

Reducing Emissions in Transportation: Technology and Policy Options

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Why do we need policy?

- ▶ Three externalities:

1. Air pollution
2. CO₂ emissions contribute to climate change
3. Congestion

Private transport decision do not take into account externalities: too much traffic from a social perspective.

- ▶ Combustion engines make crucial part of economy dependent on oil (a resource not sufficiently available in Europe).

European Automobile market

- ▶ Emission standard 2015: 130 g CO_2 /km (42 mpg)
- ▶ Emission standard 2021: 95 g CO_2 /km (57 mpg)
- ▶ National taxes and subsidies target emissions (fuel taxes, bonus malus, low emission zones,...)

- ▶ Political economy:
 - ▶ EU level regulation (no fiscal authority)
 - ▶ National level fiscal policy and enforcement of EU level rules
 - ▶ Local level (e.g. Paris bans diesel)

Summary of three papers

- ▶ Abatement Strategies and the Cost of Environmental Regulation: Emission Standards on the European Car Market, *Review of Economic Studies*, 2021, 88(1), 454-488
- ▶ Who Benefits When Firms Game Corrective Policies? with James Saltee, *American Economic Journal: Economic Policy*, 2021, 13(1), 372-412
- ▶ Colluding Against Environmental Regulation, with Jorge Alé-Chilet, Cuicui Chen, and Jing Li, October 2021

EU emission standard reduces official measures of emissions

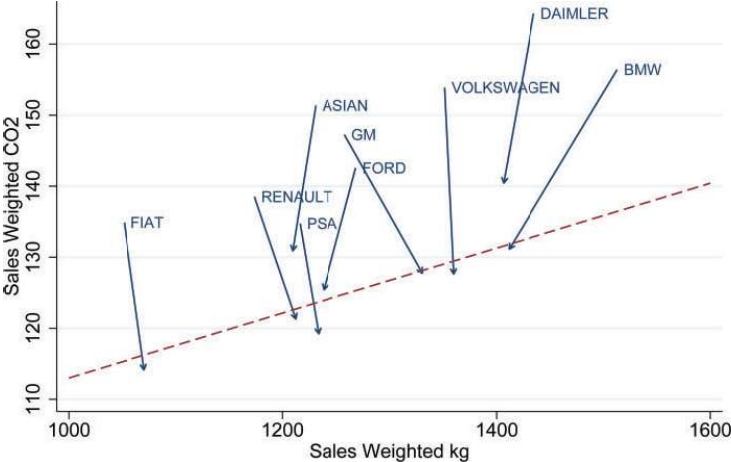


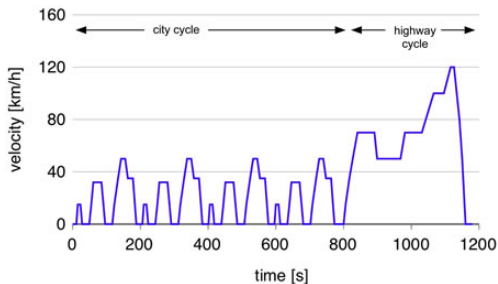
FIGURE 1
Compliance of firms in 2007 and 2011

EU emission standard fastens technology take-up

TABLE 3
Decomposing the decrease in emissions

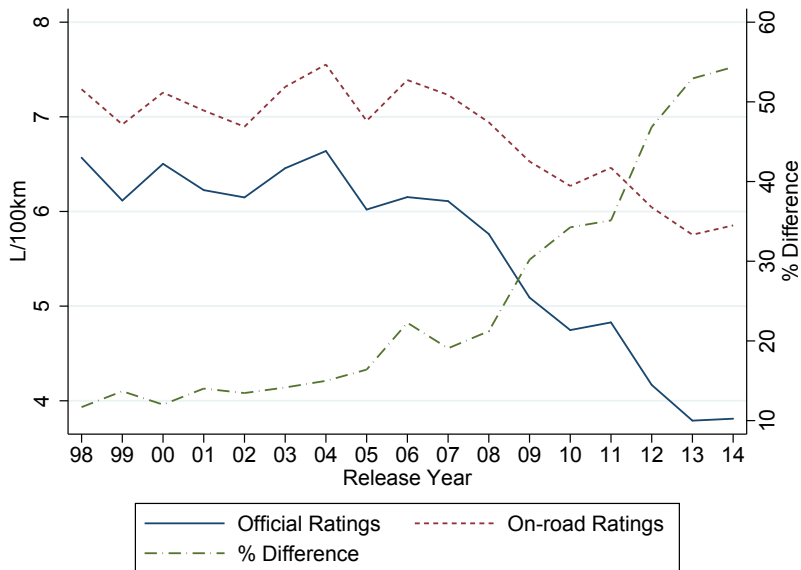
	True	All vehicles		Existing models (2007≤)	
		No Tech. \bar{e}_{jy}	Tech. \hat{e}_{jy}	No Tech. \bar{e}_{jy}	Tech. \hat{e}_{jy}
1998	169	156	172	156	172
1999	168	156	170	156	170
2000	169	155	171	155	171
2001	167	154	169	154	169
2002	164	154	166	154	166
2003	161	153	162	153	162
2004	158	152	159	152	159
2005	156	152	157	152	157
2006	154	152	155	152	155
2007	151	152	152	152	152
2008	147	152	147	151	147
2009	142	152	143	152	142
2010	135	152	136	152	136
2011	130	152	130	152	130

Measuring emissions: New European Driving Cycle



- ▶ Carbon/fuel consumption rates determined by laboratory test
- ▶ Dynamo-meter test, with simulated air flow

