Transport Reviews

ISSN: 0144-1647 (Print) 1464-5327 (Online) Journal homepage: www.tandfonline.com/journals/ttrv20

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To cite this article: Pinar Bilgin, Giulio Mattioli, Malcolm Morgan & Zia Wadud (04 Jun 2025): Ridesourcing and vehicle ownership: a systematic review, Transport Reviews, DOI: 10.1080/01441647.2025.2515453

To link to this article: https://doi.org/10.1080/01441647.2025.2515453

TRANSPORT REVIEWS
https://doi.org/10.1080/01441647.2025.2515453

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Ridesourcing and vehicle ownership: a systematic review

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ABSTRACT

Ridesourcing has received significant attention globally due to its rapid expansion. As it has been more than a decade since the first ridesourcing operation, there is a growing interest in its long-term impacts, in particular on vehicle ownership, which is a key factor behind car use and various traffic-related and environmental externalities. The two-sided business model of ridesourcing positions both drivers and passengers as customers of these platforms, making the net impact a function of effects on both groups. This systematic literature review explores the relationship between ridesourcing and vehicle ownership from both perspectives. Utilising the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) methodology, this review analyses 31 peer-reviewed articles and three reports to evaluate these impacts. The findings reveal a general negative association between the use of ridesourcing and the number of vehicles in the household, though the causality of this relationship remains unclear. Notably, while a stated reluctance to purchase cars exists among individuals in the presence of ridesourcing, in most cases in developing countries the "value enhancement effect" (the incentive for ridesourcing drivers to acquire new vehicles) has dominated the "substitution effect" (the reduction in car purchases among ridesourcing customers), leading to an increase in vehicle ownership, whereas developed countries exhibit mixed outcomes. The review thus highlights the heterogeneous relationship between ridesourcing and vehicle ownership across different countries and regions, varying with many factors including levels of development and urbanisation. Additionally, the study identifies gaps in existing knowledge and proposes directions for further research on the impacts of ridesourcing.

ARTICLE HISTORY
Received 9 July 2024
Accepted 30 May 2025

KEYWORDS
Ride-hailing; transportation network companies; vehicle ownership; ridesourcing impacts; systematic literature review; PRISMA

1. Introduction

Ridesourcing is an innovative on-demand mobility service that is provided by Transportation Network Companies (TNCs). Different from traditional taxis hailed on the road or in taxi stands, ridesourcing utilises information and communications technologies (ICT)

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to connect drivers to riders through a dynamic matching algorithm and smartphone application. Although sometimes referred to as "ride-sharing", unlike traditional ride-sharing, ridesourcing drivers operate on a for-profit basis and usually offer rides that are not aligned with their own travel needs (Rayle et al., 2016).

Ridesourcing services have grown rapidly in the mobility market due to their potential to fill gaps in public transport services and provide a viable alternative to private cars and traditional taxis by offering convenient and relatively inexpensive services (Rayle et al., 2016). Reduced waiting times (Rayle et al., 2016), avoidance of stress and time spent driving, cost savings and potential for congestion reduction, especially when rides are shared (Etminani-Ghasrodashti & Hamidi, 2019), as well as efficient first and last-mile connections to public transport (Ghaffar et al., 2020) are among the most prominent benefits of ridesourcing services. However, the increasing popularity of ridesourcing services has raised concerns about externalities related to the transport system, travel behaviour, passenger safety, and the environment. An important concern is the possible shift of passengers from more sustainable modes, such as public transit or active travel to car-based, low-occupancy ridesourcing options. Indeed, the existing literature provides evidence of ridesourcing acting as a substitute for public transit and active modes (Clewlow & Mishra, 2017; Etminani-Ghasrodashti & Hamidi, 2019; Goodspeed et al., 2019; Rayle et al., 2016). Recent studies have also shown that ridesourcing services increase vehicle miles travelled (VMT) due to empty running and induced trips (Henao & Marshall, 2018; Schaller, 2018; Tengilimoglu & Wadud, 2022). An early review on the various effects of ridesourcing by Tirachini (2020) addressed the effects on ownership briefly.

To comprehend the wider effects of ridesourcing, it is important to understand how ridesourcing has affected mobility practices. It is well-known that car ownership significantly influences travel behaviour and mode choice, often signifying a lasting commitment to using private cars. Owning a car tends to increase the likelihood of selecting a private car for transportation, making it a subject of interest from various standpoints, including energy and the environment, particularly when decarbonising transport has become a global challenge. Given their nature as car-based private mobility services, ridesourcing services have led to important questions about their potential influence on car ownership, mode choice and broader impacts on the transportation system and the environment.

As ridesourcing services have been introduced over the past decade, initially in the US and then worldwide, their impact on long-term vehicle ownership decisions has begun to emerge. Major global TNCs like Uber and Lyft have expressed their objective to decrease vehicle ownership (Hawkins, 2018; Shontell, 2015). However, whether and to what extent they have reached this goal is uncertain, and the studies on this subject have yet to reach a clear consensus.

The distinct business model of ridesourcing makes both drivers and passengers the customers of ridesourcing platforms, and development on both sides can affect vehicle ownership. On one hand, ridesourcing provides prospective drivers with an opportunity to earn extra income, especially in places where ridesourcing operations are less regulated and vehicle ownership is lower, and as such may cause an increase in vehicle numbers which is referred to as the "value enhancement" effect (Gong et al., 2017; Paundra et al., 2020). On the other hand, being the closest substitute for private cars, ridesourcing may reduce the need for private vehicles and cause a reduction in vehicle purchases, which is referred to as the "substitution" effect.

This paper presents a systematic review of relevant studies that seek *to understand the effects of ridesourcing services on vehicle ownership*. The review aims to answer the following questions:

1) How are the studies on the relationship between vehicle ownership and ridesourcing conducted (methodology, modelling techniques, etc.)?
2) Is there a consensus about the impacts in a particular direction, notably among studies from different countries and world regions?
3) Does the effect of ridesourcing on vehicle ownership vary across different regions or different urbanisation levels within the same country? If yes, what factors may account for this heterogeneity?

The remainder of the paper is structured as follows. Section 2 presents the systematic review methodology. Section 3 presents a description of the selected studies. Section 4 brings together the findings from the selected studies and answers the research questions. Section 5 presents concluding remarks with recommendations for potential directions for future studies.

2. Systematic review method

The literature search has focused on the effect of ridesourcing on vehicle ownership, which combines two key themes: "vehicle ownership" and "ridesourcing". The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-analysis) guideline (Stewart et al., 2015) was followed to select the articles included in this study, as described below. In the identification phase, three electronic databases (Scopus, Web of Science and TRID – Transport Research International Documentation) were searched in August 2023 using the search strings reported in Table 1. We also used search alerts to keep the list of selected studies updated until the submission date.

The procedure followed in this systematic review is summarised in Figure 1. The literature search was limited to articles published after 2010. The number of articles gathered from each database using the combinations of search strings was 1962 (Scopus), 150 (Web of Science) and 176 (TRID). In the selection process, book chapters, conference proceedings, editorials, book reviews and non-English publications were excluded at this stage of the review. Also, we only included transportation-related peer-reviewed journal articles, which is a common practice when conducting a systematic literature review to ensure a higher standard of reliability. After removing duplicates, 222 publications were eliminated, and 1399 publications were extracted for the abstract and title screening process. The eligibility criterion was determined as the article should report findings on the potential effects of ridesourcing services on vehicle ownership.

Table 1. Database searching terms for vehicle ownership and ridesourcing.

