Section I

연구논문

The Effects of Tax Exemption on the Sale of Electric Vehicles in Norway[1]

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This paper estimates a structural demand model on a large data set, and performs counterfactuals that show that if electric vehicles were treated similarly to combustion engine vehicles in the Norwegian car tax system, their overall market share would be around 4-5 percent, as opposed to the actual 28 percent, and Tesla's sales would be reduced by a factor of almost 100, from 2,772 units to 29 units per year.

Keywords: Discrete-choice, Electric vehicles, Car taxes, Environmental taxes

1. Introduction

Non-electric cars in Norway face a one-time registration tax depending on weight, engine power and CO2 emissions which on average accounts for one third of the total sales price, as well as a value-added tax of 25 percent. Since electric vehicles are exempt both from the registration tax and VAT, the expansion of car manufacturers' electric ranges in recent years have made Norway into a significant market for such cars. In this paper I estimate a structural model of the demand for new cars using Norwegian data from 2000 to 2015 on product characteristics and sales by sex and age of the buyer.

I use the estimated demand system to find the marginal cost for each product that is implied by the assumption that prices are a Bertrand equilibrium. Given this information, I calculate new equilibrium prices and the associated demands under alternative tax regimes, where electric vehicles are not given favourable treatment. I find that the share of electric vehicles in total unit sales falls from 28 percent to 4-5

(1) I acknowledge financial support from the Institute of Economic Research of Seoul National University. Thanks to Soojeong Jung and Euna Yang for research assistance.

percent. As a concrete example, Tesla Model S, the second best-selling product in Norway in 2015, with 2,772 units sold, falls to the 190th place in the sales ranking, as predicted units sold fall to 29.

A large literature examines environmental policies in the car market. See *e.g.* [Grigolon, Reynaert, and Verboven(2015); Verboven(2014)]. The main contribution of this paper is to present evidence from a market where such policies appear to have had very large impact, to judge from the extremely high market share of electric cars. My approach is similar to that of Fershtman, Gandal, and Markovich(1999), who evaluate the effect of a tax on new cars in Israel. My overall estimation approach is similar to Berry, Levinsohn, and Pakes(2004) and Goolsbee and Petrin(2004).

The next section presents some facts about the Norwegian automobile market and describes the data used in the paper. The third section describes the estimated demand model. The fourth section presents the estimation results and the results from the counterfactual tax experiments.

2. Data and Market

The data set is constructed by combining two data sources: new vehicle registrations with sex and age of the buyer, and price lists, from Norway 2000-2015.(2) For details about how the two data sets have been combined, see Thomassen(forthcoming). Car dealerships in Norway mostly have a stated policy of not allowing discounts to

(2) Both were provided by *Opplysningsrådet for Vegtrafikken AS* (the information council for road traffic). Regarding the role of sex and age: in 2008, 50.8 percent of households consisted of only one adult. For such households the registered buyer can be assumed to coincide with the user of the car. For households with more than one adult, it is possible that the person whose preferences determined the choice of car does not coincide with the registered owner. The estimated coefficients related to sex and age should therefore be interpreted with some caution. However, the purpose of including sex and age as explanatory variables in this paper is to capture some of the drivers of taste heterogeneity. This purpose is served even if the demographic attributes of registered owners and decision makers are correlated, but not identical in all cases.

the list price, so I assume that list prices correspond closely to transaction prices.(3) I define a product as a combination (in a given year) of brand, model ('nameplate') and fuel (petrol, diesel or electric). Often a product is sold in multiple engine power variants.

In these cases I pick the median engine power in the range and aggregate all sales of the product to that variant. All other characteristics of the product, such as price, weight and CO2 emissions then correspond to this variant. This is the same approach as used in the literature, *e.g.* BLP. Table 1 presents summary statistics of the data. All prices and taxes in the table and elsewhere in the paper have been converted to 2015 Norwegian kroner (NOK) using the consumer price index obtained from Statistics Norway.

