Voluntary Agreements and CO2 Reduction - An empirical Assessment of German Industries

Parlow, Anton and Hövelmann, Dennis

University of Kaiserslautern

15 December 2014

Voluntary Agreements and CO_2 Reduction - An empirical Assessment of German Industries

Anton Parlow [1]   Dennis Hövelmann [2]

November 2014

Abstract

Using data on 57 German industries we find that industries participating in voluntary agreements reduce their CO_2-emissions up to 30% compared to industries not participating in voluntary agreements for the period 1995 to 2010. The success of these agreements can be explained by a credible threat of the regulatory agency to impose taxes.

JEL-Classification: Q01, Q32
Keywords: Voluntary Agreements, CO_2-Emissions, Industries

1   Introduction

Voluntary agreements (VA) as an alternative to environmental regulations and taxes are a widely applied tool to reduce harmful greenhouse gases, especially CO_2-emissions.

VAs, as in the case for many European countries, are a bargained agreement between the industry and a regulatory agency. They have the advantage that they are more flexible from a firm's point of view, instead of mandatory taxes or goals set by a regulatory agency. This could increase the development (or use) of more efficient technologies on the industries own terms. Furthermore, VAs can be less costly to implement than mandates (Jochem and Eichhammer 1999).

VAs are enforced by a threat of the regulatory agency to impose taxes or other regulations if the VA is not followed by the industry. However, the effect of a VA on reducing emmissions could be less if the threat is non-credible, e.g. an industry just announces a goal to avoid mandatory actions and remains inactive in reaching the set goals (Glachant 2002). Furthermore, compared to emission quotas and trading schemes they could have lower bargained emission targets to begin with (Glachant 2002, Grepperud 2002).

However, an econometrical judgement of their potential success in reducing CO_2-emissions is mostly missing. Most studies are of descriptive nature and focus on one (e.g. at the firm level) or just a few industries (Faggi et al. 2014, Abeelen et al. 2013, Boyd 2013, Lo 2012, Rezessy and Bertoldi 2011, Chidiak 2002, Krarup and Ramesohl 2002, Johannsen 2002).

Here, we make use of a quasi natural experiment in Germany where 14 mostly energy-intense industries announced a VA in 1995 and 43 industries did not. This allows us to test the local average treatment effect of a VA. In 1995 the German industry association (BDI) and ten of its members announced to reduce CO_2-emissions up to 30% until 2005 compared to the base year 1990. The reason for the industry to negotiate a VA was to avoid mandatory energy (and eco) taxes (Jochem and Eichhammer 1999).

---

[1] Research affiliate and corresponding author, University of Kaiserslautern, Germany, antonparlow@gmail.com
[2] Graduate student, University of Kaiserslautern, Germany

Descriptive studies based on German industries (Arens 2012, RWI 2011) find a positive effect of VAs on reducing CO_2-emissions. Using a regression model, we complement these findings. Firms participating in a VA do indeed reduce their emissions compared to firms not participating in a VA by almost 30%.

Our paper is organized as follows. Section 2 introduces to the data and to our empirical model. Section 3 discusses our results. The paper concludes in section 4.

2 Empirical strategy and data

We have GDP, energy and pollution data on 57 different German industries at the two and three digit level of aggregation. These industries range from energy-producing industries, manufacturing, agriculture and to different service related industries. Annual valued added GDP data are from the economic accounting system (Inlandsproduktrechnung 2012) and are available at the industry level until 2010. Energy-related CO_2-emissions are from the environmental accounting system (Umweltgesamtrechnung 2013). Finally, we take energy-use data from the AG Energiebilanzen (2014), Destatis (2014) and from the RWI (2011).

To estimate the effect of VAs on energy-related CO_2-emissions we use the following model:

$$CO_{2it} = \alpha + \beta_1 VA_{it} + \beta_2 GDP_{it} + \beta_3 Energy_{it} + \tau + \omega_t + \gamma_i + \epsilon_{it} \tag{1}$$

VA is the main variable of interest. It is a binary variable and takes the value one if an industry is an VA, and zero if otherwise. If industries in a VA do indeed reduce CO_2-emissions, we expect the variable VA to have a negative effect on CO_2-emissions.