Key themes	Search Strings
Vehicle ownership	((vehicle *OR* car) *AND* (ownership *OR* purchase *OR* registration *OR* intention))
	AND
Ridesourcing	("ride(-)hailing" *OR* "ride(-)sourcing" *OR* "transport network compan*" *OR* "TNC" *OR* "on(-)demand mobility" *OR* "app-based taxi" *OR* "app-based mobility")

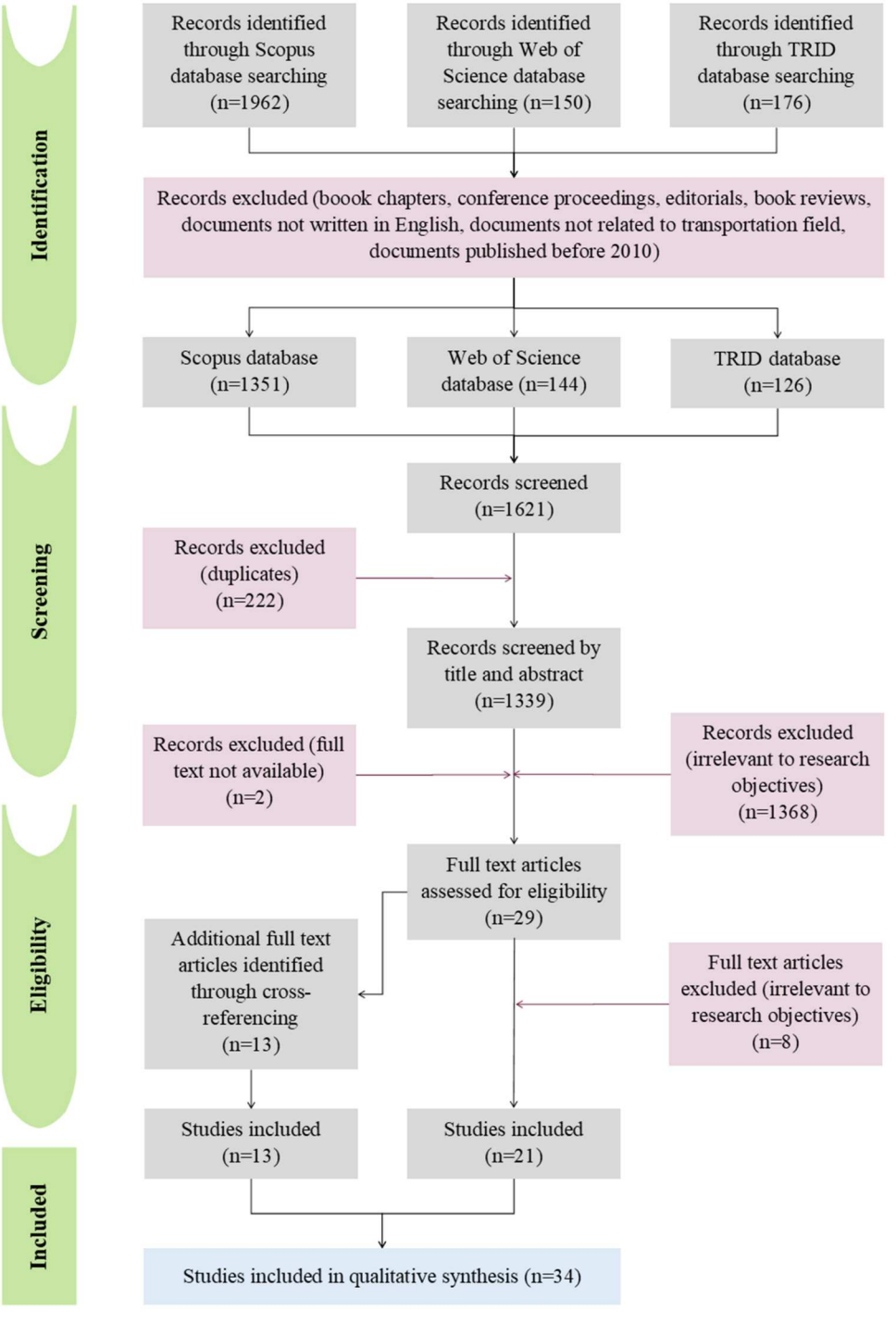

Figure 1. Systematic literature review procedure.

After evaluating the abstracts based on these inclusion criteria, 1368 articles were excluded because of ineligibility. Also, 2 articles were excluded in this step due to the full-text unavailability. In the eligibility phase, the remaining 29 articles were evaluated in detail, considering the research objectives and 8 articles were eliminated because of their irrelevance to the research objectives. 10 additional articles were determined through cross-referencing. Additionally, three research reports which are influential and frequently cited in the related literature are included in the analysis at this stage. In the final phase, overall, 34 documents were included for qualitative synthesis.

3. Descriptive analysis

In light of the eligibility criteria explained in the previous section, 34 studies were selected from the existing literature for further analysis. This section discusses the findings from the identified documents. In this section, first, we provide descriptive statistics for the selected studies, followed by a discussion on methodological approaches, including limitations of selected methodologies. An overview of selected studies can be found in Table A1 in the Appendix.

Table 2 presents the contextual classifications of the selected documents. Relevant studies to date have mainly focused on the US (17 studies) and China (9 studies)[1], with a limited but recently increasing interest in other countries (9 studies). As shown in Figure 2, apart from the US and China, more evidence comes from South and Southeast Asia, with only one relevant study from Africa and two from Europe.

In terms of the service types, the vast majority of the selected studies (33 studies) focus on car-based ridesourcing services, which is the most commonly adopted form of ridesourcing. Motorcycles are the dominant form of motorised vehicles in South and Southeast Asia and Africa, and motorcycle-based ridesourcing is the dominant form of ridesourcing in these regions. As we aim to review the studies that investigate the

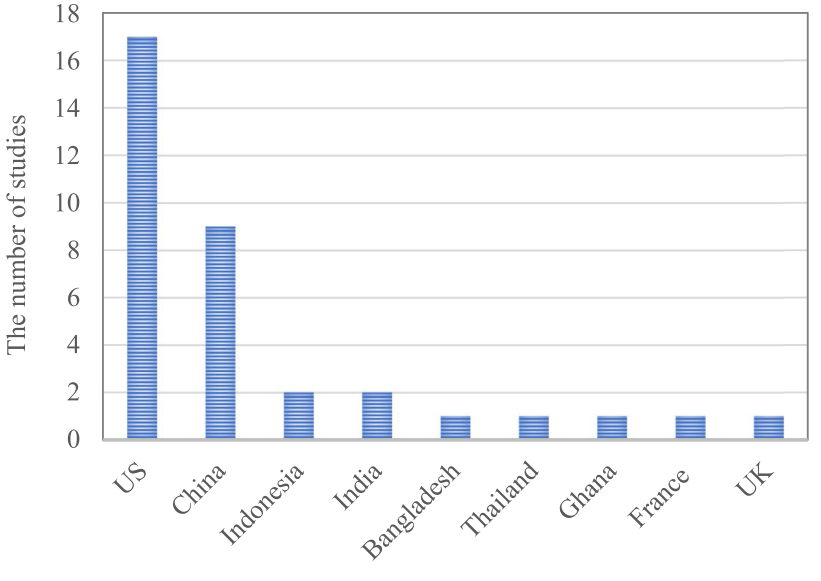

Figure 2. Number of studies by country.

Table 2. Contextual classification of selected studies in the related literature.

	Geography			Service type		Outcome of interest			
Reference	The US	China	Other	Car based	Motorcycle based	Car purchase intention	New vehicle registration	Registered vehicle numbers	Household vehicle ownership
(Acheampong et al., 2023)			X	X		X			
(Bansal et al., 2020)	X			X		X			
(Batur et al., 2023)	X			X					X
(Bekka et al., 2020)			X	X					X
(Bilgin et al., 2023a)			X	X				X	
(Blumenberg et al., 2021)	X			X					X
(Clewlow & Mishra, 2017)	X			X					X
(Das, 2020)	X			X					X
(Diao et al., 2021)	X			X				X	
(Feigon & Murphy, 2018)	X			X					X
(Gong et al., 2017)		X		X			X		
(Guo et al., 2018)		X		X			X		
(Guo et al., 2019)		X		X			X		
(Guo et al., 2020)	X	X		X			X		
(Hampshire et al., 2017)	X			X					X
(Huang et al., 2022)		X		X		X			
(Krishna, 2024)			X	X				X	
(Paundra et al., 2020)			X	X	X		X		
(Rayle et al., 2016)	X			X					X
(Sabouri et al., 2020a)	X			X					X
(Schaller, 2018)	X			X					X
(Stinson et al., 2021)	X			X					X
(Tang et al., 2020)		X		X		X			
(Thaithatkul et al., 2023)			X	X		X			
(Wadud, 2020)			X		X		X		
(Wadud & Namala, 2022)			X	X				X	
(Wang et al., 2021)	X			X					X
(Ward et al., 2019)	X			X				X	
(Ward et al., 2021)	X			X				X	
(Widita & Diwangkari, 2022)			X	X	X			X	
(Wu & MacKenzie, 2021)	X			X					X
(Yang et al., 2022)		X		X		X			
(Zheng et al., 2019)		X		X		X			
(Zhong et al., 2020)		X		X				X	

effects of ridesourcing on vehicle ownership, and these regions represent an important market for TNCs (Uber Technologies Inc., 2020), studies that look into motorcycle-based ridesourcing services (3 studies[2]) are also included in this study.

Regarding the outcome of interest related to vehicle ownership, studies using geographically aggregated datasets use new vehicle registrations (6 studies) or total vehicle registrations (8 studies) from official records, while individual-level studies use household vehicle ownership (13 studies) or stated intentions to change their vehicle ownership status (7 studies) as the outcome of interest.

