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Satisfaction with democracy and collective action problems: the case of the environment*

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Abstract

Whether a country is able effectively to address collective action problems is a critical test of its ability to fulfill the demands of its citizens to their satisfaction. We study one particularly important collective action problem: the environment. Using a large panel dataset covering 25 years for some countries, we find that, overall, citizens of European countries are more satisfied with the way democracy works in their country if (a) more environmental policies are in place and if (b) expenditures on the environment are higher, but environmental taxes are lower. The relation between environmental policy and life satisfaction is not as pronounced. The evidence for the effect of environmental quality on both satisfaction with democracy and life satisfaction is not very clear, although we find evidence that citizens value personal mobility (in terms of having a car) highly, but view the presence of trucks as unpleasant. We also document that parents, younger citizens, and those with high levels of educational attainment tend to care more about environmental issues than do non-parents, older citizens, and those with fewer years of schooling.

JEL Classification: K32, P16, Q21, Q28.

Keywords: collective action problems, environmental economics, environmental policy, environmental quality, satisfaction with democracy.

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1 Introduction

In this paper we study how the resolution of an important economic problem – ensuring high environmental quality – plays a role in how citizens perceive the quality and performance of the political system in which they live in. There is a lot of public discussion about the importance of environmental issues, and it is evident that there is a greater popular awareness for environmental problems today than some decades ago (Kirchgässner & Schneider 2003; Tanguay *et al.* 2004). What is less known, however, is: Just how important is the environment to individuals’ perceptions of the performance of their governmental regimes, taking into account that individuals also want to achieve other, potentially conflicting goals such as economic prosperity? Answering this question is critical because most environmental policies are costly. Therefore, their ultimate acceptance will hinge on the economic value the public assigns to such policies.

Even though most individuals recognize the collective benefits of treating the environment carefully, individual considerations are likely to undermine against such actions. In economic terms, the environment is a classic case of a public good, for which a collective action problem in the sense of Olson (1965) arises: The marginal collective benefits of adopting careful actions, vis-a-vis the environment, outweigh by far the marginal private benefits (even though the latter vary across individuals). Importantly, rational individuals are aware of this wedge between what they know would be good for society, and what the optimal individual course of action is. Thus, they know that environmental quality tends to be undersupplied. Consequently, the main hypothesis that we test is that citizens want an effective resolution of this dilemma. Because solutions to collective action problems are available only through a broad consensus on policies, the success a country has in tackling collective problems like the environment is a matter, among other things, of how well a political system works. Therefore, we operationalize the research question by asking more specifically: Are citizens more satisfied with the way their political system works when more environmental policies are established and/or environmental quality is higher? And how much do they care about that issue, compared to other goals, such as personal or country-wide economic welfare?

To answer these questions, we choose as the primary dependent variable a direct measure of citizens’ views on the performance of their respective governments. This measure is ‘satisfaction with democracy’ (SWD), a survey measure that is available for a wide range of countries. Satisfaction with the way democracy works is not an indicator of system legitimacy *per se*. Rather, it is one indicator of support for the performance of a democratic regime widely used in political science. Survey measures such as life satisfaction and happiness are very popular in economic research (see, among many others, Frey & Stutzer 2000, 2002; Di Tella *et al.* 2003; Alesina *et al.* 2004; Blanchflower & Oswald 2004; and Bjørnskov *et al.* 2007). Because of its comparable validity and usefulness (Linde & Ekman 2003), SWD and related measures are also increasingly being applied (see, among others, Van Praag & Ferrer-i-Carbonell 2004; and Wagner *et al.* 2009). SWD does not attempt to capture whether people support the principles of democracy, but rather how they judge it to work in practice in their actual experience. It is a summary indicator (Clarke *et al.* 1993) that measures satisfaction with ‘the constitution in operation’ (Klingemann 1999).¹ As explanatory variables for SWD (besides standard individual

¹Some work following Anderson & Guillory (1997) has considered political system determinants of SWD, but

and country-level economic controls) we use a broad array of environmental policy and quality variables. We compile a very large panel dataset, covering 16 countries in the time period from 1976 through 2000 (though we do not have data for every country-year combination).

