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Regulated Dependence: Platform Workers' Responses to New Forms of Organizing

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ABSTRACT Platform economy organizations often resolve fundamental organizing problems with novel solutions, thereby transforming their relationship with core stakeholders including regulators and workers. Despite the integral role played by platform workers, research on the interplay between platforms and regulatory conditions has yet to take workers into consideration. We investigate how Uber drivers engage with novel forms of organizing across different regulatory structures. Drawing on insights from resource dependence theory, we conduct a topic modeling analysis of drivers' online forum posts and a complementary qualitative analysis of triangulated data sources. Our findings reveal that workers do not always succumb to organizing solutions imposed upon them; they also actively oppose or supplement them. Importantly, platform workers' responses vary with the local regulatory structure, which affects the mutual dependency and balance of power between platforms and workers. We discuss implications for the literature on new forms of organizing and the platform economy.

Keywords: new forms of organizing, platform economy, regulations, resource dependence, Uber, workers

INTRODUCTION

Platform economy organizations rely on digital technologies to solve fundamental organizing problems in novel ways (Puranam et al., 2014; Reischauer and Mair, 2018). These new forms of organizing have enabled the rapid growth of the platform economy across various sectors (Parker et al., 2016; Sundararajan, 2016), but have also incited waves of criticism and fresh regulatory initiatives intended to curb platforms' activities (Cornelissen and Cholakova, 2019; Hinings et al., 2018; Tzur, 2019). Companies such

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as Uber and Airbnb are now subject to a host of targeted regulations that vary across countries, regions and cities, forcing these platforms to craft vastly different market penetration strategies based on local regulatory conditions (Uzunca et al., 2018).

Although there is much insight to be gained from the literature on the interplay between platform organizing and regulatory measures (e.g., Mair and Reischauer, 2017; Uzunca et al., 2018), so far, research has failed to adequately incorporate the perspective of a key organizational constituent: platform workers. Given that value creation in the platform economy depends on this massive pool of independent contractors, who can be mobilized on demand (Davis, 2016), this omission is consequential. For example, if 'the greatest threat to ride-hailing is the classification of drivers as employees' (Baron, 2018, p. 453), then not accounting for the drivers' points of view and any latent incentive they have to pursue legal action will limit even the most competent analysis of Uber's strategic response to regulations (e.g., Baron, 2018; Uzunca et al., 2018). Put differently, research into the platform economy requires a multilateral approach that encompasses the workers, who are caught in this interplay between platform organizations and regulations. Thus, the present study seeks to answer the questions: *How and why do workers respond to new forms of organizing in the platform economy across different regulatory environments*?

We focus on Uber drivers' perspectives on the prevailing form of organizing in the platform economy: the online and often mobile systems that connect buyers and sellers for the sake of creating shareholder value, also referred to as 'platform capitalism' (Davis, 2016). For the purposes of this paper, we narrow down the definition of the platform economy to an online marketplace for the exchange of services, also known as the on-demand economy (Frenken and Schor, 2017). From uberpeople.net – the most widely-used independent forum for Uber drivers – we draw 36,531 forum posts made between April 2014 and February 2017 to inform our structural topic modeling analysis (Blei, 2012). Discussions on online forums are valuable sources of insight into workers' experiences (e.g., Barros, 2014) as vocabularies used can reveal perceptions and meaning structures (Hannigan et al., 2019; Kaplan and Vakili, 2015; Loewenstein et al., 2012) as well as inform and transform institutions (Cornelissen et al., 2015). We zoom in on 12 US and one European city, scrutinizing regulatory differences between them (Tzur, 2019). Subsequently, we triangulate our forum data with blog posts gleaned from Uber's official website, newspaper articles, court cases, legislations and interviews with Uber's senior representatives, to compare workers' responses under different regulatory structures and analyse these responses over time.

We find that platform workers can actively oppose and supplement the platform's solutions to fundamental organizing problems such as information provision, reward provision and task allocation. Crucially, we find that Uber drivers' responses vary according to the regulatory environment. Under 'direct' regulatory structures (e.g., in New York City), where stricter regulations on all parties are imposed, drivers supplement Uber's organizing solutions more relative to drivers in 'indirect' regulatory structures (e.g., in San Francisco), which offer platform owners more discretion. In the former, drivers provide task-related information to one another, organize meetings and share advice, in this way 'filling in the gaps' where Uber's organizing solutions are unavailable or deemed insufficient. In the latter, the drivers are increasingly opposing Uber's organizing solutions and openly expressing dissatisfaction related to wage insecurity and ratings, compensation

and task allocation schemes. These patterns are further supported by an analysis of changes in regulations and drivers' responses over time. Using resource dependence theory as a lens (Casciaro and Piskorski, 2005; Pfeffer and Salancik, 1978), we explain these patterns and reveal how direct regulation implies more mutual dependence, while indirect regulation accentuates the power imbalance between Uber and its drivers.

This study makes two key contributions. For the literature on new forms of organizing, we show that workers not only evaluate and oppose organizing solutions, but also supplement solutions to fill 'organizing voids'. We provide much-needed detail about the specific topics that drivers oppose and supplement. This will serve to build stronger connections between the organizational design literature on forms of organizing (e.g., Puranam et al., 2014) and platform economy research (e.g., Frenken and Schor, 2017; Hinings et al., 2018). Second, we contribute to the platform economy literature by showing how regulations affect the ways workers respond to a new form of organizing, thereby complementing prior research demonstrating platform owners' responsiveness to local regulations (Uzunca et al., 2018). Our findings explain the central role regulations play in shaping the mutual dependence and power dynamics between workers and platforms and thereby we discern several important trajectories for future research on the platform economy.

THEORETICAL BACKGROUND

New Forms of Organizing

All forms of organizing need solutions to two fundamental problems: the division of labour and the integration of effort (Burton and Obel, 1984). The division of labour refers to the work specifications and the membership base executing the associated tasks (Tushman and Nadler, 1986). The integration of effort refers to solutions to cooperation and coordination problems (Heath and Staudenmayer, 2000; March and Simon, 1993). Puranam et al. (2014) break these two major problems of organizing into four components. Division of labour consists of (1) *task division*: defining goals and identifying tasks to complete those goals; and (2) *task allocation*: assigning tasks to agents. Integration of effort consists of (3) *reward provision*: rewarding agents for executing tasks; and (4) *information provision*: providing agents with the information they need to carry out their duties. How these four organizing problems are solved, therefore, explains how an organization operates. Considering that all four problems are interrelated, an inadequate solution to one of them could have adverse effects on the organization overall (Puranam et al., 2014).

When an organization introduces a solution to one of the four organizing problems that differ from existing measures compared to organizations with similar objectives, it is considered a new form of organizing (Puranam et al., 2014). In recent years, the advent of digital technologies has facilitated the emergence of many new forms of organizing (Hinings et al., 2018; Reischauer and Mair, 2018; Zammuto et al., 2007) and thereby novel organizing solutions that can reduce the coordination costs for task allocation, for instance (Benkler, 2006; Davis, 2016). As a consequence, traditional operations have been replaced by more distributed forms of organizing (e.g., Dobusch et al., 2019; Majchrzak

et al., 2018), where organizational boundaries blur and contributions are not defined by employment contracts (Gulati, Puranam, and Tushman, 2012).

The platform economy is an example of such a new way of organizing (Kenney and Zysman, 2016; Reischauer and Mair, 2018, p. 122; Sundararajan, 2016). Businesses that operate in the platform economy – such as Uber, Deliveroo, TaskRabbit and Handy – tend to solve organizing problems quite differently from traditional organizations. Platforms are characterized by a stable core, governed by the platform owner, from which other actors are coordinated through strictly defined interfaces (Baldwin and Woodard, 2009). Uber, for instance, allocates tasks via a complex algorithm that assigns rides (i.e., tasks) directly to drivers – an authority that has traditionally resided with top management. Uber also has novel reward provision solutions that differ from traditional taxi companies – it pays drivers per ride and relies on a sophisticated algorithm to track worker data (e.g., acceptance rates, customer ratings), which are then used as input to inform reward distribution (e.g., bonuses) (Allen, 2015).

Regulatory Environments and New Forms of Organizing

New forms of organizing may deviate from what is taken-for-granted in an existing institutional environment (Puranam et al., 2014, p. 175; Rao et al., 2000) and, as a result, may generate resistance from important stakeholders (e.g., regulators, incumbent firms) (Baron, 2018; Boon et al., 2019; Holm, 1995). Indeed, platform economy organizations have been subject to criticism and restrictions from regulators (Hinings et al., 2018) as they deviate from existing categories. For instance, home-sharing platform Airbnb has been criticized for the inconvenience created for neighbours, unfair competition and rising real estate prices, inciting new regulations such as limits to the number of days that homes can be rented (Uzunca and Borlenghi, 2019; Uzunca et al., 2018). Labour platforms (e.g., Uber, Deliveroo) that offer flexible working hours have been chastised for creating a new category of low-income labourers, shifting risk to workers (e.g., no sick pay) and generating job insecurity (Davis, 2016; O'Keefe and Jones, 2015; Petriglieri et al., 2019; Rogers, 2015). When regulators have stepped in – such as when Austin, Texas passed a regulation requiring fingerprinting from ride-hailing drivers (the norm in the taxi industry) – both Lyft and Uber quickly exited the market, putting 10,000 drivers out of work (Baron, 2018; Dockterman, 2016).

Past research has offered much insight into how organizations tend to respond to regulatory changes. Organizations may conform to the rules and norms, or choose to avoid, defy, or actively manipulate their regulatory environments (Oliver, 1991). For instance, Uber attempted to avoid taxi industry regulations by framing itself as a technology company instead of a transportation company (Elert and Henrekson, 2016). More intense pressure makes firms more likely to comply (Goodstein, 1994), whereas under-regulated environments, regulatory voids, or contradictions in regulations may present organizations with new opportunities (Chattopadhyay et al., 2001; Elert and Henrekson, 2016). The power organizations have vis-a-vis their environment impacts their leeway to resist or influence regulatory policies (Lawrence, 2008; Oliver, 1991).

In this paper, we shift the attention from platforms and regulations to observe platform workers' responses to the platform economy's new form of organizing and consider

the ways these responses are affected by the regulatory environment. Whereas workers' voices have been largely underrepresented in research on new forms of organizing, their perspective is crucial to platform economy operations (Curchod et al., 2019). Platform workers' statuses differ from those of traditional employees. First, platform workers – Uber drivers, Handy cleaners and Deliveroo riders, for example – are not bound by an employment contract. While this affords them a measure of flexibility (they can choose when and whether they want to work), it also carries a great deal of insecurity, as they can be let go at any time. In addition, traditional employment benefits such as insurance, holiday pay and sick leave do not apply to independent contractors, shifting any related risks to workers (Rogers, 2015). Finally, while traditional employees have the right to collectively bargain for higher wages and better working conditions, independent contractors do not, although attempts have been made (e.g., in Seattle; Levy, 2018).

