Metro System Performance

Analysis for Datathon

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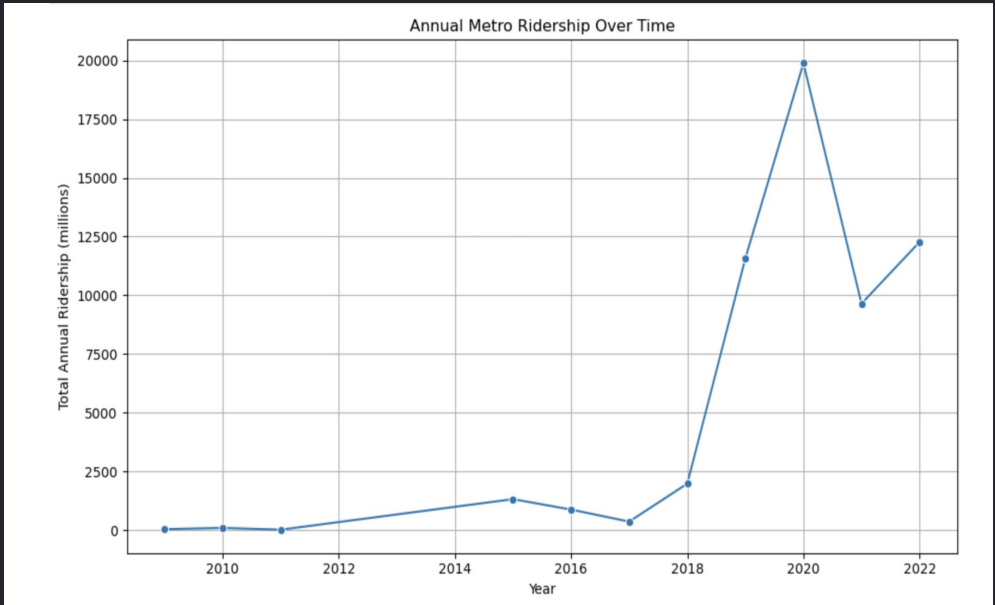
01

Descriptive Statistics

Visualizing and interpreting trends present

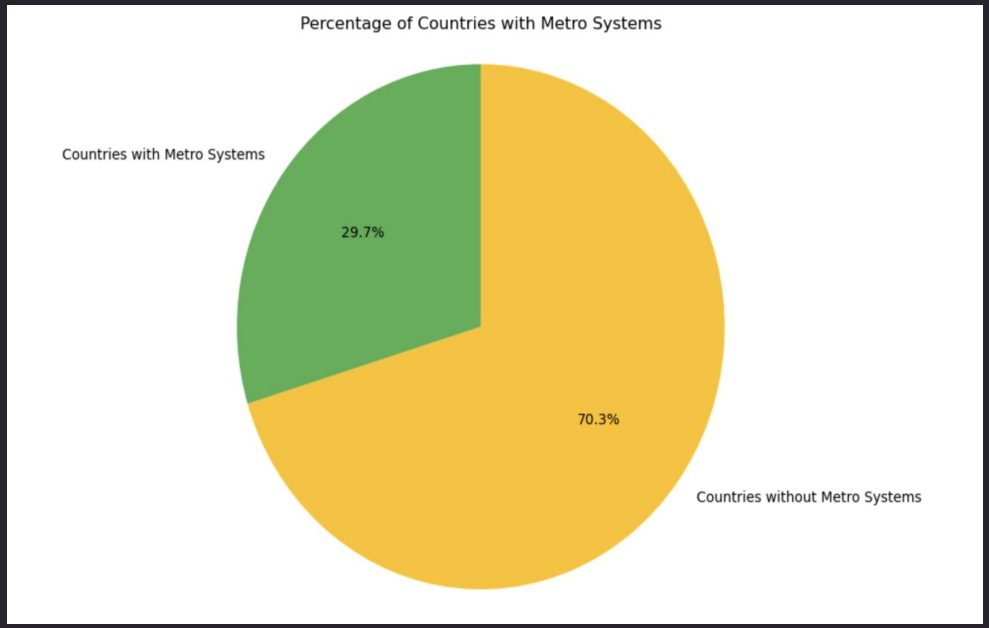
Annual Metro Ridership Over the Years



Metro Ridership (in millions)

