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Factors of development of the electric vehicle in the EU countries

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Abstract

The development of electric vehicles (EVs) has become a crucial aspect of sustainable transportation systems and greenhouse gas emissions reduction strategy. This research delves into identifying and analyzing factors that affect the growth of EV markets in European Union countries. The study utilizes panel data from 27 EU nations during the period between 2018 and 2021, employing pooled OLS and random effects regression models to evaluate various factors' impact on national EV sales. Independent variables used include national transport taxes, publicly accessible charging stations for electricity, average national energy prices, consumer gasoline prices, gross domestic product per capita, total land area, and population employment rates. Results suggest that these variables have varying impacts on the adoption rate of EVs across EU nations but may still be critical determinants for policymakers seeking to increase their nation's electric vehicle market share. The results show that national transport taxes, the number of publicly accessible power charging stations, gross domestic product per capita, total land area, and consumer prices of gas oil automobile have a statistically significant impact on the development of the electric vehicle market in the EU countries, while the average national price of electrical energy and proportion of the population that is employed do not. These findings can provide valuable insights for policymakers and industry stakeholders to design effective strategies and policies to promote the adoption and development of EVs in the EU countries.

Abbreviation	**Description**
EU	European Union
EV	Electric Vehicle
CO2	Carbone Dioxide
EC	European Commission
HEV	Hybrid Electric vehicle
BEV	Battery electric vehicle
AEV	All electric vehicle
PHEV	Plug-in Hybrid electric vehicle
PEEV	Range extended electric vehicle

Contents

Introduction

The transportation industry is a significant contributor to the amount of greenhouse gas emissions that are produced. In fact, 'it is responsible for a staggering 25.8% of the total CO2 emissions in the EU alone. As such, the EU has made a commitment to implementing a net-zero transition by 2050 as part of its ratification of the Paris Agreement on November 4th, 2016. However, this ambitious goal can only be reached if there are fundamental changes made to the transport system, which necessitates creating alternative fuel vehicles.

The demand for road transport in Europe is growing at an alarming rate; from 1995 to 2008, the total number of passenger-kilometers increased by 25%, from 3800 billion to an enormous 4800 billion kilometers covered annually. At present, cars cover about three-quarters (75%) of travel needs in Europe; trains, buses, planes and ships handle the remaining one-quarter (25%). Europe's dependence on fossil fuels - particularly dominated by road transport - poses a serious downside with respect to oil dependence and greenhouse gas emissions.

Europe's increasing reliance on crude oil consumption due to higher demand for road transportation means that any progress made in efficiency or other sectors has been offset significantly; this dependency means there is a high likelihood of interruption and disruption due to proven reserves being concentrated mainly within politically unstable regions coupled with depletion rates and growing global demands contributing towards uncertainty in oil price developments.

To mitigate these risks associated with volatile oil prices and potential future shortages caused by political instability or depletion rates requires reducing Europe's consumption levels through facilitating modal shifts towards other less oil-dependent vehicles while simultaneously promoting development initiatives aimed at producing alternative vehicle concepts and more energy-efficient vehicles powered through low-carbon sources like electromobility.

Transitioning towards low-carbon energy balance solutions faces several issues such as high car prices when it comes to electric vehicles which face significant regulatory barriers that must be overcome. Additionally, the implementation of such solutions comes with risks and trade-offs, which need to be carefully weighed up against the potential benefits. For several years now, monetary incentives have been put in place to encourage market intervention and partial elimination of these barriers but the exact stimulation effect created by these measures is currently unknown.

Despite this, sales of electric vehicles in Europe have increased significantly over recent years. However, while this growth has been strong in relative terms (compared to previous years), when taking absolute numbers into account - it remains a relatively small market. In fact, in 2021 alone, the share of the European electric vehicle market exceeded 2.4%.

Although there are numerous studies available on electric vehicles and their development, more research needs to be done to determine the impact of government support initiatives on electric vehicle adoption rates across Europe fully. Factors such as monetary incentives and charging networks will need to be analyzed carefully alongside panel data approaches before informed decisions can be made regarding the future direction of decarbonizing transport and reducing air pollution levels caused by traditional fuel-driven vehicles.

Literature review

The electric vehicle (EV) market is rapidly growing across the world, and the European Union (EU) is no exception. The EU has set ambitious climate targets and sees the transition to EVs as a crucial component in achieving those targets. In this literature review, we will explore the factors that are driving the growth of the EV market in the EU countries.

The development of the electric vehicle in the European Union (EU) countries is a complex issue influenced by various factors. Government regulations,

infrastructure availability, consumer demand, and technological advancements are among some of the key drivers that have shaped the growth of electric vehicles (EVs) in these markets.

Government regulations play a significant role in promoting EV adoption in EU countries. According to Rainnie (2016), an integrated approach covering vehicle efficiency, renewable fuels as well as measures that help reduce transport demand itself is required. Many EU member states have implemented policies such as tax incentives and subsidies for EV purchases to encourage their use over traditional internal combustion engine vehicles. These policies aim to tackle climate change by reducing greenhouse gas emissions from transportation sectors.

Infrastructure availability also plays a crucial role in supporting the development of EVs across Europe. As noted by FTI Consulting LLP (2017), Electric Charging Stations or ECS's can greatly reduce emissions associated with driving and are capable of being emission-free depending on sources utilized for electricity and hydrogen. The installation of charging stations throughout urban areas provides convenience to EV owners who need to charge their cars while away from home.

