

HOW DOES METRO RIDERSHIP AFFECT CAR USAGE AND DELHI GOVERNMENT REVENUE?

AVIYUSH SODHI*

Atma Ram Sanatan Dharma College, University of Delhi

Abstract

The Delhi Metro has, in the past decade, played a transformative role in Delhi's urban mobility system. It is able to help its citizens reach their destinations on time at low costs and also play a role in reducing pollution in the capital. This research examines the relationship between Metro ridership, car usage and government revenue by taking into account taxes on motor vehicles and the collection of sales tax/VAT by the petroleum sector of Delhi. The analysis is based on the secondary data from the Economic Survey of Delhi by the Planning Department, Government of Delhi, and the Ready Reckoners issued by the Petroleum Planning and Analysis Cell, Ministry of Petroleum and Natural Gas, Government of India, for the past decade. The study finds a significant increase in Metro ridership coupled with a downfall in vehicle registrations. The VAT revenue from petroleum sales increased disproportionately to the modest rise in oil consumption, primarily driven by a hike in tax rates from 27% to 30%. This research highlights the need for alternative revenue strategies as well, as public transport systems reduce dependency on private vehicles. Policymakers must consider these trends in planning fiscal policies and urban mobility initiatives.

JEL codes: R41, R42, H71, Q58, O18

Keywords: Delhi Metro; Urban Mobility; Vehicle Registrations; Government Revenue; Sustainable Transport

1. INTRODUCTION

The Delhi Metro, which was introduced in 2002, now spans a total network area of 395 km with 12 lines and 289 total stations, with many expansion plans in the pipeline (Delhi Metro Rail Corporation (DMRC)). It has proved to be a boon for Delhiites, giving them the much-needed relief from the unrelenting traffic.

Delhi Metro has a total of nine colour-coded lines along with the Airport Express Line, the Aqua Line of NMRC, and the Rapid Metro of Gurugram. The Delhi Metro serves not only the NCT of Delhi but also the NCR, including regions like Noida, Faridabad, Ghaziabad, Gurgaon, Bahadurgarh, and Ballabhgarh.

Delhi Metro has not only helped to reduce the travel time for its users but has also reduced pollution, at least at the local level. The Delhi Metro, powered by electricity, reduces local emissions while shifting

pollution to generation sites. According to Sharma et al., 2014, the present modal shift scenario does not yield CO₂ benefits. However, an increase in Metro ridership could be a possible solution to this problem. This paper explores the relationship between Metro ridership and car usage and its further impact on the revenue collection of the Delhi Government from sources connected to car usage, such as taxes on vehicles and collection of sales tax/ VAT by the petroleum sector.

2. LITERATURE REVIEW

Urban mobility has undergone tremendous change in the past few decades in India. The introduction of the Delhi Metro has completely changed the landscape of mass mobility and public transport not only for Delhi but for other metropolitan cities of India by serving as a blueprint for their own metro projects. Several studies have assessed the environmental and behavioural implications of the Delhi Metro system.

*Author's email address: aviush8@gmail.com

Sharma et al., 2014 investigated the environmental impacts of MRTS (Mass Rapid Transit System) in Delhi and concluded that although local emissions decrease due to electrified rail-based transport, the net carbon benefit depends on the energy mix of power generation. But it also states that with the increase in metro ridership, changes in modal shift and energy conservation initiatives by Delhi Metro, CO₂ emission savings could be possible. Since 2014, Delhi has seen both an increase in metro ridership and also the integration of solar panels on a few of its stations.

The COVID-19 pandemic has been a challenge to a lot of the existing infrastructure and trust of the public in public transportation systems. Subbarao & Kadali, 2021 find that the pandemic drastically affected public transport systems, reducing ridership and revenues while drastically increasing financial stress on infrastructure operators. Hence, their work reinforces the fragility of the public trust in public transportation systems in the situation of a health crisis.

