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COULD ELECTRIC CAR CHANGE THE DESTINY OF TÜRKİYE'S TRADE DEFICIT?[3]

Abstract

Purpose *– This study investigates the relationship between the proliferation of electric vehicles in Türkiye and its subsequent effects on oil dependency and the trade deficit of Türkiye.*

Research design/method/approach *– This study employs a frequency domain causality test to investigate the influence of electric vehicle adoption on oil imports and the foreign trade deficit of Türkiye over the 1994–2024 period. Specifically, the research utilizes the Breitung-Candelon frequency domain Granger causality approach, which decomposes causality to explore its effects in the short, medium, and long term.*

Findings – *The frequency domain causality test confirms a long-term causal effect of electric vehicle on Türkiye's oil imports. Conversely, the analysis indicates that the volume of electric vehicles demonstrates no causal relationship with the trade deficit across the short, medium, or long term.*

Practical implication – *The findings of this study demonstrate that the adoption of electric vehicles has the potential to alter Türkiye's oil demand over the long term. However, the prevailing market share and competitive advantage held by Chinese electric vehicle manufacturers pose a substantial risk, potentially leading to the persistence of Türkiye's foreign trade deficit.*

Originality/Value – *While existing literature broadly addresses electric vehicle impacts, this study fills a crucial gap by offering the first empirical analysis, to our knowledge, that specifically investigates the causality between electric vehicle sales volume and Türkiye's key macroeconomic indicators (oil imports and foreign trade deficit) using frequency domain analysis.*

Key words: *Electric Vehicle Adoption, Türkiye, Trade Deficit, Oil Import*

JEL classification: *F14, Q56*

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ДА ЛИ БИ ЕЛЕКТРИЧНИ АУТОМОБИЛ МОГАО ПРОМЕНИТИ СУДБИНУ ТРГОВИНСКОГ ДЕФИЦИТА ТУРСКЕ?[4]

Апстракт

Сврха – Ова студија истражује везу између ширења електричних возила у Турској и њених последичних ефеката на зависност од нафте и трговинских дефицита Турске.

Дизајн/метод/приступ истраживања – Ова студија користи тест узрочности у фреквентном домену како би истражила утицај употребе електричних возила на увоз нафте и спољнотрговински дефицит Турске у периоду од 1994. до 2024. године. Конкретно, истраживање користи Брајтунг-Канделонов приступ узрочности у фреквентном домену и Грејнџеровом систему, који разлаже узрочност како би истражио њене ефекте на краћи, средњи и дужи рок.

Резултати – Тест узрочности у фреквентном домену потврђује дугорочни узрочни ефекат електричних возила на увоз нафте у Турску. Насупрот томе, анализа показује да обим електричних возила не показује узрочну везу са трговинским дефицитом на краћи, средњи или дужи рок.

Практична импликација – Резултати ове студије показују да усвајање електричних возила има потенцијал да промени потражњу за нафтом у Турској на дужи рок. Међутим, преовлађујући тржишни удео и конкурентска предност коју држе кинески произвођачи електричних возила представљају значајан ризик, што потенцијално може довести до опстанка спољнотрговинског дефицита Турске.

Оригиналност/Вредност – Иако постојећа литература углавном обрађује утицаје електричних возила, ова студија попуњава кључну празнину нудећи прву емпиријску анализу, колико нам је познато, која посебно истражује узрочност између обима продаје електричних возила и кључних макроекономских индикатора Турске (увоз нафте и спољнотрговински дефицит) користећи анализу фреквентног домена.

Кључне речи: *усвајање електричних возила, Турска, трговински дефицит, увоз нафте*

Introduction

Elaboration in an era, led by the global transition to sustainable energy solutions, electric vehicles (EVs) have emerged as a key driver of economic transformation as well as many other impacts are concerned. For Türkiye where foreign trade balance has been deteriorating for a long time by energy imports and particularly crude oil, EVs adoption presents a strategic opportunity to overcome this persistent foreign trade deficit. By reducing dependency on imported crude oil and prompting the domestic energy production, EVs could reshape Türkiye's foreign trade balance dynamics in field of energy while aligning with global sustainability goals.

[4] Овај рад је настао из текућег мастер рада под називом „Утицај електричних возила на спољнотрговински дефицит Турске у оквиру увоза енергије".