We find that environmental policy and quality matter to citizens in statistically and economically important ways. Over the whole sample period, more comprehensive environmental policy is associated with more SWD. For example, an increase in the number of environmental policy measures by one standard deviation is on average associated with a rise in SWD equivalent to an increase in GDP growth by one standard deviation. Environmental expenditures also are positively associated with SWD, while environmental taxes tend to have a negative effect. For instance, by increasing environmental expenditures (measured as a share of GDP) by one percentage point, SWD for the average citizen is estimated to increase by about a quarter of a standard deviation. Our findings are robust to controlling for unobserved time-invariant heterogeneity and numerous time-varying controls at both the country level and the individual level. We also present evidence, using three distinct sample splits, that some citizens (such as parents, young citizens, and those who are highly educated) tend to care more about environmental issues than others. In sum, the results suggest that citizens, or at least important subsets of them, expect the political system to implement policies that address the environmental collective action problem.

With these findings, the paper relates to the literature on political economy, governance, and happiness. Some evidence now exists that good government (measured by broad concepts such as effectiveness, observance of the rule of law, absence of corruption, responsiveness to citizens' preferences, accountability, and political stability) is associated with greater happiness, or individual life satisfaction (Helliwell & Huang 2008). Helliwell (2006) and Layard (2006) provide summaries of related results on the relationship between public policies and happiness. However, we do not know of any study that has considered the government's success in implementing policies addressing specific collective action problems. Perhaps closest to our study are some economics papers that have studied environmental quality (but not policy) as a determinant of happiness. One line of work has considered specific environmental amenities. For example, Van Praag & Baarsma (2005) use the happiness approach to value airport noise. A second line of work studies broader environmental measures. Welsch (2006) presents evidence that air pollution, such as ambient nitrogen, particulates and lead, is negatively associated with subjective well-being for ten European countries (see also Welsch 2002). Welsch (2007) expands the analysis to a cross-section of 54 countries and calculates the marginal rate of substitution of income for pollution abatement. Rehdanz & Maddison (2005) examine the relationship between climate and happiness in an empirical analysis using data on 67 countries. They find that happiness increases with a higher mean temperature in the coldest month and decreases with higher mean temperatures in the hottest month as well as that it decreases with a more months with very little precipitation of rain.²

so far no study has considered the implications of specific policy measures.

²As such, the present paper and the cited studies can also be interpreted as complementary to the existing, rich literature in economics that has addressed the economic value of specific environmental amenities. See Freeman (1985) and Environmental Protection Agency (2000) for surveys. Standard methods include, on the one hand, revealed preference methods and hedonic pricing (Viscusi 1993; Bockstael *et al.* 1987; Rosen 1974), including those based on recreation demand estimation (Bockstael & McConnell 1983; Morey *et al.* 1993), as well as,

All of these studies use either purely cross-sectional data, or, where they use panel data, they average happiness over all individuals in a country. However, this assumes homogenous policy effects, reduces the degrees of freedom substantially, and requires cardinality of the satisfaction scores, making it a less than ideal method for the question under study. One prior study that uses individual-level data is by Ferrer-i-Carbonell & Gowdy (2007). However, their investigation of the relationship between individual happiness and attitudes towards ozone pollution and species extinction is limited to British data.

Our findings on environmental quality are broadly consistent with these studies. However, our results add to the existing literature in four important ways. First, this is the first study, to the best of our knowledge, to consider SWD as a measure of how much individuals care about the environment. Because environmental problems are by their nature collective problems, understanding variations in perceptions of the quality of the constitution in operation provides insights beyond those available from studying individual well-being. (We show in the robustness section that environmental policy and quality also matter for happiness.) Second, no study has evaluated the relationship between environmental policy measures and any satisfaction variable. Policies and quality may be related, but there may be important time lags, and citizens' evaluations of the effectiveness of the political system should take into account whether or not the right policies are in place. Third, we use what is, to our knowledge, the largest panel dataset of SWD to date. Fourth, we test for effects that are heterogenous across sub-groups of the population which is something papers using country-level averages cannot do.

The rest of the paper is organized as follows. Section 2 presents the hypotheses, describes the data, and discusses how our method differs from, and in our judgment improves on, approaches employed in related studies. Section 3 presents the findings. Section 4 concludes this paper.

2 Hypotheses, data and methodology

We begin by deriving our hypotheses. We then discuss our dependent variable(s), after which we present our key explanatory variables and our controls. Finally, we describe our estimation strategy.

