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How does the ride-hailing systems demand affect individual transport regulation?

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ABSTRACT

This paper analyses the legal issues in individual transportation derived from the entrance of ride-hailing companies into the market, based on the Brazilian legislation. The legal problem of ridesourcing services revolves around the question whether they are of public or private nature. Legislation has been proposed to either ban or legalize the service and to give municipalities the right to regulate its operations. This paper also analyses socio-demographic and travel characteristics of the ridesourcing demand in Brazilian cities. Based on this demand's point of view, a logistic regression model was generated to predict the probability of users choosing a ride-splitting system. The results show that the majority of ridesourcing trips is replacing taxi and public transport trips. Safety and cost are the main reasons that influence the decision of sharing trips via ride-splitting. The use of larger vehicles for sharing trips can introduce competition with the public transport systems. The ridesourcing interference on collective public transportation may be more noticeable than on individual public transport (taxis), given the much greater demand for the former.

1. Introduction

Felson and Spaeth (1978) describe shared economy as “those events in which one or more persons consume economic goods or services in the process of engaging in joint activities with one or more others”. These arrangements aim at urban sustainability (Wu & Zhi, 2016); they are seen as alternatives to major city infrastructure problems, such as mobility issues caused by an increase in travel needs (Banister & Marshall, 2000; Kapoor, 2014; Kriston, Szabó, & Inzelt, 2010). In this context, technological advances generate a wide range of business opportunities which include the transport sector. Since 2010, some ridesourcing companies have been created, offering a door-to-door transport service that has become a direct substitute for private cars or prebooked taxi services.

Despite the innovations brought by ridesourcing companies, their entry in the market has raised controversy. These companies were accused of unfair competition with the traditional taxi services and noncompliance with the current legislation. Given that the newer service has faced legal and corporate barriers since its origins, it has been banned in several cities (Craggs, 2017). In Brazil, the national legislation has been subject of different interpretations. As a result, while some cities have regulated the service, others have banned it or imposed strongly restrictive conditions. The debate relies on whether ridesourcing should be considered an individual public transport system, for which government regulation is necessary, or whether it is a private service, protected by free consumer's choice and by the free exercise of economic activity (Silva & Andrade, 2016). For Esteves (2015), there are no economic arguments that justify a ban on new providers of individual transportation, since they do not only raise competition, but they are also positively valued by consumers.

Nevertheless, the operation of ride-hailing companies may increase the deterioration of sustainable urban mobility, since ride-hailing services end up capturing part of the demand for public transport, thus generating several negative externalities. This could be aggravated by a new feature called ride-splitting (Gray, 2015; Lindsay, 2017), which allows the customer to share trips with other users.

Before transport authorities opt to forbid this new mobility alternative, it is necessary to understand the role of ride-hailing companies as transport providers, the characteristics of the ridesourcing demand and its impact on urban mobility. Are the users of ride-hailing systems the same group that used to hire taxis, or does this new service meet a repressed demand for public transportation, bringing new consumers into the market? What is the impact of ride-splitting on the demand for public transport? What would be the real impact of this new modality on public and private individual transportation?

This paper aims to evaluate the characteristics of the Brazilian demand for ridesourcing services and to assess the potential market for ride-splitting. In order to do that, an online questionnaire was applied

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via Google Forms, and the data obtained were analysed by logistic regression.

2. Ridesourcing companies as shared economy

Although the idea of Shared Economy comes from the late 1970s (Felson & Spaeth, 1978), what boosts the current model, which is based on sharing, are the 21st century technologies and a new generation of consumers (Posen, 2015). Thus, companies have developed platforms to help connecting people interested in sharing excess resources (e.g. houses or cars) (Gardner, 2013). As Kapoor (2014) states, a certain amount of "pain" is necessary to make people change their standard consumption habits and share – meaning that a shared economy business works best when consumers wish to get rid of a problem that has been bothering them.

