The dark side of trucking

Methodological note

November 2022

1. Assessing Black Friday's emissions

The process of determining Black Friday's emissions consists of two steps: first, the demand for goods occurring during the week of interest was estimated, second, this demand was translated into emissions.

1.1. Demand estimation

Estimating the demand for specific goods is always a challenging task in economic science due to lack of data. The approach followed here has been to try and isolate the percentage increase in demand occurring during a Black Friday week compared to an average week in the same year. A dataset with monthly sales turnover data was extracted from EUROSTAT for the period 2005-2021[1]. It includes both wholesale and retail sales and excludes food and fuel products, as they are usually outside the scope of Black Friday consumerism.

To isolate the increase in our specific week of interest, two steps were required: first, comparing sales in November against the year's monthly average, second, computing and subtracting the sales' volume increase already occurring in November but due to early Christmas activity.

The most meaningful index to look at is the percentage increase of sales in November compared to the average of January to October. December was excluded due to the exceptional turnover caused by Christmas sales in that month.

[1] https://ec.europa.eu/eurostat/databrowser/view/sts_trtu_m/default/table?lang=en

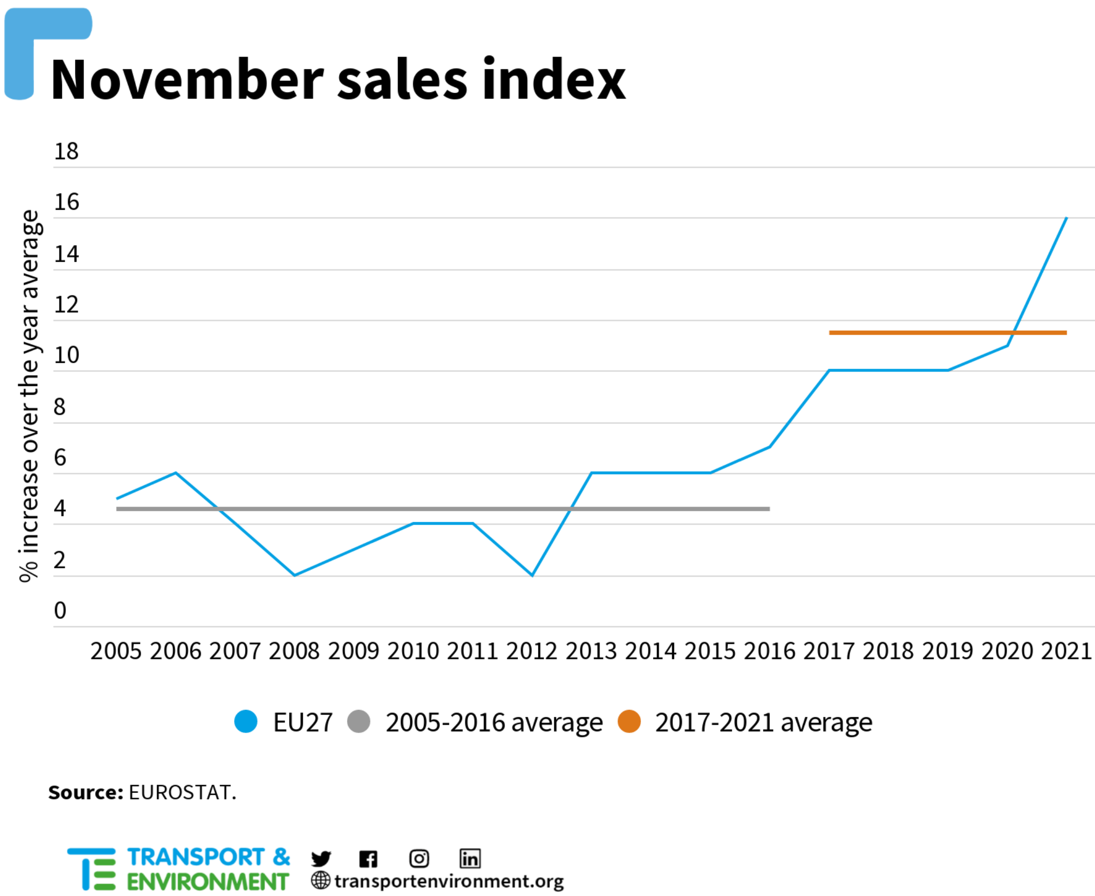

Figure 1: historical evolution of November sales index

Figure 1 shows how a big shift in the index occurs between 2016 and 2017. This coincides with the wide adoption of Black Friday in continental Europe. Hence the period of interest was determined to be 2017-2021, where the average increase in sales is 11.5% (against 4.6% between 2005 and 2016).
It is clear that simply attributing this growth to solely the Black Friday phenomenon would be rather arbitrary, as the generally increasing trend is partially responsible for it. Therefore we looked at the seasonal component, i.e. the deviation from the trend due to specific events occurring in the month under consideration.

The new variable gives a picture of the extra sales occurring in November compared to the rest of the year, but these do not coincide with just the Black Friday sales. As a part of the Christmas sales already start in late November, these must be split off. To do this, we looked at what was happening in Europe before the spread of Black Friday: the average seasonal component was significantly lower in 2005-2016 compared to 2017-2021. As no other November specific events occurred in this time frame, the difference between the two values will be the correct estimate of the extra sales attributable to Black Friday: a 4.7% increase.

