

A neo-Schumpeterian perspective on environmental regulation and innovation

Evidence from Austrian VOC emission standards

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The empirical example

- Volatile Organic Compounds (VOCs) precursors of ground level ozone
- three emission standards, adopted in late 1991 and 1995
- regulate production and use of paints, coatings, printing inks and adhesives in Austria
- toughest 'compliant coating' standard in the world
- toughest 'emission limit' standard in the world
- known to have had a considerable impact on regulated industries

Determinants of environmental innovation

- technological opportunity
- (market) demand
 - tends to be lukewarm
 - market frequently needs to be developed
- appropriability conditions
- firm-specific factors
 - firm size
 - ability to absorb and leverage outside knowledge
 - characteristics of the novel cleaner technology

Demand features

- cleaner systems superior in some dimensions but inferior in others
- users did not trust the performance of cleaner systems
- cleaner systems required new application methods
- users had to be trained in using cleaner systems

Drivers of innovation

Drivers of cleaner products: Austrian paint, coating, printing ink and adhesive manufacturers, 1999

Category	Very important		Relevant		Unimportant	
	no.	%	no.	%	no.	%
Environmental problems of important customers	22	78.6	0	0.0	6	21.4
Environmental legislation	19	67.8	5	17.9	4	14.3
Domestic	18	64.3	5	17.9	5	17.9
EU	7	25.0	4	14.3	17	60.7
Other countries (mainly Central and Eastern Europe)	0	0.0	4	14.3	24	85.7
New technological opportunities (new inputs, new processes, etc.)	14	50.0	4	14.3	10	35.7
Market potential (customer demand)	12	42.9	4	14.3	12	42.9
Internal environmental problems	5	17.9	2	7.1	21	75.0

Note: n = 28.

Source: Roediger-Schluga (2004, p. 125).

Technological consequences

- environmental regulation at most induces the diffusion and incremental improvement of technological best practice
- more technology-forcing regulation is passed by accident and adapted, if compliance turns out to be impossible

Novelty of compliant technology (I)

Starting year of R&D in low-solvent systems: Austrian paint, coating, printing ink and adhesive manufacturers, 1999

	no. of firms	% of total
Until 1970	8	29.6
Until 1980	7	25.9
Until 1990	6	22.2
After 1990	6	22.2
Of which in 1995	3	11.1

Note: n = 27.

Source: Adapted from Roediger-Schluga (2002).

- 75% of the firms had conducted R&D in at least one compliant technology before discussion on a regulation started

Novelty of compliant technology (II)

*Characterisation of compliance effort in response to VOC regulations:
Austrian paint, coating, printing ink and adhesive manufacturers, 1999*

	Waterborne systems		Powder coatings		High-solids		Radcure systems	
	no.	%	no.	%	no.	%	no.	%
A small step	4	17	0	0	0	0	0	0
A series of small steps	12	50	0	0	9	69	3	33
A large, radical step	8	33	0	0	4	31	6	67
Total	24	100	0	0	13	100	9	100

Note: n = 27.

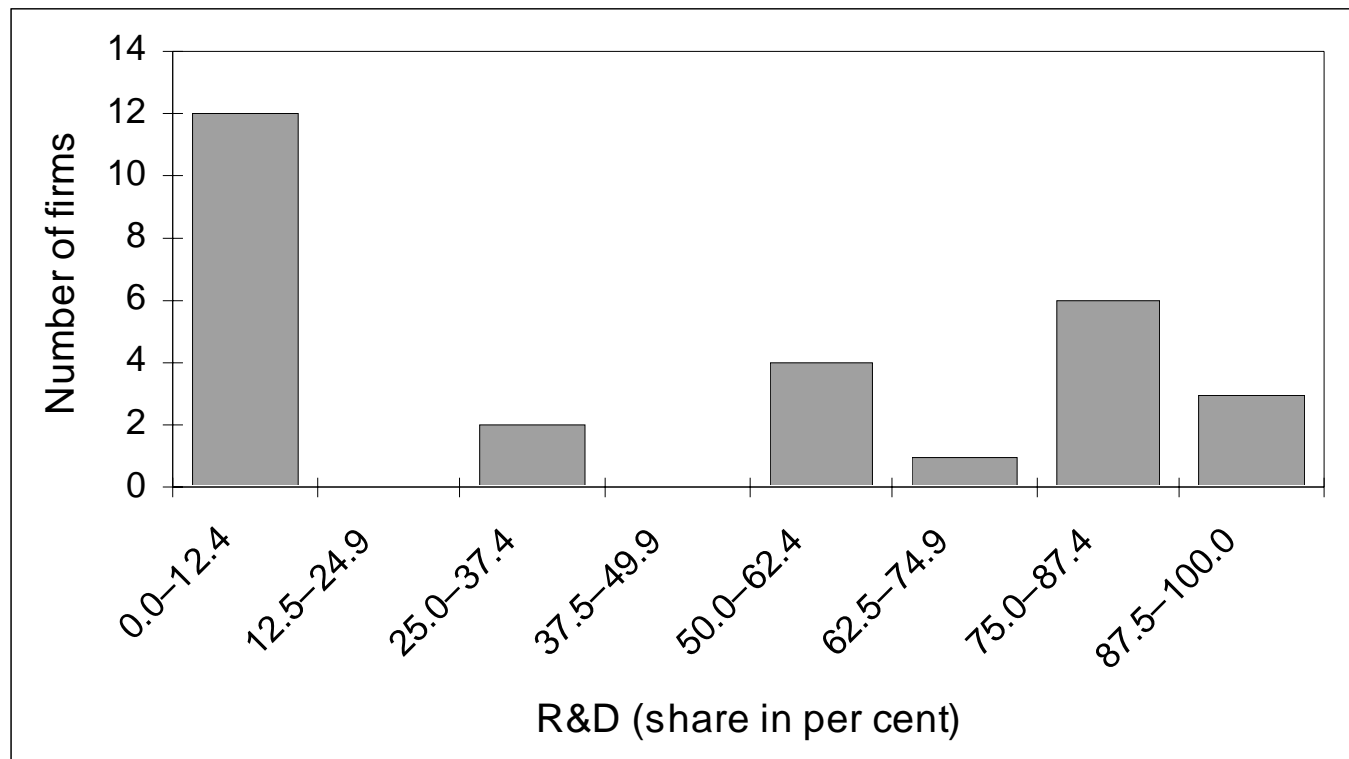
Source: Adapted from Roediger-Schluga (2002).

