Evaluating How Different Factors Have Contributed to the Sales of Electric Cars

Overview

The final project should consist of a data driven economic investigation using the tools and methods explored in the course. A short proposal for the final project is due Monday March 9th, which will constitute a small part of the final grade (see below). The point of the proposal is to ensure that you have chosen a topic and groups in a timely manner.

The project has four main components:

(1) **Creating a research question**. The formalization of a question about economic behavior, interaction, outcomes, etc. The question should be relatively narrow (for example: "How does the introduction of subsidies/tariffs affect soybean sales", or "The relation between daily energy consumption and temperature", or "The effect of public transit routes on property values " etc.). "Economic" is to be taken in the broad sense to include any relevant subfield, e.g., including Finance, Labor, Development, Behavioral/Psychology, Political Science, Education, etc.

(2) **Data acquisition and cleaning.** This includes finding relevant data that can help to illuminate the economic relations posed by your research question. Tip: think about the research question and what kind of data is available in tandem, this will ensure that you propose a feasible project. Avoid attempts to tackle questions which are too complicated and/ or require an unreasonable amount of work to complete. At the same time, the question should be of sufficient complexity to demonstrate the programming skills learnt.

(3) **Statistical analysis.** You will use the statistical techniques learnt over the course of your studies, included but not limited to those mentioned in this course, to explore and analyse the data and to draw inferences. The proposal should not include any such analysis, except possibly for some brief stylized facts.

(4) **Displaying and visualising your results and code.** Use both narrative text and data visualization techniques explored in this course to present your findings in a neat and orderly manner. While not necessary, the use of Jupyter notebooks is encouraged as both the results and the code used to generate them are relevant to the assessment.

https://www.e3s-conferences.org/articles/e3sconf/pdf/2019/44/e3sconf_icaeer18_02076.pdf

Things to do:

- Collect data on regional car sales
- Collect data on fuel price and quantity
- Map of superchargers
- Define electric car (type)
- Causality issue?? Solution??
- What coding techniques are we using??

Team Members:

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Project Title : Evaluating how different factors have contributed to the sales of electric cars in the UK.

Our project will use python as a tool extract, analyse and predict data using various data sources and will evaluate why electric cars are growing in popularity. To solve this we will use many variables such as fuel prices, uk electric subsidies and availability of "superchargers" to regress and find what the main determining factors are in the growth of the popularity of electric cars. Statistical models will follow a similar framework to the one presented by Tang and Sun in the paper "Predict the sales of New-energy Vehicle using linear regression analysis " Although their study was based in China and we will model the project using UK data to produce results that fit the UK trend.

The main aim of our study will be to use a variety of different extraction, analysis and statistical methods provided by the programming language Python to answer our question with a high degree of critical analysis. We will also be using many visualisation techniques provided by in built libraries in Python to make information and results from statistical analysis to be interpreted with ease and accuracy. We will also try to further our practical Python skills to actually try some prediction models by using multiple regression results to predict future growth of the sales of electric cars. Results from this study will hold wider implications for governments and corporations to use studies similar to ours to see what factors drive the sales of electric cars.

Comments: Can you get regional car sales, as this seems critical to evaluate the role of superchargers? Are you going to consider other types of electric vehicles? Where is the fuel price and quantity data coming from? There is also a causality issue, since clearly, if more people are using electric cars there will be more demand for charging stations. How can you get around this? What kind of visualizations are possible here?

Y: Electric vehicle sales:
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/794474/veh0203.ods

