



# GreenCAR

Transport.  
Behaviours.  
Climate.

IAEE 25/07/2023 – Ivan Petrov



# What is GreenCAR ?

- Do consumers take into account future energy/fuel costs?

Study	Valuation parameter
Gillingham, Houde, & van Benthem (2021)	0.16 - 0.39
Leard, Linn, & Zhou (2021)	0.51 - 0.56
Leard, Linn, & Springel (2020)	0.5
Grigolon, Reynaert, & Verboven (2018)	0.77 - 0.91
Allcott & Wozny (2014)	0.76
Kahn (1986)	0.33 - 0.5

Allcott, H., & Wozny, N. (2014). Gasoline Prices, Fuel Economy, and the Energy Paradox. *Review of Economics and Statistics*, 96(5), 779–795. <https://doi.org/10.1162/REST>

Gillingham, K., Houde, S., & van Benthem, A. (2021). Consumer Myopia in Vehicle Purchases: Evidence from a Natural Experiment. *American Economic Journal: Economic Policy*, 13(3), 207–238. <https://doi.org/10.1257/pol.20200322>

Grigolon, L., Reynaert, M., & Verboven, F. (2018). Consumer valuation of fuel costs and tax policy: Evidence from the european car market. *American Economic Journal: Economic Policy*, 10(3), 193–225. <https://doi.org/10.1257/pol.20160078>

Kahn, J. A. (1986). Gasoline Prices and the Used Automobile Market: A Rational Expectations Asset Price Approach. *The Quarterly Journal of Economics*, 101(2), 323–339. <https://doi.org/10.2307/1891118>

Leard, B., Linn, J., & Springel, K. (2020). *Have US Fuel Economy and Greenhouse Gas Emissions Standards Improved Social Welfare?* (Issue March).

Leard, B., Linn, J., & Zhou, Y. C. (2021). How Much do Consumers Value Fuel Economy and Performance? Evidence from Technology Adoption. *The Review of Economics and Statistics*, 105(1), 158–174. [https://doi.org/10.1162/rest\\_a\\_01045](https://doi.org/10.1162/rest_a_01045)



# What is GreenCAR ?

- Objective: Accelerate the deployment of energy efficient vehicles by proposing a solution to overcome a behavioural barrier
- Premise:
  - customers do not fully account for the future costs of ownership when making investment decisions regarding energy-consuming technologies.
  - existing energy labels neglect a key element of information required by consumers – namely usage cost in monetary terms.
- What if labels showed actual running costs?

## CONSUMER INFORMATION FUEL ECONOMY AND CO<sub>2</sub> EMISSIONS OF NEW PASSENGER CARS

Consumer Vehicle Information															
Make: XXXX Model/Version: XXXXXX VIN: W*****26 Engine CC: 2967 Transmission: Automatic	Fuel Type: Diesel Fuel Grade: <b>B7</b>														
<b>WLTP CO<sub>2</sub> emission figure (g/km)</b> 	193g/km														
<b>Grams of Carbon Dioxide (WLTP CO<sub>2</sub>) Emitted Per Kilometer: 193g/km.</b> <small>This figure may be obtained from the vehicle's Certificate of Conformity.</small>															
<table border="1"> <thead> <tr> <th>Fuel Consumption</th> <th>Litres/100km</th> </tr> </thead> <tbody> <tr> <td>Low</td> <td>10.4</td> </tr> <tr> <td>Medium</td> <td>7.5</td> </tr> <tr> <td>High</td> <td>6.3</td> </tr> <tr> <td>Extra High</td> <td>7.1</td> </tr> <tr> <td>Combined</td> <td>7.4</td> </tr> <tr> <td>Weighted Combined</td> <td>0</td> </tr> </tbody> </table>	Fuel Consumption	Litres/100km	Low	10.4	Medium	7.5	High	6.3	Extra High	7.1	Combined	7.4	Weighted Combined	0	
Fuel Consumption	Litres/100km														
Low	10.4														
Medium	7.5														
High	6.3														
Extra High	7.1														
Combined	7.4														
Weighted Combined	0														
<b>Fuel Use (estimated) for 18,000 kilometres</b> A fuel use figure is indicated to the consumer as a guide for comparison purposes. This figure is calculated by using the combined drive cycle (Low, Medium, High and Extra High fuel consumption cycles).															
	<b>1,332 Litres</b>														
<b>Taxation Information - For 2019 taxation will be calculated on NEDC-2 data</b>															
<small>Motor Tax for 12 months            Motor Tax varies according to the CO<sub>2</sub> emissions of the vehicle. New Private Cars registered on or after 1<sup>st</sup> July 2008.</small>															
	<small>€390.00</small>														



