



# Vehicle Taxation and Car Purchase Choices – A Case Study of Ireland

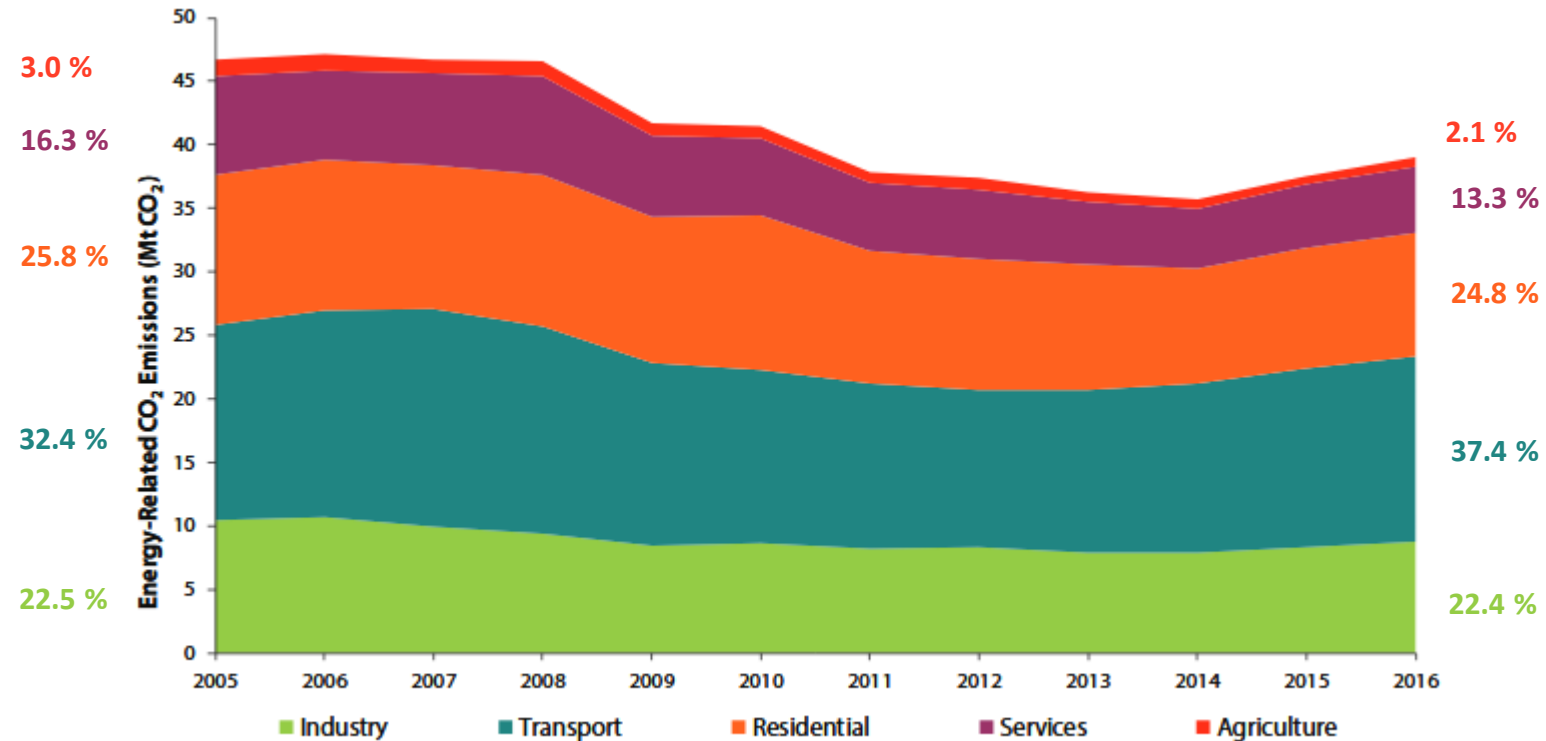
Ivan Petrov

Lisa Ryan



# Motivation

## Energy- Related CO2 Emissions by Sector



Source: SEAI

# Externalities Associated with passenger car use:<sup>6</sup>

- Environmental
  - Global and local air pollution
  - Improper disposal of vehicles, parts and liquids
- Congestion
- Accident Risk
- Oil Dependency
- Noise
- Road Damage

<sup>6</sup> Parry, I. W. H., Walls, M., & Harrington, W. (2007). Automobile Externalities and Policies. *Journal of Economic Literature*, 45(2), 373–399.  
<https://doi.org/10.2139/ssrn.927794>