- A steady increase in ridership from 2010-2018, likely due to population growth or expanded metro services.
- A sharp increase in ridership up to 2020,
- The sharp decline post-2020 aligns with the impact of the COVID-19 pandemic,
- The uptick in ridership from 2021 indicates a recovery

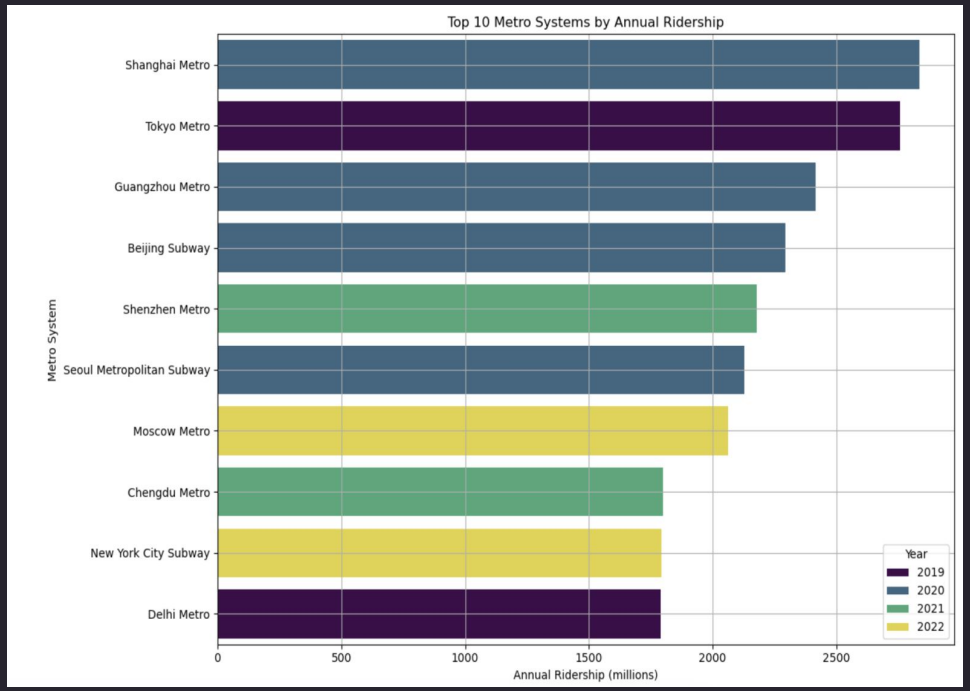
Metro-adopting Nations



Countries with Metro System

- Out of a total of 195 countries, 58 (or 29.7%) have metro systems, while 137 countries (or 70.3%) do not.
- The majority of countries globally, particularly those with smaller or less developed urban areas, do not yet have the infrastructure for a metro system.
- Reflects uneven distribution of mass transit options worldwide, as metro is limited to densely populated or economically advanced nations.