Table 3 presents the classification of the studies based on the methodological approaches. Based on the type, level and source of data, the methodological classification of the selected studies can be further reduced to three categories. The first category is disaggregated cross-sectional stated preference studies. This category covers studies using cross-sectional data at the individual or household level collected through ad-hoc surveys (14 studies). The second category is disaggregated cross-sectional revealed preference studies. Studies in this category use national household travel surveys, specifically the 2017 NHTS, which is a cross-sectional dataset at the household level (6 studies). Finally, studies using geographically aggregated historical vehicle licensing or registration statistics can be classified as aggregated longitudinal/time series revealed preference studies (14 studies).

Studies using cross-sectional datasets (specifically ad-hoc surveys and national travel surveys) constitute more than half of the identified studies (20 studies). These studies present findings on the relationship between ridesourcing availability and/or use and vehicle ownership but cannot provide conclusive evidence on the direction of the causality, i.e. whether ridesourcing leads to lower/higher vehicle ownership or lower/higher vehicle ownership leads to more/less ridesourcing use, due to their cross-sectional nature. Revealing the causal relationship requires a longitudinal dataset with rich information on other possible intervening factors on the outcome of interest for a sufficiently long period. Few studies, specifically aggregated longitudinal/time series revealed preference studies in the existing literature present findings on the potential causal relationship between ridesourcing availability and vehicle ownership (14 studies).

Depending on the data used and the objective of the study, studies use either descriptive analysis or econometric modelling techniques. While some studies that use disaggregated cross-sectional datasets only present descriptive statistics (9 studies), others employ econometric modelling methods to investigate the association between ridesourcing use and vehicle ownership (11 studies). Those using econometric modelling techniques often employ binary logit/probit or multinomial logit models to investigate the relationship between ridesourcing use or availability and vehicle ownership.

Studies investigating causal relationships typically employ the differences-in-differences method, using both geographically and temporally heterogeneous ridesourcing introduction and geographically aggregated longitudinal datasets (e.g. state level, city level). However, these studies are unable to account for the heterogeneity between individuals and are likely to introduce aggregation bias (de Munck, 2005). The literature review reveals that no study to date has used a longitudinal dataset at a disaggregated level (individual or household) to provide evidence of the causal relationship between ridesourcing and car ownership while taking into account the variation between individuals.[3]

Table 3. Methodological classification of selected studies in the related literature.

	Data type			Data level		Analysis method		Data source		
Reference	Cross-sectional	Time series	Longitudinal	Aggregated	Disaggregated	Descriptive analysis	Econometric analysis	Ad-hoc surveys	National travel surveys	Vehicle registration statistics
(Acheampong et al., 2023)	X				X		X	X		
(Bansal et al., 2020)	X				X		X	X		
(Batur et al., 2023)	X				X		X	X		
(Bekka et al., 2020)	X				X	X		X		
(Bilgin et al., 2023a)			X	X			X			X
(Blumenberg et al., 2021)	X				X		X		X	
(Clewlow & Mishra, 2017)	X				X	X		X		
(Das, 2020)	X				X		X		X	
(Diao et al., 2021)			X	X			X			X
(Feigon & Murphy, 2018)	X				X	X		X		
(Gong et al., 2017)			X	X			X			
(Guo et al., 2018)			X	X			X			X
(Guo et al., 2019)			X	X			X			X
(Guo et al., 2020)			X	X			X			X
(Hampshire et al., 2017)	X				X	X		X		
(Huang et al., 2022)	X				X		X	X		
(Krishna, 2024)			X	X			X			X
(Paundra et al., 2020)			X	X			X			X
(Rayle et al., 2016)	X				X	X		X		
(Sabouri et al., 2020a)	X				X		X		X	
(Schaller, 2018)	X				X	X			X	
(Stinson et al., 2021)	X				X		X	X		
(Tang et al., 2020)	X				X		X	X		
(Thaithatkul et al., 2023)	X				X	X		X		
(Wadud, 2020)		X		X			X			X
(Wadud & Namala, 2022)			X	X			X			X
(Wang et al., 2021)	X				X		X		X	
(Ward et al., 2019)			X	X			X			X
(Ward et al., 2021)			X	X			X			X

(Widita & Diwangkari, 2022)			X	X				X				X
(Wu & MacKenzie, 2021)	X				X			X			X	
(Yang et al., 2022)	X				X	X			X			
(Zheng et al., 2019)	X				X	X			X			
(Zhong et al., 2020)			X	X				X				X

Lastly, the effects of ridesourcing, especially the long-term effects, may not be observed immediately after its introduction but only after some time. Some studies using longitudinal datasets and econometric modelling techniques address the pattern of emergence of these effects, such as whether the change is immediate or delayed (Bilgin et al., 2023a; Gong et al., 2017; Guo et al., 2019, 2018, 2020; Wadud, 2020; Ward et al., 2019, 2021) using either the event study method or lagged treatment variable, but only a few of them test whether the change is one-off or gradual (Bilgin et al., 2023a; Wadud, 2020; Wadud & Namala, 2022; Widita & Diwangkari, 2022) by using a continuous treatment variable.

4. The relationship between ridesourcing and vehicle ownership

4.1. The mechanism of the relationship between ridesourcing and vehicle ownership

Ridesourcing is a two-sided business model in which both passengers and drivers are, in different ways, customers of the ridesourcing platforms. Therefore, processes on both sides are relevant for the net changes in vehicle ownership brought about by the introduction of ridesourcing. The mechanism of how ridesourcing could affect vehicle ownership is visualised in Figure 3.

The introduction of ridesourcing could alter vehicle ownership trends among individuals and households. In the relevant literature, the increased number of vehicles due to the potential economic benefits of ridesourcing is referred to as the value enhancement effect (Gong et al., 2017). The value enhancement effect is inherently related to the supply side of ridesourcing. The substitution effect refers to the effect of ridesourcing when it replaces private car trips and reduces the need for private cars. The substitution effect is associated with impacts on the demand side (Gong et al., 2017; Paundra et al., 2020). As a result of the value enhancement effect, individuals or households may purchase a new vehicle or decide not to abandon existing vehicles in order to use them for ridesourcing, whereas the substitution effect may lead car owners to abandon their existing vehicles or decide not to purchase a new one.[4]

At the aggregate level (e.g. state or city level), the value enhancement effect and the substitution effect coexist, and the net effect becomes the combination of these two. For the aggregated units of analysis, which are made up of many individuals or households, the value enhancement effect on some individuals or households and the substitution effect on others may offset each other and result in an insignificant change in the overall system, or one of these effects may dominate the other after offsetting, resulting in a decrease in the number of vehicles if the substitution effect is larger, or an increase in the number of vehicles if the value enhancement effect is larger.

Figure 3 also includes well-established factors that could influence vehicle ownership decisions. These factors explain some of the variability in these decisions. Besides, in many instances, the value enhancement and substitution effects of ridesourcing also depend on these factors. That is, in some cases reviewed here, ridesourcing has the potential to change the vehicle ownership status only when it interacts with other factors (Acheampong et al., 2023; Bekka et al., 2020; Bilgin et al., 2023a). Table A1 lists the factors