2.1 Hypotheses

We test three simple ideas. First, economic theory suggests that collective action problems are never fully resolved. In particular, public goods such as environmental quality will generally be undersupplied, i. e., the collective marginal benefits will be greater than the collective marginal costs even when private marginal benefits and costs are already equated (Olson 1965). This results in free-riding and a tendency for environmental degradation (that is, the production of a public bad), among what Olson (1965) termed as latent groups. Most countries fall into this category.³ Citizens recognize these collective action problems. This implies that individuals

on the other hand, stated preference (contingent valuation) methods (Mitchell & Carson 1989, Portney 1993; Hanemann 1994; Diamond & Hausman 1994).

³In Olson's (1965) analysis, group size plays an important role, but virtually all countries are so big that individual benefits from environmental quality, net of the costs of contributing to this public good, are most likely to be negative throughout.

would prefer better environmental quality than is usually provided. While Olson (1965) proposed some specific mechanisms for how participation can be induced in an otherwise latent group (such as through selective incentives, through repeated interaction, and as by-products of the actions of groups actually created for other purposes), we generally hypothesize that political systems that are more successful at resolving such problems of collective action will command more respect from their citizens. For this result to hold, we need only to assume that individuals regard environmental quality as a good thing. Specifically, our first hypothesis is that higher environmental quality leads to greater satisfaction with the way democracy works.

Citizens may also expect, more concretely, from the ‘constitution in operation’ that it allows the government to provide (at least partially) effective ways towards a resolution of the collective action problem. That is, because citizens recognize that their country is not a unitary actor and may, thus, face a collective action problem, they may perceive it as desirable to have external solutions or at least the setting of boundary conditions for individual actions imposed by the government. Some frictions in the political system are needed to generate an empirical relationship between policy and SWD. To see this, suppose that voters have single-peaked preferences over environmental policy and that environmental policy is determined by politicians to cater to the preferences of citizens (Downs 1957). In principle, in a perfectly functioning political system, under majority voting, the median voter will thus ‘set’ environmental policy (Black 1948). There would then exist no relation between policy and SWD (if one assumes that the SWD survey sample is representative enough to bracket the median voter): Each country, at each point in time, is effecting the policy regarded as optimal by the median voter. However, imperfections of the political system may lead to deviations from that optimum. First, elected candidates do not necessarily deliver on their campaign promises. Second, policies are not set continuously, and lobbying activities may lead to both over-provision (if environmental lobbyists are more powerful) or under-provision (if companies favoring laxer environmental standards carry the day); see Grossman & Helpman (2001). While we do not develop a formal theoretical model in this paper, it seems plausible that on balance the political system would lead to an under-provision of policies that generate positive externalities, compared to what a full resolution of the collective action problem would require. Thus, we also test the idea that environmental policy is generally seen as an important aspect of a well-functioning democracy and will, therefore, also lead to more SWD.

In summation, our two core hypotheses are:

Hypothesis 1: More environmental policy is associated with higher SWD.

Hypothesis 2: Better environmental quality is associated with higher SWD.

Third, citizens’ preferences over environmental issues may differ not only across countries but also within countries. Many environmental problems inherently are long-term challenges. A purely selfish individual might simply not care about what happens after he or she dies. Even rational economic models frequently assume, however, that individuals have a bequest motive, as they think about the welfare of their offspring. Issues of sustainable development and preserving the environment for future generations may, therefore, differentially affect individuals’ perceptions of the way democracy works. If individuals expect environmental problems mainly

to concern themselves only in the long run (or even to affect only future generations, not their own) this would suggest that (i) younger citizens and (ii) those with children should care more about environmental policy.

Hypothesis 3a: Younger citizens' SWD reacts more strongly to environmental policy and quality than the SWD of their older counterparts.

Hypothesis 3b: Parents' SWD reacts more strongly to environmental policy and quality than the SWD of non-parents.

Finally, one might argue that the awareness of such complex, long-term problems as the environment, and the awareness of what politics does to address them, might increase with educational attainment. Thus, one could expect a stronger reaction among citizens with more years of formal schooling.

Hypothesis 3c: More highly educated citizens' SWD reacts more strongly to environmental policy and quality than SWD of their lower educated counterparts.

2.2 Data

All our data, including the hand-collected items, will be available to other researchers upon publication of this study. Detailed information on all data used can be found in the Data appendix.

