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ANALYSIS OF THE PRICES OF PHV SERVICES THROUGH DIGITAL PLATFORMS IN MADRID: PRICE FORMATION AND VOLATILITY

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Disclaimer: This is a machine translation of the original report in Spanish. In case of inconsistencies, the Spanish version prevails.

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Analysis of the prices of PHV services through a platform in Madrid: Price formation and volatility

October 2023

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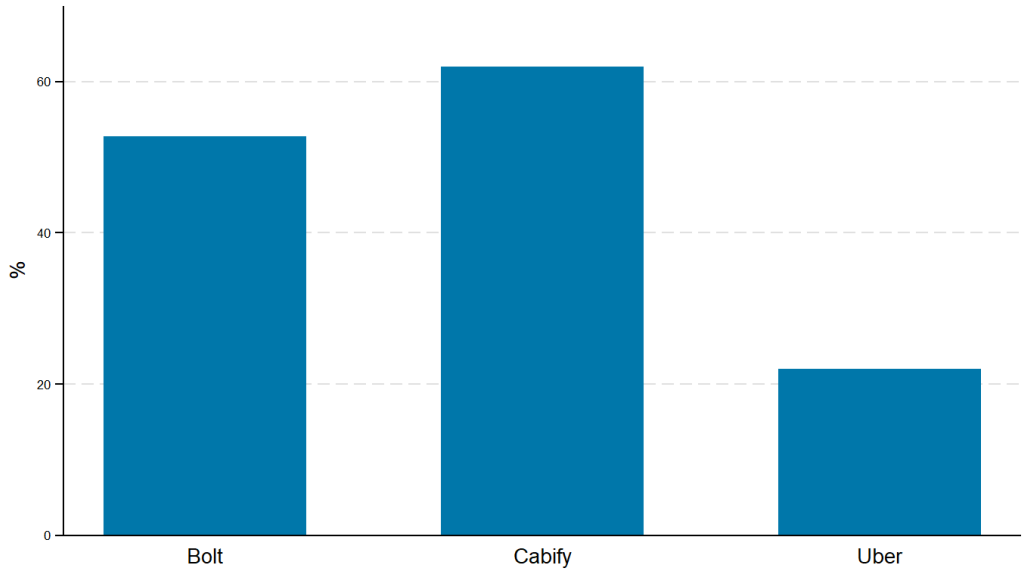
EXECUTIVE SUMMARY

- The service of urban transportation in passenger or private cars, traditionally offered by taxis and subject to heavy regulation, has undergone a disruptive change in the last decade with the emergence of the PHV (Private Hire Vehicles, VTC in Spanish) operators, which allow the service to be hired instantly through a mobile application.
- Unlike taxi prices, which are transparently set according to regulated public fares, PHV prices are dynamic prices determined by complex and opaque algorithms, which cause prices to fluctuate widely. PHV operators publish the price of each trip when requesting the service on their apps. However, the price formation of PHV services is opaque (i.e. the factors determining the prices are not known) and, from the consumer's point of view, arbitrary (i.e. the consumer cannot anticipate the price and is exposed to high volatility). Prices for a given route can vary widely and the user cannot assess whether or not the price of the service is high until the time of the trip request. In some cases, applications indicate the application of a high demand surcharge, the magnitude of which varies substantially. In these cases, where the opaque criteria of the algorithm activate the surcharge, prices can be multiplied by up to two and a half times.
- The widespread perception that PHV services introduce competition in urban transport and reduce prices does not correspond to reality, as the price formation process for PHV services is opaque and arbitrary and there is high price volatility.
- This report analyses the price formation process and price predictability of PHV services and its volatility for taxi and PHV services in the city of Madrid. The report concludes that the pricing process for PHV services is opaque and arbitrary, as the apparent transparency of the publication of the final price

hides an opaque pricing procedure; prices for PHV services are volatile and inconsistent, and can be multiplied by up to two and a half times.

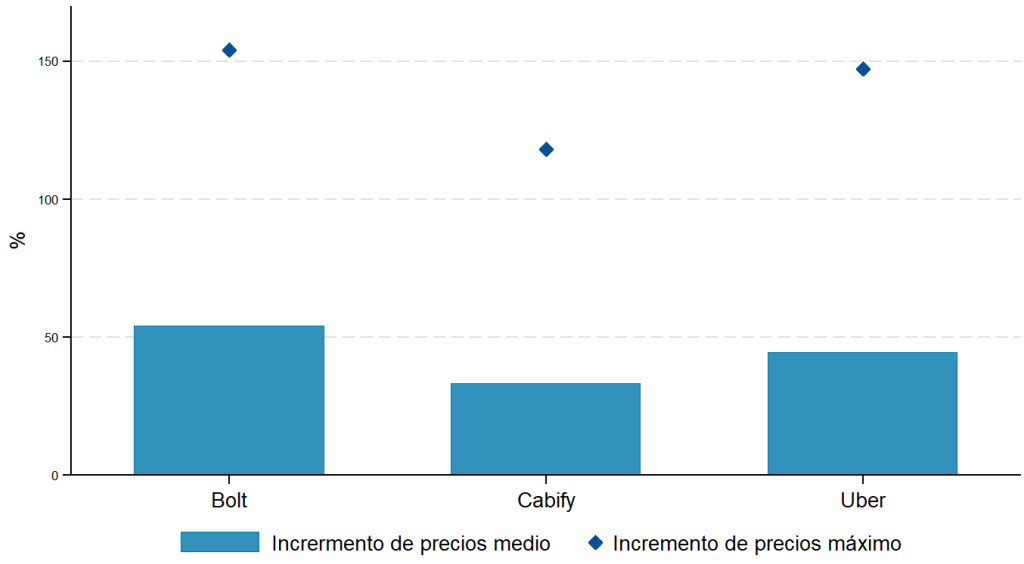
- **Prices for PHV services are determined in an opaque and arbitrary manner.** The apparent transparency of the publication of the final price hides an opaque pricing procedure:
    - “Base prices" (prices supposedly without surcharges) are opaque and unpredictable, because minimum fares do not apply, base fares are variable, and the "base price" advertised by apps does not result from the application of the advertised fares.
    - The "high demand surcharge", the application and magnitude of which is determined by an opaque algorithm, is not exceptional and varies substantially in magnitude. The activation of the high-demand surcharge occurs in a high number of trips and is not an exceptional phenomenon. In the sample analyzed, one in five UBER trips, half of BOLT trips and two in three CABIFY trips have high demand surcharges (Figure 1). The magnitude of the high demand surcharge is extremely variable, increasing prices by an average of 30-50% and sometimes up to two and a half times the base price (Figure 2).

Figure 1. Frequency of high demand surcharges application



Source: Own elaboration based on database.

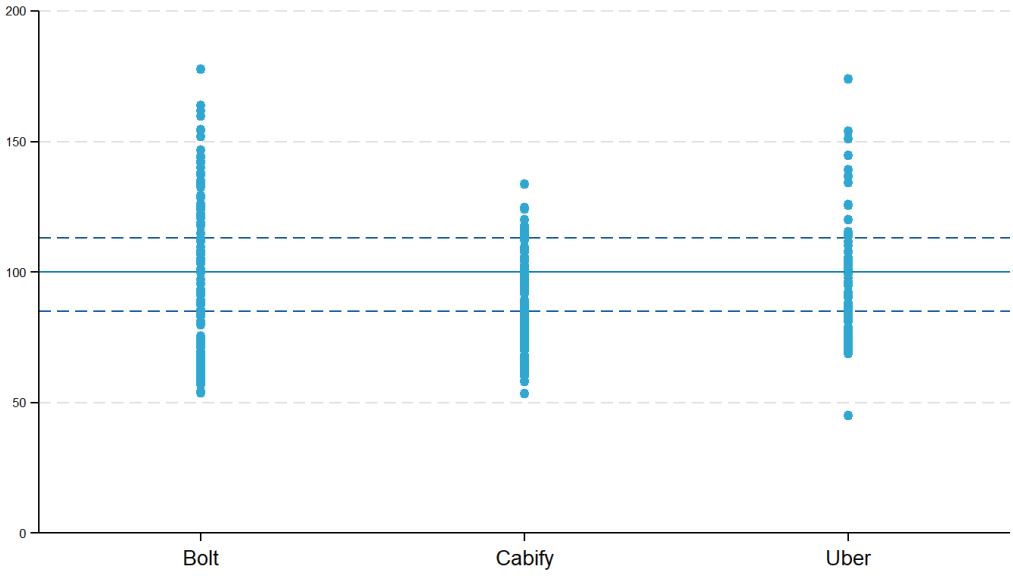
Figure 2. Average and maximum high demand surcharges



Source: Own elaboration based on database. Average and maximum of the high demand surcharges with respect to the average price for that route in that PHV.

- **Prices for PHV services are volatile and inconsistent:**
  - Prices for PHV services are inconsistent. Base prices (without high-demand surcharge) vary considerably for the same route and can even be higher than prices with high-demand surcharge.
  - The price variability of PHV services is much higher than the variability of taxi prices. While taxi prices vary around ±15% of the average price depending on traffic congestion, prices for PHV services can be as low as half of the average price or as high as up to twice the average taxi price (Figure 3).
  - Prices of PHV operators vary in parallel. When the prices of one PHV operator are high, the prices of the other PHV operators are likely to be high as well, so users will not be able to avoid the high prices of one operator by using another PHV operator.

Figure 3. Volatility of PHV vs. Taxi price (Fare 1) (Average taxi price=100)



Source: Own elaboration based on database. Average and maximum of the high demand surcharges with respect to the average price for that route in that PHV. Own elaboration based on database. Relative prices of PHV trips compared to the average of equivalent taxi trips. The lines indicate the minimum and maximum deviation in taxi prices for equivalent trips.

- In conclusion:
  - The pricing process for PHV services is opaque and arbitrary. For example, the high demand surcharge is not exceptional and its magnitude varies substantially. **PHV operators apply the high demand surcharge on up to two out of three trips**. The high-demand surcharge increases prices for PHV services by 30-50% on average.
  - The price variability of PHV services is much higher than that of taxi prices. **The price of the same PHV trip can be multiplied by up to two and a half times depending on the day and time of day.**

1 Introduction

1. The service of urban transportation in passenger cars, traditionally offered by taxis and subject to heavy regulation, has undergone a disruptive change in the last decade with the emergence of Private Hire Operators (PHV operators in Spanish), which allow the service to be hired instantly through a mobile application.
2. Unlike taxi prices, which are transparently set according to regulated public fares, PHV service prices are dynamic prices determined by complex and opaque algorithms that mean that prices fluctuate widely. PHV service operators publish the price of each trip when requesting the service on their apps, but the price formation of PHV services is opaque (i.e., the factors determining the prices are not known) and, from the consumer's point of view, arbitrary (i.e., the consumer cannot anticipate the price and is exposed to high volatility). The opacity and arbitrariness with which such prices are determined means that prices for a given route can vary widely and the user cannot assess whether the price of the service is high or not. In some cases, the apps indicate the application of a surcharge of unknown magnitude for "High Demand". In these cases, which depend on the opaque criteria of the algorithm, prices can be increased by 30-50% on average, or even two and a half times.
3. The widespread perception that PHV services introduce competition in urban transport and reduce prices does not always correspond to reality, as there is a high variability of PHV service prices due to the opacity of the pricing methodology.
4. This report analyses the price formation process and price predictability of PHV services and compares the volatility of PHV service prices taxi and PHV services, through the analysis of a sample of about 1,000 PHV trips in the city of Madrid.

5. This study shows that:

   i. **Prices for PHV services are determined in an opaque and arbitrary manner**, as base fares are not fixed and are often not applied; and the "high demand surcharge", whose application and magnitude is determined by an opaque algorithm, is not exceptional and varies substantially in magnitude. The apparent transparency implied by the publication of the final price hides an opaque procedure for the determination of the final price.

   ii. **Prices for PHV services are volatile and inconsistent:**

      a. Prices for PHV services are inconsistent. Base prices (without high-demand surcharge) vary considerably for the same route and can even be higher than prices with high-demand surcharge.

      b. The price variability of PHV services is much higher than the price variability of taxis.

      c. The prices of the three PHV platforms behave in parallel, so users will not be able to avoid the high prices of a certain operator by using another PHV operator.

2 Urban transport in passenger cars

2.1 Structure of this sector

6. Urban transportation in passenger car has traditionally been a service offered by taxis. In most cities around the world, the number of taxi licenses is limited and taxi fares are regulated by local authorities. In 2009, UBER appeared in San Francisco. UBER was presented as a platform that connected travelers with private drivers and allowed instant hiring through a mobile app[1]. UBER operated outside the taxi licensing system and its prices were not subject to regulation.
7. UBER travelers would make a trip request on the app, UBER would quote a price and, if the traveler accepted, UBER would assign that trip to a driver from its fleet. According to UBER, prices for each trip are determined by an algorithm based on the distance and time of the trip, the current supply and demand of vehicles, and other factors. UBER applied "dynamic pricing", which varied arbitrarily depending on various factors.
8. Since 2011, UBER has been operating in New York, Chicago, Paris, London and many other cities around the world. All over the world, companies are appearing in the form of ridesharing services, following the UBER model: LYFT (United States, 2012)[2], DIDI (China, 2012)[3], GRAB (Malaysia, 2011)[4], CABIFY

[1] "The history of how UBER went from the most feared startup in the world to its massive IPO", Business Insider, 18 May 2019. Available at: https://www.businessinsider.com/ubers- history.
[2] A history of Lyft, from fuzzy pink mustaches to global ride share giant", CNN, 2 April 2019. Available at: https://edition.cnn.com/interactive/2019/03/business/lyft-history/index.html
[3] "Ride-hailing giant Didi wants to be more than just the UBER of China", CNBC, 11 June 2021. Available at: https://www.cnbc.com/2021/06/11/ride-hailing-giant-didi-wants-to-be-more- more-than-just-the-uber-of-china.html.
[4] See: https://www.grab.com/my/press/consumers-drivers/myteksi-celebrates-taxi-drivers/

(Spain, 2011)[5] or BOLT (Estonia, 2013)[6]. UBER is now present on five continents[7]; BOLT operates in Europe, Africa, Asia and Latin America[8]; and CABIFY offers its services in Spain and Latin America[9].

9. In the last decade, the number of PHV vehicles has increased by more than 50% in London and New York. In Madrid, it has increased 15-fold (Table 1). In New York, PHV services accounted for 75% of daily trips in 2019[10].

Table 1. Taxi and PHV licenses

	Period	Taxi			PHV		
		Start Period	End Period	Variation	Start Period	End Period	Variation
London	2010-2022	22,445	14,695	-35%	49,355	80,857	64%
Madrid	2010-2023	15,549	14,768	-5%	579	8,658	1,395%
New York†	2016-2020	19,160	16,482	-14%	67,484	101,663	51%

Source: Own elaboration based on data from NYC Taxi & Limousine Commission (New York)[11], Observatorio del Transporte de Viajeros por Carretera (Madrid)[12] and Transport for London (London)[13].
†In New York, this includes the licenses of the traditional yellow taxis and the so- called green taxis or "boro taxis" that started operating in August 2013 to complement the service in certain areas of New York.

