



# Hybrid Work Patterns: A Latent Class Analysis of Platform Workers in Denmark<sup>1</sup>

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## ABSTRACT

*This paper presents a novel approach for studying differences and similarities among platform workers, by taking into account the wider labor market position of platform workers. Analytically, we seek inspiration from literature on labor market segmentation (SLM) and multiple jobholding (MJH) to nuance the often-dichotomized view of labor markets characterized by SLM theory. By using survey data from a set of additional questions tied to the Danish LFS, we apply latent class analysis models to discover patterns of labor market divisions among platform workers in Denmark. We identify three major groups of platform workers, and while all of them have multiple income sources, they have very different labor market positions in the traditional labor market. We categorize them as 'established workers', 'transitional workers', and 'new labor market entrants'. These divisions point to marked differences among platform workers, implying that platform work is characterized by varying blends of labor market hybridity.*

## KEYWORDS

*Labor platforms / latent class analysis / multiple jobholding / worker segmentation*

## Introduction

The emergence and spread of digitally mediated labor has been addressed as one of the major drivers in transforming the nature of work in the present as well as the future (Berg et al. 2018; Healy et al. 2017). Digital labor platforms such as Uber and Upwork are changing fundamental conceptions of the labor market; work is redefined as 'gigs', employees are often replaced with self-employed, management is governed by algorithms, and social contact is mediated through digital apps (Kovalainen et al. 2019; Vallas & Schor, 2020). What these changes entail for the future of work remains unclear,

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but they are undoubtedly challenging work organization and existing labor market structures. Some have even argued that digital platforms can have disruptive effects on the labor market due to these changes (Danish Disruption Council 2019; Hauben et al. 2020; Urzi Brancati et al. 2019). This is also the case in the Nordic countries, where the first empirical studies of platform work highlight work practices characterized by new forms of flexibility with associated social risks (Jesnes 2019; Oppegaard 2020; Sloth Laursen et al. 2021).

The new digital work arrangements brought about with the platform economy have eased people's opportunities to engage in a multitude of different tasks, combining income from diverse sources. Much labor market literature on digital platforms has predominantly been occupied with the precarious aspects of digital labor, such as low pay, uncertain working hours, and lower levels of social protection (Berg 2016; De Stefano 2016; Vallas & Schor 2020). Platform workers are not covered to the same extent by Danish labor laws and collective agreements as other groups of non-standard workers (Ilsøe & Larsen 2020). However, ample research also indicates that many platform workers rarely depend exclusively on income from platform work, but tend to use platform work as a supplementary income (Ilsøe et al. 2021; Schor et al. 2020; Urzi Brancati et al. 2019). However, the different ways in which platform workers organize labor and income-generating activities across the online and traditional labor market are less researched yet important to better apprehend the dynamics between labor platforms and the future of work.

This paper contributes to the growing body of literature on platform work by examining the interactions between the online and traditional labor market through the lenses of platform workers' various income-generating activities. Our main research question is explorative: what are the typical patterns of combining labor on digital platforms with traditional economic activities?

Our locus of analysis are platform workers in Denmark, as the Danish labor market is often portrayed as having a well-developed social safety net combined with a highly regulated labor market. Denmark thus appears well suited for analyzing the interlinkages between platform work and the traditional labor market. Analytically, we draw on labor market segmentation (SLM) and multiple job holding (MJH) literature (Campion et al. 2020; Conen 2020; Grimshaw et al. 2017; Smith & McBride 2021). By drawing on these strands of literature, we depart from the more dichotomized view of labor markets within much segmentation and MJH literature and seek to nuance the ongoing academic debates. Following these strands of literature, we expect the platform economy to attract groups belonging primarily to the periphery labor market segment, but with some variation among platform workers, as there are multiple reasons for engaging in platform work.

We use survey data from the Danish Labor Force Survey conducted in 2017 and 2019, combined with register data from Statistics Denmark concerning the Danish population's income. Combined, these data provide us with a comprehensive overview of the labor market position of a representative sample of platform workers in Denmark. Methodologically, we apply latent class analysis (LCA) models to uncover patterns of labor market segmentation.

Through our LCA, we find three distinct groups of platform workers with very different labor market positions, and from these findings, we develop new typologies for capturing hybridity between traditional labor market segments and platform work.

Our article thus contributes to the literature on digital platforms with new perspectives on both the heterogeneous workforce and how they interact with the traditional labor market. We specifically illustrate the important, but often underestimated role of the wider traditional labor market and welfare setting for individual platform workers' situation (Schor et al. 2020; Thelen et al. 2018).

The paper is structured as follows. First, we briefly introduce the Nordic and Danish platform economy with an explicit focus on labor platforms. We then develop our analytical concepts through a brief review of contemporary literature on digital labor platforms, labor market segmentation, and hybrid work arrangements. Afterwards, we present the data and methods used, followed by our analysis and results. We conclude with a discussion of our main findings.

## **The Nordic and Danish platform economy and labor platforms**

Digital labor platforms are an emerging phenomenon in the Nordic countries that has garnered increased public and academic attention. Recent figures indicate that although platform work is one of the fastest growing employment forms in the Nordic, it remains marginal on the Nordic labor markets. Between 1% and 2% of the Nordic workforce can be considered platform workers, and these figures are expected to increase in the coming years with the mushrooming of new labor platforms across distinct sectors and occupations (O'Farrell & Montagnier 2020; Piasna et al. 2022; Sutela & Pärnänen 2018).

