

Abstract

The study investigates **charging anxiety's** impact on **electric vehicle (EV)** adoption, recognizing it as a significant **psychological barrier**. It surveys **847 EV owners** in **Guangzhou** and **Taiyuan**, covering demographics, ownership details, charging preferences, and anxiety levels. Employing **SPSS** for rigorous analysis, the research uncovers intricate relationships between variables.

Findings reveal prevalent charging anxiety is common among EV owners. Notably, **familiarity with EVs** and **extended driving experience** correlate with heightened anxiety, while **owning multiple vehicles** and **private charging stations** alleviate it. **Longer daily driving distance** associate with **lower anxiety levels**, **defying the belief** that charging behavior, particularly state-of-charge management, substantially affects anxiety.

The study's practical implications stress the importance of addressing charging anxiety for EV market growth. **Policymakers, stakeholders, and manufacturers** can leverage insights to enhance charging infrastructure, promote private solutions, and optimize routines. Public awareness campaigns and incentives addressing EV range and charging convenience concerns are crucial.

In conclusion, the study **enriches EV adoption discourse** by examining **charging anxiety's impact on drivers**. By identifying influencers and proposing mitigation strategies, it contributes to a more focused approach towards sustainable electric mobility.

Research Questions

- To review the relevant **literature** and develop a **theoretical framework** for charging anxiety among electric vehicle owners.
- To identify potential underlying **factors** that contribute to charging anxiety.
- To distribute a **questionnaire** to find out the charging anxiety of electric vehicle owners.
- To **analyze** the data and makes possible recommendations to alleviate charging anxiety.

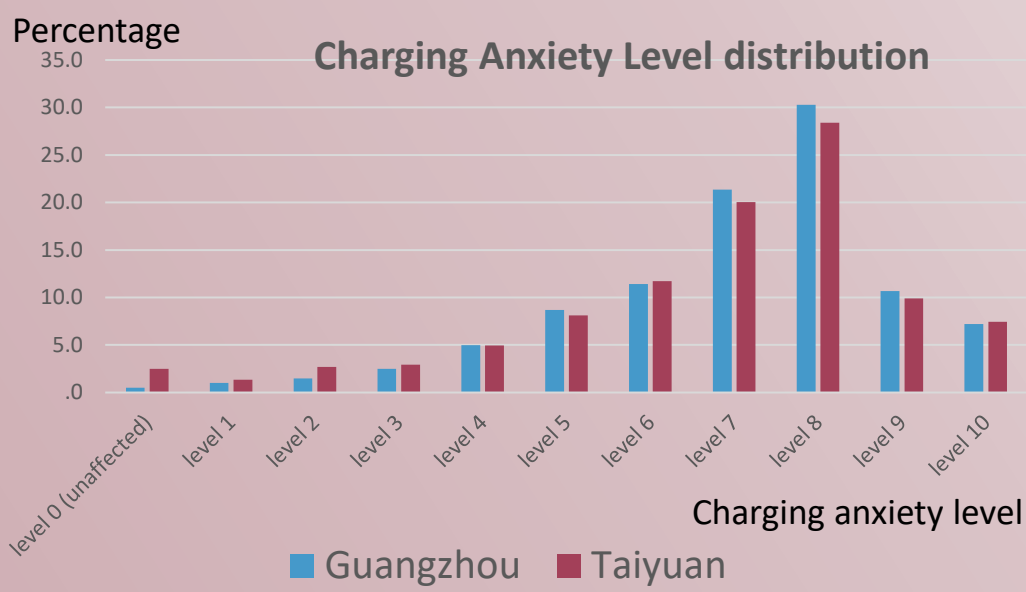
- A Survey-based assessment of - Charging Anxiety among electric vehicle owners

Methodology

The study designs a questionnaire to explore charging anxiety, encompassing two dimensions. The **first part** gathers **demographic data**, while the **second** investigates **EV-related preferences and behaviors**, including vehicle ownership, familiarity with EVs, battery attributes, private charging stations, charging preferences, and driving distances. The **research sample** consists of **electric vehicle owners** from the cities of **Taiyuan** and **Guangzhou**. This selection is strategically made considering China's extensive geographical expanse, aiming to enhance the research's findings' generalizability. This study gather data through the distribution of an **online questionnaire** and subsequently analyzed the collected data using **SPSS**.

