Guidance n°1: national road vehicle fleet and registration for a bottom-up inventory

Introduction

Deriving the real vehicle fleet for a country is one of the first steps to calculate a bottom-up emission inventory as recommended by the Enhanced Transparency Framework of the UNFCCC.

Most countries have in the first instance often difficulties to derive their real vehicle fleet. This lies into the fact that the real fleet is based on registrations (vehicles added to the fleet) and scrappage (vehicles removed from the fleet). Data is often not properly registered by country authorities, especially scrappage data. There are low incentives for people to deregister their vehicle. Further issues include cars being imported/exported for tourism purposes either from nationals living part of the time abroad or for short/middle-stays length or non-declared car use.

We will first focus on how to compare fleet and new registrations within a country, which is result of the sum of the new registration and scrappage in the past (enabling to create a vehicle fleet model). In the next step, we will elaborate on possible workarounds to eliminate uncertainties linked to scrappage data, and vehicles not in use in the country.

The time period

Usually, the time period to cover is one year, from 01.01. to 31.12., i.e. all vehicles registered within one specific year. Alternatively, inventories cover one year starting from the middle of one year to the middle of the following year. Both approaches are possible.

How to classify vehicle categories

Vehicles must be classified to allow comparisons and to correlate with mileage and fuel economy data in the context of a bottom-up inventory. The EU provides a detailed and harmonised classification of vehicles based on the UNECE standards (categories named M1, M2, M3 etc.).

This classification forms a useful basis for harmonisation, but may be expanded in some countries where vehicles do not clearly fit within the proposed descriptions.

Four hints are provided below to help identify issues with vehicle stock and/or new registrations, as well as possible alternative source as workarounds.

Hint n°1: Compare the stock with the cumulative registration data.

$$Stock_{A_y} < Stock_{A_{y-1}} + Newreg_{A_y}$$

Where,

A: vehicle category

y: year

The stock at the end of a given year, e.g. $Stock_{2024}$, should be below the sum of the vehicle stock on 31.12.2023 ($Stock_{2023}$) and the new registrations in 2024 ($Newreg_{2024}$).

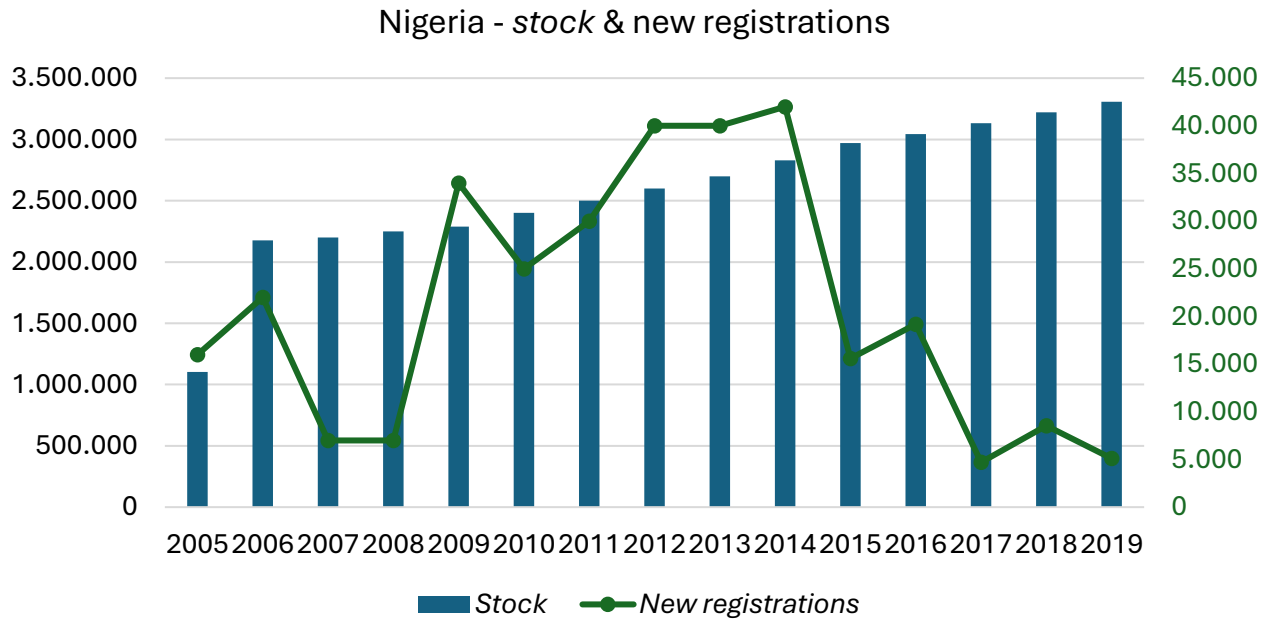
Example for Nigeria: The number of car new registrations seems not to correlate with the fleet data.

According to data provided by NationMaster on the TDC Platform, there were 3.133 million cars in Nigeria in 2017. In 2018, new registrations amounted to 8,550 cars in the same year, implying that the car stock end of 2018 should not exceed 3.142 million units. However, the dataset reports 3.221 million cars in 2018, implying that a minimum of 88,000 new cars should have been registered, 10 times more than officially registered. This reveals an inconsistency.