Consumer demand is another critical factor influencing the proliferation of EVs across Europe. In recent years there has been growing concern among consumers about environmental issues, leading many individuals towards more sustainable transportation options like electric cars instead; this recent trend outlined was confirmed by Geny's research earlier this year (2021). This shift has resulted in increased production volumes by automakers focused on producing environmentally friendly automobiles driven by customer preferences.

Technological advancements also shape the development process within which electronic vehicles operate today - especially Battery Technology & Software improvements according to both citations provided here (Geny 2021 & FTI Consulting LLP 2017). Currently existent range anxiety issues may become obsolete if battery tech continues advancing at its current pace; moreover, software optimization will continue improving charging times which could lead customers toward even greater EV adoption rates.

In conclusion, the development of electric vehicles in the EU countries is influenced by various factors - government policies and regulations promoting sustainable transportation options, consumer demand for environmentally friendly cars, improvements in infrastructure availability with more ECS's being installed throughout urban areas; ending on technological advancements including those made toward software optimization and battery tech.

Overview

In recent years, many automakers have made every effort to convert conventional cars with internal combustion engines into environmentally safe and reliable electric vehicles. The market of electric vehicles in the EU is growing every day, ahead of China, which was the largest supplier of electric vehicles. In 2020, the share of electric vehicle sales was 43%, which is twice the number of sales in 2019.

In the EU-27 countries, sales and consumption of electric vehicles and electric vans increased significantly in 2021. If 1,400,000 electric vehicles were registered in 2020, then in 2021 this number increased and about 2,110,000 were registered. It turns out that in just one year the share of the total number of registrations increased by 7.1% from 10.7% to 17.8%. As for electric vans, from 2020 to 2021, the share of the total number of registrations increased by 1% from 2.1% to 3.1%, as well as the number of registered battery electric vehicles and hybrid cars in 2020 is comparable to 2021, but in the case of vans, most of them were occupied by battery electric vehicles.

There are basically three main types of electric vehicles:

1. BEV/AEV is a car that is completely dependent on battery and electricity.

2. HEV/PHEV is a hybrid car that combines an electric motor and an internal combustion engine.

3. REEV is a car that is powered by an electric motor charged by a battery.

Tax

Tax incentives are an important element of stimulating demand for electric vehicles. Taxes on purchase, rent and road tolls are important aspects that are facilitated by the government in order to make electric cars a more attractive alternative for buyers. Taxation depends on the date of purchase of an electric vehicle, since at first owners of electric vehicles are exempt from paying taxes. Since the summer of 2018, a new law on taxes has come into force. If the electric car was registered from 05/11/2011 to 12/31/2020, the owners of electric cars are exempt from paying taxes for ten years. Also, if someone has converted their car into an electric car, then they are also exempt from paying taxes for ten years, regardless of the date of the first registration.

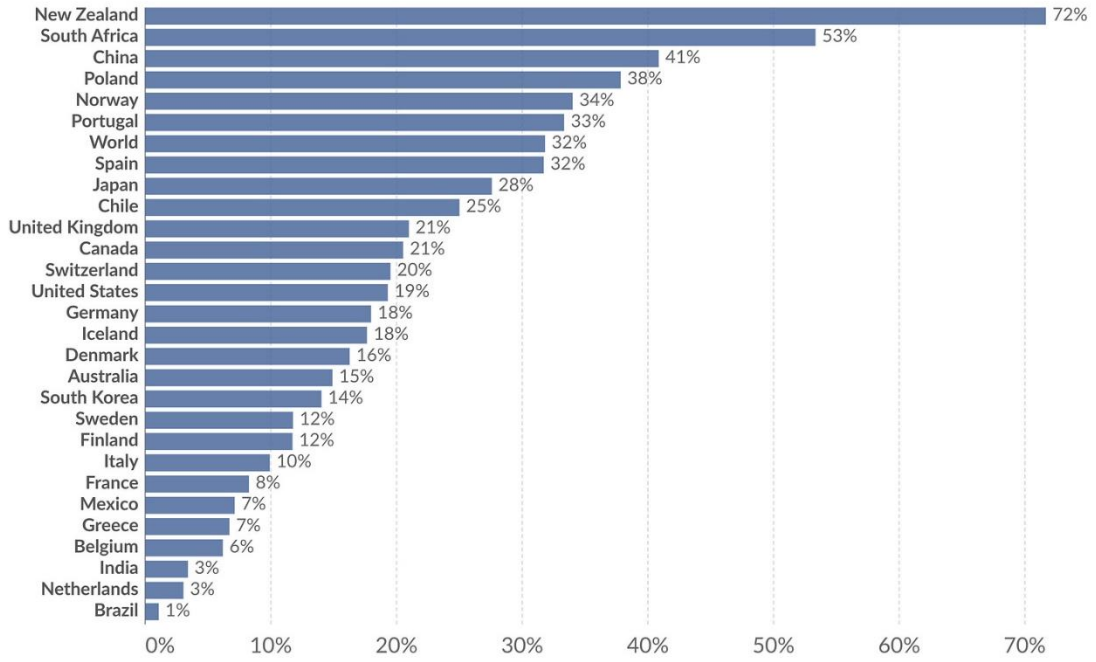
Charge

Following the growth of electric vehicles introduced into the EU countries, technologies and infrastructure for charging them are also developing. In several EU countries, the state has taken on a major role in creating an infrastructure to which electric car drivers can connect for charging. New technological developments that improve EV range, as well as increasing the availability and speed of charging parking infrastructure, will change the need for charging infrastructure in the future.

