REDUCING TRANSPORT RELATED FUEL CONSUMPTION THROUGH ELECTRIFICATION: EVIDENCE FROM A HIGH FREQUENCY ANALYSIS

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Overview

Electrification is a key strategy for decarbonising the transport sector in line with many countries' Nationally Determined Contributions (NDCs). In 2023, global electric vehicle (EV) sales neared 14 million, with the EV share of total vehicle sales increasing by 14 percentage points between 2020 and 2023 (IEA, 2024a). The International Energy Agency (IEA, 2024a) projects EV sales will rise to 17 million in 2024, potentially reducing daily oil consumption by nearly 6 million barrels by 2030. This equates to approximately 6% of the global oil demand forecasted for 2030 (IEA, 2024b). However, oil demand is expected to shift from OECD to non-OECD countries, possibly amplifying the share of substituted fuel in OECD nations as part of total global consumption.

Against this backdrop, this study evaluates whether European demand for refined petroleum products used in road transport is significantly declining. As the second-largest EV market after China (IEA, 2024a), Europe is likely to experience a considerable reduction in oil demand. However, European countries show substantial variation in EV penetration. Data from the European Alternative Fuels Observatory reveals that Norway leads with EVs accounting for nearly 18% of registered vehicles, followed by Iceland (5.8%) and Sweden (4%). Conversely, Cyprus (0.08%), Poland (0.09%), and Greece (0.1%) lag behind. Notably, a small EV market share does not necessarily imply an insignificant reduction in fuel demand—it may simply lack statistical significance.

Methods

Using monthly energy balances, we calculate petrol and diesel consumption across European countries. Drawing from financial literature, we compute monthly log-returns of fuel prices (the first difference of the natural logarithm) and realised variance (the sum of squared weekly log-returns). This approach allows us to control for both price levels and the impact of price volatility on fuel demand.

We estimate a dynamic fixed effects panel model for road transport fuel demand, incorporating EV registrations and fuel price log-returns. To enhance model robustness, we include control variables for economic activity and transport modal shifts. Unemployment serves as a high-frequency proxy for economic activity, where rising unemployment indicates economic cooling. To account for modal shifts, we include data on passenger and freight volumes transported by rail.

All monthly series are seasonally adjusted and specified in natural logarithms, approximated with the inverse hyperbolic sine transformation. This is done to retain the information contained in zero EV registrations.

Results

Our panel dataset covers 13 European countries from January 2018 to August 2024, with updates planned as new data becomes available. Preliminary findings reveal a negative relationship between EV registrations and fuel demand; however, this relationship is not statistically significant across the full sample. Interestingly, when hybrid vehicles are included, the relationship between diesel demand and EV registrations becomes statistically significant.

Additionally, our results suggest that petrol demand is more persistent than diesel demand. This outcome is unexpected, given diesel's dominance in road freight transport. This may indicate an unaccounted modal shift from road to rail freight.

These preliminary results do not yet control for economic activity or transport modal shifts. We intend to conduct subsample analyses to explore how the relationship between EV uptake and fuel demand varies across countries with differing EV fleet sizes.

Conclusions

Our analysis of EV registrations and fuel demand across 13 European countries finds a weakly significant negative correlation between EV registrations and diesel demand, while the relationship with petrol demand is negative but not statistically significant. Petrol demand appears more persistent than diesel demand, which is environmentally favourable given petrol emissions are generally less harmful than diesel emissions.

Currently, our dataset excludes key EV markets such as Norway, Iceland, and the UK due to data limitations. We plan to expand the analysis by incorporating additional data sources to include these countries, given their substantial EV adoption rates.

References

International Energy Association (IEA). (2024a). *Global EV Outlook 2024*. IEA. https://www.iea.org/reports/global-ev-outlook-2024. [Accessed: 17 January 2025]

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