Ridesourcing companies fit into this economic model, since they are based on the use of one's private car to offer an alternative travel mode. It can be said that the "pain" that triggers this service's success comes from the flaws in large cities' current transport network – especially the ones related to taxi services (Kapoor, 2014). According to Posen (2015), "taxis technically fit within the access-based focus of the sharing economy". Moreover, the importance of an accessible door-to-door transportation mode is undeniable (European Transport Safety Council [ETSC], 2016; Qian & Ukkusuri, 2017; Silva & Andrade, 2015).

Due to technological advances, taxi services have been using online platforms to connect drivers and users. In Brazil, mobile applications such as 99 Taxi and Easy Taxi have made calling a taxi a lot easier. Due to Uber's entry in the market, these services started offering discounts (Rocha, 2017), which shows the competition has started to benefit users.

Different attempts to implement shared taxis in Brazil were proposed in São Paulo, in 2013, and in Manaus (Amazon), in 2017. Different from the shared taxis reported in surveys from other countries (Badger, 2014; Barann, Beverungen, & Müller, 2017; Hosni, Naoumsawaya, & Artail, 2014; Wang, Zheng, & Lim, 2018), one of the service's features in Brazil was the use of fixed and pre-established routs and tariffs (Neto, 2017). This shared taxi idea distorts essential characteristics of individual passenger transportation, which is regulated by law – especially itinerary flexibility and charging according to the taximeter. Therefore, these projects were considered illegal and they were rejected both in São Paulo and in Manaus (Diário da Amazônia, 2017; São Paulo, 2015b).

The private companies Uber and Lyft, the most important startups in the ridesourcing industry, launched in 2014 the categories UberPool and Lyft Line, which enable the clients to split a ride and its fare with other passengers in a ridesourcing vehicle (Lyft, 2016; Uber, 2016). These categories are referred to as ride-splitting (Chen, Zahiri, & Zhang, 2017). Basically, these services work as carpooling dynamic systems, which connect passengers and drivers through online platforms in real time, aiming to increase cars' occupancy rates (Agatz, Erera, Savelsbergh, & Wang, 2011, 2012; Créno, 2014; Gargiulo, Giannantonio, Guercio, Borean, & Zenezini, 2015). They work as a for-profit service conducted by drivers previously registered in the company.

The carpooling concept of sharing trips with multiple passengers is important for the ridesourcing companies to attract more clients and open up the possibility of higher profits, because they highlight the idea of sustainability and mobility efficiency (Kokalitcheva, 2016). However, this model intensifies questions about the legitimacy of the ride-hailing platforms within current transport legislation of several municipalities around the world. In 2014, for example, the California Public Utilities Commission (CPUC) declared the carpooling operated by the startups to be illegal. Therefore, changes in the local legislation were necessary to provide more safety to users and legalize the service (Kerr, 2014; Kokalitcheva, 2016).

Due to the political influence of the taxi industry, the relationship between taxi companies, ridesourcing startups and transport authorities has been, in many cases, aggressive and hostile (Blundy, 2015; Brazil, 2015b; Lee & Kelion, 2014; Ruvolo, 2015; Westcott, 2015). However, whereas some cities struggle to organize the transport legislation in order to control possible market failures and to adjust to technological advances, others see the ride-hailing industry as a plausible alternative for some flaws in the public transport. This situation was experienced in Tampa (U.S.A.), where the government substituted two bus lines for Uber and Lyft rides, claiming better cost-benefit (Brustein, 2016).

In this changing and dynamic environment, understanding where the ride-hailing industry fits into the market gets more and more complicated. Can the startups be stated simply as the technology companies they claim to be (Uber Technologies INC., 2015), or are they beyond the basic idea of shared economy and have become a transportation business aiming for more space into this market?

3. Regulatory issues in Brazil

The vehicle-for-hire industry, including taxi services, has a worldwide history in regulations. This tendency is due, in some cases, to the need to characterize it as a public service, aiming to reduce the externalities that rise from its use (public takeover), or due to the requirement of deregulating aiming market equilibrium (Cairns & Listonheyes, 1996; Cetin & Eryigit, 2013; Schaller, 2007; The Transport Committee, 2004). Recently, the ride-hailing platforms boosted the need for adjustments in regulation (European Transport Safety Council [ETSC], 2016; Farren, Koopman, & Mitchell, 2016; Rienstra, Bakker, & Visser, 2015).