Therefore, although platform workers are only loosely coupled to platforms, they are essential to the platform's successful implementation of solutions to the four key problems of organizing (Mair and Reischauer, 2017). Workers' responses, possibly ranging from positive to negative (Chreim, 2006; Greenwood and Hinings, 1996; Oreg et al., 2018), can inform and transform organizations and institutions (Cornelissen et al., 2015). Communication among workers goes beyond the expression of cognitions or intentions – as the process of communication about work also has a performative dimension and is constitutive of organizational reality (Austin, 1962; Cornelissen et al., 2015). Therefore, understanding communications among platform workers is essential if we want to understand platform-based organizations and ways platform operations can be transformed and otherwise impacted by these communications.

Mutual Dependence and Power Relations around Platforms

To understand workers' responses to platform-imposed work organization, we turn to resource dependence theory, with the understanding that the interplay between platform organizations and platform workers is shaped by power and interdependence. Resource dependence theory posits that power dynamics are influenced by organizations' dependence on those who control key resources, in this way exercising power over them (Davis and Cobb, 2010; Hillman et al., 2009; Pfeffer and Salancik, 1978). Following Casciaro and Piskorski (2005) we differentiate between (1) mutual dependence – which captures the existence of bilateral dependencies in the dyad; and (2) a power imbalance – the power differential between two actors' dependencies.

Resource dependence theory predicts that the likelihood of mutually beneficial relationships is contingent upon a power balance (Hillman et al., 2009). When mutual dependence is low, power-advantaged actors can use their position with little regard for their counterparts. High mutual dependence, in contrast, means power-advantaged actors must be more attentive to other parties to offset the risk of failing to work together at all (Casciaro and Piskorski, 2005). Organizational actors typically seek to address dependencies that create power imbalances (Hillman et al., 2009). Actors can respond to dependencies by seeking to gain influence over the actor that they depend upon (e.g., by establishing alliances, interlocking directorates and using political action) or, alternatively,

by trying to decrease dependencies (e.g., by cultivating other sources of supply, or buffering resources) (Bode et al., 2011; Pfeffer and Salancik, 1978).

Platforms and workers typically exhibit mutual dependence, but platforms enjoy a more powerful position (Reischauer and Mair, 2018). The workers obviously depend on the platforms to access customers, information and generally, income. For instance, Rosenblat and Stark (2016) argue that platform algorithms are built so as to create information asymmetries between them and workers, increasing platforms' relative power. Digital solutions replace traditional managerial observation by algorithmic monitoring of workers (Curchod et al., 2019). Still, platforms also critically depend on workers to fulfil their service obligations (Reischauer and Mair, 2018). Platforms need workers to attract users and kick-off the self-reinforcing, indirect network effects that will grow their businesses (Katz and Shapiro, 1985; Parker and Van Alstyne, 2005). In addition, since platform workers such as Uber drivers are, in most cases, not legally bound by employment contracts and have significantly lower entry barriers compared to traditional workers (e.g., taxi drivers), it is impossible to exert control over them to the same extent that traditional organizations have exerted control over their employees.

While platforms are usually in a more powerful position because they define the rules that workers have to follow to generate income, industry regulations may influence these power dynamics and mutual dependencies (Casciaro and Piskorski, 2005). Holm (1995), for instance, explains how government backing for mandated sales organizations gave Norwegian fishermen more power vis-a-vis fish merchants and Baron (2018) analyses how regulation impacts Uber's market strength compared to incumbent taxi companies. More recently, Curchod et al. (2019) documented how online customer evaluations and algorithmic control prompt platform workers (eBay sellers) to increase their sense of agency by turning to collective practices initiated on online discussion forums.

In sum, platform workers, who are not bound by traditional employment relationships and yet represent a vital component of platform business models, are in a double bind: they may be critical of organizational solutions but depend upon them as well. Because relationships between platforms and workers and between platforms and regulators are affected by various power and dependence dynamics, workers' responses to new organizing solutions are likely to vary between regulatory structures. Workers' experiences in this regard are crucial, yet not well understood in the platform economy literature. In the coming sections, we will examine Uber's triadic platform-worker-regulator relationships across cities that present different regulatory structures.

METHODS

Research Setting

The platform economy is an excellent setting for the study of workers' responses to new forms of organizing because workers drive platforms' value creation (Davis, 2016). We chose to focus on Uber in particular for several reasons. First of all, Uber is one of the most well-known examples of a platform organization and considered a market leader among transport network companies (TNCs). Founded in 2009 by Travis Kalanick and

Garrett Camp, it is now allegedly worth around $74 billion (Swartz, 2019). Besides being the most valued among platform economy organizations, Uber employs the largest number of platform workers – reportedly 3.9 million at the end of 2018 (United States Securities and Exchange Commission, 2019). This makes it ideal for studying the workers' perspective. Secondly, this fast-growing company is credited with inspiring the 'Uber of everything', and being a role model for businesses like Deliveroo, Handy and Upwork. Uber has also fought numerous regulatory battles, carving out a path for other platforms. Thirdly, Uber – and the industry in which it operates – are perfectly suited for this kind of study because TNCs are mostly regulated at the municipal level (Tzur, 2019), allowing for comparison across regulatory structures. To explore this, we employ the quantitative technique of topic modeling and further supplement our data with additional documentation (e.g., newspaper articles, interviews) that we analyse qualitatively, as we discuss further in more detail.

Data

Forum data. We selected the *uberpeople.net* forum as our main source of data as it is the most popular independent forum for Uber drivers (Kiberd, 2016) and hence provides a wide representation of workers' perspectives. The forum was initiated in April 2014 by an anonymous Uber driver, who wanted the community to have a place to share their experiences. Many use the forum to connect with the community, seek and offer advice (Bowles, 2016).

We began data collection by extracting forum posts from *uberpeople.net* using web crawlers. The 120,116 available forum posts, created in the period between 9 April 2014 and 14 February 2017, had been generated by 24,058 unique users, of which 2,853 were female and 16,492 male, based on self-reported gender (4,713 users had not reported their gender). Most of the forum users were Uber drivers, however, since ride-hailing drivers tend to work for multiple platforms simultaneously (Katz, 2018), many of them could also be Lyft, Juno or Via drivers, as evidenced by some forum posts.

To analyse how platform workers' responses vary across regulatory structures, we selected posts originating from the 40 largest cities in the USA, in line with Tzur (2019). Only cities with at least 1,000 documents present in the dataset were selected, as a lower number of documents constrain the interpretability of a topic model (Nguyen, 2015; Schmiedel et al., 2019). This concentrated our dataset on 36,531 posts from 12 US cities and one European city – London – Uber's largest European market (Murgia, 2017).

Cities were differentiated as having a direct or indirect regulatory structure. In direct regulatory structures, regulators set rules and enforce them for all: TNCs, drivers and vehicles; whereas in indirect regulatory structures, some authority is passed onto TNCs, which have leeway in setting or enforcing rules on drivers and vehicles. Crucially, these two regulatory structures inform Uber's business decisions in different cities (Senior Uber Representative, August 24, 2018). This distinction between direct and indirect regulatory structures is closely related to differences between strongly and weakly regulated cities that were captured by Tzur (2019). Building upon and extending Tzur's classification we grouped cities according to regulatory structure: (1) direct regulation (Chicago, Houston, London, Miami, New York City and Seattle) and (2) indirect regulation (Boston, Dallas,

Los Angeles, Phoenix, San Diego, San Francisco and Washington DC) (see Table I). We classified each city with regard to specific regulations concerning company license fees, driver license fees, mandatory checks (e.g., background check, vehicle inspection) and targeted limitations (e.g., cap on the number of drivers) (see Table I for details). While relying on multiple indicators and different sources of information to categorize cities into this framework, the most important consideration was the regulatory structure itself, that is – whether regulations are enforced directly or mediated by the TNC (Uber in this case).

Qualitative data. We complemented our main data source – forum posts – and subsequent topic modeling analysis with qualitative data from interviews and documents to find and explain patterns across regulatory environments. The first author conducted interviews with two senior representatives at Uber, one based at Uber's European headquarters in Amsterdam and the other at Uber's global headquarters in San Francisco. The interviews

Table I. Classification of cities

City	*Regulatory structure*	*Company license fees*	*Driver license fees*	*Mandatory checks*	*Targeted limitations*
Chicago	Direct	Medium	None	Medium	Strong
Houston	Direct	Strong	Weak	Strong	Weak
London	Direct	Strong	Strong	Strong	Strong
Miami	Direct	Medium	Strong	Medium	Weak
New York City	Direct	Strong	Strong	Strong	Strong
Seattle	Direct	Medium	Weak	Strong	Medium
Boston	Direct	Strong	None	Medium	Weak
Dallas	Indirect	Weak	Weak	Medium	Weak
Los Angeles	Indirect	Weak	None	Medium	None
Phoenix	Indirect	None	None	Weak	None
San Diego	Indirect	Weak	None	Medium	None
San Francisco	Indirect	Weak	None	Medium	None
Washington DC	Indirect	Weak	None	Weak	None

Note: Strong/medium/weak refers to the extent of limitation that restricts market entry for companies/drivers. *Company license fees* refers to fees a Transport Network Company (TNC) must pay in order to obtain operational license. License fees below $5,000 were regarded as weak, up to $50,000 as medium, whereas higher fees were regarded as strong (Tzur, 2019). In addition to this, we consider the more recent introductions of taxes that TNCs must pay per ride a strong limitation (e.g., 20 cent per ride over 10-year period); *Driver and vehicle license fees:* As a number of TNC drivers work part-time, they are very sensitive to entry barriers. A driver license fee of more than $20 was considered a weak limitation, whereas more than $100 was regarded as a strong limitation (Tzur, 2019); *Mandatory checks* refers to both drivers and vehicles and it describes the extent of background checks required for operation. Minimum checks conducted by TNCs themselves were regarded as weak, whereas more comprehensive checks such as extensive vehicle inspection by an external entity, were regarded as a medium. Finally, harsh checks such as fingerprinting, were regarded as strong, especially if it needs to be done by an external entity (Daus and Russo, 2015; Tzur, 2019); *Targeted limitations* measures the extent of limitations directed at TNCs, which constrain its freedom to operate. Minor restrictions such as the maximum vehicle year of production were regarded as a weak limitation, whereas requirements that restricted both firms and drivers, such as requiring a driver to be physically present at the city hall for the license to be issued was regarded as a medium. Finally, if requirements required a change in the business model such as the number of drivers the firm can hire, or specific requirements such as an English language test for drivers, this was considered a strong limitation.

focused on the company's approach in different cities in response to local regulatory conditions (see Appendix A for interview questions). Further, the authors gathered information from newspaper articles, court cases, legal documents and Uber's official PR website (https://www.uber.com/newsroom/). These additional data were used to gather insight into regulations in different cities and to document generic Uber policies, its responses to regulations and any other relevant actions it took.

