *Logit* and multinomial *logit* models

	Model I		Model II							
	Logit model PW vs. No PW		Multinomial *logit* model PW by intensity (Sporadic vs. Marginal vs. Secondary vs. Main)							
#obs.	41,747		6,333							
Log pseudolikelihood	-14,978,46		-79,823,39							
	Prob (PW)		Prob(sporadic PW)		Prob(marginal PW)		Prob(secondary PW)		Prob(main PW)	
Predicted probability (*y*)	0.1518		0.2155		0.2394		0.3663		0.1787	
Independent variables (*x*)	dy/dx	z-stat	dy/dx	z-stat	dy/dx	z-stat	dy/dx	z-stat	dy/dx	z-stat
Work situation (ref. PE)										
SE	0.1326	18.11 ***	-0.0265	-1.69 *	-0.1203	-8.08 ***	-0.0197	-1.05	0.1665	9.69 ***
PE+SE	0.2267	38.56 ***	-0.0876	-8.05 ***	-0.0474	-3.92 ***	0.0511	3.79 ***	0.0839	8.1 ***
PW type (ref. On location)										
On web	--	-- --	0.0372	2.7 ***	0.0129	0.92	-0.0240	-1.57	-0.0261	-2.19 **
Both	--	-- --	-0.1218	-9.58 ***	-0.0399	-2.86 ***	0.1055	6.6 ***	0.0562	4.39 ***
Demographic characteristics										
Female	-0.0569	-17.59 ***	0.0462	4.38 ***	-0.0016	-0.14	-0.0253	-2.04 **	-0.0193	-1.99 **
Age (ref. 16-25)										
26-35	-0.0998	-14.49 ***	0.0338	2.52 **	0.0120	0.84	-0.0341	-2.06 **	-0.0117	-0.89
36-45	-0.1676	-24.89 ***	0.0273	1.84 *	0.0374	2.31 **	-0.0468	-2.59 ***	-0.0179	-1.27
46-55	-0.1912	-28.27 ***	0.0251	1.45	0.0309	1.63	-0.0409	-1.93 *	-0.0151	-0.91
More than 55	-0.2029	-27.77 ***	0.0130	0.58	-0.0102	-0.42	-0.0050	-0.17	0.0022	0.09
Cohabiting	0.0124	3.21 ***	-0.0127	-1.1	-0.0212	-1.67 *	0.0253	1.8 *	0.0085	0.77
# dependent children	0.0280	16.85 ***	-0.0133	-2.5 **	-0.0167	-2.94 ***	0.0124	2.04 **	0.0176	3.86 ***
Educational attainment (ref. Basic education)										
Medium education	0.0154	2.86 ***	-0.0472	-2.12 **	-0.0101	-0.44	0.0320	1.31	0.0253	1.42
High education	0.0570	10.63 ***	-0.0330	-1.53	-0.0225	-1.01	0.0120	0.51	0.0435	2.57 **
Country dummies (ref. Spain)										
Croatia	-0.0965	-10.32 ***	0.1183	5.07 ***	0.0216	0.85	-0.0445	-1.51	-0.0954	-4.2 ***
Finland	-0.1378	-14.08 ***	0.2224	6 ***	-0.0050	-0.14	-0.1022	-2.67 ***	-0.1152	-4.21 ***
France	-0.1106	-11.56 ***	-0.0296	-1.27	0.0235	0.79	-0.0179	-0.53	0.0241	0.84
Germany	-0.0460	-4.35 ***	0.0523	2.25 **	0.0250	0.95	-0.0361	-1.2	-0.0412	-1.68 *
Hungary	-0.1202	-12.73 ***	0.0608	2.34 **	-0.0245	-0.88	-0.0445	-1.31	0.0081	0.27
Italy	-0.0375	-3.67 ***	-0.0019	-0.1	-0.0114	-0.49	0.0203	0.73	-0.0070	-0.3
Lithuania	-0.1326	-15.43 ***	0.2058	8.28 ***	0.0024	0.09	-0.1395	-5.04 ***	-0.0687	-3.04 ***
Netherlands	-0.0705	-6.96 ***	0.0351	1.45	0.0294	1.07	-0.0394	-1.29	-0.0251	-1
Portugal	-0.0428	-4.44 ***	0.1400	6.79 ***	0.0519	2.29 **	-0.1016	-4.04 ***	-0.0902	-4.47 ***
Romania	-0.1122	-12.63 ***	0.0484	2.27 **	0.0528	2.09 **	-0.0151	-0.53	-0.0862	-4.02 ***
Slovakia	-0.1317	-14.03 ***	0.0650	2.39 **	0.0920	2.8 ***	-0.0361	-1.01	-0.1209	-4.77 ***
Sweden	-0.1089	-11.23 ***	0.1519	5.23 ***	-0.0210	-0.76	-0.0624	-1.92 *	-0.0685	-2.66 ***
United Kingdom	-0.0634	-6.47 ***	0.0272	1.23	-0.0085	-0.34	0.0131	0.45	-0.0318	-1.35
Czech Republic	-0.1541	-15.31 ***	0.0889	2.34 **	0.0366	0.92	-0.0720	-1.6	-0.0536	-1.38
Ireland	-0.0749	-6.75 ***	0.0420	1.56	-0.0198	-0.71	0.0073	0.21	-0.0295	-1
Year dummies (ref. 2017)										
2018	0.0232	6.89 ***	-0.0095	-0.91	0.0728	6.71 ***	0.0330	2.63 ***	-0.0963	-9.3 ***