2.2.1 Dependent variable

The primary dependent variable for our empirical analysis is a 4-point scale measure of SWD on an individual level from the *Eurobarometer* survey, based on the question '*On the whole, are you very satisfied, fairly satisfied, not very satisfied or not at all satisfied with the way democracy works in our country?*'. The *Eurobarometer* is a biannual survey launched in 1970 (turning into a quarterly survey in 2000) and includes questions about opinions and basic attitudes regarding the EU and its institutions, politics, economy and society. The question on SWD was first asked in a core of nine countries in 1973, continued to be asked of respondents from these countries in 1976, and was expanded after 1980, in a stepwise manner, to include respondents from an additional seven countries. We obtain these data from the *Mannheim Eurobarometer Trend File, 1970-2002*. This is an integrated set of data covering harmonized variables for the years 1970 through 2002 that allow a cross-time (and cross-country) comparison. The question on SWD was not asked in every survey round in each country since 1973. However, as Table 1 shows, we have information from 313 country-years (covering responses from more than 570,000 participants).⁴

As Figure 1 shows, there is substantial variation across countries in terms of the average level of SWD. Luxembourg exhibits the highest SWD in the whole EU, with a mean of 2.90.

⁴In our regression analysis below, we have to exclude all observations from the nine country-years from 1973 since no (comparable) information on labor market status is available. We further lose some observations due to missing information on several individual-level control variables.

Norway, Denmark, the Netherlands and Austria (all values above 2.69) also do very well in terms of satisfying their citizens' expectations of democracy. Ireland, Sweden and Germany are all slightly above the EU average of 2.58 (calculated by averaging country-averages). The larger economies, such as the United Kingdom, France and Spain have values below the average. The country with the lowest levels of satisfaction is Italy, with an average of 1.96.

[Insert Table 1 and Figure 1 about here]

SWD is a survey measure and, as such, it is, in principle, subject to the same criticisms as any survey. Our line of reasoning in using this dependent variable is pragmatic: SWD has been validated and applied widely (Anderson & Guillory 1997; Linde & Ekman 2003), and we take its usefulness as a starting point.⁵ Note also that, in contrast to contingent valuation approaches, the subjects we study answered the questions about their SWD independently of a specific policy context. Thus, our approach does not require that the respondents be aware of any cause-and-effect relationship. It is not even necessary that respondents know the level of environmental quality. Therefore, our approach is cognitively less demanding than contingent valuation, and whatever relationship we find cannot be caused by strategic answers.

As an alternative dependent variable, we use overall well-being. This will allow us to contrast our findings for SWD with the related findings in this domain. The *Eurobarometer* includes a question on life satisfaction: '*On the whole, are you very satisfied, fairly satisfied, not very satisfied or not at all satisfied with the life you lead?*', and another one on happiness '*Taking all things together, how would you say things are these days – would you say you're very happy, fairly happy, or not too happy these days?*'. Since the number of available observations is substantially larger in the case of the former question (648,083 versus 134,607), we use this 4-point scale variable to capture overall well-being, and refer to this variable as life satisfaction (LS) below. Figure 1 indicates that SWD and LS are related, but by no means equivalent. The correlation between the two variables on the individual level is 0.331. On the aggregate level, we see that SWD is typically somewhat lower and more volatile than LS.

2.2.2 Environmental policy

We collect information from different sources in order to capture different aspects of environmental policy with different measures: (i) the existence of a wide array of certain policy measures, (ii) revenues from environmental taxes as a percentage of GDP, (iii) public expenditure on the environment as a percentage of GDP, and (iv) the share of votes for green parties.

Information on the existence of certain policy measures intended to protect the environment are collected from Binder (2002). These policy measures essentially cover the full spectrum of environmental regulation: from subsidies for renewable energy to environmental ministries, from environmental regulation: from subsidies for renewable energy to environmental ministries, from environmental labels to the existence of a nature conservancy act.⁶ For each policy action, a

⁵See Canache *et al.* (2001) for a critique of SWD and Anderson (2005) for a response to that critique.

⁶We read this information from the tables and graphs in Binder (2002). The full list of the 16 available policy measures is as follows: quota for electricity from renewable energy sources, energy/CO₂ tax, packaging rules, sustainability council, subsidy for electricity from renewable energy sources, energy efficiency labels, environmental plan, ecolabels, environmental office, environmental expert council, general environmental act, environmental

binary variable is defined that is set equal to one if a country had taken that action in a given year. For example, the variable energy/ CO_2 tax is equal to one when a country had an energy tax in place in a given year and zero otherwise. We then calculate a *summary measure*, which is simply the number of all policy acts implemented in a given year. It encapsulates the degree to which a country has established a comprehensive set of environmental policies. It is apparent from Figure 2 that there is a tremendous variation in the adoption of such policies across the sample countries. The Netherlands started early and had implemented all 16 policy measures by 1999. In contrast, Belgium was a late adopter and still lags far behind at the end of the sample period.