The costs of large-scale development of charging infrastructure in Europe are very large so that only the public sector can finance it (figure 1 slows charging station costs ~ 2000 euros and this is only for equipment), because one of the most important tasks for the popularization of electric vehicles is to achieve commercial viability with the development of charging infrastructure.

FIGURE 1

Share of public electric vehicle chargers, 2021



(https://hannahritchie.substack.com/p/public-ev-chargers, n.d.)

Along with the growth in sales of electric vehicles, the availability of charging stations also increased. The current introduction of charging stations mainly falls on cities, and this complicates long-distance travel. As a rule, there are charging stations located in houses, they charge up to 22 kilowatts and supply alternating current. There are also charging stations like the Tesla Supercharger that supply direct current. Charging stations that are in the public domain also produce an alternating current of 22 kw. These charging stations are important because they are a budget way to increase the number of charging points. One 11-kilowatt station costs 700-900 euros, and a 22-kilowatt station costs around 2,000 euros. Such small charging stations are located either in private homes or directly in the city, since owners of electric vehicles need to travel a long distance beyond the outskirts and, accordingly, they need more powerful charging stations using direct current. The power in such charging stations varies from 50 to 350 kilowatts.

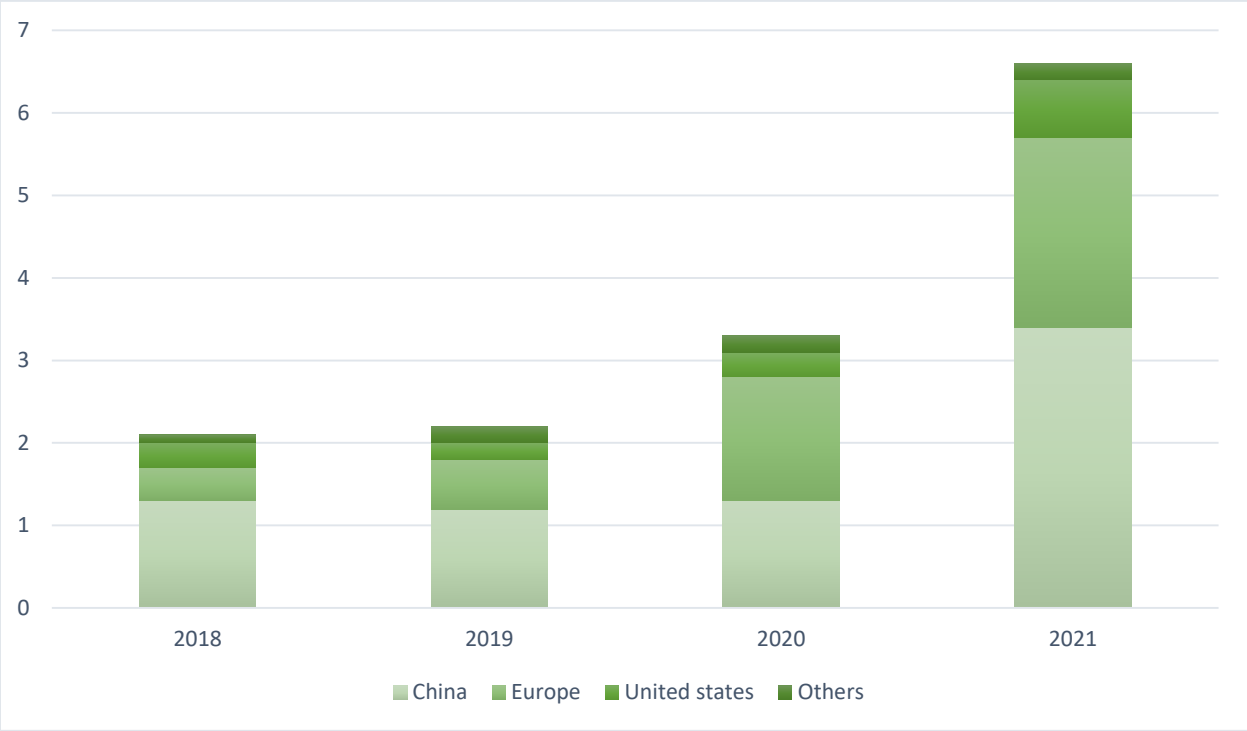
However, recently in Germany, it was decided to limit the charging of electric cars in private homes. For several years, German motorists will not be able to use home charging at their discretion. It will be forbidden to charge electric cars during

rush hour and they will also reduce the charging time to a couple of hours. This is done so that owners of electric vehicles use public stations directly with their tariffs.