*Notes: : * 0.1 >p 0.05; ** 0.05 >p 0.01; *** p< 0.01. PW (digital platform work); PE (paid-employment); SE (self-employment); PE+SE (hybrid self-employment).*
Source: Own elaboration using microdata from COLLEEM I (2017) y II (2018).

Table 2. Predicted probabilities of PW and marginal effects by work situation and gender

Work situation	Predicted probability of PW			Marginal effect of work situation						Marginal effect of gender					
	PE	SE	SE + PE	PE		SE		SE + PE		PE		SE		SE + PE	
Gender				dy/dx	z-stat	dy/dx	z-stat	dy/dx	z-stat	dy/dx	z-stat	dy/dx	z-stat	dy/dx	z-stat
Male	0.1265	0.2681	0.3710	*Ref.*		0.1416	14.00 ***	0.2446	30.97 ***	*Ref.*		*Ref.*		*Ref.*	
Female	0.0763	0.1997	0.2834	*Ref.*		0.1234	11.66 ***	0.2071	24.32 ***	-0.0501	-15.16 ***	-0.0683	-4.82 ***	-0.0876	-8.02 ***

Notes: Predicted probabilities and marginal effects are from model I in table 1, but including interaction term between work situation and ge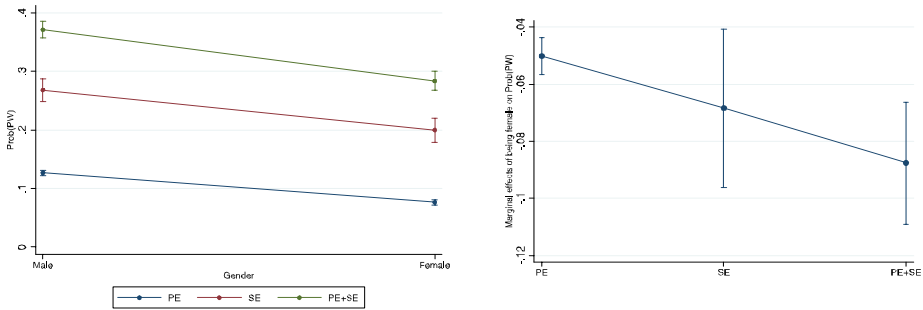nder. * 0.1 >p 0.05; ** 0.05 >p 0.01; *** *p*< 0.01. PW (digital platform work); PE (paid-employment); SE (self-employment); PE+SE (hybrid self-employment).

Figure 1. Predicted probabilities of PW and marginal effects by work situation and gender

Notes: Predicted probabilities and marginal effects are from model I in table 1, but including interaction term between work situation and gender. PW (digital platform work); PE (paid-employment); SE (self-employment); PE+SE (hybrid self-employment).

Turning our focus to age (Table 3 and Figure 2), our results show that being older is associated with lower probabilities of being a digital platform worker, independently of the work situation, but the marginal effect is more pronounced for self-employed and hybrid self-employed workers. (Hybrid) self-employment is positively associated with digital platform work, independently of the age band, but the positive marginal effect of (hybrid) self-employment is decreasing in age, being highest for the youngest age group 16-25.