[Insert Figure 2 about here]

The data on revenues from environmental taxes and government expenditure on environment protection (both measured as a percentage of GDP) are from the database of *Eurostat*. The evolution of the adoption of these policy measures in each country also is depicted in Figure 2. Unfortunately, these variables are not available for the whole sample period. Information on taxes is missing completely before 1980, and in the case of expenditures, even before 1990. Notably, the level of government expenditure on environment protection is lower throughout than the revenues from environmental taxes. The revenues from environmental taxes, as a percentage of GDP, are in a range from 1.54% (Spain 1989) to 5.39% (Denmark 1999). Expenditures range between 0.2% (Sweden, 1995–1999) and 1.5% (Luxembourg, 1992–1994). Of course, the ability of tax revenues (alone) to capture the degree of environmental friendliness may be limited. For instance, low revenues can either be due to little use of environmental taxes, or due to a broad and effective use of such taxes, where high tax rates have altered citizens' behavior. However, when we employ this variable below, we control for other environmental policy measures, allowing us to draw *ceteris paribus* conclusions.

Finally, we have data on the percentage of total cabinet posts held by green parties (weighted by days) from the *Comparative Political Data Set I*. This variable serves as a control variable, and we have *per se* no clear hypothesis on its *ceteris paribus* effect on SWD. We think of this variable as a good proxy for the degree of environmental awareness, and we will use it as a covariate to check the robustness of our results.

As Table 2 shows, environmental policy and environmental expenditures are (perhaps surprisingly) essentially uncorrelated. Environmental taxes are positively correlated with both the summary policy measure and environmental expenditures. As expected, we see that the larger is the share of green parties in the cabinet, the greater is the number of implemented environmental policy measures and the higher the environmental expenditures.

[Insert Table 2 about here]

reporting rules, waste disposal act, environmental protection as a constitutional goal, nature conservancy act, and a soil protection act.

2.2.3 Environmental quality

To measure environmental quality we use data on (i) emissions⁷ and on (ii) road networks and traffic. In particular, we use data from the *OECD Environmental Data Compendium 2004* on emissions of sulphur oxides (SO_x), nitrogen oxides (NO_x), carbon monoxide (CO), volatile organic compounds (VOC) and carbon dioxide (CO₂). The main human sources of SO_x are from burning fossil fuels, smelting and paper manufacture. SO_x emissions cause adverse effects on respiratory systems of humans and animals, and damage to vegetation. In particular, they contribute to acid rain and thus have negative effects on aquatic ecosystems. NO_x emissions – mainly due to the burning of fossil fuels at high temperatures – play an important role in the production of photochemical oxidants and of smog, and contribute, together with SO_x, to acid precipitation. CO interferes with the absorption of oxygen by red blood cells and causes adverse health effects. Emissions of VOC are considered, along with NO_x, to be the main precursors of photochemical air pollution. Finally, man-made CO₂ emissions result mainly from the burning of fossil fuels. The *World Health Organization* reports that the atmospheric concentration of CO₂ has increased by more than 30% since pre-industrial times. This disturbs the balance of the earth’s radiative energy budget. It is associated with a rise in the earth’s surface temperature and is related to effects on climate change, sea levels and global agricultural production. CO₂ contributes the largest share to global warming (OECD 2004).

Table 3 (see columns 1 to 5) and Figure 3 summarize the variation in emissions across countries and over time. We can see that the variation across countries (and also across categories within countries) is in fact more pronounced than the variation over time. Interestingly, many countries perform quite well in one category, but emit well above average in other categories. For instance, Norway has below average per capita emissions of SO_x and CO₂. It is, however, by far the biggest per capita emitter of VOC. Its 76.19 tons per 1,000 population is more than twice that of the sample average. Greece is the biggest per capita emitter of SO_x, but in all other categories it is below average. Luxembourg (almost an outlier) is a huge per capita emitter of CO, CO₂, NO_x, and VOC. Sweden, on the other hand, performs quite well in all categories.