10. In Spain, the three largest operators offering PHV services are UBER, CABIFY and BOLT. CABIFY started operating in Madrid in 2011[14] and UBER

[5] See: https://cabify.com/cl/sobrenosotros#:~:text=Nacimos%20en%202011%2C%20en%20Madrid,%2C%20M%C3%A9xico%2%20Per%C3%BA%20y%20Uruguay.
[6] See: https://bolt.eu/en/press/#:~:text=About%20BOLT&text=We%20are%20fighting%20for%20betterand%20food%20and%20grocery%20delivery.
[7] See https://www.uber.com/global/en/cities/
[8] See: https://bolt.eu/en/cities/
[9] "In what which cities does CABIFY? CABIFY. Available at: https://help.cabify.com/hc/es/articles/115000996089--En-qu%C3%A9-ciudades-opera-CABIFY-
[10] NYC Taxi & Limousine Commission (2020, p. 7).
[11] NYC Taxi & Limousine Commission (2018, 2020).
[12] Directorate General for Land Transport (2010, 2023).
[13] See: https://tfl.gov.uk/info-for/taxis-and-private-hire/licensing/licensing-information
[14] See: https://cabify.com/cl/sobre-nosotros

in 2014, providing services in Barcelona[15] and Madrid[1617]. Finally, BOLT started operating in Spain in July 2021[18]. Currently, UBER is present in more than 80 cities in Spain[19]; CABIFY offers its services in 12 cities[20]; and BOLT operates in Barcelona, Madrid, Malaga, Seville and Zaragoza[21].

11. Since 2014, the number of authorized passenger cars for hire with driver (PHV) has increased sevenfold (Figure 4). The number of taxis has remained relatively stable over the last 15 years (above 60,000 authorizations) and decreased by 9% in 2023. The Community of Madrid accounts for 48% of the total national PHV fleet (25% taxi), Catalonia for 16% (19% taxi) and Andalusia for 18% (15% taxi)[22].

[15] "What's up Barcelona! Your Uber POP is coming!", UBER, 3 April 2014. Available at: https://www.uber.com/es-ES/blog/que-tal-barcelona-su-uberpop-esta-llegando/

[16] "UBER arrives in Madrid with its cheapest option: UBER Pop", EUROPAPRESS, 23 September. 2014. Available at: https://www.europapress.es/portaltic/sector/noticia-uber-llega-madrid-opcion-mas-economica-uberpop-20140923133315.html.

[17]UBER had to cease its activity in Spain from the end of 2014 to 2016 by judicial decision for operating without the required administrative authorizations (Order of the Mercantile Court No. 2 of Madrid of 9 December 2014 in appeal 707 /2014).

[18] 8 "BOLT, nuevo rival en España de UBER y CABIFY, capta 600 millones", CINCODÍAS, 2 August 2021.Available at: https://cincodias.elpais.com/cincodias/2021/08/02/companias/1627901744_445549.html

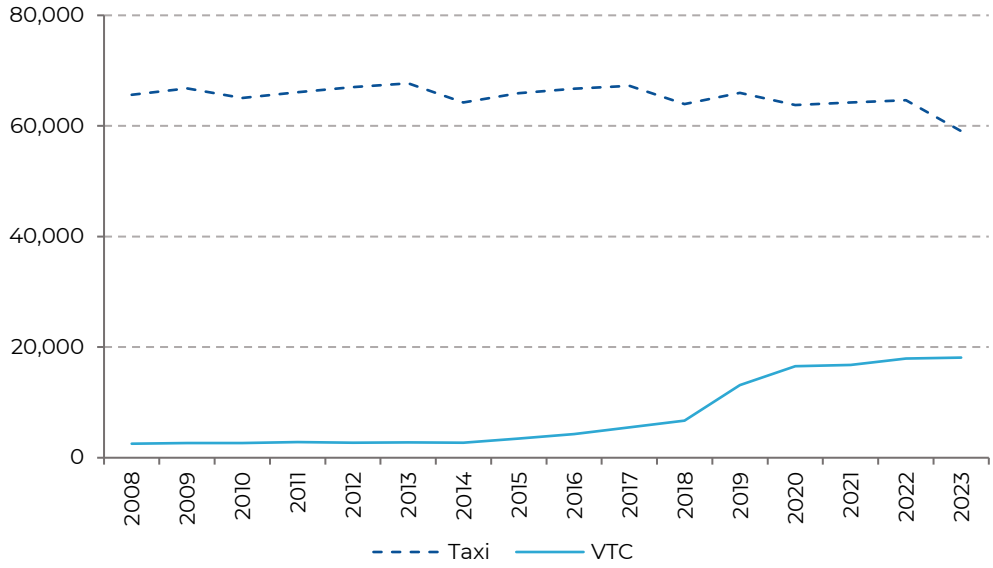
[19]See: https://www.uber.com/global/es-es/cities/?uclick_id=a694442a-1087-4acd-8807- c5898124a331

[20] See: https://help.cabify.com/hc/es/articles/115000996089--En-qu%C3%A9-ciudades-opera-CABIFY-

[21] See: https://bolt.eu/es-es/cities/

[22] Directorate General for Land Transport (2023, p. 18).

Figure 4. Passenger cars authorized for passenger transport in Spain (2008-2023)

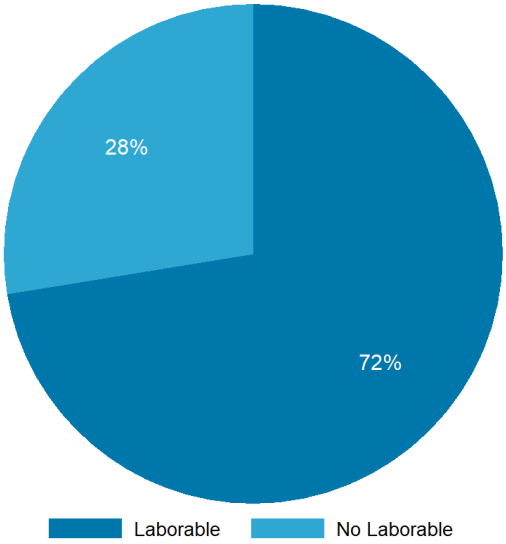


Source: Road Passenger Transport Observatory. Supply and Demand. January 2023.

2.2 Demand for urban transport in passenger cars

12. The demand for urban transport services in passenger cars originates mainly from work and leisure trips. Demand for urban transport services varies according to the day of the week (working/non-working) and the time of day.
13. Seven out of ten urban passenger car trips in the city of Madrid take place on weekdays and three out of ten on non-working days (Figure 5).

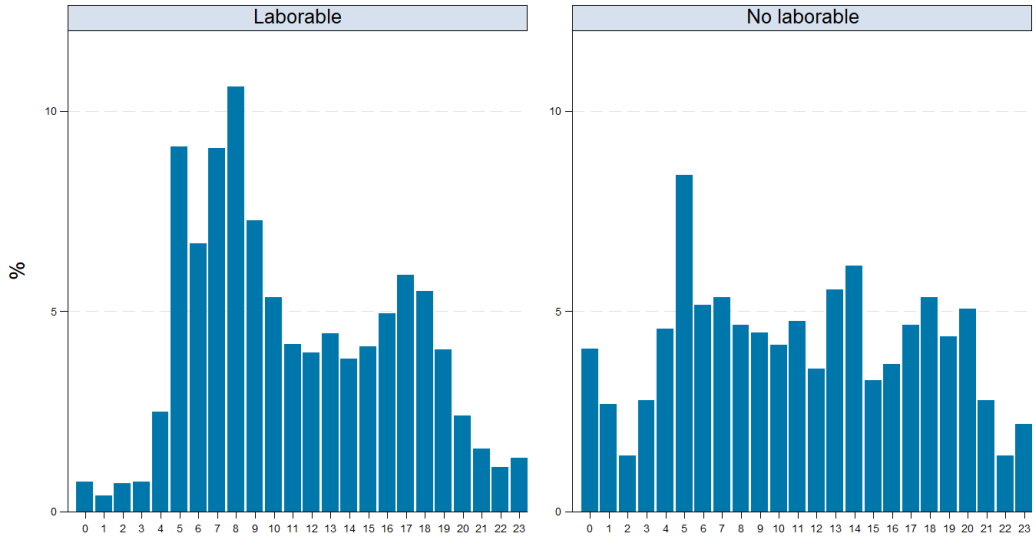
Figure 5. Taxi trips by day of the week (%)



Source: Own elaboration based on data provided by PIDETAXI (April-June 2023).

14. Peak demand for urban transport services is between 7:00 and 9:00 a.m. (one in four trips) on weekdays [23]and between 5:00 and 7:00 a.m. (one in five) and 1:00 and 3:00 p.m. (15%) on non-working days (Figure 6).

Figure 6. Taxi trips in days per hour (%)



Source: Own elaboration based on data provided by PIDETAXI (April-June 2023).

15. Eight out of ten taxi trips originate and end in the municipality of Madrid (Table 2).

Table 2. Origin and destination of taxi trips

Origin	Destination	
	Madrid	***Outside Madrid***
Madrid	81%	4%
Outside Madrid	10%	4%

Source: Own elaboration based on data provided by PIDETAXI.

[23] This pattern is also observed in the study published by the Madrid City Council on taxi service (Vectio, 2017) and in the Community of Madrid's 2018 Working Day Mobility Household Survey (Encuesta domiciliaria de movilidad en día laboral de 2018 en la Comunidad de Madrid edM2018, 2019).

3 Pricing

16. The main difference between taxi and PHV services lies in the determination of their prices. The prices of taxi services in the city of Madrid are regulated and determined on the basis of the fares set by the corresponding regulatory bodies and are, therefore, established in a transparent and objective manner. In contrast, the prices of PHV services are "dynamic prices"[24] which, according to the platforms themselves, are determined by algorithms that make prices fluctuate throughout the day for the same route.

3.1 Taxi fares

17. The prices of taxi services are determined on the basis of public fares set by regulatory bodies according to objective and transparent criteria. Taxi service prices are regulated at national, regional and municipal level.
18. In the Community of Madrid, different fares are established depending on the day of the week; the timetable; the origin and/or destination; and the distance of the trip[25]. Seven out of ten trips take place in fare 1 (weekdays from 7am to 9pm) and fare 2 (nights and public holidays) (Table 3).

[24] Hall et al., (2015) and Cohen et al. (2016).
[25] See APPENDIX I for a detailed description of taxi fares in the Community of Madrid

Table 3. Fares for taxi services in Madrid (2023)

Fare	Days	% trips
1	Weekdays (7-21 h)	37%
2	Weekdays (21-7 h) and Saturdays, Sundays and Public Holidays (24 h)	31%
Other		32%

Source: Own elaboration based on Resolution of 2 December 2022, BOAM 9.285/3619 of 19 December 2022 and PIDETAXI data.

19. Taxi fares consist of the following items, which vary according to the type of fare (Table 4):

    i. **Service start price**: fixed amount applied to each fare. This is the amount commonly known as the "bajada de bandera".

    ii. **Kilometric price**: variable amount applied according to the kilometers travelled.

    iii. **Hourly price**: a variable amount that applies only during the minutes when the vehicle speed is below a certain value called the "crawl change speed". The towing speed is the result of dividing the hourly price (€/h) by the kilometric price (€/km)[26]. Thus, for fare 1 the towing speed is 18.27 km/h while for fare 2 it is 18 km/h.

[26] Royal Decree 1596/1982, of 18 June 1982, approving the regulations for the approval of tachychronometric meters known as "taximeters". BOE no. 175, 23 July 1982, p. 19857-19860.

20. When the speed of the taxi is lower than the speed of the towing change, the calculation of the service charge is based on the application of the hourly price, and when the speed is higher than the speed of the towing change, the kilometric price is applied[27].

Table 4. Fare system for taxi services in the municipality of Madrid (2023)

Fare	Price start service (€)	Kilometric price (€/km)	Hourly price (€/h)
1	2.50	1.3	23.75
2	3.15	1.5	27

Source: Resolution of 2 December 2022, BOAM 9.285/3619 of 19 December 2022.

3.2 The prices of PHV services

21. All PHV operators apply similar pricing schemes. According to PHV operators, the price of the trip is calculated according to the duration and distance of the trip; and additionally, prices may be increased in situations that PHV operators identify as "High Demand" (allegedly rush hour, adverse weather conditions, crowded events or vehicle shortage). PHV operators inform about the final price of the trip in the app before hiring it.

[27] Order ICT/155/2020, of 7 February, regulating the State metrological control of certain measuring instruments of the Ministry of Industry, Trade and Tourism. BOE no. 47, of 24 February 2020, Appendix I.

22. The application and magnitude of the high demand surcharge is unpredictable. PHV operators explain vaguely how their algorithms determine the high demand surcharge:

    i. According to UBER, the price of a trip is calculated from a "base price" according to the duration and distance of the trip and when the number of users requesting a trip exceeds the number of available vehicles, "prices may temporarily increase"[28].

    ii. According to CABIFY, the price of a trip is calculated at the time of order taking into account the price per kilometer, the price per minute and other items (service, safety and sustainability fee). CABIFY foresees the application of unspecified "additional costs" "due to high demand".[29]

    iii. According to BOLT, the price of the trip is calculated on the basis of an "initial fare", a "fare for each kilometer of travel" and a "fare for each minute during the trip"[30] and the fares "may change from time to time" taking into account "the balance of supply and demand "[31].

23. UBER, CABIFY and BOLT display the final price of the trip in the app before the trip is booked, but each operator displays different information about the price components (Table 5 and Figure 1 to Figure 3).

[28] How much does an UBER ride cost?", UBER. Available at: https://www.uber.com/global/es/price-estimate/

[29] "How to calculate the price of a trip", CABIFY. Available at : https://help.cabify.com/hc/es/articles/360000932905--C%C3%B3mo-se-calcula-el-precio-de-un-viaje-

[30] "BOLT launches chauffeur-driven services in Madrid", BOLT. Available at: https://bolt.eu/es-es/blog/bolt-lanza-servicios-de-conduccion-con-conductor-en-madrid/

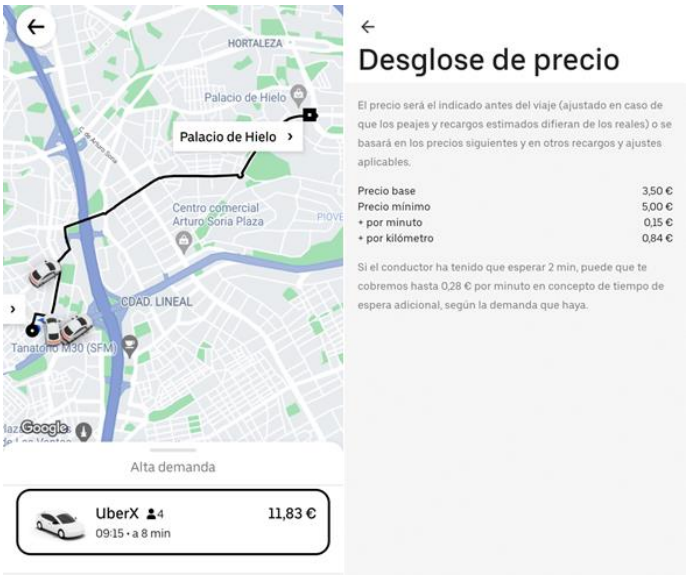
[31] "General Conditions for Drivers", BOLT, 27 January 2023, available at: https://bolt.eu/es-es/legal/py/terms-for-drivers/.