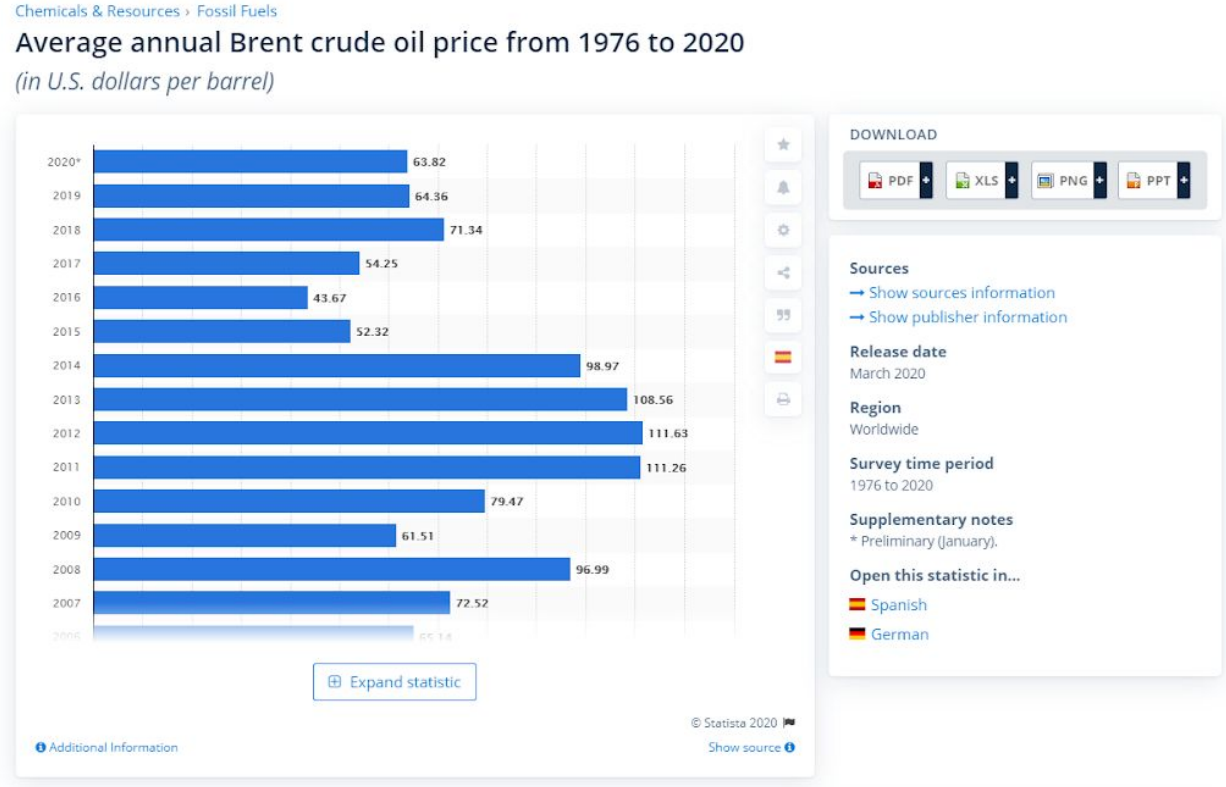
Department for Transport statistics
Vehicle Licensing Statistics (https://www.gov.uk/government/collections/vehicles-statistics)

Table VEH0203
Licensed cars at the end of the year by propulsion / fuel type, Great Britain from 1994; also United Kingdom from 2014

