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ASSESSING FISCAL TRADE-OFF IN UTTAR PRADESH'S SHIFT TOWARDS ELECTRIC MOBILITY

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Abstract

The fast pace of electric cars (EVs) adoption in India is an important move towards sustainability. The increasing popularity of EVs in Uttar Pradesh is linked to incentives by both the state and central government (e.g., road tax exemption, waived registration fees, etc.) as part of schemes like Faster Adoption and Manufacturing of Electric Vehicles (FAME) India. As the proportion of EVs and government subsidies in the form of incentives and tax exemptions increases with a goal towards ensuring sustainable mobility, it has an impact on the fiscal state of the state and EVs acceptance among various categories of vehicles. In this paper, we will look into two areas of the EV transition in Uttar Pradesh: how much fiscal spending can be estimated based on the amount of EV-related subsidies and tax exemptions, and which of the segments of EVs are being most impacted by the incentives provided.

The study estimates the direct costs incurred by the state in terms of financial incentives by using secondary data on the FAME India dashboard, VAHAN vehicle registration portal, and the UP Budget documents. Fiscal spending to encourage EV adoption is calculated with the help of a formula that is determined by the policy guidelines. The findings suggest that even with continued provisioning of EV subsidies and exemption from road tax, state governments still have a lower impact on fiscal revenue due to factors such as lower adoption of EVs, the amount of subsidy allotted to different segments of EVs, and road tax exemption provisioned as per policy. The results highlight the significance of the balance between environmental aspirations and financial stability and indicate that a gradual and data-driven method should be used to encourage the electrification of mobility in Uttar Pradesh.

Introduction

Electric vehicles (EVs) are at the forefront of the global shift toward sustainable and low-emission transportation systems. As concerns over climate change, air pollution, and fossil fuel dependence intensify, EVs have appeared as a condemnatory part in the transition to greener mobility. Over the past decade, EV uptake has accelerated speedily around the world. According to the International Energy Agency (IEA), global EV sales transcended fourteen million units in 2023, with China, Europe, and the United States leading the adoption. This growth has been pushed by technological advancements, declining battery costs, and overarching government support through fiscal incentives and regulatory measures. Despite this progress, sustaining EV growth requires careful steady stability of environmental goals with fiscal realities, particularly as in India, state governments depend heavily on indirect taxes to fund public expenditures, in which revenue earned from taxes on vehicles is a major source.

India, the world's third-largest automotive market as of 2024–25, having roughly 27 million passenger vehicles and over 20 million two-wheeler vehicles running on non-renewable fuels like petrol and diesel, highlighting their continued dominance in India's road transport fleet, is experiencing robust expansion, which stood at approximately 5.1 million units in 2023 and is projected to surge to 7.5 million units by 2030, reflecting a compound annual growth rate of over 5% (Karunakar et al., 2021). Amid this, the Government of India has set progressive targets for EV penetration, aiming for 30% of new vehicle sales to be electric by 2030. Driving this transformation, the government has carried through a range of incentives like the FAME scheme, now in its second phase (FAME-II), which provides substantial purchase subsidies. Additionally, policy measures such as lower Goods and Services Tax (GST) rates and incentives under the PLI (Production-Linked Incentive) scheme and state-level subsidies and tax waivers. However, this push for clean mobility comes at a fiscal cost, as this sector is a significant revenue source specifically for state governments, as in India state governments are dependent on indirect taxes (SIAM report on automobiles 2024). EVs constituted around 5% of new vehicle sales in 2024, with ambitious policy commitments aiming for a 30% EV share by 2030. The EV market is projected to expand dramatically: from between US$8 and 23 billion in 2024 to US$118 billion by 2032. While these policies accelerate adoption across two-wheelers, three-wheelers, and private cars, they also raise fiscal challenges, since vehicle-related taxes remain among the top five revenue sources for state government in India.