# WP4: Field trial with partner Hyundai

- Idea – to test the provision of energy and CO<sub>2</sub> information at the point of sale.
- 5-year CO<sub>2</sub> and energy cost savings estimates.
- Developed an app to display energy use cost and CO<sub>2</sub> emissions information to potential buyers



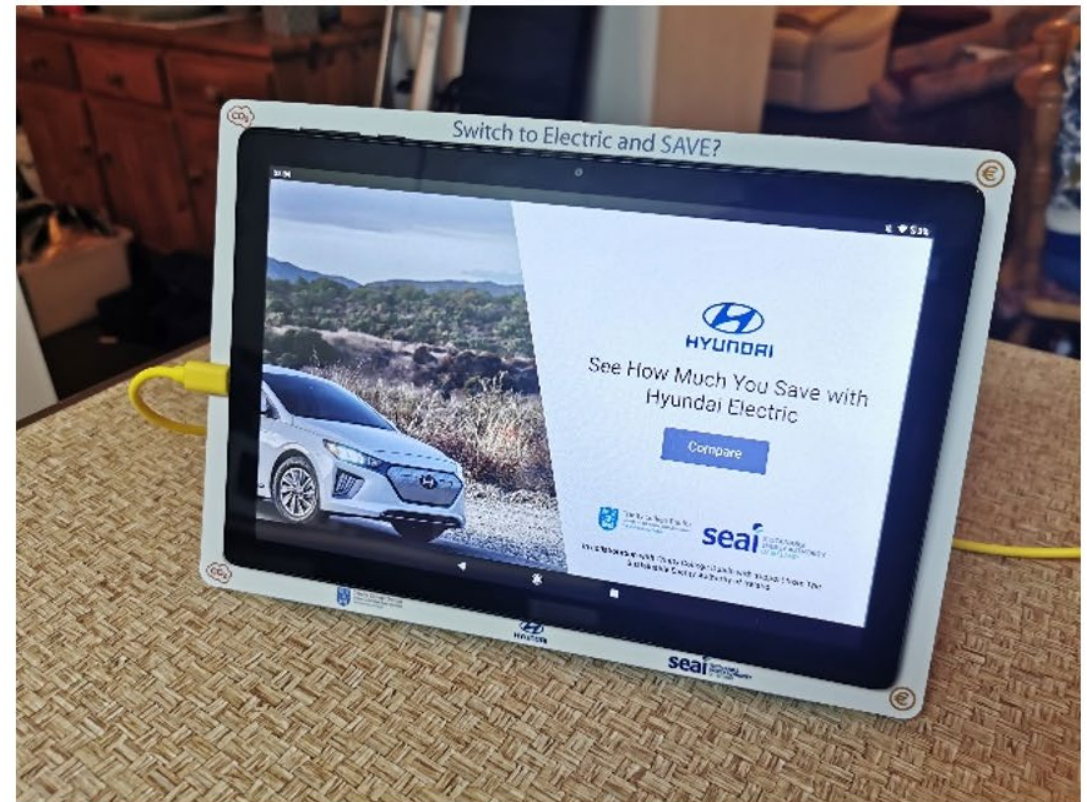
# Field Trial – Application

## Field Trial Website Display Stands

Main Showroom Stand



Coffee Table Stand





# Field Trial – Application



  
**HYUNDAI**

See How Much You Save  
with Hyundai Electric

[Compare](#)


 Trinity College Dublin  
Coláiste na Tríonóide, Baile Átha Cliath  
The University of Dublin

 **seai** SUSTAINABLE  
ENERGY AUTHORITY  
OF IRELAND


In collaboration with Trinity College Dublin with  
support from The Sustainable Energy Authority  
of Ireland

Please Choose An Electric  
Vehicle or Plug-In Hybrid  
Vehicle


IONIQ5 Electric




Kona Electric




IONIQ Electric



Santa Fe Plug-in Hybrid



Tucson Plug-in Hybrid



[Back To Start](#)



# Field Trial – Application

Will This Be A Company Car?

Yes No

[Back To Start](#)

[← Choose a different car](#)

How many kilometers do you drive per year?