Results

The charging anxiety levels among electric vehicle owners in **Taiyuan and Guangzhou** exhibit a **remarkable similarity**, implying a consistent trend across these two cities. In both Taiyuan and Guangzhou, a substantial portion of respondents reported experiencing some form of charging anxiety. Notably, a considerable number of respondents fell **within the mid-range of the impact scale** (ranging from level 4 to level 8). This observation suggests that a notable portion of EV owners in **both cities encounter a moderate to moderately high level of charging anxiety**.



		Residence	Annual household income	Year of driving experience	Number of vehicles owned	Knowledge level of electric vehicles	Driving experience with electric vehicles	Whether to install private charging stations	Daily driving distance	SoC for charging electric vehicles	Charging Anxiety
Residence	Pearson Correlation	1									
Annual household income	Pearson Correlation	-0.13	1								
Year of driving experience	Pearson Correlation	-0.41	-0.080*	1							
Number of vehicles owned	Pearson Correlation	-0.37	.148**	-.122**	1						
Knowledge level of electric vehicles	Pearson Correlation	-0.23	.040	-.139**	-.119**	1					
Driving experience with electric vehicles	Pearson Correlation	-0.003	.044	-.045	.242**	-.042	1				
Whether to install private charging stations	Pearson Correlation	-0.32	.075*	-.216**	.342**	-.174**	.167**	1			
Daily driving distance	Pearson Correlation	-0.33	.034	-.116**	.290**	-.136**	.124**	.220**	1		
SoC for charging electric vehicles	Pearson Correlation	-0.18	.035	-.098**	.255**	-.208**	.098**	.121**	.197**	1	
Charging Anxiety	Pearson Correlation	.061	-.055	.126**	-.162**	.079*	-.033	-.136**	-.269**	-.114**	1

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

The correlation analysis reveals links between factors and charging anxiety among electric vehicle owners.

- More driving experience associates with **higher** anxiety (correlation: 0.126**).
- Higher EV knowledge also **increases** anxiety (correlation: 0.079*).
- Owning more cars shows **lower** anxiety (correlation: -0.162**).
- The private charging station ownership **reduces** anxiety (correlation: -0.136**).
- Charging anxiety is **lower** when charging at higher battery levels (correlation: -0.114**).
- Longer daily driving distance **decrease** anxiety (correlation: -0.269**).

Conclusion

By merging **range anxiety** and **smartphone charging anxiety** concepts, the study redefines EV owners' charging anxiety as unease from EV SoC drops during driving.

The correlation findings reveal prevailing charging anxiety levels among respondents, which could deter potential EV owners.

EV knowledge and **driving experience** correlate with **higher anxiety**, while **owning multiple cars** or **private charging stations** correlate with **lower anxiety**. **Longer commutes** are linked to **reduced anxiety**, and **proactive charging behavior** diminishes **anxiety levels**.

Regression analysis highlights shorter daily drives as associated with higher anxiety, whereas private charging stations alleviate anxiety. **Unlike SoC's clear impact on range anxiety, specific charging preferences show less influence on charging anxiety.**

Selectivity and charging options impact anxiety more, emphasizing the need to enhance EV drivers' charging confidence for anxiety alleviation. Other factors like **daily driving distance** and **charging infrastructure availability** also shape charging anxiety, particularly for individuals with longer commutes or limited charging choice.

Findings underscore widespread charging anxiety, with experienced EV owners feeling higher anxiety due to range concerns. In contrast, those with multiple vehicles or private charging stations experience lower anxiety levels. Longer commutes correlate with reduced anxiety, linked to daily charging planning.

Unlike previous studies, this research suggests charging behaviour's limited impact on overall anxiety. Charging infrastructure accessibility plays a pivotal role.

Implications encompass policy adjustments, refining technology, and expanding charging options for EV makers and policymakers.

Future research pathways include policy impact and regional disparities.

Limitation

While this study offers insights into EV owners' charging anxiety, limitations exist. The focus on select factors, like daily distance and private stations, within an 8.2% explained variance, neglects variables like mileage perception and charging infrastructure density.

The limited sample size, concentrated in Guangzhou and Taiyuan, might hinder generalizability. Broader and more diverse samples could enhance external validity, especially when considering the preferences of potential EV buyers.

Sampling bias may emerge from self-reported data, influenced by pro-EV bias or inaccurate recall. Social desirability bias might skew results, leading to under- or over-reporting of charging anxiety.