[Insert Table 3 and Figure 3 about here]

Arguably, traffic, and in particular roadway congestion, plays a major role in day-to-day perceptions of environmental quality. To capture the quality and the extent of the road network in relation to the stock of passenger cars and all other motor vehicles (basically trucks) we construct three variables based on information collected from the *OECD Environmental Data Compendium 2004*. We use (i) the number of passenger cars per kilometer of the total road network and (ii) the number of trucks per kilometer of the total road network. Moreover, (iii), since the road network can be divided into ‘normal’ roads and highway miles, we calculate highways miles as a share of the distance spanned by a country’s total road network and include this variable as a control for the structure of the road network. Columns 6 to 8 of Table 3 and

⁷Ideally, one would like to use the actually relevant impact for individuals. To the extent that we find emissions to be negatively associated with SWD, this effect, therefore, also captures the positive non-use value of lower emissions. Even that, however, ignores the possibility that for individuals living at the border of another country, that other country’s policies and outcomes may be more relevant than the home country’s policies.

Figure 4 provide descriptive statistics for these three variables. There is substantial variation across countries for all three measures. Moreover, in general, we observe a (rather modest) upward trend in congestion and in the share of highways.

[Insert Figure 4 about here]

2.3 Control variables

2.3.1 Country-level

To control for various determinants of SWD other than environmental factors, we employ a set of (economic) control variables. Better economic performance is most likely associated with higher SWD. As proxies for the overall economic performance we use real GDP per capita, the real GDP growth rate, the inflation rate (the annual rate of change in the prices of consumption goods), and the annual budget deficit. Moreover, we include openness (exports plus imports divided by real GDP), the total receipts of the government as a percentage of GDP, population size, and an index of the degree of electoral fractionalization of the party-system.⁸

2.3.2 Individual-level covariates

It is common in studies of SWD to also include demographic variables. We include a set of socio-economic control variables capturing: age, sex, family status, education, and labor market status. Clearly, we would have preferred to control for income, also on the individual level. However, this information is not available for several years and several countries. In any case, education (captured by school leaving age) and labor market status (where we compare employed citizens to unemployed, self-employed, and those out of the labor force) arguably are good proxies for income.

2.4 Empirical strategy

Our empirical approach is simple. We run regressions with individual SWD as the dependent variable and our key environmental variables as well as control variables (on an individual and a country level). Specifically, due to the nature of the dataset we are able to employ a panel regression, and include country and year fixed effects. Since our dependent variable SWD is measured on a four-point scale, we estimate an ordered logit model.

Two aspects of this empirical approach merit comments. First, note that to explore the effect of environmental policy and environmental quality on SWD, we have to deal with data measured on two different levels. While we observe SWD on an individual level, we measure environmental policy and environmental quality on a country-level.⁹ Moulton (1990) drew economists' atten-

⁸In particular, we use the index proposed by Rae (1968) that is defined as $1 - \sum_{i=1}^n v_i^2$, where v_i is the share of votes for party i and n the number of parties. That means, a larger value of this *Rae-Index* indicates a more fractionalized system. Note that, because all our countries are democracies, controlling for the extent of democracy is not likely to yield added insights. We also included the institutional quality indices found by Wagner *et al.* (2009) to be correlated with SWD. Whilst this substantially reduces the number of observations, the overall results remain similar and are available on request.

⁹In fact, we would prefer individual-level data for environmental policy and environmental quality, but these data do not exist, at least not in a dataset that measures individuals' SWD.

tion to the fact that applying standard estimation methods in this setup can lead to standard errors that are biased downward. Early work tried to meet this challenge by using averaged data. But this ignores heterogeneity on the individual level and assumes homogenous policy effects. Moreover, it reduces the degrees of freedom substantially and requires cardinality of the satisfaction scores. We instead wish to make full use of the information collected at the individual level. Therefore, we follow standard practice and calculate Huber (1967)-White (1980) standard errors robust to clustering on the country-year level (Froot 1989; Williams 2000).¹⁰

The second issue we highlight is that of causality. If we observe a statistically significant coefficient on environmental policy in a regression explaining SWD, this does not necessarily mean that environmental policy *causes* higher SWD. To make a clean causal statement, we would need truly exogenous variation, i. e., random assignment of environmental policies across countries. In fact, however, policy is also endogenous. There are two broad classes of endogeneity concerns: reverse causation and omitted variables. It appears somewhat unlikely that there is reverse causation from SWD to environmental policy. But we cannot completely exclude the possibility that some other omitted (and perhaps unobservable) factors are correlated with both SWD and environmental policy. While this is a concern that is not to be taken lightly, we note that by including many (time-varying) control variables, we ameliorate this concern to a large extent. The longitudinal component of the dataset is also particularly useful in another way: Since we include fixed effects on a country level we control also for all *unobserved* time-invariant factors. Overall, this control strategy facilitates, though does not completely guarantee, a causal interpretation of our results.¹¹