The post-pandemic behaviour has further been analysed by Das et al., 2021, who in their study report a significant shift towards cars and private transport due to hygiene concerns. However, the study also states that age, gender and monthly income tend to significantly influence mode switch preferences, with the younger and lower-middle-income demographic still sticking with public transport. In addition, the study also points out that trip characteristics, including travel time, overcrowding and hygiene, are strongly associated with mode shift preferences from public transport to car use. With the increase in metro lines and the DMRC also recently collaborating with services like “Rapido” to offer last-mile connectivity, those issues have been addressed as well.

Tripathi & Ahuja, 2022 explore the socio-economic impact of the COVID-19 pandemic. Their study finds that the pandemic resulted in increased income inequalities. This has, hence, led to an increased dependence on cheaper public transport alternatives, like the metro.

These studies provide very important context for understanding the changes that have arisen in how Delhi moves. They support the view that Metro

ridership is shaped by both infrastructure and broader economic and social factors.

3. RESEARCH METHODOLOGY

The research methodology for this paper involves collecting data from Economic Surveys of Delhi (2013-14 to 2023-24) and also from the various Ready Reckoners (2013-14 to 2023-24) published by the Petroleum Planning and Analysis Cell, Ministry of Petroleum and Natural Gas, Government of India. The paper started with examining important and relevant reports, articles, journals, and government publications to understand the possible connection between Metro ridership and the number of vehicles being registered during the same timeline. After this, using the yearly ready-reckoners published by PPAC, an effort was made to understand and hence establish a relationship between oil sales and the sales tax/VAT collected by the petroleum sector of Delhi. The data was analysed using Excel to identify trends in Metro ridership, vehicle registrations, and VAT collections. External factors like policy changes and the pandemic were considered to minimise confounding effects. The graphs present a clear view of all the relations and hence, provide the basis for the conclusion. This methodology helps in reaching a broader conclusion and establishing a clear relation between the factors taken. While the study relies on secondary data, the absence of primary survey data on commuter preferences limits the analysis.

4. FINDINGS & DISCUSSION

4.1. Impact on Vehicle Registrations

The data collected from the Economic Surveys of Delhi (2013-14 to 2023-24) in regard to the metro ridership and number of vehicles registered (cars and jeeps) is as given in Table 4.1.1.

Figure 4.1.1 in the next page shows that the average daily ridership and number of vehicle registrations both increased from 2013-14 to 2019-20. After that, there is a sharp decline in daily average ridership in 2020-21 while the number of vehicles registered kept increasing where one of the reasons might be the COVID-19 pandemic. People at this time were either working from home, or if they were travelling to work, they preferred private vehicles rather than

public modes of transport. According to Subbarao & Kadali, 2021 “The COVID-19 pandemic has significantly affected the PT system, including revenue and ridership.” This shows that the pandemic, not only reduced the ridership for public transport but also, as a result, has made running public transport facilities more expensive.

Another study done by Das et al., 2021 shows that while there has indeed been a shift towards cars and private transport during the Pandemic there are certain steps that can be undertaken to minimise the ill effects of these changes. Also, they observed that while the older demographic might prefer cars, the younger audience is still biased towards public transport due to various reasons like the unavailability

Table 4.1.1: *Average Daily Metro Ridership and Vehicle Registrations (2013-23)*

Year	Average Daily Ridership	% Change in Average Daily Ridership	No. of Vehicles Registered	% Change in No. of Vehicles Registered
2013-14	22,04,908	-	26,25,250	-
2014-15	24,02,850	8.98%	27,90,566	6.30%
2015-16	26,15,050	8.83%	29,86,579	7.02%
2016-17	28,00,792	7.10%	31,52,710	5.56%
2017-18	25,87,271	-7.62%	32,46,637	2.98%
2018-19	25,93,090	0.22%	32,49,670	0.09%
2019-20	27,80,000	7.21%	33,11,579	1.91%
2020-21	8,78,000	-68.42%	33,84,736	2.21%
2021-22	25,16,068	186.57%	20,76,113	-38.66%
2022-23	46,26,592	83.88%	20,71,115	-0.24%

Source: *Economic Survey of Delhi (2013-14 to 2023-24)*,
Planning Department, Government of NCT of Delhi