Looking at a larger time period, between the given stock in 2005 and the one in 2019 2.2 million cars were added to the stock over the period, i.e. a 200 % increase. However, only 300,150 new cars have been registered within these 14 years.

This shows that the data must be questioned and reviewed. A comparison with alternative data sources should be made to correct the data or their labelling (e.g. new registration are only new cars registered and do not content second-hand vehicles?), or at least clearly indicate its incompleteness.

It must be notified here that the statistics of the OICA "vehicle in use", which were probably used by NationMaster for stock data, are no longer available, only statistics to production and sales. According to analysis, the data for "New registrations" are sales data, as presented by the CEIC.



Source: Analysis based on data published on the TDC Platform (original source: NationMaster, OICA). Data can be visualised here. The axis on the right refers to new registration data (in green).

Hint n°2*: *Check the number of motor vehicle rate per inhabitant.

According to the ACEA, the European Union had an average of 570 passenger cars[1], 85 commercial vehicles and 1,000 buses per 1,000 inhabitants in 2024. Within the EU, Luxembourg leads with 680 cars per 1,000 inhabitants, while Latvia displays the lowest density with 410 cars per 1,000 inhabitants. Vehicle ownership rates vary significantly across other continents. According to an analysis of the Visual Capitalist (2020), the number of cars and commercial vehicles per 1,000 inhabitants in the world ranges as follows:

- Africa: from 56 in Nigeria to 490 in Libya
- Central and South America: from 88 in Peru to 311 in Argentina
- Asia/Oceania and Middle East: shows the highest diversity, with 20 in Pakistan, 223 in China, and 869 in New Zealand[2].

Nigeria data check: Based on car stock data, as published on the TDC with original source OICA and population data of the World Bank, the car motorization rate should be around 15 cars per 1,000 inhabitants in Nigeria (without LCV), not aligning with the Visual Capitalist, which original source of data seems to be the OICA as well. In absence of the original file on the OICA website (not available anymore), the hypothesis is made, that the 56 vehicles per 1,000 inhabitants refer to all vehicles and not only cars. Several sources seem to use "cars" as proxy for road vehicles, evaluated at around 12.5 million vehicles in 2018 as stated here by the Federal Road Safety Corp of Nigeria.

To ensure meaningful comparisons, the vehicle stock data for the analysed country can be benchmarked against countries on the same continent with similar levels of economic development. This approach helps verifying whether the scale of the vehicle stock is consistent with comparable nations.

If the recorded values are unusually high, this may indicate the presence of *"ghost vehicles"* – vehicles that remain registered in official records but are no longer in use or have been removed from the road without being deregistered.

[1] 578 according to Eurostat

[2] As data accessibility and calculation methodology diverge between sources, this type of data should be used as order of magnitude only.

Hint n°3: Check the database for vehicles above technical and expert based maximum use age.

The number of road vehicles in the stock should be below the sum of the new registrations of the last years, as deregistrations should occur in parallel.

$$Stock_{A_y} < \sum_{i=y-X}^{y} (\text{Newreg})_{A_i}$$

Where,

A: vehicle category

y: year of calculation

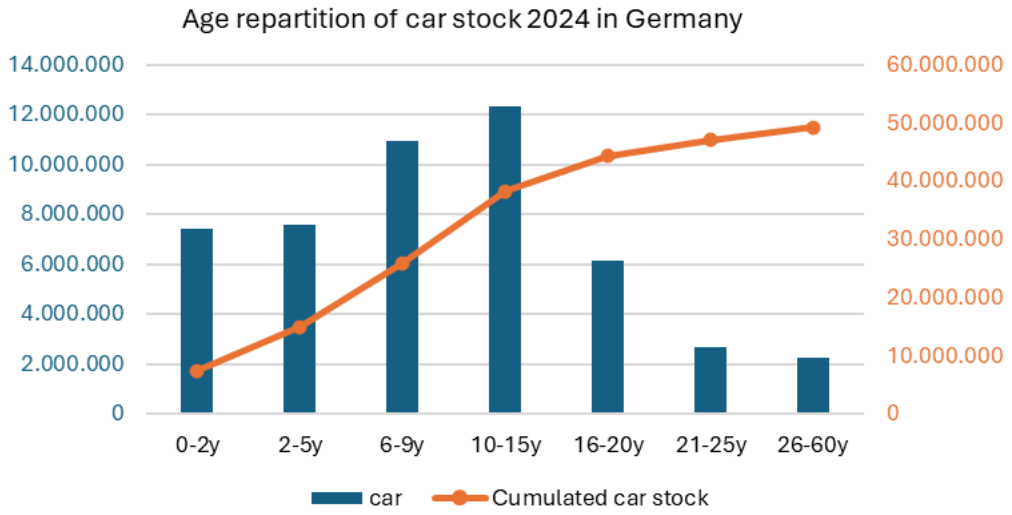
X: number of years to be cumulated (X= average vehicle age + x [3])

The value of X, similarly to the previous hints, depends on the country as well as the vehicle category and should be assessed case by case.

