

The role of non-waste 'product innovation' for waste production through reduced lifetime of goods

Giovanni Marin^{1,2,3} Roberto Zoboli^{1,4,3}

¹IRCrES-CNR, Milano (Italy) ²OFCE-SciencesPo, Sophia Antipolis (France) ³SEEDS, Ferrara (Italy)

⁴Catholic University of Milan (Italy)

Green Growth Knowledge Platform Conference
Venezia, January 2014

Background

- ▶ **Environmental policies** targeted to **specific** environmental issues may have **unintended consequences** on other environmental domains
 - ▶ **Positive feedbacks** ⇒ **ancillary benefits** in terms of reduced local pollution linked to climate change mitigation policies
 - ▶ **Negative feedbacks** ⇒ increase **material and energy use** (and end-of-life waste) from **substitution** of **old** inefficient **durable goods** with new more efficient goods
- ▶ **Stategic behaviours** of manufacturers to **reduce** the **useful lifetime** of durable goods (e.g. planned obsolescence) may have **ambiguous consequences** for overall environmental performance

Objective of the paper

- ▶ The **transportation** sector contributes substantially to **environmental pressures**
 1. During the **manufacture of vehicles** (air emissions from energy use, material use)
 2. During the direct **use of vehicles** (GHG and toxic emissions)
 3. During the **scrapping of vehicles** (waste generation)
- ▶ The **aim** of the paper is to evaluate the **driving forces** of car **scrapping** in the **Italian car market**
 - ▶ Assessment of the **role played by innovation** in the car industry to accelerate the rate of scrapping
 - ▶ Evaluation of the scrapping induced by **scrapping schemes** introduced by the Italian government in 2009
 - ▶ Discussion of the **environmental consequences** of increased scrapping

Planned obsolescence and reduced useful lifetime

- ▶ **Manufacturers** of **durable** goods want to **increase** the **frequency** of **purchase** by consumers to increase their revenues
- ▶ They put in place **strategies** aimed at **inducing customers** to **feel** they **need** to **replace** their current durable good even though it is still providing its services ⇒ **planned obsolescence**
- ▶ Vast **theoretical** (e.g. Swan, 1972; Lee and Lee, 1998) and **empirical** literature (e.g. Izuka, 2004) that **confirms** the relevance of these strategies
- ▶ **Economic efficiency losses** (effective useful life of durable goods lower than the efficient level)
- ▶ **Negative environmental effects** in terms of, for example, excessive waste generation (e.g. Rechberger and Truttmann, 2006, for washing machines, and Steubing et al, 2010, for computers)

ACI database

‘**Autoritratto**’ database of the **ACI** (Automobile Club Italiano)

- ▶ Detailed information on vehicles **stock**, vehicles **registration** and vehicles **deregistration** for the period **2002-2012**
 - ▶ by **region** NUTS2 (our unit of analysis)
 - ▶ by **year** of **registration**
 - ▶ by **environmental standard** (Euro0, Euro1, etc)
 - ▶ by **power** (kW)
 - ▶ by **type** of vehicle (cars, trucks, etc)
 - ▶ by **brand**
- ▶ Focus on **cars**
- ▶ We exploit the **various dimensions** to build our **measure of innovation** (cars by brand), to **evaluate scrapping schemes** (year of registration) and to quantify **environmental consequence** (environmental standard)

Proxy variable for innovation in the car industry (I)

- ▶ Many possible **alternatives**
 - ▶ Number of **patents** by car manufacturers
 - ▶ **R&D** expenditure by car manufacturers
 - ▶ Introduction of **new products**
- ▶ Being the car market a **global market**, **innovation perceived** by specific customers (e.g. in specific regions) **cannot be based** on the **nationality of manufacturers**

Proxy variable for innovation in the car industry (II)

- ▶ We collect information on **new car models** (source: **Quattroruote**) introduced into the **Italian market** for every year by car manufacturers (**24 brands** that account for at least 0.5 percent of the car fleet) from all over the world
- ▶ We assume that the **preferences** of a **region** for specific car characteristics are **reflected** by the **composition** of the existing **car fleet** in terms of **distribution** of cars **across** different **brands**
- ▶ We use **past** regional **distribution** of cars across brands to **weight new models** introduced by the market
- ▶ In presence of **brand loyalty** (that has been found to be important in the car market - Anderson et al., 2012; Schiraldi, 2011) the **innovation 'perceived'** by customers in a region will be **positively correlated** with the relative number of **new models** introduced by **manufacturers** that have a **higher market share** (i.e. in the current car fleet) in the **local market**