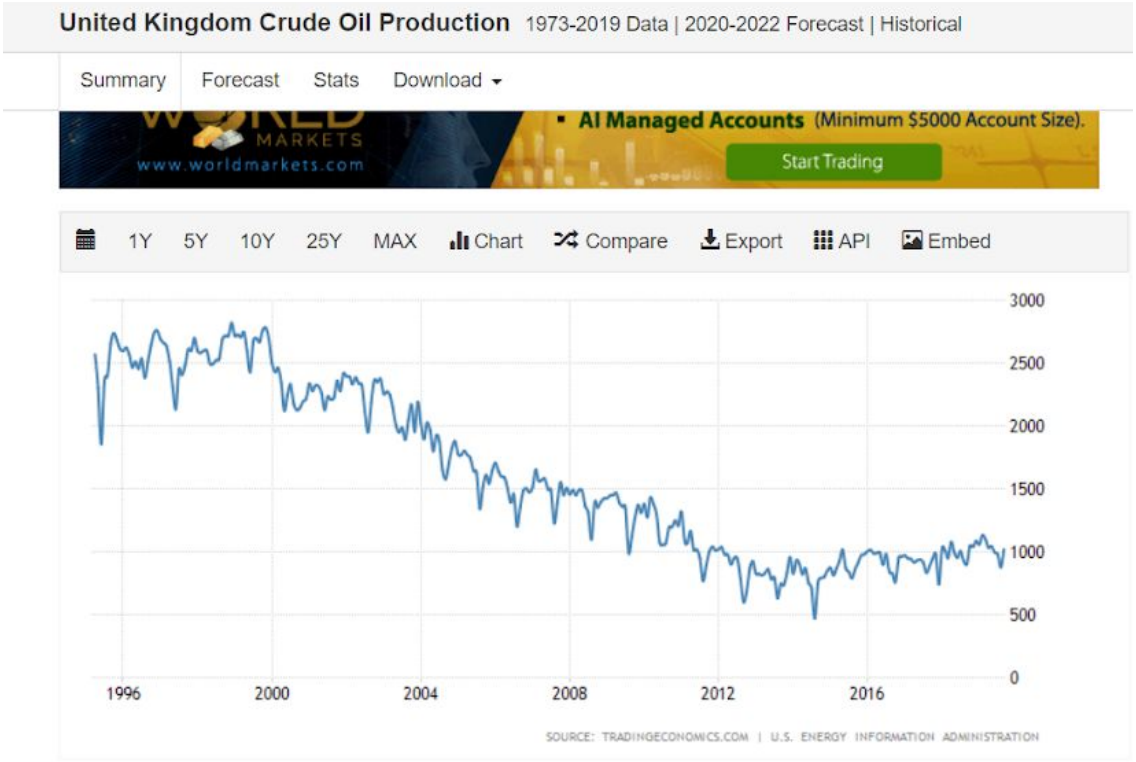
Great Britain — Thousand / *Percentage*

Year	Petrol	Diesel	Hybrid Electric [1]	Plug-in Hybrid Electric [2]	Battery Electric	Range-Extended Electric [3]	Fuel Cell Electric [4]	Gas [5]	Other [6]	Total
Thousands										
1994	19,620.9	1,576.2	0.0	0.0	0.1	0.0	0.0	1.8	0.2	21,199.2
1995	19,499.8	1,891.3	0.0	0.0	0.1	0.0	0.0	2.9	0.1	21,394.1
1996	20,051.6	2,181.6	0.0	0.0	0.1	0.0	0.0	4.1	0.1	22,237.5
1997	20,384.7	2,440.5	0.0	0.0	0.1	0.0	0.0	6.2	0.1	22,831.7
1998	20,590.5	2,692.9	0.0	0.0	0.2	0.0	0.0	9.6	0.1	23,293.3
1999	21,031.0	2,929.9	0.0	0.0	0.2	0.0	0.0	13.8	0.1	23,974.9
2000	21,232.4	3,152.7	0.2	0.0	0.2	0.0	0.0	20.0	-	24,405.5
2001	21,640.8	3,459.5	0.8	0.0	0.3	0.0	0.0	24.4	0.1	25,125.9
2002	21,839.2	3,912.4	1.1	0.0	0.3	0.0	-	28.8	0.1	25,781.9
2003	21,805.2	4,399.6	1.5	0.0	0.3	0.0	-	33.6	0.1	26,240.4
2004	21,976.4	5,010.6	3.0	0.0	0.4	0.0	-	37.6	0.1	27,028.1
2005	21,875.8	5,596.1	8.3	0.0	0.6	0.0	-	39.5	0.1	27,520.4
2006	21,465.6	6,083.3	16.9	0.0	0.8	0.0	-	42.4	0.2	27,609.2
2007	21,264.2	6,657.4	32.1	0.0	1.2	0.0	-	45.1	0.3	28,000.3
2008	20,898.9	7,163.5	47.0	0.0	1.3	0.0	-	49.6	0.4	28,160.7
2009	20,490.9	7,641.4	61.3	0.0	1.5	0.0	-	50.9	0.4	28,246.5
2010	20,082.9	8,202.7	82.1	0.3	1.5	0.0	-	51.0	0.5	28,420.9
2011	19,548.2	8,763.5	102.0	0.5	2.6	-	-	49.9	0.4	28,467.3
2012	19,158.6	9,385.1	124.0	1.1	4.1	0.5	-	48.7	0.4	28,722.5
2013	18,870.1	10,064.2	151.3	1.7	6.2	0.9	-	46.3	0.4	29,140.9
2014	18,632.4	10,730.9	182.4	7.9	12.1	2.2	-	43.2	0.4	29,611.5
2015	18,511.5	11,428.9	221.8	23.8	20.5	3.8	-	39.7	0.4	30,250.3
2016	18,410.2	12,052.1	268.5	49.1	29.1	5.5	-	35.4	0.4	30,850.4
2017	18,348.1	12,360.2	332.7	78.5	41.2	7.7	0.1	31.3	0.4	31,200.2
2018	18,499.6	12,397.6	411.7	115.5	55.3	9.5	0.1	27.8	0.3	31,517.6
Percentage										

X1; Crude oil prices yearly average:
https://www.statista.com/statistics/262860/uk-brent-crude-oil-price-changes-since-1976/