Kilometers


- 16000 +

Compare


Note - the average mileage in Ireland is about 16,000km

Your Comparison Vehicles Are:

IONIQ5 Electric

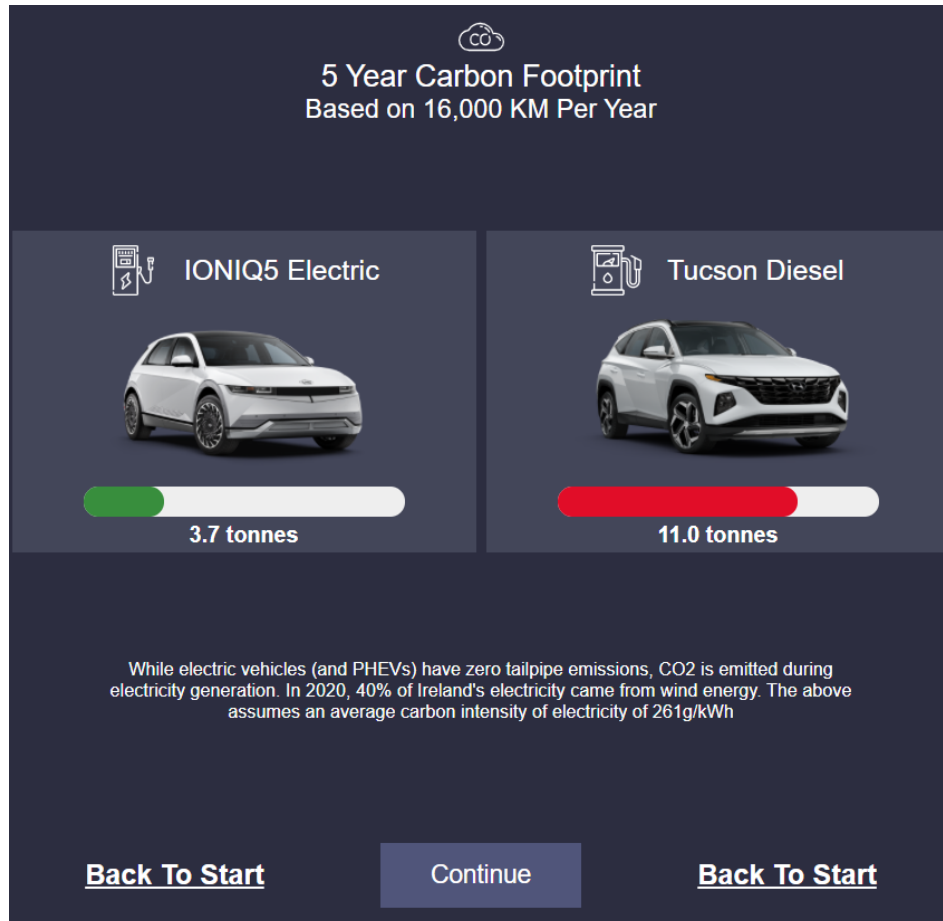


Tucson Diesel





# Field Trial – Application



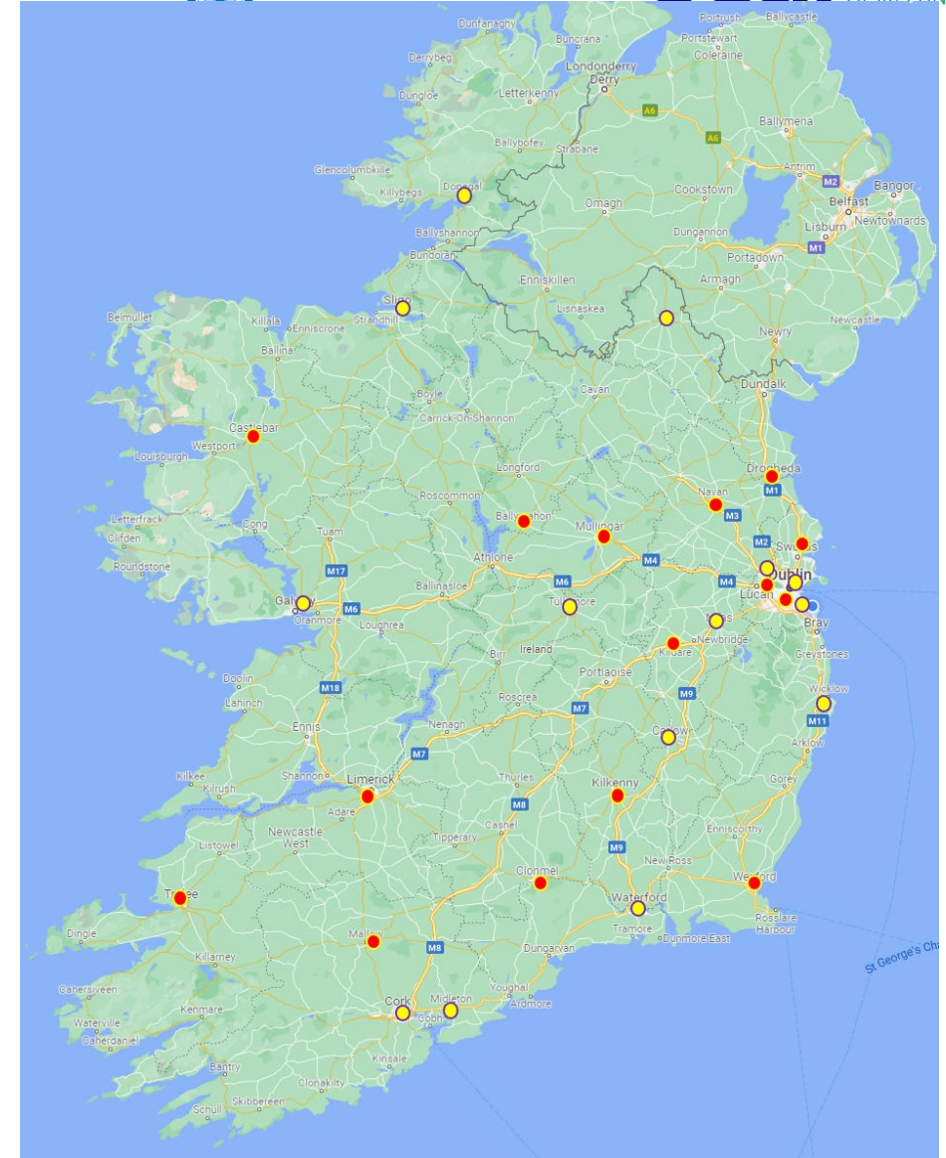




# Field Trial

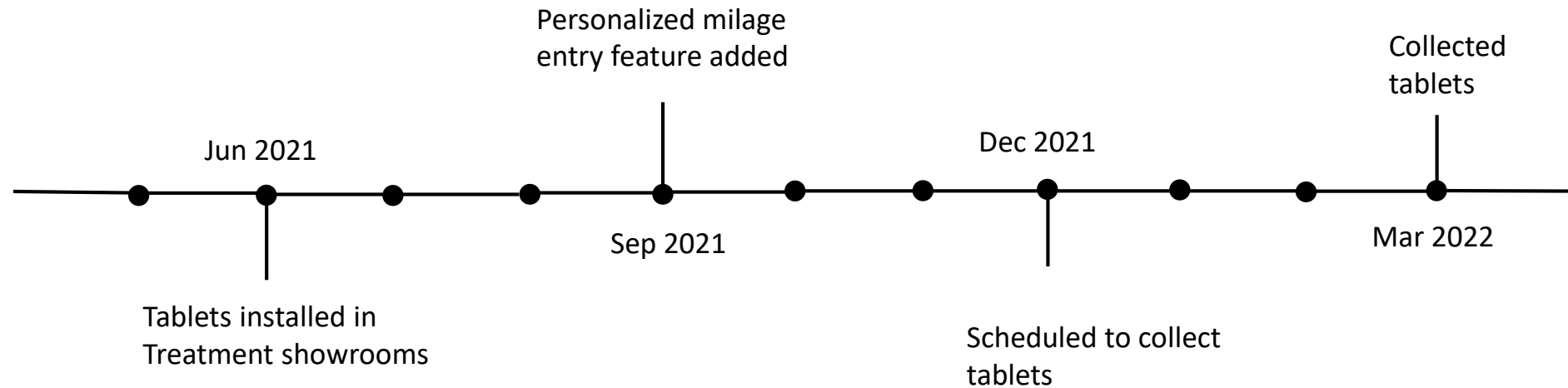
## Treatment Allocation

TREATMENT GROUP <span style="color: red;">●</span>	CONTROL GROUP <span style="color: blue;">●</span>
Drogheda Car Sales Ltd	Doran Motors
Limerick Motor Centre	Kearys of Midleton
Michael Barrable Motors Hyundai	Martin Reilly Cars
Adams of Tralee	Mooney's Hyundai Deansgrange
Nally Bros.	Hutton & Meade
Bolands Wexford Hyundai	Kearys of Cork
Michael Lyng Motors Kilkenny	Michael Lyng Motors Carlow
Fitzpatricks Garages Hyundai Kildare	Bolands of Waterford
Kearys of Mallow	Fairview Motors Ltd
Monaghan & Sons Castlebar Ltd	Connolly's Hyundai
Barlo Hyundai	Avon Motors
Mooney's Hyundai Longmile Road	Fitzpatrick's Garages Hyundai
O'Brien's Hyundai	Divers Hyundai
Kingstown Stillorgan	Fitzpatricks Garages Hyundai Naas
Navan Hyundai	