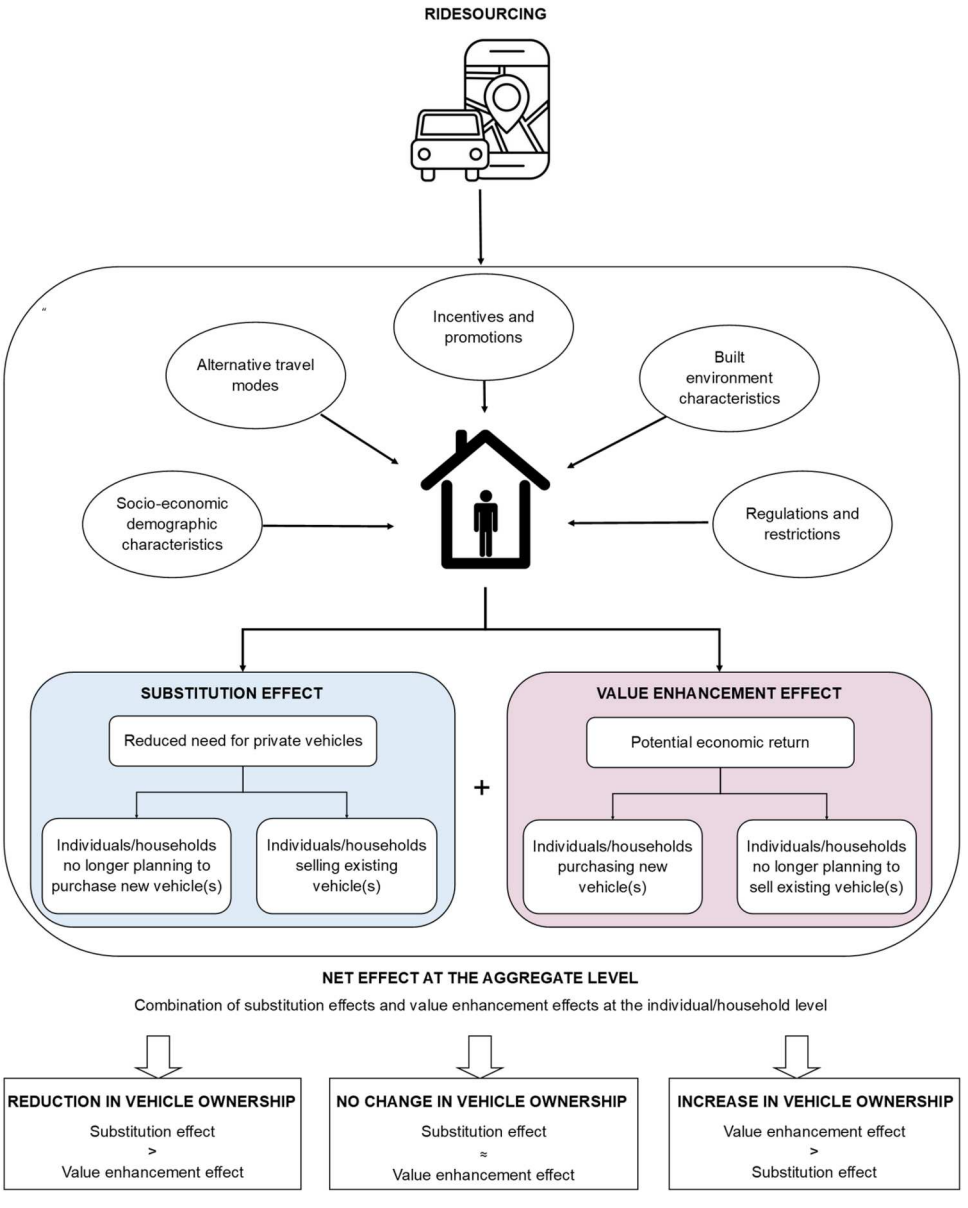

Figure 3. The mechanism of how ridesourcing could relate to vehicle ownership.

considered in each study along with the corresponding results. The role of these factors will be discussed in the subsequent sections when discussing the heterogeneity in estimated effects.

4.2. The association between ridesourcing and vehicle ownership

Studies using cross-sectional datasets, specifically national travel surveys, provide evidence of the association between ridesourcing and vehicle ownership and are covered in this section.

The 2017 NHTS data emerged as an important source for examining the relationship between ridesourcing use and vehicle ownership in the US, as it includes information on ridesourcing use frequency. Controlling for various socioeconomic and demographic characteristics and built environment characteristics, a negative association was consistently found between ridesourcing use frequency and the number of household vehicles in the US (Batur et al., 2023; Blumenberg et al., 2021; Das, 2020; Sabouri et al., 2020a; Schaller, 2018; Wang et al., 2021; Wu & MacKenzie, 2021). That is, more frequent ridesourcing users tend to have fewer vehicles in the household. In addition, there is a persistent negative association between the duration of Uber's operation in a county and the number of vehicles owned by households, suggesting that in the long run, the presence of ridesourcing could be expected to reduce vehicle ownership (Sabouri et al., 2020a).

Although these studies provide important evidence of the association between ridesourcing and vehicle ownership, the direction of the effect is uncertain (e.g. whether people use ridesourcing more because they have no or fewer cars, or whether people have no or fewer household cars because they use ridesourcing more) due to the nature of the datasets used in these studies. However, there have been attempts to gain insight into the direction of the effect using cross-sectional datasets (e.g. Batur et al., 2023; Wang et al., 2021). They consistently found an inverse relationship between ridesourcing service usage and vehicle ownership in both directions. Nevertheless, these types of studies are unable to fully demonstrate the existence of a causal relationship.

4.3. The causal effects of ridesourcing on vehicle ownership

Studies in the early stages of ridesourcing use stated preference type of surveys and ask participants whether they made a change in their vehicle ownership status because of ridesourcing, and about the substitute mode they would use for a particular trip if ridesourcing was not an option. These studies find that most people do not change their car ownership status but tend to use their cars less after they start using ridesourcing as a substitute for driving (Clewlow & Mishra, 2017; Feigon & Murphy, 2018; Rayle et al., 2016). The literature points to five potential reasons for no or small changes in vehicle ownership status. First of all, it may not be possible to observe a significant change in vehicle ownership – a long-term decision – in the short term. Second, frequent ridesourcing users have been characterised as having no or fewer household vehicles (Bekka et al., 2020; Rayle et al., 2016; Schaller, 2018; Wu & MacKenzie, 2021). Households with multiple vehicles have a greater tendency and flexibility to make a change in their household vehicle fleets in the existence of an alternative (Dargay & Hanly, 2007), while households with fewer vehicles are less likely to do so. Third, ridesourcing operations have been mostly concentrated in urban areas (Clewlow & Mishra, 2017; Schaller, 2018), where vehicle ownership is already much lower than in suburban and rural areas. Therefore, it may be less likely to observe meaningful changes in vehicle number of ridesourcing users. A fourth reason may be that a significant proportion of ridesourcing trips are undertaken occasionally, specifically for leisure and recreational purposes, rather than as a primary mode of transport (Clewlow & Mishra, 2017; Feigon & Murphy, 2018; Guo et al., 2018; Rayle et al., 2016). Therefore, the advent of ridesourcing as an alternative mode for occasional use may not result in a change in vehicle ownership status in the early stages (Guo et al., 2018). Finally, from a supply-side perspective, due to the

uncertainty of ridesourcing demand in the early stages, prospective drivers who do not own a car before may lack enough motivation to purchase a new vehicle to participate in ridesourcing platforms (Guo et al., 2018). Therefore, we might not expect to observe significant changes in vehicle ownership in the early stages, but a clear substitution effect in some trips, especially leisure trips, can be observed. Nevertheless, it should be noted that these studies provide early evidence on the effects of ridesourcing and may not fully reflect the current dynamics of this now more mature and evolved industry.

Hampshire et al. (2017) present evidence on the impact of the availability of ridesourcing services on travel behaviour, taking advantage of the "natural experiment" provided by a disruption of ridesourcing services. Their results show that after the suspension of Uber and Lyft in Austin, Texas, most (45%) of the previous ridesourcing users returned to using their cars. They also find that 9% of former ridesourcing users surveyed purchased a car after the ridesourcing services ceased in Austin. This is indicative of its substitution effect as a replacement for car trips as well as a potential reduction in vehicle ownership in the presence of ridesourcing.

Vehicle ownership is a long-term decision that takes time to develop. It is often state-dependent which suggests that the number of cars owned in the present strongly depends on the number of cars owned in the previous period, so a proper analysis of changes in vehicle ownership must also incorporate the temporal dimension (Hanly & Dargay, 2000; Simma & Axhausen, 2003). For this reason, the effect of ridesourcing on vehicle ownership has only recently begun to be explored using geographically aggregated longitudinal datasets. The introduction of ridesourcing has been consistently found to increase new vehicle registrations in emerging economies, specifically in China and Bangladesh (Gong et al., 2017; Guo et al., 2019, 2018, 2020; Wadud, 2020), where vehicle ownership levels are yet to reach saturation. In such countries, in addition to the potential for additional income, TNCs' driver pool expansion strategies (offers for new vehicle purchases) attract people to purchase a vehicle. Special agreements between TNCs and car manufacturers have become the main motivators for prospective drivers to purchase new cars. These promotions primarily target the supply side of the ridesourcing market, intending to expand the driver network and reach a broader demand base. Especially, findings show an increased interest in light vehicles with small engines, which are more fuel-efficient, after the introduction of ridesourcing in China (Gong et al., 2017; Guo et al., 2018). This is not just because these types of cars are more economical and leave drivers with higher profits, but also because car manufacturers offer special discounts and offers on these models for ridesourcing drivers (Guo et al., 2019, 2018). This is especially apparent when different ridesourcing platforms are competing to dominate the market (Guo et al., 2019). Therefore, in China, where the expressed reluctance of ridesourcing users to purchase a car (Tang et al., 2020; Yang et al., 2022; Zheng et al., 2019) does not align with official vehicle registration statistics that show a statistically significant increase in new vehicle purchases after the introduction of ridesourcing (Gong et al., 2017; Guo et al., 2019, 2018, 2020).