The Nordic countries are a special case concerning the spread of platform work. The Danish labor market—together with other Nordic labor markets—is often mentioned as an example of a densely regulated labor market with extensive social security provided by both labor market institutions and universal welfare states. This is also the case when it comes to emerging forms of employment like solo self-employment and platform work. However, digital labor platforms often rescind from traditional employer responsibilities, leaving more in the hands of platform workers and subsequently platform workers are often less covered by Nordic social protection schemes, which set different criteria for employees and self-employed (Hotvedt et al. 2020; Jesnes 2019). In fact, platform workers often work in the grey zones between traditional employment and self-employment, and they thus tend to struggle to meet these eligibility criteria, even if Denmark in Nordic comparisons is often considered one of the trendsetters for protecting platform workers within the wider welfare and industrial relations setting (Hotvedt & Alsos 2021; Vandaele 2022). Labor platforms operate in many different submarkets; however, the focus in Denmark has so far been on the development in the service-sector, e.g., food-delivery and cleaning, where the Danish industrial relations model is comparatively weaker (Mailand & Larsen 2018).

### **Digital labor platforms and labor market divisions: An analytical framework**

Developing our analytical concepts, we start from the discussions in the literature on platform work, where we mainly concentrate on the definitions of labor platforms.



We then briefly engage with theories of labor market segmentation as well as seek inspiration from theories and findings on multiple job holding, as these literatures offer concepts that will enable us to better apprehend the hybrid work arrangements of platform workers. While ample research focuses on different aspects of the platform economy, it rarely engages with these interlinkages between platform work and the traditional labor market, which seems increasingly important since platform work tends to be a secondary source of income for most workers.

## Digital labor platforms

There are ample and often ambiguous definitions of digital platforms and the platform economy, but in this paper, we focus rather narrowly on labor platforms defined as digital intermediaries facilitating the exchange of monetary compensation for the provision of labor such as Wolt and Upwork, as opposed to capital platforms like Airbnb (Schor & Attwood-Charles 2017; Vallas & Schor 2020). Thereby, we include work performed online as well as offline; in addition, we focus exclusively on the platform workers performing tasks facilitated through the platforms, and not, e.g., the architects or back-office workers developing and maintaining the platforms. We choose this analytical lens on platform workers, as our object of interest is the relationship between platform work and the traditional labor market. When we distinguish between labor platforms and the traditional labor market, we define the latter as the labor market where there is a direct relation to the employer, which encompasses both standard and non-standard work, but is dominated by the standard employment relationship.

Labor platforms are usually characterized by a few set features, often defining themselves as intermediaries linking platform workers looking for work with customers looking for easy solutions. There are relatively low entry barriers on most platforms and they often offer flexibility to individual platform workers in terms of free choice of hours and work organization (Kovalainen et al. 2019; Vallas & Schor 2020). The platforms operate digitally, meaning that the relationship between customer, worker, and platform is primarily handled through internet applications and mobile devices, often governed by algorithms. They also tend to engage in a fragmentation of the labor processes into smaller tasks or gigs, and platforms will often categorize their workers as independent contractors or solo self-employed, i.e., self-employed without employees (Thelen 2018; Urzi Brancati et al. 2019). Thereby, platform workers often control when and (to some degree) how they want to work, while many platforms (especially those facilitating smaller tasks) maintain power over pricing and work allocation (Vallas & Schor 2020). However, there are significant variations among labor platforms, and multiple studies have developed typologies on different types of digital labor platforms and platform work (Berg et al. 2018; Hauben et al. 2020). Some frequently used distinctions are whether the work is location-based or web-based, whether it entails high- or lower-skilled, the level of autonomy for workers and the duration of work (Howcroft & Bergvall-Kåreborn 2019; Kalleberg & Dunn 2016). Other studies have focused on the differences among platform workers. Urzi Brancati et al. (2019) stress that a majority of platform workers only use platform work as a sporadic or secondary income, while a minority of workers have platform work as their main income. In a similar vein, a study by Schor et al. (2020) finds that workers who only use platform work as a supplemental

income and are not economically dependent upon the platform express considerably higher satisfaction than workers who rely upon income from the platform to pay basic expenses. In the Danish context, platform work is primarily used as a supplementary income (Ilsøe et al. 2021). While we are unable to distinguish between different types of labor platforms or worker satisfaction, we can contribute to this important literature on the interlinkages between platform work and the traditional labor market with a new perspective, by looking at the patterns of hybrid work that platform workers engage in.

## Segmented labor markets

Our main analytical outset is labor market segmentation (SLM) theory, which analytically distinguishes between core and periphery labor market segments according to distinct indicators like labor market status, types of employment forms, skill levels, wages, and working conditions (Atkinson 1987; Doeringer & Piore 1971; Peck 1996). In the SLM developed by Doeringer and Piore (1971), they emphasize the demand-led factors, notably companies' role in the shaping of employment inequalities and thus offers a different perspective to the neoclassical economic understanding that companies adjust their labor supply based on human capital (Leontaridi 1998). Following SLM, different companies tend to develop core and periphery labor markets depending on their needs for specialized knowledge and flexible work as well as adjusting to the shifting economic cycles and technological advancements (Doeringer & Piore 1971; Rosenberg 1987). The core labor market is characterized by high wages, stable employment, and opportunities for career advancement for a core group of employees (Grimshaw et al. 2017). In contrast, the periphery labor market is characterized by low wages, unstable employment, and missing career opportunities (Doeringer & Piore 1971). As such, there will over time evolve distinct labor market segments with sharp demarcations between the different segments and this in turn limit labor market mobility between segments, and, for example, standard and non-standard employment (Kalleberg 2011; Rosenberg 1987). More recent research utilizing SLM theory emphasize increasingly supply-led factors, illustrating that individual worker characteristics such as gender, age, skills, financial situation, and other jobs also influence labor market segmentation, where individuals tend to join different segments based on their bargaining power (Palier & Thelen 2010; Rubery & Piasna 2017). In this context, much segmentation literature use employment stability as an indicator of core and periphery, which tend to be portrayed as standard vis-a-vis non-standard employment (e.g., temporary and part-time work) (Lukac et al. 2019; Seo 2021; Yoon & Chung 2016). Likewise, educational level is an important indicator in much segmentation literature, as high-skilled and low-skilled workers are generally understood to be in different segments of the labor market (Kalleberg 2011; Leontaridi 1998). Age is another important differentiator concerning labor market position, as young people are less likely to be in standard employment and more likely to experience shifts in their occupational status and find better employment as they age (Doeringer & Piore 1971).