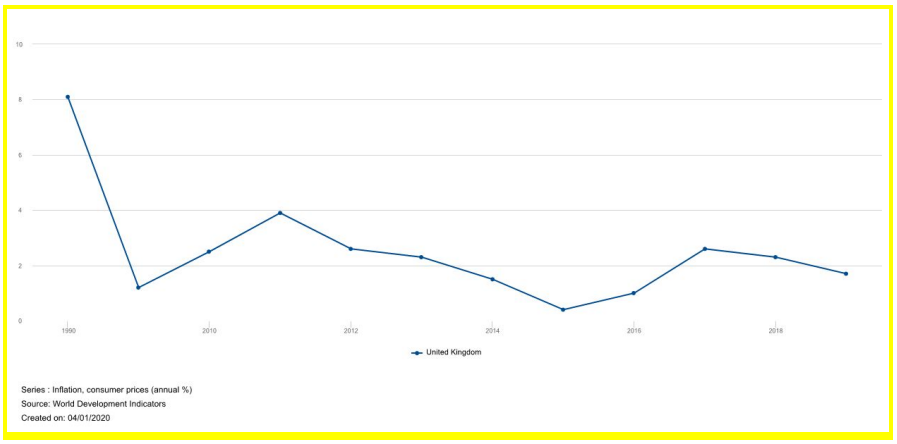


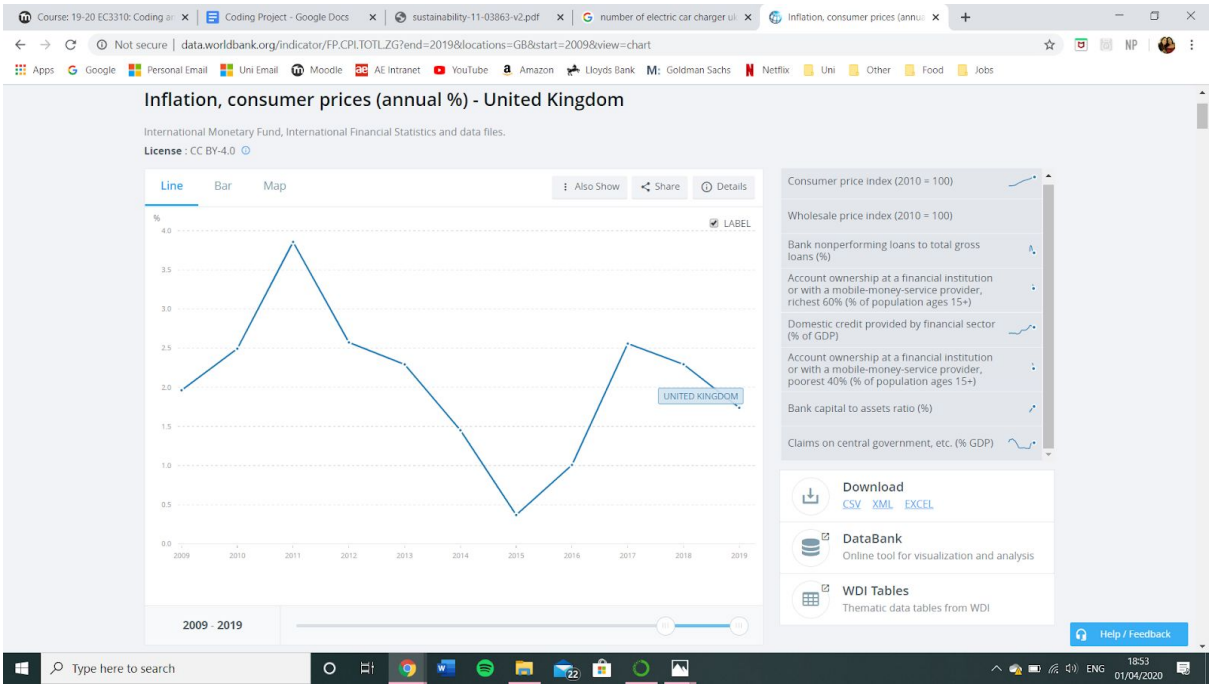
X2: Crude oil volume:
https://tradingeconomics.com/united-kingdom/crude-oil-production