Economic consequences

- environmental regulation imposes adaptation costs
- adaptation costs are limited in size
- environmental regulation creates novel opportunities

Compliance R&D

Compliance R&D as a fraction of total R&D: Austrian paint, coating, printing ink and adhesive manufacturers, 1999



Note: n = 28.

Source: Roediger-Schluga (2003).

Displacement effect

Impact of compliance R&D on other R&D: Austrian paint, coating, printing ink and adhesive manufacturers, 1999

Frequency	Other R&D projects were ...						Total no.
	Cancelled no.	Cancelled %	Postponed no.	Postponed %	Unaffected no.	Unaffected %	
<i>Product group</i>							
OEM	4	30.8	7	53.8	2	15.4	13
Architectural coatings	2	25.0	2	25.0	4	50.0	8
Printing inks	0	0.0	1	25.0	3	75.0	4
Adhesives	0	0.0	1	33.3	2	66.7	3
All firms	6	21.4	11	39.3	11	39.3	28

Note: n = 28.

Source: Roediger-Schluga (2003).

- Displacement technology-specific and declining with firm size -> small firms may be technological laggards

Impact on competitiveness

Reported impact of VOC emission standards on competitiveness: Austrian paint, coating, printing ink and adhesive manufacturers, 1999

Region	Austria		EU/EFTA		Other countries	
	no.	%	no.	%	no.	%
Unaffected	21	75.0	12	66.7	15	78.9
Deteriorated	4	14.3	2	11.1	2	10.5
Improved	3	10.7	4	22.2	2	10.5

Notes: The percentages represent the share of respondent firms; n = 28.

Source: Roediger-Schluga (2003).

Compliance innovation and market entry

Compliance innovation and market entry: Austrian paint, coating, printing ink and adhesive manufacturers, 1999

Category	Frequent		To some extent		Never	
	no.	%	no.	%	no.	%
Firm size						
Small	2	40.0	1	20.0	2	40.0
Medium	5	45.5	3	27.3	3	27.3
Large	5	50.0	4	40.0	1	10.0
Product group						
OEM	8	61.5	4	30.8	1	7.7
Architectural coatings	3	42.9	2	28.6	2	28.6
Printing inks	1	33.3	0	0.0	2	66.6
Adhesives	0	0.0	2	66.6	1	33.3
All firms	12	46.2	8	30.8	6	23.1

Notes: The size categories have been defined in accordance with Recommendation 96/280/EC; n = 26.

Source: Roediger-Schluga (2004, p. 277).

Unexpected Benefits of Compliance (I)

Share of firms obtaining new ideas from compliance R&D: Austrian paint, coating, printing ink and adhesive manufacturers, 1999

	Firms		Total no.
	no.	%	
Product group			
OEM	9	69.2	13
Architectural coatings	3	37.5	8
Printing inks	1	33.3	3
Adhesives	2	100.0	2
Firm size			
Small	3	60.0	5
Medium	6	50.0	12
Large	6	66.7	9
All firms	15	57.7	26

Note: n = 26.

Source: Roediger-Schluga (2004, p. 261).

Unexpected Benefits of Compliance (II)

Impact of compliance R&D on knowledge base: Austrian paint, coating, printing ink and adhesive manufacturers, 1999

	Compliance R&D helped us acquire new ...							
	Knowledge/Competencies				Technologies			
	Many (%)	Some (%)	None (%)	no.	Many (%)	Some (%)	None (%)	no.
Product group								
OEM	53.8	7.7	38.5	13	46.2	15.4	38.5	13
Architectural coatings	28.6	28.6	42.9	7	28.6	28.6	42.9	7
Printing inks	66.7	0.0	33.3	3	66.7	0.0	33.3	3
Adhesives	33.3	0.0	66.7	3	33.3	0.0	66.7	3
Firm size								
Small	80.0	20.0	0.0	5	60.0	20.0	20.0	5
Medium	36.4	9.1	54.5	11	36.4	18.2	45.5	11
Large	40.0	10.0	50.0	10	40.0	10.0	50.0	10
All firms	46.2	11.5	42.3	26	42.3	15.4	42.3	26

Note: n = 26.

Source: Adapted from Roediger-Schluga (2003).

References

- Roediger-Schluga, T. (2004), *The Porter Hypothesis and the Economic Consequences of Environmental Regulation: A Neo-Schumpeterian Approach*, Cheltenham, UK and Northampton, MA, US: Edward Elgar.
- Roediger-Schluga, T. (2003), 'Some microevidence on the "Porter Hypothesis" from Austrian VOC emission standards', *Growth and Change*, **34** (3), 357–77.
- Roediger-Schluga, T. (2002), 'The stringency of environmental regulation and the "Porter Hypothesis"', in L. Marsiliani, M. Rauscher and C. Withagen (eds.), *The International Dimension of Environmental Policy*, Boston, MA; Dordrecht, Netherlands: Kluwer, 123-48.