Although there is a common conception of the existence of a core and periphery labor market segment, including their general characteristics within the SLM literature, there is no scholarly consensus on how to delineate labor market segments or how to assess the precise number of segments (Leontaridi 1998). Instead, SLM often functions



as an umbrella term for a broader polarization or dualization trends of employment structures that may relatively be less prominent in the Nordic countries, yet still noticeable (Boje 1986; Palier & Thelen 2010; Rasmussen et al. 2019). The segmentation literature thus provides us with an analytical lens for understanding the development and structuring of platform labor as a new labor market segment.

In this broader context, studies on labor platforms often portray platform workers as another periphery segment characterized by low pay and insecure employment with limited career prospects, as platforms often operate on the fringes of the regulated labor market (Berg et al. 2018; De Stefano 2016; Kalleberg and Vallas 2018). Following this literature, platform work with its fewer entry barriers, low pay, and often insecure and low skilled work compared to the traditional labor market is expected to attract certain groups sharing characteristics with other non-standard workers and thus add yet another layer of segmentation due to limited mobility between the core and the periphery segments. Therefore, we expect that labor platforms primarily attract workers from the periphery segment in the traditional labor market, when looking at individual characteristics like income, education, labor market status, and age.

### Hybrid work and multiple jobholding

To analyze the complex income arrangements of platform workers, we draw on theories and findings on hybrid work and multiple jobholding (Campion et al. 2020; Conen 2020; Smith & McBride 2021). Most studies on hybrid work arrangements focus on *multiple jobholding*, which Champion et al. (2020: 170) define as ‘the act of working more than one job simultaneously, including working for employers and self-employment, wherein all tasks, or sets of tasks, are performed in exchange for, or expectation of, compensation’. However, ample research has also looked beyond the focus on jobs, and included different types of income such as student allowances, unemployment benefits, and social assistance (Carter et al. 2004; Kibria 1994). Studies on labor platforms also indicate that platform workers often combine income sources from other than just primary and secondary employment (Piasna et al. 2022; Schor et al. 2020; Urzi Brancati et al. 2019). This distinction between multiple jobs or other income sources offers thus a perspective that moves beyond the usual approach within much segmentation literature that posit limited mobility between distinct segments. The concepts of hybrid work and MJH assume that individuals combining multiple income/jobs are active in distinct segments such as the digital platform economy and the traditional labor market, where they may have income from various sources such as other jobs, unemployment benefits, or other forms of social security. Thereby, these strands of literature provide us with ways to capture the interlinkages and possible bridges between distinct segments such as the digital platform and the traditional labor market, even if such research also adopts the notion of primary and secondary jobs.

Studies on motives behind MJH are often grouped into one of two broad categories ‘financial necessities’ (i.e., individuals are *pushed* into MJH for financial reasons) or ‘boosting preferred job portfolios’ (i.e., *pull* factors, where MJH is for personal or professional fulfilment) (Campion et al. 2020; Conen 2020). Grounded in the MJH literature, we would thus expect multiple drivers of mobility among platform workers, but we here focus on the role of income and employment in the traditional labor market for

people active in the online labor market. Ample research stresses that low and insecure earnings from individual's primary income source tend to be an important driver for people taking on additional jobs or gigs, even at a lower wage and thus point to close ties between people's engagement with platform work and the traditional labor market (Hirsch 2016; Ilsøe & Larsen 2020; Schor et al. 2020). Therefore, annual income from non-platform sources is a crucial indicator for measuring labor market divisions among platform workers. Drawing on these insights, we use the concept of hybrid work to explore segmentation at the nexus between the digital platform and the traditional labor market, which also allow us to broaden our analytical focus from purely employment relations to the wider economic activity of individuals. From this literature, we expect to observe platform workers working across multiple labor market segments due to multiple drivers of mobility.

### **Our analytical framework**

Contributing to the academic debates on platform work, we offer a perspective that departs from the often more dichotomized view of labor markets characterized by much literature on SLM, MJH, and platform work. We explore if the common notion within much segmentation, MJH, and platform literature that the labor market is divided into distinct segments comprised of a core and periphery or good and bad jobs/gigs may explain differences among platform workers based on their employment status in the traditional labor market. From the literature reviewed above, we expect from SLM that 1) platform workers belong primarily to a periphery labor market segment due to the comparatively lower levels of regulation in the platform economy; and 2) we expect, following the MJH theory of multiple drivers of mobility, some heterogeneity among platform workers. The platform economy may attract distinct labor market groups ranging from those with low and insecure earnings to those with other reasons than financial. We thus expect to see patterns of labor market division among platform workers following individual characteristics like income, education, labor market status, and age.