In Brazil, taxis work in accordance to the National Law n° 12.468 (Brazil, 2011) and are classified as **individual public transport**, which is defined by the National Mobility Policy (Law n° 12.587/2012) as a "paid passengers transportation service open to the public, through vehicles-for-hire, for individual trips" (Brazil, 2012). However, there are some nuances that disfigure taxi as a public service (Silva & Andrade, 2016), such as the possibility of transferring a taxi license to one's heirs, according to the Law n° 12.865 (Brazil, 2013), which leads to questioning its legal nature (Nasser, 2014; Sarmento, n.d.).

Nevertheless, National Law n° 12.468 (Brazil, 2011) defines the prerequisites for the taxi driver profession, delineating quality and safety requirements. It also loosely determines the fare regulation, stating that vehicles in cities with more than 50,000 inhabitants must use taximeters. Although, it's the local transport authorities that fix the fares, after negotiating with local taxi driver unions (Brazil, 2016b).

Uber, the world's most influential ride-hailing company, started its operations in Brazil just before the start of the 2014 FIFA World Cup. Whereas the population soon welcomed the ride-hailing app, taxi drivers claimed that the startup acted against the law, as it promoted public individual passenger transport without following any of the regulations applicable to this type of transport (Brazil, 2015b). Uber, in turn, asserts that they are a technology business which promotes private individual transport (Brazil, 2015a). The question regarding what is public and what is private has led to legal clashes and, up to this moment, it remains unsolved.

In April 2015, justice determined the suspension of the Uber app throughout the national territory, declaring in a precautionary measure that the company provided a clandestine service (TJSP, 2015b). However, a month later, in May 2015, Uber's injunction was dismissed, with the argument that only the Public Ministry may take such decision (TJSP, 2015a). Afterwards, several Brazilian cities formulated draft bills prohibiting the use of private cars registered in mobile applications for paid individual passenger transportation, aiming to solve the conflict between Uber and the taxi drivers (Rio de Janeiro, 2015; São Paulo, 2014). Nonetheless, as judicial decisions were not definitive, preliminary decisions extinguished them later (Ferreira, 2016; Pinho, 2016; Rio de Janeiro, 2016).

As these processes went back and forth, allowing and prohibiting

ride-hailing companies to operate, the City of São Paulo issued the Decree n° 56.981, regulating the economic activity of remunerated passenger transportation. This regulation allows the functioning of ride-hailing companies in the city areas, by means of kilometres credits, which control the number of trips performed by them. Additionally, the companies must pay a specific fee and inform the local transport authority about the trips taken (São Paulo, 2016).

On the national level, draft bill no. 5.587/2016 aims to change the National Mobility Policy (Brazil, 2012), to update the definitions of public and private transport and to insert ride-hailing apps in that context. This draft bill is under Congress evaluation (Brazil, 2016a). The process started in June 2016 and, since then, it has undergone several changes. Initially, it aimed to stipulate that individual paid transportation is an activity intended only for taxi drivers. However, the text was modified in order to provide the following definition to individual private passenger transportation: "paid passenger transport service, private activity, not open to the public for individual or shared trips, requested exclusively by previously registered users through mobile applications or other networking platforms" (Brazil, 2017a).

Therefore, the service provided by ride-hailing companies would fit this category and would be regulated by the municipalities and Federal District, as described on bill n° 5.587/2016. However, the term "private activity" was removed from the last version of the document, approved by the National Congress in April 4th, 2017 (Brazil, 2017b). This meant, as stated by congressman Daniel Coelho, that the activity offered by the companies becomes public, which makes their operation unfeasible (Calgaro, 2017). Uber declared that the approved proposal is an over-past law, a disguised ban meant to kill the new mobility model (Uber Blog, 2017). The draft bill now waits appreciation in the National Senate.

In the midst of the legal debate, specific determinations about ride-splitting have not evolved, except for the inclusion of the "shared mode" definition (Brazil, 2017a). Currently, UberPool operates only in São Paulo and Rio de Janeiro. The focus right now is rather on framing the service as public or private than defining the carpooling mode. Moreover, the current changes in regulation do not specify the type of vehicle used to provide individual paid transportation, which leaves room for future legal discussions on ride-splitting, should ride-hailing startups be legalized.