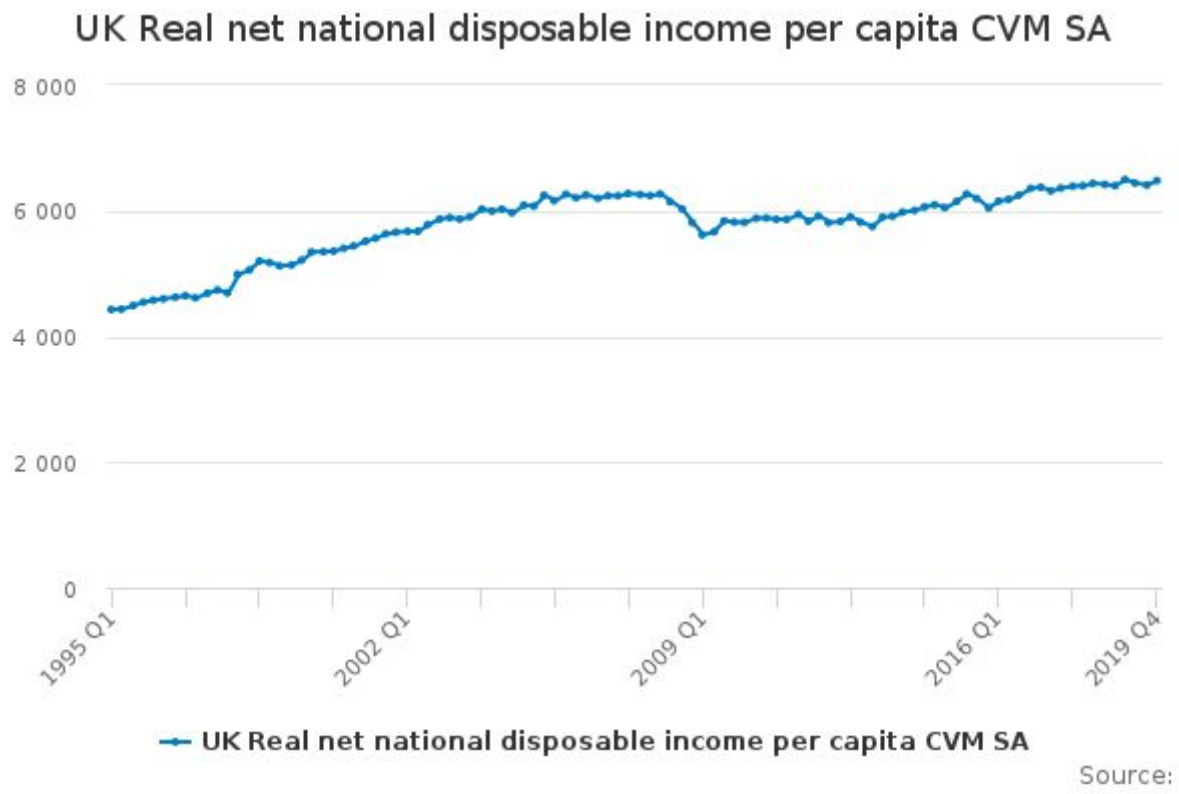
X3: Gdp per capita uk
https://www.ons.gov.uk/economy/grossdomesticproductgdp/timeseries/ihxw/pn2

X4: CPI:
https://data.worldbank.org/indicator/FP.CPI.TOTL.ZG?end=2019&locations=GB&start=2009&view=chart



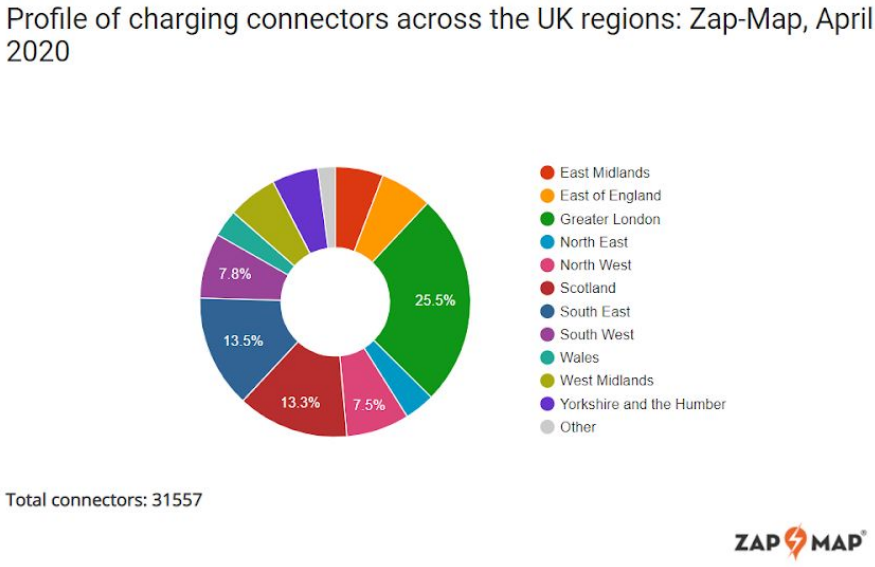


X5: Disposable Income per capita:
https://www.ons.gov.uk/economy/grossdomesticproductgdp/timeseries/mwb7/ukea