### **Research design, data, and used methods**

#### **The Danish Labor Force Survey and platform work**

This paper uses data from the Danish Labor Force Survey (LFS) of 2017 and 2019, where added questions regarding activity on digital platforms were introduced. The LFS is conducted every year, and its size and scope make it particularly useful for our endeavor, as it provides a comprehensive overview of the labor market position of a representative sample of the working age population in Denmark, which covers the ages of 15–74 years. In the first quarter of both 2017 and 2019, participants in the LFS were asked if they during the last 12 months had generated income by performing work done through websites or apps. In Q1 2017, there was a response rate of 52% with 18,043 Danes participating in the survey, and in Q1 2019, there was a response rate of 56% with 18,583 respondents. Around 1% of the respondents in both 2017 and 2019 answered yes, to whether they had generated income by performing work tasks



on digital platforms, and this group is the basis of our analysis. The large size of the survey makes it ideal for measuring the labor market demographics of the relatively small group of platform workers in Denmark. However, the small number of platform workers also set some limitations on the level of detail in our analysis. This trade-off between the LFS providing representative samples and comparability with general labor market statistics, but small absolute numbers of platform workers are one of the difficulties in measuring platform labor (O’Farrell & Montagnier 2020; Piasna et al. 2022). In compliance with Statistics Denmark’s guidelines on reporting results from the LFS, all results are weighted (Statistics Denmark 2012). We choose to pool the platform workers from the 2017 and 2019 survey in order to increase the sample size for the analysis.

The subject of our analysis is platform workers irrespective of their employment status in the traditional labor market, i.e., employed, unemployed, or outside the labor force. This also means that our locus of analysis varies slightly from a traditional labor market perspective, as we are not only interested in combinations of traditional and digital work, but also want to capture supply-side variations among platform workers, irrespective of their employment status in the traditional labor market. We use the term hybrid work to capture this heterogeneity, which entails that we broaden our analysis to include not only the traditionally employed population as is often the case in much labor market research, but we also include students, pensioners, and unemployed, who are also active on labor platforms, but not necessarily active in the traditional labor market.

### Who are the platform workers?

In Table 1, we present how the platform workers compare to the employed Danish population in 2019 on central demographic and labor market characteristics covered in the LFS, combined with register data on annual income. We categorize ‘Main labor market status’ as *Standard employment*, *Non-standard employment*, *Student*, and *Other*. Standard employment are individuals on an open-ended position and working more than 30 hours weekly in the traditional labor market. Non-standard employment is defined as individuals whose main status is employment, but other than standard employment in the traditional labor market. This covers temporary workers, part-time workers, and solo self-employed. The *Other* group is composed of retirees, permanently disabled and unemployed, and were merged into one group due to too few observations in each of these groups to treat them individually, but at the same time, they represent a small, although relevant part of the labor platform workforce. They share similar characteristics in that they have all been active on a labor platform, but are inactive in the traditional labor market.

From the results in Table 1, we see that the Danish platform workers are quite similar to the general employed population concerning gender and ethnicity, but vary on other key characteristics. There is also a quite large heterogeneity among platform workers themselves. While platform workers are generally younger and more often students than the employed population, we find a large group of platform workers aged 40 years+. In addition, platform workers are less likely to be in standard employment within the traditional labor market and their total annual income tends to be in the lower end (Table 1). Yet, among the platform workers, one-third are also standard



**Table 1** Descriptive statistics comparing platform workers and the general employed Danish population, ages 15–74 years

	Platform workers		Employed population, 2019	
	Frequency	Percent	Frequency	Percent
<b>Gender</b>				
Male	47,000	56%	1,522,000	53%
Female	37,000	44%	1,346,000	47%
<b>Ethnicity</b>				
Danish	68,000	81%	2,471,000	86%
Non-Danish	16,000	19%	644,000	14%
<b>Age</b>				
15–25	31,000	37%	471,000	16%
26–39	25,000	29%	807,000	28%
40–74	29,000	34%	1,591,000	55%
<b>Main labor market status</b>				
Standard employment	29,000	34%	2,013,000	70%
Non-standard employment (excl. Student and Other)	18,000	22%	526,000	18%
Student	27,000	32%	256,000	9%
Other (unemployed, retired, disabled)	11,000	13%	74,000	3%
<b>Educational level</b>				
Primary education	26,000	31%	602,000	21%
Upper secondary + vocational training	34,000	40%	1,200,000	42%
Tertiary education	25,000	29%	1,066,000	37%
<b>Annual income</b>				
<150,000 DKK	37,000	44%	417,000	15%
150,000–300,000 DKK	18,000	21%	577,000	20%
>300,000 DKK	30,000	35%	1,874,000	65%
<b>Observations N (weighted data)</b>	<b>84,000</b>		<b>2,869,000</b>	

employed, as defined by their relation to the traditional labor market, and 35% earn more than 300,000 DKK annually, in comparison the Danish median income is ca. 250,000 DKK. In most cases, platform workers are viewed as self-employed, and it is therefore their own responsibility to report earnings from platform work to the public authorities. However, screenings performed by the Danish tax authorities suggest that workers on labor platforms misreport their earnings in 95–99% of the cases (Fink & Ettrup 2019). We therefore regard these platform workers as multiple income earners, since the income from platform work is most likely not a part of their registered income and therefore not included in the annual income described in Table 1.