Top 10 Metro Systems Globally



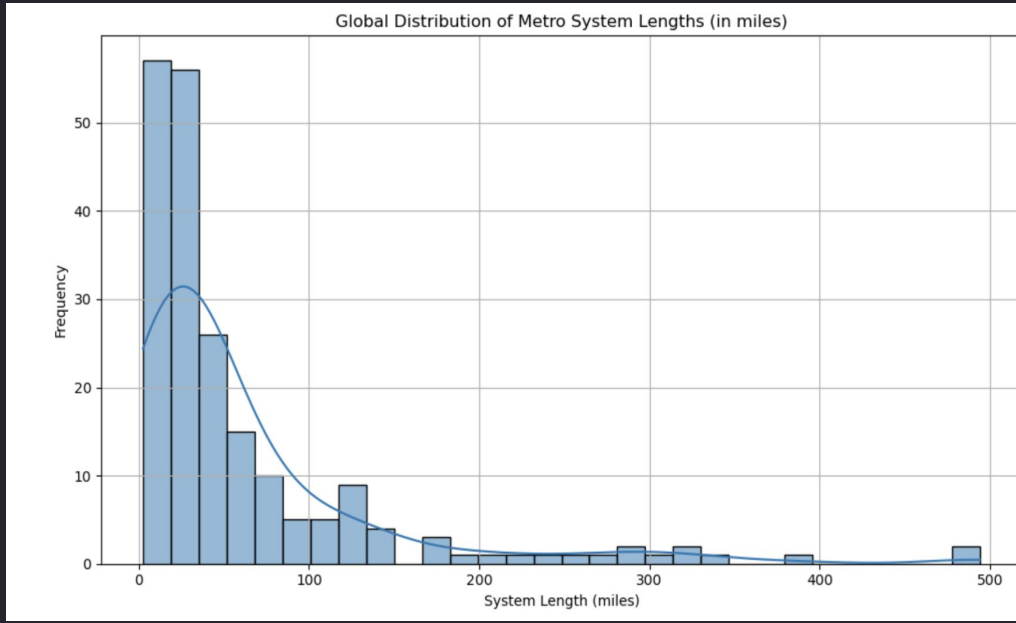
Top 10 Metros ~ Annual Ridership

- Shanghai is the busiest, with 2600 million riders in 2021.
- Tokyo follows closely, reaching 2550 million riders in 2019.
- The next two systems after Tokyo are also based in China, reflecting the dominance of Chinese metros in global urban transit

Distribution of Metro System Lengths

Metro System Length (miles)

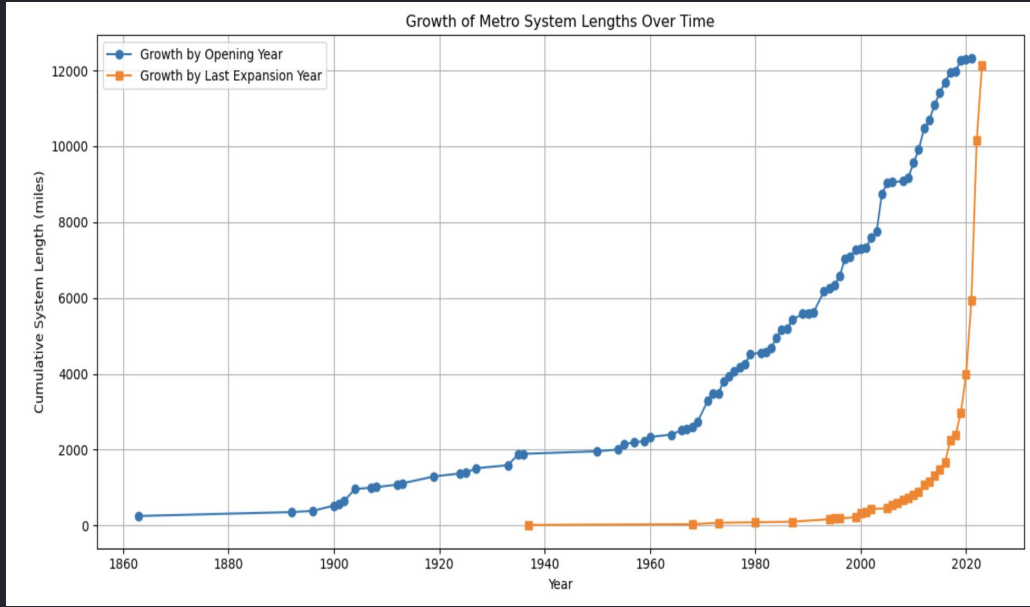
- Most countries have relatively short or no metro systems at all, with the peak frequency occurring near zero miles, underscoring that many countries still lack this infrastructure.
- A significant number of countries with metro systems have lengths between 50 and 150 miles, indicating smaller networks in many cities.
- Beyond 200 miles, we see a long tail representing a small number of cities with expansive systems, extending up to 400 or 500 miles.
- This pattern emphasises the global disparity in metro system development, with only a few major cities having extensive networks.