Table 5. Information provided by the PHV platform apps

Price component	UBER	CABIFY	BOLT
Total price	✓	✓	✓
Minimum price (€)	✓	×	✓
Initial fare (€)	✓	×	✓
Fare/min (€/min)	✓	×	✓
Fare/km (€/km)	✓	×	✓
High demand indicator	✓	✓	✓
High demand surcharge	×	✓	×
Service, safety and sustainability fee	Not Applicable	✓	Not Applicable
Estimated distance	×	✓	×
Waiting time	✓	✓	✓
Estimated time of arrival	✓	×	✓

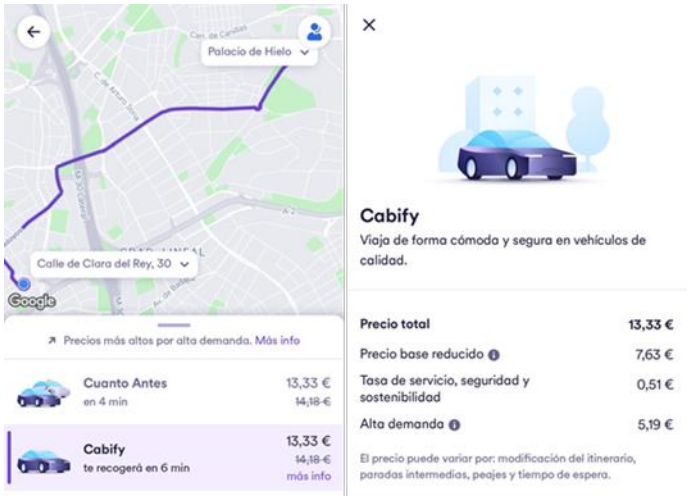
Source: Own elaboration based on the information available in the UBER, CABIFY and BOLT applications.

Illustration 1. Travel information on the UBER app



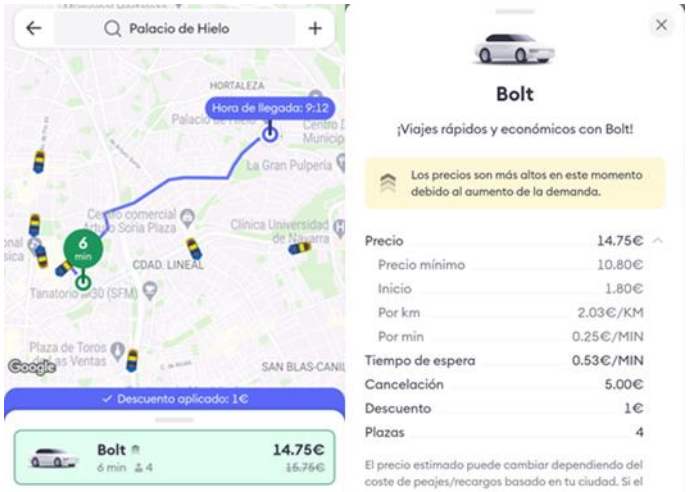
Source: UBER app.

Illustration 2. Travel information on the CABIFY app



Source: CABIFY app.

Illustration 3. Travel information on the BOLT app



Source: BOLT app.

3.2.1 The "Base Price"

24. According to UBER, CABIFY and BOLT, the so-called "base price" of the trip, i.e., the price in situations where high demand surcharges do not apply, is determined on the basis of the following items:

    i. Initial fare: fixed amount that is always charged.

    ii. Minute fare: variable amount applied to the estimated duration of the trip.

    iii. Kilometric fare: variable amount applied to the estimated distance of the trip.

    iv. Minimum price: this is the price that will be charged as a minimum.

25. The pricing system of UBER, CABIFY and BOLT is based on minimum fares that supposedly determine the base price of trips contracted through their applications (Table 6).

Table 6. BOLT, CABIFY and UBER minimum fares (2023)

	BOLT†	CABIFY	UBER‡
Minimum price	5.00 €	4.33 €	4.50 €
Initial fare	0.50 €	1.25 €	2.75 €
Fare/km from	0.85 €	0.65 €	0.84 €
Fare/min from	0.13 €	0.09 €	0.15 €

Source: Prepared by the authors based on information available on the CABIFY[32] and BOLT [33]websites and on the BOLT and UBER applications. Data as of the date of this report.
† BOLT only publishes on its website the fare per kilometer and per minute. The rest of the fares have been obtained from the PHV services price database of this report.
‡ UBER does not publish minimum fares on its website. The minimum fares have been calculated from the minimum values obtained in the observations of the sample analyzed.

[32] See https://cabify.com/es/tarifas/madrid/#p-cabify
[33] See https://bolt.eu/es-es/cities/madrid/

26. However, in practice, the pricing information published by UBER, CABIFY and BOLT does not allow us to know how the so-called "base prices" are determined:

    i. The breakdown of the price components shown in their respective applications is not sufficient to verify the calculation of the base price.

    ii. The fares that are supposedly used to calculate the "base price" of the trip are opaque. UBER does not publish fares on its website, but only shows them when making a trip request on its app, and CABIFY and BOLT only publish minimum base fares, but do not specify under what conditions they are increased.

    iii. Fares are not stable but vary depending on unknown factors. UBER, CABIFY and BOLT algorithms show different fares (starting, per kilometer and per minute) even for trips with the same origin and destination requested at times that would not be affected by high demand.

27. This opacity and lack of predictability of "base prices" is also pointed out in various studies and media that show that prices for PHV services do not only depend on the distance and duration of the trip and the demand at that moment, but also on other hidden factors, such as the origin and destination of the trip[34]:

    i. A study by Chang et al. (2022) documents that UBER sets higher prices for travelers staying in more expensive hotels in major US cities[35];

[34] "UBER may charge you more based on where you're going", Business Insider, 20 May 2017, Available at: https://www.businessinsider.com/uber-controversial-pricing-charging-more- based-on-neighbourhood-2017-5.

[35] 35 Chang et al. (2022) analyses UBER prices on routes from the same airport to different hotels and conclude that UBER charges more for travelers staying in more expensive hotels. Specifically, a traveler transferring from the airport to the hotel with UBERX, and their hotel has a higher than median room rate, will, on average, pay $1.03, $0.85 and $0.63 more for their transfer in Los Angeles, New York and San Francisco, respectively (Chang et al., 2022, p. 12).

another study by Pandey & Caliskan (2021) shows that UBER prices in Chicago are higher for commuters in young, highly educated neighborhoods[36]

ii. According to a Bloomberg article, UBER prices are higher in higher income neighborhoods[37] . Two commuters located a few meters apart can observe very different prices. For example, according to a study by Chen et al. (2015) in New York, the price of a trip can be twice as much if requested from Times Square as if requested from an adjacent street[38].

iii. As documented in Calo and Rosenblat (2017), UBER analyses travelers' willingness to pay based on the information it collects through its app and, for example, according to UBER's own director of economic research, Keith Chen, it can learn that users are willing to pay more when their phone battery is about to run out (although UBER denies using this information in its pricing)[39].

3.2.2 The high demand surcharges

28. The high demand surcharge is supposedly applied in situations that PHV operators identify as "High Demand" (supposedly rush hour, adverse weather conditions, crowded events or vehicle shortages). The high demand surcharge arbitrarily and unpredictably increases the price of the PHV operators' service.

[36] Pandey & Caliskan (2021, p. 828).
[37] "UBER Can Charge More in Rich Neighborhoods", Bloomberg, 26 May 2017. Available at: https://www.bloomberg.com/news/articles/2017-05-26/uber-can-charge-more-in-rich-neighbourhoods#xj4y7vzkg
[38] Chen et al. (2015, p. 507).
[39] "UBER Charges More If They Think You're Willing to Pay More", Forbes, 30 March 2019. Available at: https://www.forbes.com/sites/nicolemartin1/2019/03/30/uber-charges-more-if- they-think-youre-willing-to-pay-more/?sh=47ec51927365.
Calo and Rosenblat (2017, p. 1656) point out that the mere fact that UBER monitors mobile battery level raises questions about the criteria the company might use to determine its prices.

29. In the US, high demand surcharges for UBER of up to five times the base price have been documented[40]. At the end of the year in New York, UBER prices increased six-fold[41]. In Washington DC, it has been documented that UBER prices change every 3-5 minutes, with up to 20 price changes in an hour. UBER's price can double in a matter of five minutes[42].

30. All three operators include "High Demand" indicators to indicate that prices are higher at a given point in time, but no operator reports the magnitude of the price increase compared to the base price. The "High Demand" indicator does not allow differentiation between high and low prices. With the information provided, the user cannot assess whether the price of the service is high or not.

31. The application of the high demand surcharge is unpredictable, as it depends not only on demand conditions, but also on the availability of drivers. Operators' algorithms apply the high demand surcharge arbitrarily.

4 The data

32. To carry out the analysis, this report uses prices of PHV services within the municipality of Madrid in the months of May and June 2023, obtained from

[40] In the four major US markets (San Francisco, New York, Chicago and Los Angeles), UBER's high demand multiplier can range from 1.2x (i.e. it increases prices by 20%) to 5x (Cohen et al., 2016, p. 27). Moreover, price volatility is enhanced by the fact that the multiplier can only include one decimal place (i.e. 1.2x, 1.3x, 1.4x...). Two trips made under roughly equal supply and demand conditions may generate a multiplier of 1.249x for the first trip and 1.251x for the second, and the first trip will be multiplied by a multiplier of 1.2x while the price of the second trip will be multiplied by 1.3x (Cohen et al., 2016, pp. 3-4).

[41] Hall et al. (2015, p. 6) show how, in New York City, on New Year's Eve, UBER fares went up to six times their value (6x).

[42] "In our data we found that UBER prices change every three or five minutes, up to 20 times per day. hour." (Diakopoulos, 2015).

926 trip requests in the corresponding mobile applications of UBER, CABIFY and BOLT (Table 7)[43].

33. The prices analyzed are closed prices without discounts[44] for five different routes within the municipality of Madrid (Table 8) at different times of the day during the period analyzed (Table 9). The five routes include one short route (4-5 km) (route 1), two medium routes (5-10 km) (routes 2 and 3) and two long routes (>13 km) (routes 4 and 5). Trip requests are made for each of the routes on the three applications at three times of the day and every day of the week between 16 May and 5 June 2023.

[43] The pricing data for PHV services and the corresponding screenshots have been compiled by FPTM, following the instructions of GAMES Economics. GAMES Economics has verified the correspondence of the data and the screenshots. Closed prices without discounts offered by the three PHV apps for trip requests of the same characteristics have been collected. The trips have not been carried out.
[44] All PHV operators offer occasional temporary or customized discounts. Prices without discounts are analyzed in this report.

Table 7. Observations by PHV operator

Application	No. of observations
UBER	309
CABIFY	308
BOLT	309
Total	**926**

Source: Own elaboration based on database.

Table 8. PHV routes analyzed

Route code	Origin	Destination	Type of route†	*Observations*
1	C/Clara del Rey, 45	Palacio de Hielo	Short	*189*
2	C/Clara del Rey, 45	C/Bravo Murillo, 365	Medium	*189*
3	C/ Fernando Ossorio, 55	C/ Méndez Álvaro, 4	Medium	*180*
4	C/Clara del Rey, 45	Universidad Autónoma de Madrid	Long	*189*
5	C/ Fernando Ossorio, 4	Universidad Autónoma de Madrid	Long	*179*
			Total	***926***

Source: Own elaboration based on database.
†Short (4-5 km), medium (5-10km) and long (+13 km).

Table 9. Distribution of the sample

Time period	Working	Non-working	*Total*
Morning (7-10h)	90	218	*308*
Day (10-21h)	90	219	*309*
Night (21-7h)	90	219	*309*
Total	**270**	**656**	***926***

Source: Own elaboration on database.

5 Analysis of the prices of PHV services

34. This report analyses the price formation process and price predictability of PHV services and analyses and compares the price volatility of taxi and PHV services in the city of Madrid.

35. The analysis of the sample of prices for PHV services shows that:

    i. Prices for PHV services are determined in an opaque and arbitrary manner. The apparent transparency of the publication of the final price hides an opaque procedure for the determination of the final price:

        a. "Base prices" (prices supposedly without surcharges) are opaque and unpredictable, because minimum fares do not apply, base fares are variable, and the "base price" advertised by apps does not result from the application of the advertised fares.

        b. The "high demand surcharge", the application and magnitude of which is determined by an opaque algorithm, is not exceptional and varies substantially in magnitude. The activation of the high-demand surcharge occurs in a high number of trips and is not an exceptional phenomenon. In the sample analyzed, one in five UBER trips, half of BOLT trips and two in three CABIFY trips have high demand surcharges. The magnitude of the high demand surcharge is extremely variable, increasing base prices by an average of 30-50% and sometimes up to two and a half times the base price.

    ii. Prices for PHV services are volatile and inconsistent:

        a. Prices for PHV services are inconsistent. Base prices (without high demand surcharge) vary considerably for the same route and may even be higher than the prices with a high demand surcharge.

        b. The price variability of PHV services is much higher than the variability of taxi prices. While taxi prices vary around ±15% of the

average price, prices of PHV services can vary from half to twice the average taxi price.

c. Prices of PHV operators vary in parallel. When the prices of one PHV operator are high, the prices of the other PHV operators are likely to be high as well, so users will not be able to avoid the high prices of one PHV operator by using another PHV operator.

5.1 The Price formation process of PHV services is opaque and arbitrary

36. PHV operators publish on their apps the final price of the trip and announce when the high demand surcharge applies. In the case of UBER and BOLT, the apps publish the fares per kilometer and minute that are supposed to determine the base price. CABIFY and BOLT publish on their websites the "minimum fares" (but not the maximum fares) per item.

37. The pricing of PHV services is opaque (i.e., the factors that determine prices are not known) and, from the consumer's point of view, arbitrary (i.e., the consumer cannot anticipate the price and is exposed to high volatility). All three operators publish on their websites that the price per trip is calculated on the basis of fixed base fares per kilometer and per minute and the application, where appropriate, of a high demand surcharge. However, the pricing system for PHV services is opaque and arbitrary from the consumers' point of view, given that that base fares and the high demand surcharge have a high variability:

i. **"Base fares"** (price for a trip supposedly without surcharges) are opaque and unpredictable. Base prices vary considerably for the same route because base fares are variable, minimum fares do not apply and the "base price" advertised by the apps does not result from the application of the advertised fares. In particular,

it is observed that:

a. Minimum fares never apply in the case of CABIFY and BOLT.
b. The fares used for the calculation of the base price are not fixed, but PHV operators apply different "base fares" for each trip (without indicating the application of any surcharge).
c. The "base price" does not result from the application of the fares advertised by the app. Three out of four BOLT trips and one out of three UBER trips are priced differently than would result using the advertised fares for that trip.

ii. The **"high demand" surcharge** is applied frequently, and its magnitude varies widely:

a. The activation of the high-demand surcharge occurs frequently and is not an exceptional phenomenon. One in five UBER trips in the sample, half of the BOLT trips and six in ten of the CABIFY trips apply a high demand surcharge.
b. The magnitude of the high-demand surcharge is extremely variable, increasing prices for PHV services by between 33% and 54% on average. Prices can be multiplied by up to two and a half times due to the application of the high demand surcharge.

5.1.1 Base prices are opaque and unpredictable

38. The information on the price formation process provided by the three platforms on their websites and apps may give the impression that the fares that determine the base prices of PHV services are fixed and transparent, and that they are only increased at specific times when the high demand surcharge is applied. Theoretically, according to this information, the fares that determine the base price of a trip would always be the same if the application does not notify that the high-demand surcharge has been activated. However, this is not the case: the fares that the apps use to determine the so-called 'base prices' are not fixed and vary without the user being aware of it.

39. As a result, base prices are not predictable in advance, as the fares that apps use to determine them vary systematically or do not correspond to those actually applied:

    i. Minimum fares do not apply.

    ii. The fares used for the calculation of the base price are not fixed.

    iii. The base price does not result from the application of t h e rates advertised by the app.

5.1.1.1 Minimum fares do not apply

40. Minimum fares do not apply to the majority of trips. By publishing minimum fares, operators seek to convey a false sense of transparency in price formation. In reality, prices are often not based on the operators' own published fares and are higher than the price resulting from the application of such fares.