## Method: Latent class analysis

When we look at the descriptive statistics, our results echo other platform studies (Piasna et al. 2022). However, there are also significant differences among the platform workers, and these differences tend to get lost in quantitative research studies. In studies using variable-centered approaches like regression analysis, focus is often on the relationship between variables in an assumed single population where differences are averaged out (Howard & Hoffman 2018). With such an approach, we would, for example, compare the average platform worker to the average standard-employed on a parameter of interest. However, both qualitative and quantitative platform studies indicate that platform workers are not a single population. We therefore argue for the use of a person-centered approach, where instead of comparing averages, we turn to differences within the population (Howard & Hoffman 2018). A person-centered approach is useful to determine if different subgroups of platform workers exist, and to describe the differences among them according to given characteristics.

In this case, we use LCA as a method to identify subgroups based on distinct labor market characteristics. LCA is a latent variable model, which means that it presupposes a latent, unobserved variable that is estimated through observed indicator variables (Collins & Lanza 2009). In LCA, both the latent variable and the indicator variables are treated as categorical, as opposed to cluster analysis that takes continuous variables as input. LCA uses maximum likelihood estimation to assign individuals to classes based on their response patterns on the observed variables. In other words, we estimate the probability function that is most likely to have caused the response patterns we observe in our data. All data-work was done in Stata, and we implemented LCA using the Stata Plugin developed by Lanza et al. (2018).

LCA has been applied in different ways to derive labor market groupings. Van Aerden et al. (2014) used LCA to develop a typology of employment arrangements in the European Labor Force, and both Yoon & Chung (2016) as well as Lukac et al. (2019) have measured segmentation patterns in the labor market using LCA. While these studies have shown the value of LCA in studying the complexity of labor market segmentation, their focus is entirely on individuals active on the traditional labor market. As several studies have established, digital platform workers are often multiple-jobholders or using platform work to supplement their income from outside the labor market (Schor et al. 2020; Urzi Brancati et al. 2019). In Denmark, recent studies indicate that hardly any individuals have platform work as their main source of income, and the majority of platform workers earn less than 25,000 DKK annually (Ilsøe et al. 2021).

To grasp the hybrid work arrangements that platform workers engage in, we widen our lens from purely labor market characteristics, to focus on more general work-life characteristics. This means that instead of looking at, i.e., wages and occupational class, we include annual income, attained educational level, labor market status, as well as age. We selected these variables, as they relate to the supply side factors of the labor market, that is, the characteristics of platform workers. Annual income is a central indicator of economic security, which is an important aspect of both multiple jobholding and segmentation literature. Educational level reflects the skill level of the workers, and unlike occupational class that only holds information for the currently employed, educational level is a meaningful measure for both platform workers employed and unemployed in the traditional labor market. We also include primary labor market status, where we

distinguish between standard employment and non-standard employment as well as students and others outside the labor market. Lastly, we include age as an important aspect of the work life, since young people in general are more likely to experience employment instability and shifts. By focusing on the platform workers and the supply side perspective, we also complement the varied literature developing platform typologies based on the demand side, e.g., gig-platforms vs. freelance platforms.

## Model selection

We use latent classes as an analytic tool for representing the heterogeneity among platform workers across the dimensions of age, labor market status, educational level, and annual income. This does not mean that the classes found in this model are representative for all individuals in the population, but it allows us to conceptualize different segments of platform workers based on empirical observations.

Each latent class model was run with 100 randomly chosen starting values for the maximum-likelihood estimation. The two and three-latent-class models were clearly identified and converged to the same mathematical solution in 95–100% of the cases. The four and five-latent-class models converged at the same solution in 16% and 8%, respectively, of the cases, indicating under-identification issues, i.e., the information in the data becomes scarce compared to the amount of parameters estimated (Collins & Lanza 2009).

Once identified, there are no clear guidelines in the literature for assessing the best fit of a latent class model (Weller et al. 2020). While there is no agreement on the best way to determine the correct latent class solution, there are some common approaches. The preferred process in most LCA studies is a combination of using information criteria and model interpretability when choosing the optimal solution (Collins & Lanza 2009; Weller et al. 2020). The most commonly used information criterion is the Bayesian Information Criterion (BIC), which is used to assess the relative model fit and where lower values indicate a better solution. When evaluating the different latent-class models, we also referred to model parsimony and interpretability by looking at homogeneity *inside* the classes, and separation *between* the classes (Collins & Lanza 2009). Homogeneity means that the item-response probabilities are relatively close to zero or one, indicating intra-class uniformity, as individuals in each group are likely to have the same response-patterns. Latent-class separation is observed in the way that classes are distinctively characterized by the response probability outcomes, i.e., none of the classes have similar profiles.

Table 2 presents summary information for the various model-fit statistics we used in evaluating and choosing a latent class model.