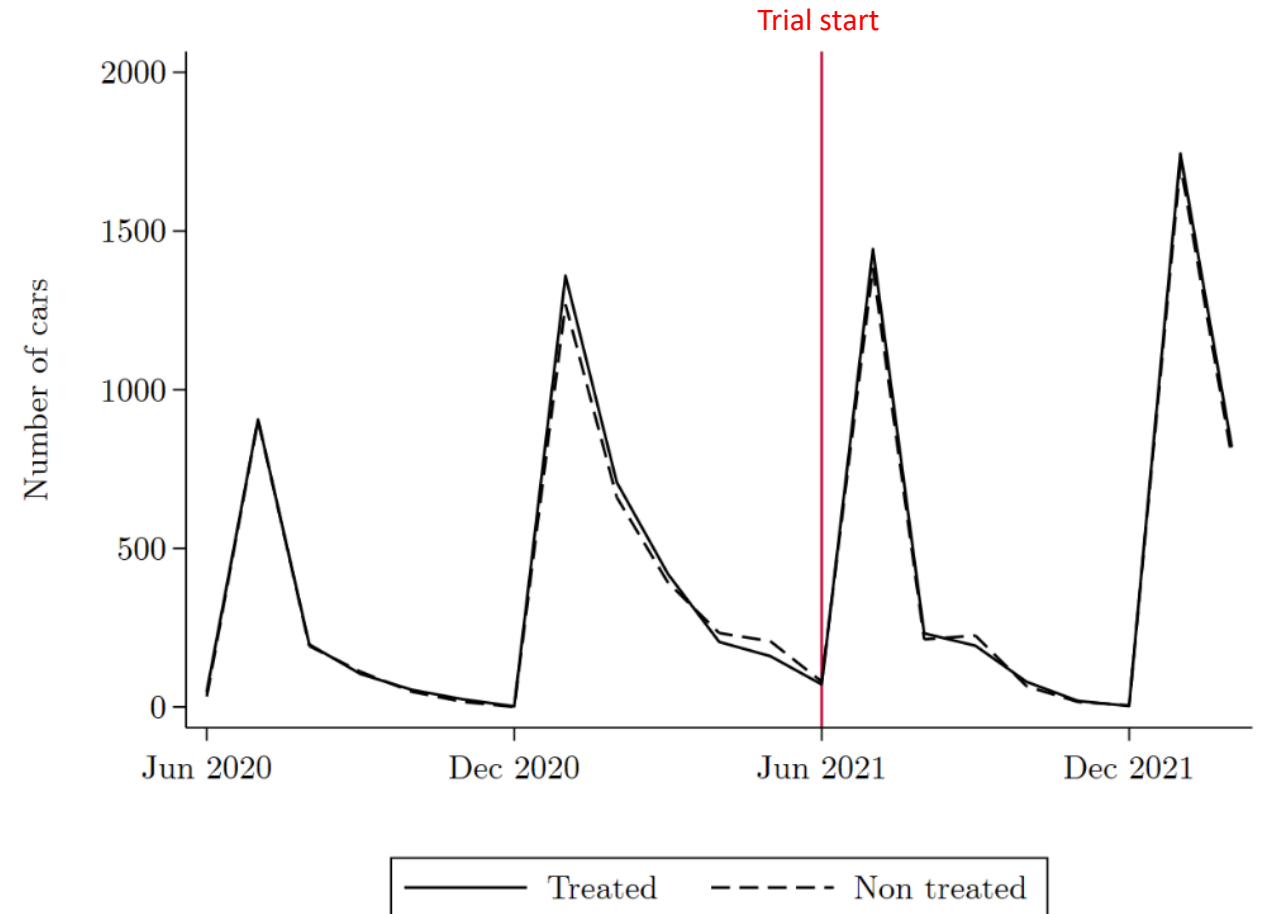
# WP4 Field Trial



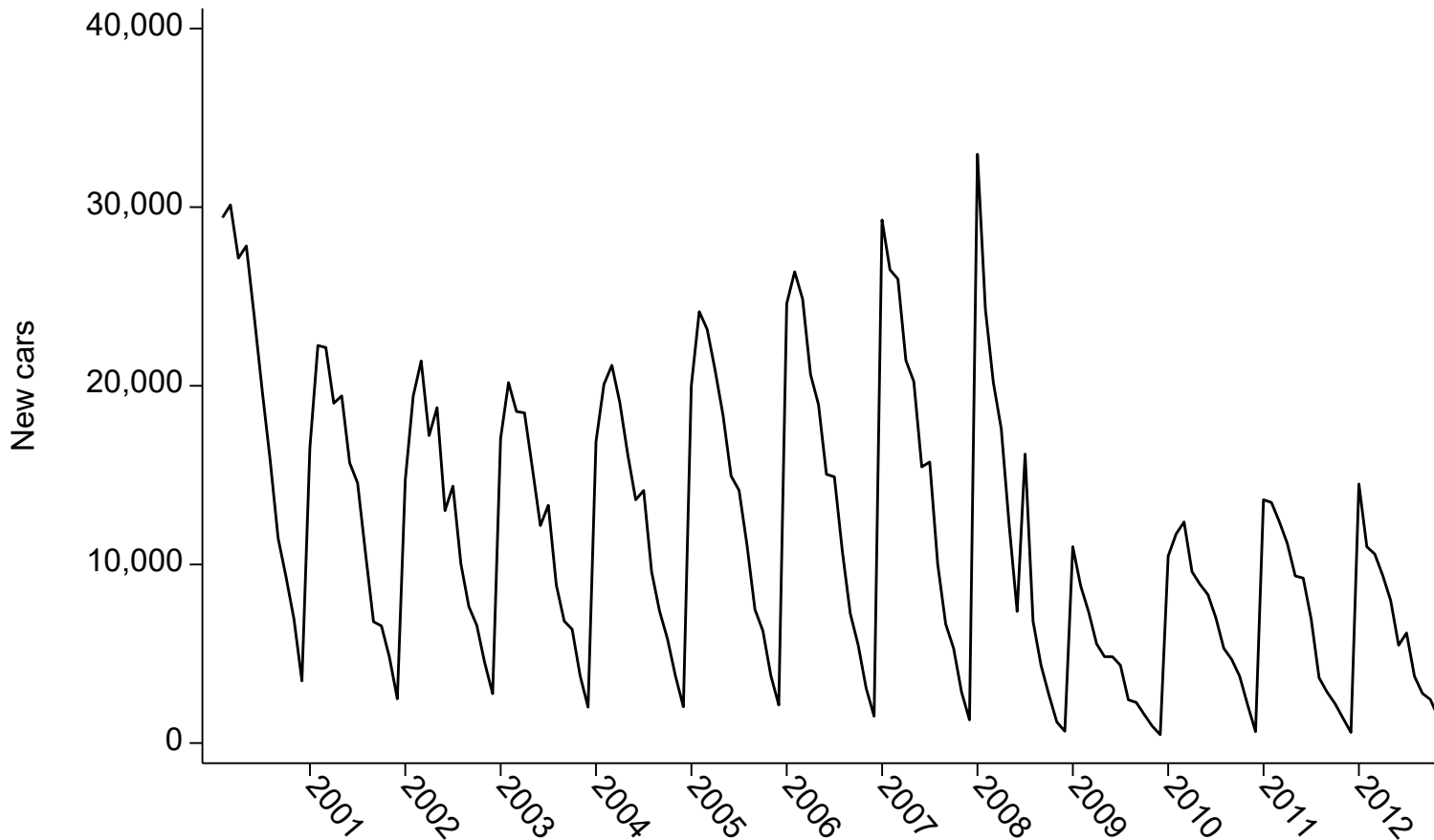


# Preliminary Results

Treat group	Period		Total No.	$\Delta$	% $\Delta$
	Pre No.	Post No.			
Non treated	4,066	4,487	8,553	+421	+10%
Treated	4,187	4,606	8,793	+419	+10%
Total	8,253	9,093	17,346	+840	+10%
Diff	+121	+119			
Diff in diff		-2			