The parameter τ represents developments common for all industries, e.g. the increased use of alternative energy sources in the production (RWI 2011) or structural changes in the East German in the 1990s ("Wall-Fall-Effect", Jochem and Eichhammer 1996). The parameter ω_t reflects time fixed effects, e.g. developments affecting every industry the same in a given year. This could be a recession for instance. Industry-specific but time invariant characteristics are represented by the parameter γ_i. Finally, ϵ_{it} is the usual (robust) error term.

3 Results

Basic Results

Our results are presented in Table 1. We show results for a baseline model (Model 1) and a model including a VA-specific trend (Model 2). Most of the variation in CO_2-emissions is explained by energy use, as expected, given we use energy-related emission data. Thus, industries producing energy, as well as energy-intense industries have the highest potential to reduce CO_2-emissions in the production of goods and services. To no surprise, these firms also participate in a VA because a mandatory eco-tax could hurt them the most (Jochem and Eichhammer 1999). Furthermore, the participation in a VA could also create a positive image in the public for these rather heavy polluting industries (Lyon and Maxwell 2003).

We find that industries participating in a VA emmit up to 30% less CO_2 than firms not participating in a voluntary agreement. In this light, VAs can be seen as a successful tool in reducing emissions.

Some Dynamics

Here, we test if the participation in a VA has a long term effect in reducing CO_2-emissions. We use five leads to model the dynamics. Results can be found in column 3 of Table 1 (Model 3). We exclude the year 1995

from this analysis because most VAs where announced in the middle of the year and it is more likely that efforts to reduce CO2-emissions started in 1996.

We find that the firms participating in a VA do continously decrease their emissions, e.g. by using more energy-efficient technologies (RWI 2011).

Table 1: Industries - 1995 to 2010

	Model 1	Model 2	Model 3
VA	-.253***	-.291***	
	(.079)	(.084)	
VA_{t+1}			-.101*
			(.055)
VA_{t+2}			-.124***
			(.036)
VA_{t+3}			.037*
			(.022)
VA_{t+4}			-.125***
			(.026)
VA_{t+5}			-.172***
			(.052)
Energy	.436***	.439***	.308**
	(.162)	(.162)	(.128)
GDP	.013	.017	.055
	(.048)	(.046)	(.051)
Trend	-.016***	-.017***	-.007
	(.002)	(.003)	(.005)
VA*Trend	-	.003	.001
		(.003)	(.005)
Time F.E.	Yes	Yes	Yes
Industry F.E.	Yes	Yes	Yes
R^2	0.97	0.97	0.98
n	824	824	606

Note: significant at *** 1%, ** 5%, * 10%. Robust standard errors are in parentheses and the adjusted R^2 is reported. Energy data and GDP data are log-transformed. GDP is measured as value added GDP. Voluntary agreements (VA) includes all industries adopting a voluntary agreement.

4   Conclusion

If industries face a credible threat (e.g. environmental taxes) voluntary agreements (VA) can be successful in reducing CO_2-emissions. The German government announced that if industries do not reach the agreed CO_2-targets a energy tax and other mandatory regulations will be implemented (Jochem and Eichhammer 1999). Thus, this credible threat ensured that the industries participating in these VAs reach the agreed targets (RWI 2011). However, the full potential of CO_2-reduction is not reached if some industries do not participate in these VAs. Mechanisms (e.g. tradeable pollution rights) targeting all industries can decrease emissions beyond the agreed level in VAs. Especially in the light of global warming unused potentials in reducing CO_2-emissions should be addressed (IPCC 2014)

References

[1] Abeelen Christiaan, Harmsen Robert, and Worrell Ernst (2013) "Implementation of energy efficiency projects by Dutch industry", Energy Policy, Vol. 63, pp.408-418