	2005-2016 average	2017-2021 average	Difference
Observation	4.6%	11.5%	6.9%
Observation, deseasonalised	0.5%	2.8%	2.3%
Seasonal component	4.1%	8.7%	4.7%

Table 1: summary of the sales' index for different timeframes and time series decomposition. Values may not add up due to rounding.

A 4.7% monthly increase corresponds to a 20% weekly increase[2]. However, recall that the data used to extrapolate the index still take into account goods that are not subject to Black Friday discounts. An assumption is thus needed to properly isolate just those items who are subject to Black Friday week deals.

<u>Assumption 1</u>: the amount of transported goods equals the amount of sold goods.

This is reasonable as we are interested in the emissions linked to the goods sold during Black Friday, regardless of when they were transported to the store or warehouse. As the amount of transported goods must be greater than or equal to the number of sold goods, in the worst case, the emissions are underestimated, since we don't consider goods which are transported but not sold for whatever reason.

Eurostat[3] reports yearly data for goods transported by heavy duty vehicles (non-food and non-fuel goods, 2016-2021 period considered). Goods are divided into 20 categories. Those of interest for Black Friday are number 5 (textile, leather and derived products), 6 (wood, paper products, recorded media), 11 (computers, office machinery, watches), 13 (furniture), 15 (mails, parcels) and 16 (equipment used to transport goods). Thanks to Assumption 1, we can divide the sales increase calculated above by the proportion of these goods' transport activity over the total (21%). This yields the increase in activity during the Black Friday week due to Black Friday sales: +94%.
From the same data, the activity in the average week is calculated (again, December is not considered)[4].

[2] November has 4.28 weeks

[3] https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Road_freight_transport_by_type_of_goods#Road_freight_transport_by_type_of_goods_.28NST_classifications.29

[4] Total freight activity was taken from the EU Reference Scenario. The value for 2022 is obtained assuming linear growth between 2020 and 2025.

January-November activity (Gtkm)	Activity in average week (Gtkm)	Increment during the BF week	Activity in the BF week (Gtkm)
345.27	7.12	+94%	13.82

Table 2: summary of Black Friday activity calculation.

1.2. Emissions estimation

With all the values on truck activity at hand, it is finally possible to calculate Black Friday emissions. In its European Transport Roadmap Model (EUTRM), T&E has calculated activity and fuel consumption for trucks in grams of CO_2 per ton-km. It is then sufficient to multiply the truck activity related to Black Friday goods to obtain the emissions. Truck activity due to Black Friday goods is estimated to be emitting 1.23 million tons of CO_2 in 2022.

	Fuel consumption (gCO_2/ton-km)	Activity share
Heavy trucks	71.00	80.8%
Medium trucks	153.69	15.4%
Small trucks	207.68	3.8%
Total	88.96	100%

Table 3: fuel consumption, total and broken down by truck categories.

2. Emissions equivalents

Data sources and calculation tools used to convert emissions into relatable equivalents are listed below.

2.1. Flights

CO_2 emissions for the route were calculated using T&E's internal aviation tool for a one-way trip of 5,849 kilometres[5]. The aircraft considered for the analysis is a Boeing 777-300ER, widely used for long-haul flights, and full occupancy was assumed.

[5] https://www.airmilescalculator.com/distance/jfk-to-cdg/. Our total emissions differ slightly from those calculated in the source as we also consider non-CO_2 effects.

2.2. Diesel

Data on fuel consumption in litres of fuel per km of activity are taken from the EUTRM. The total activity in ton-km is split across categories[6] and translated into km by dividing it by the payload. Then, multiplying fuel consumption[7] by activity and summing the three categories up yields the total amount of diesel consumed.

2.3. Pools

Given the dimensions of an olympic swimming pool, 50 m length, 25 m width, 2 m depth, it is possible to calculate its volume: 2,500 m^3, equal to 2.5 million litres.

2.4. Country

Data on country specific emissions come from UNFCCC[8]. As the sector code 1.A.3.b.iii refers to 'Heavy duty trucks and buses', the value reported must be multiplied by the share of HDV emissions coming from trucks (i.e. excluding urban buses, coaches and vocational vehicles). Bulgaria's 1.37 Mt CO_2 (64%[9] of the 2.14 Mt reported in the UNFCCC assessment) is the number that best matches the result of this study.

3. Future CO_2 savings

The last step is to look at the emissions savings in case T&E's proposal for the review of the heavy duty vehicles CO_2 standards were adopted: 100% of new sales to be zero-emission in 2035[10]. According to the scenario simulation on the EUTRM, CO_2 emissions would drop by 11% in 2030 and 48% in 2035 as a consequence of this policy measure. It is sufficient to reduce the above-calculated emissions by the same factor to obtain Black Friday related emissions savings for trucks under T&E's proposal.

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[6] In the EUTRM, trucks are divided into three categories according to the VECTO criteria: small, medium and heavy.

[7] Fuel consumption in litres of diesel per km is calculated by applying a factor of 2639.52 g CO_2/l to fuel consumption expressed in g CO_2 per km.

[8] 2019 values were used as 2020 activity was affected by COVID-19 restrictions.

[9] Value for Bulgaria. Source: EUTRM.

[10] Here is the link to T&E study https://www.transportenvironment.org/wp-content/uploads/2022/09/2022_09_Addressing_heavy-duty_climate_problem_final.pdf