Analysising the Impact of Vehicle Type on Air Emission in Netherlands

1. Introduction

1.1 Main Question:

Which type of vehicle contributes the most to air emissions, and what is the highest emission type in the Netherlands?

1.2 Description

This project aims to analyze the relationship between different types of vehicles and their respective contributions to air emissions in the Netherlands from 2017 to 2020. The goal is to identify which vehicle types (e.g., cars, trucks, buses) are the largest contributors to air pollution and determine the most prevalent type of emission (e.g., CO2, NOx, PM10) during this period. By examining emission trends and vehicle usage data, we aim to provide insights for policymakers and stakeholders to develop strategies for reducing air pollution and improving air quality in the Netherlands.

2. Used Data

2.1 Data Sources

Datasource 1: Emissions to air on Dutch territory; road traffic

URL: https://opendata.cbs.nl/statline/#/CBS/en/dataset/85347ENG/table
Data Type: CSV
Description: Data on air emissions in the Netherlands from road traffic, including foreign vehicles, and average emissions per vehicle kilometre, covering various sources of emissions (2017-2022).
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Datasource 2: Vehicle kilometres goods vehicles; kilometres, vehicle weight

URL: https://opendata.cbs.nl/statline/#/CBS/en/dataset/84651ENG/table
Data Type: CSV
Description: Data on total and average annual kilometres of goods vehicles in the Netherlands, segmented by vehicle origin, territory, type, construction year, and weight (2015-2020).
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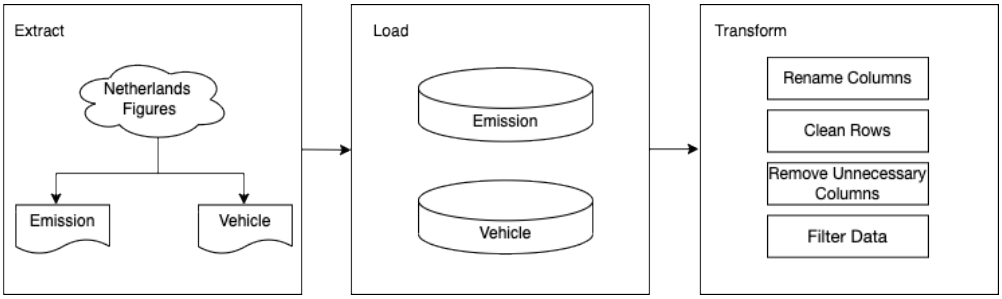
2.2 Data Pipeline

download_csv_from_url(url): Downloads a CSV file from a given URL using Selenium WebDriver.
read_emission_csv(): Reads the first CSV file starting with "Emissions" from the download directory.
read_vehicle_csv(): Reads the first CSV file starting with "Vehicle" from the download directory.
load_to_database(df, table_name): Loads a DataFrame into a specified table in the SQLite database.
run_pipeline(): Orchestrates the entire process for both emissions and vehicle datasets.