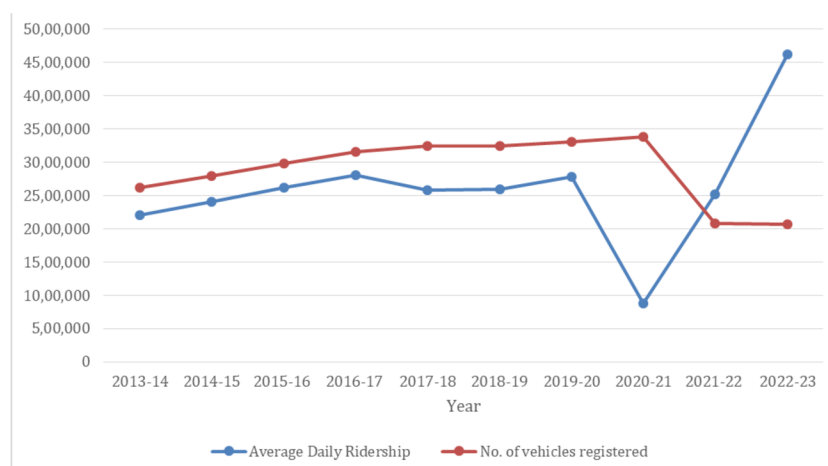
of cars or not possessing a driving licence. They also observe that many might still prefer public transport for shorter trips (>15 minutes), but as the trips get longer, more and more people prefer cars. This shows the need to make public transport both more comfortable and more economical for longer trips in order to capture this demographic as well.

After 2020-21, we see a very sharp rise in average daily metro ridership while car registrations fall drastically. This also shows connections with the aftereffects of the pandemic. The pandemic saw the unemployment of people in large numbers. This basically reduced the disposable income for many households. This had two main results. First, people started preferring the cheaper public transport rather than private transport. Along with this, people also strayed away from purchasing cars, etc., because of the large cost of not only buying them but also running and maintaining them.

According to Tripathi & Ahuja, 2022, the pandemic has greatly increased the income inequality in India and has pushed many to extreme poverty. This aligns with the previous assertion that the pandemic reduced the disposable income in the hands of Indian consumers. This hence worked in favour of public transport and increased the ridership.

After this, it is seen that while Metro's average daily ridership saw an even more upshot, the number of vehicle registrations dwindled further. This can be seen as a positive shift towards public transport and more and more people choosing Metro over private vehicles. Therefore, in the past few years, the average daily ridership has gone up while vehicle registrations have gone down, from which it can be concluded that it is in recent years that Metro ridership has led to a decline in car usage. Between 2021-22 and 2022-23, Metro ridership increased by 83.85%, while vehicle registrations declined marginally by 0.24% highlighting a substantial modal shift in commuting behaviour.

Figure 4.1.1: *Trends in Metro Ridership and Vehicle Registrations (2013-23)*



Source: *Economic Survey of Delhi (2013-14 to 2023-24)*, Planning Department, Government of NCT of Delhi

4.2. Impact on VAT Revenue

The data collected from the Economic Surveys of Delhi (2013-14 to 2023-24) and the PPAC in regard to the sale of petroleum, vehicle tax and sales tax/VAT collection by the petroleum sector of Delhi is as below:

Table 4.2.1: Taxes on Motor Vehicles, HSD Sales, and VAT Revenue in Delhi (2013-23)

Year	Taxes on Motor Vehicles (in Rs crores)	% Change in Taxes on Motor Vehicles	HSD Annual Industry Sales ('000 metric tonnes)	% Change in HSD Annual Industry Sales	Collection of Sales tax/VAT by the petroleum sector (in Rs crores)	% Change in Collection of Sales Tax/VAT by the petroleum sector
2013-14	1409.27	-	1129.19	-	3108	-
2014-15	1558.83	10.61%	1268.81	12.36%	2,797	-10.01%
2015-16	1607.01	3.09%	1508.28	18.87%	3,158	12.91%
2016-17	1808.8	12.56%	1267.47	-15.97%	3,589	13.65%
2017-18	2115.76	16.97%	1193.78	-5.81%	3,930	9.50%
2018-19	2054.75	-2.88%	1020.83	-14.49%	4,379	11.42%
2019-20	1948.09	-5.19%	835.26	-18.18%	3832.8	-12.47%
2020-21	1676.18	-13.96%	499.194	-40.23%	2652.6	-30.79%
2021-22	1955.68	16.67%	597.468	19.69%	3658.7	37.93%
2022-23	2884.08	47.47%	662.021	10.80%	4398.1	20.21%