**Table 2** Summary information for choosing latent class model

No. of classes	AIC	BIC	Adj. BIC	L2	d.f.	Entropy sq.	Pct. of seeds associated with best fitted model
1 class	594	629	601	-1629	98	1	100%
2 class	247	321	261	-1446	88	0.85	100%
<b>3 class</b>	<b>207</b>	<b>320</b>	<b>228</b>	<b>-1416</b>	<b>78</b>	<b>0.77</b>	<b>95%</b>
4 class	204	355	232	-1404	68	0.81	16%
5 class	196	387	231	-1391	58	0.82	8%

We find that the three-class model represents the best solution in this case, as it has the lowest BIC value of all models. This model also has the highest degree of interpretability while maintaining parsimony, as we observe both homogeneity and clear latent-class separation. While assessing our latent class models, we compared the chosen three-class solution with the two and four latent-class solutions (see appendix). In the two-class solution, we see that the response probabilities in both classes are generally lower than in the three-class solution, indicating a lower degree of homogeneity inside the groups and making them less distinct. We interpret this as the three-class solution adding substantial interpretive power to the analysis. In the four-class solution, we note that two of the classes are very similar on three of our four indicators, showing low class separation. Therefore, we determine that the four-class solution does not add enough extra analytic power weighed up against model parsimony. Summing up, we find that the three-class solution is optimal based both on statistical indicators like the BIC, and on interpretability, and we see three clearly distinct groups of platform workers on the Danish labor market, which we will present in the next section.

## Results: Patterns of hybridity among three classes of platform workers

We will now present the results from the three-latent-class model that we found best represented the patterns of labor market division among the platform workers in our data. Table 3 presents the item response probabilities conditional on latent-class membership for the four indicator variables used in the model. These values can be understood as the probability of an individual in a given class to express a certain characteristic. Based on the included set of variables in the LCA, we have coined the three classes that we find as *New labor market entrants* (younger students), *Established workers* (high-income, full-time employed), and *Transitional workers* (low-income, low employment security); they each represent approximately one-third of the respondents. We will now present each group in more detail.

The *new labor market entrants* are characterized by a high probability of young people aged 25 years or younger (91%) and they are most likely students (77%). This group also tends to have primary education as their highest attained educational level (65%), and their annual income is typically below 150,000 DKK (99%). We have chosen to label this group as *new labor market entrants* primarily due to their age and employment status. These variables indicate that this group are in a phase of their life cycle, where they have just entered the labor market and they will most likely shift labor market position later in their career, as we know that young people tend to be highly mobile (Sloth Laursen et al. 2021). These findings are, however, not surprising, as young people with limited career trajectories tend to be overrepresented among other groups of non-standard workers and thus the so-called periphery segment on the labor market according to much segmentation and platform studies, as well as in line with our expectations (Berg 2016; Healy et al. 2017; Pesole et al. 2018).

The *established workers* are characterized by a high probability of being in standard employment (80%), they are most likely to have an annual income above 300,000 DKK (90%), they are substantially older than the other two classes with a 56% probability of being 40–74 years old, and they have a relatively high probability of having completed

tertiary education (55%). Their relatively high income and employment in permanent, full-time positions as well as their age and educational level points to this class being established on the traditional labor market, which is why we have chosen to label them as *established workers*. This group is perhaps the most surprising to find on digital labor platforms. In traditional labor market segmentation theory, they would likely be considered as part of the core segment, and we could expect that this group is primarily active on high-skilled platforms. This is interesting, and not as expected from the literature, since they seem to be established in a core labor market segment, but they also have one foot in the platform economy, indicating some kind of mobility among this group.

The last class, the *transitional workers*, is not as clearly defined as the previous two classes. While these workers are characterized by some degree of heterogeneity, they do have a substantially higher probability of being in non-standard employment (31%) and having employment status *Other* (32%), which is comprised of different groups outside the labor market (unemployed, pensioners, etc.) compared to the other two classes. They are also very unlikely to have an annual income above 300,000 DKK (7%), which distinguishes them very clearly from the established workers. Considering the generally low income and insecure employment often associated with non-standard work, we have chosen to label this class as *transitional workers*. They share a number of features for

**Table 3** LCA results for three-class model

	<b>Established workers</b>	<b>Labor market entrants</b>	<b>Transitional workers</b>
Latent class prevalence	0.36	0.30	0.34
Item responses	Response probabilities conditional on class		
<b>Age</b>			
15–25	0.05	0.91	0.22
26–39	0.39	0.00	0.44
40–74	0.56	0.09	0.34
<b>Labor market status</b>			
Standard employment	0.80	0.03	0.12
Non-standard employment	0.14	0.19	0.31
Student	0.00	0.77	0.25
Other (unemployed, retired, disabled)	0.05	0.00	0.32
<b>Educational level</b>			
Primary education	0.13	0.65	0.34
Upper secondary + vocational training	0.32	0.34	0.42
Tertiary education	0.55	0.01	0.25
<b>Annual income</b>			
<150,000 DKK	0.00	0.99	0.51
150,000–300,000 DKK	0.09	0.00	0.42
>300,000 DKK	0.90	0.01	0.07



groups typically belonging to periphery segment characterized by insecure employment, low pay, and non-standard work. In fact, their low income, age, and small probability of being in standard employment indicate that this group, in line with our expectations, is probably closest to how platform workers are often portrayed within the literature. However, we also see some degree of sideways mobility within the periphery segment on the labor market, i.e., between the traditional and the online labor market.

To check the internal validity of our results, we have calculated the average latent class posterior probability (Weller et al. 2020). This is a way to assess the latent class model's risk of misclassification of individuals between classes. There is no standard for what is considered ideal values, but an average closer to one indicates high certainty of class membership. Some researchers have suggested using values above 0.8 as an acceptable cut-off (Weller et al. 2020). The results from our calculations are portrayed in Table 4. Here, we see that the individuals who are classified as *established workers* have on average a 94% probability of belonging to this class, and a 6% probability of belonging to the *transitional workers*. Interestingly, there is no overlap between the *established workers* and the *labor market entrants*. These two classes are very clearly distinct. It is only the *transitional workers* where there is, on average, a small probability of belonging to either of the other two classes.