Sales

FIGURE 2

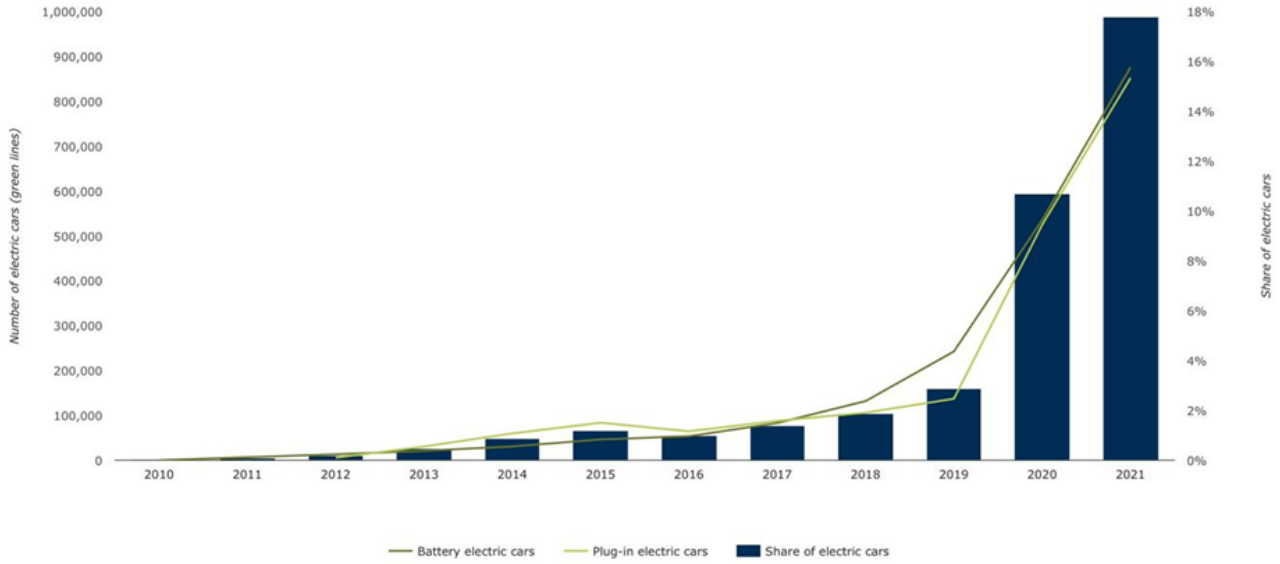
Global electric-car sales



The figure (Figure 2) shows the sales of electric vehicles in Europe from 2018 to 2021. 2021 was a very good year for China, as sales increased from 1.3m to 3.4m. Also in Europe, sales increased by 65% from 1.5m to 2.3m. In the US, sales do not exceed the 1 million mark and the market share of electric vehicles remains much lower than in Europe and China.

Also in 2020, production of more than 65 new electric vehicles was launched in Europe – this is twice as much as in China, and in North America only 15 models were released in 2020. In 2021, Europe planned to release about 99 new models of electric vehicles, and North America planned to release 64 new models.

FIGURE 3

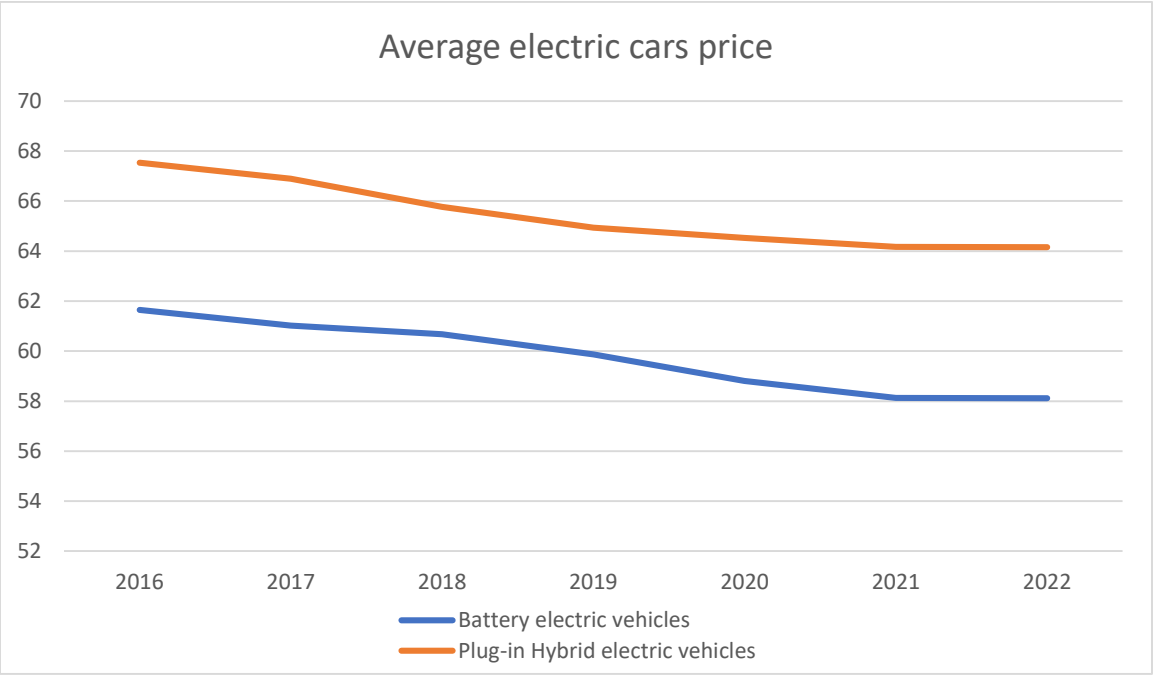


(https://www.eea.europa.eu/data-and-maps/daviz/new-electric-vehicles-in-eu-2#tab-chart_3, n.d.)

Year	Battery electric cars	Plug-in electric cars	Total cars	Share of electric cars
2010	591		11128785	0
2011	7179		10498868	0,1
2012	13730	6225	9369664	0,2
2013	21454	31079	9573937	0,5
2014	31197	60370	10075476	0,9
2015	46857	84115	11150601	1,2
2016	54065	65011	12027051	1
2017	83491	88334	12574590	1,4
2018	132377	106502	12753440	1,9
2019	242966	137632	12991283	2,9
2020	536186	525311	9924123	10,7
2021	876527	852440	9695706	17,8

The graph and table (Figure 3) show the number of Battery electric cars, Plug-in electric cars, the total number of electric vehicles and the share of the total number of registrations in the EU-27 countries from 2010 to 2021.