Table 3. Predicted probabilities of PW and marginal effects by work situation and age

Work situation	Predicted probability of PW			Marginal effect of work situation						Marginal effect of age					
	PE	SE	SE + PE	PE		SE		SE + PE		PE		SE		SE + PE	
Age				dy/dx	z-stat	dy/dx	z-stat	dy/dx	z-stat	dy/dx	z-stat	dy/dx	z-stat	dy/dx	z-stat
16-25	0.2168	0.4470	0.5468	*Ref.*		0.2302	9.53 ***	0.3299	21.66 ***	*Ref.*		*Ref.*		*Ref.*	
26-35	0.1293	0.2901	0.4065	*Ref.*		0.1607	9.24 ***	0.2772	23.60 ***	-0.0874	-11.31 ***	-0.1569	-5.44 ***	-0.1402	-7.93 ***
36-45	0.0758	0.1995	0.2819	*Ref.*		0.1238	8.91 ***	0.2062	19.29 ***	-0.1410	-18.87 ***	-0.2475	-9.13 ***	-0.2648	-15.33 ***
46-55	0.0601	0.1479	0.2363	*Ref.*		0.0878	7.33 ***	0.1762	13.61 ***	-0.1567	-21.06 ***	-0.2992	-11.42 ***	-0.3104	-16.56 ***
More than 55	0.0609	0.1235	0.1746	*Ref.*		0.0626	4.70 ***	0.1137	7.10 ***	-0.1558	-19.13 ***	-0.3235	-12.13 ***	-0.3721	-17.90 ***

Notes: Predicted probabilities and marginal effects are from model I in table 1, but including interaction term between work situation and age.* 0.1 >p 0.05; ** 0.05 >p 0.01; *** *p*< 0.01. PW (digital platform work); PE (paid-employment); SE (self-employment); PE+SE (hybrid self-employment).

Figure 2. Predicted probabilities of PW and marginal effects by work situation and age
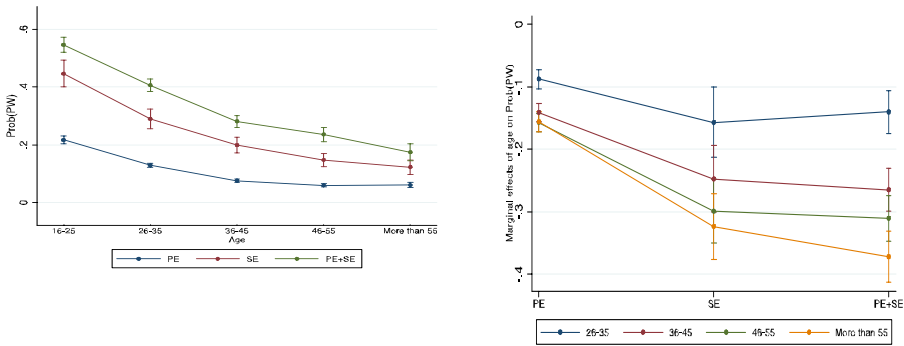
Notes: Predicted probabilities and marginal effects are from model I in table 1, but including interaction term between work situation and age. * 0.1 >*p* 0.05; ** 0.05 >*p* 0.01; *** *p*< 0.01. PW (digital platform work); PE (paid-employment); SE (self-employment); PE+SE (hybrid self-employment).

Finally, in terms of educational attainment (Table 4 and Figure 3), our results indicate that having medium education, as compared with low education, is associated with higher probabilities of being a digital platform worker for those who are paid employees, but not for those who are (hybrid) self-employed workers. Having high education, as compared with low education, is associated with higher probabilities of being a digital platform worker, independently of the work situation. Being a (hybrid) self-employed worker is associated with a higher probability of being a digital platform worker, independently of the educational attainment.

Table 4. Predicted probabilities of PW and marginal effects by work situation and educational attainment

Work situation	Predicted probability of PW			Marginal effect of work situation						Marginal effect of education					
	PE	SE	SE + PE	PE	SE		SE + PE			PE		SE		SE + PE	
Education				dy/dx z-stat	dy/dx	z-stat	dy/dx	z-stat		dy/dx	z-stat	dy/dx	z-stat	dy/dx	z-stat
Low	0.0654	0.2023	0.3019	*Ref.*	0.1369	6.60 ***	0.2365	11.67 ***		*Ref.*		*Ref.*		*Ref.*	
Medium	0.0855	0.1901	0.3064	*Ref.*	0.1046	9.18 ***	0.2209	22.08 ***		0.0201	3.95 ***	-0.0122	-0.53	0.0044	0.20
High	0.1220	0.2717	0.3553	*Ref.*	0.1497	14.38 ***	0.2333	30.31 ***		0.0566	11.02 ***	0.0694	3.07 ***	0.0533	2.53 **