**Table 4** Average latent class posterior probability

	<b>Established workers</b>	<b>Labor market entrants</b>	<b>Transitional workers</b>
Established workers	<b>0.94</b>	0.00	0.06
Labor market entrants	0.00	<b>0.90</b>	0.10
Transitional workers	0.05	0.09	<b>0.86</b>

These findings support our understanding of this class as *transitional workers*; in some aspects, a few of them may resemble the new labor market entrants, and a few may be a bit closer to the established workers. However, overall, the average latent class posterior probabilities in our model are close to one indicating a low classification error.

Additionally in furthering our understanding of the three groups, we have also examined their gender and ethnicity composition, as these are commonly used indicators in both platform and labor market studies. Table 5 depicts the proportion of individuals in each latent class who are respectively male and of Danish ethnicity. Here, we see that the established workers are predominantly men and of Danish ethnicity, while among the transitional workers, only two-thirds are of Danish ethnicity. The new labor market entrants is the only class with a majority of women. As such, we see some very clear gender and ethnic differences among our three classes that resemble what we may have expected from the literature. Women and ethnic minorities are often reported as being more vulnerable with higher risks of low income and employment instability (Fiadzo et al. 2020). This corresponds well with our findings, where especially the transitional workers have a substantially higher degree of non-Danish ethnicity. These results support the claim that our latent-class model is able to distinguish labor divisions among platform workers.

**Table 5** Gender and ethnicity

	<b>Established workers</b>	<b>Labor market entrants</b>	<b>Transitional workers</b>
Male	0.69	0.39	0.57
Danish ethnicity	0.91	0.81	0.67

## Discussion and conclusion

Most platform studies examine the platform economy often with limited consideration for the wider labor market and welfare setting and may thus overlook important aspects influencing individual platform workers' situation (Vallas & Schor 2020). The research aim of this paper has been to contribute to the growing body of literature on platform work by exploring the typical patterns of individuals combining activities in the online and the traditional labor market. Drawing on the notion within much segmentation theory of a dichotomized labor market comprised of a core and periphery segment, we expected platform workers to belong primarily to a periphery labor market segment. Supplementing this perspective, we introduced MJH theory leading to the assumption that there would be some variation among the platform workers due to multiple drivers of mobility. To explore empirically these assumptions, we draw on two large-scale representative cross-sectional surveys and apply LCA to uncover such potential patterns of segmentation. Three main aspects are emphasized in our discussion of our results and the used method.

*Methodologically*, recent studies have increasingly applied LCA to explore segmentation as a multidimensional phenomenon (Lukac et al. 2019; Seo 2021; Yoon & Chung 2016). Inspired by this work, we apply LCA to explore the often-dichotomized view of the labor market into core and periphery labor markets as well as uncover patterns of segmentation at the nexus of the online and traditional labor markets. LCA thus provides useful insights in our case, as it is designed for determining heterogeneous response patterns across different indicators (Collins & Lanza 2009). This allows us to identify commonalities between individuals, and differences between groups in large datasets. We find that this sensitivity toward heterogeneity is important for understanding platform workers as a more complex group than just yet another group of periphery or non-standard workers. Nonetheless, it should be mentioned that LCA is a data-reduction method, and so, there will be finer differences among platform workers that we cannot capture with this method; however, we still find LCA to be a valuable heuristic tool for generalizing different types of platform workers.

### Novel typologies for capturing the heterogeneity among platform workers

The results from our analysis demonstrate marked differences among platform workers with varying blends of hybridity than often assumed in much platform and segmentation literature (Jesnes 2019; Schor et al. 2020; Vallas & Kalleberg 2020). We identify three clearly distinct groups of platform workers that we categorize as 'established workers',



‘transitional workers’, and ‘new labor market entrants’, respectively. The group labeled *established workers* are characterized by combining platform work with often high-skilled and well-paid full-time permanent jobs in the conventional labor market. They also tend to be middle-aged men of Danish origin and thus share many of the features often considered as core workers in much platform and segmentation literature (Atkinson 1987; Berg 2016; Rubery 2015). Although these groups could be expected to be primarily active on high skilled labor platforms, the presence of a large group of established workers on the Danish labor market engaging in platform work is interesting, notably due to the broad assumptions within the literature, which we also expressed. Platform work is often considered just another layer of a periphery segment within the labor market, which our findings question as we find online activities even among high skilled and well-paid workers (Jesnes 2019; Vallas & Kalleberg 2020). There are some limitations to have in mind when interpreting these results. The analysis is based on a relatively small, but representative sample of platform workers surveyed in 2017 and 2019. The sample size of our population of platform workers reduces the granularity with which we can describe the three classes, and there may be internal differences that our model does not capture. Likewise, the platform economy is flexible by nature and the relative sizes of the different types of platform workers may thus change over time.