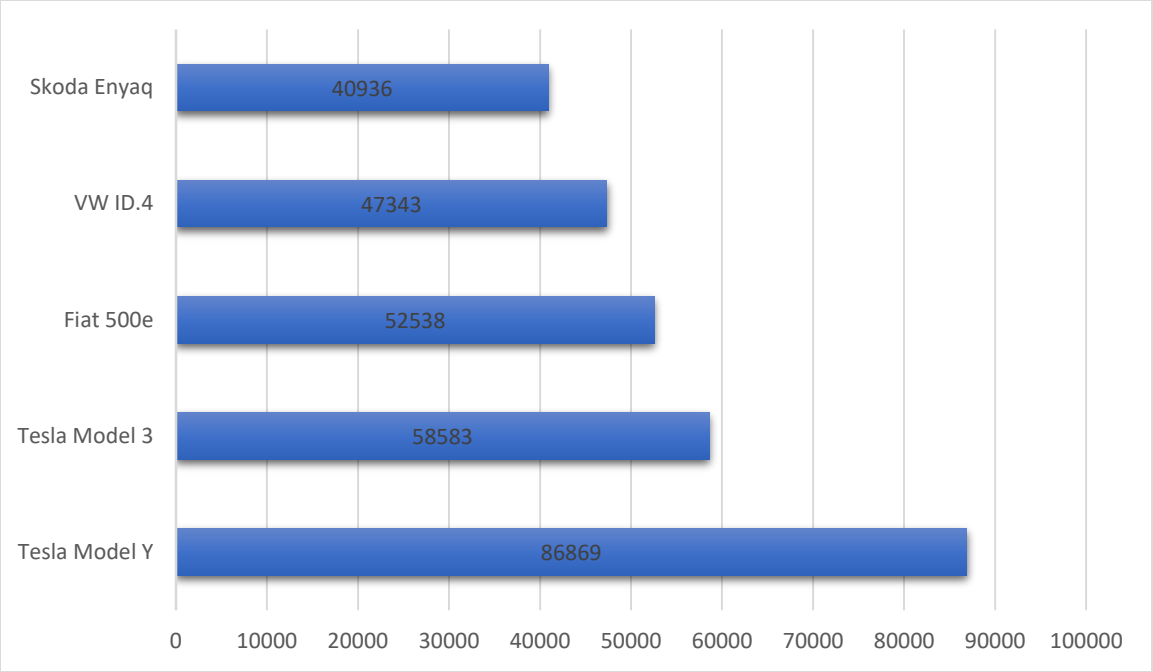
FIGURE 4



Starting from 2016 to 2022, prices for electric cars began to fall rapidly. All because of the subsidies that the state allocates and thanks to them, every European can safely buy an electric car. The governments of France and Germany are singled out, which have raised the amount of subsidies to 7,000 and 9,000 euros to stimulate the market and increase sales.