To allow for the possibility that the overall number of cars purchased changes when the tax regime changes, I must include an outside option (the alternative of not buying a new car). This requires an estimate of the number of people (in each sex and age group) who choose the outside option in the data. Similarly to in Fershtman, Gandal, and Markovich(1999) and Ivaldi and Verboven(2005), I define the market size of a consumer group as twice number of people in that group who bought a new car.(4)

In recent years, the Norwegian car market has be characterized by an unusually high market share for electric vehicles. Figure 1 shows that from the early 2000s diesel cars gained ground over petrol vehicles. Then, with the introduction of a new

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(3) At the end of the 1990s car dealerships dropped their prices as they introduced a policy of no bargaining over prices. The newspaper VG reports in 1999: "Net prices or fixed prices are now arriving for new cars. (...) Toyota Norway reduces prices on all new cars from 1 March this year. (...) 'We introduce fixed prices or 'already discounted' prices for all car buyers' (...) Per Arne Skramstad, head of communications in Toyota Norway, tells VG. (...) Saab Norway has the longest experience with net prices - without discounts or reduced prices. BMW and Mercedes, and from last autumn also Volvo and Renault, have switched car pricing completely to net prices with no room for haggling." http://www.vg.no/forbruker/bil-baat-og-motor/prisras-paa-nye-biler/a/45954/ (Retrieved 9 Jan 2017.)

(4) Fershtman *et al.*: "the size of the market is just a scaling factor and does not significantly affect (...) the elasticity of demand between the inside and the outside goods."

<Table 1> Summary Statistics of Data

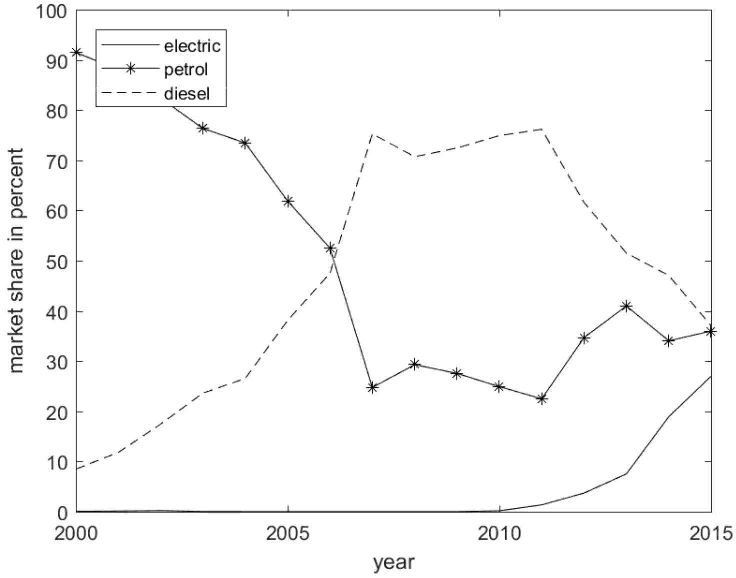
years of data	2000-2015
total unit sales recorded in data	980,015
number of year/brand/model/fuel combinations	4,585
number of brand/model/fuel combinations	727
number of brand/models	444
number of brands	51
	Mean
age	51.04
woman	0.31
price	481.51
price, sales-weighted (1000s NOK)	352.39
registration tax	177.95
registration tax, sales-weighted	115.25
engine power (kW)	104.62
engine power (kW), sales-weighted	90.93
length (cm)	439.76
length (cm), sales-weighted	439.36
CO2 (g/km) [only available from 2008]	148.44
CO2, sales-weighted	125.14

Source: Information Council for Road Traffic (OFV)

generation of electric vehicles after 2010, combined with renewed focus on particle emissions from diesel vehicles, the sale of electric vehicles shot up, while the sale of diesel cars fell back again. The introduction of electric vehicles that are comparable in functionality to cars with combustion engines, as well as the improvement in diesel engines are largely global phenomena. The very high market share of electric vehicles is specific to the Norwegian market, however. Figure 2 shows that the top-selling electric vehicle has almost 12 percent of the total market of cars sold to individuals.(5)