The two groups—*transitional workers* and *new labor market entrants*—differ from the *established workers* on several parameters and they share similar features with the groups that are often overrepresented in the so-called periphery labor market segment (Atkinson 1987; Healy et al. 2017). Platform workers belonging to the group of *new labor market entrants* are typically young people and students with few educational credentials and low income, typically in the form of student allowances or student jobs in the traditional labor market. Unlike new labor market entrants, the group of *transitional workers* appear more heterogeneous, but with a higher degree of platform workers that are aged 25+ years with low paid non-standard jobs or without a job in the traditional labor market. These findings suggest that while the new labor market entrants may be in a phase of their career, where they are most likely to shift labor market position, this may only apply to some within the group of transitional workers. Unemployed, retirees, and other groups outside the labor force are overrepresented among this group, and for some, platform work could appear to be a stepping-stone into paid employment, while others may experience the vicious circle of combining distinct forms of low paid non-standard work across different periphery segments, i.e., the online and traditional labor market. The presence of both groups of *labor market entrants* and *transitional workers* is in line with expectations from the literature. In further research, it could be interesting to explore the differences between distinct groups often operating on the outskirts of the labor market such as the unemployed looking for labor market re-entry and other groups such as retirees not necessarily seeking to re-enter, but primarily seeking to exit slowly the labor market. Such analyses may display important differences as to these individual groups’ motives to engage in platform work as well as the role of platform work for their employability in the traditional labor market.

It has been suggested that platform work holds the potential for individuals to bridge segments and it could potentially lead to upward mobility for some groups, as it offers a leeway into the labor market (Healy et al. 2017). This is supported by the fact that the three groups identified within our data question the common notion of limited mobility between segments within much segmentation literature (Rubery & Piasna



2017). We identify examples of individuals active across distinct core and periphery segments where some combine platform work with a relatively high income and standard employment in the traditional labor market. Others combine mainly low paid and non-standard jobs in both the online and traditional labor market and thus appear to be shifting sideways between distinct periphery segments on the labor market. Therefore, we see a slightly different form of mobility than what is usually considered within much segmentation and MHJ literature (Grimshaw et al. 2017; Hirsch 2016). This calls for further research into the career trajectories of these groups. It seems especially pertinent to understand how they develop over time. Do we see certain ‘recruitment paths’ into platform work for the different groups, and how do their labor market experiences outside the platform develop over time? The existence of three distinct groups of platform workers suggests that labor platforms are associated with a higher degree of mobility, but we need to apply a longitudinal employment perspective to understand these dynamics genuinely.

### **Interlinkages between platform work and the traditional labor market**

Our analysis illustrates the important, but often underestimated role of the wider traditional labor market and welfare setting when analyzing the platform economy (Schor et al. 2020). In Denmark, most platform workers combine their online activities with alternative income, typical paid work in the traditional labor market, findings that corroborate with other comparative research (Pesole et al. 2018; Sloth Laursen et al. 2021). In fact, our results also indicate that divisions in the traditional labor market are important when analyzing the platform economy and trying to understand platform workers. Labor market segmentation theory is usually applied in a dichotomous way with a sharp demarcation between periphery and core with limited mobility between the segments, and most of the literature on platform workers can be argued to consider them as part of the periphery (Atkinson et al. 1987; Vallas & Kalleberg 2020). By widening the analysis of platform workers to include the different types of hybrid work they engage in, we find a more nuanced view of individuals on labor platforms. Our analyses point to distinct segments of workers with different labor market positions, where some groups, especially those belonging to the category of *established workers*, appear more protected against the associated risks of low pay, uncertain hours, and job insecurities when operating in the less regulated online labor market. Their often well-paid and high skilled permanent jobs in the traditional labor market offer a sort of buffer against such insecurities, while their peers combining platform work with non-standard employment or other income sources like unemployment benefits in the traditional labor market appear less protected. They may not only struggle to qualify for social protection, but they also risk to exhaust their rights due to the various eligibility criteria often associated with social benefits, aspects that are also emphasized in other studies on platform work, MJH, and non-standard work (Conen et al. 2021; Hotvedt et al. 2020; Thelen et al. 2018). Therefore, the interlinkages between the online and traditional labor market, notably the variations in the hybridity and blends of mobility among platform workers, may have crucial implications for policy development and call for further studies that systematically engage with the dynamics between the digital platform economy and the wider traditional labor market and welfare setting.

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## Appendix

### AI Latent class model with two classes

	Class 1	Class 2
Class membership	0.57	0.43
Item responses	Response probabilities conditional on class	
<b>Age</b>		
15–25	0.60	0.05
26–39	0.21	0.41
40–74	0.19	0.54
<b>Employment status</b>		
Standard employment	0.05	0.73
Non-standard employment	0.25	0.17
Student	0.54	0.01
Other	0.15	0.09
<b>Educational level</b>		
Primary education	0.43	0.14
Upper secondary + vocational training	0.44	0.34
Tertiary education	0.12	0.52
<b>Annual income</b>		
<150,000 DKK	0.75	0.02
150,000–300,000 DKK	0.23	0.19
>300,000 DKK	0.02	0.79

**A2** Latent class model with four classes

	<b>Class 1</b>	<b>Class 2</b>	<b>Class 3</b>	<b>Class 4</b>
Class membership	0.28	0.37	0.18	0.18
Item responses	Response probabilities conditional on class			
<b>Age</b>				
15–25	0.11	0.05	0.91	0.85
26–39	0.53	0.39	0	0.01
40–74	0.36	0.56	0.09	0.13
<b>Employment status</b>				
Standard employment	0.12	0.80	0.03	0.07
Non-standard employment	0.30	0.14	0.11	0.33
Student	0.23	0.00	0.85	0.55
Other	0.35	0.05	0.01	0.05
<b>Educational level</b>				
Primary education	0.40	0.13	0.81	0.01
Upper secondary + vocational training	0.35	0.32	0.19	0.84
Tertiary education	0.25	0.55	0	0.14
<b>Annual income</b>				
<150,000 DKK	0.52	0.00	1	0.64
150,000–300,000 DKK	0.42	0.10	0	0.33
>300,000 DKK	0.06	0.90	0.00	0.03