When a sufficient number of vehicles are available to support ridesourcing services effectively, reliance on private vehicle ownership tends to decline, reflecting a substitution effect. For instance, in Indonesia – where both motorcycle – and car-based ridesourcing services are offered – contrasting impacts have been observed on new vehicle purchases. Following the introduction of motorcycle-based ridesourcing services in

Indonesia, where motorcycles are the dominant mode of transport, new motorcycle purchases declined (Paundra et al., 2020). This decrease can be attributed to the integration of existing motorcycle taxi service providers into ridesourcing platforms, ensuring an adequate supply of service providers to meet on-demand travel needs and reducing the need to own a motorcycle (Paundra et al., 2020). Conversely, a value enhancement effect is evident with car-based ridesourcing services in Indonesia, as new car registrations increased after their introduction (Paundra et al., 2020). This rise is likely driven by efforts from TNCs to recruit more drivers in response to an initially insufficient supply of vehicles. However, despite the growth in new car purchases, the overall number of cars per capita in Indonesia has declined (Widita & Diwangkari, 2022), suggesting that the substitution effect ultimately outweighs the value enhancement effect. A different trend is observed in Dhaka, Bangladesh, where motorcycle-based ridesourcing services are widely used amid generally low vehicle ownership levels. In this context, the number of motorcycles has gradually increased over time (Wadud, 2020).

Krishna (2024) investigates the impacts of ridesourcing on private and commercial vehicle numbers separately, which helps present a clearer picture of the change in both the demand and supply sides of the ridesourcing market in India. The results suggest an increase in commercial vehicle numbers (vehicles licensed to provide on-demand mobility services, including taxis), which is consistent with the value enhancement effect. Using private car registration records, Krishna (2024) found a decrease in the number of private cars, as opposed to the number of commercial cars, after the introduction of ridesourcing in India. Wadud and Namala (2022) investigate the effect on the total number of vehicles in Indian metropolitan cities and find that the introduction of ridesourcing services slowed down the increase in car numbers. Taken together, the results of these studies may suggest that the substitution effect on private cars may dominate the value enhancement effect on commercial cars, leading to an overall deceleration in motorisation growth in India.

In developed countries, the findings are mixed. The introduction of ridesourcing in Great Britain was found to have a statistically insignificant effect on vehicle ownership (Bilgin et al., 2023a), while in the US states, an average 3% decrease in vehicle registrations per capita (Ward et al., 2019) and an average 8% decrease in new car sales (Guo et al., 2020) were found after ridesourcing was introduced in the states. This suggests that the introduction of ridesourcing potentially slows motorisation growth in US states by reducing new vehicle purchases.

Stinson et al. (2021) and Bansal et al. (2020) are among the few studies that have explored the subject from the supply side's perspective in the US context. They consistently find that when there is potential for earning extra income through commercial utilisation of existing household vehicles or newly purchased ones, people are inclined to increase their household vehicle numbers. This tendency is more apparent when there are changes in circumstances, such as changes in the workplace, income or household structure (Stinson et al., 2021) and especially among low-income single drivers (Bansal et al., 2020). These are consistent with the findings using vehicle registration statistics that found an increase in the number of vehicles after the introduction of ridesourcing in the US urban areas (Ward et al., 2021). However, the case of the US may not be linked with low initial vehicle ownership but with car dependence and the regulatory environment for ridesourcing. As a result of the deregulation of the US taxi market for

ridesourcing services, entry barriers to the taxi market were lowered considerably. Ridesourcing regulations in the US do not limit the number of vehicles as the medallion system does for traditional taxis, or do not require drivers to have a commercial licence in most states (Moran et al., 2017). As a result, low entry barriers encourage people in already car-dependent areas to purchase a car after the introduction of ridesourcing, which provides an opportunity to pay off the use and ownership costs of cars. The higher increase in vehicle numbers in urban areas with higher initial vehicle ownership also supports this inference (Ward et al., 2021). In conclusion, the introduction of ridesourcing also has the potential to facilitate vehicle purchases in car-dependent places where ridesourcing licensing and operations are highly deregulated.

While these studies provide better evidence of a causal relationship, their reliance on aggregated data introduces certain limitations and requires careful interpretation. First, the use of geographically aggregated datasets could lead to an inaccurate reflection of the relationships at the individual level, where the decision to own a car is often made. Therefore, longitudinal analysis at the disaggregate level is required to reveal the actual causality between ridesourcing and vehicle ownership. Moreover, due to data availability, reviewed studies (except for Krishna (2024)) do not separate the number of vehicles in private use, which represents the demand side, and the number of vehicles in commercial use, which represents the supply side. When an alternative is available, households' decision to acquire or dispose of a car may follow different patterns, i.e. it may require some time for people to decide to discard their cars, while the car acquisition decision is rather immediate. Therefore, the relationship between ridesourcing and car ownership decisions on the demand and supply side may be better reflected by different model specifications, such as models with leads and lags depending on the underlying theory or assumptions. This type of separation could also be more informative when analysing effects on car use, which could be a better indicator of broader effects, such as the overall effect of ridesourcing on the transportation system. Finally, findings substantially vary by location, even within the same country, leading to inconclusive results and a need for more research on this subject.

4.4. Heterogeneous relationships and potential contributing factors

The reviewed studies show a clear heterogeneity in the estimated relationship between ridesourcing and vehicle ownership, not only between countries but also within the same country. Differences between countries, such as transportation systems, culture and regulations, may account for an important variation between countries. In addition to between-country heterogeneity, the findings in different studies suggest different results for the same country. Differences in methodologies, including data used (sample, aggregation level, etc.), modelling techniques, and geographical and temporal coverage, may potentially explain an important part of this variation.

Some studies reviewed here also examine the heterogeneity within the country depending on different factors such as the level of urbanisation, development or settlement size. In China, the more developed and larger cities have experienced a greater decline in car registrations after the introduction of ridesourcing than the less developed and smaller cities (Guo et al., 2018; Zhong et al., 2020). In Indonesia, ridesourcing leads to an increase in vehicle ownership in rural areas, which the authors attribute to the

potential shift of agricultural jobs to ridesourcing, while the number of vehicles decreased in urban and metropolitan areas (Widita & Diwangkari, 2022). This result contrasts with the findings in the US, where ridesourcing has the opposite effect on vehicle ownership in rural areas (Ward et al., 2019; Ward et al., 2021). The findings suggest that the introduction of ridesourcing has caused a decrease in per capita vehicle registrations in middle urban and rural areas (Ward et al., 2019) but not in urban areas (Ward et al., 2019, 2021), resulting in an average decrease at the state level in the US (Guo et al., 2020; Ward et al., 2019). These findings suggest that the value enhancement effect of ridesourcing more than offsets the substitution effect in urban areas, while the opposite is true in rural areas in the US. Therefore, these results further highlight the heterogeneous impacts between developed and developing countries and the need to differentiate between them when examining the impacts of ridesourcing (Vanderschuren & Baufeldt, 2018).

Findings from Great Britain (Bilgin et al., 2023a), where the mobility market is relatively stable and has reached a certain level of maturity, are to some extent comparable to the findings of Ward et al. (2019) in the US. In both countries, vehicle ownership has decreased in rural areas. However, in London (by far the largest metropolitan area in the UK) vehicle numbers also decreased after the introduction of ridesourcing, unlike what happened in other urban areas and metropolitan districts in the UK where the introduction of ridesourcing has no statistically significant effect on vehicle numbers, which contrasts with what Ward et al. (2019) find in the US. Bilgin et al. (2023a) attribute this difference to advanced public transit services that can be complemented by ridesourcing, less car-oriented design of the built environment, car use and ownership costs and restrictions in London – which points to the complementary effect. Likewise, several studies emphasise the importance of frequent, reliable, and high-quality public transit services to ensure successful and environmentally sustainable integration of ridesourcing services into the transportation system (Bekka et al., 2020; Feigon & Murphy, 2018; Schaller, 2018; Thaithatkul et al., 2023). The findings from Diao et al. (2021) corroborate this view and show that ridesourcing has contributed to a slight reduction in vehicle ownership in places with well-developed public transit systems in the US. Indeed, ridesourcing has the potential to change vehicle ownership when it is integrated into a transportation system with a good public transport network (Acheampong et al., 2023; Bekka et al., 2020; Bilgin et al., 2023a; Tang et al., 2020).