Analysis

We took a two-step approach in our analysis. First, to analyse the forum posts and corresponding metadata, we utilized the Structural Topic Model (STM) – a framework for topic modeling that reveals latent themes present in a collection of documents (Blei, 2012) and their relationship with other covariates (Roberts, Stewart, and Airoldi, 2016). Its analytical value has recently been demonstrated in management research by Hannigan et al. (2019), Croidieu and Kim (2018), Kaplan and Vakili (2015) and Boudreau et al. (2014). Second, we followed an established multistep process to interpret generated topics (e.g., Croidieu and Kim, 2018) and conducted the qualitative analysis of additional data sources we collected (see section 'Data') to offer more depth to our findings.

Overview of topic modelling. Considering the size of our dataset, topic modeling emerged as the most suitable automated content-analysis method (Krippendorff, 2004). Topic modelling has specifically been designed for analysing the meaning structures in large text corpora such as ours (DiMaggio et al., 2013; Mohr and Bogdanov, 2013). We chose the Structural Topic Model (STM) in particular, as its key feature is the ability to incorporate metadata (Roberts et al., 2016). This allowed us to study the workers' responses over time and across different cities. STM has been shown to yield superior results to latent Dirchlet allocation (LDA), the most frequently used type of topic modeling, when it comes to predictive power and subsequent qualitative interpretation (Roberts et al., 2016). Specifically, the algorithm has several important features that are especially useful for our study.

First, topic modeling allowed us to analyse meaning structures. Intuitively, the topic modeling algorithm identifies words that occur within a collection of documents, deduces latent topics within them and uncovers originating documents that contribute the most to each generated topic (Blei, 2012). A topic is defined as 'a mixture over words, where each word has a probability of belonging to a topic' (Roberts et al., 2016, p. 2). A document, on the other hand, is a distribution over topics and thus a single document can contain multiple topics (Roberts et al., 2016).

Second, the topic modeling algorithm does not depend on pre-determined guidelines. It is a form of automated text analysis using machine learning and can be characterized as having an unsupervised nature. Topic modeling is inductive – there is no need to specify categories prior to the analysis, as the method allows the data to infer the topics (Kaplan and Vakili, 2015). While a document's words are observed, its topics, their distribution per document and the distribution of words in topics are all unobserved and thus must be 'discovered' (Blei, 2012), a procedure primarily based on Bayesian statistical theory (Gelman et al., 2014). Therefore, once the algorithm infers the topics, the researcher

interprets their meaning based on the principles of grounded theory (Croidieu and Kim, 2018; Gioia et al., 2013).

Third, topic modeling meets this study's requirement for polysemy – the capacity for words to have different meanings in different contexts (Kaplan and Vakili, 2015). This feature is an improvement in comparison to widely used text analysis methods in the social sciences such as word count and keyword analysis (Kaplan and Vakili, 2015). Finally, while LDA assumes independence among topics, STM accounts for correlations among them and the corresponding metadata (Roberts et al., 2014), which enabled us to examine relationships among date and city covariates, which were included at the topic estimation stage.

Topic modelling procedures. To utilize the Structural Topic Model (STM), we engaged in a two-step process. First, we inserted the raw text data and used built-in STM functions for pre-processing (e.g., removing common words, punctuation and special characters). Since we were interested in analysing forum posts across different locations and capturing changes over time, we ran the model with two covariates: date and location (cities).

Second, since the only input from the researcher side is the number of topics, we began with the suggested 100 topics, given the size of our dataset (Blei and Lafferty, 2007) and subsequently lowered that number with the understanding that constraining the number of topics makes the interpretation more viable. A model consisting of 25 topics was selected based on semantic coherence and exclusivity criteria (Roberts et al., 2014). These criteria were also used to assess the quality of topics within the chosen model that led to exclusion of five topics due to overall low quality – low semantic coherence or exclusivity (topics: 2, 4, 6, 19) and one additional topic (topic 21) was excluded due to irrelevance (discussions included stories and news in general, not specifically related to Uber) (see also Figure 1 which confirms that these topics are not related to Uber's specific organizing solutions). Therefore, the final model used for the analysis consisted of 20 topics that were both semantically coherent and highly exclusive (Roberts et al., 2014, 2016).

Topic modeling interpretation. After the standard set of procedures was performed to evaluate the model, we used a multistep process to interpret the generated topics, a process that similar studies have also followed (e.g., Croidieu and Kim, 2018; Hannigan et al., 2019). The first step was to examine raw generated topics, which we interpreted based on the ten most probable words that generated each topic, as well as at the top ten FREX words – words that are both frequent and exclusive to a particular topic. As a team, we independently labelled all topics and discussed discrepancies to reach consensus on topic labels.

In the second step, we grouped topics into second-order themes and aggregate dimensions by combining two methods for cross-validation: hierarchical cluster analysis and qualitative interpretation of topics. The hierarchical cluster analysis was performed using the hclust function within the R Stats package (Murtagh and Legendre, 2014), whereby the algorithm starts with each topic forming its own cluster and then continues to iteratively join the two most similar clusters until there is just a single cluster (Müllner, 2013). In other words, similar topics eventually belonged to the same cluster (see dendrogram in Figure 1). This cluster analysis was complemented with the examination of

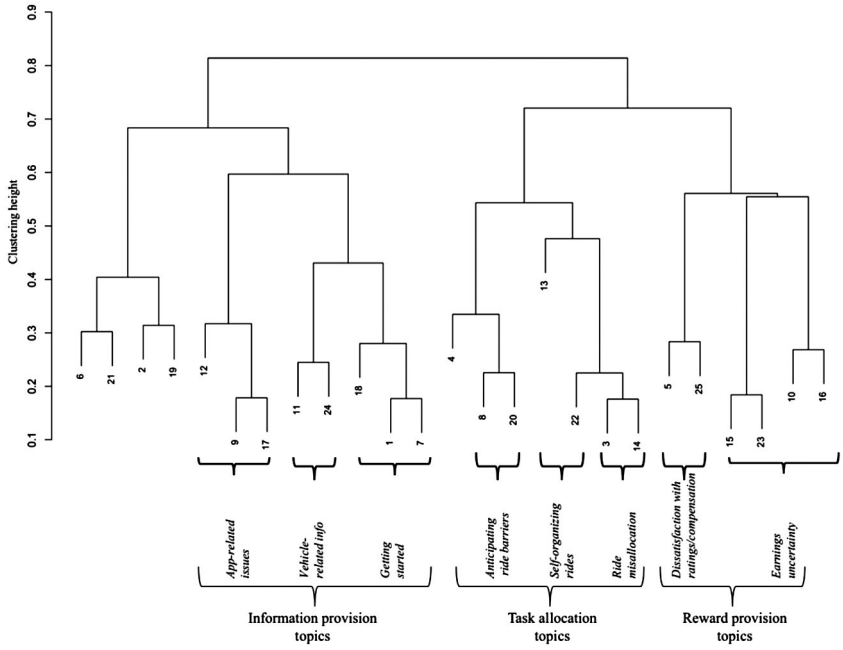

Figure 1. Dendrogram - cluster analysis of topics

Note: *The clustering height indicates the (dis)similarity/distance between two clusters.

the results by the authors, who checked the most representative posts of each generated topic for cross-validation and subsequently grouped the second-order themes into aggregate dimensions. The cluster analysis clearly indicated that on the higher level, topics belonged to three major groups, which reflected three of Puranam et al.'s (2014) fundamental problems of organizing (information provision, reward provision and task allocation).[1] Table II provides a detailed overview of the data structure of the first-order themes, second-order themes and aggregate dimensions.

Finally, during the analysis, it became apparent that the nature of posts differed across groups of topics. Namely, certain topics appeared to add to Uber's organizing solutions, while others opposed them. This observation led us to group the second-order themes into two categories: *supplementing* and *opposing*. Themes were coded as supplementing when the analysis of the top 20 representative posts that generated each topic clearly indicated that drivers were adding onto Uber's organizing solutions. On the other hand, themes coded as opposing criticized or demonstrated drivers' active resistance towards Uber's organizing solutions (for full definitions and detailed examples see the Findings section).

To validate our categorization of topics into supplementing and opposing, we recruited 100 raters on Prolific.ac (Palan and Schitter, 2018) and asked them to code sets of posts from our data as supplementing or opposing (see Appendix B for a more elaborate explanation of the test procedures and its results). Considering that our test used a nominal scale and the initial analysis pointed to high agreement and low variance among raters,

Table II. Data structure

Topic #	*Top probability words*	*First-order theme*	*Second-order theme*	*Aggregate dimension*
1	can, help, want, will, pleas, post, know, let, experi, read	Meetups and ideas	Getting started	Information provision - *Supplementing*
7	guy, think, sign, one, thought, free, share, friend, heard, give	Recommendations		
18	just, lyft, new, look, ive, thank, start, wonder, seem, done	New drivers		
11	car, uber, year, use, month, can, work, buy, vehicl, leas	Car leasing and renting	Vehicle-related info	
24	insur, vehicl, licens, will, compani, requir, tlc, inspect, cover, nyc	Insurance		
9	anyon, els, today, week, pay, yet, got, notic, havent, anybodi	App-generated pay statements	App-related issues	
12	app, use, phone, tri, updat, see, log, show, set, onlin	App use		
17	uber, email, check, say, account, ask, receiv, support, got, messag	Uber support services		
10	rider, fare, trip, will, fee, price, charg, uberx, earn, base	Earnings	Earnings uncertainty	Reward provision - *Opposing*
16	mile, per, pay, total, gas, cost, tax, plus, expens, dollar	Expenses		
15	hour, week, work, last, guarante, night, time, weekend, trip, day	Hourly guarantees		
23	drive, get, make, now, day, like, money, take, much, know	Earnings per day		
5	uber, driver, rate, tip, give, will, mani, custom, low, passeng	Ratings and tips	Dissatisfaction with ratings/ compensation	
25	dont, peopl, even, like, thing, way, job, think, time, feel	Economic relationship with Uber		
13	area, map, time, citi, miami, south, place, event, seattl, beach	Events	Self-organizing rides	Task allocation - *Supplementing*
22	got, back, around, ping, airport, lot, get, wait, home, went	Rides		
3	pax, minut, cancel, get, trip, wait, away, call, time, destin	Ride problems	Ride misallocation	Task allocation - *Opposing*
14	ride, surg, request, accept, pool, time, see, select, notic, zone	Surge		
8	pick, passeng, drop, stop, turn, traffic, block, pickup, lax, line	Traffic	Anticipating ride barriers	Task allocation - *Supplementing*
20	street, park, san, side, polic, road, diego, lane, near, will	Road closure information		

we used Gwet's AC_1 reliability statistic. Gwet's AC_1 is an improved version of Cohen's kappa, and most importantly, not sensitive to measurement scale nor low variance known as the paradox of kappa (Gwet, 2008; Lang et al., 2012; Wongpakaran et al., 2013). Our inter-rater reliability test revealed that seven out of eight themes had moderate to very high reliability (Gwet, 2014) (Gwet's AC_1 index ranging from 0.40 to 0.98). One theme – 'App-related issues' [Information provision] – had poor reliability (0.23) and was hence excluded from further analysis of supplementing vs. opposing themes.