Notes: Predicted probabilities and marginal effects are from model I in table 1, but including interaction term between work situation and educational attainment.* 0.1 >*p* 0.05; ** 0.05 >*p* 0.01; *** *p*< 0.01. PW (digital platform work); PE (paid-employment); SE (self-employment); PE+SE (hybrid self-employment).
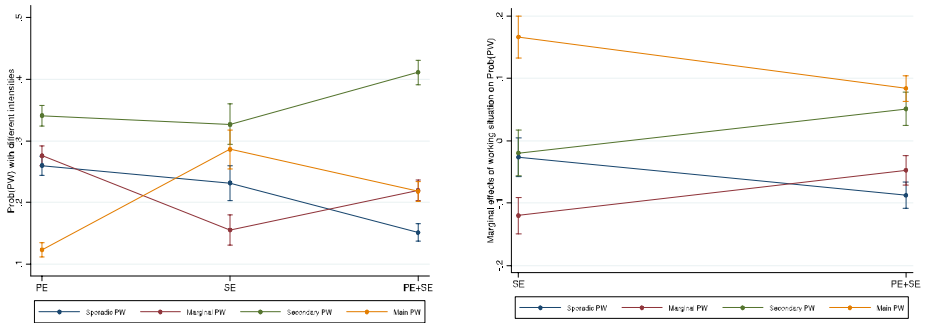
Figure 3. Predicted probabilities of PW and marginal effects by work situation and educational attainment
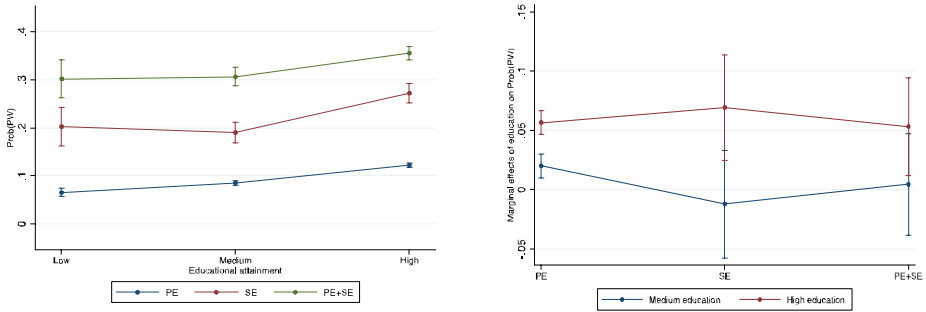
Notes: Predicted probabilities and marginal effects are from model I in table 1, but including interaction term between work situation and educational attainment. * 0.1 >*p* 0.05; ** 0.05 >*p* 0.01; *** *p*< 0.01. PW (digital platform work); PE (paid-employment); SE (self-employment); PE+SE (hybrid self-employment).

Table 1, model II reports estimates of a multinomial logit model where we consider the heterogeneity within digital platform work by considering four categories of workers, depending on the intensity of platform work: (i) sporadic digital platform workers, (ii) marginal digital platform workers, (iii) secondary digital platform workers and (iv) main digital platform workers (Table 1, model II and Figure 4). Since this specification includes only digital platform workers, we can add as a regressor a categorical variable that indicates the type of platform work the individual performs: on location, on web, or both — on location and on web. In this case, we concentrate on the probability of being a *main* digital platform worker to look for differentiated effects of work situation and type of platform work (Table 5 — rightmost column — and Figure 5). Being a (hybrid) self-employed worker is associated with higher probabilities of being a main digital platform worker, independently of the type of platform work. As compared with on-location platform workers, being an on-web platform worker is associated with lower probabilities of being a main digital platform worker for those individuals whose work situation is paid employment or hybrid self-employment, but with higher probabilities of being a main digital platform worker for those individuals whose work situation is self-employment. Probabilities of being both, on location and on-web, main platform workers are higher than those of being on location main platform worker, independently of the work situation, but the impact is higher for self-employed workers.