While national-level policies are condemning, the role of state governments is equally important in shaping localized EV adoption trends. Uttar Pradesh (UP), India's most populous state with over 241 million (17% of the national total), has one of the fastest-expanding vehicle ecosystems in the country. As of FY 2024–25, the state recorded 3.79 million new vehicle registrations, pushing its total on-road fleet beyond fifty million vehicles, having a projected annual growth rate of 9% of the motorized population (CEEW report on vehicle ownership 2025). On the electric mobility front, UP has emerged as a national leader. The state consistently ranks among the top three in EV registrations, with over 414,000 EVs as of mid-2025, led by e-rickshaws, which account for 85% of sales. To accelerate this transition, the state introduced the Uttar Pradesh Electric Vehicle Manufacturing and Mobility Policy 2022, which provides 100% road tax and registration waivers and direct purchase subsidies, alongside manufacturing incentives. In 2024–25, taxes on vehicles alone are expected to yield ₹12,505 crore, the sixth largest source of state revenue.

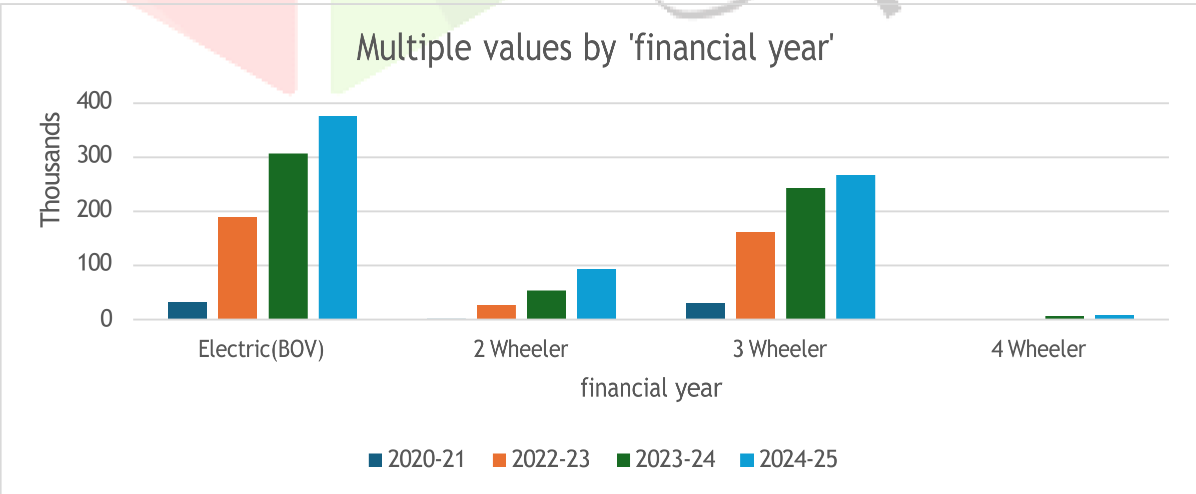

Table 1. Units of electric vehicles sold in Uttar Pradesh (FY 2020–21 to 2024–25).

However, these fiscal incentives come with trade-offs. While they constructively lower the upfront cost of EVs and stimulate demand, they also result in revenue foregone, particularly from established sources, which form a sizeable part of state tax revenues. As EV uptake grows, Uttar Pradesh faces a dual fiscal challenge: rising expenditure on EV subsidies and declining income from taxes. These dynamic raises important questions about what the long-term fiscal cost of subsidy could be as per the sale of EVs and how subsidy does impact different segments of electric vehicles.

Against this backdrop, this research focuses on quantifying the fiscal expenditure incurred by Uttar Pradesh through EV subsidies and tax exemptions under varying EV segment adoption. By analysing these two dimensions, the study aims to provide policymakers with evidence-based insights to design an EV strategy that balances environmental ambition with fiscal responsibility.