Growth of Metro System Lengths

Opening Year vs Last Expansion Year

- Linear growth by opening year suggests that metro systems have been consistently established over the decades, with the most significant growth occurring between 1980 and 2020.
    - Reflecting the need for efficient mass transit systems in rapidly growing cities during this period.
- The growth by expansion year follows a more logarithmic pattern, with no substantial expansions until after 2000.
- The sudden and sharp rise in expansions after 2003 suggests that cities with existing metro systems began heavily investing in expanding their networks around this time.
    - Potentially due to rising population densities, economic growth, or policy shifts.

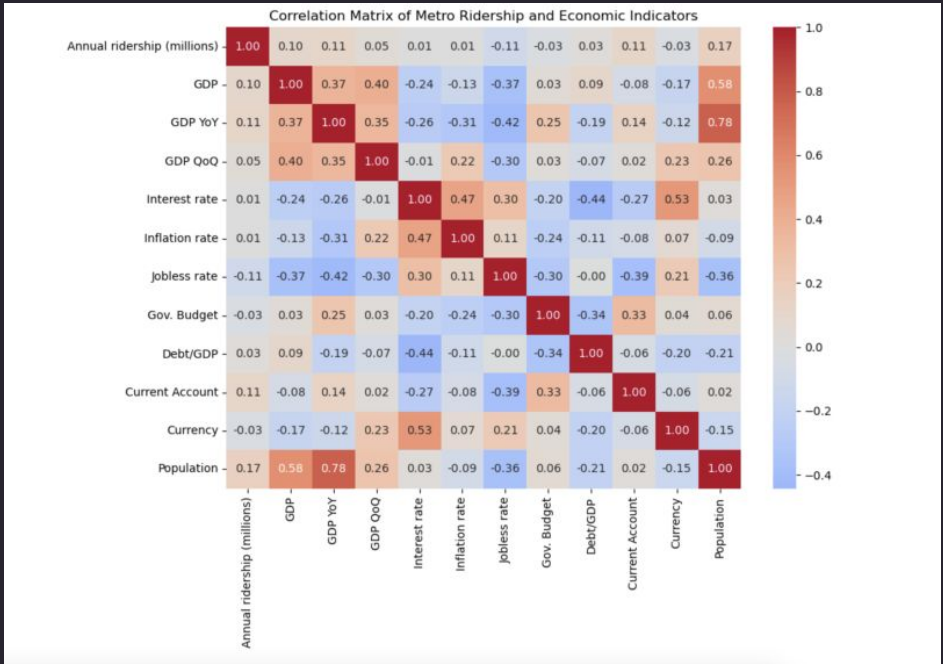


02 Predictive Model

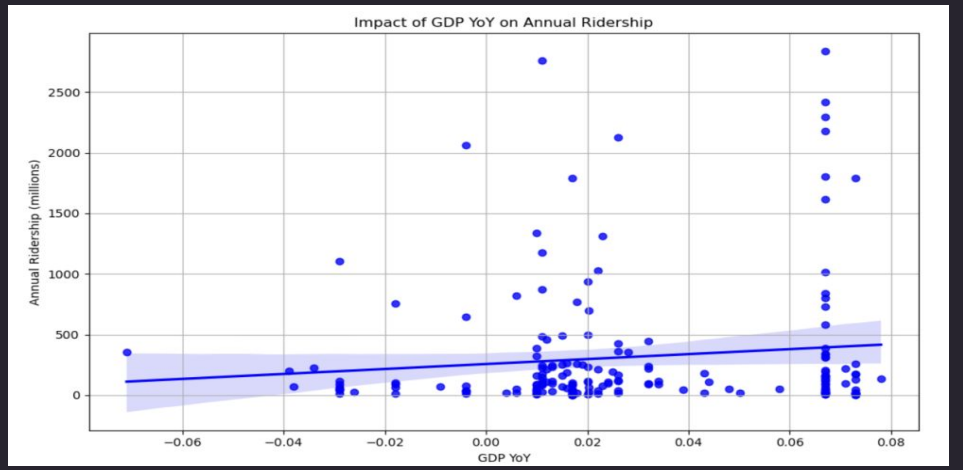
Forecasting future ridership