Total scrapping by region

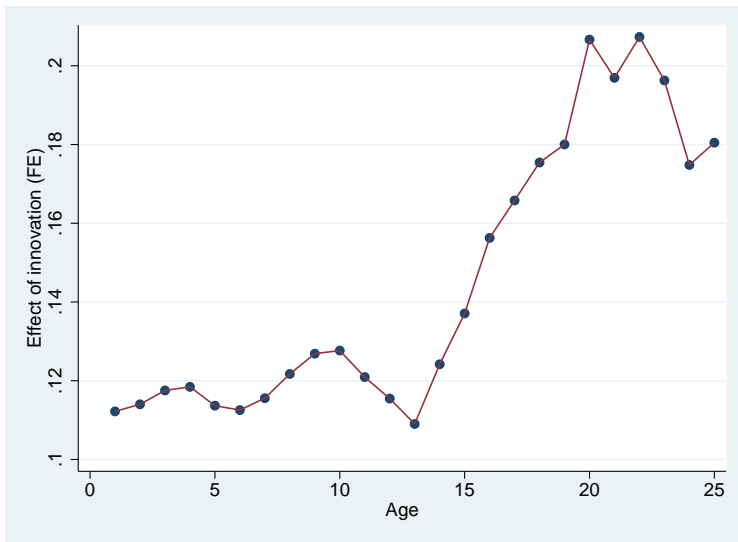
$$\text{Deregistration}_{i;t} = \beta^1 \text{Innovation}_{i;t,t-1,t-2} + \beta^2 \text{Fleet}_{i;t-1} + \mu_i + \tau_t + \varepsilon_{i;t}$$

Dep: total deregistered cars	(1) OLS	(2) FE	(3) Diff-GMM	(4) NB FE
ln(fleet size,t-1)	1.044*** (0.0368)	-0.611 (0.598)	0.537 (0.349)	0.463*** (0.0825)
Innovation (t,t-1,t-2)	0.228*** (0.0782)	0.112*** (0.0217)	0.0576* (0.0327)	0.0938** (0.0368)
Lag dep variable			0.307*** (0.118)	
N	200	200	180	200
F	635.5	286.0		
Chi sq			2464.8	1012.1

Table: Simulation of deregistration keeping innovation at 2003 levels ($\beta^1 = 0.112$)

	2004	2005	2006	2007	2008
Deregistrations predicted by innovation	32,174	216,001	147,144	281,557	154,962
Actual deregistrations	1,739,460	1,685,639	1,767,420	2,158,630	1,761,276
Share of deregistrations induced by innovation	1.85%	12.81%	8.33%	13.04%	8.80%
	2009	2010	2011	2012	Total
Deregistrations predicted by innovation	185,595	91,032	286,188	125,417	1,520,070
Actual deregistrations	1,918,254	1,638,759	1,388,641	1,411,695	15,469,774
Share of deregistrations induced by innovation	9.68%	5.55%	20.61%	8.88%	9.83%

Effect of innovation on vehicles of different age

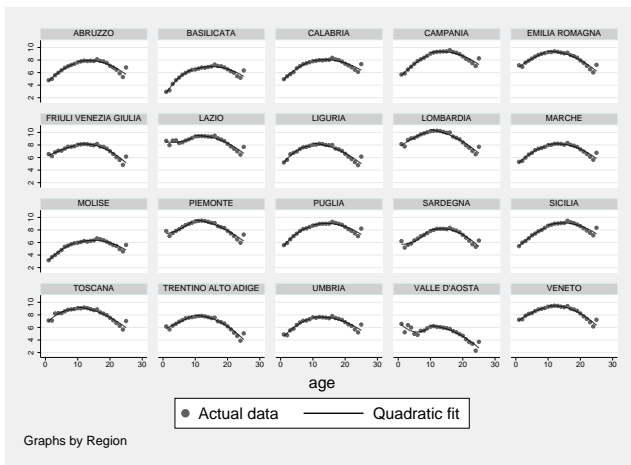


Description of the scrapping scheme (2009)

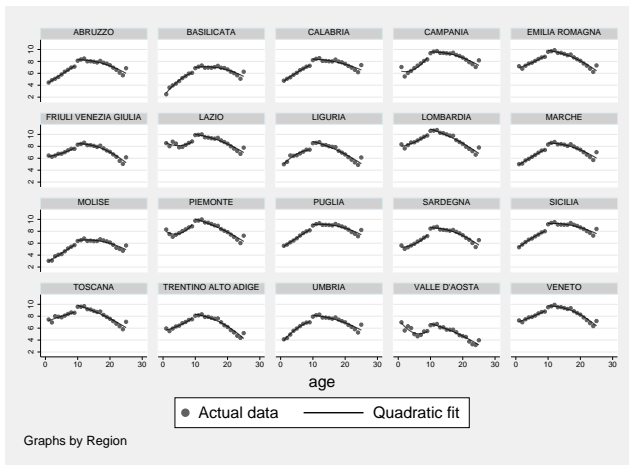
- ▶ **Scrapping scheme** introduced by the Italian government in **February 2009** (L. 33/09):
 - ▶ **Subsidy** of 1500 euro (with no budget limit) for **buying a new vehicle** after **scrapping a vehicle registered before January 2000** and compliant with **EURO2 or lower**
 - ▶ **Further increase** in the subsidy if the new car was fuelled with **LPG**
 - ▶ Programme active **until December 2009**
- ▶ The **scheme** is **national**, but targeted to **specific categories of cars** (i.e. older than 10 years)
- ▶ We exploit this **discontinuity** to **identify** the effect of the scheme
 - ▶ The **likelihood** of scrapping a car that is **9 years old** is **similar** to the one of scrapping a car that is **10 years old** (in absence of the scheme)
 - ▶ **Before** (2008) and **after** (2010) the scheme there should have been **no particular discontinuity** around the **age of 10** for scrapping cars