It is important to mention that the debate on sustainable mobility has not been able to emerge from the juridical contest. Besides not understanding the characteristics of the ride-hailing demand, it is not yet known whether these services subtract their demand from public transportation passengers, encouraging the use of automobiles to a certain extent. In addition, the possibility of using vehicles of greater capacity generates discussions about the economic sustainability of the urban public transport network (Silva, 2017). Therefore, this paper aims to investigate the social and travel characteristics of Brazilian Uber users, in order to better understand their travel behaviour and, consequently, improve transport planning. It will also analyse which variables influence the probability of one using UberPool – the only ride-splitting system available in Brazil so far.

4. Methodology

In order to understand ride-splitting from the Brazilian demand's point of view, data were collected, from March to May 2017, by means of an online survey presented via Google Forms. The questionnaire was published in various Facebook groups and sent to e-mail lists of Brazilian postgraduate programs and Regional Councils of Engineering and Agronomy (CREA). The cities where the survey was conducted are listed on Table 1.

The focus of this research was the use of the Uber platform, since it is the main ridesourcing company operating in Brazil nowadays. The questionnaire was divided in two sections: (i) socio-demographic information and (ii) opinions about the ridesourcing service and possible use of UberPool.

Table 1
Cities where the surveys were implemented.

City	State	City	State
Maceió	AL	Jaboatão	PE
Salvador	BA	Londrina	PR
Juazeiro do Norte	CE	Medianeira	PR
Fortaleza	CE	Curitiba	PR
Brasília	DF	Rio de Janeiro	RJ
Vitoria	ES	Duque de Caxias	RJ
Vila Velha	ES	Niterói	RJ
Aparecida de Goiânia	GO	São João de Meriti	RJ
Senador Canedo	GO	Mesquita	RJ
Goiânia	GO	Caxias do Sul	RS
Belo Horizonte	MG	Porto Alegre	RS
Betim	MG	Joinville	SC
Juiz de Fora	MG	Florianópolis	SC
Ibirité	MG	Blumenau	SC
Itabira	MG	Ribeirão Preto	SP
Uberlândia	MG	Rio Claro	SP
Contagem	MG	Campinas	SP
Pouso Alegre	MG	Sorocaba	SP
Belém	PA	Caçapava	SP
João Pessoa	PB	Jundiai	SP
Bonito	PE	São Bernardo do Campo	SP
Recife	PE	São Paulo	SP
Paulista	PE	Jaú	SP
Olinda	PE	São Carlos	SP
Moreno	PE	Palmas	TO
Camaragibe	PE		

Research participants were asked if they would be interested in ride-splitting. The question was "Would you like to pay less for sharing your trip with another passenger through UberPool?". This answer originated a dichotomous dependent variable named "Pool": yes (success) = 1; no (failure) = 0. Additionally, using a five level Likert scale, they evaluated the following variables: cost, travel time, travel with unknown passengers, environment, and safety. Table 2 shows the variables assessed in the questionnaire.

These criteria were chosen according to a literature review mostly on factors that influence the carpooling decision. This was due to the similarity between carpooling and ride-splitting, and the lack of research specifically addressing ride-splitting (Buliung, Soltys, Habel, & Lanyon, 2009; Chen et al., 2017; Cools, Tormans, Briers, & Teller, 2013; Correia & Viegas, 2011; Delhomme & Gheorghiu, 2016; Li et al., 2008; Neoh, Chipulu, & Marshall, 2015; Tezcan, 2016; Waerden, Lem, & Schaefer, 2015).

The questionnaire was sent to several universities, professional associations and labour unions throughout the country, aiming Uber users as their target population. After receiving the responses, some adjustments had to be made in order to balance the sample proportions to the number of cities where Uber operates. A sample of 384 respondents were necessary to reach 95% statistical confidence and 5% error, considering an infinite population (Agresti & Finlay, 2012). The outlier Labeling Rule was applied to exclude discrepant data (Hoaglin & Iglewicz, 1987).