We further analysed supplementing vs. opposing themes across regulatory structures and over time. In order to provide a deeper analysis of regulatory change over time as well as the interplay of workers' responses and Uber's actions, we conducted a detailed longitudinal analysis zooming-in on Houston, Texas, which we treat as an illustrative case study. Houston was selected because, unlike other cities that kept a relatively stable regulatory stance (e.g., New York City), it has seen the most pronounced regulatory changes during the time period of our study.

FINDINGS

In total, 84.9 per cent of the workers' posts concerned Uber's solutions to three out of four fundamental problems of organizing: information provision (33.8 per cent of mean topic proportions); reward provision (31.0 per cent); and task allocation (20.1 per cent) (see Table III). While the three aggregate dimensions grouped topics thematically, our qualitative analysis revealed that within topics, the workers also exhibited different types of responses to Uber's organizing solutions, which we labelled as supplementing and opposing responses. Before drawing links between discussions of organizing problems and drivers' responses, we need to define these two types of responses.

We define supplementing responses as *responses that add to the platform's way of organizing*. Supplementing responses are rooted in dependence on a platform and the form of organizing it enacts to ensure ongoing streams of income, yet indicate that these organizing solutions do not suffice. Drivers make the platform work for them by initiating and carrying out additional organizing activities on the forum. In our empirical context, this means drivers giving and seeking information about how to get started with driving and car renting/leasing and insurance, or drivers self-organizing rides. Supplementing is a way to attenuate the dependencies on solutions by the platform owner that are deemed

Table III. Mean topic proportions per organizing problem

Organizing problems	*# of topics*	*Mean % of occurrences*	*Mean % of occurrences per regulatory structure*		*t(df) = t-statistic*	*Effect size (Hedges' g)*
			Direct	*Indirect*		
Information provision	8	33.8	37.5*	31.4*	$t(29053) = 30.66$	0.33
Reward provision	6	31.0	29.1*	32.2*	$t(32291) = 21.62$	0.23
Task allocation	6	20.1	17.2*	22.1*	$t(32433) = 29.83$	0.31

*$p < 0.001$, corresponding to the p-value of two-sample T-Test.

insufficient. It is done in collaboration with other drivers, without the platform owner, but in a way that is ultimately cooperative and also helps the platform owner meet its goals. So supplementing resolves some of the limitations that the platform's organizing solutions pose to workers who depend upon it.

On the other hand, opposing responses are defined as *responses that question, criticize, or actively resist the platform's way of organizing.* Like supplementing responses, opposing responses are rooted in dependence on the form of organizing enacted by the platform, which is deemed unsatisfactory. Yet, whereas supplementing responses resolve limitations by additional organizing actions beyond the platform, opposing responses reject some of the organizing solutions or their consequences. In our empirical context, opposing includes, for instance, drivers complaining about earnings, arrival of payments, or the ratings system, as well as drivers expressing their frustration with misallocation of rides through the app. Opposing can be seen as a manifestation of a power imbalance that favours the platform owner and thereby pushes workers to respond. When such opposing responses are taken beyond the confines of the forum and voiced publicly, they may reduce the platform's relative power position (Griswold, 2019).

In the coming sections, we will explain how these two types of responses relate to the three fundamental problems of organizing (information provision, reward provision and task allocation) by using the most representative posts[2] to illustrate our findings. We will then discuss the differences between the supplementing and opposing responses across regulatory structures, before finally offering a deeper look into these differences by a longitudinal analysis of an illustrative case of the city of Houston.

Workers' Responses to Information Provision Solutions

Topics referring to information provision were the most discussed in the entire corpus (33.8 per cent of mean topic proportions). This aggregate dimension contained three second-order themes: getting started (13.4 per cent), vehicle-related info (7.1 per cent) and app-related issues (13.3 per cent), covering in total 8 out of 20 topics that were included in the analysis. We discuss the first two themes, which represent supplementing responses.[3]

Getting started. This theme covers posts in which drivers organize meetups (topic 1), give recommendations about driving for Uber (topic 7) and offer advice to new drivers (topic 18) (see Table II for all first-order topics). What is common to these types of posts is that drivers are helping one another to get started with Uber. A representative post from this theme read

> Just started driving less than a week ago but I've read several different threads in this forum and it sounds like the Uber Partner app is a lot better on the Android platform than on IOS. True or False? (July, 2016)

This post illustrates that drivers seek and give help related to quicker entry into the labour market, thereby adding on to Uber's solutions to information provision, as such detail is not part of Uber's organizing solution.

Vehicle-related info. This second-order theme reflects drivers' discussions about car leasing/renting (topic 11) and insurance (topic 24), thus information drivers require in order to have the means for driving. A representative post from this theme read

> Hello my friends. Where can I find pco ready car with insurance for rent in London what you recommend? Rent? Buy? Lease? (October, 2016)

Uber generally provides drivers with information about options for car leasing and renting (Uber, 2018); however, we saw that drivers supplement Uber's solution to this organizing problem by further informing one another about buying, renting and leasing options. This could either indicate that the information provided by Uber comes across as insufficient or that there is a lack of trust towards Uber, but it could also be an attempt to reduce dependency on Uber as the only source of information.

Workers' Responses to Reward Provision Solutions

Reward provision was the second most discussed aggregate dimension in the corpus (31.0 per cent of topics). It contains two second-order themes: earnings uncertainty (18.4 per cent) and dissatisfaction with ratings/compensation (12.6 per cent), covering in total 6 out of 20 topics that were included in the analysis. Both second-order themes, as we will explain below in more detail, typically portray opposition to Uber's organizing solutions.

Earnings uncertainty. This theme, which voices opposition to Uber's solution for reward provision, speaks of earnings (topic 10), expenses (topic 16), hourly guarantees (topic 15) and earnings per day (topic 23), reflecting drivers' uncertainty and insecurity concerning compensation. Drivers expressed uncertainty about the arrival of pay checks, the amount of financial compensation they stood to receive and their actual earnings. In doing so, they evinced disagreement with Uber's solutions to this organizing problem while also reaching out to other drivers for confirmation. One representative post read

> Just a couple of months ago, I was averaging at least 20-25 an hour, now, suddenly I can't seem to make more than 12 an hour. That's not even taking away taxes and gas!! So after that I feel like I'm probably making below minimum wage. How can they think it's okay to get rates to this all-time low while they're still taking so much?? I wish there was a way drivers could strike because this is just unfair and no longer worth it … when just a couple of months ago this was something that was really helping as extra money to make ends meet. What happened, uber? And what now? (July 2015)

This post exemplifies the drivers' uncertainty about bonuses and guaranteed compensation, their inferior power position and distrust in Uber's willingness to address their situation. While this theme clearly opposes Uber's solutions to reward provision, the next theme demonstrates that drivers go beyond mere complaining to taking direct action to change their situation.

Dissatisfaction with ratings/compensation. This theme reflects drivers' dissatisfaction with ratings and tips (topic 5) and their economic relationship with Uber (topic 25). Unlike

'earnings uncertainty', topics in this theme directly oppose Uber's solutions to reward provision and even actively resist it. The following post illustrates drivers' frustration with their pay:

> That their full-time drivers are living hand-to-mouth? At least to this extent. For some reason, I get this weird feeling that they think their drivers are still doing well and that maybe they're just that out of touch. Even though it's more than likely that they both know and just don't care, part of me doesn't want to believe it. (October 2016)

This post demonstrates the drivers' generally weaker position of power – they feel that Uber does not care about their lives and livelihood. However, the drivers do not accept their position as such and at least sometimes engage in active resistance as an attempt to change the status quo. In one instance, a driver encouraged others to accept tips in cash although Uber at the time did not allow drivers to ask for tips. A representative post read

> I been driving for a year with 3,000 trips. I continually hear from riders that Uber drivers REFUSED a cash tip. WTF!!! Yes, Uber discourages tips but PLEASE accept your cash tips. Why would you refuse money??? And PLEASE educate your riders that tips are NOT included in the fair as many believe tips are automatically included. Uber has been shady with the whole tipping policy. IF we continue to educate we will get more tips. It's discouraging to take an airport run and see the taxi and other pre-set ride drivers getting tips EVERYTIME and I get nothing. We do the same service!! AND Thank you LYFT for being tip friendly. IF only I could get more rides with you in SD. (November, 2015)

By proposing their own solution to reward provision, drivers not only show opposition but also actively resist Uber's solution in a way that could be harmful to Uber.

Workers' Responses to Task Allocation Solutions

Task allocation accounted for 20.1 per cent of mean topic proportions. It contained three second-order themes: self-organizing rides (6.8 per cent), ride misallocation (8.2 per cent) and anticipating ride barriers (5.1 per cent). In total, 6 out of 20 topics included in the analysis concerned task allocation. The themes of 'self-organizing rides' and 'anticipating ride barriers' represent attempts to supplement Uber's organizing solutions to task allocation, while the theme 'ride misallocation' opposes them.

Self-organizing rides. This theme is mainly concerned with supplementing Uber's solutions to task allocation. Even though Uber assigns rides with a complex algorithm, drivers self-organize rides by providing the exact time and location of busy events (topic 13) and specifying ride-related information such as the best time to drive or enable a surge (topic 22), in this way directing each other to specific jobs. Although Uber informs drivers of important events happening in a particular city via its app (Uber, 2018), drivers arguably have more city or even neighbourhood-specific knowledge, allowing them to react more rapidly and self-organize. An example post read

> Electric Zoo music festival is this weekend, Friday, Sat and Sun. There will be nearly 75,000 people per night leaving Randall's Island between 10PM and 1230AM. Best bet is to pick them up on the island itself (for longer fare), but traffic there will be a nightmare. (September 2016)

In addition, drivers not only supplement Uber's solutions to help each other get an additional task assigned but also to make sure the ride actually gets completed. One post, in which a driver voices puzzlement about Uber's colour coding of maps in the app, shows that task-related information was incorrect or confusing, leading the drivers to augment Uber's organizational solution. Or as this driver puts it:

> Does Uber provide this in an understandable format? I am going to assume the light green areas are the Geozone areas; we can wait for fares until told otherwise. (October 2015)

Anticipating ride barriers. This supplementing theme discusses traffic (topic 8) and road closure (topic 20), which can impose barriers to task completion. From the post below, it is evident that Uber does not provide sufficient or clearly organized information about road closures, hence drivers add on to this solution by, in this case, searching out and enumerating road closures themselves.