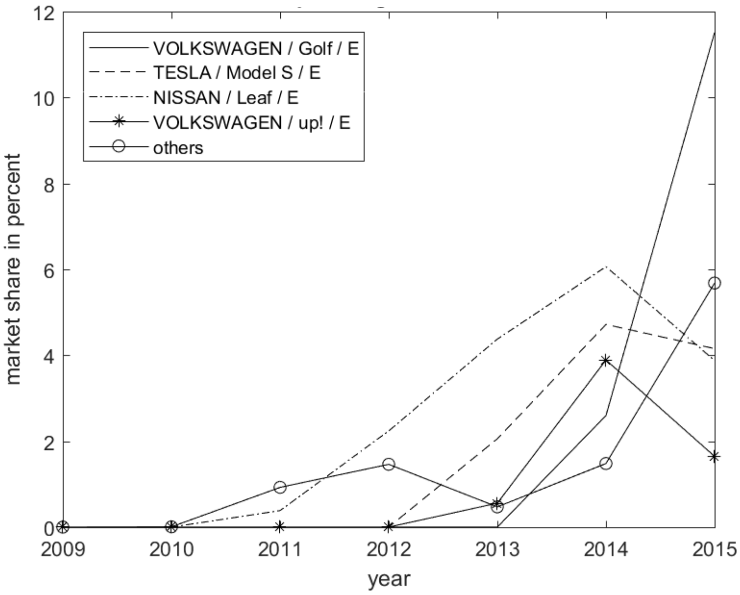
Several other electric vehicles also have very high market shares in the last few years.

(5) In 2013-2015 there are also some hybrid combustion-electric vehicles that have reached a certain popularity. However, their combined market share in these years is only 2.3 percent. They have been dropped from the analysis in this paper. They are not counted in the denominator used to calculate the market shares discussed in the text.



Source: Information Council for Road Traffic (OFV)

<Figure 1> Market Shares by Fuel Type

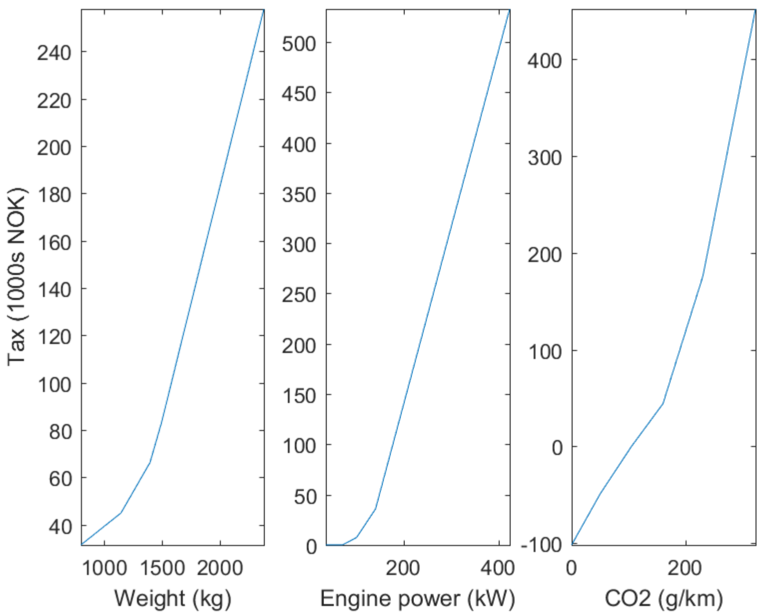


Source: Information Council for Road Traffic (OFV)

<Figure 2> Market Shares of Best-Selling Electric Vehicles

Other than various incentives intended to encourage purchases of electric vehicles—such as free parking, battery charging and car ferry transport, and the ability to drive in bus lanes—the main policy that has driven the success of electric vehicles in Norway is the exemption of such cars from the high registration tax and value-added tax payable on other vehicles. Before discussing the tax regime, I note that for the estimates in this paper I do not explicitly model non-tax incentives to buy electric cars. However, they are controlled for in the estimated demand model through the inclusion of an *electric* dummy, as well as a linear and quadratic time trend for the unobserved utility of electric vehicles. These variables capture time-constant and time-varying attractiveness of electric vehicles depending on non-tax incentives.