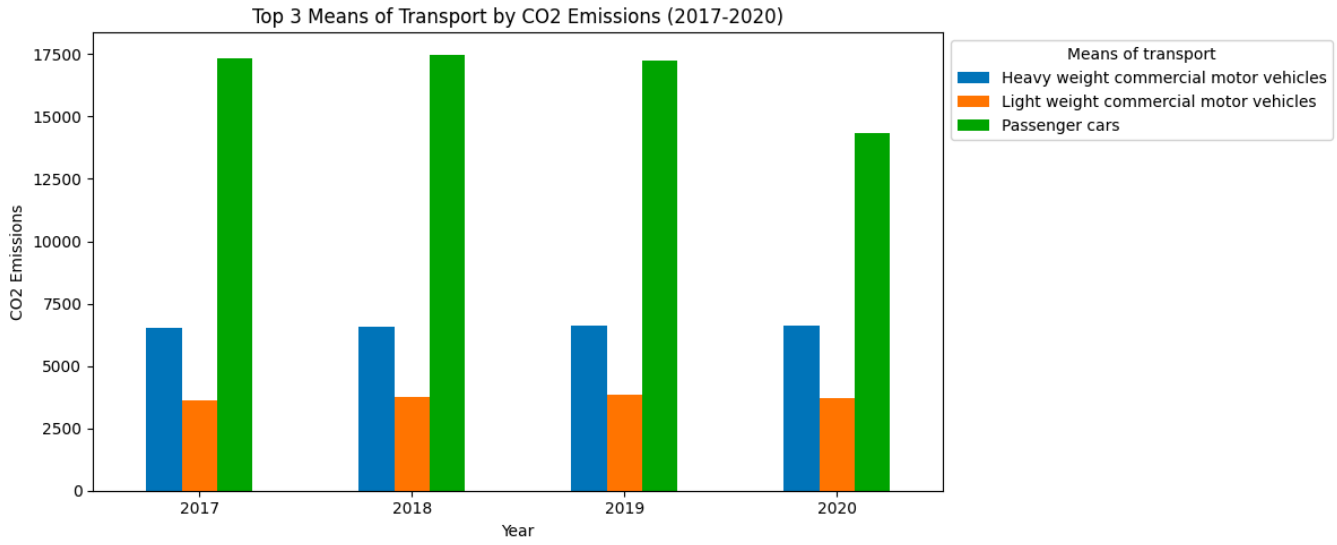
2.3 Data Preprocessing

Load Data: Read CSV, skip first 3 rows.
Rename Columns: Adjust column names for clarity.
Clean Rows: Remove header and footer rows, reset index.
Remove Columns: Drop irrelevant 'Fleet' columns.
Clean 'Period': Strip asterisks, convert to numeric.
Filter Data: Select years 2017-2020.
Rename Columns: Simplify column names by extracting relevant text.

3. Analysis

3.1 Which type of vehicle contributes the most to air emissions

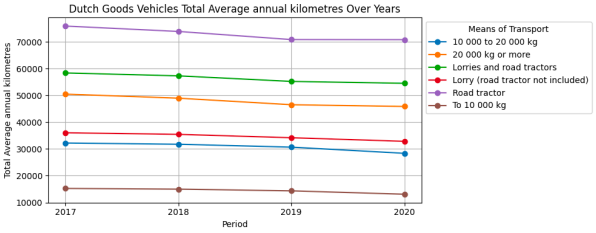
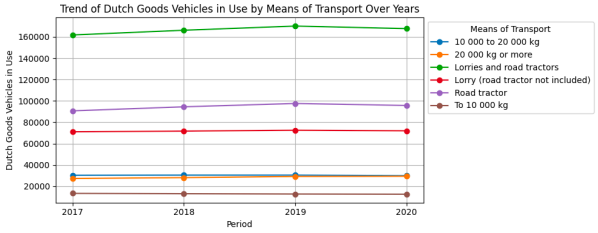
Passenger cars are the leading contributors to air emissions, surpassing the second-ranking source by more than double. Unfortunately, detailed data on passenger cars is unavailable for various reasons. However, the combined emissions from the second and third top contributors also constitute a significant figure, which are heavy or light-weight commercial motor vehicles. Therefore, this analysis aims to investigate which heavy or light-weight commercial motor vehicles are the primary contributors to air pollution.



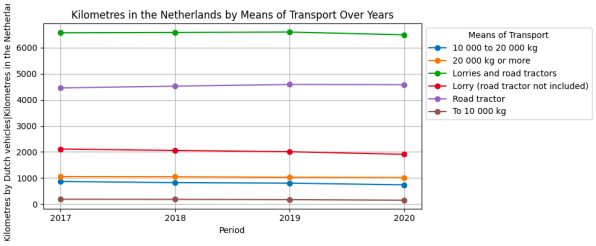
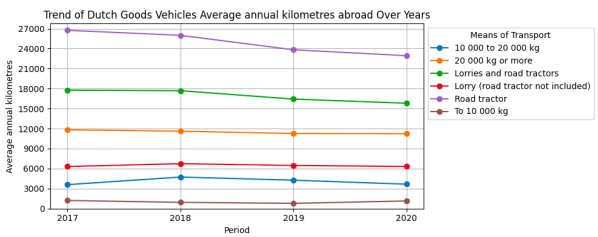
Another constraint is only vehicle kilometers are available for commercial motor vehicles without detailed emission numbers. Nevertheless, vehicle kilometers and emissions are highly correlated, making it worthwhile to

investigate which commercial motor vehicle has the highest vehicle kilometers and then infer its emissions. Vehicle kilometers are composed of three parts: total average annual kilometers, total kilometers in the Netherlands, and kilometers abroad.

The figure below shows the total average annual kilometers traveled by different commercial motor vehicles from 2017 to 2020. Road tractors, which contribute the most to air emissions, recorded the highest average distance of 75,874 km in 2017. The number of vehicles in use remained relatively stable, with a slight increase from 2017 to 2019, followed by a slight decrease in 2020, returning to levels similar to those in 2017.