41. CABIFY and BOLT publish on their respective websites the fares for the determination of the base price of trips, depending on the duration and

distance of the trip[45]. In the case of UBER, it does not even publish any kind of fare on its website. If one tries to replicate the price observed in the app on the base of published far es, one finds that, in most cases, those fares are not applied. That is, the base prices are almost always different from the prices calculated from the minimum fares. In the example in Table 10, the actual price is 21% above that resulting from the application of minimum/published fares[46].

Table 10. Price according to published fares vs. actual price of a CABIFY trip (route 3)

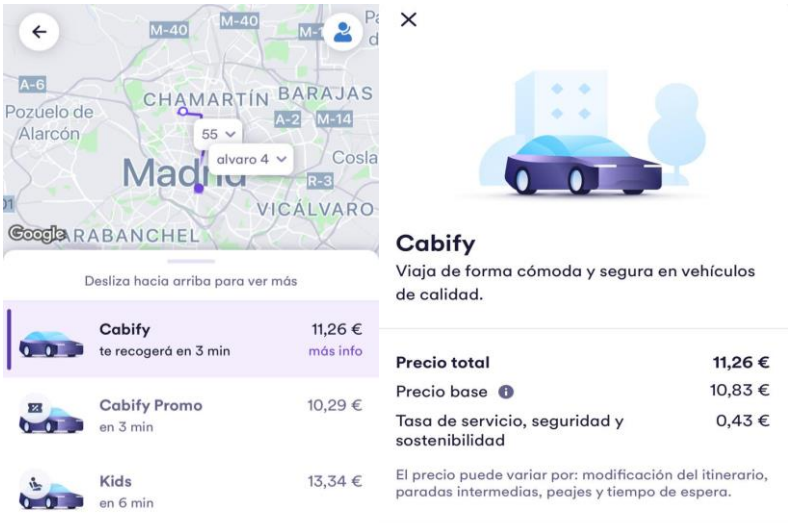
Starting price (€) [A]	1.25
Fare per km (€/km) [B]	0.65
Distance (km) [C]	8.39
Fare per min (€/min) [D]	0.09
Duration (min) [E]	25
Service, safety and sustainability fee (%) [F]	4%
Price according to fares *[A+B*C+D*E]*[1+F]*	**9.31€**
Actual price in app	**11.26€**
Difference	**+21%**

Source: Own elaboration based on a database. This is a trip with a base price, i.e., without a high demand surcharge (Illustration 4).

[45] While UBER and BOLT are based on these principles, CABIFY adds a "Service fee, safety and sustainability fee". See section 3.2 for more details on the pricing system for PHV services.

[46] Since BOLT does not break down the estimated trip distance, the fare is calculated using the distance of the route in question according to Google Maps. In the case of CABIFY (which does not break down the estimated trip time), the duration of that trip according to Google Maps is used.

Illustration 4. Example of trip with discrepancies between advertised and calculated CABIFY price (route 3).



Source: CABIFY app.

42. In the case of BOLT, nine out of ten trips analyzed have a different base price than the one that would result from applying minimum/published fares. In the case of CABIFY, minimum/published fares are hardly ever applied (Table 11).

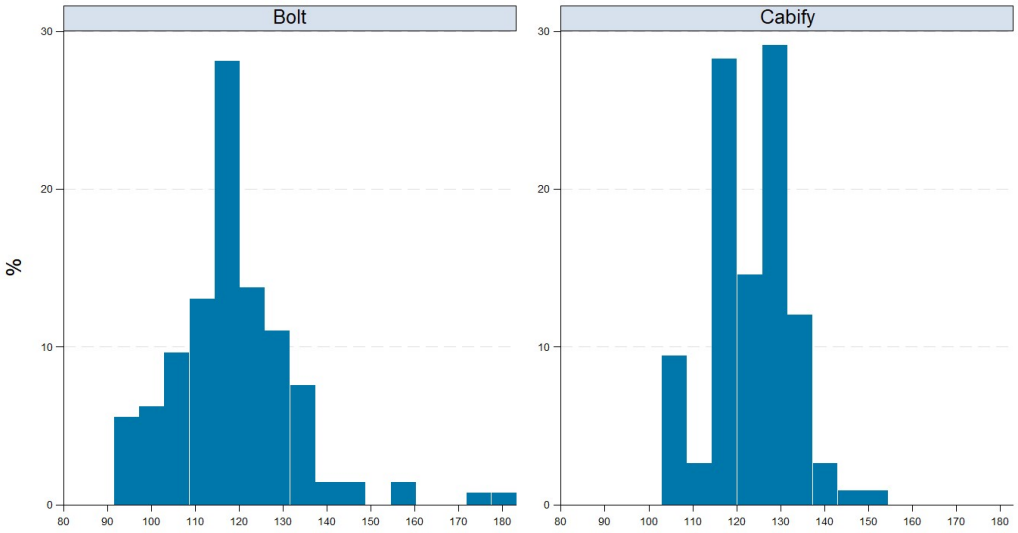
Table 11. Trips at prices different from those resulting from the application of the minimm/published fares

BOLT	91.91%
CABIFY	99.03%

Source: Own elaboration based on database. Trips with a deviation of more than ±5%.

43. Moreover, in most cases, the base prices are higher than those replicated with the minimum/published fares (Figure 7). Virtually all CABIFY and BOLT trips have higher prices than those resulting from the application of the minimum/published fares[47]. This implies that BOLT and CABIFY minimum/published fares are irrelevant as they are never applied.

Figure 7. Price deviation relative to minimum/published tariffs fares (price at minimum tariffsfares=100)



Source: Own elaboration based on database. Relative price equals 100 if the base price is equal to the price calculated with the minimum/published fares.

[47] Trips with a price deviation from the minimum fare of more than 5%.

5.1.1.2 *The fares used for the calculation of the base price are not fixed*

44. Each operator's description of price formation conveys the message that a surcharge on the base fares will only be applied in the event that "high demand" is triggered. However, the fares applicable for the calculation of the base price are not fixed and are often higher than the minimum/published fares, so that a 'hidden surcharge' on the minimum fares is already implicit in the so-called 'base price'.

45. In the case of UBER, the minimum price for trips without high demand surcharge in the sample analyzed varies between 4.50 and 5 € and the starting fare varies between 2.75 and 3.15 €[48], with no apparent explanation[49]. BOLT offers three different kilometric fares for trips without high demand surcharge (between 0.85 and 1.13 € per km), and two different hourly fares varying between 0.13 and 0.14 € per minute.

46. The application of one or the other basic fare does not seem to meet any logical criterion:

    i. For an equivalent trip (same route, day of the week, month, trip time and time zone), BOLT applies substantially different mileage fares (0.85 €/km for trip 1 - Illustration 5 and 1.13 €/km for trip 2 - Illustration 6) and different initial fares (€1.75 on trip 1 - Illustration 5 versus €0.5 for trip 2 - Illustration 6).

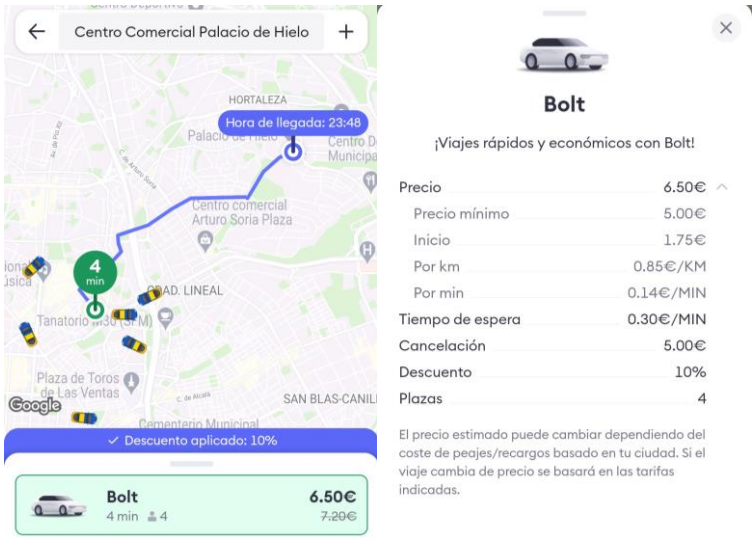
    ii. For an equivalent trip, UBER applies different initial fares (€2.75 vs. €3.5, see Illustration 7-Illustration 8) without any apparent explanation (i.e., no surcharge is announced).

[48] Confusingly referred to by UBER as a "base fare" as it uses the same terminology as for the price of the service excluding high demand surcharges.

[49] From the analysis of UBER's fares, no conclusions can be drawn on the patterns that justify these variations of this starting fare and this minimum fare in the periods when the high demand surcharge is not activated.

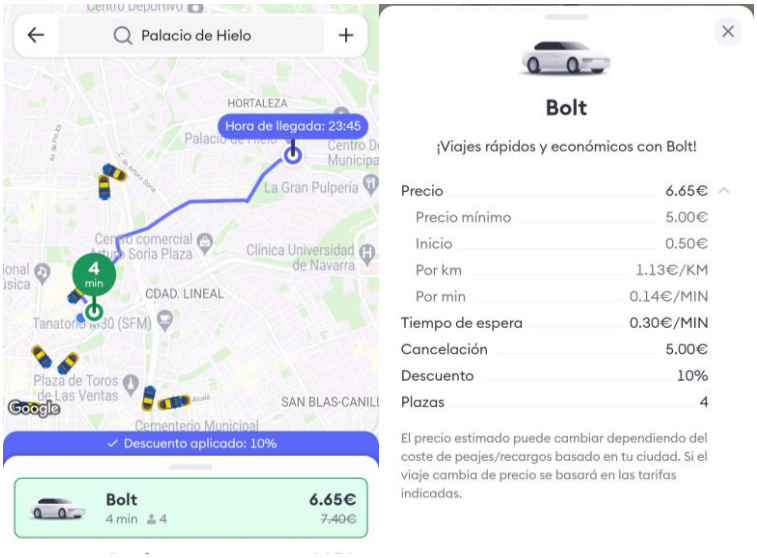
iii. CABIFY does not provide the fares used to calculate the price of each trip, but it can be seen that it charges different prices for the same trip (15,99 versus 17.77, see Illustration 9 - Illustration 10) despite travelling the same route and on the same day of the week at the same time, so traffic should be similar.

Illustration 5. Trip 1 - BOLT: Route 1



Source: BOLT app.

Illustration 6. Trip 2 - BOLT: Route 1

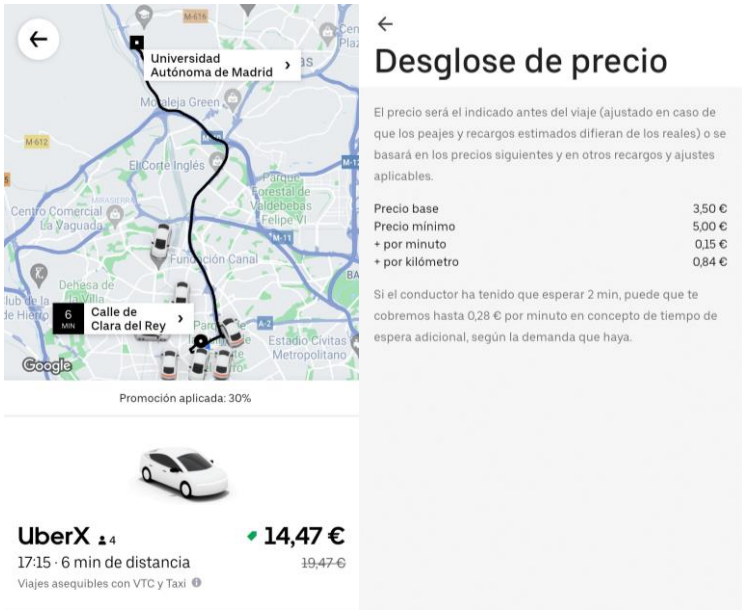


Source: BOLT app.

Illustration 7. Trip 1 - UBER: Route 4

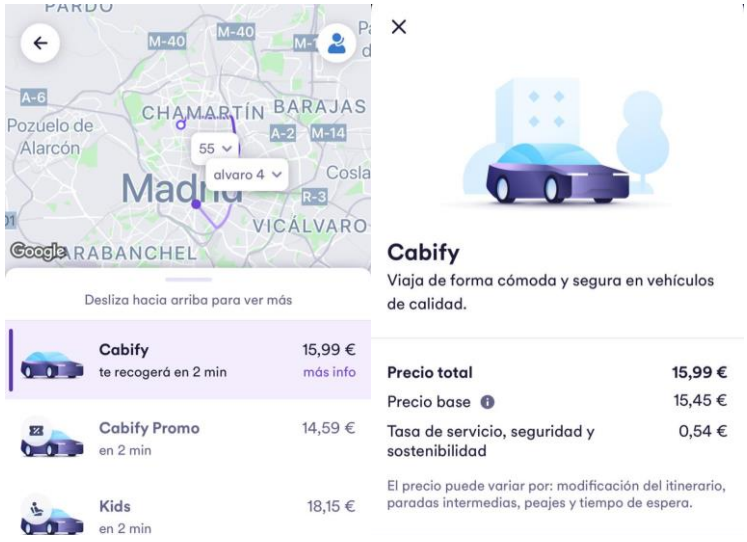
Source: UBER app.

Illustration 8. Trip 2 - UBER: Route 4



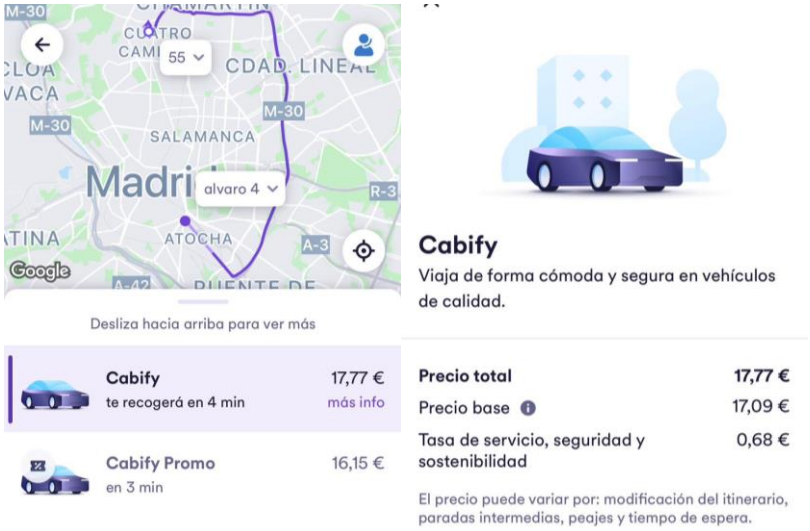
Source: UBER app.

Illustration 9. Trip 1 - CABIFY: Route 3



Source: CABIFY app.

Illustration 10. Trip 2 - CABIFY: Route 3



Source: CABIFY app.

5.1.1.3 *The base Price for PHV services does not result from the application of the advertised fares*

47. The base price observed for trips without a high demand surcharge does not result from the application of the fares advertised at the time of each travel request.

48. BOLT and UBER display on each trip request the specific fares that are supposed to have been used for the calculation of the base prices[50]. However, the base prices (on trips without high demand surcharge) are systematically different from those that would result from the application of the fares that PHV operators advertise on the display of each of those trips. In the example in Table 12, the actual price is 18.5% higher than that resulting from the application of the advertised fares[51].