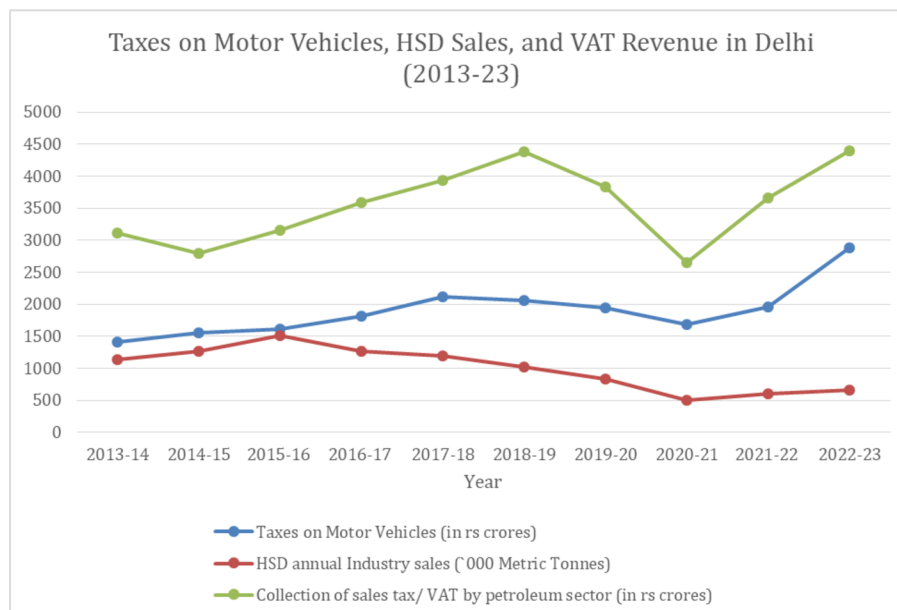
Source: Economic Survey of Delhi (2013-14 to 2023-24), Planning Department, Government of NCT of Delhi and Yearly Ready Reckoners (2013-14 to 2023-24), Petroleum Planning and Analysis Cell, Ministry of Petroleum and Natural Gas, Government of India

From the above data it is seen that taxes on motor vehicles follow a similar trend to that of vehicle registrations till 2020-21. According to the Ministry of Road Transport and Highways, Government of India, "In India, motor vehicle tax is imposed by state governments. The motor vehicle tax is calculated on the basis of various factors including engine capacity, seating capacity, unladen weight, laden weight and cost price of the vehicle" (Ministry of Road Transport

and Highways). As the number of vehicle registrations increased till 2019-20, the tax on motor vehicles also on average, increased or decreased by very small margins. But the major conflict arises when the vehicle registration falls but the tax on motor vehicles is actually seen rising from 2021 to 2022. This can be attributed to various reasons, including but not limited to fluctuating tax rates and the dynamic nature of the tax itself as defined by the MoRTH.

When HSD (High Speed Diesel) annual industry sales and collection of Sales Tax/VAT by the petroleum sector in Delhi are compared, a relation can be established, especially in the 2018-19 to 2022-23 period. The tax on fuel remained the same up till 2020 at 27% VAT (According to the Economic survey of Delhi 2018-19 to 2019-20). This along with the fall in HSD sales is visible in the graphs and hence can be concluded that as sales fell the tax collection also fell. But in 2020-21 to 2021-22 the tax has risen to 30% VAT (according to the Economic survey of Delhi 2020-21 to 2021-22). So even though sales have increased just marginally which point towards greater dependence on public transport, the tax revenue of the government has actually experienced an upshot. This also coincides with the reduction in vehicle registrations during this period. Between 2021-22 and 2022-23, while HSD sales increased by only 10.80%, the VAT revenue collected from the petroleum sector surged by