Review of related literature

Wagh's (2023) study talked about momentum in the surge of electric vehicles in India. Demonstrated that 30 percent of the vehicles taken on as EVs would save 60 billion of the oil imports and a 37 percent reduction in emissions, and how affordability resulted in an increase in EV ownership, yet the overall cost of ownership remains high because of the lack of charging infrastructure. Subsequently experienced an increase in EVs based on vehicle category, including 2W, 3W, 4W, and E-Buses. In addition to demonstrating how the different schemes like the Faster Adoption and Manufacturing of Electric Vehicles Scheme, PM-eDrive, the National Electric Mobility Mission Plan and product-linked incentives contribute to the development of demand, creation of infrastructure that will facilitate the charging process and the production of EVs in India.

Sarkar, Sheth, and Ranganath (2022) measured the viability and sustainability of the electric rapid transit system in Ahmedabad. The paper employed a social cost-benefit analysis method to examine the economic (revenue and fuel saving), environmental (air pollution) and social benefits (travel time saving). A 25 year analysis with discount rate of 12 per cent gave a benefit-cost ratio of 1.45. It is projected that it will have a 50% environmental benefit and a 29% decrease in fossil fuel consumption. The result indicated positive vindication based on the perspective of the advantages accrued by the society and lucrative returns and value addition of infrastructure investment, which ultimately proved the usage of such a transport system.

With the US, China, and European countries in mind, Sheldon, Dua, and Alharbi (2021) were able to study the subsidy cost per tonne of CO 2 as well as to save the cost-effectiveness of subsidy policy. The emphasis was to have the long-run impact of the existing subsidies to encourage PEC adoption. Detailed analysis of factors such as tailpipe emission, price of the vehicle and subsidy incentives. The same type of vehicle was used as a substitute to guarantee the correct estimation of tailpipe emission savings. Findings indicated that the percentage of PEV price subsidies by the government had a very linear relationship with the subsidy cost per added net tonne of CO 2 avoided. Also demonstrated that the USA and China possess the largest absolute CO 2 savings; the subsidies of high-end PHEVs or luxury BEVs are not efficient. Proposed focused subsidy per income and vehicle price ceiling to enhance cost-effectiveness of subsidies.

Under different combinations of consumer fiscal incentives, Sunanda and Paruchare (2024) had evaluated economically two-wheeler battery electric vehicles through the consideration of the effectiveness of the existing subsidy and tax rate on the cost of ownership in comparison to the traditional two-wheelers. In calculating total cost of ownership, first purchase price and operation-maintenance cost were taken into consideration; the author chose TVS brand vehicles. Cost per KM was low in EV which was analyzed but because of the high cost of battery replacement, the overall cost of ownership of EV is close to conventional vehicles. The modelling of subsidy requirement by the author using a scenario starting with high subsidy and ending with low subsidy indicates that subsidy is required to ensure make total cost of ownership less than traditional two-wheelers. Thus, EVs are affordable depending on electricity price, battery price and subsidies.Shrimali (2021) asserts that there are three types of subsidy: capital expenditure subsidy (includes a one-time subsidy at the time of purchase), operating expenditure subsidy (yearly subsidies given in per-kilometer terms based on distance travelled per year), and financing expenditure subsidy (sharing of financing costs such as interest rate subsidy). Together, they can be compared for net present value. Based on analysis of total cost of ownership considering the operation and maintenance cost, the author assessed that no subsidy is needed for 2Ws, 3Ws, 4W taxis, or buses. Subsidies needed for: 4W personal cars, 4W long-haul trucks. The most cost-effective subsidy choice is a CAPEX subsidy that drives early scale. And making the FINEX subsidy as least cost-effective as possible. It is recommended to subsidize only segments needing help, like 4W-personal cars and 4W-trucks, to use the CAPEX subsidy only.