According to Bloomberg New Energy Finance's updated zero-emission vehicles' progress stats, EVs successfully reduce the demand for oil. The adoption of EVs prevented the demand for approximately 1.5 million barrels of oil per day in 2021, reaching approximately 3.3% of total demand all around the world. Stats point out that this amount is foreseen to rise up to 16 million barrels of oil per day in 2035 which will mean that dependence on oil in transportation will be permanently eliminated (Bloomberg NEF, 2022).

Again, in line with the Oil 2023 report published by the International Energy Agency (IEA) it is anticipated that the annual demand grow is going to rise 6 %. This is supported by the petro chemical and aviation sectors and reaches 105.7 million barrels per day. However, the annual demand is rise is expected to decline from 2.4 million barrels to 0.4 million barrels in 2028 (IEA, 2023).

Another case study – Türkiye Electric Vehicles Outlook published by Sabancı University Istanbul International Center for Energy and Climate (IICEC) puts forth that in a fast grow projection scenario up to 2030, the market share of EVs potentially rises up to 1/3 of total market in Türkiye will reduce the crude oil import up to 2.5 billion USD per year. (Sabancı University IICEC, 2021).

This study explores Türkiye's foreign trade balance, focusing on historical trends and the emerging influence of EVs on fossil fuel consumption and trade dynamics. Given Türkiye's persistent trade deficit, largely attributed to high fossil fuel imports such as crude oil and natural gas, this research investigates how the shift towards EVs might alleviate this energy dependency. Leveraging econometric analysis, the study examines the projected impact of EV adoption on Türkiye's trade balance within the broader context of rising global environmental concerns and the transition to sustainable energy sources. As countries worldwide embrace EVs to curb greenhouse gas emissions, Türkiye finds itself at a strategic crossroads, balancing the imperative of trade deficit reduction with the opportunity to lead in a rapidly expanding EV market.

In line with the global trends, potential effects of widespread EV adoption and the subsequent reduction in fossil-based fuel consumption on Türkiye's trade deficit is observed by employing quantitative analysis and estimate its impact on the Foreign Trade Balance. By reviewing available trade data, industry trends, and economic forecasts, the study explores Türkiye's trade deficit trajectory, focusing on the influence of EVs in a nation heavily reliant on crude oil. The analysis incorporates current economic trends, strategic national plans, and the anticipated effects of increased electricity demand resulting from EV usage. The research aims to test the hypothesis that "Türkiye's foreign trade deficit is expected to decrease with the increase in electric vehicles," offering insights into the broader implications of EV adoption on foreign trade balances.

Literature Review

Elaboration the transition to EVs has been a focal point and widely studied across different regions, with a focus on their economic, environmental, and policy-related implications. A central concern across the literature is how EV adoption influences national economies, especially in terms of trade balances, energy imports, and macroeconomic dynamics.

The potential to alleviate pressure on Türkiye's foreign trade balance constitutes a core argument driving the development of the EV ecosystem. In terms of account deficit Bayar et al. (2014) employed a VAR model to identify the key drivers behind Türkiye's deficit from 2000 to 2013, pinpointing oil import prices as a major contributor. This finding reinforces the inference that a reduction in oil imports—potentially catalysed by EV adoption—could significantly support Türkiye's macroeconomic stability. Further supporting this perspective, Karadaş and Işık (2018) conducted an econometric analysis confirming that dependency on fossil fuels exacerbates external imbalances, which further underscores the strategic role of the EV transition in the nation's long-term economic planning.

International studies consistently corroborate similar macroeconomic effects stemming from EV adoption. Lin and Wu (2021) utilized a Computable General Equilibrium (CGE) model to simulate the effects of EV adoption in China. The results of these simulations demonstrated that EV growth shifts energy consumption away from fossil fuels, reduces oil imports, and consequently alters broader economic indicators. Similarly, Guo et al. (2023) focused on China and Japan, using time series analysis to examine how EV adoption influences crude oil imports. Their work recommends the necessity of complementary policies—such as vehicle ownership limits and fuel taxation—to maximize the economic gains derived from the EV transition.

However, the impact of the EV transition on the trade balance is not unidirectional and is contingent upon the structure of the supply chain. For instance, Sigurdsson (2010) evaluated Iceland's experience, finding that while EVs reduce gasoline imports, the high initial cost of EV imports can negatively affect the trade balance in the short term, particularly in the absence of domestic EV production. In contrast, a forward-looking input-output analysis for Indonesia by Pirmana et al. (2023) suggests the opposite: investment in domestic EV production would boost GDP, create jobs, and capitalize on national resource advantages, especially in battery materials like nickel. These findings suggest that for Türkiye, the ultimate net benefit of EV adoption on foreign trade will largely depend on how rapidly and comprehensively local production capacity is developed.