In addition to the factors mentioned above, there may be other factors that contribute to the variation in the effects of ridesourcing between different areas. For example, the role of ridesourcing regulations and licensing practices is overlooked but closely related to both the demand and supply sides' views regarding vehicle ownership. Moreover, although the level of urbanisation may partially reflect the effect of ridesourcing availability, the level of ridesourcing services, which may substantially vary between different areas and be an important source of the heterogeneity in the estimated effects, remains an unexplored factor.

Finally, there is a wide literature that investigates varying levels of ridesourcing use by different levels of vehicle ownership (e.g. Correa et al., 2017; Sabouri et al., 2020b). While this review does not focus primarily on the effects of vehicle ownership or related factors on ridesourcing use, it is important to acknowledge the potential bidirectional relationship between the two. Recognising this relationship is essential, as it may have significant implications for interpreting the conceptual framework presented in Figure 3.

5. Conclusions

5.1. Key takeaways

This study presents the findings from the documents systematically selected through the PRISMA procedure, aiming to understand the effects of ridesourcing on vehicle ownership. As a result of a thorough identification, screening and selection process, 34 studies were selected for further qualitative analysis and discussed in this study.

The results of this systematic review clearly show that the identified effects of ridesourcing on vehicle ownership substantially differ across countries and even in different areas within the same country, likely because of differences in transportation systems, starting levels of vehicle ownership, public transport networks, built environment, culture, policy, regulations and restrictions. It is especially inconclusive for developed countries, where the literature presents mixed findings. In these countries, the relationship between ridesourcing and vehicle ownership is much more complex and is often dependent on other factors, rather than simply on the potential income or alternative to driving that ridesourcing offers. Comparing the findings for the US and Great Britain, results suggest that less car-dependent urban areas experience more plausible effects on vehicle ownership after the introduction of ridesourcing. In that sense, we may conclude that the potential of ridesourcing to reduce vehicle ownership can only be achieved when it is implemented as "*an extension, not a replacement, for fixed route transit*" (Schaller, 2018) in a transportation system supported by a less car-dependent built environment design. Furthermore, although ridesourcing is generally recognised as an urban phenomenon, it appears that ridesourcing has slowed the growth of car ownership in these regions, a valuable finding with important policy implications for transport planning in rural areas. In these areas, ridesourcing can be effectively used to connect rural populations to public transport hubs and to fill temporal and spatial gaps in the transport system. While it may not be able to make people in these areas car-free, it can at least help to reduce multiple car ownership.

For emerging economies, on the other hand, ridesourcing clearly encourages new vehicle purchases with the boosting effect of incentives and promotions offered by TNCs to attract prospective drivers and expand their fleets. This is particularly evident in these countries when several TNCs operate, resulting in intense competition between platforms (Guo et al., 2019; Paundra et al., 2020). The vehicle ownership increases in emerging economies such as China, Indonesia, and Bangladesh can be explained by the low starting levels of income and vehicle ownership. In these countries, where vehicle ownership has not yet reached saturation levels and where, in some cases, vehicle numbers are inadequate to provide a ridesourcing service, TNCs offer additional ways to purchase a vehicle through promotions and discounts and to earn additional income as a ridesourcing driver. In that way, TNCs aim to reach a broader user base and increase the convenience of ridesourcing services for passengers through increased availability. However, it is uncertain how long TNCs' expansion will continue and whether it will begin to reduce reliance on private cars in emerging economies where ownership is often a status symbol. Therefore, in the long term, more research is required to observe the effects on vehicle ownership in these countries.

Although the literature has not presented empirical findings on the role of ridesourcing regulations on the change in vehicle ownership, they are shown to have an important role when implementing ridesourcing into the incumbent taxi market and managing the

excess increase in the number of ridesourcing vehicles (Bilgin et al., 2023b). However, heterogeneity in the impacts of ridesourcing on vehicle ownership this review highlights brings about heterogeneity in the policy implications and regulatory frameworks. The results of the studies reviewed here show a clear heterogeneity between countries. Therefore, there is no single framework that can be universally applied, as each country, and even different regions within the same country, vary in terms of their transportation systems, built environment, and cultural contexts. Therefore, there is a need for tailored, location-specific policies, as not only the impacts of ridesourcing but also the expansion strategies of TNCs vary by context, requiring nuanced approaches to effective urban and transport planning, as well as ridesourcing regulation.

The findings of this study also offer practical implications for various issues relevant to policymakers and transport authorities. There is a growing focus on shaping future transportation around automation, electrification, and shared mobility to address the challenges of current systems. Among these, automation has gained significant interest. Shared autonomous vehicles are expected to be a primary deployment mode, closely resembling today's ridesourcing services but without drivers. Despite high initial costs, driverless ridesourcing could halve per-mile costs (Heineke et al., 2022) by reducing labour expenses and extending service hours, and may affect vehicle ownership decisions, especially in urban areas (Litman, 2020). Therefore, the insights derived from this literature review may be used to support the planning and design of systems for future mobility.

5.2. Recommendations for future research

Despite the growing number of relevant studies, there are still important gaps in knowledge, which are listed and elaborated below for future research directions.

The existing literature overwhelmingly focuses on the US (17 studies) and China (9 studies). However, the results of this review clearly revealed the heterogeneity across countries. Therefore, more evidence from other countries is needed, as we cannot assume that the results of these studies can be transferred or generalised to other countries. Moreover, ridesourcing operations are more intense in urban areas, which potentially results in different patterns of adoption and operation, and hence different impacts in rural areas. Although some studies address the potential heterogeneity across different areas, this aspect is largely overlooked in the literature. Examining potential heterogeneity would be especially useful for transport authorities and policymakers when managing and regulating ridesourcing operations to avoid negative impacts and ensure efficient services, as well as for TNCs when making strategic decisions about their operations in different countries and different areas.

Because of the data types and analysis methods used in the literature, there is more evidence of the potential association rather than the causal relationship between ridesourcing services and vehicle ownership. While a few studies examined the potential causal relationship between ridesourcing availability and vehicle ownership using longitudinal datasets, these studies use geographically aggregated datasets. In these studies, the use of geographically aggregated datasets may introduce aggregation bias that masks important variations between individuals (de Munck, 2005). This limitation could lead to an inaccurate reflection of the relationships at the individual level, where the decision to own a car is often made. While studies using aggregated datasets provide

valuable insights into broader trends, it does not allow for causal inferences about how ridesourcing influences individual car ownership decisions. Following this, these studies use ridesourcing availability in the analysis unit (city, state, local authority district, etc.) to represent the effect of ridesourcing. However, the service level of ridesourcing may not be homogeneous within and across these large areas. Also, the adoption rate and frequency of ridesourcing use, which are shown to correlate with the number of household cars (Sabouri et al., 2020b), may vary between individuals in these areas. Therefore, studies using geographically aggregated longitudinal datasets may not fully represent the causal relationship. Hence, more studies should be conducted using longitudinal datasets, specifically at the individual/household level.[5]

The net impact on vehicle ownership is the combination of delaying or completely giving up car purchases or disposals, shedding existing cars without replacement, and purchasing a car to become a ridesourcing driver (Feigon & Murphy, 2018). Existing research also suggests that when alternative transportation options are available, households tend to change the number of vehicles they own rather than completely forgoing vehicle ownership (Smart & Klein, 2020). Therefore, another research direction that is worth investigating may be the effect of ridesourcing services on household car ownership dynamics. Specifically, an interesting research question for future research is whether ridesourcing services motivate individuals to buy a car, stop them from buying an additional car that they might have bought, get rid of one or all of their cars, or create opportunities to keep their existing cars.

Although this review aims to investigate the relationship between ridesourcing and vehicle ownership, which is a long-term decision that is closely related to the commitment to car use in future trips, due to the access-based two-sided business model of ridesourcing, the change in car ownership may not reflect the actual change in car use. In that case, the difference in VMT may be a better indicator for investigating the change in car use after the introduction of ridesourcing, but the reluctance of TNCs to share trip data still remains a major challenge.

Lastly, TNCs offer on-demand ride services similar to traditional taxis, which are most directly impacted by the advent of these services. Ridesourcing lowers entry barriers in the on-demand mobility market, affecting demand for established service providers and leading to changes in the existing structure. In some contexts, ridesourcing may introduce a new group of service providers through job creation, potentially leading to an excess influx into the taxi market, thereby increasing the number of vehicles on the road and their associated impacts, if not managed properly. In other contexts, ridesourcing might lead to a transition of jobs from existing taxi service providers, altering booking methods without significantly changing the size or the composition of taxi and ridesourcing fleets. Therefore, concerning vehicle ownership, the evolving dynamics within taxi service providers should be recognised as a crucial aspect of the supply-side effects of ridesourcing. Future research should explore whether ridesourcing fundamentally alters the taxi market dynamics or simply causes shifts within existing fleets.