The registration tax has three components that are increasing and convex in a vehicle's weight, engine power and CO2 emissions, respectively. From Table 1 we see that the sales-weighted mean registration tax paid over the years of the data is about 115,000 NOK, or 33 percent of the sales-weighted mean price paid. During



Source: Norwegian Customs

<Figure 3> Registration Tax Paid by Component the period of the data (2000-2015) the tax system has remained broadly unchanged, except the move in 2007 from using cylinder volume to CO2 emissions as the third tax component. Apart from this, the overall direction has been towards penalizing heavy and high-emission vehicles ever more strongly.

Figure 3 shows plots of the 2015 tax functions. The graph shows the total amount of registration tax payable for each of the three tax components, for each value of the relevant technical characteristic. The horizontal axis of each plot spans the range of the relevant attribute for products actually in sale in 2015. Two features stand out in the graphs: first all three of them get steeper as we move to higher values of the variables. Secondly, for the third component, CO2 emissions, the tax is negative for low values. This is a relatively recent feature of the tax system, which means that for vehicles with particularly low CO2 emissions, this feature offsets some (or even all) of the tax incurred from weight and engine power. Still, the final tax is constrained to be nonnegative. In addition to the registration tax, there is a value added tax of 25 percent payable on the pre-VAT price of the car minus the registration tax, so that the final price can be decomposed as

$$\text{price} = (\text{markup} + \text{marginal cost}) \cdot (1+\text{vat}) + \text{registration tax}, \tag{2.1}$$

where vat = 0.25.

The crucial feature of the tax system that favours electric vehicles is that they are exempted both from the registration tax and from value-added tax. In Section 4 of this paper, I calculate the equilibrium prices and demands that obtain under two counterfactual tax regimes in the 2015 markets that are intended to show how the demand for electric vehicles is influenced by the favoured tax treatment.

3. Model and Estimation

Products, indexed by j, are combinations of brand, model ('nameplate') and fuel type (petrol, diesel or electric). In a given year t, there is a set J_t of available products.

A consumer i gets the following utility from product j:

(3.1) $$u_{ij} = x_j(\beta_0 + \beta_i) + \xi_j + \varepsilon_{ij},$$

where x_j is a $K \times 1$ vector of product characteristics. The vector β_0 gives the taste component common to consumers, while β_i is a vector that depends on consumer attributes in the following way (for the k-th entry of β_i):

(3.2) $$\beta_{ik} = \gamma_{1k}\, age_i + \gamma_{2k}(age_i)^2 + \gamma_{3k} woman_i .$$

The scalar ξ_j represents consumers' common perception of the product's quality, unobserved in the data. Finally ε_{ij} is a type-1 extreme value random variable, iid across products and consumers, which gives a logit model of consumer decisions. By gathering the utility components that do not vary across consumers in the scalar

(3.3) $$\delta_j = x_j\beta_0 + \xi_j ,$$

we can rewrite (3.1) as

(3.4) $$u_{ij} = x_j\beta_i + \delta_j + \varepsilon_{ij} .$$

The probability that consumer i chooses product j is given by the standard logit choice probability

(3.5) $$P_{ij}(\gamma,\delta) = \frac{\exp(x_j\beta_i + \delta_j)}{\sum_{j' \in J_t} \exp(x_{j'}\beta_i + \delta_{j'})}$$

where $\gamma = (\gamma_1, \gamma_2, \gamma_3)$.