FIGURE 5

The most popular models, 2022

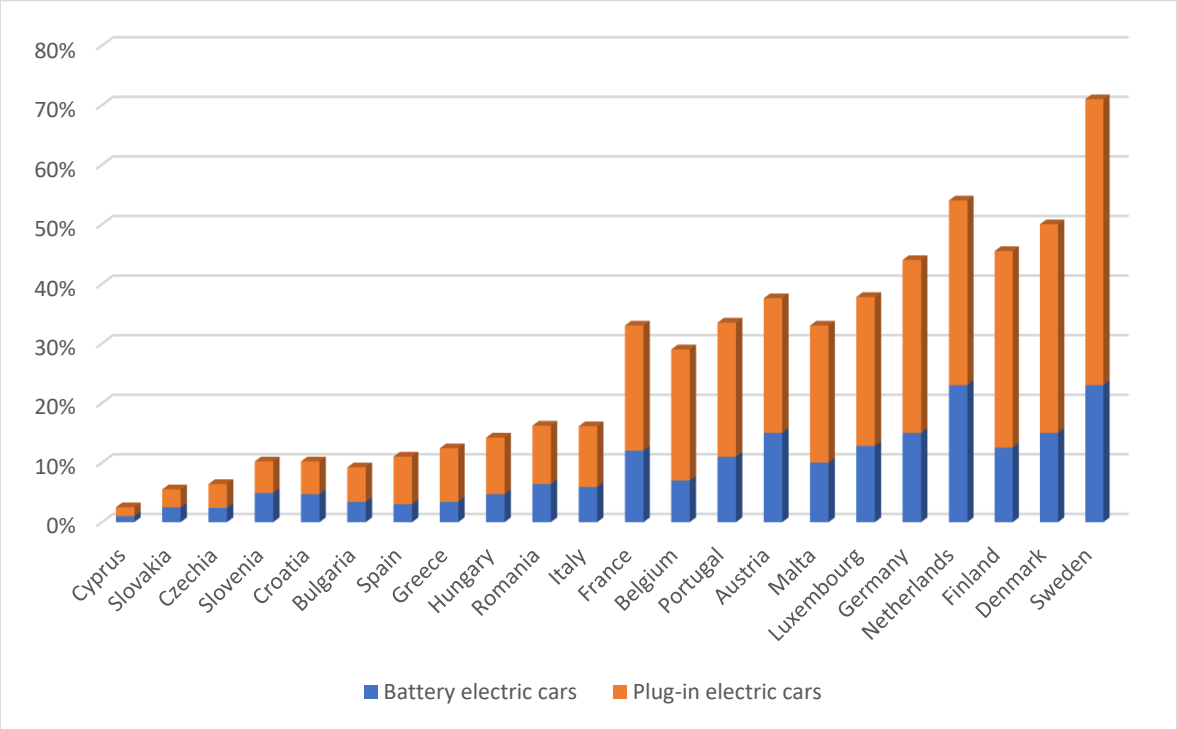


The most popular models of electric vehicles that were registered in 2022 (Figure 5). In the first and second places is the Tesla brand with two popular models that received 86.869 and 58.583 registrations. However, European automakers are doing everything to overtake the American automaker and some succeed. For example, the Volkswagen ID.4 brand, which registered 6,158 electric vehicles in October 2022, becoming the absolute leader in Europe. Also, many Tesla manufacturers claim that such a decline in the company occurred due to logistics problems, while others believe that it happened due to the emergence of many new brands of electric vehicles in Europe. Nevertheless, Tesla is not going to slow down and is going to complete the construction of a gigafactory factory in Germany for consumers in Europe.

As for the prices for charging with electricity, we can consider this on the example of one of the popular models of electric vehicles Tesla Model 3. At a cost of 40 cents per kWh of electricity, it turns out that every 100 km of the way on the Model 3 will cost 8.32 euros, and at a speed of 160 km / h, 30 kWh of electricity will be required for 100 km of the way.

FIGURE 6

Registration of electric vehicle by city



In the diagram, you can see that the majority of registrations are in Denmark, Netherlands and Sweden. Overall, the total percentage of registration of electric vehicles in these three countries is 44%, and Sweden in 2021 registered a greater number of electric vehicles and the total percentage of sales was 46%. The smallest number of registrations in countries such as Cyprus, Slovakia and the Czech Republic. In these three countries, the number of registrations of electric vehicles is only 1% of the total share.

Thanks to all of the above, we can conclude that the sales of electric vehicles are influenced by many factors such as electricity prices, taxes, the number of charging stations, etc.

Data

The European Union has set a goal of transitioning to electric vehicles and implementing a green energy approach. The aim is to phase out internal combustion engines, starting with passenger cars. This will have a significant impact on the development of new technologies and infrastructure that are environmentally friendly and promote progressive societal growth. To better understand the current state of electric vehicle sales in the EU, we analyzed data from various sources such as Eurostat, EAFO (European Alternative Fuels Observatory), DG Energy, and World Bank.

Our analysis focused on 27 EU countries including Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary Ireland Italy Latvia Lithuania Luxembourg Malta Netherlands Poland Portugal Romania Slovakia Slovenia Spain Sweden between 2018 and 2021. We used different variables to measure EV sales throughout this period. One essential variable was "EV Sales" obtained from EAFO - it helped us understand sales trends in the region by measuring popularity and demand for electric vehicles.

Another critical variable we considered was the number of charging stations in each country (PCs) also taken from EAFO. The availability of charging infrastructure has been slow but is developing steadily with current trends.

We also examined tax data from Eurostat to determine how taxes affect EV sales in the region. Additionally, "price of electricity" data was collected from Eurostat since there is an inverse correlation between electricity prices and EV sales.

Furthermore, "Price of diesel" expressed in euros per 1000 liters was obtained from DG Energy as it helps explain why there is a positive correlation between diesel prices and electric vehicle sales across Europe.

Gross domestic product (GDP), geographic area size and employment data were also used as independent variables to analyze our findings further. These datasets were acquired from the World Bank website.

We identified multiple factors that contribute to variations in EV adoption rates across different EU countries during our analysis using these various datasets.

Variable	Description	Sources
Sales	National sales of battery electric vehicles	EAFO
PC (Power Charging)	Number of publicly accessible power charging stations in a country	EAFO
Tax	National transport taxes as % of GDP (excluding fuel taxes)	Eurostat
Pelec (Price of Electricity)	Average national price of electrical energy for household consumers (all taxes and levies included)	Eurostat
Pdie (Price of Diesel)	Average prices of gasoline (1000L) including taxes in a country.	DG Energy
GDP (Gross Domestic Product)	Gross domestic product per capita based on purchasing power parity	World Bank
Area	Country's land area in sq km.	EAFO
Emp (Employmed)	The percentage of people in a nation who have jobs	World Bank

Variable	N	Mean	St. dev	MIN	MAX
Sales	108	38369.398148	90872.432515	143.0000	658972.000
Tax	108	11790.977315	17217.876601	0.0000	64714.0000
P elec	108	27.809607	287.118059	0.97900	2984.0000
PC	108	6805.814815	14324.121668	0.0000	82803.000
Area	108	156486.185185	170342.203604	316.0000	638475.000
P die	108	1232.728674	178.916355	516.6000	1677.044286
GDP	108	47311.985185	20290.520081	23011.500	134544.5000
Emp	108	0.550000	0.048414	0.420000	0.64000

Methodology

The analysis uses panel data regression methods to estimate the model where explain EV sales by a number of independent variables. To account for unobserved variables, country fixed effects are included. These factors remain constant over time and include climate, and road infrastructure. Additionally, time fixed effects control for variables that remain unchanged across countries like new technologies or macroeconomic shocks. Taking the logarithm of all variables reduces bias since it simplifies coefficient interpretation and comparison while mitigating issues associated with heteroskedasticity and outliers. This approach also reduces the impact of extreme values. Robust estimators are further used to address heteroskedasticity concerns.