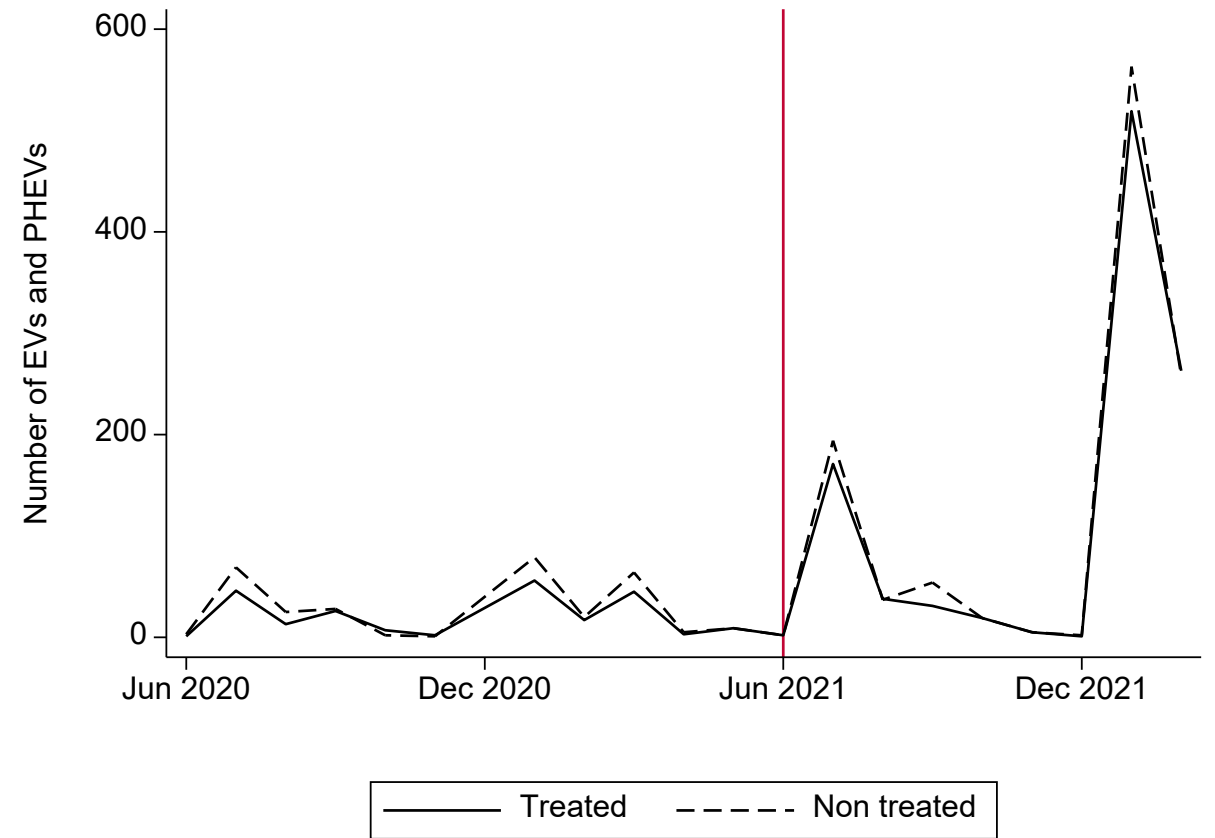
# Car sales in Ireland – behavioural impact



Source: CSO <https://data.cso.ie/table/TEM01> - Vehicles licensed for the first time - new passenger cars

# Preliminary Results EVs and PHEVs

Treatment group	Time period		Total No.	$\Delta$	% $\Delta$
	Pre No.	Post No.			
Control	305	1,134	1,439	+829	+272%
Treated	225	1,049	1,274	+824	+366%
Total	530	2,183	2,713	+1,653	+312%
Difference	-80	-85			
Diff in diff		-5			



# Analysis – triple diff-in-diff model

$$Y_{itm} = \beta_0 + \beta_1(T_i \times P_t \times E_m) + \beta_2(T_i \times E_m) + \beta_3(P_t \times E_m) + \beta_4(T_i \times P_t) \\ + \beta_5 T_i + \beta_6 P_t + \beta_7 E_m + \sum_1^r \beta_{7+r} X_m + \varepsilon_{itm}$$

- Dependent variable  $Y_{itm}$  = count of cars sold of model  $m$  in month  $t$  and showroom  $i$ .
- $T_i$  = treatment indicator and  $P_t$  = post treatment dummy.
- $E_m$  = number of measures (energy cost, emissions, number of EV or PHEV purchased).
- Control for a number of other model characteristics  $X_m$  (e.g. price, size, power).
- Estimated using negative binomial regression (Poisson also used).