Notes

1. One of the studies (Guo et al., 2020) includes both the case of the US and China.
2. Paundra et al. (2020) and Widita and Diwangkari (2022) have examined both types.

3. There is only one study we are aware of that examines the causal effects of ridesourcing on household vehicle ownership, utilising data from over forty thousand households collected over 11 years (Bilgin et al., 2025). However, this study has not yet been published.
4. No study has examined how ridesourcing relates to such ownership decision patterns.
5. Although we are aware of one work in progress on this topic that focuses on the case of the United Kingdom (Bilgin et al., 2025), more evidence from different countries is needed.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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Appendix

Table A1. Summary of selected studies in the related literature.

Reference	Temporal coverage	Geographical coverage	Analysis unit	Data source	Dependent variable(s) of interest	Explanatory variables	Modelling approach	Major findings
Rayle et al., 2016	2014	San Francisco, The US	Individual	Intercept survey	Vehicle ownership	Ridesourcing use	Descriptive analysis	While 40% of survey participants reduced driving frequency after starting using ridesourcing, 90% of participants stated no change in their vehicle ownership status.
Clewlow & Mishra, 2017	2014–2016	7 major USA cities	Individual	Online survey	Personal and household vehicle ownership	Ridesourcing use frequency, public transit use	Descriptive analysis	Vehicle ownership status did not change among the majority of the ridesourcing users (91%). However, frequent ridesourcing users were more likely to reduce the number of household vehicles.
Gong et al., 2017	2010–2015	China	Prefecture-level city	Transportation Authority of a major city in China	Number of new car registration	Ridesourcing availability, population, number of employed workers, number of registered unemployed citizens, average wage of employed workers, GRP per capita, number of mobile subscribers, number of Internet subscribers, highway passenger traffic, number of buses, bus passenger volume, number of taxis, road area per capita, metro length, gasoline price	Difference-in-differences	The introduction of ridesourcing services caused an 11% increase in the number of new car registrations. This effect grew over time and reached about a 20-28% increase.

Hampshire et al., 2017	2016	Austin, Texas, The US	Individual	Online survey	Vehicle ownership	Ridesourcing availability	Descriptive analysis	After the ridesourcing service disruption, about 9% of pre-service users purchased an automobile.
Feigon & Murphy, 2018	2016	5 metropolitan areas in the US	Individual	Online survey	Household vehicle ownership	Ridesourcing use	Descriptive analysis	5%−21% of survey participants reduced the number of household cars after they started using ridesourcing.
Guo et al., 2018	2015	China	Prefecture-level city	New car registration and licensing records from Chinese Vehicle Management Offices	Number of new car registration	Ridesourcing availability, per capita income, GDP growth rate, population, number of mobile phone subscriptions, number of buses, paved road density, Baidu index	Propensity score matching Difference-in-differences with	Ridesourcing service entry into the cities caused a 6.5%−21.4% increase in new car registrations per month. This effect was not observed immediately but starting from one month after the entry date.
Schaller, 2018	2012–2016	The US	Central cities	American Community Survey	Household vehicles	Ridesourcing introduction	Descriptive analysis	After ridesourcing services were introduced, the growth of household vehicle ownership (8% −11%) exceeded the growth of population in 17 out of 20 large cities.
Guo et al., 2019	2013–2015	China	Prefecture-level city	New car registration and licensing records from Chinese Vehicle Management Offices	Number of new car registrations	Ridesourcing availability, population, unemployment rate, average wage, number of mobile phone subscriptions, number of internet subscriptions, highway passenger traffic, number of buses, number of taxis, annual volume of passengers transported by buses, length of the metro network, paved road area, Baidu index	Propensity score matching Difference-in-differences	When one ridesourcing company entered the market, the number of new car registrations dropped. However, the entrance of the second ridesourcing company into the same city caused platform competition and led to an increase in new car sales.

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Table A1. Continued.

Reference	Temporal coverage	Geographical coverage	Analysis unit	Data source	Dependent variable(s) of interest	Explanatory variables	Modelling approach	Major findings
Ward et al., 2019	2005–2015	The US	State	U.S. DOT's State Statistical Abstracts and Highway Statistics Series	Vehicle registration per capita	Ridesourcing availability, real personal income, Section 177 status, potential vehicle hurricane damage, potential vehicle storm damage, number of participants in vehicle scrappage program, average gasoline price, % urban population, the population of the centre city in the largest MSA, population density of the centre city in the largest MSA, GDP of the largest MSA	Propensity score matching Difference-in-differences with	After the introduction of ridesourcing, per-capita vehicle registration declined by 3.1% on average at the state level. However, the effect varies by the urbanisation level of the states.
Zheng et al., 2019	2017	Hangzhou, China	Individual	Online survey DiDi Chuxing ride-splitting order data	Willingness to buy a new car (of ride-splitting service users)	Ride-splitting service availability, number of household cars	Descriptive analysis	Ridesplitting service users tended to postpone new car purchase plans. Willingness to purchase a new car decreases with decreasing number of household vehicles.
Bansal et al., 2020	2017	The US	Individual	Survey	Preference of TNC drivers to buy a new vehicle	Driving frequency, gender, age, education, annual income, residing in the metropolitan area, number of vehicles owned, being an early adopter	Binary logit	TNCs' promotions that assist potential drivers in purchasing cars for their services tend to encourage low-income, single drivers to buy a new vehicle.

Bekka et al., 2020	2017	Paris, France	Individual	Online survey	Household vehicle ownership reduction	Ridesourcing availability, parking conditions, traffic conditions, life events, ownership cost, car breakdown, public transit services, active modes usability	Descriptive analysis	Only 4% of survey participants mention that they dispose of a car/cars because of the availability of ridesourcing. The availability of ridesourcing services was a facilitator along with the other factors rather than the main decisive factor.
Das, 2020	2016–2017	10 core-based statistical areas in the US	Individual	2017 NHTS	Household vehicle ownership	Ridesourcing use frequency, urban-rural classification, annual household income, educational attainment, race, gender, household size, generation, number of employed people in the household, household structure	Propensity score matching Quasi-Poisson regression	This study found evidence of a positive relationship between ridesourcing use and multimodality. However, the impact of ridesourcing on vehicle ownership remained inconclusive in this study.
Guo et al., 2020	2008–2016 (China) 2006–2014 (The US)	China The US	Province (China) State (The US)	New car registration and licensing records from the Chinese Vehicle Management Office (China) The annual number of new car registration and licensing records from the US Department of Transportation (The US)	Growth rate of new car registration	Ridesourcing availability, GDP per capita, income, unemployment rate, population, number of buses	Propensity score matching Difference-in-differences	In China, the entrance of ridesourcing services caused a 62-92% increase in new car registrations. Conversely, in the US ridesourcing caused around a 3-8% decrease.

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Table A1. Continued.

Reference	Temporal coverage	Geographical coverage	Analysis unit	Data source	Dependent variable(s) of interest	Explanatory variables	Modelling approach	Major findings
Paundra et al., 2020	2013–2017	Indonesia	Province	Indonesian Traffic Police	Monthly number of new vehicle registrations	Ridesourcing availability, user online behaviour, unemployment rate, GDP per capita, population, fuel price change	Difference-in-differences	Motorcycle-based ridesourcing led to a decrease in the number of new motorcycle registrations due to the readily available motorcycles in service. However, car-based ridesourcing caused an increase in car registration numbers because of the insufficient number of cars to provide service in the market.
Sabouri et al., 2020b	2016–2017	The US	Household	2017 NHTS	Number of household vehicles	Ridesourcing use frequency, number of years Uber has operated in the county, ridesourcig or taxi use frequency, number of employed people in the household, household income, number of drivers in the household, homeownership, race, gas price, activity density, job-population balance, transit stop density, intersection density, % of 4-way intersections, population density, housing density	Multi-level Poisson regression Random forests	After controlling for socioeconomic and built environment variables, there is a negative association between vehicle ownership and ridesourcing use and the number of years ridesourcing services have operated in a county. This suggested that ridesourcing services have the potential to reduce vehicle ownership over time.