> Once I got the ping from Uber about how busy it was going to be, I immediately started looking for the street closures … of course there is little information to be had. They would rather get their impound fees from city residents than to actually make it easy to find out. Here's the best I've got. Copy paste and/or rearrange info already here so that we eventually have an organized list that's easy to see. Main closures for the loop: Columbus Drive from Randolph Street to Roosevelt Road Jackson Drive from Lake Shore Drive to Michigan Avenue Balbo Avenue from Lake Shore Drive to Michigan Avenue Congress Parkway from Columbus Drive to Michigan Avenue… (October 2015)

Ride misallocation. Unlike 'self-organizing rides' and 'anticipating ride barriers', both of which supplement Uber's solutions to task allocation, this theme opposes them. It reveals ride problems (topic 3) and issues with 'surge pricing' – Uber's dynamically adjusted prices during the times of high demand (topic 14). The drivers clearly express their frustration with ride-related problems but also evince distrust in Uber, highlighting the power imbalance. A representative post says.

> New driver here. Every time I'm out and see a surge somewhere in the vicinity, I make a beeline for it and as SOON as I touch the perimeter of the surge zone, it mysteriously vanishes! At 1st, I thought 'coincidence'. But 3 or 4 times later, it's happened with consistency. No way that's a coincidence. Unless I'm already in a surge zone (which has only been once), I don't chase them anymore. It's defeating. I'm beginning

to think the app is programmed to generate these surges artificially to keep naive drivers (like me) circulating unnecessarily. (November 2015)

Evidently, part of the drivers' opposition stems from information asymmetries – the drivers simply do not know whether the app has been programmed in a certain way and they clearly express their subordinate position of power in this regard.

While the previous paragraphs discussed the three aggregate dimensions and the themes that belong to each, in the next section we aim show how drivers' responses to Uber's organizing solutions vary per regulatory structure – the core of our findings.

Workers' Responses under Different Regulatory Structures

Overall, Uber drivers exhibited more opposing responses on the forum (see Table IV; mean percentage of occurrences: 39.2 per cent of opposing responses vs. 32.4 per cent of supplementing responses). However, drivers' responses depend on the regulatory environment (see Figure 2). Recall that in direct regulatory structures, TNCs, drivers and vehicles are all subject to regulation, while in indirect regulatory structures the regulations are imposed directly on TNCs, who then enforce them on drivers and vehicles. This implies higher mutual dependence between Uber and the drivers in direct

Table IV. Mean topic proportions per response type

Response Type	*# of topics*	*Mean % of occurrences*	*Mean % of occurrences per regulatory structure*		*t(df) = t-statistic*	*Effect size (Hedges' g)*
			Direct	*Indirect*		
Supplementing	9	32.4	35.2*	30.7*	$t(28263) = 28.90$	0.32
Opposing	8	39.2	35.4*	41.6*	$t(31837) = 36.25$	0.38

*$p < 0.001$, corresponding to the p-value of two-sample T-Test.

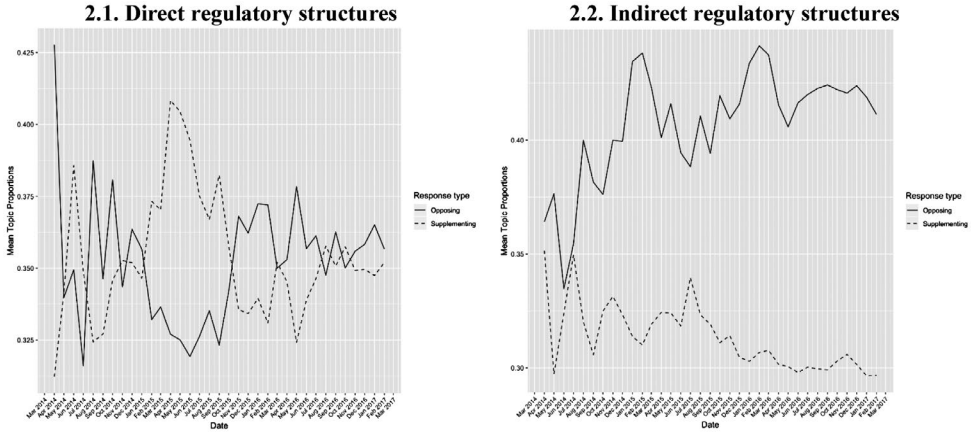

Figure 2. Supplementing vs. opposing responses by the regulatory structure

regulatory structures, while indirect regulatory structures accentuate a power imbalance that favours Uber. Consistent with this interpretation, our analysis shows that in directly regulated cities, drivers engaged in both supplementing and opposing; whereas in indirectly regulated cities they were more opposing and less supplementing. Thus, we see significantly more supplementing responses in directly regulated cities as compared to indirectly regulated cities, and significantly more opposing in indirectly regulated cities, compared to directly regulated cities (see Table IV). The effect sizes of the differences in supplementing and opposing responses provide further indication that these differences are meaningful (effect sizes in the range of Hedges' g = 0.30 to 0.40 are equivalent to correlations between r = 0.15 and 0.20, which exceeds in magnitude approximately 50 of the effect sizes reported in prior research on employee attitudes towards their organization; see Bosco et al., 2015).

In what follows we explain how and why drivers' responses varied according to the regulatory structure as we draw upon an in-depth qualitative analysis of the drivers' responses, specific regulations, Uber's actions and interview data.

First, market-entry processes for both TNCs and drivers are markedly different depending on the structure of regulation. Direct regulatory structures are defined by relatively strong and frequent mandatory checks (e.g., background, vehicle inspection), requirements for commercial insurance, limitations on the number of licences and vehicles and/or relatively high license fees for both TNCs and drivers (see Table I). The difficult process of becoming an Uber driver in direct regulatory structures is on full display in this post:

> Hey guys, just wanted to share and vent off a little about my experience starting up and setting up with UBER in NYC. I don't know who to blame here first but the process is atrocious. After weeks of obtaining my hack license: completing defensive driving course, going to DMV to switch and pay for a new E-class license, then going to the most unpleasant public office called TLC in Long Island City for the heck license to be mailed to you, given you had all paperwork in order. $625 application fee. Then I go get my plates, DMV office … $468/fee per year … (New York City, July 2015; Information provision)

On the contrary, indirect regulatory structures are characterized by a more lenient approach to regulations whereby some authority is passed onto Uber (Senior Uber Representative, 24 August 2018). This includes lower license fees for both drivers and TNCs, which reduces entry barriers and increases competition among drivers. Drivers in indirectly regulated cities also have more opportunities to 'multihome' (i.e., work for competing platforms such as Lyft and Juno; Rochet and Tirole, 2003). Consequently, Uber has a larger pool of drivers to draw on in indirectly regulated cities. This explains why we observe drivers to be more concerned with reward provision themes, which are all opposing in nature.

Second, regulatory differences in the processes of becoming a driver also impact drivers' subsequent behaviour. Namely, once in the industry, drivers in direct regulatory structures become more dependent on Uber – not only to recoup invested time, effort and money that went into becoming a driver, but also due to a lack of alternative TNCs

to switch to. This dependency between Uber and its drivers cuts both ways – Uber also depends more on drivers when their market entry is constrained, leaving them with a limited pool of potential workers. This creates an incentive for drivers to make things work. As the following forum post explicates, drivers initiate actions, in this case, a meetup, in order to essentially cooperate with Uber to its end, which illustrates the interdependent nature of their relationship:

> The meeting is ON! Starbucks 9500 Higgins Rd (Rosemont) … Going back and forth via our avatars is fun, but if we really want to figure out a way to collectively get our voices heard then we need to meet face to face … Drivers are obviously the backbone of these companies. Without us there is no Uber or Lyft. We are partners in this grand rideshare experiment and there are many things we can do to get our voices heard. I think we all want rideshare to succeed and I believe that as Partners we have valuable input which will help these organizations to that end. (Chicago, January 2016; Information provision)

Uber has confirmed their awareness of a clear pattern between entry barriers and time spent on the app – the higher the drivers' entry barrier, the longer they stay logged in to the app (Senior Uber Representative, 2 July 2018). Thus, in cities that impose direct forms of regulation where drivers go through a long and costly vetting process and where there may not be a choice but to drive for a single platform, drivers are more tightly tethered to a platform. Accordingly, we see relatively more supplementing responses in direct regulatory structures compared to indirect ones (see Table IV and Figure 3).

It is important to note that more supplementing does not indicate drivers' acceptance of Uber's organizing solutions. Drivers also engaged in opposing in directly regulated structures (see Table IV); however, their underlying intention is to make it work, which stems from their mutual dependence. This is illustrated by the nature of their responses during specific events. For instance, in January 2016 Uber announced rate cuts for passengers. Although Uber claimed that lower rates for riders would not negatively affect drivers' earnings (Uber Newsroom, 2016), drivers showed concern by opposing Uber's decision. This was also evident from the increase in discussions about reward provision topics (see Figure 4).