Several studies investigate Türkiye's readiness and challenges in the shift toward electric mobility. Key studies utilize modelling and policy analysis to assess the impact of this shift on the energy sector, economy, and consumer behaviour. Specifically, Coban, et al. (2022) utilized simulation and optimization models to analyse the effects of EV integration on the national power grid. Their findings suggest that EV adoption could not only enhance grid efficiency but also strengthen energy security and reduce reliance on imported oil.

Moving from energy policy to fiscal structure, Ökde (2022) analysed Türkiye's EV taxation policies in comparison with the EU framework. This analysis highlighted how current fiscal structures may inadvertently impede widespread EV adoption. Consequently, the study recommends harmonizing tax policy to facilitate market growth and accelerate progress toward energy independence goals. Complementing this economic perspective, Kocaöz and İğde (2022) investigated Turkish consumer preferences from a behavioural standpoint. Their research indicates that perceived price value and environmental concerns are significant determinants of purchasing behaviour, thereby reinforcing the importance of targeted financial incentives and public awareness initiatives.

The success of the EV transition, particularly concerning its broader economic benefits, is intrinsically linked to macroeconomic stability. Kaya (2022) examined the critical impact of exchange rate volatility on renewable energy investment and trade balances within Türkiye. This work underscores the necessity of policy stability to foster long-term sustainability and enhance economic resilience. These are preconditions for successfully implementing large-scale, capital-intensive transitions like the shift to electric mobility. The IEA (2021) evaluated Türkiye's energy policy structure, noting the persistent dominance of fossil fuels—particularly coal. The IEA report explicitly emphasized the significant potential of EVs to bolster energy independence, simultaneously advocating for expanded consumer incentives, improved charging infrastructure, and policy harmonization with European Union (EU) standards. IEA (2021) not only evaluates Türkiye's policy but also offers a comparative framework by analysing member countries' transition efforts. It highlights key challenges such as inconsistent incentives and infrastructure gaps that are common across developing economies. Collectively, these studies reveal that EV adoption plays a crucial role in shaping energy policies, economic stability, and environmental sustainability. While Türkiye and other countries are taking steps toward increased EV adoption, challenges such as tax policies, trade balance implications, and fossil fuel reliance must be addressed to ensure a smooth transition. The research suggests that integrating EVs strategically can reduce oil dependency, enhance energy security, and contribute to economic growth, making the shift toward sustainable mobility a global priority.

As a conclusion, the reviewed literature demonstrates that EV adoption has multifaceted impacts—ranging from energy efficiency to significant macroeconomic shifts. In Türkiye, the alignment of fiscal, infrastructural, and consumer policy remains critical. Globally, successful EV transitions are often supported by integrated industrial and trade policies. Collectively, these studies reveal that EV adoption plays a crucial role in shaping energy policies, economic stability, and environmental sustainability. Türkiye and other countries are taking significant steps toward increased EV adoption. However, challenges such as tax policies, trade balance implications, and fossil fuel reliance must be addressed to ensure a smooth transition. These findings support the development of an econometric model to explore how EV adoption could influence Türkiye's foreign trade balance, oil imports, and broader economic indicators.

This study offers a unique contribution to literature by empirically examining the relationship between electric vehicle adoption and the trade balance within an econometric framework. The proposed model not only captures the dynamics specific to Türkiye but also provides a methodological template applicable to other economies facing similar structural constraints in their energy and trade systems.

Research Design, Methodology, and Research Tasks

Data

Building on prior research that has examined Türkiye's external imbalances through VAR frameworks (e.g., Bayar, Kılıç & Arıca, 2014) and highlighted the strategic role of EV adoption for reducing oil dependency (e.g., Coban et al., 2022; IEA, 2021),

this study adopts a time-series econometric approach. In line with these contributions, we focus on a core set of variables—foreign trade deficit, crude oil imports and electric vehicle registrations. This article employs an annual dataset spanning the period 1994–2024 for Türkiye. The data were compiled from Turkish Statistical Institute (TÜİK). The focus is on variables that capture the country's foreign trade balance, energy dependency and the penetration of EVs. The variables of the study are as follow:

- Foreign Trade Deficit of Türkiye to be this study's dependent variable can briefly be defined as the gap between the exports and imports of Türkiye in million US $.
- Total Crude oil imports of Türkiye that measured in tons.
- The number of registered EVs in Türkiye.