Figure 4.2.1: Taxes on Motor Vehicles, HSD Sales, and VAT Revenue in Delhi (2013-23)



Source: Economic Survey of Delhi (2013-14 to 2023-24), Planning Department, Government of NCT of Delhi and Yearly Ready Reckoners (2013-14 to 2023-24), Petroleum Planning and Analysis Cell, Ministry of Petroleum and Natural Gas, Government of India

20.21%, indicating that higher tax rates, rather than fuel consumption, were the primary driver of revenue growth. Hence, we can see that by increasing the tax rates the Government of Delhi was not only able to gain higher revenue but also discourage the purchase of cars, which can be noted as a win-win situation.

From the above analysis it is clear that the government is able to increase its revenue via cars even though the average metro ridership has actually increased thanks to its higher tax rates.

5. LIMITATIONS & ADDITIONAL INFLUENCING FACTORS

While the above data indicates a correlation between increased Metro ridership and a decline in private vehicle registrations, it is important to point out that these patterns may be shaped by some external factors. This section outlines those other factors like, policy developments, infrastructural changes, and economic considerations that could have independently or jointly contributed to the observed shifts.

5.1. Post-COVID Metro Expansion

Post 2020, the DMRC has undertaken various expansionary projects for the Delhi Metro to increase connectivity. According to the Delhi Metro Rail Corporation LTD., in the 4th phase of metro expansion, the Delhi Metro has completed several key extensions. The completion of the Pink Line corridor (Majlis Park-Shiv Vihar) and the recent expansion on the same line (Majlis Park-Jagatpur Village), along with expansions on the Airport Express Line have improved connectivity. The plan for 2 new lines which are the Brown Line (Lajpat Nagar-Saket G Block) and the Golden Line (Aerocity-Tughlakabad), prove that DMRC aims to provide connectivity to every part of Delhi. The Metro has become a better commuting option for those who previously relied on cars or buses by expanding access to areas like Najafgarh, Bahadurgarh, and Ballabgarh. It has also reduced transfer times between key interchange stations. Therefore, increased Metro availability and improved service frequency played an important role in making public transport a more attractive choice.

5.2. Delhi Government's Policy of Scrapping Old Vehicles

Another plausible reason for the decline in vehicle registrations could be the Delhi government's vehicle scrappage policy. According to the Transport Department, Government of NCT of Delhi, 2025 the government began mandating the deregistration of older vehicles, specifically petrol vehicles older than 15 years and diesel vehicles older than 10 years. The policy gained traction post 2021 when the Delhi government started with stricter implementation measures, including restrictions on re-registering and automatic de-registrations on the "Vaahan" portal.

This policy had dual effects. First, it directly reduced the number of vehicles eligible for re-registration which lowered the overall registration counts. Second, it served as a deterrent against purchasing new private vehicles, as people worried about long-term ownership restrictions and compliance burdens. In this context, the Metro emerged as a stable and long-term commuting alternative. The scrappage policy, therefore, likely reinforced the behavioural shift toward public transport.

5.3. Other Influencing Factors

While the above data shows a correlation between increased Metro ridership and a fall in private vehicle registrations, it is important to point out that these patterns may be shaped by some external factors. This tendency may have been affected by a number of factors which include rising fuel prices, decreased disposable income after the COVID-19 pandemic, the scrappage policy of the Delhi Government that targeted older cars, and shifting societal attitudes regarding public transportation. Because of this, the results are suggestive rather than conclusive, but they do offer insightful avenues for further causal investigation and research.

Between 2019–20 and 2022–23, retail inflation rate increased from 4.1% to 6.7% (Reserve Bank of India, 2023). This coincided with a 32% rise in average retail fuel prices (Petroleum Planning & Analysis Cell, 2023). Both of these combined likely contributed to a shift in consumer behaviour since higher fuel costs and reduced real purchasing power made private transport relatively less affordable. While this study focuses primarily on ridership and

fiscal indicators, these inflationary and price-related dynamics strengthen the conclusion that economic pressures have reinforced public transport preference in recent years.

