

# Tradeoffs between the cost and speed of electric vehicle charging in Korea

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## Abstract

This study examines the trade-offs between charging speed and cost among EV owners in South Korea, a context complicated by high population density and limited charging infrastructure expansion. Utilizing survey data from 1,600 EV owners collected in July 2023 and 2024, we employ logistic regression analysis with controls for demographic, socioeconomic, and behavioral factors to analyze preferences between slow and fast chargers at varying price points. Our findings reveal a consistent preference for home slow charging, even as price differences between slow and fast charging narrow. This suggests that consumers prioritize convenience and cost-effectiveness associated with slow charging over the speed of fast chargers. The results indicate that investing in expensive fast-charging infrastructure may not be an efficient use of resources if the cost to consumers remains high relative to slow-charging options, and the specific type of facility they are installed on may also play a role in determining preferences.

## Introduction and Motivation

Electric vehicles (EVs) present unique challenges that influence consumer decisions, particularly regarding longer and significantly variable charging times, diverse charging locations, and significant differences in charging costs (Noel et al., 2020). Thus, consumers must navigate trade-offs between charging speed and cost when selecting charging options, particularly when considering 'range anxiety' that is continued to be associated with EVs (Pevac et al., 2020). The convenient home-based chargers typically offer slower charging at lower costs, suitable for overnight charging, while fast chargers are often found in public areas and provide higher speeds at increased prices, catering to those needing quick turnaround times or lacking access to home chargers (Mahmud et al., 2023).

## Applied Method

This study employs survey data collected in 2023 and 2024, featuring different charging scenarios based on speed and cost, to examine the trade-offs between these two factors. The dependent variable in each of the nine models is a binary choice between selecting a slow or

fast charger for each given price point. Due to this, logistic regression was employed. To check the robustness of the model, we employ two steps. First, we rely on a linear probability model with robust standard errors. Second, we utilize a linear probability model with regional clustered errors because the EV subsidies are different across different regions. These checks provide greater confidence in the reliability of our logistic regression estimates.

## Results

The consistent preference for home slow charging among EV owners persists despite variations in absolute and relative charging costs, whereas fast charging devices are presented with negative coefficient values. Slow charging devices are significantly more economical to purchase and install, requiring less infrastructure compared to fast-charging counterparts—often by factors of tens to hundreds, or more, in terms of cost.

We also find that fast chargers in office areas are not readily preferred regardless of the different price points presented to the respondents, questioning the effectiveness of these devices installed and made available on these locations. For public charging devices, we find that certain models do have statistical significance at the 5% and 10% levels, indicating that they could potentially be attractive if the charging rate is competitive against the slower options.

## Conclusions

Our study provides insights into EV owners' charging preferences in relation to charger availability and pricing scenarios. The findings emphasize, in alignment with other research works globally, the strong preference for home slow charging and suggest that policy measures and infrastructure investments should align with consumer behavior to optimize resource allocation.

## References

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