All variables have been transformed into natural logarithms to stabilize the variances, reduce the effect of outliers.

Methodology

Granger (1969) causality analyses the relationship between variables via p-order vector autoregressive (VAR) model. Geweke (1982; 1984) and Hosoya (1991) defined frequency domain Granger test through Wald-type approach to determine certain frequency causality. Breitung and Candelon (2006) constructed a new causality model by testing null hypothesis at frequency ω.

Methodologically, it is taken as reference Geweke's method (Geweke,1984) to measure the causality between variables when one of them is taken conditional. The VAR system used in this study can be expressed in its moving-average and frequency-domain forms following Breitung and Candelon (2006):

$$\begin{pmatrix} x_t \\ y_t \end{pmatrix} = \Phi(L)\varepsilon_t = \begin{vmatrix} \Phi_{11}(L) & \Phi_{12}(L) \\ \Phi_{21}(L) & \Phi_{22}(L) \end{vmatrix} \begin{pmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{pmatrix} = \Psi(L)\eta_t = \begin{vmatrix} \Psi_{11}(L) & \Psi_{12}(L) \\ \Psi_{21}(L) & \Psi_{22}(L) \end{vmatrix} \begin{pmatrix} \eta_{1t} \\ \eta_{2t} \end{pmatrix}$$

where

$$\eta_t = G\varepsilon_t, \quad E(\eta_t \eta_t') = I, \quad \Phi(L) = \Theta(L)^{-1}, \quad \text{and } \Psi(L) = \Phi(L)(G)^{-1}$$

to avoid spurious or indirect causal effects, the frequency-domain framework can be extended to include additional conditioning variables. In such cases, the Breitung–Candelon test is computed conditional on these variables, following the approach suggested by Geweke. The conditioning is implemented by including the lagged values of an additional variable z_tin the VAR system.

For simplicity, assuming a single conditioning variable z_t, the test of the null hypothesis $H_0: M_{y \to x|z}(\omega) = 0$ (no causality from y_t to x_t at frequency ω, conditional on z_t) can be presented as follow:

$$M_y \to x(\omega) = \log 1 + \frac{|\psi_{12}(e^{-i\omega})|^2}{|\psi_{11}(e^{-i\omega})|^2}$$

rejecting H_0 implies that y_t Granger-causes x_t conditionally on z_t at frequency ω.

In light of the evidence presented, this study aims to elucidate the impact of EV proliferation on crude oil imports and, consequently, on Türkiye's foreign trade balance. At the frequency ω the particular variable is the cause for prediction of the effected

variable (Tastan, 2015). As specified by Ciner (2011), the frequencies 0.5, 1.5, and 2.5 denote long-term, medium-term, and short-term causalities, respectively.

Research Results and Discussion

This study utilizes frequency-domain causality analysis to examine the relationship between the number of EVs, oil imports, and Türkiye's foreign trade deficit. The descriptive statistics for the variables, presented in their levels, are displayed in the following table.

Table 1: Descriptive Statistics of Variables

Variable	Mean	Std. Dev.	Minimum	Maximum
lnDeficit	17.5	0.78	15.45	18.51
lnOil	16.96	0.19	16.47	17.32
lnEV	3.33	4.05	0	12.12

Prior to the econometric modelling, the time-series properties of the variables were rigorously examined. The maximum lag length for the variables was determined in order to implement the frequency-domain causality test. The results of the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests are presented in Table 2.

Table 2: Unit Root Tests Results

	ADF Test Results		Phillips Perron Test Results	
Variables	I(0)	I(1)	I(0)	I(1)
lnoil	-1.898	-6.975***	-1.805	-7.304***
lndeficit	-1.816	-4.701***	-2.844*	-7.202***
lnev	1.842	-2.998**	1.252	-2.960**

***Note:** *, **, and *** refer to significance level successively at 10%, 5% and 1%.*

To test unit roots, both the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests were employed. The use of each test ensures robustness, as ADF controls correlation through lagged differences while PP adjusts for serial correlation and heteroskedasticity in the error terms. The results, summarized in Table 1, show that none of the variables are stationary in levels, but all become stationary at first differences. Thus, all variables are integrated into I(1). Since the variables are integrated of I(1). Additionally, the analysis is conducted within a VAR framework with four lags. The VAR model results are presented in Table 3.