The explainable variables on the probability of using UberPool were used to obtain a logistic regression model (Agresti, 2002). Strong collinearities between ordinal variables were excluded using Spearman's *rho* (Field, 2009; Göktaş; İşçi, 2011). The statistical software IBM Statistic Package Social Science - SPSS 23 was used to analyse the data.

5. Results and analysis

500 responses were obtained through the online questionnaire in 16 Brazilian states from all regions of the country. This sample was adjusted so that the number of respondents was proportional to the regional populations of Brazil, considering only the cities where Uber

Table 2
Variables collected in the questionnaire applied.

Variable code	Description
Income	Mean familiar income: 0 - no income; 1 - up to 2 minimum wage (MW)[a]; 2 - higher than 2–5 MW; 3 - higher than 5–10 MW; 4 - higher than 10–20 MW; 5 - higher than 20 MW
Age	Respondent's age
Gender	1 - female; 0–male
Owner	Vehicle ownership: 0 - none; 1 - car; 2 - motorcycle; 3 - car and motorcycle
Alternative	Travel alternative for Uber: 1 - walking; 2 - bicycle; 3 - car; 4 - carpool; 5 - taxi; 6 - public transport; 7- motorcycle
Reason	Trip purpose: 1 - work; 2 - study; 3 - leisure; 4 - shopping; 5 -services; 6 - back home
Score	Ridesourcing service evaluation: grades from 0 (very poor) to 100 (excellent)
Info	Acquaintance with UberPool: 0 - none; 1 - have heard about it but never used it; 2 – have heard about it and used it.
Reduction	Acceptable price reduction to justify using UberPool: 0 - would not use the service under any circumstance; 1 - up to 30%; 2 - from 31% to 70%; 3 - from 71% to 100%
Group	Number of passengers with whom it would be acceptable to share a trip: from 0 to 7 (assuming 9 people, including the driver, as the higher capacity of an automobile)[b]
Cost	Importance of the cost when choosing UberPool: from 1 (very relevant) to 5 (very irrelevant)
Time	Importance of travel time when choosing UberPool: from 1 (very relevant) to 5 (very irrelevant)
Unknown	Importance of sharing a trip with unknown passengers when choosing UberPool: from 1 (very relevant) to 5 (very irrelevant)
Environment	Importance of the environment when choosing UberPool: from 1 (very relevant) to 5 (very irrelevant)
Safety	Importance of safety when choosing UberPool: from 1 (very relevant) to 5 (very irrelevant)

[a] The minimum wage in Brazil is equivalent to US$ 286.54 per month – rate of R$ 3.27 in June 9th 2017 (BCB, 2017).
[b] Brazilian Traffic Code (Brazil, 2008a).

Table 3
Sample characteristics.

Variable	Category	*n*	%	Variable	Category	*n*	%
Gender	Male	205	53.4%	Alternative	By foot	3	0.8%
	Female	178	46.4%		Bicycle	1	0.3%
	Not informed	1	0.3%		Car	40	10.4%
Income	No income	5	1.3%		Carpooling	31	8.1%
	Up to 2 MW	38	9.9%		Taxi	191	49.7%
	> 2 a 5 MW	79	20.6%		Public transport	116	30.2%
	> 5 a 10 MW	124	32.3%		Motorcycle	2	0.5%
	> 10 a 20 MW	81	21.1%	Reason	Work	58	15.1%
	> 20 MW	57	14.8%		Study	22	5.7%
Owner	None	78	20.3%		Leisure	175	45.6%
	Car	267	69.5%		Shopping	5	1.3%
	Motorcycle	8	2.1%		Services	37	9.6%
	Both	31	8.1%		Return to home	85	22.1%
Age	16 to 26	153	39.8%	Score	50 to 60	29	7.6%
	27 to 36	140	36.5%		61 to 70	43	11.2%
	37 to 46	48	12.5%		71 to 80	110	28.6%
	47 to 56	25	6.5%		81 to 90	159	41.4%
	57 to 69	18	4.7%		91 to 100	43	11.2%
Info	None	119	31.0%	Group	0	83	21.6%
	Never used	198	51.6%		1	51	13.3%
	Used	67	17.4%		2	119	31.0%
Reduction	Would never use	82	21.4%		3	39	10.2%
	Up to 30%	88	22.9%		7	92	24.0%
	> 30%–70%	201	52.3%				
	> 70%–100%	13	3.4%				

operates; it ended up with 384 valid questionnaires. Table 3 shows the sample's characteristics.