However, drivers in directly regulated cities, while clearly unsatisfied, responded by supplementing and appealing to the government rather than to Uber:

> I just sent an email I was working on for over an hour on the changes I would like to see and not like to see. I emailed ****@********.GOV & *********@*********.GOV. Let's help uber – they did make it possible for all of us to make a little money with this job and keep food on the table – they just have to remember we help them and they are only as strong as our support and stop lowering the rates. (Miami, January, 2016; Information provision)

In contrast, in indirectly regulatory cities where mutual dependence between the drivers and Uber is weaker, the drivers' disadvantaged position is aggravated. For instance, on 2 February 2018, New York City capped the number of daily hours a driver could work for

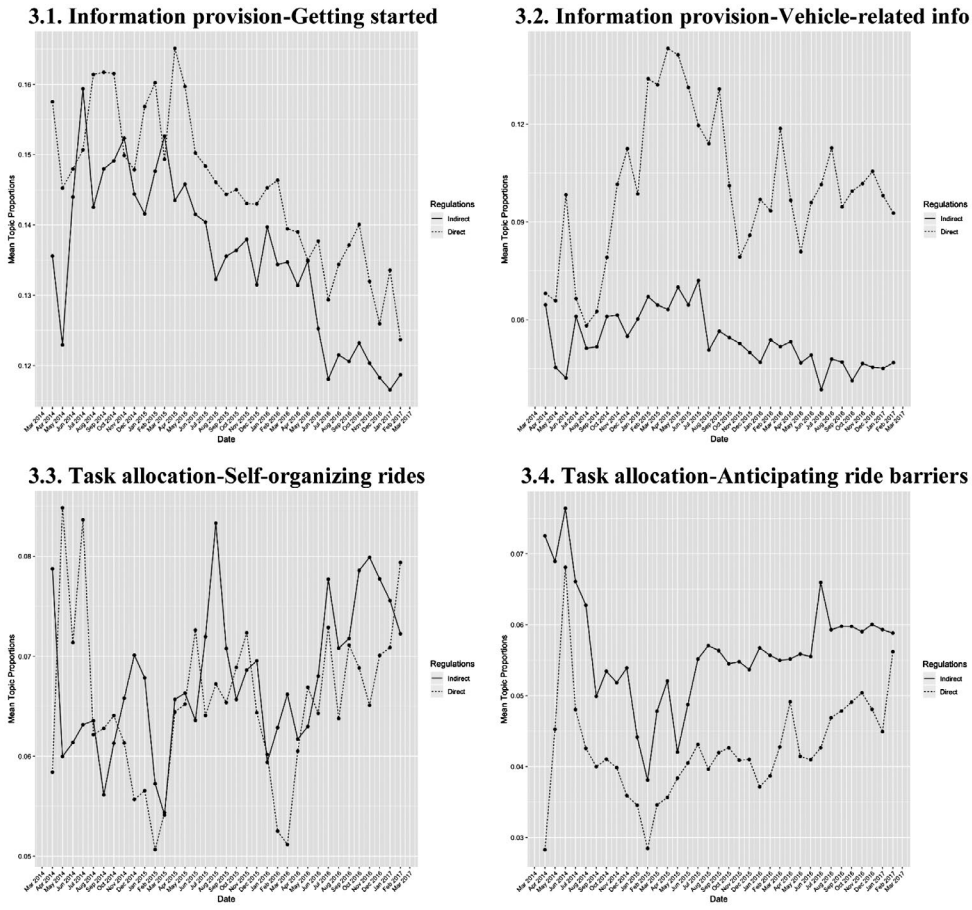

Figure 3. Supplementing themes by the regulatory structure

Uber to ten to prevent fatigue (The City of New York, 2018), requiring TNCs to track driving hours. When Uber introduced this policy globally, it capped the hours to 12 (Kansal, 2018). However, soon after, reports emerged accusing Uber of playing psychological tricks to keep drivers on the road, despite the new policy (Rosenblat, 2018). Correspondingly, we observe more opposition towards Uber's organizing solutions, reflecting drivers' view of Uber as an opponent rather than as a partner. A representative post read:

> It's funny how when I first started driving, Uber's enemies were taxi drivers, but now Uber's enemies are their own drivers. Uber has enemies from within. Uber must start treating drivers with respect and dignity. You drivers are the heart and soul of uber. I can't stand how uber patronizes us. Uber will cut your pay and then tell you it's for your benefit. \'more money in your pocket\'. Uber will call you a partner and then tell your customer that you are not worthy of a freewill offering. Uber must change their policies and practices. We demand a base fare like all other major markets. (Los Angeles, 9 September 2016; Reward provision)

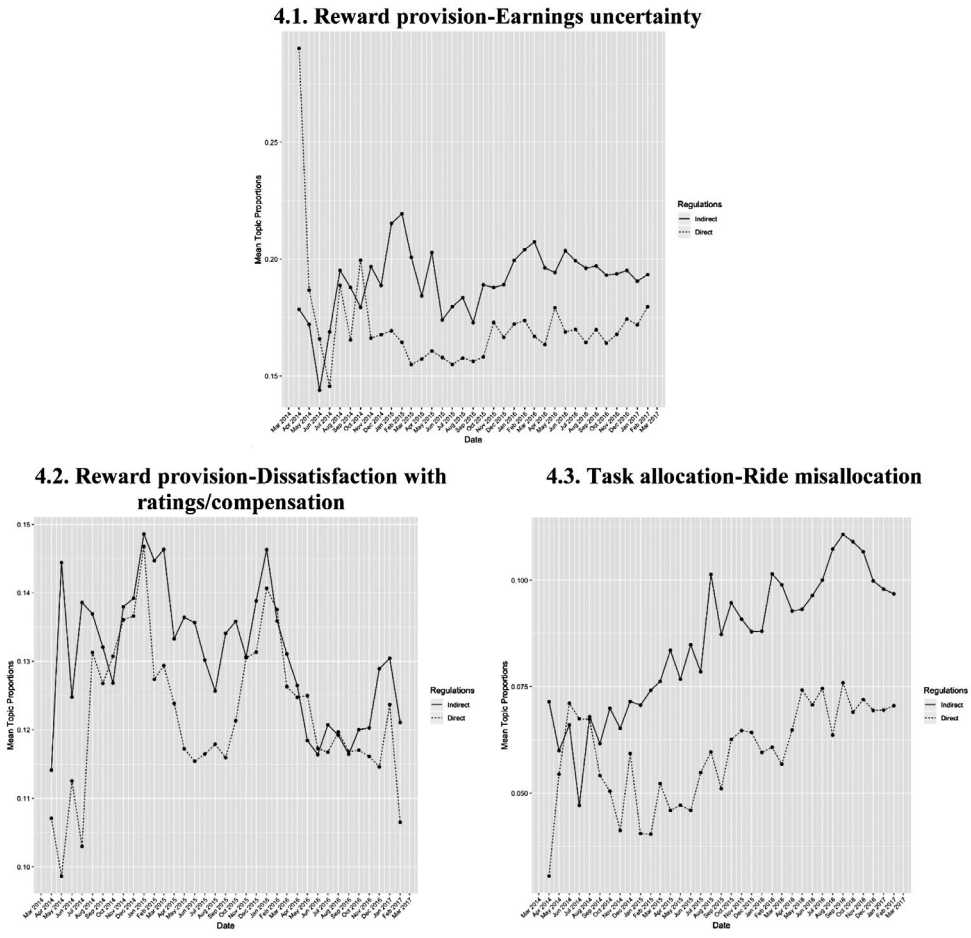

Figure 4. Opposing themes by the regulatory structure

Further, operating under indirect regulation, drivers also face fierce competition from peers. Potential entrants, who can complete the driver vetting process in the matter of days, and for which Uber is not the primary source of income (Senior Uber Representative, 2 July 2018), are not particularly motivated to build collaborations with other drivers and thus collaboration as a whole is weakened. Consequently, and unlike in direct regulatory structures where drivers might appeal to Uber or the government, when wishing to increase earnings or fight for a fair ratings system, drivers rely more and more on themselves:

> I have adopted the TAG program. When pax [passengers] ask how I like driving for Uber I answer \'The wages are really low, but the tips are great\'. I have signs posted in my car saying. \'Tips are great. Tips gratefully accepted by cash or credit card\' (I ordered a free Square Reader to process credit card tips if I ever get any) I have a cup in the centre console full of 5's and 1's. Visible from front or back seat. I never directly

> ask for a tip. And I am polite and give excellent service. (San Francisco, February 2016; Reward provision)

At the time this post was made, Uber did not allow drivers to accept tips. This initiative is, therefore, both a clear manifestation of drivers' will to change the situation for the better and an expression of self-reliant opposition. When drivers take matters into their own hands, it is often in a form of active resistance to Uber's current organizing solutions (or the lack thereof). This illustrates the greater power imbalance, as drivers in indirectly regulated cities seem to believe that they can only get their voices heard by hurting Uber's business. In this post, for example, the driver suggested manipulating surge prices:

> Been driving for quite a while now and don't normally post but sad to see many uber drivers around the IE driving right now. 64 cents a mile are you kidding me? I know some may say that we don't have to drive for uber if we don't like it which I respect your opinion but come on uber, smh. Hint: turn off your driver app, make it surge many of you know what I'm talking about. Good luck and be safe out there. (Los Angeles, January 2016; Reward provision)

Even when regulations and policies seem to be universal, they can be deployed with more adverse consequences for drivers in indirectly regulated cities, which enables Uber to take advantage of the leeway provided by regulators. For instance, on April 21 2016, the settled lawsuit (Case No. 3:13-cv-03826-EMC) in California required Uber to give at least two notices before deactivating drivers for low acceptance rates. The same month Uber published a new acceptance policy on its website (Uber, 2016) to be implemented across the United States. However, in cities that belong to the indirect regulatory structure, we still see drivers facing deactivation for low-acceptance rates. A representative post said

> So you would think that the robo texts would be turned off after the settled lawsuit in which the acceptance rating would no longer be used for deactivation. But on Saturday morning, I received emails/texts about my acceptance again telling me to go offline if I do not want to accept trips 20+ minutes away or outside of a 2*+ surge zone from my uber performance on Friday night. Fun times … Does that mean the acceptance rate is still being used for their PDB incentives at 75 per cent acceptance? (San Francisco, April 26 2016; Task allocation)

Therefore, since regulation enforcement is weaker in indirect regulatory structures than in direct ones, Uber faces less risk of penalty for non-compliance. As a consequence, drivers were primarily concerned with reward provision and task allocation, opposing Uber's solutions to these issues. Discussions about information provision, which were more prevalent in direct regulatory structures, became secondary. They require cooperation and time investment, which becomes less important if drivers' primary motive – earnings – is not satisfied (see Figure 4).

In sum, when compared to direct regulation, indirect regulation seems to entice drivers' opposition to Uber's organizing solutions. As evident by the relative share of

supplementing responses, direct regulation tames drivers' opposition and enhances the mutual dependence on Uber. However, as mutual dependence is loosened under indirect regulation, Uber's power over drivers is immense. Driving for Uber under indirect regulation means that drivers are pushed to allocate their time differently, rely on individual actions to address their power imbalance and reduce collaboration among each other. This dynamic is eventually galvanizing opposing responses, some of which lead to actions that are directly harmful to Uber.

As we explore next, whereas this general pattern is clearly evident in our data, it also shows some meaningful variation over time.

Workers' Responses Over Time

As Tzur (2019) finds, in most cities, regulations have become milder over time as 'the largest US cities mostly chose to formally approve TNCs; and when they did not, their de facto enforcement of the TNCs' lawlessness was unexpectedly lenient' (p. 12). In our data, the only cities that remained quite consistent in their approach to regulating TNCs were London and New York City, while the rest seem to have experienced a shift towards more lenient regulations (though none completely flipped its structure in the time period covered). Simultaneously, we see supplementing responses decreasing over time, while opposing responses show an increasing trend, in both regulatory structures (see Figure 2).[4] This indicates further support for our findings on the effect of regulatory structures on workers' responses.

In order to study the temporal dimension of our data in more depth, we take the City of Houston, Texas as an illustrative case, since it underwent the most pronounced regulatory changes in the time period covered by our study. In doing so, we note the contrast between Houston and New York City, the latter providing a counter example in that it stayed relatively stable over time. Below we triangulate data sources with news articles, legal documents and drivers' forum posts focusing on how the complex interplay of regulations, Uber's practices and drivers' responses play out over time.