Ghosh & Sarkar (2022) assess the effectiveness of the electric vehicle subsidy in achieving the intended CO_2 reduction, targeting the 4W passenger vehicle only. For annual emission of combustion vehicle tailpipe emission, and annual average distance travelled were taken for EV tailpipe emission, which was replaced by EV efficiency and electricity emission intensity. For the cost of emission reduction, the total subsidy was divided by the annual emission reduction and the expected vehicle life, and the cost was taken for both diesel and petrol vehicles compared with EVs. Results showed the equivalent annual emission for each state is different. States with high dependency on coal-based electricity generation emission for EVs are more than 80 percent of that of petrol. Subsidy is beneficial for states where electricity generation is less dependent on fossil fuels. Arguing that current Indian EV subsidies are expensive for CO2 reduction, and cost-effectiveness varies sharply by state grid CO_2 intensity.

Soman et al. (2020), in a comprehensive study by the Council on Energy, Environment and Water, explored the potential role of India’s electric vehicle (EV) transition. The study examined whether achieving 30% EV sales penetration would contribute positively to India’s energy security, economic growth, environmental goals, and fiscal stability. The research employed a Gompertz function-based vehicle stock model to project vehicle ownership trends across distinct categories. The model projected a 2.7-fold increase in total vehicle stock between 2016 and 2030. Under the EV30 scenario, India’s oil import bill was projected to decrease by ₹1.1 lakh crore. The scenario also delivered significant environmental benefits: 17–18% reductions in particulate matter (PM), NOx, and CO emissions. From a fiscal perspective, the study highlighted that petroleum tax revenues for central and state governments would decline by approximately 15%, causing pre-emptive diversification of fiscal revenues.

Khurana and Saini (2021) have used the data to conduct an evaluation using econometric modelling in order to assess the impact of financial incentives and public charging stations on the penetration of electric vehicles in Indian states. They discovered that the amount of charging stations is statistically significantly correlated with the sales of EVs, as is the case internationally. Interestingly, the count of charging stations was a more powerful foreteller of EV sales than subsidies in some states, highlighting the relevance of physical infrastructure in enhancing financial motivators. Their model justifies the statistical tests employed in this paper (including regression and correlation) and justifies the importance of multivariate analysis in explaining EV adoption patterns..

Research Objectives:

To quantify the total fiscal expenditure incurred by Uttar Pradesh through EV-related subsidies and road tax exemptions.

To analyze the distribution of fiscal incentives across different EV segments (2W, 3W, 4W).

Research Questions

How much fiscal expenditure has Uttar Pradesh incurred through EV subsidies and road tax exemptions since the implementation of the UP EV Policy 2022?

What is the comparative fiscal impact of subsidies and tax exemptions across two-wheelers, three-wheelers, and four-wheelers?

Data Sources and

method Data descriptions

Analysis is done by using the secondary data from various sources targeting the data for subsidies, tax exemptions, EVs sold year-wise, and further categorizing EVs into their types, then selecting the EVs for cost estimation of maximum tax benefit provided under different segments of EVs as per the cost. According to the segment-wise analysis, the maximum per-unit subsidy as per the UP-government's EV policy 2022 was estimated, which was capped to a limited number of units. The vehicle selected for cost estimation for the largest subsidies and max road tax exemption was selected as per earlier research studies. Since the maximum EVs sold in the 3W segment are used for the commercial segment, therefore, as per the UP EV policy, the subsidy granted to the 3W segment is limited to the number as mentioned in the policy.

Parameter	Value	Source
Road tax rate	Tax is levied structurally as per ex-factory price	UP Transport Department MV Tax rates. Different tax rates are levied accordingly, from 2 to 8 percent for 2W and 3 to 11 percent for 4W
2W ex-factory price	₹1,00,000 (average 5 percent tax)	NITI Aayog's 2022 FAME II analysis, CSEP 2025 paper (mean 2W EV price ~₹1L for urban markets)
3W ex-factory price	₹2,50,000 (benefits capped to number of vehicles sold for commercial vehicle)	CSEP 2025 paper—market price of typical L5 electric auto (main EV 3W segment), cross-validated with VAHAN registration data & market leader pricing (e.g., Bajaj RE Compact, Bajaj RE, and Piaggio Ape E City)
4W ex-factory price	₹14,50,000 (8 percent tax)	CSEP 2025 paper—average of Nexon EV (₹15–₹17L on-road, ₹7–₹8L ex-factory), MG ZS EV, and mid-segment EV cars targeted in UP market

Table 2. Estimated subsidy outlay and road-tax exemptions across segments in Uttar Pradesh.