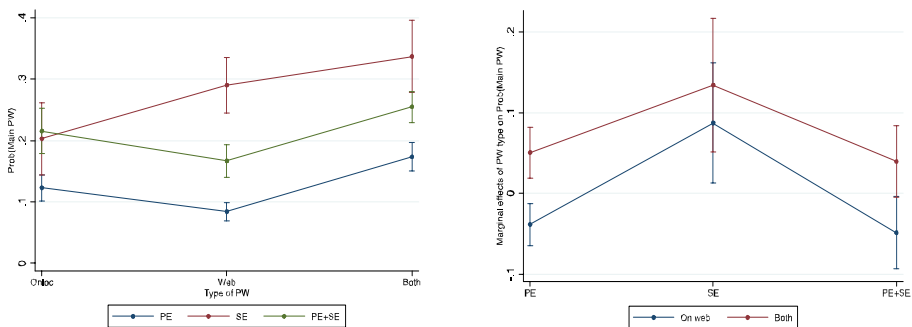**Figure 4**. Predicted probabilities of PW with different intensities and marginal effects of work situation

Notes: Predicted probabilities and marginal effects are from model II in table 1. * 0.1 >*p* 0.05; ** 0.05 >*p* 0.01; *** *p*< 0.01. PW (digital platform work); PE (paid-employment); SE (self-employment); PE+SE (hybrid self-employment).

Table 5. Predicted probabilities of main PW and marginal effects by work situation and type of PW

Work situation	Predicted probability of being main PW			Marginal effect of work situation						Marginal effect of type of PW					
	PE	SE	SE + PE	PE		SE		SE + PE		PE		SE		SE + PE	
Type of PW				dy/dx	z-stat	dy/dx	z-stat	dy/dx	z-stat	dy/dx	z-stat	dy/dx	z-stat	dy/dx	z-stat
On location	0.1227	0.2027	0.2154	*Ref.*		0.0800	2.50 **	0.0927	4.29 ***	*Ref.*		*Ref.*		*Ref.*	
On web	0.0839	0.2899	0.1666	*Ref.*		0.2060	8.43 ***	0.0826	5.23 ***	-0.0387	-2.90 ***	0.0872	2.30 **	-0.0488	-2.11 **
Both	0.1734	0.3367	0.2547	*Ref.*		0.1633	5.06 ***	0.0813	4.68 ***	0.0507	3.15 ***	0.1340	3.16 ***	0.0393	1.75 *

Notes: Predicted probabilities and marginal effects are from model II in table 1, but including interaction term between work situation and type of PW. * 0.1 >*p* 0.05; ** 0.05 >*p* 0.01; *** *p*< 0.01. PW (digital platform work); PE (paid-employment); SE (self-employment); PE+SE (hybrid self-employment).

Figure 5. Predicted probabilities of main PW and marginal effects by work situation and type of PW

Notes: Predicted probabilities and marginal effects are from model II in table 1, but including interaction term between work situation and educational attainment. * 0.1 >*p* 0.05; ** 0.05 >*p* 0.01; *** *p*< 0.01. PW (digital platform work); PE (paid-employment); SE (self-employment); PE+SE (hybrid self-employment).

We complete the analysis with the consideration of two additional elements. First, using data from the 2017 wave of COLLEEM, we study the determinants of different types of motivations to perform digital platform work (models III to VI, in Table 6). Second, we use the 2018 data to analyze the determinants of different working conditions of digital platform work (models VII to X in Table 7).[14]

Focusing on the work situation, we observe that, as compared with paid employees, self-employed workers have lower probabilities of declaring that their motivation to be digital platform workers is driven by necessity reasons, and higher probabilities of declaring that digital platform work allows them to find more clients or customers or being their own boss. Being a hybrid self-employed worker, however, increases the probability of declaring both necessity and opportunity reasons, highlighting the heterogeneous nature of this particular collective.

Moreover, it seems that self-employed workers enjoy better working conditions in digital platform work than paid employees, as being a self-employed worker is associated with lower probabilities of suffering health or safety risks, and of having monotonous work, along with higher probabilities of having autonomy to choose or change the speed or pace of the work. However, the picture for hybrid self-employed workers is different, in a manner that, as compared with paid employees, hybrid self-employed workers have higher probabilities of facing health and safety risks, experiencing monotonous work and/or suffering stress.

Overall, our results indicate that although self-employment and hybrid self-employment may be similar in terms of their association to digital platform work prevalence, differences exist in terms of motivations and working conditions, emphasizing the importance of taking into consideration different sources of heterogeneity on self-employment and digital platform work.

Finally, when focusing on the type of digital platform work (on location vs. on web), Tables 6 and 7 show that platform workers who perform both types (providing services on location *and* on web) have a particularly vulnerable profile, as they are more likely to report difficulties in finding standard employment, working part-time, and experiencing health and safety risks during work, monotonous work, and stress. Future research will need to dig deeper to find out what's behind this remarkable result regarding the type of digital platform work.