Let $d_{ij} = 1$ if consumer i is observed to choose product j, and $d_{ij} = 0$ otherwise. The log likelihood, letting, is

$$l(\gamma,\delta) = \sum_{t=1}^{T} \sum_{i \in N_t} \sum_{j \in J_t} d_{ij} \log[P_{ij}(\gamma,\delta)] \tag{3.6}$$

where T is the number of time periods in the data and N_t is the set of consumers observed in t.

The estimation approach is similar to that of Goolsbee and Petrin(2004) (although their utility model is probit rather than logit), in that the parameters γ are estimated by maximum likelihood, while the vector of product fixed-effects δ is found (for each time period t) as the solutions to the system of equations

$$s_{tj} = P_{tj}(\gamma, \delta_t), \quad j \in J_t;\ t = 1,..., T, \tag{3.7}$$

where

$$P_{ij}(\gamma,\delta_t) = \frac{1}{\# N_t} \sum_{i \in N_t} P_{ij}(\gamma,\delta) \tag{3.8}$$

and $\#N_t$ is the number of consumers in t (*i.e.* the number of elements of the set N_t).

Berry(1994) shows that (3.7) has a unique solution, and Berry, Levinsohn, and Pakes(1995) [BLP] show that for logit models (among others) the solution can be found by iterating (with iterations indexed by r) on the contraction

$$(\delta_t)^{r+1} = (\delta_t)^r + \log(s_j) - \log P_{tj}[\gamma,(\delta_t)^r],$$

for any given γ. Since the system (3.7) has a unique solution for each γ, and we have an algorithm for finding this solution, we can write the solution as function of γ: $\delta(\gamma)$.

In maximizing the log likelihood (3.6), for each trial parameter vector γ I use the BLP contraction (3.9) to find $\delta(\gamma)$. Therefore, I maximize a log likelihood function that depends only on γ:

(3.9) $$l(\gamma) = l[\gamma, \delta(\gamma)].$$

This estimation by MLE of the parameters γ is the first stage of the estimation. The second stage involves decomposing δ to obtain the parameters β_0. I do this, similarly to Goolsbee and Petrin(2004) or Nevo(2001), by regressing δ_j, obtained from the value of γ found in the first stage of estimation, on the product characteristics x_j, *i.e.* by estimating (3.3), where ξ_j is simply the error term in the regression.

The main challenge in this second stage, as is well known from the literature, is that ξ_j, given its interpretation as unobserved product quality, is likely to be correlated with price. I therefore estimate this second-stage regression by two-stage least squares, using the registration tax as an instrument for price. I follow the literature in assuming that the other components of x_j are exogenous. The registration tax is obviously partially correlated with price (after controlling for the other explanatory variables) since it is a component of price and a nonlinear function of product characteristics. Since it is a function of exogenous variables, it is itself exogenous.

4. Results

In this section I first discuss the estimates, and then the results from the counterfactual experiments. Table 2 shows the maximum likelihood estimates from the first stage. All parameters are precisely estimated. We see for instance that price sensitivity first falls with age and then increases again. Also, women are on average slightly more price sensitive than men.

Table 3 shows the results from the second-stage regression. Results both from OLS and 2SLS (using registration tax as an instrument for price) are reported. Comparing the coefficients, -9.1 from OLS and -15.3 from 2SLS, we can conclude that the difference is consistent with the expected endogeneity bias under OLS: since price is likely to be positively correlated with the unobservable (ξ_j), we should expect an upward bias on the OLS coefficient on price. That is, while a high price is partly due to a high value of ξ_j, OLS rules this out and attributes the relatively high resulting demand