6. CONCLUSION

From the above data, it is noted that in recent years, while there has been an uptick in the average daily Metro ridership, at the same time, it is also coupled with a decline in the number of vehicle registrations. While the data for taxes on motor vehicles does not give us a clear idea to establish an exact relationship, the data on the sale of HSD and the collection of Sales Tax/VAT fill the void. The data clearly shows

how an increase in the tax rate has not only led to an increase in government revenue but has also done so while ensuring that the use of oil doesn't go up too much. At the same time, we also see that this Sales Tax/VAT is also one of the reasons that has contributed to the fall in vehicle registrations. In conclusion, Metro ridership has significantly contributed to reducing car usage which was aided by the government's strategic increase in petroleum-related tax rates. These taxes also played a major role in increasing government revenue. To keep these trends going, policymakers could explore further expansion of the Metro connectivity. Also, incentivising public transport usage and investing in renewable energy for public transit systems.

REFERENCES

1. Das, Sanhita, Alice Boruah, Arunabha Banerjee, Rahul Rainier, Suresh Nama, and Akhilesh K. Maurya. 2021. "Impact of COVID-19: A radical modal shift from public to private transport mode." *Transport Policy* 109 (August): 1-11. <https://www.sciencedirect.com/science/article/pii/S0967070X21001438>.
2. Delhi Metro Rail Corporation (DMRC). n.d. "The Network Map." Delhi Metro Rail Corporation (DMRC) | Official Website. Accessed January 22, 2025. https://delhimetrorail.com/network_map.
3. Delhi Metro Rail Corporation LTD. n.d. "Phase-IV." Delhi Metro Rail Corporation. <https://delhimetrorail.com/pages/en/phase-iv>
4. Ministry of Road Transport and Highways. n.d. "What is Motor Vehicle Tax and how it is decided?" Parivahan Sewa. Accessed January 22, 2025. <https://parivahan.gov.in/parivahan/en/content/what-motor-vehicle-tax-and-how-it-decided>.
5. Petroleum Planning & Analysis Cell, Ministry of Petroleum & Natural Gas, Government of India. Ready Reckoner, March 2024 (Version 01). New Delhi: Petroleum Planning & Analysis Cell, December 26, 2023. PDF file. https://ppac.gov.in/download.php?file=rep_studies/1717754089_Ready_Reckoner_March_2024_Ver01.pdf.
6. Reserve Bank of India. Annual Report 2022-23, Appendix Table. Mumbai: Reserve Bank of India, May 30, 2023. PDF file. https://rbidocs.rbi.org.in/rdocs/AnnualReport/PDFs/APPENDIXTABLE_1E6FDF84C636C43B2BC094727AD4D84AC.PDF
7. Sharma, Niraj, Anil Singh, Rajni Dhyani, and Shweta Gaur. 2014. "Emission reduction from MRTS projects – A case study of Delhi metro." *Atmospheric Pollution Research* 5, no. 4 (October): 721-728. <https://www.sciencedirect.com/science/article/pii/S1309104215302804>.
8. Subbarao, Saladi S., and Raghuram Kadali. 2021. "Impact of COVID-19 pandemic lockdown on the public transportation system and strategic plans to improve PT ridership: a review." *Innovative Infrastructure Solutions* 7, no. 1 (November): 97. <https://link.springer.com/article/10.1007/s41062-021-00693-9>.
9. Transport Department, Government of NCT of Delhi. 2025. "GUIDELINES FOR SCRAPPING OF MOTOR VEHICLES IN DELHI, 2018 | Transport Department." Delhi Transport Department. <https://transport.delhi.gov.in/it/guidelines-scrapping-motor-vehicles-delhi2018>.
10. Tripathi, Veena, and Deepti Ahuja. 2022. "Poverty and Income Distribution Amid Covid-19: An Analysis of India." *Future of Work and Business in Covid-19 Era*, 73-80. https://link.springer.com/chapter/10.1007/978-981-19-0357-1_7.