Methodology

After sourcing the data, study creates a fiscal modelling approach to estimate the impact of Uttar Pradesh's EV transition on its fiscal condition. The analysis focuses exclusively on direct subsidies provided on purchase of EV under the Uttar Pradesh EV Policy (2022) and Motor Vehicle (MV) registration tax revenue which is forgone due to 100% tax exemptions for EVs. The policy implemented starting in FY 2022–23 providing subsidies and exemptions; hence the study only considers vehicles registered post-policy till the end of fiscal year 2024-25.

For estimation of subsidy for each vehicle segment, the following formula is formulated to compute total subsidy outlay:

Subsidy = Units Sold Post-Policy (considering the policy Cap) × Subsidy per Unit

Units Sold Post-Policy = cumulative units sold from FY 2022–23 onward.

Policy Cap = maximum number of units eligible for subsidy under the UP EV Policy.

Subsidy per Unit = segment-specific fixed amount defined in the policy.
For Registration Tax Revenue Forgone, the total road tax exemption is calculated using the following formula:
Road Tax Exemption = Eligible Units × (Average Vehicle Price × Road Tax Rate)
Eligible Units = number of vehicles allowed as per policy for different segments of EVs.
Average Vehicle Price = estimated average ex-factory price per vehicle, drawn from validated market sources.
Road Tax Rate = segment-specific tax rate applicable in Uttar Pradesh
The analysis using the above method covers the two-wheeler (2W), three-wheeler (3W), and four-wheeler (4W) EV segments aligned with the structure of the UP EV Policy. The policy was implemented starting in 2022 till fiscal year 2024-25; hence, the study only considers vehicles registered post-policy. The policy cap is only present for three-wheelers, as they are mostly used for commercial purposes. Using this method, we tried to provide an approach to assessing the fiscal cost of EV incentives in Uttar Pradesh, focusing on formula-driven, policy-grounded calculations.

Results
Uttar Pradesh's EV transition fiscal impact is based on total sales since the 2022 UP EV Policy, including purchase subsidies and registration tax exemptions.
According to data obtained from FY 2022–23 onward, the following number of EV units sold in these three major segments, for two wheelers its 80,203 units, three-wheelers numbers are 404,679 units and for four wheelers its 14141 units.

Segment	**Subsidy Disbursed (₹ crore)**	**Road Tax Exempted (₹ crore)**
2W	40.10	40.10
3W	60.00	31.25
4W	141.41	164.04
Total	**241.51**	**235.39**

Table 3. Comparative subsidy outlay and road-tax exemptions by vehicle segment (2W, 3W, 4W) in Uttar Pradesh.

Based on the formula formulated, segment wise maximum allotted subsidies multiplied by number of units sold at each specific segment (considering the policy cap for three-wheeler segment), hence subsidies provisioned for each segment as shown on table. And accordingly, the formula derived for tax exemption, eligible units multiplied by average price of taken vehicle for this study of specific segments and further multiplying with tax rate of each segment, hence road tax exemption calculated as given in above table.