Table 3: VAR Model Results

Lag	Ll	LR	df	p	FPE	AIC	HQIC	SBIC
0	-84.5095				.131159	6.48218	6.525	6.62616
1	-18.8505	131.32	9	0.000	.001986	2.28522	2.45648	2.86115*
2	-9.1339	19.433	9	0.022	.00194	2.23214	2.53183	3.24001

3	4.96529	28.198	9	0.001	.001433	1.85442	2.28256	3.29424
4	20.6482	31.366*	9	0.000	.001014*	1.3594*	1.91597*	3.23116

To select the optimal lag length standard information criteria such as the Akaike Information Criterion (AIC), the Hannan-Quinn Information Criterion (HQIC), and the Schwarz Bayesian Information Criterion (SBIC) were employed. As reported in Table 2, all three criteria consistently indicate that a lag length of four (lag[4]) provides the best model fitting. Consequently, four lags were adopted in the subsequent estimations to ensure robust and reliable inference.

To further investigate the dynamic linkages among the core variables—foreign trade deficit, crude oil imports, and electric vehicle (EV) registrations—this study applies the Breitung–Candelon frequency-domain Granger causality (BCG) test. Unlike conventional time-domain causality tests, which provide a single causal inference over the entire sample, the BCG approach decomposes causality across different frequencies. This enables the distinction between short-term fluctuations (high frequency) and long-term co-movements (low frequency) in the relationships among variables. By employing both unconditional and conditional BCG specifications, the analysis examines the direct causality between EV adoption and crude oil imports or trade deficit. This methodological choice allows us to capture more nuanced interactions. Specifically, it helps determine whether EV adoption exerts immediate effects on crude oil dependency and foreign trade balances, or whether such impacts unfold gradually over the long run.

The Breitung–Candelon frequency-domain causality (BCG) tests were applied for four specifications: (i) lnEV → lnOil, (ii) lnEV → lnOil | lnDeficit, (iii) lnEV → lnDeficit, and (iv) lnEV → lnDeficit | lnOil. The figures below plot the test statistic across frequencies, with the 5% critical value as a reference line.

Test results reveal a strong causal relationship from EV adoption to crude oil imports at low and medium frequencies, indicating that the effect is concentrated in the long run. While the relationship remains statistically significant, though weaker, at intermediate frequencies, it disappears at higher frequencies, suggesting no short-term impact. These findings highlight that EV penetration contributes to reducing oil dependence primarily through long-term adjustments rather than short-run fluctuations.

The conditional BCG causality test, controlling for the foreign trade deficit, shows that the causal effect from EV adoption to crude oil imports is not statistically significant across the frequency spectrum. P-values remain well above conventional thresholds, indicating that once the external balance is accounted for, EV penetration does not exert an independent influence on oil imports. This suggests that the long-run link observed in the unconditional setting may be mediated through the foreign trade deficit rather than reflecting a direct EV–oil relationship.

The unconditional BCG causality test from the trade deficit to crude oil imports reveals no statistically significant causal effect across the frequency range. P-values remain above conventional thresholds, indicating that fluctuations in Türkiye's trade deficit do not directly explain changes in crude oil imports. This suggests that oil import dynamics are shaped more by other structural factors, such as energy demand and EV adoption, rather than by the deficit itself.

The conditional BCG causality test from the foreign trade deficit to EV adoption,

with crude oil imports included as a conditioning variable, provides no evidence of statistical significance across the spectrum. As it is monitored in the r(W) matrix, test statistics remain low and the corresponding p-values consistently exceed conventional thresholds (0.05), both in the long-run frequencies (0.01–0.40) and in the higher-frequency bands. This indicates that fluctuations in the trade deficit, once oil imports are controlled for, do not exert a causal influence on EV registrations. The absence of significant results across all frequencies suggests that the trajectory of EV adoption in Türkiye. It is not directly driven by external balance dynamics but is instead more responsive to structural determinants such as energy policy, infrastructure development, and consumer preferences.

Table 4: The Breitung–Candelon Frequency-Domain Granger Causality Test Results

Null Hypothesis	**Time Domain Causality (F-stat., p-value)**	**Long-run**		**Medium-run**		**Short-run**	
		(ω=0.01)	(ω=0.05)	(ω=1.00)	(ω=1.50)	(ω=2.00)	(ω=2.50)
lnEV is not Granger cause of lnOil	4.36 (0.042)**	6.163**	6.181***	0.867	0.334	0.062	0.045
lnEV is not Granger cause of lnOil | lnDeficit (Conditional)	5.27 (0.021)**	23.593***	23.657***	1.706	0.475	0.412	0.336
lnEV is not Granger cause of lnDeficit	0.22 (0.641)	0.001	0.004	0.783	0.553	0.531	0.562
lnEV is not Granger cause of lnDeficit | lnOil (Conditional)	0.17 (0.685)	0.749	0.747	0.603	0.582	0.699	0.917

*Note: *, ** and *** denote significance at 10%, 5% and 1% levels respectively.*

The long-term relationship indicates that the number of EVs in Türkiye is Granger cause of country's oil import volume. Conversely, in the short and medium term, no causal link is observed running from EV adoption to either oil imports or the trade deficit. Specific details regarding frequency domain causality are documented in Table 5.