3 Estimation results

Our primary results for environmental policy are presented in Table 4, and those for environmental quality are presented in Table 5. In order to provide interpretable estimation output, we report – besides the coefficients (β_k) and the standard errors – standardized coefficients and changes in the predicted probabilities. Coefficients rescaled by their standard deviation (henceforth denoted by σ) enable a simple interpretation just like coefficients from a linear regression model. For non-binary explanatory variables we report the *fully standardized coefficients*, given by $\beta_k^{Sf} = \sigma_k \beta_k / \sigma_{SWD^*}$, which can be interpreted as the standard deviation increase in SWD associated with a one standard deviation increase in each of the respective explanatory variable, holding all other variables constant. In the case of binary explanatory variables we report the *standardized coefficients*, given by $\beta_k^S = \beta_k / \sigma_{SWD^*}$, which measures the estimated *ceteris paribus* standard deviation increase in SWD when the binary explanatory variable switches from zero to one. For the variables of primary interest we report in addition the predicted probabilities of

¹⁰Country-level regressions, where we use average SWD as the dependent variable and regress it on our environmental policy measures, all country-level control variables used in the paper, as well as country and year fixed effects, yield results that are similar overall to those produced by individual-level regressions.

¹¹In a predecessor working paper, we employed an alternative empirical strategy, namely a hierarchical (multi-level) model. The original paper, which used only a cross-sectional dataset, is available upon request. Unfortunately, a hybrid of the two approaches (fixed effects and hierarchical modeling) is still an underdeveloped area of econometric research (Kim & Frees 2006). While, broadly speaking, the results in the original paper were similar to the present one, the richer data and the empirical strategy employed here – in particular the ability to control for country fixed effects – imply that the present results should be seen as more reliable.

being ‘not at all satisfied’ ($m = 1$), ‘not very satisfied’ ($m = 2$), ‘fairly satisfied’ ($m = 3$) and ‘very satisfied’ ($m = 4$) due to a discrete change in the respective covariate by half of a standard deviation holding all other covariates at their mean ($\bar{\mathbf{x}}$), that is, $\Delta\Pr(\text{SWD} = m|\bar{\mathbf{x}})/\Delta x_k$.

[Insert Table 4 about here]

3.1 Individual and country-level characteristics

We begin by commenting briefly on our control variables. Regarding the individual-level characteristics, it is worth noting that we find very robust effects. That is, the qualitative and quantitative results concerning the demographic covariates are rather similar across all specifications. Substantively, we find that females have a significantly lower level of SWD. Holding all other covariates constant, specification (I) in Table 4 suggests that their SWD is 0.013 standard deviations less than that of male respondents.¹² With respect to age we find an inverted U-shaped relationship. Young citizens (i. e., between 15 and 24 years of age, the base group) have a comparably high SWD. Thereafter, we observe a decrease in SWD with rising age. This downward trend, however, reverses for citizens in the more senior age group (i. e., 65 years of age and older). To some extent, this suggests that SWD decreases over the period of working life (when citizens contribute most in terms of taxes). Married citizens are on average more satisfied (plus 0.053 standard deviations). The coefficients of the variables capturing individual economic status by and large are mainly statistically significant. As expected, unemployed citizens are – compared to employed citizens – less satisfied (minus 0.280 standard deviations). Somewhat surprisingly, self-employed individuals are also comparably less satisfied with the way democracy works (minus 0.022 standard deviations). It is, for instance, possible that entrepreneurial citizens would on average value more opportunities for political involvement, or entrepreneurial activity *per se* typically reveals certain shortcomings of the political system. Citizens out of the labor force (i. e., the retired or housewives) do not exhibit a statistically significant different level of SWD compared to employed citizens. Finally, satisfaction rises with education. Compared to the base group of citizens with low educational attainment (i. e., below 16 years of formal education), the SWD of citizens with medium and high levels of educational attainment is greater by 0.034 and 0.086 standard deviations, respectively. The peak level of SWD, however, is achieved by currently enrolled citizens; their SWD is even 0.128 standard deviations larger.

The results for the country-level characteristics are also instructive (see, for instance specification (II) in Table 4). Richer, faster-growing, smaller economies and those that run larger deficits but have lower government revenue to GDP ratios have higher SWD. Openness and SWD are negatively correlated. Inflation enters positively, which may have to do with the fact that in the period under consideration, inflation in these countries was relatively moderate and arguably related to economic growth.