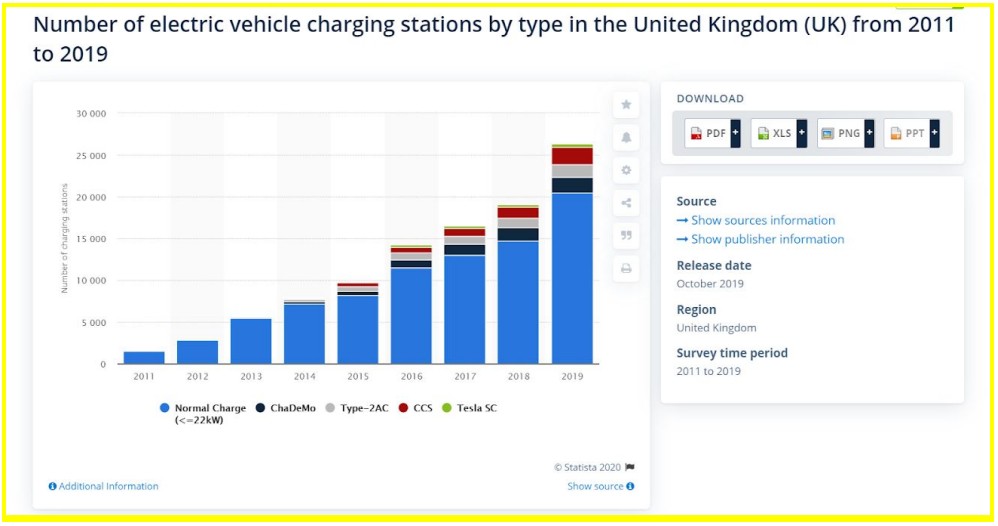


X6: GBP/USD exchange rate:
https://www.macrotrends.net/2549/pound-dollar-exchange-rate-historical-chart

X7: Number of charging stations:
https://www.zap-map.com/live/



https://www.statista.com/statistics/932692/number-of-electric-vehicle-charging-stations-uk/



Y: Electric vehicle sales - Hybrid electric, Plug-in Hybrid electric, Battery Electric, Range extended electric (2009 - 2019) **(import from excel)**
X1: Oil prices (USD/barrel) **(import from excel)**
X2: Oil volume **(api)**
X3: GDP per capita **(web scrape/ api/ import)**
X4: CPI **(web scrape/ api/ import)**
X5: Disposable Income per capita **(import)**
X6: Exchange rate (GBP/USD) **(import)**
X7: Number of charging stations **(import)**
X8: Subsidies **(Manual)**
X9: Price new cars **(web scrape/ api/ import)**
X10: Range of electric cars **(import)**
X11: Gov bans/ regulations (ulez) **(manual)**
X12: Electricity prices **(import)**
X13: Cost/availability of public transport **(import)**
X14: electricity production **(api)**

Visualisations
Correlation matrix

Limitations - timeframe

Layout

Intro - motivation, contribution, outline - aim, objective, hypothesis
Literature review
Economic theory and econometric model
Data and methodology - how we collected, different libraries
Results, analysis, presentation and interpretation
Conclusion and Evaluation