The majority of the respondents are male (53.4%) and young (76.3% from 16 to 36 years-old), belong to the middle class, have a family income over 5 times the minimum wage (68.2%) and have a car at home (69.5%). They are also well informed: 69% of the participants had heard about UberPool. In general, Brazilian Uber users rated the supplied service as good: all respondents rated the service above 50, in a scale from 0 to 100, and most of them (81,2%) rated it over 70. As to the trip purpose, the main reasons for ridesourcing are leisure (45.6%), followed by return trips to home (22.1%).

Most of the respondents stated that they would travel by taxi (49.7%) or public transport (30.2%) if Uber was not an available alternative. Thus, one can say that ridesourcing companies affect directly the taxi demand, which triggers the discussions about individual transport competition. However, although a significant part of Uber's demand in Brazil derives from public transport, it does not represent a significant impact on its demand. This is because a very small part of the population uses individual paid transport, while the use of public transport is much more expressive (Instituto da Cidade Pelópidas Silveira, 2016; São Paulo, 2015a).

While 70.3% of the respondents declared to be interested in sharing a trip through ride-splitting, 21.4% affirmed they would never use UberPool, despite the fare discount, and 21.6% stated that they would not share a trip with any unknown passenger (group = 0). Thus, one can say that around 9% of the respondents, although declaring not being interested in ride-splitting, would be open to traveling by this mode, in case of some unidentified condition.

Only 31.0% of the respondents would feel comfortable sharing a trip with two other passengers, and 24.0% would be open to ride-splitting with the greatest possible number of passengers – assumed as 7 in this study, considering an automobile capacity according to the Brazilian Traffic Code (Brazil, 2008a). The carpooling proposal is, in some way, a low capacity transport mode. Thus, if the ridesourcing companies start

to use higher capacity vehicles, the price of the trip may become more competitive when compared to the public transport, allowing a higher modal switch, due mainly to the poor quality of Brazilian public transportation (Araújo et al., 2011).

Despite this result, the characteristics of the passengers with whom the respondents would be willing to share a trip were not specified (Badger, 2014; Silva, 2017). In practice, psychological factors can affect this decision and therefore must be considered.

Additionally, it was observed that women are more resistant than men when it comes to using a shared system: while 59.3% of the female population stated they had no interest in ride-splitting, 58.9% of the male population declared to be interested. This is possibly related to Brazilian safety and security problems, and to the fact that women are usually an easier target for violence (Santos, 2017; Silva, 2017).

A logistic regression model was generated to test the variables that affect the probability of using UberPool (or ride-splitting in general). The variables *cost*, *time*, *unknown*, *environment* and *safety* are categorical and fragmented, so that $x_i = 1$ for observations recorded in category *i* and $x_i = 0$ if observations are not recorded (Agresti, 2002). Level 1 of each criterion (very relevant) is assumed as the base level, therefore it does not appear in the model.

The determination of the logistic model was based on Wald statistical significance for each predictive variable, besides the model's prediction accuracy, Nagelkerke R^2 and Spearman correlation coefficient. Table 4 shows the regression results, where the variables *reduction, group, cost, and safety* were used.

It was found that the variable *unknown* would be significant to the model, but it is strongly correlated with the variable *safety* (Spearman's *rho* = .705; ρ = .000), also significant. Among both factors, *safety* showed a better fit, resulting in a higher Nagelkerke R^2. The socioeconomic variables (i.e. gender, age, family income, vehicle ownership) were not significant in the decision of using the ride-splitting platform. Four criteria became part of the final model: tariff reduction, number of people sharing a trip, cost and safety evaluation.

Through the model classification table, one can say that the generated model has a predictive accuracy of 91.1%. Moreover, the model Nagelkerke R^2 is equal to 0.650.