<Table 2> First-Stage Estimates

	[unit]	est.	s.e.
age	[age]*1e-2	-4.172	0.174
engine power x age		17.780	0.093
length x age		-7.634	0.055
electric x age		11.464	0.066
diesel x age		4.047	0.028
CO2 x age		-2.399	0.019
weight x age		12.679	0.101
price x age		13.931	0.188
age squared	[age^2]*1e-4	12.870	0.292
engine power x age squared		-17.517	0.162
length x age squared		5.574	0.093
electric x age squared		-18.197	0.121
diesel x age squared		-5.615	0.047
CO2 x age squared		3.125	0.032
weight x age squared		-12.044	0.176
price x age squared		-14.624	0.325
woman	[0/1]	6.649	0.036
engine power x woman		-0.595	0.021
length x woman		-1.219	0.012
electric x woman		-0.426	0.014
diesel x woman		-0.342	0.006
CO2 x woman		0.201	0.004
weight x woman		-0.312	0.024
price x woman		-1.007	0.044
number of observations		980,015	
log likelihood		-6474705.9	

Source: Author's calculations.

as a sign of price insensitivity. With 2SLS this bias should be removed, and we find consumers to be more price sensitive. Of other parameters, we can read off the effect of *electric* in 2015 by using the fixed electric effect as well as the linear and quadratic time effects: $-1.46 + 0.18 \cdot 16 - 0.004 \cdot 16^2 = 0.40$ (where 2015 is the 16th year in the data). Although some of the effects are not significant, this says that, everything else equal, on average consumers slightly prefer an electric car to a petrol car, indicating that to a typical consumer, electric cars are attractive not only because of their

<Table 3> Second-Stage Regression Estimates

	[unit of explanatory variable]	OLS		2SLS	
		est.	s.e.	est.	s.e.
price	[millions of NOK]	-9.118	0.301	-15.327	0.617
constant	[1]	-30.545	2.629	-19.961	2.894
time trend	[year 1 - 15]	-0.070	0.019	0.056	0.023
CO2	[g/km]*1e-2	0.921	0.148	0.282	0.164
engine power	[kW]*1e-2	-6.468	0.288	-3.501	0.394
length	[metres]	12.546	1.239	6.843	1.384
electric	[0/1]	-2.824	2.055	-1.466	2.151
diesel	[0/1]	-3.331	0.223	-3.059	0.234
diesel x time trend		0.335	0.042	0.209	0.045
diesel x squared time		-0.013	0.002	-0.007	0.002
electric x time trend		0.306	0.316	0.180	0.331
electric x squared time		-0.007	0.016	-0.004	0.016
engine power x time trend		-0.060	0.016	-0.235	0.022
engine power x diesel		1.115	0.157	1.874	0.177
engine power x electric		-0.071	1.092	-0.773	1.143
CO2 squared		-0.409	0.064	-0.051	0.073
engine power squared		1.245	0.076	1.937	0.099
length squared		-1.134	0.145	-0.431	0.163
brand dummies		yes		yes	
number of observations		4,585			

Source: Author’s calculations.

low taxes, but presumably also for other reasons such as the ability to park for free or drive in bus lanes.

In Table 4, note how for electric vehicles, mean percentage margin and mean percentage marginal cost add up to 100, since there is no tax. For non-electric vehicles, however, the registration tax and VAT drive a wedge between the firm’s margin and the price paid by the consumer. The absence of this wedge for electric vehicles allows firms to obtain a higher margin (twice as high as the average). However, this also benefits buyers of electric vehicles, since price for these products is a smaller multiple of marginal cost than for the average vehicle.

I now discuss the tax experiments, which are only performed for the 2015 market. The first experiment, *Counterfactual #1*, removes the CO2 component from tax for

<**Table 4**> Elasticities, Markups and Marginal Cost

	Median	Mean
own-price elasticity	-4.31	-5.75
own-price elasticity, electric vehicles	-2.46	-2.81
cross-price elasticity	0.0016	0.0065
margin as percentage of price	19.0	20.3
margin as percentage of price, electric vehicles	41.4	41.2
marginal cost as percentage of price	37.9	37.5
marginal costas percentage of price, electric vehicles	58.6	58.8

Source: Author's calculations.

all vehicles, and then imposes the same tax (*i.e.* VAT, weight tax and engine power tax) for electric vehicles as for all other products. The second, *Counterfactual #2*, does the same thing for electric vehicles as in #1, but leaves the tax for petrol and diesel vehicles at their actual values. The aim of these experiments is to see what happens to equilibrium demand for electric vehicles when they are treated similarly to other vehicles. The reason I remove the CO2 component for electric vehicles (and for all cars in #1) is that electric vehicles have no recorded CO2 emissions, since no combustion takes place when the car is driven. Because of the negative component that can be seen in the third panel in Figure 3, this would give electric vehicles a large tax discount if included.