Analysis
It has been analyzed that the subsidies provided, and the revenue foregone are highly dependent on the type of vehicle, with both being different in terms of the unit prices and policy design. The results shows that although a small share of total EV registrations (14,141 units) of four-wheelers (4Ws), accounted for the largest share of subsidy disbursal (₹141.41 crore, 58.55%) and road tax exemptions (₹164.04 crore, 69.69%). This is due to the fact that the average ex-factory price is high and the higher rate of tax that they are subjected to. Comparing with 2Ws, having a larger base (80,203 units)

contributed ₹40.10 crore in subsidies and road tax exemptions, showcasing the moderate subsidies and tax exemption burden due to lower average unit price. Which is consistent with previously reported results by Kumar and Chakrabarty (2020) who observed that overall cost of ownership of 2Ws is such that these naturally compete with 2W combustion segment, and do not require sustained subsidies.
The policy had a limit of 50,000 units on subsidies, which meant that overall subsidies would be 60 crore, since the 3W segment was highest selling category in UP (404,679 units). There are also moderate tax exemptions on 3Ws (₹31.25 crore). But mainly exploited in the business sector, with good environmental and social externalities (shared mobility, lower urban emissions, livelihood support), but with moderate fiscal burden, the social payback of fiscal investment is high than the private-use 4Ws according to Shrimali (2021), who suggested subsidies must focus on commercial-use and high-impact segments.
The accumulating impact of incentives from post policy onwards is evaluated to ₹476.9 crore, with subsidies and tax exemptions having almost equal contribution. Though the figures are significantly less than 0.1 of the annual budget of UP 2024-25, implying that the short-term financial cost of policy incentive can be handled, and the long-term increase in the number of EVs cars segment can increase the cost, the condition of incentives criteria stays the same. This resonates with national-level estimates that Kaur, Das, and Tongia (2025) made, that EV adoption using current incentives would eliminate fiscal revenues beyond those in fuel taxes, but also GST and registration revenues.

Conclusion

The findings of this study analysed the possible fiscal challenge that could occur in Uttar Pradesh's EV transition. The findings indicate that the present EV policy in the state has facilitated the adoption of EVs in the various EV car categories and the fiscal impact has been moderate. The analysis revealed that fiscal costs unevenly affect segments, even though the benefits of subsidies and tax exemptions are disproportionately received by the owners of four-wheelers privately.
In terms of policy, that Uttar Pradesh ought to examine a gradual method of offering incentives to various EVs segment. Gradual adjustment of purchase subsidies and tax exemption on purchase of 4Ws of this segment since this segment is already getting consumers hence avoiding unnecessary loss of revenue as the adoption increases. Subsidy and tax breaks must continue to be focused on the three wheelers and extended to the public buses of which social benefits (shared access and emission reductions) greatly exceed fiscal costs. To make matters worse, an increase in investment in charging infrastructure can.

offer a more sustainable long-term assistance than direct subsidies to the structural barriers to adoption.
As the analysis indicates, though EV adoption is a way of decarbonizing the transport sector in Uttar Pradesh, fiscal sustainability should be a key factor in policy design, balancing through constant monitoring and regular recalibration of policies.

Research limitations and future scope

The study focuses on primarily direct impacts of subsidies and road tax exemptions on UP's fiscal. It fails to consider fiscal implication of indirect subsidies of charging infrastructure and concessional electricity tariffs. It goes through short term period limited to EV adoption since the implementation of post-UP EV Policy (2022). As such, it does not capture long-term adoption trajectories such as battery costs or technological improvements which can itself reduce cost of EVs. The study relies on assumption in estimating average vehicle prices and tax rates estimated using market sources and policy reports. The differences in ex-factory prices, profit margins of a dealer and adherence to taxation may result in the discrepancy between the actual values reflecting the fiscal effect.
Long-term scenario analysis with different rates of EVs adoption, lower battery prices, and policy changes, can be embraced in future studies to estimate the cumulative fiscal impact over a longer period. Incorporating into the analysis charging infrastructure investments, electricity subsidies, and

environmental benefits would give a more comprehensive cost-benefit framework. Comparative evaluation of such states as Maharashtra, Tamil Nadu and Karnataka with the high rate of EV adoption, would assist in defining the best practices towards the balance of EV promotion and fiscal stability.

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