The case of Houston, Texas. Houston started off, alongside New York City (Taylor, 2016), as the most regulated city in the United States when it comes to ride-hailing industry, setting precedent for how Uber acted in other cities (Batheja, 2015). As an Uber's spokeswoman puts it, 'Over the past year, the company has pulled out of other cities that launched fingerprint requirements in large part because of our experience in Houston' (Batheja, 2015). Like New York City, Houston used to have a burdensome process for issuing permits to TNC drivers: after passing Uber's test, drivers had to undergo the city's procedure, which included a background check, drug test and physicals. The process could take up to four months and would cost drivers up to 200 dollars (Martin, 2016). Other restrictions such as the age of vehicle and requirement to have a fire extinguisher in the car further limited entry for new drivers.

Throughout our data collection period, the City of Houston made numerous regulatory changes and Uber made various policy changes (see Appendix C). Overall, as we detail below, our analysis shows that as regulations become less strict – giving Uber more leeway – drivers increased their opposition and decreased their supplementing discussions.

We begin our analysis from the last quarter of 2014, considering that first Uber drivers in Houston begun the application process around that time, with first cars getting onto the streets in November 2014 (Pitman, 2014). Up to Q4 of year 2015, we see drivers clearly supplementing Uber's organizing solutions more than opposing. A representative post from this time period read

> Where did you go to get the physical and drug testing? Was it two different places or just one? I am trying [to] find something close to Katy that does both Physical and Drug Testing with chain of custody per required City of Houston. Also how much did you guys pay. Post where you went and how much even if it not in the Katy area to help other people out. (Houston, April 2015, Information provision)

The drivers also appeared to perfectly understand that the City of Houston was behind the strict regulations and not Uber. In this regard their objective – to get started with driving – was in line with Uber's, hence they tried to help one another with advice and recommendations while also encouraging each other to work collectively for this joint goal. A representative post read

> On the TNC license application from the City of Houston, one of the questions is if you had any traffic violations in the last 12 months. I got a ticket in November for allegedly speeding which I took defensive driving for. I remember when I pulled my driving history for that, it doesn't show previous tickets just an entry for a driving safety course. Should I answer Yes or No to this question on the TNC application? Has anyone else gotten a speeding ticket and applied, having any problems getting their TNC license? (Houston, May 2015; Information provision)

From this post it is evident that there was a lot at stake for drivers; being cautious was necessary to make it through the burdensome process of becoming an Uber driver in Houston, so they sought help. Since fewer part-time drivers signed up with Uber in Houston due to the costly and difficult process of becoming a driver (Begley, 2016), getting their license denied could have adverse effects on their lives and livelihoods.

However, around Q3 we already see supplementing and opposing responses being represented about equally, with opposing gaining a higher foothold from Q4 of year 2015 (see Figure 5). In contrast, we see that the trendlines for supplementing and opposing responses in New York City remained relatively stable over the same period. While the overall trend in Houston from Q4 of the year 2015 was towards more opposing responses, the City of Houston famously changed its policies. Uber itself claimed that the policies had gotten even stricter towards the end of 2015 (Delaughter, 2016). Indeed, in December 2015 the City of Houston introduced new regulations (e.g., requiring trade dress – a clear sign on a car indicating the car is an Uber car) – the last example of strong direct regulations. And we see drivers respond by supplementing responses, warning each other that checks were in place. A representative post read

> I think this is an ARA shake down. I don't believe that car had an airport sticker … but not sure. I couldn't get close enough. The car had its pink TNC sticker removed.

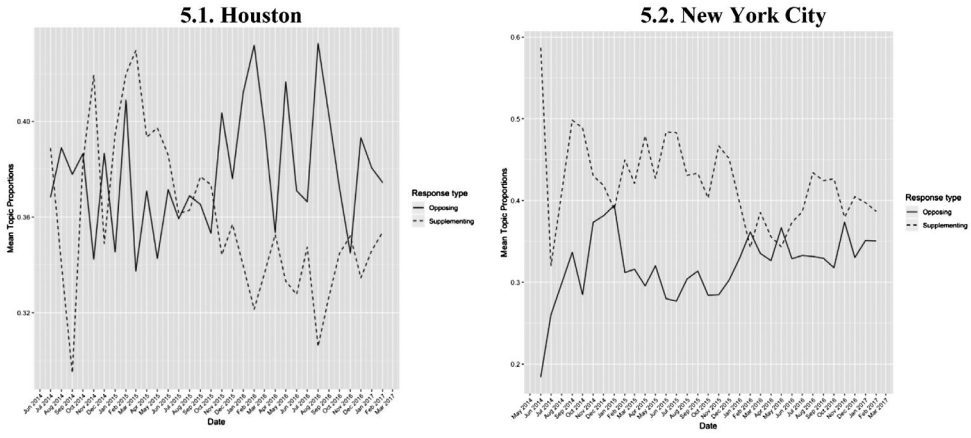

Figure 5. Temporal analysis – the case of Houston, TX

> That's a bad day. I assume tickets were issued. You're an embarrassment to the trade dress sir. [license plate cropped out to protect privacy of driver] (Houston, December 2015, Task allocation)

However, over time, as Uber advanced its negotiations with the City of Houston, more drivers got licensed and the regulations became less burdensome (e.g., no more physical exams), Uber begun introducing its own policies (e.g., rate cuts). Around that time, we also observe drivers engaging more in opposition of Uber's organizing solutions. In addition, we see growing distrust in Uber, which is also apparent in cities that have been indirectly regulated from the beginning (e.g., San Francisco). In particular, in January 2016 Uber introduced rate cuts across 100 US cities, including Houston. In the same time period – Q1 of 2016 – we see a peak in opposing themes where drivers discuss precisely that (see Figure 5). A representative post read

> Beware of Uber Propaganda Email saying people making $40/hr last year during Rodeo. Do these MoFos know they just lowered the rate by 20 per cent and increased the SRF from $1 to $1.95 from last year, these dkheads has no ethics no shame just lying through their teeth saying you can make what you made last year by driving during Rodeo. They don't tell you about the lowered rate and thousands new drivers on the road. Why the fk are they telling us about last year's data other than just to trick us into driving thinking we gonna make the same money. God I wish these tricksters would just stop the shady business practices. (February 2016, Reward provision)

While earlier drivers were helping one another get through the city licensing process, supplementing Uber's solution to information provision, reactions to Uber's policies after 2016 show the growing distrust in the company, which now has more control over drivers (see more posts in Appendix C).

Later that year, in September 2016, Uber begun to experiment with flat rates in central Houston – all rides $7.13 or less, but under a promise that drivers would receive

normal rates, with the company covering the difference. Again, we see drivers responding by warning one another about it and showing distrust in the company as well as clear disbelief that Uber's objectives are in line with that of the drivers.'

> Can you believe they are blaming the drivers for this loss? Funny thing is they don't post the numbers on where the money is going. Maybe they should put the blame where the blame lies. Which is with themselves for setting such low prices. If they just set reasonable fares then we would all be making money. Maybe they are spending a few dollars on these driverless cars? Back when they had reasonable rates, we all made money. Now nobody makes money. But something tells me Travis is taking more of the money than the drivers. (September 2016, Reward provision)

The last easing of regulations in the second half of November 2016 essentially reduced the cost of permitting to around $70 and the time required to obtain the permit to about 20 minutes. Consequently, we see a rise in the opposing responses (see Figure 5). It appears that as Uber gained more power, drivers became more dissatisfied with their wages and the distrust in the company kept growing. A representative post read

> What rate did Uber guarantee in your city for the holidays? List your city and rate they promoted. I am in Houston TX and they guaranteed us 1.3 and 1.5 WHAT A JOKE … THAT LOW NUMBER IS A SMACK IN THE FACE. SHAME ON YOU UBER. NOT EVEN A 2.0 IN A CITY THIS MASSIVE … WOW! (December 2016; Reward provision)

Finally, in Q1 of 2017, we see drivers actively resisting Uber's solution to reward provision, and we observe a growing distrust towards Uber, same as we observe in the indirectly regulated cities. A representative post read

> I am quite sure Fuber using bogus surge to coax drivers go online or go where they want you be. The map shows surge area is nearby, but when you are close to it, it disappears all the sudden. I even doubt Fuber using individualized surge map for different driver. Maybe we shall capture surge map every day at certain time points, like 8AM, 5PM, etc. If that's real, we will have more evidence to sue Fuber. (February 2016)

In this post the driver encourages others to unite and collect evidence that may be used to sue Uber. Evidently, as barriers to market entry are lowered and Uber serves as an auxiliary income source to many drivers, mutual dependence weakens. While drivers are willing to earn extra cash in the available time they have, the platform tries to extract the most it can for the time being, knowing drivers would eventually leave but new ones will come, and hence the cycle continues. A representative driver post read

> I just don't get it!!!! Why does Uber continue to treat their partners (drivers) like pure horse crap? If it's not the low pay then it's the wacky rating system, the low guarantee rates and now the crappy fuel card. I love to drive people around. Meeting new people. Using my time the way I want to without a set schedule. That's what makes Uber so

> b*tching. This is why we are here its not solely for the money. We make peanuts once you factor in all the costs. Anyway Uber promised lower rates for gas yet I do not see it, they are supposed to deduct the fees from our pay on payday (they do it daily). How does that help? If you're going to take the money right away why give us a card? We can just use our own cash. To make matters worse they are charging me for stuff I didn't even use. Wth????? I am livid. I will never use their card again. Why can't Uber just treat us right? (January 2016; Reward provision)

Overall, this analysis of temporal trends in our data reveals a similar pattern: When regulations are more stringent, drivers engage more in supplementing. However, as regulatory changes make the environment more favourable for the platform owner, drivers show more opposition towards the platform's organizing solutions. Accordingly, reward provision becomes the primary concern and information provision, which supplements organizing solutions, tends to wane.

DISCUSSION

This study set out to investigate how and why workers respond to new forms of organizing in the platform economy across different regulatory environments. We found that platform workers – Uber drivers – actively oppose and supplement the platform's solutions to the fundamental organizing problems of information provision, reward provision and task allocation. Moreover, the drivers' responses varied both in kind and degree depending on whether cities employed a direct or indirect regulatory structure, revealing a complex multilateral power dynamic between platforms, workers and the regulatory environment.

In cities employing a direct regulatory structure, drivers engaged more in supplementing Uber's solutions, primarily to information provision. In contrast, drivers in cities characterized by indirect regulatory structures engaged more in opposing Uber's organizing solutions and did so by expressing insecurity with earnings, dissatisfaction with ratings and compensation and voicing concerns with the way tasks are allocated. Although drivers across regulatory structures exhibited both types of responses – supplementing and opposing – their underlying motives were different. In directly regulated cities, drivers seemed to prioritize working with Uber, although they at times opposed certain solutions such as those pertaining to reward provision. On the other hand, drivers in indirectly regulated cities showed contempt and even attempted to resist certain organizing solutions, at times doing that at the expense of Uber.