Tang et al., 2020	2016	10 major urban areas, China	Individual	Ridesourcing app-based survey	Willingness to buy a new car/replace the old car (of ridesourcing users)	Ridesourcing/splitting use, household structure, alternative travel mode, travel time, distance to public transit, length of the metro route, number of taxis, the Internet penetration rate in transportation	Binary logit	The permanent availability of ridesourcing services reduces the willingness of about 7% of survey participants to buy a car. Also, improvements in public transit services encourage ridesourcing users to give up new car purchase decisions.
Wadud, 2020	1995–2018	Dhaka, Bangladesh	City	New vehicle registrations by Bangladesh Road Transport Authority (BRTA)	Number of new motorcycle registrations	Motorcycle ridesourcing availability, real income per capita, policy change	Segmented multiple regression	Motorcycle ridesourcing services caused about a 7.5% increase in motorcycle ownership in Dhaka.
Zhong et al., 2020	2010–2016	China	Prefecture-level city	China City Statistical Yearbook	Private car ownership	Ridesourcing availability, population density, GDP per capita, average wage of employed people, number of employed people, number of unemployed people, GDP growth rate, number of college students, distance to metro, number of public transit vehicles per 10000 people, number of taxis, urban road area, number of mobile phone subscribers	Propensity score matching Difference-in – differences	With the introduction of ridesourcing services, private car ownership decreased by about 9% in urban areas. This trend first strengthened over the years, then started weakening. Ridesourcing services' impacts on vehicle ownership were heterogeneous across the country with greater change in (more developed) eastern cities when compared to (less developed) western cities.

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Reference	Temporal coverage	Geographical coverage	Analysis unit	Data source	Dependent variable(s) of interest	Explanatory variables	Modelling approach	Major findings
Blumenberg et al., 2021	2016–2017	The US	Household	2017 NHTS	Being zero-vehicle household The ratio of vehicles to household adults	Ridesourcing use, race, ethnicity, nativity, age, education, presence of a child, homeownership, number of workers, income, financial and physical constraints, residential density, Metropolitan statistical area size, NYC as a residential location	Logistic regression Multinominal logistic regression	Ridesourcing use was found to have an association with a decreased number of household vehicles per adult in the household. Also, ridesourcing users are more likely to be zero-vehicle households.
Diao et al., 2021	2005–2016	The US	Metropolitan Statistical Areas (MSAs)	American Community Survey (ACS)	Vehicle ownership	Ridesourcing availability, population, GDP, median household income, unemployment rate	Difference-in-differences	The average effect of ridesourcing services on vehicle ownership was insignificant. However, in the top 10 MSAs with good public transit services, vehicle ownership decreased by an increasing amount over the years. This suggested that ridesourcing may substitute for private cars by complementing public transit services.
Stinson et al., 2021	-	The US	Individual	Stated preference survey	Change in vehicle ownership	Household car deficiency, household income, presence of children, education level, being a student, change in household income	Multinomial logit	Potential for income earning encourages prospective drivers to buy new vehicles or keep their existing vehicles, hence stimulates household vehicle ownership.

Wang et al., 2021	2016–2017	The US	Household	2017 NHTS	Number of household vehicles	Ridesourcing use frequency, age, number of drivers, household size, gender, employment status, house ownership, race, educational attainment, income, internet access, access to rail transit, roadway density, GDP per capita, vehicle miles per capita, passenger miles per capita, daily VMT per capita, daily traffic, rental housing %, population density, housing density, worker density	Bivariate ordered probit	Beyond a certain frequency of ridesourcing usage (four times or more in 30 days) ridesourcing usage has a negative association with household vehicle numbers.
Ward et al., 2021	2011–2017	The US	Urban area (of the city)	Polk/IHS Markit	Vehicle registration per capita	Ridesourcing availability, population, unemployment rate, income, the proportion of households with no children,% of the population commuting by transit, state average gas prices	Propensity score matching Difference-in-differences	Ridesourcing service introduction in urban areas increased vehicle registration per capita by 0.7%. The more car-dependent the city, the greater the increase in vehicle ownership.
Wu & MacKenzie, 2021	2016–2017	The US	Individual	2017 NHTS	Number of household vehicles	Ridesourcing use frequency, age, race, gender, education, work status, homeownership, household size, family income, population density, urban-rural classification, core-based statistical area (%)	Propensity score matching Difference-in-differences	Frequent ridesourcing users tend to own fewer household vehicles when compared with occasional users and non-users. People who have access to household vehicles tend to downsize their fleet as they use ridesourcing services more frequently.

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Reference	Temporal coverage	Geographical coverage	Analysis unit	Data source	Dependent variable(s) of interest	Explanatory variables	Modelling approach	Major findings
Huang et al., 2022	2019	Chengdu, Sichuan Province, China	Individual	Survey	Car purchase intention	Perceived service quality of ridesourcing, perceived service quality of public transportation, perceived risk of private cars, attitudes, subjective norms, perceived behavioural control, age, gender, income, education, marriage and childbirth	Path analysis and factor analysis	Ridesourcing may only reduce car purchase intention when it complements good public transit services.
Wadud & Namala, 2022	2001–2017	18 large cities in India	City	Vehicle registration	Vehicles per 1000 people	Introduction of ridesourcing, real state GDP per capita, real state GDP per capita squared, vehicle price indices, fuel price	Difference-in-differences	The introduction of ridesourcing services has slowed down vehicle ownership by 7.7%.
Widita & Diwangkari, 2022	2013–2017	West Java, Indonesia	City and district	Annual vehicle registrations West Java Statistical Yearbook in Jabar Open Data website	Per capita vehicle ownership	Ridesourcing availability, % population poverty level, GDP, number of enrolled elementary school students, annual household expenses per capita, number of disasters, population density, number of buses, indicator for nationwide fuel reform policy in 2015	Difference-in-differences	Ridesourcing services have led to an average reduction in per capita car ownership of around 3.6% and per capita motorcycle ownership of around 1.2%, suggesting the potential to slow the growth of vehicle ownership in Indonesia.
Yang et al., 2022	2018	Chengdu, China	Individual	Intercept survey	Willingness to buy a car	Ridesourcing use frequency	Descriptive analysis	Ridesourcing services didn't change the willingness of the vast majority of the survey participants (78%) to buy a new car. 17.5% gave up buying a car which suggests a potential to decrease car ownership in the future.

Acheampong et al., 2023	2021	Accra and Kumasi, Ghana	Individual	Survey	Car purchase intention	Ridesourcing use, gender, age, employment, income, driver licensure, car ownership, ridesourcing use in last 7 days, ridesourcing use frequency, ridesourcing trip vehicle occupancy, ridesourcing trip purpose, substituted mode, attitudes	Structural equation modelling	Young adults perceive ridesourcing and private cars as similar. In the short term, ridesourcing may fulfil the mobility needs of people without a private car, but in the long term, it encourages car ownership. Lack of sufficient public transportation leads to an increase in car-based transport mode use and car ownership aspiration among young adults in Ghana.
Batur et al., 2023	2019	4 Metropolitan Areas in the US	Individual	Survey	Number of household vehicles per adults	Ridesourcing use frequency, gender, age, education, race, employment, household income, household size, housing unit type, number of children, population density, city, attitudes	Latent segmentation modelling Bivariate ordered probit	Vehicle ownership and ridesourcing use frequency are negatively associated with each other in both directions.
Bilgin et al., 2023a	2001–2019	Great Britain	Local authority district	Vehicle registration statistics by the Department for Transport	Number of vehicles per 1000 people	Ridesourcing availability, residential location, real GDHI per capita, vehicle price index, real fuel price, population density, number of buses per 1000 people, rail transport availability, availability of low emission zone	Difference-in-differences	On average, ridesourcing has no statistically significant impact on vehicle ownership in Great Britain. However, the impacts of ridesourcing on vehicle ownership are heterogeneous across Great Britain with a decrease in vehicle numbers per 1000 people in London and rural areas. No statistically significant change was found in other metropolitan and urban areas.

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Reference	Temporal coverage	Geographical coverage	Analysis unit	Data source	Dependent variable(s) of interest	Explanatory variables	Modelling approach	Major findings
Thaithatkul et al., 2023	2020	Bangkok, Thailand	Individual	Survey	Intention to purchase a new car	Ridesourcing use, gender, age, education, income, number of members in the household, residential type, distance from home to the urban rail station, having motorcycle driving license, owning a motorcycle, the primary mode of travel, frequency of using application for travel planning	Descriptive statistics and binary logistic regression	Ridesourcing use is positively related to the intention to purchase a car. This relationship is stronger among younger and higher-income people.
Krishna, 2024	1991–2020	Five metropolitan cities in India	Regional Transport Office	The Ministry of Road Transport and Highways	Private vehicle ownership Commercial vehicle ownership	Years of ridesourcing in service, per capita gross state domestic product, population density, bus and auto per 1000 people, metro and mass rapid transit services, linear trend of metro availability, policy	Difference-in-differences	The emergence of ridesourcing has had a gradual and negative impact on private car ownership, while the impact on commercial car ownership (taxis) has gradually increased in line with the value enhancement effect.