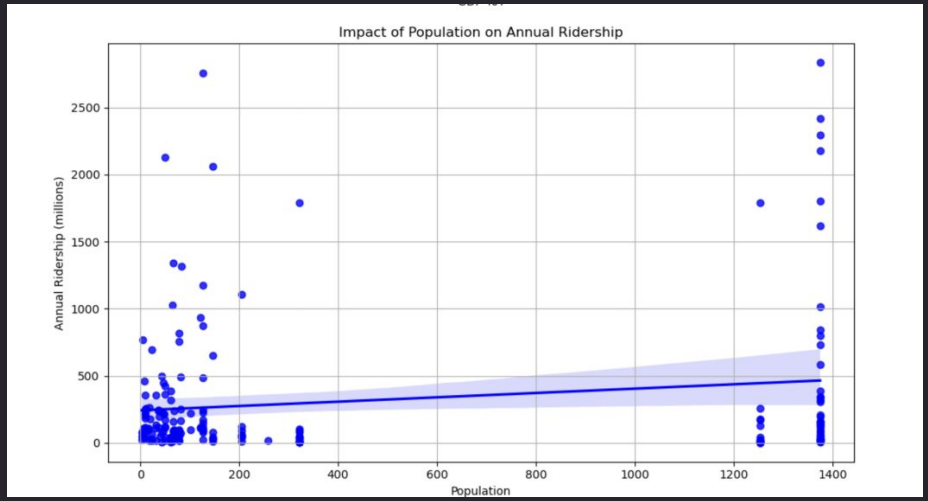
CORRELATION

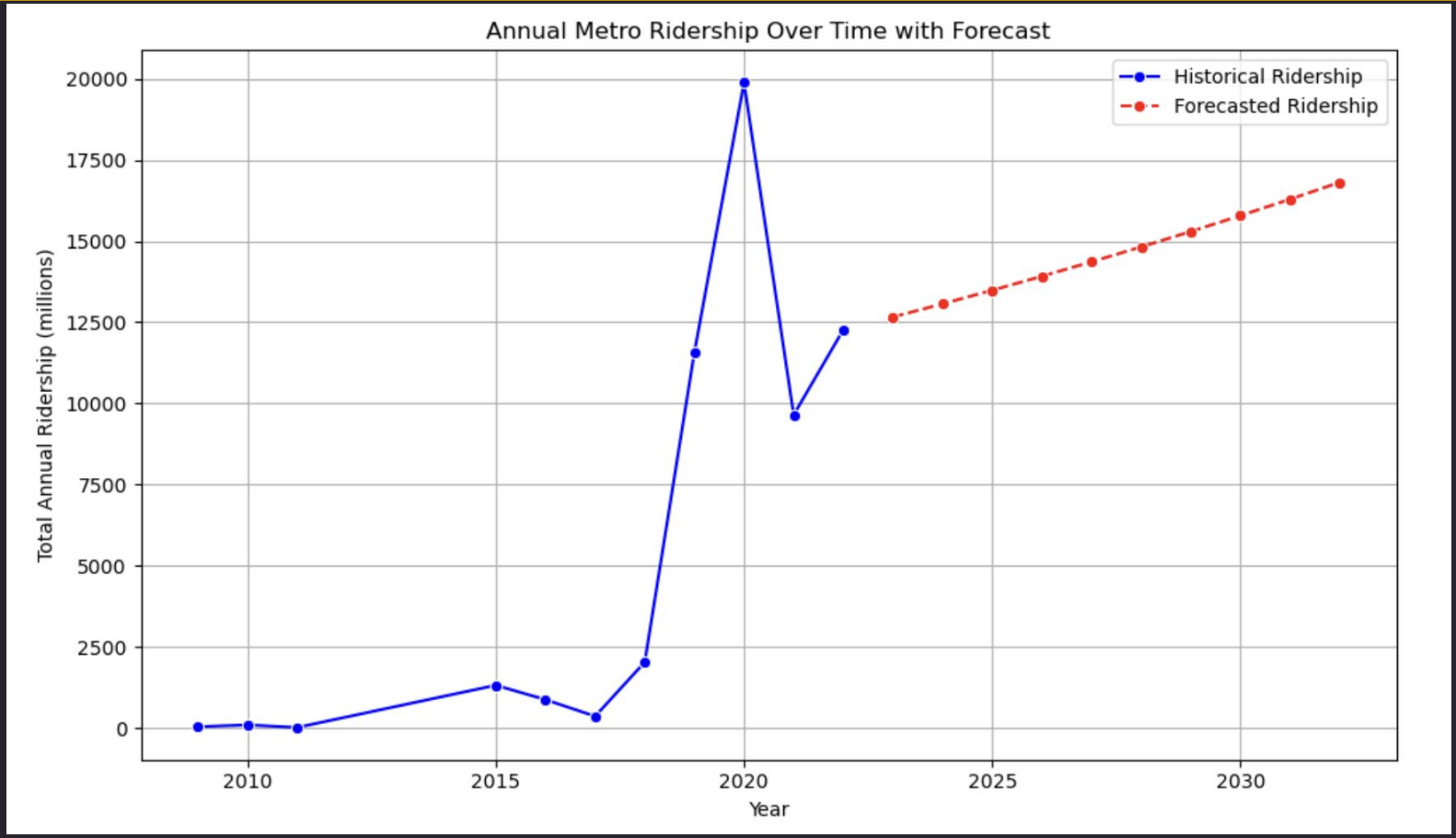
- Based on the correlation heat map, Annual ridership has highest correlation with GDP YOY and Population.



Assessing Variable Relationships






Annual Metro Ridership Over Time with Forecast
Historical Ridership
Forecasted Ridership
Total Annual Ridership (millions)
20000
17500
15000
12500
10000
7500
5000
2500
0
2010
2015
2020
2025
2030
Year

Actionable Recommendations

Metro Network Expansion

Focus on expanding metro lines in densely populated areas and regions with growing economic activity to accommodate the projected increase in demand.

Replace Aging Trains

Upgrading older trains that require frequent maintenance with modern, more reliable trains can enhance service reliability, reduce operational downtime, and accommodate rising ridership.

Optimize Train Schedules

Adjust schedules dynamically based on real-time ridership data to reduce congestion during peak hours and ensure sufficient trains during off-peak times, balancing demand and capacity.

Mobile Application

Create or improve existing mobile apps to provide real-time updates on delays, schedules, links to other transportation systems and alternative routes, enhancing rider convenience and experience.

Smart Fare Pricing

Utilize dynamic pricing models based on factors like demand, time of day, and passenger data to optimize revenue and balance ridership across peak and non-peak hours and improve capacity management.

AI-Powered Maintenance

AI-powered sensors and predictive maintenance systems to monitor the health of metro infrastructure and trains, reducing downtime and preventing delays by addressing issues before they escalate.

Thank you for listening!