# Difference-in-differences (triple)

	(1) EV/PHEV	(2) €/100km	(3) gCO <sub>2</sub> /km		(1) €/100km	(2) gCO <sub>2</sub> /km	(3) EV/PHEV
Treat*Post*EV/PHEV	0.19 (0.16)			Cost (cost in €/100km)	-0.44*** (0.02)	-0.58*** (0.02)	-0.61*** (0.02)
Treat*EV/PHEV	-0.29* (0.12)			CO <sub>2</sub> (WLTP emissions rating in gCO <sub>2</sub> /km)	0.02*** (0.00)	0.03*** (0.00)	0.02*** (0.00)
Post*EV/PHEV	1.97*** (0.09)			EV/PHEV (indicator = 1 if EV or PHEV)	-0.83 (0.43)	-0.71 (0.43)	-1.37** (0.46)
Treat*Post*Cost		-0.02 (0.03)		Purchase price (in €000's)	-0.07*** (0.01)	-0.07*** (0.01)	-0.07*** (0.01)
Treat*Cost		0.06** (0.02)		Engine power (in KW)	0.01*** (0.00)	0.01*** (0.00)	0.01*** (0.00)
Post*Cost		-0.20*** (0.01)		Vehicle mass (in 100kg)	0.04 (0.03)	-0.02 (0.03)	-0.04 (0.03)
Treat*Post*CO <sub>2</sub>			-0.02 (0.02)	Wheelbase (in cm)	-0.04*** (0.00)	-0.04*** (0.00)	-0.05*** (0.00)
Treat*CO <sub>2</sub>			0.03** (0.01)	Steering axle width (in cm)	0.23*** (0.01)	0.24*** (0.01)	0.26*** (0.01)
Post*CO <sub>2</sub>			-0.17*** (0.01)	Constant	-24.30*** (1.23)	-24.98*** (1.24)	-24.51*** (1.23)
Treat*Post	0.02 (0.05)	0.20 (0.20)	0.33 (0.20)	ln(α)	1.46*** (0.03)	1.43*** (0.04)	1.42*** (0.04)
Treat	-0.06 (0.18)	-0.47 (0.28)	-0.49 (0.29)	N	9,135	9,135	9,135
Post	0.18*** (0.03)	1.91*** (0.09)	2.53*** (0.11)				

Notes: Estimated using a negative binomial regression with dependent variable = count of number of vehicles of model  $m$  sold in month  $t$  and showroom  $i$ . Standard errors in parentheses.



# Summary of results from field trial

- We do not find conclusive evidence of an (immediate) treatment effect.
- Results are preliminary (waiting for further follow-up sales data).
- Additional analytics data – on usage of tablets.





# Qualitative data - additional interviews

- Semi-structured interviews with showroom staff – approx. 30 mins.
- 10 interviews completed in March 2022 – range from junior sales staff (1-3 years experience) to sales staff with 20-25 years experience to store-room owners/manages
- **Some common responses:**
  - **Switch to an EV does not/rarely happens in the showroom.**
    - The decision to purchase a new vehicle can take from between 1-6months for a household.
    - Significant research is done beforehand by most purchasers.
  - **Most of the research is done at home.**
    - People come in asking specific questions about within model specifications.
    - Nearly quizzing the sales staff to test their knowledge.
    - Where is the research done – car websites/YouTube/WhatsApp/forums.



# Qualitative data - additional interviews

- **Demographics important**
  - Older individuals less likely to engage with the tablets.
  - Make up majority of customers - particularly in regional dealerships.
- **Engagement with tablets in stores depended on sales staff**
  - Younger staff more likely to use it as a sales tool
  - Particularly tablet in waiting area.
- **COVID 19 significant impact on the industry:**
  - People less likely to spend time indoors
  - Phoning in ahead asking if its safe to come in
  - People wearing gloves, put off from touching surfaces (sales staff helped enter details)
  - Organising test drives an issue
  - An increased emphasis on telephone and email sales.
  - “Lower quantity – higher quality” customers – “Less tyre kickers”



# Thank you

Any suggestions/feedback very welcome!

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