I perform the counterfactuals in two steps, in the same way as in the literature, *e.g.* [Nevo(2000)]. Assuming that observed prices are a Bertrand equilibrium, I use the first-order conditions for the profit of each firm, and the decomposition in (2.1) to find the markup implied by the demand derivatives. From this I can infer marginal cost. I then change the taxes and, now using marginal cost as an input, solve for the prices that solve the first-order conditions under the new tax regime. See Thomassen [forthcoming] for more details.

Table 5 shows a summary of the results from the tax counterfactuals. First note that the mean registration tax across the products on sale in 2015, without weighting by sales, falls under counterfactual #1 and remains unchanged under #2. The reason for this is that the CO2 component is removed for combustion engine vehicles under

<**Table 5**> Results from Counterfactual Experiments

	[unit]	Actual taxes	Tax counter-factual #1	Tax counter-factual #2
Profit	[million NOK]	4,557	4,213	3,685
Profit from electric vehicles	[million NOK]	1,552	235	261
Revenue from registration tax	[million NOK]	4,766	5,644	5,694
Revenue from value-added tax	[million NOK]	2,357	3,307	2,926
Total tax revenue	[million NOK]	7,123	8,950	8,620
Unit sales		63,653	63,181	55,068
Unit sales electric vehicles		17,909	2,703	3,004
Unweighted mean registration tax	[1000s NOK]	153	124	157
Sales-weighted mean registration tax	[1000s NOK]	75	89	103
Unweighted mean price	[1000s NOK]	463	507	468
Sales-weighted mean price	[1000s NOK]	341	351	361
Sales-weighted mean engine power	[kW]	102	102	99
Sales-weighted mean CO2 emissions	[g/km]	89	122	117
Sales-weighted mean weight	[kg]	1,383	1,397	1,376

Source: Author’s calculations.

#1, and that the number of electric products on offer is small. These numbers show that in some sense, at least, the tax counterfactuals do not entail extreme changes to taxation. The unweighted mean tax is the only quantity in Table 5 that is independent of consumer and firm reactions to the tax regime (assuming that product offering is predetermined).

Let us now look at how outcomes change. The key fact, and the key result of this paper, is that the sales of electric vehicles falls quite dramatically, from 17,909 to 2,703 and 3,004, respectively, under the two scenarios. In terms of total market share of electric vehicles, this is a drop from 28 percent to 4 and 5 percent, respectively. The difference in the electric market share between the two counterfactuals is due to the fall in the total number of cars sold in the second scenario. In the first scenario, the increase in the tax burden on electric vehicles is offset by a reduction in the tax burden on combustion-engine vehicles, so that overall sales remain stable. In the second counterfactual scenario, there is no such compensation, so new cars on average become less attractive.

If we look at profits obtained by firms, the effect (on electric vehicles) is similar or slightly larger than for sales, indicating that the introduction on taxes on electric vehicles not only reduces sales, but also the market power that firms can exert for these products. As a share of industry profits, profits from electric vehicles falls from 34 percent to 6 and 7 percent respectively.