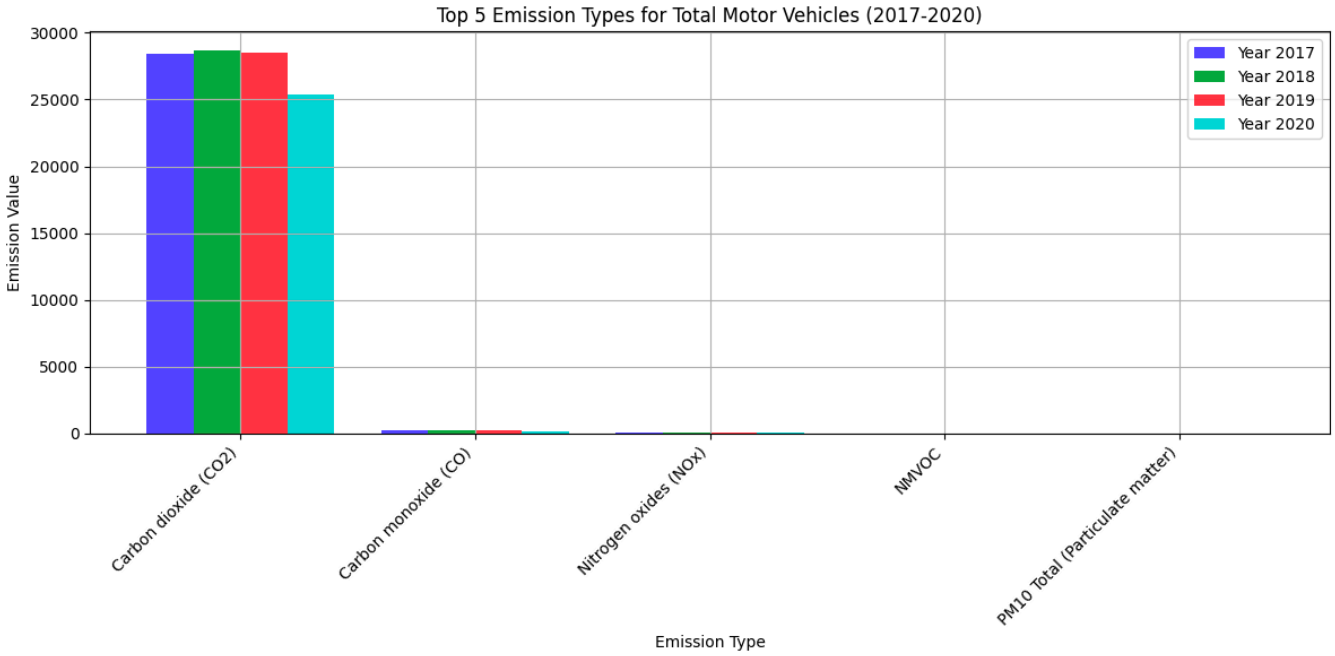
Vehicle Total Average Annual Kilometers	Amount of Vehicle in Use
	

In general, goods vehicles have shown a decrease in vehicle kilometers in recent years, possibly due to increasing environmental awareness. Among goods vehicles within the Netherlands, Lorries and road tractors have recorded the highest total vehicle kilometers, while Road tractors have the highest kilometers abroad.

Vehicle Kilometers within Netherland	Vehicle Kilometers Abroad
	

3.2 What is the highest emission type

The highest emission type is CO2 with an extremely high value. The slighlt decrease in 2020 might be due to the reducing vehicle kilometers.



4. Result

4.1 Conclusion

This analysis investigates the significant impact of heavy and light commercial vehicles on air emissions in the Netherlands between 2017 and 2020. Among these vehicles, road tractors emerge as the foremost contributor to air pollution, driven by their high vehicle kilometers both domestically and abroad. Despite limitations in detailed emission data, particularly for passenger cars, the study underscores the importance of addressing emissions from commercial vehicles to mitigate air pollution effectively.

4.2 Limitation

A major limitation of this study is the reliance on a limited dataset spanning only four years (2017-2020). This timeframe restricts the ability to draw definitive conclusions about long-term emission trends or predict future patterns accurately. Additionally, the absence of detailed emission data for passenger cars poses challenges in fully assessing their impact on air quality. Future studies should aim to incorporate more comprehensive datasets and extend the analysis over a longer period to provide robust insights for policy-making and environmental management.