Theoretical Implications

The first main contribution of this study is that it shows how platform workers, typically not formally employed by platform organizations, play a multifaceted role when it comes to establishing the platforms' modus of organization. Uber drivers opposed and supplemented Uber's organizing solutions. Most studies of distributed organizational structures (e.g., Wikipedia, Linux), have focused on how external actors contribute to realizing organizational goals (e.g., Dobusch et al., 2019; Kornberger, 2017). However, these studies

posit that such contributions were purposefully incited by the organizational construction, encouraging contributions across fluid organizational boundaries (Boudreau and Lakhani, 2013). We add key insights by showing how Uber drivers opposed organizing solutions they found unfair and supplemented others with their own solutions, in ways not intended by the organizational design.

Although the question of how an organization operates is often irrelevant to external stakeholders (Puranam et al., 2014, p. 175), a new form of organizing cannot treat its work design choices as an internal matter, because the platform's solutions are not necessarily going to be blithely accepted by relevant external actors. While this might be obvious in the case of incumbent organizations that have been affected by the disruptive potential of a new form of organizing (e.g., Baron, 2018), we show that this also holds true for platform workers as key constituents in the platform economy. By identifying the second-order themes that oppose Uber's organizing solutions (reward provision themes 'earnings uncertainty' and 'dissatisfaction with ratings/compensation' and task allocation theme 'ride misallocation'), we offer empirical insight into the key concerns of platform workers as discussed with their peers. In particular, we find that all topics that relate to reward provision were critical in nature, echoing prior concerns about job insecurity, low compensation and the shift of risk to workers (Davis, 2016; Rogers, 2015). Also, task allocation, in particular the way Uber assigns tasks (rides) to drivers, another factor that differs from traditional organizing, received much criticism.

We found that, in response to organizing problems not fully addressed by the platform organization, workers also put forward their own supplementary solutions. The topics that drivers discussed made clear that Uber's solutions, particularly those related to information provision themes 'getting started' and 'vehicle-related info' and task allocation themes 'self-organizing rides' and 'anticipating ride barriers', were insufficient. The drivers would compensate for the platform's organizing voids with their own solutions by, for example, alerting each other to tasks (possible rides). This resembles prior findings on how Amazon Mechanical Turk workers supplemented Amazon's solutions by creating a ratings system for platform clients (Irani and Silberman, 2013). Such supplementary solutions create a paradoxical situation as they emerge beyond organizational boundaries as traditionally defined by asset ownership or employment contracts (Simon, 1953), and although not intentionally designed top-down, are still crucial to platform organizations as they help realize its overall goals.

Our findings revealed that these supplementary solutions remained rather isolated from Uber's solutions. Uber's form of organizing relies on a typical platform architecture and simple, standardized interfaces facilitating interaction between platform's core and periphery, which makes it easy for workers to 'plug in' to Uber's application and avoid any need for intense interaction between core and periphery (Baldwin and Woodard, 2009). As a consequence of utilizing such strictly defined interfaces, supplementary organizing among workers remains loosely coupled from Uber's solutions. This is distinct from other crowd-based, distributed forms of organizing with more fluid connections among the contributors and between the core and periphery of the organization, such as at Wikipedia or the crowd-based Hyperloop Transportation Technologies (Dobusch et al., 2019; Majchrzak et al., 2018). Drivers' supplementation was mostly collaborative in spirit, aimed at making the overall form of organizing work. However, drivers at times

engaged in active resistance or activities that were harmful to Uber (e.g., attempts to manipulate surge pricing), which were more prevalent in indirect regulatory structures. This further accentuates the power dynamic imbalance between Uber and its drivers. Overall, this points to the immense potential for more synergy in the co-design of organizing solutions by workers and platforms, should these connections be made.

The second major contribution of our study is that we demonstrate how regulations influence platform workers' actions. Whereas prior studies documented how regulations affect the actions of platform organizations (Sundararajan, 2016; Uzunca et al., 2018), or explored power dynamics between platform owners and workers (Curchod et al., 2019), we show that regulatory structures affect how drivers respond, even when platform owners' actions are not affected. Workers may respond differently to new forms of organizing in the platform economy depending on whether the regulatory structure directly addresses workers (typically in cities with stronger regulations) or indirectly (associated with cities that have weaker regulations). This distinction in the structure of the regulation as introduced here is a far more parsimonious characterization of regulatory variation (as compared to lists of indicators, see Tzur, 2019). Our evidence that this distinction impacts Uber's policies across cities and influences workers' responses, is important as it charts a pathway for future studies to explore how regulatory structure may shape other relevant organizational processes and outcomes.

Our explanations of the differences in workers' responses across regulatory structures offer fundamental insights into the role of power relations and mutual dependencies in the platform economy, thereby also informing resource dependence theory (as called for by Davis and Cobb, 2010). As prior research on platforms has noted, platform owners hold a powerful position, as their control over platform's architecture enables them to enforce rules, enjoy information exclusivity and control access to the back-end of the platform (Curchod et al., 2019; Eisenmann et al., 2009; Gawer, 2010), all of which might lead them to exploit this leverage over other stakeholders. The workers clearly expressed the feeling of being dominated by Uber and their evidently subordinate position of power.

Our findings explain that a regulatory structure can impact the mutual dependency shared by the platform and its workers. As Reischauer and Mair (2018) noted, to an extent, platform owners are dependent upon external workers just as workers are on them. To this, we add that in direct regulatory structures, the relationship between Uber and drivers was characterized by stronger mutual dependence due to restrictions on TNC licenses, stringent TNC driver application procedures and high license fees. Consistent with resource dependence theory arguments that mutual dependency incites more cooperative behaviour (e.g., Casciaro and Piskorski, 2005; Reischauer and Mair, 2018), Uber also made long-term investments to reduce uncertainty, putting resources in developing test centres or providing English language classes for drivers (e.g., in London) to help drivers overcome high entry barriers. Drivers, on their end, were also more cooperative; not by engaging in collaboration with Uber, but by supplementing – crafting their own solutions that, in combination, made the platform model work 'for them' as well as for Uber.

Under an indirect regulatory structure, on the other hand, the degree of mutual dependency is lower because the procedure to become a driver is more lenient, the license

fees are lower or non-existent, TNCs have low barriers for entry and there are regulatory voids that give TNCs more freedom and control. Power imbalance accentuates as platform owners get more leeway to set and enforce its own rules. Under these conditions, drivers seek fairness, but also resort to a more rebellious attitude, aiming to show Uber that they also have power, which is why we saw them gaming the system, manipulating surge or simply protesting. These actions mimic the behaviour of organizations under power imbalance that are very unlikely to form a formal partnership (Casciaro and Piskorski, 2005). The workers' motivation to engage in negotiations, however, is not equal to their ability to do so as a platform owner is unlikely to relinquish its position of dominance. The clout afforded to platforms under indirect regulation clearly incited stronger opposition from drivers, indicating that there are limits to the benefits of self-regulation (Cohen and Sundararajan, 2015).

Taken together, our findings strongly suggest that mutual dependencies and power imbalances are sensitive to the complex interplay among platforms, regulators and workers. Our study particularly highlights how the dynamics in this triangle are affected by regulatory structures. In fact, our work develops and validates the distinction between direct and indirect regulation, positioning it as both empirically and conceptually meaningful, especially in the platform economy. Our findings, therefore, do not only strengthen the overall argument that regulations play a critical role in tempering power imbalances and fostering positive mutual dependencies between workers and platforms, but further show that where regulation is weaker, workers express concerns about being deceived or mistreated by the platform owner.

Limitations and Future Research

Our study is not without limitations; however, it offers an avenue of possibilities for future research. First, the forum users may not be representative of all Uber workers or platform workers more generally. In addition, their posts may be disproportionately reflecting more negative evaluations of Uber, having been written by drivers seeking advice, revenge, or change. While these concerns are not negligible, previous studies have demonstrated that forums are a valuable source of insights into workers' experiences (e.g., Barros, 2014). Furthermore, social media is an important channel for individuals to connect with their community and influence organizations (Castello, Etter, and Årup Nielsen, 2016), thus all platform workers may resort to using it, regardless of the nature of their evaluation of the organization.

It is also important to recognize that while our study was primarily focused on the kind of concerns workers have and how they vary between regulatory structures, which we believe our dataset adequately captures, there could be city-specific differences between workers. For instance, values, culture and norms may differ in the geographic areas of direct vs. indirect regulations, possibly accounting to an extent for the differences in responses. Future studies could benefit from triangulating posts on social media with additional data sources such as surveys and interviews, allowing them to control for possible demographic differences.

Second, our study addressed a particular industry within the platform economy – ride-hailing, characterized by localized regulations (Tzur, 2019). Regulatory challenges

become more complex with online labour platforms (e.g., Upwork) that allow for borderless work, making the situation particularly favourable for workers in specific geographic regions (Fabo et al., 2017). This further begs the question as to who is responsible for setting and enforcing regulations, as online labour platforms are registered in different locations independent from the physical location of their workers (de Groen and Maselli, 2016). Future research could investigate differences between mobile labour markets (e.g., Uber, TaskRabbit) and online labour markets (e.g., Upwork, CoContest) (Codagnone et al., 2016) comparing the variation in workers' responses. One could speculate that supplementing a platform's organizing solutions is more accessible as a measure to workers partaking in online labour markets, because task allocation and task execution take place online. Indeed, the study of Amazon Mechanical Turk workers provided compelling example that points in this direction (Irani and Silberman, 2013).

Finally, while we show that workers are important stakeholders in the platform economy whose responses are affected by a platform's actions and external regulatory structures, the influence of those responses remains uncertain. While we know that drivers can institute change – for instance, a UK court ruling granted two Uber drivers the status of employees vs. independent contractors (Kerr, 2016) – we need a more systematic account of the causal connection between workers' responses and subsequent organizational and institutional changes.

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NOTES

[1] Task division was not discussed in the dataset, perhaps suggesting implicit acceptance of organizing solutions pertaining to it. Arguably, the typical Uber ride as a unit of labour does not differ much from other taxi companies and solutions to problems of organizing are more likely to be discussed when they deviate from existing solutions.

[2] Relates to top 20 most representative posts with a high topical content (Roberts et al., 2016). Some posts have been shortened to leave out less relevant parts. To ensure anonymity, we only reproduce quotes from users who used nicknames on the forum.

[3] Information provision App-related issues were excluded due to low inter-rater reliability statistic.

[4] Note that early months show more variability in the prevalence of themes because the forum had just started, hence the total number of posts was relatively smaller.

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