The main regression model is represented by the following equation:

$$log(Sales) = \beta 1\ incentives + \beta 2\ log(Tax) + \beta 3\ log(Pelec) + \beta 4\ log(PC) + \beta 5\ log(Pdie) + \beta 6\ log(Area) + \beta 7 log(GDP) + \beta 8\ log(Emp)$$

There are two ways to control for country fixed effects: utilizing the first-difference method or incorporating fixed or random effects into the model. However, using the first-difference method can decrease statistical power by reducing sample size. As there were not many observations available, this study did not use this approach. Additionally, it is unsuitable for the dependent variable of battery electric vehicle sales due to its unique characteristics. Thus, fixed and random effects were included in the model to account for country fixed effects.

The Hausmann test is used for panel data analysis to test the possibility of endogeneity (missing important unobserved variables in the regression). The Null hypothesis set is that the random effects model is better than the fixed effects model.

Based on the test, with the p-value being much less than 0.05, we can reject the Null hypothesis at a 5% significance level. If the Hausmann test suggests the presence of endogeneity the fixed effects model is believed to produces more reliable estimates.

Finally, the inclusion of time random effects in the model was tested, and the null hypothesis that the coefficients for all years were equal to zero was strongly rejected. This implies that time random effects are necessary to control for time-specific shocks in the analysis.

Results

The primary regression results are presented in a table, where the initial column serves as a benchmark and is represented by pooled OLS. The R2 value for the model is 0.762, with an adjusted R2 of 0.746, indicating that nearly 80% of the variance in national EV sales can be explained by independent variables. The tax and power charging coefficients for the main explanatory variables are both statistically significant at a rate of 1%, and positive. Moreover, an increase of 1% in national charging infrastructure results in an expected rise of 0.41% in BEV sales. Sales have a positive relationship with country size according to pooled OLS and are statistically significant as well, indicating that larger countries tend to have higher sales levels. As anticipated, the coefficients for GDP per capita and tax are also positive and statistically significant; however, it was surprising to find no positive correlation between diesel prices and BEV sales. Instead, the coefficient is indeed positive (and statistically significant), suggesting that a rise of 1% in diesel prices would result in a corresponding increase (of about 1.6%) in BEV sales - these finding contrasts earlier research on HEVs that found a connection between HEV market share and gasoline prices (Diamond, 2009; Gallagher & Muehlegger, 2011). Sierzchula et al.'s (2014) more recent study discovered no noticeable link between EV market share and gasoline prices either.

It is evident that the average consumer prices of gas oil automobiles in a country have significant impacts on the sales of BEVs. The correlation between these two variables indicates that government policies and taxation are crucial factors to consider when promoting sustainable transportation solutions. As taxes increase by 1%, sales of BEVs increase by 0.25%. This observation highlights the need for governments to implement favorable policies and incentives aimed at promoting eco-friendly vehicles such as battery electric vehicles. It is clear that

consumers are becoming more environmentally conscious, hence their inclination towards green transport solutions like BEVs.

The equation in the second regression (2) is estimated through a random effects model that considers country heterogeneity. The key variation in this model concerns diesel or gasoline. Despite the coefficient negative, it is not statistically significant anymore. This could be due to the index showing no significant change over time, which the random effect takes into account. While there are minor differences in magnitude for other variables, the overall conclusions match those of pooled OLS (1).

In the third regression analysis, a fixed effects model is used instead of the random effects model. The variables for GDP and Diesel Price still show positive and significant coefficients at a one per cent level. However, it is noticeable that the impact of GDP has become more pronounced while the effect of improved charging infrastructure on vehicle sales has become less significant.

Time-invariant heterogeneity is eliminated from data by fixed effects models, which means that any variable that does not change over time in each country will be excluded from the model. Conversely, random effects models suppose that time-invariant heterogeneity has no correlation with the included regressors. Hence, a variable that remains constant over time for each country can still be incorporated into a random effects model.

Main regression

Variables	**Pooled OLS** **Log Sales**	**Random effects** **Log Sales**	**Fixed effects** **Log Sales**
Intercept	-9.766 ***	-13.380 ***	
Log Tax	0.251 ***	0.198 .	-2.379 *
Log Pelec	-0.008	-0.028	0.001
Log PC	0.407 ***	0.202 ***	0.116 *
Log Area	0.217 *	0.462 **	
Log Die	1.686 *	-0.392	-2.217 **
Log GDP	1.085 **	3.123 ***	10.409 ***
Log Emp	-0.613	-1.253	-1.064

N	108	108	108
R^2	0.762	0.502	0.590

The estimated coefficient for GDP per capita is statistically significant at the 10% level and positive. This means that if all other variables remain constant, a 1% increase in GDP per capita is associated with a 1.085% increase in electric vehicle sales. This finding is consistent with our intuition that wealthier countries tend to have higher EV sales.

Tax increase on traditional gasoline or diesel vehicles could make BEVs relatively more attractive to consumers, leading to an increase in BEV sales. This could be particularly true if the tax increase is significant and results in a noticeable increase in the cost of driving a traditional vehicle. Additionally, if the tax increase is accompanied by government incentives for BEV purchases, such as tax credits or rebates, this could further incentivize consumers to switch to BEVs.