From a social point of view, we can first note that tax revenue goes up as a result of the tax reforms. Perhaps more interestingly, the sales-weighted mean CO2 emissions are substantially higher in the counterfactuals, at 123 and 117 grammes per kilometre, as opposed to only 89 under the actual tax regime. The explanation is to be found in the fact that electric vehicles have zero CO2 emissions while driving. While the direct CO2 incentives for combustion engines is removed in counterfactual #1, this does not seem to be very important, since taxes for combustion engines under #2 are equal to the observed taxes, and both counterfactuals give similar average CO2 numbers. So to the extent that reducing CO2 emissions from driving are an important goal, the current Norwegian car tax system seems very successful, as it is responsible for a reduction of (117-89)/117 = 24 percent reduction in emissions, relative to a system which does not favour electric vehicles as much.(6)

Table 6 looks in some more detail at the outcome of the counterfactual tax reforms on individual products. It shows the twenty products with the highest observed sales. Perhaps the most dramatic changes are seen in the sales and sales rank of the top few products on the list, which are all electric vehicles. Tesla, a very popular car in Norway, falls from second to 191th and 188th, respectively, on the sales ranking. This dramatic fall in sales is clearly due to the large increase in tax, since Teslas are heavy and have powerful engines.

(6) This calculation does not take into account any effect on the distance driven. For instance, if people tend to drive less when they have an electric car, the overall effect on emissions would be even larger.

<**Table 6**> Changes for Selected Products

	Unit sales			Sales rank (/328)			Price (1000s NOK)			Reg. tax (1000s NOK)		
	obs.	#1	#2	obs.	#1	#2	obs.	#1	#2	obs.	#1	#2
VW / Golf / E	7,681	1,201	1,352	1	11	4	254	379	379	0	89	89
TESLA / Model S / E	2,772	29	29	2	191	188	612	914	922	0	242	242
NISSAN / Leaf / E	2,575	525	590	3	36	29	193	301	301	0	82	82
MAZDA / CX-5 / D	1,494	1,837	1,699	4	2	1	450	437	450	96	82	96
SKODA / Octavia / D	1,433	1,227	1,633	5	10	2	286	297	287	41	52	41
VW / Golf / G	1,220	1,662	1,471	6	4	3	301	280	295	72	56	72
VOLVO / V70 / D	1,130	1,731	1,293	7	3	5	600	573	600	175	148	175
TOYOTA / Rav4 / G	1,099	2,057	1,227	8	1	6	409	368	409	139	97	139
VW / up! / E	1,071	413	462	9	44	37	191	256	256	0	45	45
MERCEDES / B / E	1,006	108	111	10	117	109	272	421	427	0	108	108
VOLVO / XC60 / D	999	1,452	1,141	11	5	7	597	574	597	180	155	180
SKODA / Octavia / G	911	1,128	1,018	12	15	9	301	287	301	76	62	76
NISSAN / X-Trail / D	877	1,262	1,026	13	9	8	317	294	316	111	90	111
MAZDA / CX-3 / G	874	1,303	964	14	7	13	279	252	279	78	50	78
NISSAN / Qashqai / G	849	1,184	961	15	12	14	247	224	246	85	63	85
MAZDA / CX-5 / G	835	1,287	931	16	8	15	427	398	427	111	81	111
NISSAN / Qashqai / D	835	822	971	17	27	12	281	283	280	63	66	63
KIA / Sportage / G	812	1,423	908	18	6	16	257	220	257	103	65	103
KIA / Soul / E	806	104	111	19	121	110	236	373	377	0	102	102
VW / Golf / D	797	859	988	20	25	11	307	303	301	54	55	54

Source: Author's calculations.

5. Conclusion

The taxes payable on new cars in Norway are unusually high. The complete exemption of electric vehicles from these taxes are the likely explanation for the very high overall market share of electric vehicles (28 percent) and of individual electric products, such as the electric VW Golf (12 percent) and Tesla Model S (4.3 percent). This paper estimates a structural demand model on a large data set, and performs counterfactuals that show that if electric vehicles were treated similarly to combustion engine vehicles in the tax system, their overall market share would be around 4-5 percent, and Tesla's sales would be reduced by a factor of almost 100, from 2,772 units to 29 units. The current policy is very effective in reducing average CO2 emissions from driving, reducing it by about 24 percent by encouraging purchases of electric vehicles.

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