Master's Thesis of Jad Ezzeddine

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The Difference-in-Differences (DiD) analysis quantified the causal effect of cycling lane expansion on traffic congestion across Paris, comparing districts with significant cycling infrastructure development to those with limited changes from 2014 to 2023. Results indicated a statistically significant yet moderate relationship, with each additional kilometre of cycling lane correlating with a reduction in traffic flow of approximately 1.21 vehicles per hour. Notably, this modest impact suggests that while cycling infrastructure has contributed positively to reducing vehicular traffic, other influencing factors have played substantial roles as well. These include enhancements in public transportation, shifts in travel behaviours due to increased telecommuting, changes in urban economic activity, and general societal trends towards sustainable mobility. Consequently, while cycling infrastructure expansion is an essential element of urban mobility policies, it must be complemented by additional, integrated strategies to realize more significant congestion alleviation.



Emission Development in Paris (2004-2022)

The ARIMA time-series forecasting model was employed to predict Paris' traffic flow for the year 2023 based on historical data from 2012 to 2019, assuming no significant policy interventions occurred. The comparison between the ARIMA forecast and actual observed data revealed a substantial reduction in real-world traffic flow—ranging between 12% to 15%. This substantial decrease is primarily attributable to mobility policies and cycling infrastructure expansion under "Plan Velo," aimed at promoting sustainable transportation options. However, despite this marked reduction in overall vehicle numbers, the congestion levels within the city have not significantly improved. This intriguing observation underscores the multifaceted nature of urban congestion, where factors beyond simple traffic volumes—such as road space reallocation, behavioural adaptation of users, urban structure, and management policies—play critical roles in shaping traffic conditions.



The results of this research demonstrate substantial environmental and mobility improvements directly linked to Paris' mobility policy initiatives. Between 2004 and 2022, the city achieved remarkable reductions in emissions, including a 36.21% decline in overall GHG emissions, and significant decreases in key pollutants such as nitrogen dioxide (NO₂) by 50%, PM2.5 by 47.62%, and PM10 by 38.71%. Additionally, the modal share for cycling showed promising growth, with forecasts suggesting it will reach between 20% and 35% by 2030, reflecting a substantial shift towards sustainable transport modes. Nonetheless, considerable spatial disparities remain evident, particularly in cycling infrastructure investment across districts, largely driven by historical preservation constraints and urban morphological differences. Moreover, complementary strategies, including public awareness campaigns, behavioural incentives, and comprehensive safety improvements, are essential to support and sustain the shift towards environmentally friendly transport modes in Paris and similar urban contexts.