Labeling 1–4 if the variable is considered: (1) relevant, (2) neutral, (3) irrelevant, (4) very irrelevant.

According to the model, the most relevant criterion on the ride-splitting choice is safety. The lack of security and safety is currently the main reason citizens switch from public transport to car use in some Brazilian cities (Santos, 2017). Thus, this variable is considered extremely important for sharing trips with unknown passengers. Whether one categorizes *safety* as relevant or irrelevant to the decision to UberPool, this factor always raises the probability of ride-splitting. It means that users cherish the use of a safe transport mode, so the companies involved must ensure that sharing trips with strangers is a safe choice. When one classifies *safety* as "relevant", the probability of UberPool use increases about 697% (safety(1) Exp(β) = 7.972). On the other hand, the variable does not show statistical significance (ρ ≤ .05) when classified as "irrelevant" or "very irrelevant". Therefore, the safer the service is judged and experienced by users, the greater the likelihood of its use.

Table 4
Logistic regression result.

Variables	B	S.E.	Wald	Df	Sig.	Exp(β)	95% C.I.for Exp(β)	
							Lower	Upper
reduction	.477	.236	4.081	1	.043	1.612	1.014	2.561
Group	.451	.111	16.347	1	.000	1.570	1.261	1.953
Cost			24.692	4	.000			
cost(1)	−.569	.421	1.828	1	.176	.566	.248	1.292
cost(2)	−2.905	.689	17.769	1	.000	.055	.014	.211
cost(3)	−3.372	.930	13.162	1	.000	.034	.006	.212
cost(4)	−1.484	.726	4.181	1	.041	.227	.055	.940
Safety			19.493	4	.001			
safety(1)	2.076	.515	16.222	1	.000	7.972	2.903	21.894
safety(2)	1.396	.570	5.999	1	.014	4.039	1.322	12.343
safety(3)	1.329	.987	1.814	1	.178	3.777	.546	26.121
safety(4)	.726	.787	.851	1	.356	2.068	.442	9.675
Constant	−.436	.467	.874	1	.350	.646		

The other factors in the model are directly or indirectly related to costs. A greater tariff discount raises the probability of using ride-splitting. At each tariff band (see Table 1) increase (e.g. from "up to 30%" to "31%–70%"), the probability of successful ride-splitting increases by 61.2% (Exp(β) = 1.612). Thus, the tariff is essential to the user decision.

Notwithstanding, people still show some resistance in paying for a shared service, given that the variable *cost* reduces the probability of its use. When said "relevant", this factor is not significant at the .05 level. However, when categorized as "irrelevant" for the sharing decision, the variable *cost* reduces the probability in up to 96.6% (cost(3) Exp(β) = .034). Finally, ride-splitting success increases 57.0% (Exp(β) = 1.570) for each additional passenger sharing a trip. This criterion is indirectly related to travel cost, since the journey's individual cost reduces as the number of passengers increases.

To this point, the analysis is directed towards the possible use of greater capacity vehicles by ridesourcing companies. Cost is an appealing criterion in the choice of shared trips and increasing the number of passengers can optimize and reduce individual passenger costs. Therefore, sharing a trip with more people can be attractive to the demand, as long as the service is safe.

Besides the legal issues, a problem faced by the companies is the lack of critical mass, which allows the drivers to quickly connect to multiple passengers (attribute required for the platforms dynamicity, Créno, 2014). It is precisely due to this scarcity that UberPool operates only in the two most populous Brazilian metropolitan areas, São Paulo and Rio de Janeiro. However, less expressive metropolitan areas could generate demand by creating lines with predefined routes, as suggested by the pre-launched Buser (2017) platform that will offer inter-municipal trips by bus. Nevertheless, this would probably fall into a legal clash far greater than the one between the ridesourcing industry and taxi services – although this conflict might be easier to solve, with the immediate characterization of the new service as illegal transportation.

6. Conclusions

Based on urban mobility issues and the possibilities derived from technological advances, a business opportunity characterized as shared economy was found. Ridesourcing is a way of personal door-to-door transportation offered in private vehicles by drivers registered in a technology company. This new way of traveling has generated market tensions by affecting the demand of the consolidated taxi industry.