It is plausible that an increase in taxes on all automobiles, including battery electric vehicles (BEVs), may have a negative impact on the sales of all vehicles. The relationship between tax increases and BEV sales could potentially be contentious. Additionally, this could have adverse ramifications for low-income buyers who are already struggling to afford vehicle purchases. In such cases where they cannot bear the increased expense of a BEV, this might further affect their sales. While it's true that BEVs are becoming more popular in recent years due to advancements in technology, government incentives, and growing environmental awareness among consumers - a potential tax hike can create roadblocks for those interested in purchasing these eco-friendly cars. Low-income buyers may be particularly affected by such levies as they will struggle with affordability issues. This consideration is even more relevant given the current economic situation brought about by the COVID-19 pandemic. Therefore, it is essential to examine how increasing automobile taxes will affect the overall market for both gasoline and electric-powered cars while considering its implications towards low-income groups' ability to transition towards sustainable modes of transportation effectively.

Conclusion

Analyzing the influence of various factors on the growth of battery electric vehicles in Europe was the objective of this research. A panel dataset comprising four years' worth of data from European nations was compiled for this purpose.

In terms of charging infrastructure, which is an important factor in BEV adoption, the results are significant and positive. It means that an increase in charging infrastructure is associated with higher BEV adoption rates, holding other factors constant. This suggests that a lack of charging infrastructure may be a barrier to the adoption of BEVs, and that policies aimed at improving charging infrastructure may help to increase the adoption of BEVs.

Surprisingly, we found a positive and statistically significant relationship between area and EV sales. This may indicate that larger countries have more opportunities to implement BEVs, such as more affordable charging infrastructure or more diverse transportation options.

The charging infrastructure is a crucial factor that significantly influences the adoption of battery electric vehicles (BEVs). As we have seen throughout results, creating a comprehensive and accessible charging network is essential in eliminating range anxiety among consumers. The availability of reliable charging stations will provide drivers with peace of mind, knowing they can recharge their BEVs when needed. The future looks bright for BEV adoption as governments across the world continue investing heavily in electrification efforts. However, there’s still work to be done concerning establishing adequate EV infrastructures such as increasing accessibility to power supply locations or building more fast-charging stations. In summary, creating an efficient and accessible charging infrastructure is critical towards boosting consumer confidence and driving up demand for electric vehicles.

National transport taxes as a percentage of GDP (excluding fuel taxes) have a significant impact on the sales of battery electric vehicles (BEVs). In fact, when these taxes increase by 1%, sales of BEVs increase by 0.25%. This correlation highlights the importance of tax policies in encouraging clean transportation options for consumers. Throughout history, governments around the world have

implemented various types of transportation taxation to generate revenue and regulate vehicle usage. The focus has always been on fuel taxes as they are considered an important source of income for infrastructure development and maintenance. However, with more people shifting towards cleaner forms of travel such as electric cars, governments need to adapt their tax policies accordingly. It is important to note that national transport taxes can also be used as a tool to encourage sustainable behavior among consumers. Hence why it is crucial policymakers consider implementing lower or even zero tariffs on EVs while increasing taxation on petrol-based vehicles.

It is important to emphasize that generating electricity with low carbon emissions is vital, even though it was not the main topic of discussion in this article. In order for electric cars to become a reliable alternative, we must have a more environmentally friendly energy mix across Europe in the future.

References

Encyclopedia of Environment and Society—PDF Free Download. (n.d.). Retrieved April 9, 2023, from https://epdf.tips/encyclopedia-of-environment-and-society.html

Electric Vehicle Market 2022, Share, Size, Share, Revenue, Industry Analysis Forecast by 2030. (2023, March 14). http://web.archive.org/web/20230314183927/https://www.linkedin.com/pulse/electric-vehicle-market-2022-share-size-revenue-industry-riyaz-attar

Disadvantages & limitations of using Electric Vehicles—Elecles. (2023, January 29). https://elecles.com/disadvantages-limitations-of-using-electric-vehicles/

Research, B. I. S. (n.d.). *Direct Air Capture: A Technology That Can Help Save the Planet*. Retrieved April 9, 2023, from https://blog.marketresearch.com/direct-air-capture-a-technology-that-can-help-save-the-planet

Winton, N. (n.d.). *High Price, Limited Performance Of European Electric Cars Might Boost China Minis*. Forbes. Retrieved April 9, 2023, from https://www.forbes.com/sites/neilwinton/2020/12/06/high-price-limited-performance-of-european-electric-cars-might-boost-china-minis/

When teachers are asked to deploy other teachers, we learn a lot about teacher preferences—EdTech Hub. (n.d.). Retrieved April 9, 2023, from https://edtechhub.org/2022/05/13/when-teachers-are-asked-to-deploy-other-teachers-we-learn-a-lot-about-teacher-preferences/

Ammunition Market Size & Industry Outlook|2022 – 2031. (n.d.). Retrieved April 9, 2023, from https://www.researchdive.com/3619/ammunition-market

sales@tritonmarketresearch.com. (n.d.). *MIDDLE EAST AND AFRICA SUPER ABSORBENT POLYMER (SAP) MARKET 2019-2028*. Retrieved April 9, 2023, from https://www.tritonmarketresearch.com/reports/middle-east-and-africa-super-absorbent-polymer-(sap)-market

Pasaoglu, G., Honselaar, M., & Thiel, C. (2012). Potential vehicle fleet CO2 reductions and cost implications for various vehicle technology deployment scenarios in Europe. *Energy Policy*, *40*, 404–421. https://doi.org/10.1016/j.enpol.2011.10.025

Thiel, C., Schmidt, J., Van Zyl, A., & Schmid, E. (2014). Cost and well-to-wheel implications of the vehicle fleet CO2 emission regulation in the European Union. *Transportation Research Part A: Policy and Practice*, *63*, 25–42. https://doi.org/10.1016/j.tra.2014.02.018