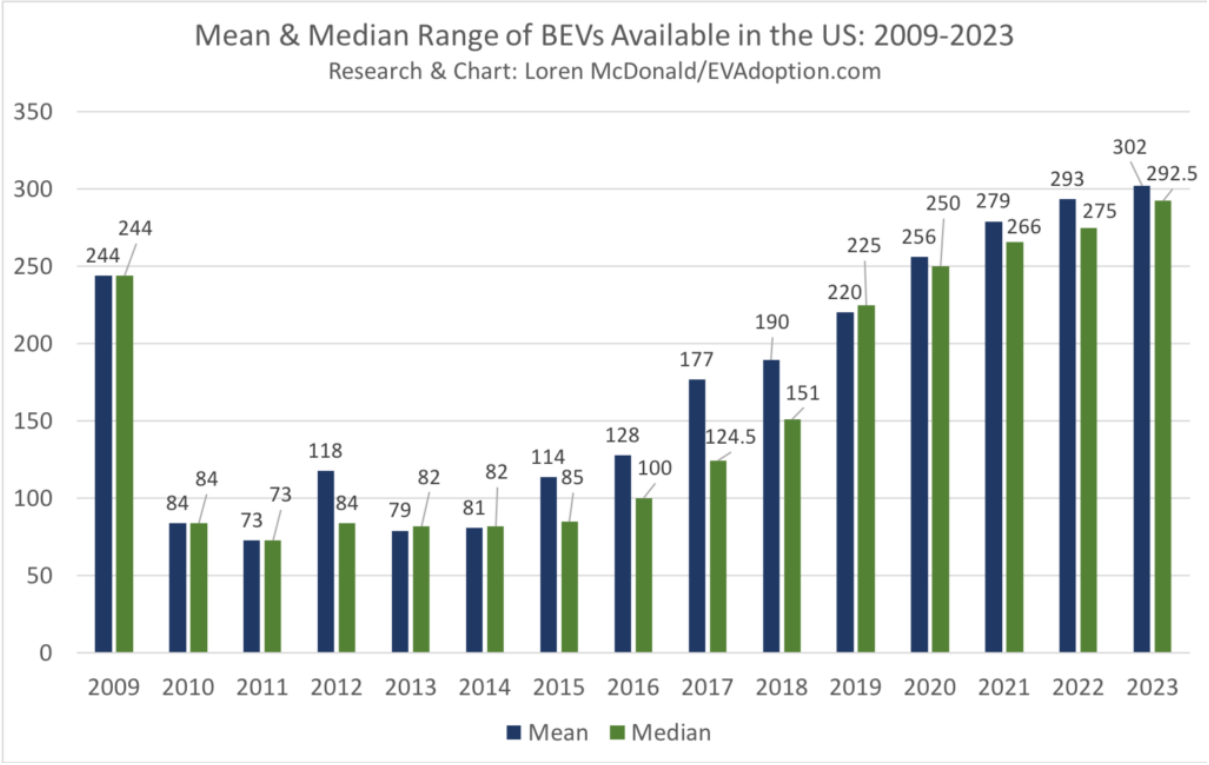
X8: Subsidies:
https://www.buyacar.co.uk/cars/economical-cars/low-emission-cars/536/government-electric-car-grant-the-complete-guide
- The grant was first launched in 2011, when the government was offering £5,000 off the price of plug-in cars.

- In March 2016, the scheme was revamped. The maximum incentive was cut to £4,500, categories were introduced, which meant that plug-in hybrids generally lost half of their subsidy and the price cap was introduced for categories 2 and 3.
- The scheme altered again in October 2018 when the discount was cut to £3,500 for electric cars and was axed entirely for plug-in hybrid vehicles.

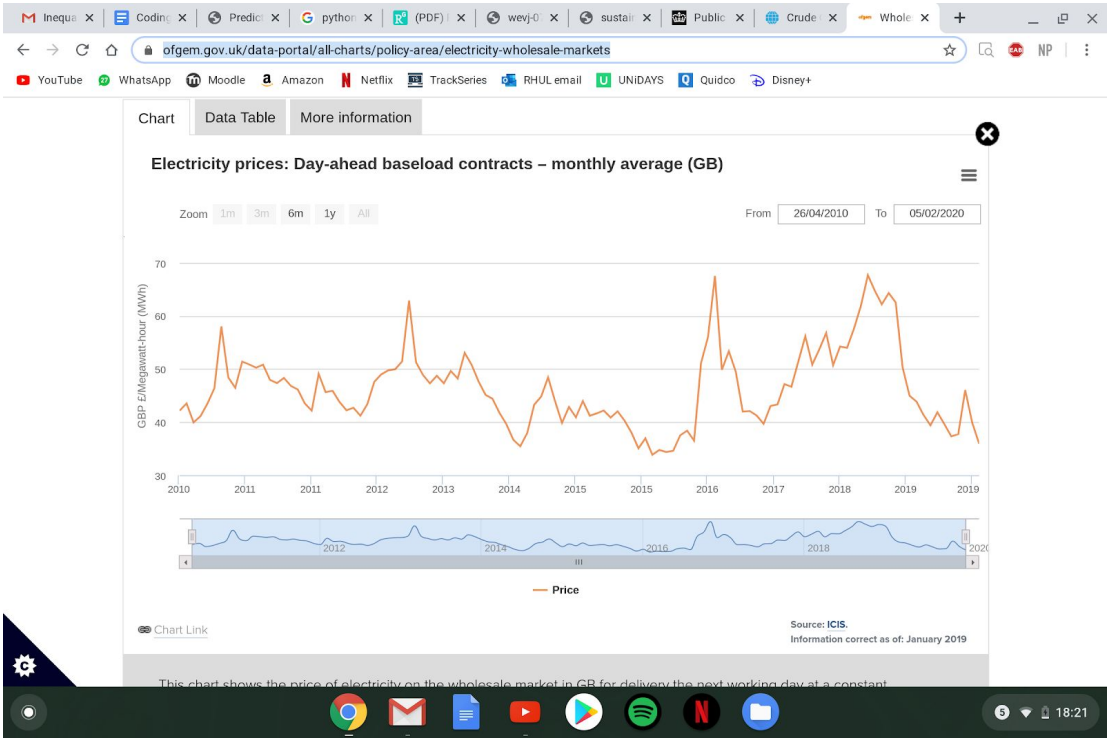
X9: Price of new cars using cpi:
https://www.ons.gov.uk/economy/inflationandpriceindices/timeseries/cjxn/mm23