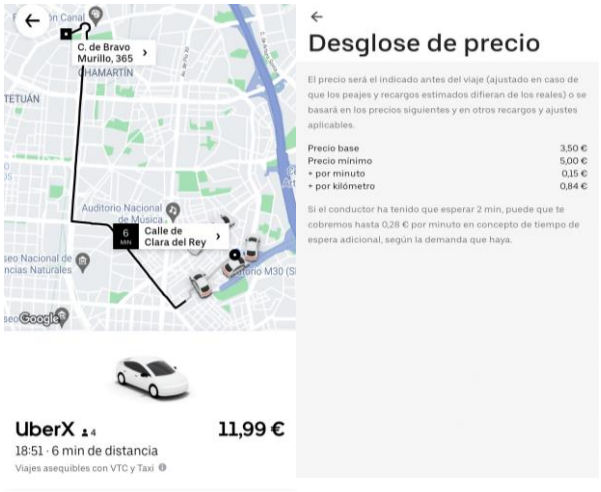
Table 12. Price according to advertised fares vs. actual price of an UBER (route 2)

Starting price (€) [A]	3.50
Fare per km (€/km) [B]	0.84
Distance (km) [C]	5.2
Fare per min (€/min) [D]	0.15
Duration (min) [E]	15
Price according to fares *[A+B*C+D*E]*	**10.12€**
Actual price in app	**11.99€**
Difference	**+18.5%**

Source: Own elaboration based on database. This is a trip with a base price, i.e., without a high demand supplement high demand surcharge (Illustration 11).
* Estimated distance of the route obtained from Google Maps.

[50] CABIFY does not provide a breakdown of fares per km and per minute for each trip. It only includes a "base price" (variable per service) and a "service, safety and sustainability fee", which corresponds to 4% of the base price.
[51] Since UBER and BOLT do not break down the estimated trip distance, the fare is calculated using the distance of the trip in question according to Google Maps.

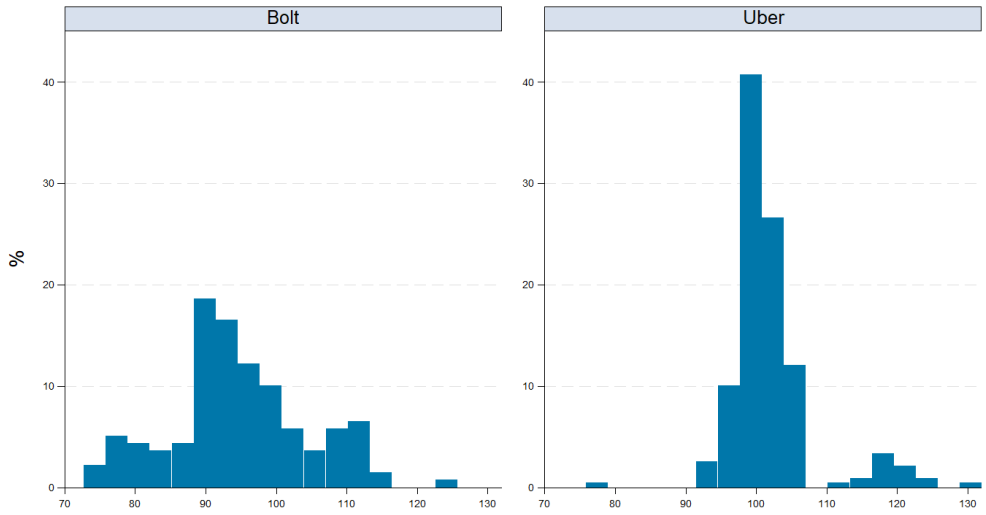
Illustration 11. Example of trip with discrepancies between advertised and calculated UBER price (route 2).



Source: UBER app.

49. Three out of four BOLT trips and one out of three UBER trips are priced differently from the advertised fares for that particular trip (Figure 8).

Figure 8. Price deviation from advertised tarifffares (price at advertised tarifffares=100)



Source: Own elaboration based on database.

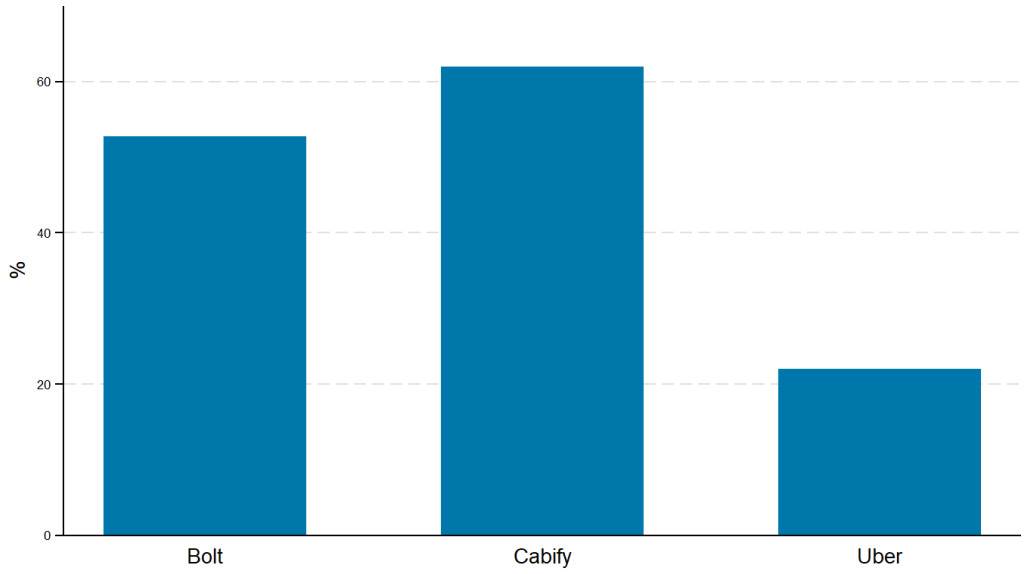
5.1.2 The high demand surcharge is applied frequently and its magnitude is highly variable

5.1.2.1 *The high demand surcharge is not an exceptional phenomenon*

50. The activation of the high demand surcharge, which implies a variable price premium, is not an exceptional phenomenon but, in the case of CABIFY, seems to be the norm as it is applied on almost two out of three trips in the sample analyzed.

51. The activation of the high demand surcharge is justified by PHV operators as a system to manage episodes of high demand or vehicle shortage. The high frequency of this phenomenon (one out of five UBER trips, half of BOLT trips and two out of three CABIFY trips; Fig.9) shows that high demand activation of the surcharge is not an exceptional occurrence and the threshold for activation of the surcharge is very low

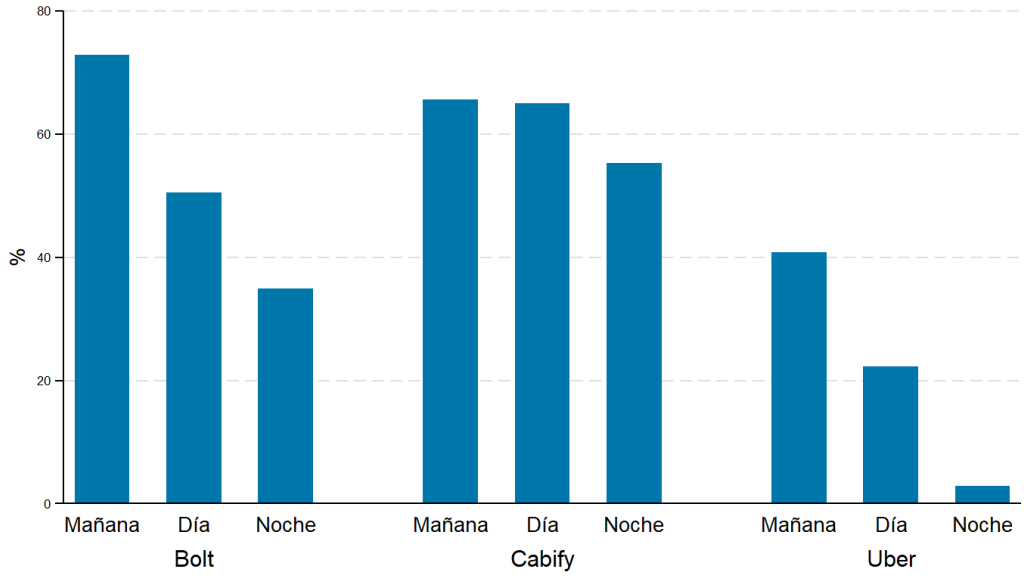
Figure 9. Frequency of high demand surcharge application



Source: Own elaboration based on database.

52. Activation of the high demand surcharge is especially prevalent during the mornings (7:00-10:00), when the high demand surcharge is applied on seven out of ten BOLT trips, two out of three CABIFY trips and four out of ten UBER trips (Figure 10).

Figure 10. Frequency of application of the high demand surcharge by time period



Source: Own elaboration based on database.

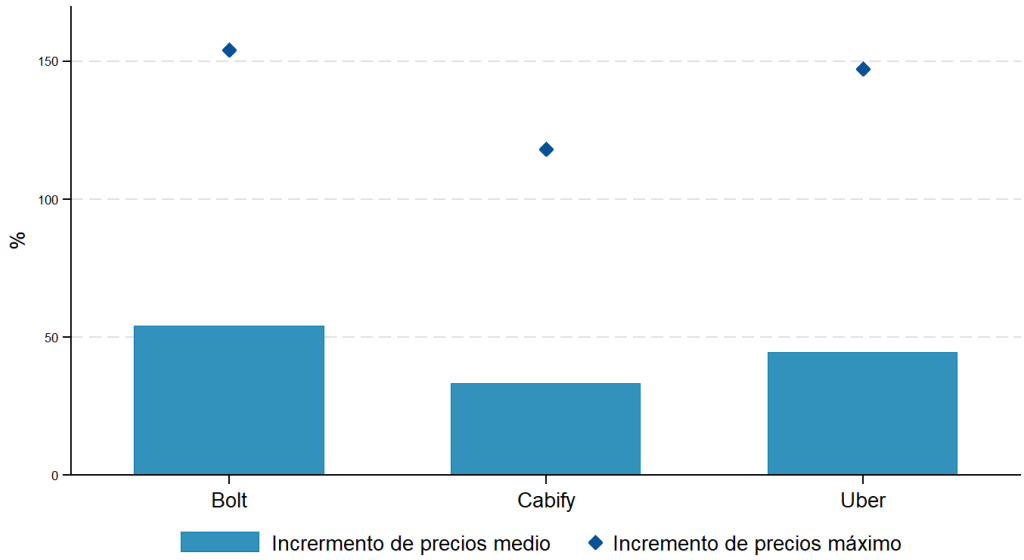
5.1.2.2 *The high demand surcharge significantly increases prices for PHV services and varies substantially.*

53. PHV operators report the application of high demand surcharges, but the amount of the surcharge is variable. In addition, two of the three operators do not report the amount of the surcharge.

54. High demand surcharges are not fixed and can be up to two and a half times the base fare for the same trip. Neither UBER nor BOLT provide information on the size of the surcharge. The activation of high demand surcharges leads to average price increases. 33% in the case of CABIFY, 45% in the case of UBER and 54% in the case of BOLT (Figure 11).

55. In addition, high demand surcharges can at certain times push prices well above such average price increases, multiplying the average base prices of PHV services by up to two and a half times (Figure 11).

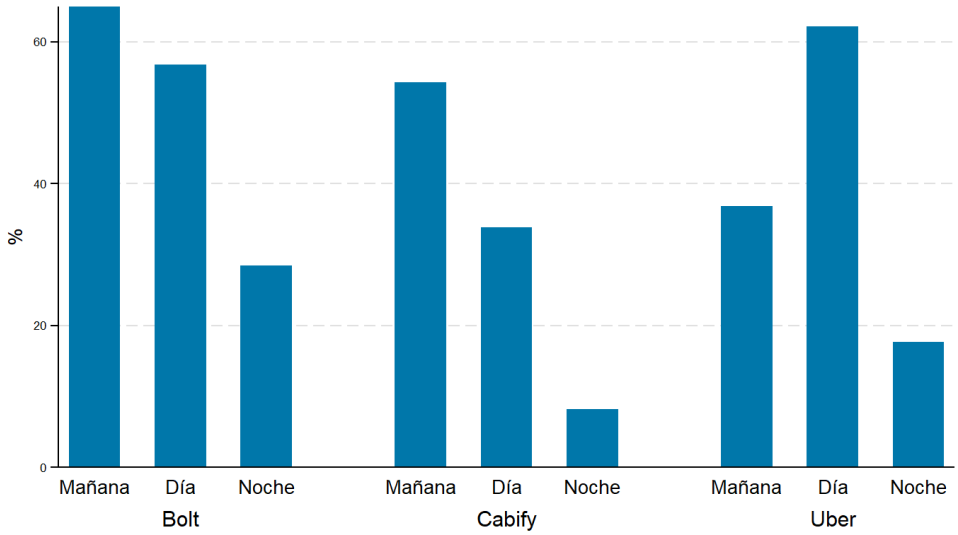
Figure 11. Average and maximum surcharges due to high demand



Source: Own elaboration based on database. Average and maximum of high- demand surcharge with respect to the average base price of that route without high-demand surcharge in that PHV.

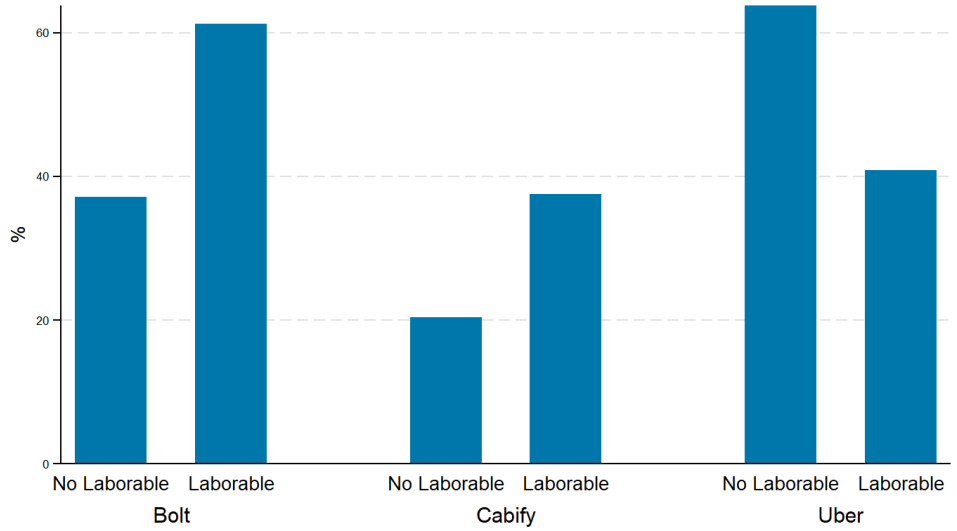
56. The high demand surcharge is significant at any time of the day. The average high demand surcharge is higher in the mornings (around 50-60%) and on weekdays (between 40-60%) (Figure 12 and Figure 13).

Figure 12. Average high-demand surcharges by time period



Source Own elaboration based on database. Average of high-demand surcharges with respect to the average base price of that route without high-demand surcharge on that PHV. Morning: 7-10; Day: 10-21; Night: 21-7.

Figure 13. Average high-demand surcharges per day



Source: Own elaboration based on database. Average of high demand surcharges with respect to the average base price of that route without high demand surcharge in that PHV.