# Taxes associated with owning a passenger car in Ireland

- VRT – Vehicle Registration Tax (One time tax – at purchase of vehicle)
- AMT – Annual motor tax (circulation tax)
- Fuel tax – Excise duty, Carbon Tax, VAT

<b>Pump price</b>	<b>146.1c</b>	<b>136.8</b>
Price before taxes are added	58.009c	61.318c
Breakdown of taxes x 3:		
1. Excise (including carbon)*	58.771c	47.902c
2. Nora**	2c	2c
3. VAT (23%)	27.32c	25.58c
Total taxes	88.091c	75.482c
Estimated retailer margin	4c	4c
Estimated wholesaler margin	8c	8c
Average price of a barrel of oil (accurate as of 20 May)	\$72.40	\$72.40
Currency exchange rate - US\$1 to Euro (accurate as of 20 May)	€0.90	€0.90
Tax as %	60.30%	55.18%

# 1<sup>st</sup> July 2008 – Internalizing the Environmental Externality

- Changes to VRT and AMT from engine capacity based to CO2 ratings based

Engine capacity cm <sup>3</sup>	Annual motor tax €	VRT (% OMSP)
Not over 1,000	165	22.5%
1,001 to 1,100	249	
1,101 to 1,200	275	
1,201 to 1,300	298	
1,301 to 1,400	320	
1,401 to 1,500	343	
1,501 to 1,600	428	25%
1,601 to 1,700	453	
1,701 to 1,800	530	
1,801 to 1,900	560	
1,901 to 2,000	590	
2,001 to 2,100	754	
2,101 to 2,200	791	30%
2,201 to 2,300	827	
2,301 to 2,400	861	
2,401 to 2,500	899	
2,501 to 2,600	1,067	
2,601 to 2,700	1,109	
2,701 to 2,800	1,147	
2,801 to 2,900	1,189	
2,901 to 3,000	1,231	
3,001 or more	1,491	
Electrical	146	

Rating	CO2 g/km		Annual Motor Tax (AMT)	Vehicle Registration Tax (VRT) as % of selling price
	Lower Limit (>)	Upper Limit (<=)		
A	0	120	€100	14%
B	120	140	€150	16%
C	140	155	€290	20%
D	155	170	€430	24%
E	170	190	€600	28%
F	190	225	€1000	32%
G	225	225+	€2000	36%

# Additional Policy Changes

Category	Lower Limit (>)	Upper Limit (<=)	1st July 2008		1st Jan 2009		1st Jan 2012		1st Jan 2013	
			AMT	VRT (%)	AMT	VRT (%)	AMT	VRT (%)	AMT	VRT (%)
A0	0	0	100	14	104	14	160	14	120	14*
A1	1	80							170	14
A2	80	100							180	15
A3	100	110							190	16
A4	110	120							200	17
B1	120	130	150	16	156	16	225	16	270	18
B2	130	140							280	19
C	140	155	290	20	302	20	330	20	390	23
D	155	170	430	24	447	24	481	24	570	27
E	170	190	600	28	630	28	677	28	750	30
F	190	225	1000	32	1050	32	1129	32	1200	34
G	225		2000	36	2100	36	2258	36	2350	36

(i) Initial Change

(ii) Flat 4-5% Increase in AMT

(iii) Disproportionate increase for A and B (AMT)

(iv) New Bands & Increases

(v) Scrappage Scheme – Jan 2010 – June 2011 - VRT relief of up to €1,500 for cars 10 years or older

- New car must have rated emissions of 140g/CO<sub>2</sub>/km or less (i.e. A or B rated)

# Research Question

- What is the impact of this transition on car purchase choices?

# Previous Literature

- For Europe:
  - Gerlagh et. Al.(2018) registration affect car purchase choices, circulation taxes do not.<sup>7</sup>
  - Ryan, Ferreira and Convery (2009) vehicle taxes influence composition of the vehicle fleet. <sup>8</sup>
- For Ireland:
  - Giblin and McNabola (2009) – Car choice model: predict. <sup>9</sup>
  - Hennessy and Tol (2011) – Car purchase model and aggregate data: predict. <sup>10</sup>

<sup>7</sup> Gerlagh, R., van den Bijgaart, I., Nijland, H., & Michielsen, T. (2018). Fiscal Policy and CO2 Emissions of New Passenger Cars in the EU. *Environmental and Resource Economics*, 69(1), 103–134. <https://doi.org/10.1007/s10640-016-0067-6>