1998	18.00
1999	21.00
2000	34.00
2001	29.00
2002	28.00
2003	31.00
2004	32.00
2005	33.00
2006	31.00
2007	27.00
2008	26.00
2009	26.00
2010	23.00
2011	25.00
2012	24.00
2013	21.00
2014	23.00
2015	24.00
2016	25.00
2017	27.00
2018	28.00
2019	26.00
2020	23.00

X10: Range of electric cars:
https://cleantechnica.com/2018/10/27/us-electric-car-range-will-average-275-miles-by-2022-400-miles-by-2028-new-research-part-1/



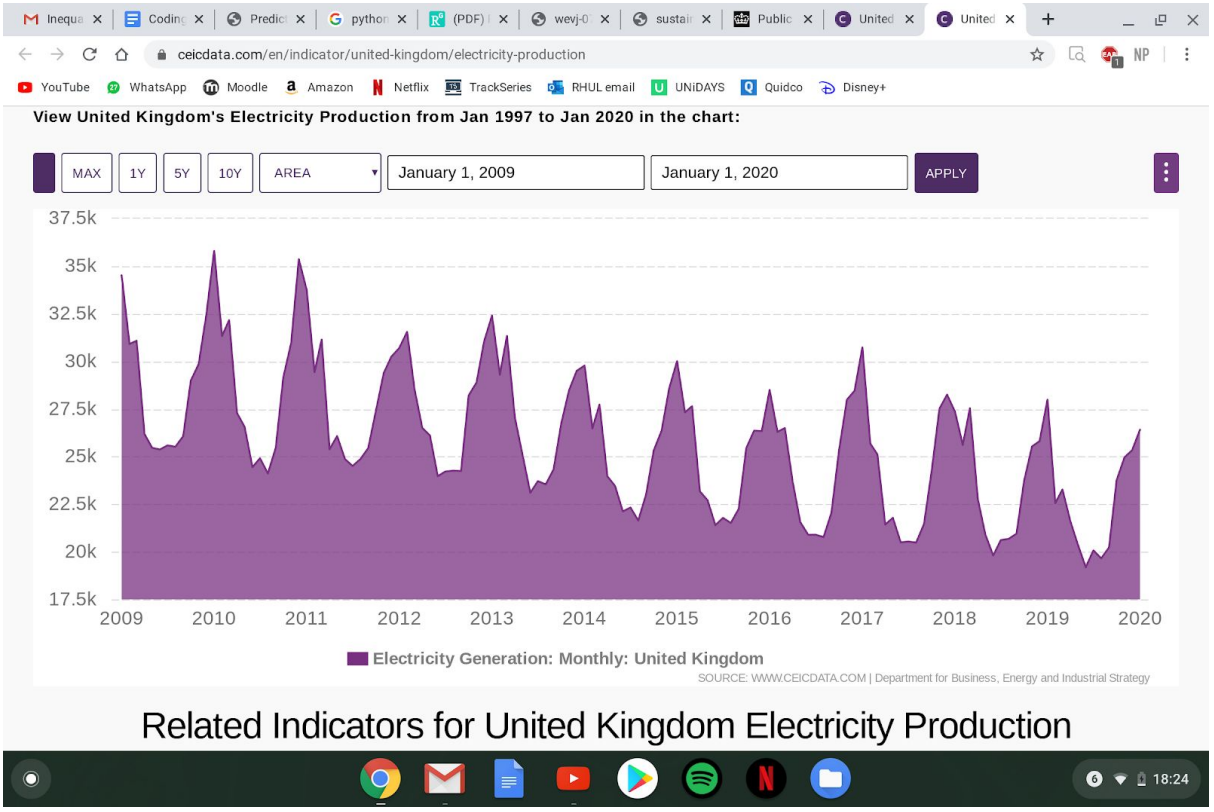
X12: Uk electricity prices:
https://www.ofgem.gov.uk/data-portal/all-charts/policy-area/electricity-wholesale-markets



X13: Cost of public transport:
https://www.gov.uk/government/statistical-data-sets/bus04-costs-fares-and-revenue
ODS links, someone try open them

X14: Uk electricity production:

https://www.ceicdata.com/en/indicator/united-kingdom/electricity-production



TEST GIT