5.2 Prices for PHV services are volatile and inconsistent

57. Arbitrariness in the price formation process of PHV services leads to volatile and inconsistent prices:
    i. Prices for PHV services are inconsistent:
        a. Base fares (without high demand surcharge) vary considerably for the same route.
        b. Base prices (without high demand surcharge) may be higher than prices with high demand surcharge.
    ii. The price variability of PHV services is much higher than the variability of taxi prices. While taxi prices vary around ±15% of the average price depending on traffic congestion, prices for PHV services can range from half to twice the average taxi price (Figure 17 on p. 53).
    iii. Moreover, PHV operators' prices vary in parallel. When the prices of a given PHV operator are high, the prices of the other PHV operators are likely to be high as well, so that users will not be able to avoid the high prices of a given operator by using another PHV operator.

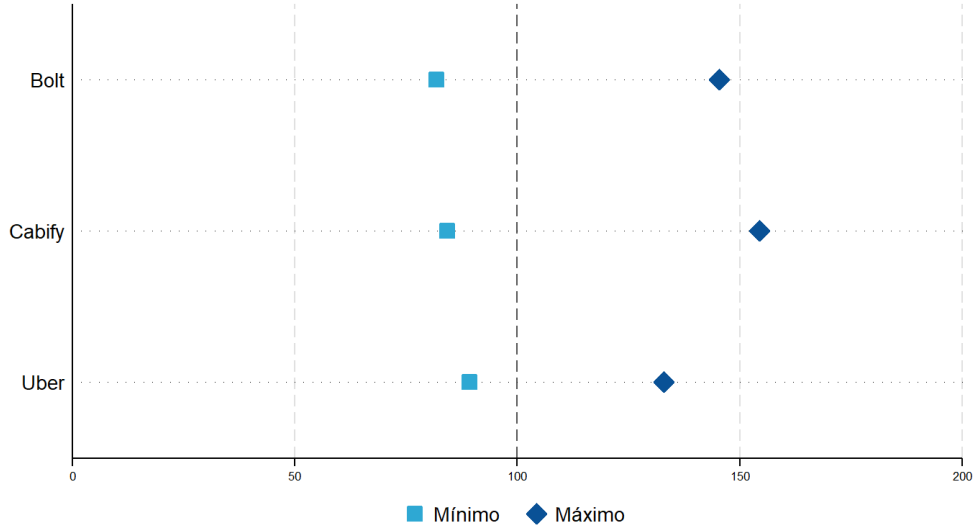
5.2.1 Base prices for PHV services vary considerably and are inconsistent

58. Arbitrariness in the pricing process of PHV services generates inconsistent prices: base prices (when the high demand surcharge is not activated) vary considerably for the same route and may even be higher than the prices with the high demand surcharge for the same route.

5.2.1.1 *The base prices of PHV services vary considerably for the same route*

As a consequence of the arbitrariness in the formation of base prices (when the high demand surcharge is not activated), the base prices of PHV services vary considerably for the same route (Figure 14). BOLT's base prices are between 18% below the average base price and 45% above the average base price for that route (Figure 14)[52]. CABIFY's base prices vary between -11% and +33% above the average base price. UBER's base prices vary between -11% and+33% above the average base price.

Figure 14. Minimum and maximum base price of PHV services (average base price =100)

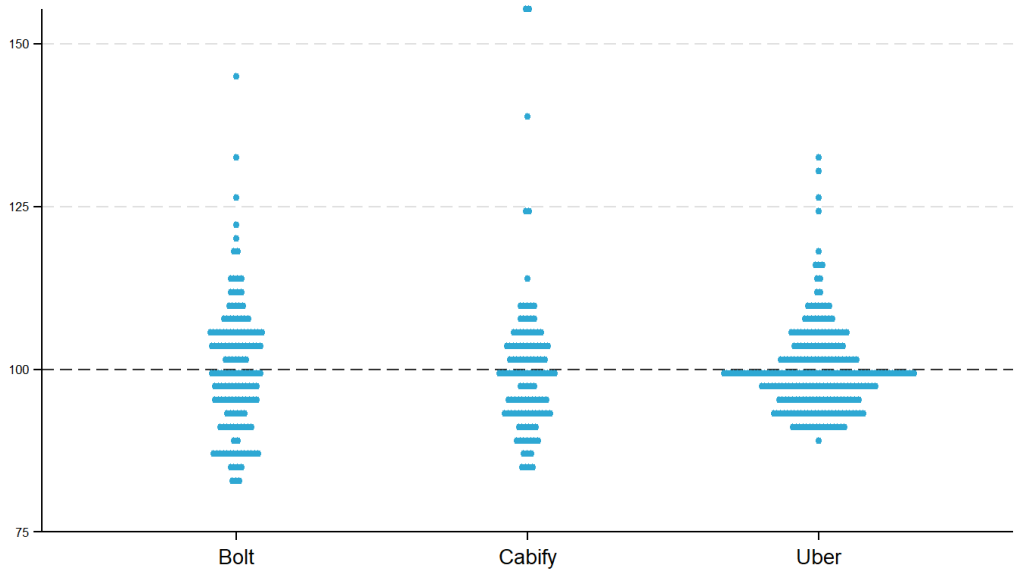


Source: Own elaboration based on database. Minimum and maximum relative base prices of PHV services. Relative base price equals 100 if the base price is equal to the average base price for that trip without high demand surcharge.

[52] Averages for each trip and PHV in periods when the high-demand surcharge is not applied. This variability in prices for trips without a high-demand surcharge occurs for all trips for all PHVs (see APPENDIX III).

59. The existence of base prices different from the average base price is not an anecdotal event, but it is common for prices to deviate from their average. As a consequence, there is a high dispersion of base prices from the average (Figure 15).

Figure 15. Distribution of PHV base prices (average base price=100)



Source: Own elaboration based on database. Relative base price equals 100 if the base price is equal to the average base price for that trip without high demand surcharge.

5.2.1.2 *Base prices for PHV services can be higher than prices with a high demand surcharge.*

60. The application of hidden surcharges to the base prices results in inconsistencies between base prices and prices with high-demand surcharges, and sometimes base prices can be higher than prices with high- demand surcharges (even if the app does not indicate the application of any surcharge).

61. Due to the application of hidden surcharges on the base prices, a customer may pay a higher base price than the price with a high demand surcharge without being aware of it. For example, PHV operators can charge substantially more

for a trip that is supposedly without surcharges (base fare) than for the same trip with a high demand surcharge (Table 13).

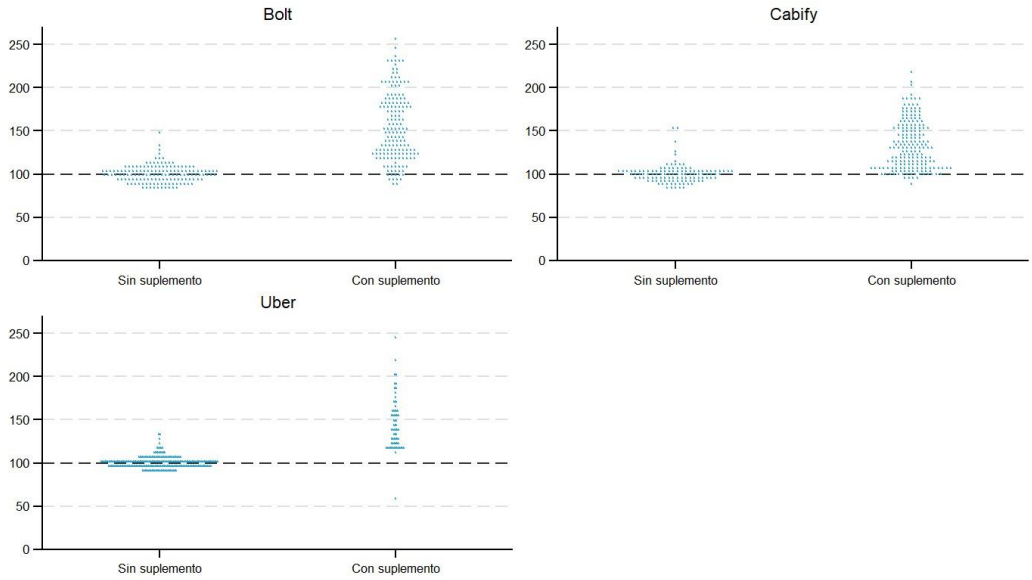
Table 13. Examples of trips with base price higher than the price with high demand surcharge on the same trip

	Base price	Price with high demand surcharge	High Demand Difference (%)	*Route and dates*
BOLT	9.95 €	7.55 €	-24%	*Route 1 (01/06/23 - 21/05/23)*
CABIFY	17.86 €	13.58 €	-24%	*Route 5 (27/05/23 – 23/05/23)*
UBER	20.02 €	11.75 €	-41%	*Route 4 (22/05/23 – 23/05/23)*

Source: Own elaboration based on database.

62. Although average prices with high demand surcharge are substantially higher than the average base price, there are numerous episodes where the base price is higher than the price with high demand surcharge, without any announced surcharge. The dispersion of base prices and high-demand- surcharged prices overlaps, so that there are base prices higher than high-demand-surcharged prices (Figure 16).

Figure 16. Prices of PHV services without and with high demand surcharge (average price=100)



Source: Own elaboration based on database. Relative price equals 100 if the price is equal to the average base price for that trip (price without high demand surcharge).

5.2.2 Prices of PHV services are significantly more volatile than taxi prices

63. The high price volatility of PHV services contrasts with the stability of taxi prices. While prices for PHV services are changeable and unpredictable, taxi prices vary only according to traffic and time zone.[53]

64. For a given trip at a given time, the taxi price may vary according to the time taken to complete the trip. In the case of PHV prices, to the variability of time is added the variability of base prices and the possibility of the application of the high demand surcharge. This means that the variability of PHV prices is much higher than the variability of taxi prices[54].

65. For taxi trips equivalent to the analyzed PHV trips made at fare 1 (weekdays between 7:00 and 21:00), prices are between 15% below and 14% above the average price for that taxi trip (Figure 17). However, the price dispersion of PHV services is much higher during these periods (Figure 17):

    i. The price of a BOLT trip can be between 46% below and 78% above the price of an equivalent taxi trip;

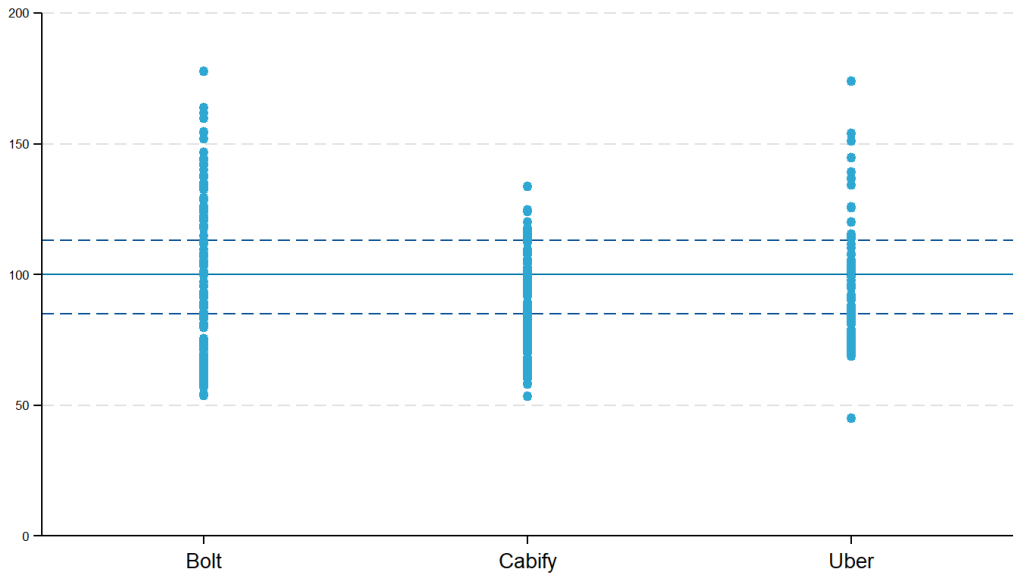
    ii. The price of a CABIFY trip can be between 47% below and 34% above the price of an equivalent taxi trip; and

    iii. The price of an UBER trip can be between 45% and 74% lower than the price of an equivalent taxi trip.

[53] Taxi fares include a price per minute component that is triggered when the speed is below 18.27 km/h for fare 1 and 18 km/h for fare 2.

[54] The variability of taxi fares is calculated for each equivalent trip as the maximum and minimum deviation from the average taxi fare for that trip. Equivalent trip is selected according to the methodology detailed in APPENDIX II (section b).

Figure 17. Volatility of PHV vs Taxi price (Fare 1) (Average price taxi=100)



Source: Own elaboration based on database. Relative prices of PHV trips compared to the average of equivalent taxi trips. The lines indicate the minimum and maximum deviation in taxi prices for equivalent trips.

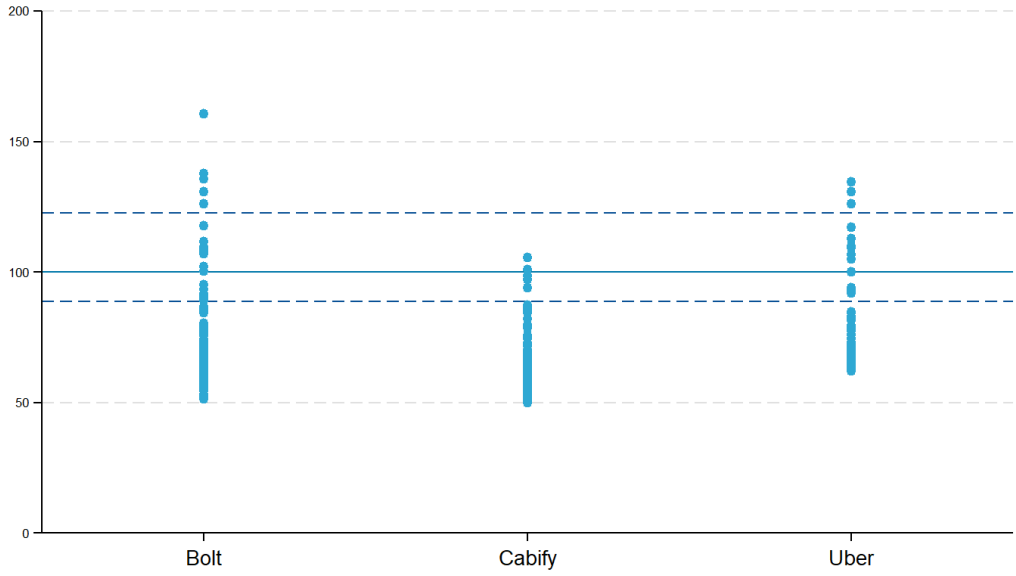
66. Variability is also higher for PHV prices than for taxi prices on non-working days and working nights (21:00- 7:00), when taxi fare 2 applies. Prices for taxi trips equivalent to those analyzed for PHV are between 12% below and 23% above the average price for that taxi trip (Figure 18). However, the dispersion of prices for PHV services is higher for these trips (Figure 18):

i. The price of a BOLT trip can be between 49% below and 61% above the price of an equivalent taxi trip;

ii. The price of a CABIFY trip can be between 50% below and 6% above the price of an equivalent taxi trip;

iii. The price of an UBER trip can be between 48% and 35% lower than the price of an equivalent taxi trip.

Figure 18. Volatility of PHV vs Taxi price (Fare 1) (Average price taxi=100)



Source: Own elaboration based on database. Relative prices of PHV trips compared to the average of equivalent taxi trips. The lines indicate the minimum and maximum deviation in taxi prices for equivalent trips.

5.2.3 Prices for PHV services are rising in parallel

67. The correlation between PHV operators' prices is high, which means that prices behave in parallel. When the prices of a given PHV operator are high, the prices of all other PHV operators are likely to be high as well.