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14. Availability of data makes it impossible to perform analyses in tables 6 and 7 for the appended sample using both waves of COLLEEM.

Table 6. Determinants of PW motivation – COLLEEM I (2017) – *Logit* models

Model	III		IV		V		VI	
Dependent variable	I HAVE HAD DIFFICULTIES IN FINDING STANDARD EMPLOYMENT		THIS ALLOWS ME TO FIND MORE CLIENTS / CUSTOMERS		I LIKE BEING MY OWN BOSS		I PREFER TO WORK PART TIME	
Predicted probability (*y*)	0.6745		0.8417		0.8717		0.7171	
Independent variables (*x*)	dy/dx	z-stat	dy/dx	z-stat	dy/dx	z-stat	dy/dx	z-stat
Work situation (*ref.* PE)								
SE	-0.0609	-1.9 *	0.0562	2.62 ***	0.0964	5.56 ***	-0.0328	-1.07
PE+SE	0.0663	3.08 ***	0.0455	2.73 ***	0.0559	3.66 ***	0.1318	6.74 ***
PW type (*ref.* On location)								
On web	-0.0233	-0.88	-0.0089	-0.42	-0.0333	-1.88 *	0.0073	0.3
Both	0.1056	4.07 ***	0.0799	4.01 ***	0.0072	0.41	0.1064	4.31 ***
PW intensity (*ref.* sporadic PW)								
Marginal PW	-0.0018	-0.06	-0.0212	-0.89	0.0393	1.83 *	0.0170	0.61
Secondary PW	0.0969	3.48 ***	0.0285	1.38	0.0546	2.74 ***	0.0446	1.75 *
Main PW	0.0750	2.42 **	0.0331	1.44	0.0429	1.9 *	0.0395	1.38
Demographic characteristics								
Female	0.0448	2.24 **	0.0090	0.58	0.0249	1.81 *	0.0329	1.76 *
Age (*ref.* 16-25)								
26-35	-0.0252	-0.93	0.0173	0.8	0.0206	1.02	-0.0288	-1.09
36-45	-0.0218	-0.77	0.0161	0.71	0.0143	0.66	0.0234	0.86
46-55	-0.0073	-0.22	0.0160	0.63	0.0523	2.31 **	0.0233	0.75
More than 55	-0.0301	-0.63	0.0297	0.87	0.0859	3.23 ***	0.0048	0.11
Cohabiting	-0.0378	-1.74 *	-0.0149	-0.91	-0.0173	-1.17	-0.0324	-1.6
# dependente childen	0.0094	0.93	0.0242	2.96 ***	0.0239	3.15 ***	0.0211	2.18 **
Educational attainment (*ref.* Basic education)								
Medium education	-0.0922	-2.55 **	-0.0439	-1.7 *	-0.0223	-0.85	-0.0604	-1.69 *
High education	-0.1272	-3.69 ***	-0.0668	-2.68 ***	-0.0295	-1.17	-0.0642	-1.88 *
Country dummies (*ref.* Spain)								
Croatia	-0.2374	-4.87 ***	-0.0399	-1.15	-0.0354	-1.09	-0.0899	-2.08 **
Finland	-0.0724	-1.12	-0.1508	-2.68 ***	-0.0533	-1.13	-0.0995	-1.67 *
France	0.0102	0.21	-0.0364	-0.86	0.0024	0.07	-0.0589	-1.19
Germany	-0.0404	-0.86	-0.1154	-2.88 ***	-0.0398	-1.18	-0.0935	-2.11 **
Hungary	-0.1103	-2.15 **	-0.0016	-0.04	0.0338	1.14	-0.0028	-0.06
Italy	0.0808	2.22 **	-0.0174	-0.56	-0.0067	-0.23	-0.0131	-0.36
Lithuania	-0.0689	-1.59	0.0173	0.57	-0.0550	-1.7 *	0.0616	1.72 *
Netherlands	-0.1318	-2.61 ***	-0.1245	-2.85 ***	-0.1008	-2.52 **	-0.1160	-2.39 **
Portugal	-0.0327	-0.82	0.0145	0.5	0.0163	0.62	-0.1011	-2.66 ***
Romania	-0.0664	-1.47	0.0553	1.94 *	0.0021	0.07	-0.1806	-4.09 ***
Slovakia	-0.1191	-2.17 **	-0.0185	-0.46	0.0287	0.88	-0.0800	-1.6
Sweden	-0.1210	-2.21 **	-0.0547	-1.25	-0.0344	-0.9	-0.0892	-1.77 *
United Kingdom	-0.0155	-0.36	-0.0392	-1.1	-0.0341	-1.06	0.0261	0.66
# obs.	2,246		2,388		2,432		2,386	
Log pseudolikelihood	-1,319.5104		-983.13		-880.63		-1331.75	

Notes: * 0.1 >*p* 0.05; ** 0.05 >*p* 0.01; *** *p*< 0.01. PW (digital platform work); PE (paid-employment); SE (self-employment); PE+SE (hybrid self-employment).
Source: Own elaboration using microdata from COLLEEM I (2017).