[2] AG Energiebilanzen (2014) "Auswertungstabellen", `http://www.ag-energiebilanzen.de/10-0-Auswertungstabellen.html`, last accessed 11/03/2014

[3] Boyd Gale (2013) "Estimating the changes in the distribution of energy efficiency in the U.S. automobile assembly industry"

[4] Chidiak Martina (2002) "Lesson from the French experiences with voluntary agreements for greenhouse-gas reduction", Journal of Cleaner Production, Vol. 10, pp.121-128

[5] Destatis Statistisches Bundesamt (2014) "Energieverbrauch (Energy-use)", `https://www.destatis.de/DE/ZahlenFakten/Wirtschaftsbereiche/Energie/Verwendung/Tabellen/TabellenEnergieverwendungVG.html`, last accessed 11/03/2014

[6] Faggi Ana, Zuleta Gustavo, and Homberg Marina (2014) "Motivations for implementing voluntary environmental actions in Argentine forest companies", Land Use Policy, Vol. 41, pp.541-549

[7] Glachant Matthieu (2007) "Non-Binding voluntary agreements", Journal of Environmental Economics and Management, Vol. 54, pp.32-48

[8] Grepperud Sverre (2002) "Voluntary environmental agreements: bargaining over more than emissions", European Journal of Political Economy, Vol. 18, pp.545-559

[9] Inlandsproduktberechnung (2012) "Inlandsproduktsberechnung - Detaillierte Jahresergebnisse - Fachserie 18 Reihe 1.4", `https://www.destatis.de/DE/Publikationen/Thematisch/VolkswirtschaftlicheGesamtrechnungen/Inlandsprodukt/InlandsproduktsberechnungEndgueltigXLS_2180140.xlsx?__blob=publicationFile`, last accessed 04/10/2014

[10] IPCC - Intergovernmental Panel on Climate Change (2014) "Climate Change 2013: The Physical Science Basis", `http://www.climatechange2013.org/images/report/WG1AR5_ALL_FINAL.pdf`, last accessed 04/11/2014

[11] Jochem Eberhard, and Eichhammer Wolfgang (1999) "Voluntary Agreements as an Instrument to Substitute Regulating and Economic Instruments. Lessons from the German Voluntary Agreements on CO2 Reduction" in Fondazione Eni Enrico Mattel (FEEM) Series on Economics, Energy and Environment, Vol. 14 Chapter 12, pp.209-227

[12] Johannsen K.S. (2002) "Combining voluntary agreements and taxes - an evaluation of the Danish agreement scheme on energy efficiency in industry", Journal of Cleaner Production, Vol.10, pp.129-141

[13] Krarup S., and Ramesohl S. (2002) "Voluntary agreements on energy efficiency in industry - not a golden key, but another contribution to improve climate policy mixes", Journal of Cleaner Production, Vol. 10, pp.109-120

[14] Lyon P. Thomas, and Maxwell W. John (2003) "Self-regulation, taxation and public voluntary environmental agreements", Journal of Public Economics, Vol. 87, pp.1453-1486

[15] Rezessy Silvia, and Bertoldi Paolo (2011) "Voluntary agreements in the field of energy efficiency and emission reduction: Review and analysis of experiences in the European Union", Energy Policy, Vol. 39, pp.7121-7129

[16] RWI - Rheinisch-Westfälisches Institut für Wirtschaftsforschung (2011) "Die Klimavorsorgeverpflichtung der deutschen Wirtschaft - Monitoringbericht 2010", `http://www.rwi-essen.de/media/content/pages/publikationen/rwi-projektberichte/RWI_PB_Monitoringbericht-2011-und-2012.pdf`, last accessed 10/13/2014

[17] Umweltgesamtrechnung (2013) "Umweltnutzung und Wirtschaft - Tabellen zu den Umweltökonomischen Gesamtrechnungen", `https://www.destatis.de/DE/Publikationen/Thematisch/UmweltoekonomischeGesamtrechnungen/Querschnitt/UmweltnutzungundWirtschaftTabellenband.html`, last accessed 04/10/2014