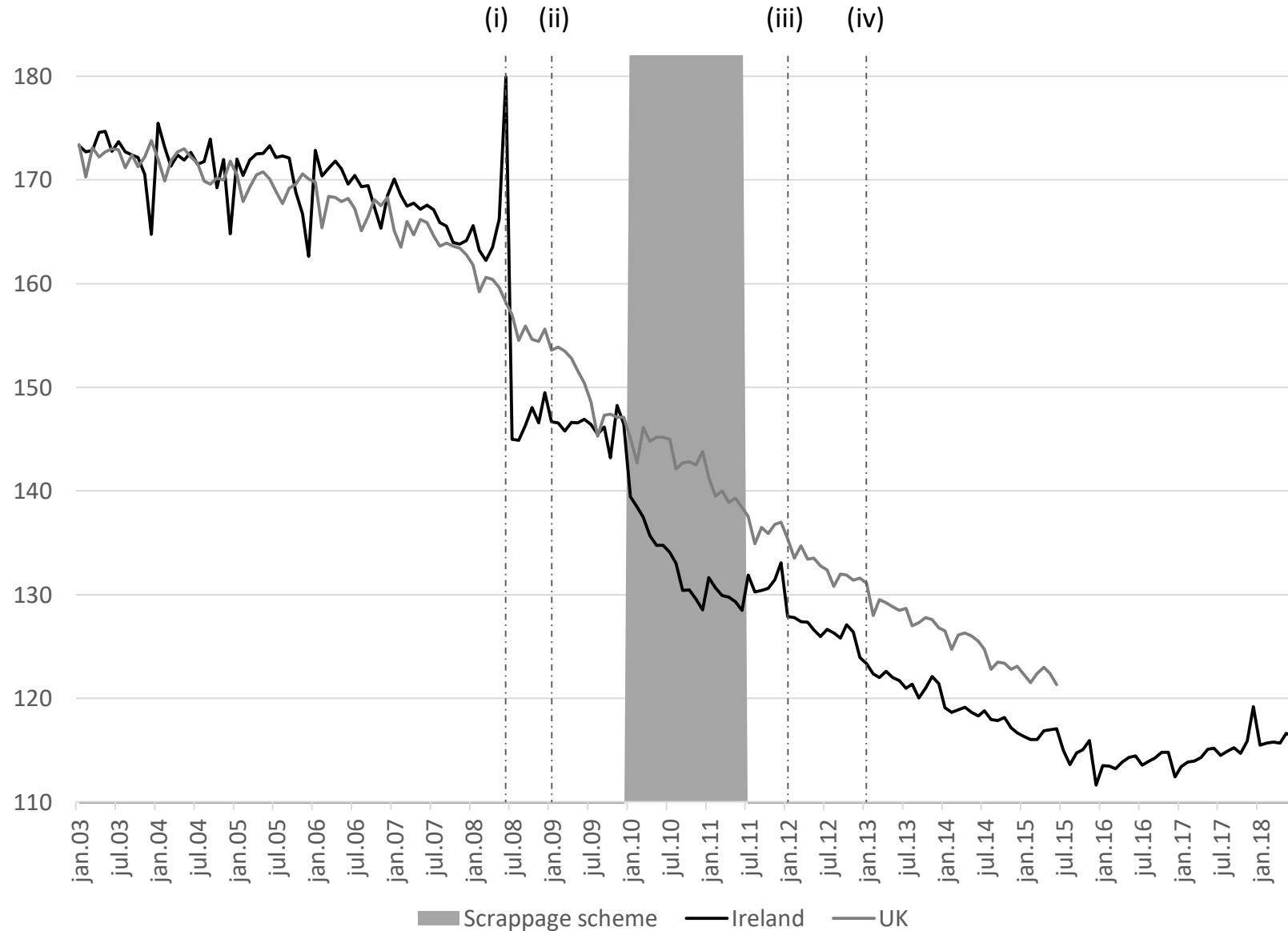
<sup>8</sup> Ryan, L., Ferreira, S., & Convery, F. (2009). The impact of fiscal and other measures on new passenger car sales and CO2 emissions intensity: Evidence from Europe. *Energy Economics*, 31(3), 365–374. <https://doi.org/10.1016/j.eneco.2008.11.011>