⇒ **Regression Discontinuity Design (RDD)**

RDD - year 2008 (placebo)

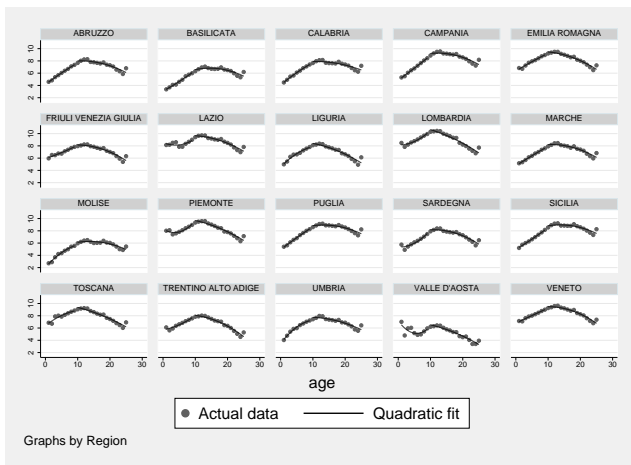


RDD - year 2009



- **Quantification:** the scheme induced the **deregistration** of **336,241** cars, that is about **21 percent** of total cars older than 10 years deregistered in 2009

RDD - year 2010 (placebo)



Conflicting goals?

Table: Waste generated from ELV (Eurostat)

Country	2007	2008	2009	2010	2011
France	837,000	875,144	1,046,624	1,464,843	1,548,451
Germany	449,280	420,424	387,693	1,596,831	516,128
Italy	1,310,050	1,472,446	1,106,929	1,379,027	1,240,204
Spain	885,689	839,194	712,440	913,787	805,623
United Kingdom	970,582	1,105,480	1,175,195	1,289,019	1,123,872
EU26 (Malta not included)	5,781,185	6,030,229	5,938,676	8,371,553	7,196,107

Table: Distribution of the Italian car fleet by 'Euro' environmental standard and year (ACI)

Year	Euro0	Euro1	Euro2	Euro3	Euro4	Euro5	Euro6	Other
2005	23.59	15.10	26.63	27.45	7.19	0.00	0.00	0.15
2006	18.32	11.88	28.90	24.71	16.11	0.00	0.00	0.01
2007	15.93	9.61	27.26	24.05	22.96	0.00	0.00	0.05
2008	14.45	8.20	25.29	23.28	28.53	0.00	0.00	0.06
2009	13.32	6.92	22.76	22.73	33.33	1.07	0.00	0.07
2010	12.50	6.02	20.52	21.90	36.24	2.82	0.00	0.07
2011	11.93	5.30	18.80	21.01	34.77	8.21	0.01	0.02
2012	11.53	4.79	17.30	20.23	34.23	11.84	0.03	0.02

Conclusions

- ▶ We have investigated the **drivers of car scrapping** in **Italian** regions
- ▶ **Innovation** by car manufacturers has **contributed substantially** to overall scrapping ⇒ **planned obsolescence**?
- ▶ **Scrapping schemes** motivated by **environmental** or 'keynesian' motives have induced **substantial increases** in **scrapping** rates
- ▶ Even though we **do not directly link** innovation and policy to **environmental outcomes**, we **observe** that the fuel (and emission) **efficiency** of the Italian and European **car fleet** has **improved** substantially in the recent past
- ▶ **Waste from ELV** has also **increased** ⇒ **environmental damages** (extraction of raw materials and disposal of residuals) have been **attenuated** by specific EU **policies** aimed at increasing **recovery** and **recycling** rates of ELVs (ELV Directive, 2000/53/EC; see Mazzanti and Zoboli, 2006)
- ▶ **Further research** is needed, however, to jointly **evaluate all lifecycle environmental consequences** of increased car scrapping

THANK YOU FOR YOUR ATTENTION

giovanni.marin@ircres.cnr.it