Not all technology reduces actual emissions



Technology adoption is costly for consumers and producers

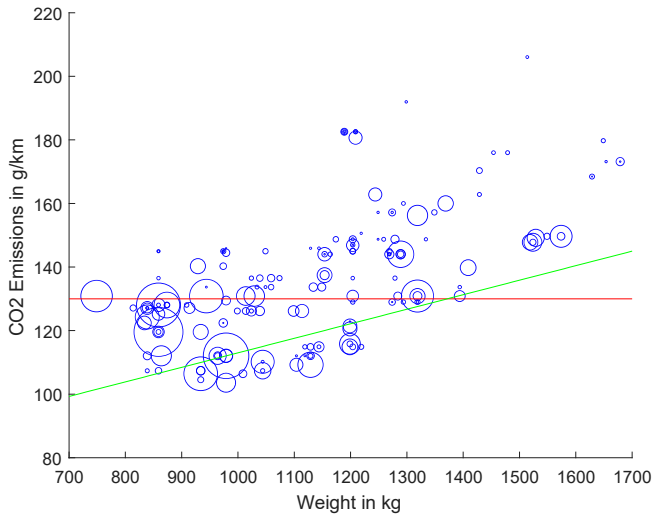
	Technology and Gaming	Technology
Gaming	0.7	0
Sales (%)	-1.08	-1.73
Emissions (%)	-4.58	-12.6
Consumer Surplus	-2.57	-4.45
Profits	-0.60	-0.95
CO2 Value	0.34	0.87
Other Externalities	2.19	3.25
Undervaluation	1.52	3.89
Total	0.88	2.87

Why did we see gaming in response to emission standard?

- ▶ Political economy and attribute-based regulation:
 - ▶ Romano Prodi, Prime Minister, Italy: *"A steeper value curve would lead to a significant distortion of competition and an illegitimate hardship for the producers of small cars"*
 - ▶ Angela Merkel, Chancellor, Germany: *"The proposed value curve is already a reduction duty far above average for larger cars"*
 - ▶ Nicolas Sarkozy, President, France: *"There is no legitimate reason to give the buyer of a heavy vehicle a right to more pollution than any other buyer"*

The Role of Attribute Basing

Position of the Fiat fleet



The Role of Enforcement

- ▶ Recent European Parliament report:
 - ▶ Gaming was enforcement failure of member states
 - ▶ Gaming was oversight failure of EU commission
- ▶ Enforcement fell on nations that were reluctant to be stringent on own car makers
- ▶ Incomplete regulation: no formal definition of defeat devices, no road testing (contrary to EPA)
- ▶ Currently in a legal swamp between countries, consumer groups and car makers

The Role of Enforcement

	Base	Fooled	Enforced	Not Enforce
Gaming	0.7	0.7	0	100
Consumers fooled?	No	Yes	No	No
Sales (%)	-1.08	-0.12	-1.73	0
Emissions (%)	-4.58	-3.81	-12.6	0
Share Small (%-point)	0	0	1	0
Consumer Surplus	-2.57	-2.62	-4.45	0
Profits	-0.60	-0.13	-0.95	0
CO2 Value	0.34	0.26	0.87	0
Other Externalities	2.19	0.24	3.25	0
Undervaluation	1.52	1.19	3.89	0
Total	0.88	-1.07	2.87	0

European Commission Rules a Case of Technical Cooperation as a Cartel



Restricting Competition in Emission Cleaning Technology

*By reaching a common understanding to avoid competition on the effectiveness of the [emission-cleaning] system they breached our competition rules. The carmakers agreed on the **size** of the AdBlue tanks placed in the diesel cars and on the **ranges until the next re-fill**.*

– EC Executive Vice-President Vestager

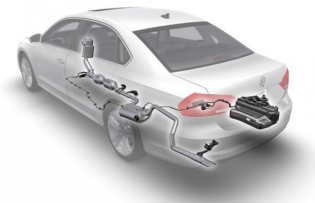


Figure credit: thetruthaboutcars.com

Unilateral vs. Joint Noncompliance

Noncompliance	Variable Profits	Regulatory Consequence
Unilateral	preserve quality save cost	incur expected penalty
Joint	demand substitution ?(↓) cost efficiency ?(≈ 0)	expected penalty ?(↓↓)

Colluding on noncompliance **necessarily** reduces expected penalty.

Possible mechanisms for expected penalty reduction:
diffusion of responsibility, skin in the game, reduction in detection
probability

Collusion against Environmental Regulation

- ▶ Collusion against environmental regulation reduces expected penalties.
- ▶ Residual claims of 1.46 – 7.37 billion euros to remedy damages to rest of society
 - ▶ European Commission fines without leniency/novelty/settlement discounts: 2.7 billion
 - ▶ Additional fines possible from national courts

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- ▶ Residual claims of 1.46 – 7.37 billion euros to remedy damages to rest of society
 - ▶ European Commission fines without leniency/novelty/settlement discounts: 2.7 billion
 - ▶ Additional fines possible from national courts
- ▶ Policy Lessons
 1. Collusion on noncompliance may arise in other regulatory settings w/ imperfect monitoring
 2. Antitrust & regulatory authorities have complementary roles in enforcing regulation

Conclusion

- ▶ Solving externality problems is not easy: need good regulation
- ▶ Political economy matters: member states enforce and firms act strategically
- ▶ Need well-designed policy that is enforceable and politically feasible
- ▶ Road ahead is complicated because transport and electricity markets will interconnect