<sup>9</sup> Giblin, S., & McNabola, A. (2009). Modelling the impacts of a carbon emission-differentiated vehicle tax system on CO2 emissions intensity from new vehicle purchases in Ireland. *Energy Policy*, 37(4), 1404–1411. <https://doi.org/10.1016/j.enpol.2008.11.047>

<sup>10</sup> Hennessy, H., & Tol, R. S. J. (2011). The impact of tax reform on new car purchases in Ireland. *Energy Policy*, 39(11), 7059–7067. <https://doi.org/10.1016/j.enpol.2011.08.011>



# Impact on CO2 Emissions Ratings



Data: New registrations in Ireland and UK

Source: Society of the Irish Motor Industry (SIMI) and UK Society of Motor Manufacturers and Traders (SMMT)

Method: Difference in Differences – using UK as counterfactual

$$Y_{st} = \gamma_{0s} + \gamma_{1s}t + \lambda_t + \delta D_{st} + X'_{st}\beta + \epsilon_{st}$$

# UK as a counterfactual?

- Parallel trends assumption
- No major changes to UK taxation over period from 2001 to 2017
  - Apart from the introduction of a small “show-room” tax on 2010.
- Similar road infrastructure/driving rules
- Close proximity/similar climate

# Diff-in-Diff Results CO2

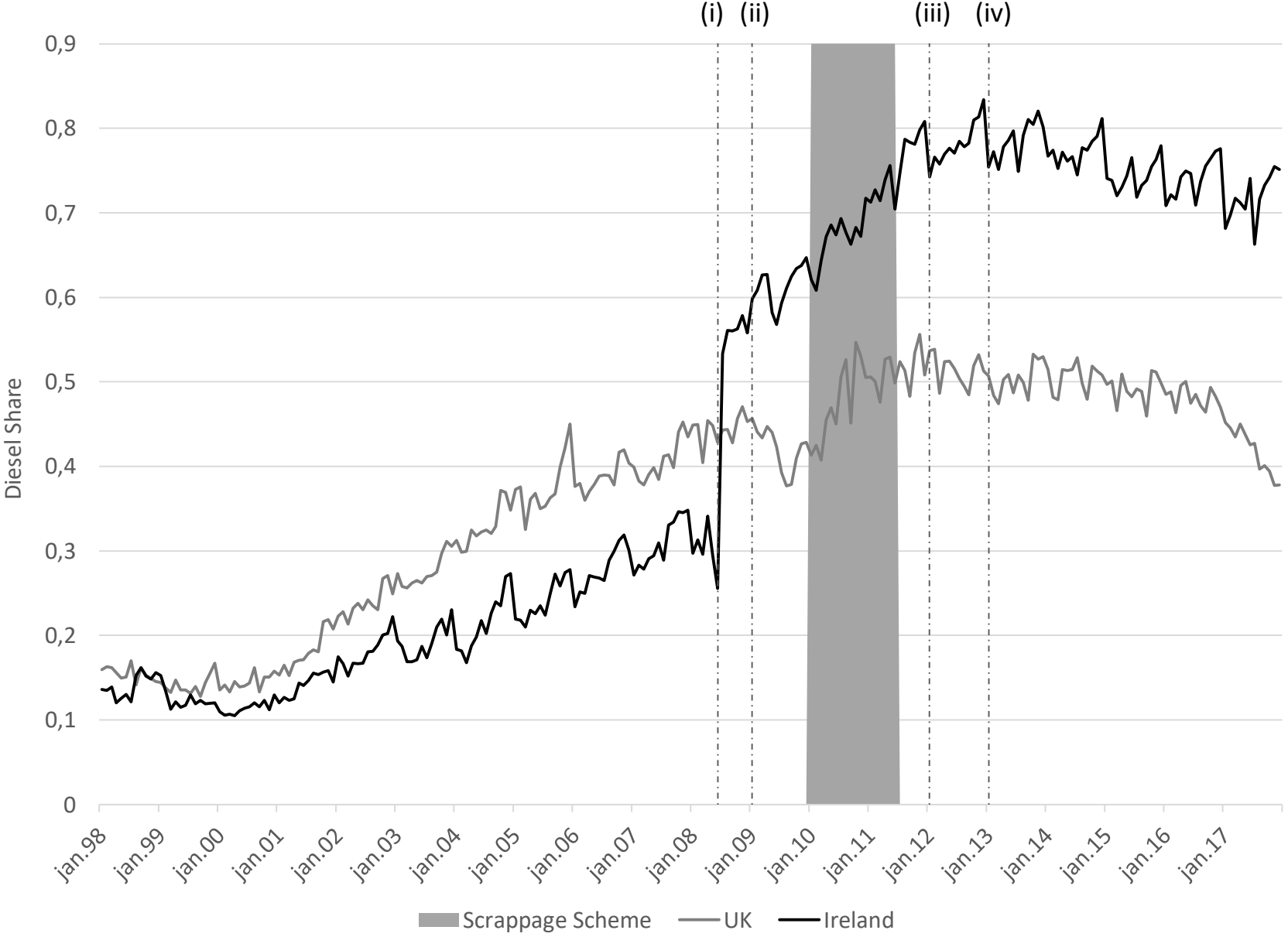
	(1)	(2)	(3)	(4)
Initial policy (2008)	-8.4341 *** (0.5305)	-10.2867 *** (1.2322)	-9.1726 *** (1.5756)	-11.0948 *** (1.7125)
Interim policy change A (2009)		4.4843 *** (1.3622)	4.6711 *** (1.5178)	4.1186 *** (1.5029)
Scrappage scheme		-5.8059 *** (0.9632)	-6.5564 *** (1.0403)	-6.2573 *** (1.0262)
Interim policy change B (2012)		-2.0461 * (1.0769)	-2.4954 ** (1.1108)	-3.3853 *** (1.1415)
Final policy change (2013)		-0.1239 (0.987)	0.1249 (1.0086)	-0.9659 (1.0741)
Household consumption			0.0124 * (0.0064)	-0.0001 (0.0079)
Price of petrol			-0.0098 (0.0126)	-0.005 (0.0125)
Price of diesel			0.0026 (0.0133)	0.0001 (0.0131)
Country-specific trend	No	No	No	Yes
N	300	300	300	300