Table 7. Determinants of PW working conditions – COLLEEM II (2018) – *Logit* models

Model	VII		VIII		IX		X	
Dependent variable	THIS WORK PUTS YOUR HEALTH OR SAFETY AT RISK		THIS WORK IS MONOTONOUS		YOU EXPERIENCE STRESS IN THIS WORK		YOU ARE NOT ABLE TO CHOOSE OR CHANGE THE SPEED OR PACE OF THIS WORK	
Predicted probability (y)	0.4116		0.4960		0.4544		0.1820	
Independent variables (x)	dy/dx	z-stat	dy/dx	z-stat	dy/dx	z-stat	dy/dx	z-stat
Work situation (ref. PE)								
SE	-0.0916	-3.38 ***	-0.0917	-3.13 ***	-0.0020	-0.07	-0.0483	-2.08 **
PE+SE	0.1005	5.23 ***	0.0405	2.04 **	0.0987	4.98 ***	-0.0482	-3.02 ***
PW type (ref. On location)								
On web	-0.0792	-3.51 ***	-0.0105	-0.45	-0.0334	-1.42	-0.0194	-1
Both	0.0740	3.3 ***	0.0707	3.07 ***	0.0935	4.07 ***	-0.0448	-2.4 **
PW intensity (ref. marginal PW)								
Secondary PW	0.1115	5.77 ***	0.0175	0.86	0.1010	5 ***	0.0026	0.16
Main PW	0.1075	4.2 ***	0.0185	0.69	0.1373	5.17 ***	-0.0328	-1.59
Demographic characteristics								
Female	-0.0112	-0.63	-0.0550	-2.96 ***	-0.0035	-0.19	0.0303	1.99 **
Age (ref. 16-25)								
26-35	0.0453	1.97 **	-0.0210	-0.87	-0.0010	-0.04	-0.0319	-1.7 *
36-45	-0.0268	-1.04	-0.1002	-3.68 ***	-0.0582	-2.16 **	0.0159	0.71
46-55	-0.0759	-2.5 **	-0.1262	-3.9 ***	-0.0915	-2.89 ***	-0.0068	-0.26
More than 55	-0.0796	-2.01 **	-0.1838	-4.42 ***	-0.0866	-2.11 **	-0.0173	-0.52
Cohabiting	-0.0011	-0.05	-0.0452	-2.1 **	0.0118	0.56	0.0081	0.47
# dependente childen	0.0199	2.32 **	0.0109	1.18	0.0005	0.05	0.0075	1.04
Educational attainment (ref. Basic education)								
Medium education	-0.1367	-3.72 ***	-0.0745	-1.95 *	-0.0797	-2.11 **	-0.0579	-1.68 *
High education	-0.1764	-4.97 ***	-0.1134	-3.07 ***	-0.1015	-2.78 ***	-0.0790	-2.36 **
Country dummies (ref. Spain)								
Croatia	-0.0480	-1.15	-0.0847	-1.91 *	-0.0605	-1.37	0.1045	2.54 **
Finland	0.1250	1.9 *	-0.1195	-1.76 *	-0.0975	-1.5	0.0749	1.22
France	0.1154	2.49 **	0.0640	1.35	-0.0446	-0.94	-0.1120	-3.57 ***
Germany	0.0998	2.33 **	-0.0028	-0.06	0.0211	0.47	-0.1147	-3.91 ***
Hungary	0.0807	1.65 *	-0.0793	-1.56	0.0556	1.1	-0.0394	-1
Italy	0.1721	4.45 ***	-0.0518	-1.28	-0.0053	-0.13	-0.0774	-2.64 ***
Lithuania	0.0237	0.53	-0.1174	-2.47 **	-0.0809	-1.73 *	0.0080	0.2
Netherlands	0.0881	2.11 **	-0.0385	-0.88	-0.0031	-0.07	0.0216	0.57
Portugal	-0.1099	-3.21 ***	-0.1542	-4.07 ***	-0.0904	-2.39 **	-0.0362	-1.2
Romania	0.0121	0.32	-0.1260	-3.12 ***	-0.0701	-1.75 *	0.0218	0.62
Slovakia	0.1201	2.29 **	-0.0377	-0.7	-0.0451	-0.84	-0.0432	-1.09
Sweden	0.2351	4.86 ***	0.0342	0.68	0.0800	1.61	0.1062	2.29 **
United Kingdom	0.2404	5.89 ***	0.1184	2.85 ***	0.1322	3.16 ***	-0.0075	-0.22
Czech Republic	0.0502	0.92	-0.0660	-1.17	-0.1477	-2.73 ***	-0.0766	-1.95 *
Ireland								
# obs.	2,957		2,968		2,984		2,868	
Log pseudolikelihood	-1,784.93		-1,935.62		-1,931.39		-1,306.4389	