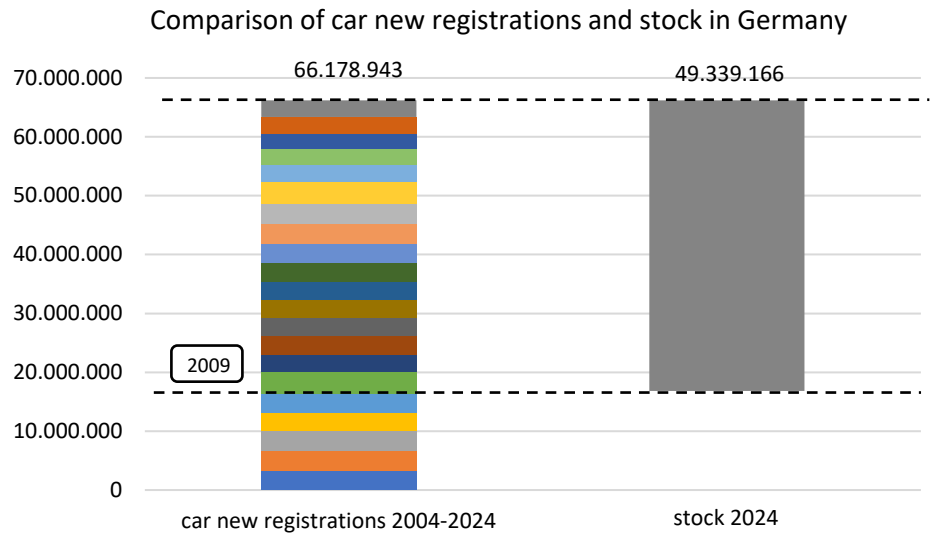
The value that X should take depends on the average vehicle age and the rate of deregistration in the given country, so basically except for vintage cars, most vehicles will not exceed a certain age and be slowly deregistered. If very old cars are found in great quantities in the stock data, it is an indication that ghost vehicles remain counted in the stock.

[3] X amounts for most industrial countries to *5 to 10 years*

In Germany, half of the stock is below 10 years of age, but almost 5 million cars remain in the stock which are more than 20 years old. This leads to the fact that the average age of cars is 10.6 years in 2024.



In Germany, the stock in 2024 equals the sum of new registrations since 2009 i.e. X = 16 years; where x=5,4 (X=10,6 (average age) + x)



Frost & Sullivan published a map of average vehicle age worldwide, showing average age spans from 5.4 years in Saudi Arabia to 18 years in Colombia; in Nigeria it is 16 years according to Africon. One should also consider that some countries have no age constraint on importations of used vehicles. The average age of trucks in the EU is higher than of private cars. In 2022, the average age was 14 years for trucks - reaching almost 23 years in Estonia and decreasing to 7.4 years in Austria - compared to an average of 12.7 years for cars - spanning from 8.2 years in Luxembourg up to 17.8 years in Greece in 2024 (source: ACEA).

Hint n°4: If doubts on the completeness of fleet data exist, compare with parallel sources.

Parallel sources are especially helpful when doubts arise on the completeness of datasets. Several sources can be used and combined; the best option depending on sources availability and completeness, among others the options are:

1. **Vehicle tax register:** by compiling the number of vehicles paying the annual circulation tax, the quality of the vehicle stock can be checked. The advantage is that, in most countries, all motor vehicles must pay a purchase or annual registration tax. The main limitation is the accessibility of these data.

2. **Vehicle insurance:** this approach is useful when the number of insurance companies is limited and they are willing to collaborate (including the exchange of data). Furthermore, this approach only works if vehicle assurance is compulsory for the relevant vehicle categories and has been implemented.

The Nigerian Insurers Association, NIA, says that only about three million vehicles out of 13 million on Nigerian roads are insured, indicating that about 77 % are uninsured. In this case the databank would not bring any further hint on the vehicle stock data.

3. **Vehicles sales:** this kind of data can be compared with new registrations. In some countries, vehicles distributors gather sales data at the national level, and worldwide statistics associations such as the OICA also gather statistics of new vehicles sales. However, it should be noted that the data in the OICA sales database is either sales or registration data, and the two are not differentiated. Second-hand vehicle sales (i.e. vehicles entering the country as second-hand cars) are often not included in new vehicle sales data, depending on the country.

For example, in Morocco the AIVAM publishes monthly statistics on vehicle sales as well as yearly annual report on vehicles sales, which have been used by the Moroccan Transport Ministry to check internal new vehicle registration databank.

4. **Vehicle inspections: i**t is possible to identify vehicles that are no longer in use by looking at the number of vehicles undergoing annual technical inspections. However, this method is only reliable when inspections are consistently enforced, which is not always the case. Newly registered vehicles often do not require inspection during the first years, so they must be considered in the methodology to derive the vehicle stock for a given year.