\*\*\* Statistically significant at  $p < 0.01$

\*\* Statistically significant at  $p < 0.05$

\* Statistically significant at  $p < 0.1$

# Impact on Diesel Share of Registrations



Method: Same as for CO2

# Diff-in-Diff Results Diesel share

	(1)	(2)	(3)	(4)
Initial policy (2008)	0.3169 *** (0.0005)	0.1823 *** (0.0020)	0.2133 *** (0.0021)	0.2348 *** (0.0021)
Interim policy change A (2009)		0.0960 *** (0.0023)	0.0943 *** (0.0025)	0.1009 *** (0.0025)
Scrappage scheme		0.0058 *** (0.0016)	0.0046 ** (0.0017)	0.0159 *** (0.0017)
Interim policy change B (2012)		0.0545 *** (0.0019)	0.0259 *** (0.0020)	0.0803 *** (0.0021)
Final policy change (2013)		0.0062 *** (0.0015)	-0.0109 *** (0.0016)	0.0379 *** (0.0017)
Household consumption			-0.0002 *** (0.0000)	-0.0000 (0.0000)
Price of petrol			0.0001 *** (0.0000)	0.0001 *** (0.0000)
Price of diesel			0.0000 *** (0.0000)	-0.0000 *** (0.0000)
Country-specific trend	No	No	No	Yes
N	50,305,356	50,305,356	50,305,356	50,305,356

\*\*\* Statistically significant at  $p < 0.01$

\*\* Statistically significant at  $p < 0.05$

\* Statistically significant at  $p < 0.1$

# Example: Ford Focus

- Most popular model in Ireland in 2008



Make	Model	Fuel	Exact CC	Rated Co2	Sale Type	County	Reg Month	OLD AMT	OLD VRT	NEW AMT	NEW VRT	
FORD	FOCUS	ZETEC 1.6 5SP	Petrol	1596	159	N	KY	1	428	25%	430	24%
FORD	FOCUS	ZETEC 1.6TDCI 90PS 5SP	Diesel	1560	118	N	C	3	428	25%	100	14%

# Conclusion

- Initial policy shift to CO<sub>2</sub> based taxation decreased rated emissions by between 8 to 12 gCO<sub>2</sub>/km
  - Scrappage Scheme also appears to have had a significant impact.
- However, this was achieved by a significant shift towards diesel powered vehicles.
  - Higher levels of other pollutants such as Nox and PM.
  - Findings are consistent with prediction made by Hennessy and Tol (2011)<sup>10</sup>

<sup>10</sup> Hennessy, H., & Tol, R. S. J. (2011). The impact of tax reform on new car purchases in Ireland. *Energy Policy*, 39(11), 7059–7067.  
<https://doi.org/10.1016/j.enpol.2011.08.011>

# Thank You

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