Table 5: The Breitung–Candelon Frequency-Domain Granger Causality Interpretations

Direction Causality	Conditioning	Interpretation
lnEV → lnOil	Unconditional	EV adoption significantly Granger-causes oil imports at low frequencies, suggesting that rising EV penetration contributes to structural reductions in oil demand.
lnEV → lnOil	Conditional on lnDeficit	Causality remains significant even after conditioning on trade deficit, reinforcing the robustness of the EV–oil nexus.
lnEV → lnDeficit	Unconditional	No significant causal relationship is detected; EV adoption does not directly drive trade deficit.
lnEV→ lnDeficit	Conditional on lnOil	No significant causal effect is found; EV adoption and fluctuations in the trade deficit are independent once oil imports are controlled for.

The BCG frequency-domain Granger causality tests provide nuanced insights into the dynamic interrelationships. Results indicate that EV adoption exerts a statistically significant and robust long-run causal influence on crude oil imports, both unconditionally and when conditioned on trade deficit. Conversely, no significant causal influence is found from the trade deficit to either oil imports or EV adoption. This pattern suggests that the structural shift toward EVs plays a pivotal role in reducing oil dependence, while trade balance fluctuations alone do not shape EV diffusion dynamics.

Conclusion

The world-wide rapid transition from conventional internal combustion engine technology to EVs driven by new global trends will inevitably have social, cultural, environmental, and economic consequences. This study investigated the dynamic relationship between Türkiye's foreign trade deficit, crude oil imports, and EV adoption through a time-series econometric framework. Results reveal that the three core variables are integrated of order one and exhibit no long run cointegration. Accordingly, their interactions are better captured in a short-run VAR framework. The empirical evidence derived from unit root, cointegration, VAR, and frequency-domain causality analyses demonstrates a clear and statistically significant causal relationship between electric vehicle (EV) adoption and crude oil imports. Specifically, higher EV penetration leads to reductions in oil import demand over the long run, confirming that electrification of the transport sector has the potential to ease one of the key structural vulnerabilities in Türkiye's fiscal accounts. This finding aligns with international evidence that EV adoption can alter the energy mix, decrease fossil fuel dependency, and contribute to environmental sustainability.

However, the results also show that EV growth does not directly translate into improvements in the foreign trade deficit. That is, we rejected our hypothesis "Türkiye's foreign trade deficit is expected to decrease with the increase in electric vehicles". Türkiye remains structurally dependent on imported energy, and total energy import volume is expected continuing to rise due to reasons such as economic growth, population growth, and increase in industrial production despite the gradual adoption of EVs. This asymmetry suggests that while EV transition can mitigate crude oil dependency and indirectly relieve some pressure on the foreign trade balance, it cannot on its own resolve Türkiye's persistent foreign trade deficit. To maximize economic benefits, EV policies must be integrated into a broader energy and trade strategy that reduces fossil fuel

reliance, diversifies domestic energy production, and strengthens industrial capacity in EV and battery manufacturing.

In light of this data, it would be more efficient for Türkiye to focus on research in sustainable energy and recycled materials alongside the EV transition. Doing so would replace fossil fuels and substitute crude oil-based materials, leading to a significant improvement in the foreign trade deficit caused by energy imports. On the other hand, battery technology remains heavily dependent on foreign markets. This dependency explains why EV adoption does not significantly influence the trade deficit across any frequency band. However, it is crucial to foster domestic EV and battery production facilities. In the long run, these efforts will contribute to the recovery of the foreign trade deficit.

While this research provides some findings, it is crucial to recognize certain limitations, which also offer directions for future research. A primary constraint of the study is the unavailability of the data. The analysis starts from 1994, as official statistics for road motor vehicles are unavailable for earlier years. It is recommended that future studies utilize dynamic econometric modelling to explore the EV impact on foreign trade deficit of Türkiye.

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