68. There is a high correlation in the activation of high demand episodes. Whenever UBER applies the high demand surcharge, BOLT and CABIFY also apply it. For example, 85% of the time when BOLT applies the high demand surcharge, CABIFY also applies it (Table 14). UBER is the operator that applies the high demand surcharge least frequently (see section Table 14), which leads to the fact that on all occasions that UBER applies a high demand surcharge, both BOLT and CABIFY also apply it.

Table 14. Coincidence between high demand episodes

	BOLT	CABIFY	UBER
BOLT	-	85%	42%
CABIFY	72%	-	35%
UBER	100%	100%	-

Source: Own elaboration based on database. Each event is defined as a trip on one day and in one time slot.

69. The coincidence in the activation of high demand surcharges is such that at almost half of the times (44.80%)[55], at least two PHV operators activate high demand (Table 15).

Table 15. Simultaneous activation of high demand

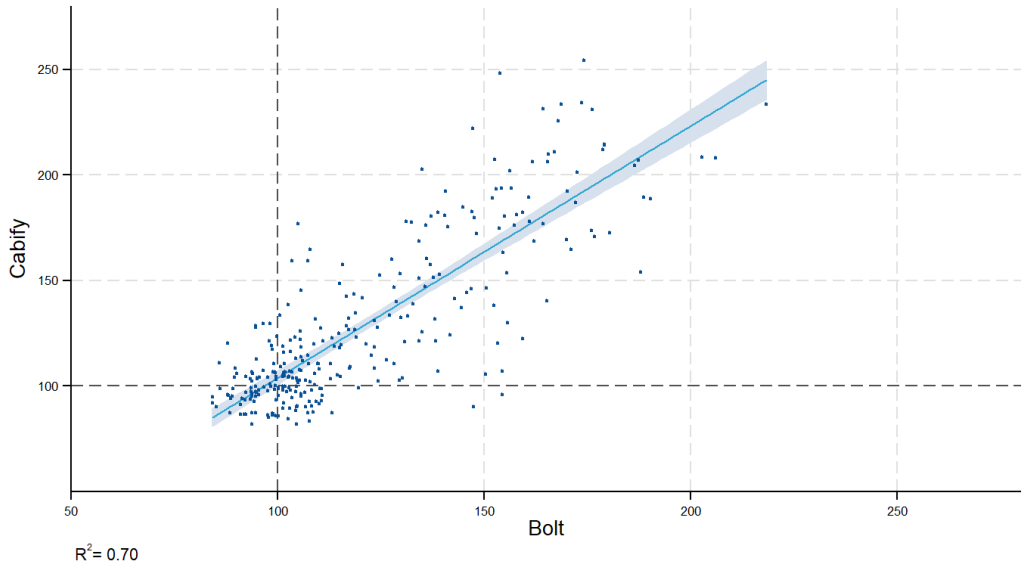
No. of operators who agree on the activation of high demand	Events	Percentage
0	93	30.19%
1	77	25.00%
2	71	23.05%
3	67	21.75%
Total	**308**	

Source: Own elaboration based on database. Each event is defined as a trip on one day and in one time slot.

70. Price coincidence is not only limited to the activation of high demand surcharges, but there is a strong relationship between the prices of the three operators. This relationship is particularly strong between BOLT and CABIFY (Figure 19), where 70% of the variations in CABIFY's relative prices can be explained by variations in UBER's relative prices. In any case, this positive relationship between relative prices also exists between these two operators and UBER (Figure 19 - Figure 21).

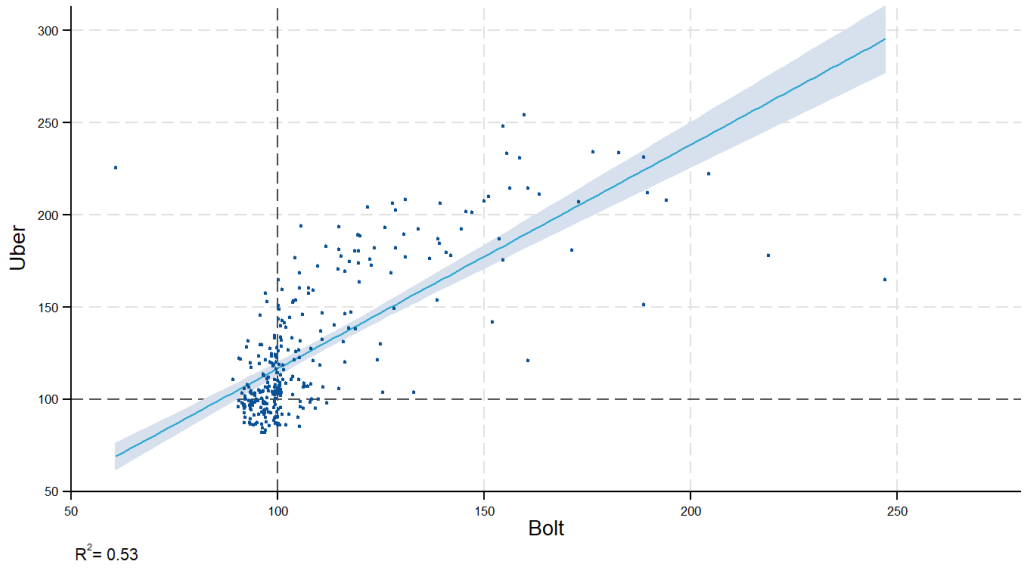
[55] Each moment is defined as a trip in a day and a time slot.

Figure 19. Relationship between the relative prices of BOLT and CABIFY



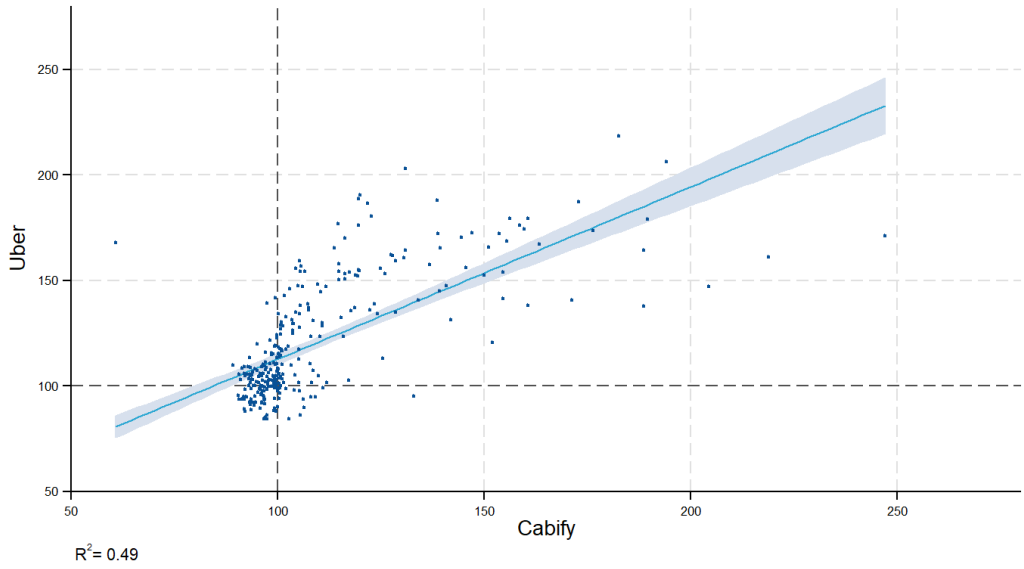
Source: Own elaboration based on database. Relative price equals 100 if the price is equal to the average base price for that trip without a high demand surcharge. Each point represents an event in the database. An event is defined as a trip on a day and in a time slot.

Figure 20. Relationship between the relative prices of BOLT and UBER



Source: Own elaboration based on database. Relative price equals 100 if the price is equal to the average base price for that trip without a high demand surcharge. Each point represents an event in the database. An event is defined as a trip on a day and in a time slot.

Figure 21. Relationship between the relative prices of UBER and CABIFY



Source: Own elaboration based on database. Relative price equals 100 if the price is equal to the average base price for that trip without a high demand surcharge. Each point represents an event in the database. An event is defined as a trip on a day and in a time slot.

6 Conclusions

71. Unlike taxi fares, which are transparently set according to regulated public fares, PHV fares are dynamic fares determined by complex and opaque algorithms, which cause prices to fluctuate widely.

72. The pricing of PHV services is opaque (i.e., the factors that determine prices are not known) and, from the consumer's point of view, arbitrary (i.e., the consumer cannot anticipate the price and is exposed to high volatility). The opacity and arbitrariness with which prices for PHV services are determined makes prices completely unpredictable for the user before making the trip request in the application. As they are dynamic prices that vary according to PHV operators' opaque algorithms, the user has no way of knowing in advance when and to what extent prices will be increased due to high demand.

73. **Prices for PHV services are determined in an opaque and arbitrary manner.** The apparent transparency of the publication of the final price hides an opaque pricing procedure:

    i. Base prices" (prices supposedly without surcharges) are opaque and unpredictable, because minimum fares do not apply, base fares are variable, and the "base price" advertised by apps does not result from the application of the advertised fares.

    ii. The "high demand surcharge", the application and magnitude of which is determined by an opaque algorithm, is not exceptional and varies substantially in magnitude. The activation of the high-demand surcharge occurs in a high number of trips and is not an exceptional phenomenon. In the sample analyzed, one in five UBER trips, half of the BOLT trips and two out of three CABIFY trips have a high demand surcharge. The magnitude of the high demand surcharge is extremely variable, increasing prices by an average of 30-50% and sometimes up to two and a half times the base price.

74. **Prices for PHV services are volatile and inconsistent:**

i. Prices for PHV services are inconsistent. Base prices (without high demand surcharge) vary considerably for the same route and can even be higher than prices with demand surcharge.

ii. The price variability of PHV services is much higher than the variability of taxi prices. While taxi prices vary around ±15% of the average price depending on traffic congestion, PHV prices can be as much as half to twice the average taxi price.

iii. Prices of PHV operators vary in parallel. When the prices of one PHV operator are high, the prices of the other PHV operators are likely to be high as well, so users will not be able to avoid the high prices of one PHV operator by using another PHV operator.

75. In conclusion:

i. The pricing process for PHV services is opaque and arbitrary. For example, the high demand surcharge is not exceptional and its magnitude varies substantially. **PHV operators apply the high demand surcharge on up to two out of three trips.** The high-demand surcharge increases prices for PHV services by 30-50% on average.

ii. The price variability of PHV services is much higher than that of taxi prices. **The price of the same PHV trip can be multiplied by up to two and a half times depending on the day and time of day.**

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APPENDIX I. Taxi fare regulation

76. In the so-called Área de Prestación Conjunta (APC) of the Community of Madrid, according to current regulations[56], different fares are established for taxi trips depending on the day of the week (working day, weekend or public holiday); the timetable; the origin and/or destination; and the distance of the trip (Table 16).

Table 16. Fares for taxi services in Madrid (2023)

Fare	Days	Timetable	Origin	Destination
1	Weekdays	7-21 h	APC	APC
2	Weekdays	21-7 h	APC	APC
	Saturdays, Sundays and Public Holidays	24 h		
3	Every day	24 h	Adolfo Suárez-Barajas Airport	Outside the M-30
4	Every day	24 h	Adolfo Suárez-Barajas Airport	Inside the M-30 (or vice versa)
5	Weekdays	7-21 h	Outside APC	Outside APC
6	Weekdays	21-7 h	Outside APC	Outside APC
	Saturdays, Sundays and Public Holidays	24 h		
7	Every day	24 h	• Atocha and Chamartín train stations. • Avda. América and Sur Méndez Álvaro bus stations. • Juan Carlos I Trade Fair Park (IFEMA).	-

Source: Own preparation according to the Resolution of 2 December 2022, BOAM 9.285/3619 of 19 December 2022 (Fares 1-4 and 7) and the Order of 17 December 2019 BOCM no. 304 of 23 December 2019 (Fares 5 and 6).

[56] The trips within the so-called Área de Prestación Conjunta (APC) are regulated by the Resolution of 2 December 2022 of t h e Director General of Traffic Management and Surveillance, which establishes the appropriate measures for the due control of the application of taxi service fares in the Área de Prestación Conjunta de Madrid, applicable as of 1 January 2023. Published in BOAM no. 9.285/3619 of 19 December 2022, p. 49-52. Trips to and from municipalities outside the APC are regulated by Order 17 December 2019 of the Regional Ministry of Transport, Mobility and Infrastructure on the fare system for inter-city taxi services. Published in BOCM no. 304 of 23 December 2019, p. 73-75.

Note: Arranged services, i.e. those previously contracted at a fixed price via telephone, radio and telematic means are identified as Fare 9.[57]

77. Fares for taxi services are regulated and vary according to the type of fare (Table 17):

Table 17. Fare system for taxi services in Madrid (2023)

Fare	Start service rate (€)	Mileage rate (€/km)	Hourly rate (€/h)	Franchise km*.
1	2.50	1.3	23.75	0
2	3.15	1.5	27	0
3	20.00	1.3	23.75	9.5 km
4	30.00	0	0	0
5	2.50	1.25	22	0
6	3.10	1.3	25	0
7	7.50	1.3	23.75	1.45 km

Source: Own preparation according to the Resolution of 2 December 2022, BOAM 9.285/3619 of 19 December 2022 (Fares 1-4 and 7) and the Order of 17 December 2019, BOCM no. 304 of 23 December 2019 (Fares 5 and 6).
* After the indicated excess meters (or equivalent initial time). the taximeter continues to count at the corresponding fare.

[57] Article 6 of the Order of 17 December 2019 of the Regional Ministry of Transport, Mobility and Infrastructure.

APPENDIX II. Description of the analytical sample

78. To carry out the analysis, prices of PHV and taxi trips within the municipality of Madrid between May and June 2023 were used.

    i. Prices for PHV trips have been obtained by making travel requests on the corresponding UBER, CABIFY and BOLT mobile apps.

    ii. Taxi fares have been obtained from the PIDETAXI database.

a. PHV services pricing database

79. Prices for PHV services are analyzed from a sample of 926 observations. These are closed prices obtained by making trip requests on each of the three PHV apps -UBER, CABIFY and BOLT- for five specific trips (detailed in Table 8, p. 29). Trip requests are made for each of the trips on the three apps at three times of the day and every day of the week between 16 May and 5 June 2023 as described in Table 18.[58]

[58] The pricing data for PHV services and the corresponding screenshots have been compiled by FPTM, following the instructions of GAMES Economics. GAMES Economics has verified the correspondence of the data and the screenshots. The closed prices offered by the three PHV applications for trip requests of the same characteristics are collected. Trips are not made.60 The different time slots have been defined taking into account: the definition of peak traffic hours as defined in the traffic reports of the Madrid City Council; the definition of peak hour of the PHV companies; and the timetable for the application of taxi fares 1 and 2.

Table 18. Sample characteristics

Feature	Description
Type of trip	Urban, with origin and destination in the municipality of Madrid. It does not include trips that have surcharges on the standard fare due to the origin or destination.
Trip distances	Short (4-5 km) (route 1) Medium (5-10km) (legs 2 and 3) Long (>13 km) (legs 4 and 5)
Period	16 May - 5 June 2023
Frequency	Every day of the week (Monday-Sunday)
Time slots[59]	Morning (7:00-10:00 h) Day (10:00-21:00h) Night (21:00-7:00 h)
Type of vehicle	Standard fleet vehicle: "UBERX", "CABIFY" and "BOLT".[60]
Service	Immediate application (without reservation). Means of payment: bank card.
Prices	Prices without surcharges, surcharges, discounts or promotions. High Demand" is identified as those trips in which applications show the high demand indicator.

Source: Own elaboration based on database.