In Brazil, controversies and legal disputes revolve around the definition of the newly provided service as public or private transportation. Changes in the current legislation are being proposed to define the legal nature of ridesourcing companies. On one hand, once defined as public, it will be up to the local governments to define rules for the individual passenger transport operation – thus the service will tend to follow the same rules imposed on taxi services. On the other hand, once described as private transport, it will open competition with individual paid transportation, based on the constitutional principle of free enterprise. Currently, the legal changes are more inclined to the first situation described; a bill awaits approval of the National Senate House (Brazil, 2017b), but the results are still unpredictable.

Meanwhile, ride-hailing companies expand the vision of sharing and start offering ride-splitting services, which is a form of dynamic carpooling offered by the companies' partner drivers. Beyond the legal scope of individual transport in Brazil, this research sought to

understand the demand characteristics of Uber, the main ridesourcing platform used in the country.

It has been found that leisure is the main reason for traveling by ridesourcing, followed by the return to home. This may be related to the enforcement of the so-called *Lei Seca* (Dry Law), which determines a fine and the driver's license suspension for drivers caught with any level of blood alcohol concentration (Brazil, 2008b). While people do not want to take the risk of drinking and driving, they still prefer the comfort of door-to-door transportation. Note that the use of ridesourcing is rather sporadic than daily based for both travel purposes mentioned above (leisure and return to home). This kind of usage may show the users' high valuation of the service. A further analysis of rating versus Uber's running time showed that, the more familiar with the service, the more the public notices its failures and rate it with poorer evaluations.

Approximately 50% of Uber's demand is composed by former taxi users. The current taxi service has been considered technologically outdated. Therefore, it has lost part of its demand since the opening of competition, taking into account that the majority of Uber users are young and that the technological appeal attracts this audience. Another disparity between ridesourcing and taxi services is the power of advertising: while the former invests heavily on marketing, selling a positive image of the service, this strategy is absent in the latter. This factor probably has direct influence on the demand capture.

Finally, the tariff differences reinforce the competition, as the trip cost is an important variable in the modal choice. This competition between taxis and ridesourcing companies is economically healthy, because it breaks the monopoly of the taxi industry, forcing it to improve the quality of the supplied service.

Most of current Uber users accept well the possibility of ride-splitting. Nevertheless, it has not been taken into account with whom the trip will be shared, which has the potential for affecting the sharing decision. About 79% of them would use UberPool (Uber's ride-splitting service), depending on the fare conditions and the number of passengers sharing the same trip. The logistic regression model showed that safety is the most important factor in sharing. It is implicit that this criterion has a greater effect on the female audience, although gender did not show significance in the model, being thus removed. This conclusion matches a previous survey on carpooling mode conducted in Recife, Brazil, as it concludes that women are more afraid of sharing trips with strangers, building a psychological barrier due to safety issues (Silva, 2017).

Travel cost relates either directly or indirectly to other factors that affect the probability of using ride-splitting systems. The studied population still shows some resistance to pay for a shared travel service. Therefore, the cheaper the fare, the greater the service's acceptability. One reason that makes the trip less expensive is the number of passengers who share it: the cost per person is inversely proportional to the number of travellers. Thus, it opens the idea that ride-hailing companies may start using higher capacity vehicles. The sharing systems can start competing with collective public transport, if there is enough critical mass to execute fast connections. The competition generated would certainly create conflicts greater than the ones between taxi services and ridesourcing companies, since public transport operators have more political and economic power in the decision-making processes.

In conclusion, defining the legal nature of the services provided by these companies, finally deciding if they are public or private, is extremely important in order to decide their rights and obligations before the transport authority of each municipality. Simply allowing or banning the operation of platforms is not enough to solve the problems involving ridesourcing and ride-splitting. According to the Brazilian Constitution (Brazil, 1988), the government must regulate the essential services (including public transport) aiming to expunge market failures for the sake of the public interest. It can be concluded from this study that this new market will hardly be regulated without a strong public support.

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