Notes: : * 0.1 >p 0.05; ** 0.05 >p 0.01; *** p< 0.01. PW (digital platform work); PE (paid-employment); SE (self-employment); PE+SE (hybrid self-employment).
Source: Own elaboration using microdata from COLLEEM II (2018).

5. Conclusions

This paper studied the prevalence and characteristics of self-employed workers in digital platform work using data from the COLLEEM Survey, appending data from 14 European countries in 2017 and 2018. Although incertitude, discontinuity and the demand of services in terms of tasks may turn self-employment into the natural employment status for providing these services, our first set of results related with digital platform work prevalence shows that there exist differentiated effects of employment status on the probability of being a digital platform worker in terms of gender, age and educational attainment.

The statistical significance of country dummies are possibly related to the existence of idiosyncratic factors, and likely related to the institutional framework. Furthermore, multivariate analysis using a non-ordered multinomial logit model showed that these effects are different depending on the intensity in the digital platform work, a second source of heterogeneity.

We also explored motivations and working conditions as a way to demonstrate the heterogeneity of self-employment into digital platforms. In that sense, our results show that behind the large prevalence of self-employment into digital platform work lies both necessity/dependent entrepreneurs working in the gig sector — precarious workers with low bargaining power and underemployed —, and professionals and freelancers who voluntarily decide to become self-employed workers in digital platforms. Regarding the former group, it is the coexistence of rigidities and the needs of on demand work that instigates the growing number of dependent self-employed workers. The substitution of regular employment by this new labour relation is associated to precariousness and to gig work.

Our results on the motivations and working conditions of digital platform workers suggest that precarious platform workers are more often found among the hybrid self-employed, as compared to paid employees and workers who are self-employed in their main job, hybrid self-employed workers more often indicate to have difficulties finding a standard job, to work part-time, and to experience health and safety risks, monotonous work, and stress during their job. In contrast, platform workers who are self-employed in their main job are associated with a much more positive profile where work autonomy ('being my own boss') and a varied job stand out.

Our findings provide useful guidelines for policy makers. Governments spend great amounts of money in both promoting the entry into self-employment —for opportunity- and necessity-driven entrepreneurship —, as well as devising portfolios of policies and institutions for defining labour market relations which guarantee social protection. The challenge for policy makers is to find a point of balance between the promotion of a flexible framework for voluntary entrepreneurs and the loss of social protection for the vulnerable group of involuntary self-employed workers within digital platform work, for re-

establishing atypical workers' rights independently of their contractual arrangements and employment status. In this context, policy makers are in need of solid results based on exhaustive empirical analysis on the workforce composition and on the characteristics of the different groups of digital platform workers. Our findings might serve for guiding governments in establishing strategies on digital platform work.

The new availability of microdata on digital platform workers allowed us to investigate self-employed workers in digital platforms. To the best of our knowledge our contribution is novel. However, we cannot completely rule out the possibility that the results are biased to some extent due to data limitations. Identifying the existing heterogeneity within the self-employed workforce is not straightforward, due to data limitations. The two waves of the COLLEEM represent a valuable attempt to provide data on digital platform workers. However, the sample size does not allow the identification of more refined categories within self-employment such as dependent versus independent self-employed, and self-employed with and without employees. Further research is needed to determine whether different taxonomies of self-employed workers provide diverse findings and to this end the availability of ad-hoc modules on digital platform workers in Labour Force surveys is critical. Nevertheless, we believe our paper has made a first and valuable step in revealing the heterogeneity of digital platform workers, on which future research can build further.

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