[59] The different time slots have been defined taking into account: the definition of peak traffic hours as defined in the traffic reports of the Madrid City Council; the definition of peak hours of the PHV companies and the timetable for the application of taxi fares 1 and 2.

[60] UBER, CABIFY and BOLT also offer their services in other types of vehicles, which may be at a surcharge (e.g. high-end vehicles, high-capacity vehicles, etc.).

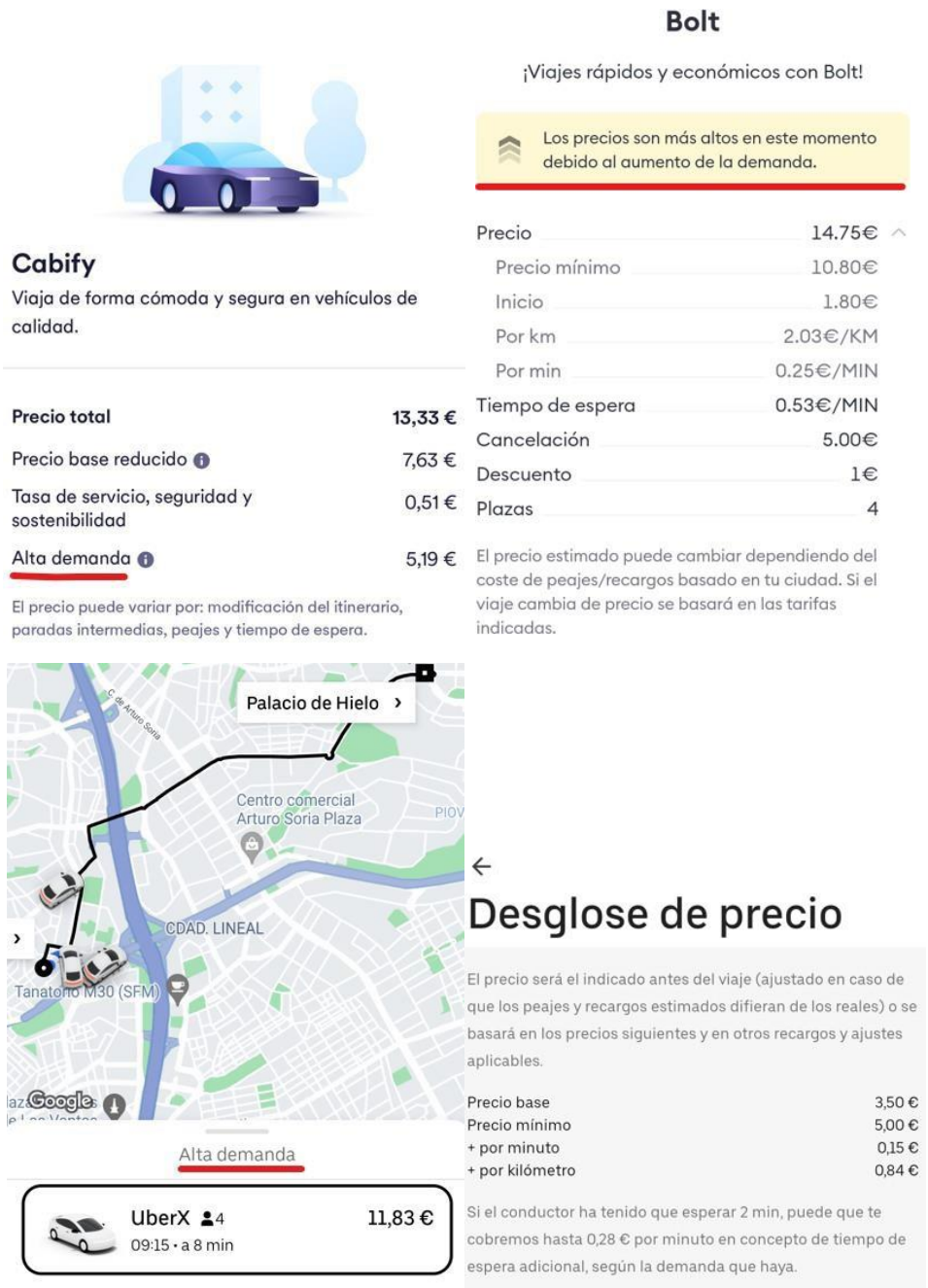
80. The price components and trip data (distance and time) that could be obtained vary depending on the PHV application as each one provides a different breakdown of information (Table 19 and Figure 22).

Table 19. Price components broken down for each UBER, CABIFY and BOLT application

Application	Price components	Estimated distance	Estimated time†
UBER	Minimum price (€) Base price (€) Price/min (€/min) Price/km (€/km)	No	Yes
CABIFY	Basic price (€) Service, safety and sustainability levy (€) High demand (€)	Yes	No
BOLT	Minimum price (€) Starting price (€) Price/min (€/min) Price/km (€/km)	No	Yes

Source: Own elaboration based on the information available in the UBER, CABIFY and BOLT applications.
†The estimated time on UBER and BOLT is calculated from the difference between the estimated time of arrival and the time of the trip request (minus waiting time).

Figure 22. Breakdown of CABIFY, BOLT and UBER prices in the app (Route 1 - 23/5/2023 morning)



Source: Own elaboration based on the information available in the UBER, CABIFY and BOLT applications.

81. The identification of trips with a high demand surcharge is carried out as follows:

i. UBER: when the high demand indicator appears (marked in red in Figure 22).

ii. CABIFY: when the price breakdown shows the "high demand" surcharge (marked in red in Figure 22).

iii. BOLT: when the high demand indicator (marked in red in Figure 22) appears.

b.Construction of equivalent prices for taxi services

82. Taxi service prices have been obtained from the PIDETAXI database, which includes prices of actual trips made with the taxi service in the months of April to June 2023.

83. In order to establish the comparison with the prices obtained from PHV applications, only those trips with origin and destination within the municipality of Madrid (81% of trips, Table 2, p. 17) and with Fare 1 or Fare 2 (68% of trips, Table 3, p. 19) are considered.[61]

84. In total, information is available on 3,676 taxi trips made with origin and destination in the municipality of Madrid and with Fare 1 (55%) or Fare 2 (45%) exclusively (Table 20)[62] distributed over the three time slots of analysis (Table 21).

Table 20. Taxi trips in the municipality of Madrid under Fare 1 or 2

Fare	No. observations	% of total
Fare 1	2,006	55%
Fare 2	1,670	45%
Total	**3,676**	**100%**

Source: Own elaboration based on data provided by PIDETAXI.

[61] The initial PIDETAXI database has been cleaned in order to use only observations with complete and valid data. Thus, the following are excluded from the analysis: trips with no destination; trips with no distance data or, by construction, a negative distance; and/or duration; trips with no sale price or with a sale price lower than the flag down charge; subscriber trips; trips where the taxi driver indicates that the customer is not present; trips whose fare does not correspond to the fare applicable at the time of dispatch acceptance (for example, a fare 1 trip on a working day at 6:00 a.m.). In total, the database is reduced to 6,858 observations out of a total of 141,585 observations from the original database, mainly due to the large number of trips with no destination and trips for which the trip distance cannot be calculated due to the lack of a customer pick-up time.

[62] These 3,676 trips are mostly (98%) trips for which the price is determined at the end of the trip according to the taximeter. A 2% are trips with a fixed price contracted through the PIDETAXI app.

Table 21. Taxi trips in the municipality of Madrid by time slot

Time band	Working	Non-working	Total
Morning (7-10h)	716	146	862
Day (10-21h)	1,290	510	1,800
Night (21-7h)	657	357	1,014
Total	**2,663**	**1,013**	**3,676**

Source: Own elaboration based on data provided by PIDETAXI.

85. For each of the PHV trips, their equivalent taxi trips are defined in order to obtain the average price, the minimum price and the maximum price of that taxi trip for each type of fare (1 and 2). The equivalent trips correspond to trips in the city of Madrid:

    i. for a distance similar to the PHV trip distance. The similar distance is defined as the distance of the route ±2%.[63]

    ii. with a trip time[64] between the shortest and the longest trip of the sample of PHVs on that route during the days and hours of application of that taxi fare.[65]

86. Thus, each PHV trip is compared with those taxi trips that have similar characteristics in terms of distance and trip time in the fare 1 periods (Table 22) and in the fare 2 periods (Table 23).

[63] The distance of the taxi trip is calculated as the difference between the total distance and the distance to the door.

[64] Taxi trip time is calculated as the difference between the end time of the service and the time of arrival at the customer's door.

[65] In UBER, for requests without the high demand surcharge, the base price and the minimum price vary for the same trip depending on the time of day, but the price per kilometer and the price per minute remain stable.

Table 22. Characteristics of fare 1 taxi trips equivalent to each PHV trip in the sample

PHV route	Minimum duration	Maximum duration	Distance (Google Maps)	Distance deviation (-2%)	Distance deviation (+2%)
Route 1	11	18	4.20	4.11	4.28
Route 2	10	22	5.20	5.10	5.30
Route 3	19	29	8.60	8.43	8.78
Route 4	15	30	15.75	15.44	16.01
Route 5	17	28	13.00	12.74	13.26

Source: Own elaboration based on data provided by PIDETAXI.

Table 23. Characteristics of fare 2 taxi trips equivalent to each PHV trip in the sample

PHV route	Minimum duration	Maximum duration	Distance (Google Maps)	Distance deviation (-2%)	Distance deviation (+2%)
Route 1	10	17	4.20	4.11	4.28
Route 2	11	16	5.20	5.10	5.30
Route 3	17	26	8.60	8.43	8.78
Route 4	11	25	15.75	15.44	16.01
Route 5	14	28	13.00	12.74	13.26

Source: Own elaboration based on data provided by PIDETAXI.

87. For each PHV trip, the minimum, maximum and average price of the equivalent taxi trips in fare 1 (Table 24) and fare 2 (Table 25) are calculated.

Table 24. Fare 1 taxi fares equivalent to the PHV fares in the sample

	Remarks	Minimum price	Maximum price	Average price
Route 1	26	9.70	12.90	11.41
Route 2	14	12.55	15.45	13.73
Route 3	17	16.25	20.45	18.17
Route 4	20	23.75	27.65	26.19
Route 5	29	21.60	25.00	23.32

Source: Own elaboration based on data provided by PIDETAXI.

Table 25. Fare 2 taxi fares equivalent to PHV fares in the sample

	Remarks	Minimum price	Maximum price	Average price
Route 1	12	11.10	14.25	12.40
Route 2	10	12.65	14.75	13.94
Route 3	10	16.75	23.10	18.86
Route 4	27	26.80	32.05	29.36
Route 5	30	23.60	27.50	25.40

Source: Own elaboration based on data provided by PIDETAXI.

APPENDIX III. Variability of PHV base prices

89. In the case of CABIFY and BOLT, the so-called "base fares" are not unique for the same trip when the so-called high demand is not activated, but different fares are charged for the same trip at different times.[66]

90. For example, for the same trip (trip 1) without high demand surcharge, BOLT applies different minimum prices, starting prices, prices per kilometer and prices per minute for different trips (Table 26). As a result, the same trip can cost €7.35 or €9.95 with BOLT, i.e. 35% more without the high-demand surcharge.

Table 26. BOLT base prices (without high demand surcharge) for route 1

Date	Time of request	Price total (€)	Minimum price (€)	Price start (€)	Price per km (€)	Price per min (€)
28/05/2023	23:31	8.00	6	1.00	1.13	0.13
31/05/2023	22:41	7.35	5	0.50	1.13	0.14
01/06/2023	11:32	7.55	5	1.75	0.85	0.14
01/06/2023	22:19	9.95	6	2.90	1.00	0.14

Source: Own elaboration based on data from travel requests in the BOLT application.

91. In CABIFY, the calculation of the price of the trip is even more opaque because the application only shows a price that they call "base price" and that is different every day and every hour for the same trip, without specifying how it is calculated (Table 27).

[66] In UBER, for requests without the high demand surcharge, the base price and the minimum price vary for the same trip depending on the time of day, but the price per kilometer and the price per minute remain stable.

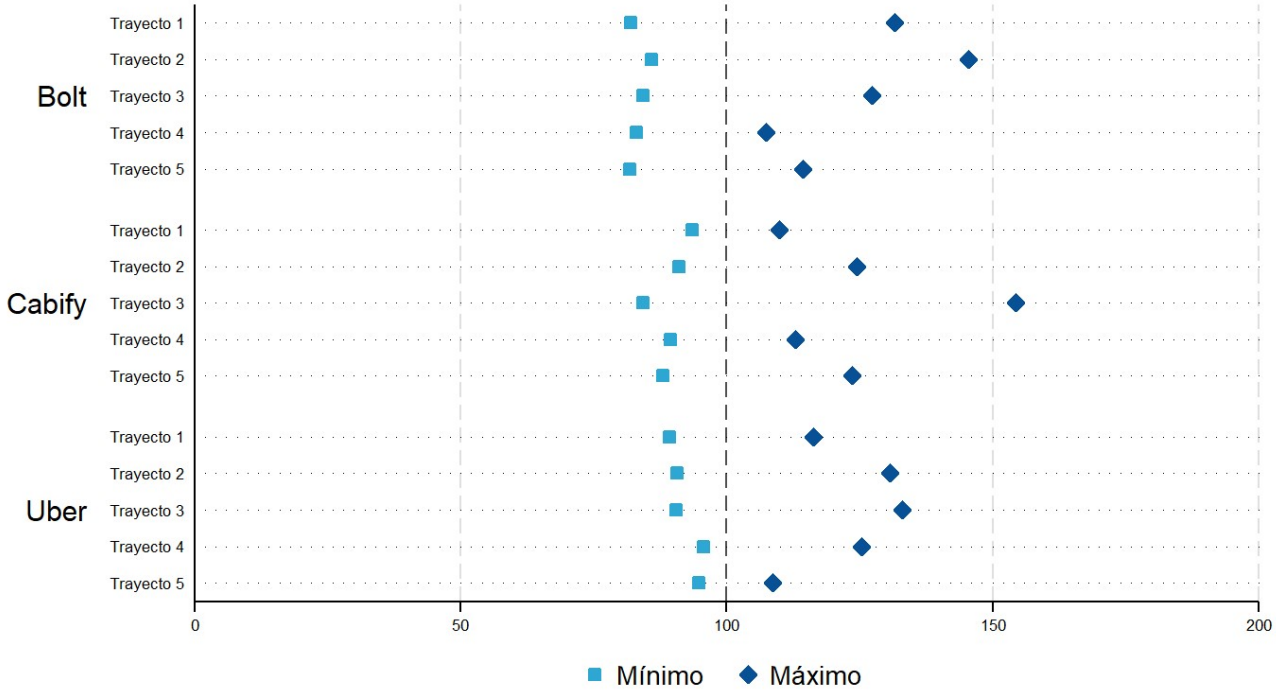
Table 27. CABIFY base fares (without high demand surcharge) for route 1

Date	Time of request	Price total (€)	Price Base (€)	Service, safety and sustainability fee[†] (€)
20/05/2023	08:32	7.09	6.16	0.25
20/05/2023	22:21	6.63	5.79	0.20
30/05/2023	07:27	7.55	6.56	0.26
30/05/2023	22:15	6.56	5.70	0.23

Source: Own elaboration based on data from travel requests in the CABIFY application.
CABIFY's service, safety and sustainability fee is 4% of the total CABIFY travel.

APPENDIX IV. Minimum and maximum base price for PHV services per trip

Figure 23. Minimum and maximum base price per trip (Average price=100)



Source: Own elaboration based on database. Minimum and maximum relative prices of PHV services. Relative price equals 100 if the price is equal to the average base price for that trip.

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