¹²It is outside the scope of this paper to determine whether or not this may be explained by discrimination against women in various aspects of life, such as the labor market, but this would appear to be an important question for further research.

3.2 Environmental policy

The primary finding of interest in Table 4 is the impact of our summary measure of environmental policy on SWD. The strong and robust result that emerges is that, controlling for a large variety of individual and country-level explanatory variables, a more developed environmental policy is applauded by citizens. The summary measure enters as a statistically significant determinant of SWD. Specification (II) suggest that an increase in the number of implemented policy measures by one standard deviation (which is equal to 3.78 policies) increases SWD by 0.09 standard deviations (which is equal to 0.075 points). Equivalently, the probability that a citizen is ‘fairly satisfied’ (‘very satisfied’) with the way democracy works is 2.9 (1.3) percentage points higher if the number of implemented policy measures increases by half of a standard deviation. This quantitative effect is comparable to that of real GDP growth. The average marginal effect (not tabulated) of these two variables is about the same: An additional environmental policy measure implemented, or an increase in GDP growth by one percentage point both increase SWD by 0.006 points. Compared to the gender-gap in SWD, an additional environmental policy measure creates an average effect seven times larger than the male-female difference in SWD.

Notably, the results on the effect of our summary measure of environmental policy on SWD remain unchanged when controlling for the share of green parties in the cabinet, as in specification (III) of Table 4. This is important because the green parties’ percentages of total cabinet posts can be interpreted as time-varying proxies for the degree of environmental awareness. Specification (IV) finally introduces fiscal activities of the government with respect to environmental policies; note here that the sample size is reduced considerably. Still, even when we control for environmental taxes and expenditures in this smaller sample, the effect of the summary measure of environmental policy is present and significant (p-value of 0.09). We also tested whether the effect of the summary measure changes over time (i.e., we introduced interaction terms between year fixed effects and the summary measure). While we find that the effect is significantly different in various years, no clear long-run trend is visible. These results are available upon request.¹³

In line with the estimated positive effect of our summary measure of environmental policy on SWD, we find that citizens’ SWD increases with public expenditures on the environment. An increase in expenditures by one standard deviation (0.272 percentage points of GDP) is associated with a 0.062 standard deviation increase in SWD. The estimated average marginal effect (i.e., the effect of an increase in expenditures by one percentage point of GDP) is equal to 0.055 points. With respect to environmental taxes we find a negative effect on SWD. One could have expected that environmental taxes might have a positive effect on SWD due to the potential double dividend they offer in the form of a reduction of negative externalities and a reduction of other distortionary taxes. However, our results do not support this prediction. Instead, citizens seem to find only government intervention through enhanced spending appropriate, but SWD

¹³In untabulated regressions, we have considered ‘kitchen-sink’ models including binary variables for all of the individual policy measures. Only a few individual policy measures are consistently positively or negatively related with SWD; instead, the sign (and significance) often depends on the introduction of additional controls. The statistical significance of individual measures may also arise as an artefact of the correlations between the many policy variables included in the horserace. While the summary measure is, by definition, a cruder proxy for environmental policy, the results obtained with it are more stable.

is *ceteris paribus* lower when environmental taxes are higher. Our estimation suggests that an increase in environmental taxes by one standard deviation decreases SWD by 0.073 standard deviations. The average marginal effect is 0.025 points. The positive effects of the summary measure and the public environmental spending, in combination with the negative effect of taxes, are consistent with an economic understanding of environmental problems as collective action problems, i. e., the notion that most individuals care about the environment but few are willing to bear the costs of protecting it. Overall, we interpret our findings as substantial support for *Hypothesis 1* that the adoption of more policy measures increases SWD.

3.3 Environmental quality

The second hypothesis that we test is that environmental quality should be positively associated with SWD. Table 5 shows the results for this hypothesis, first introducing various categories of emissions, then introducing three measures of traffic and congestion, and then including all measures (along with the share of green parties in the cabinet). A number of interesting findings emerge from studying these sets of variables both individually and jointly.

Across all specifications we find negative coefficients for sulphur oxide (SO_x), nitrogen oxide (NO_x), and carbon monoxide emissions (CO). However, only the estimated effects of nitrogen oxides are statistically significant throughout. An increase in emissions of nitrogen oxides by one standard deviation decreases SWD by about 0.1 to 0.15 standard deviations. The estimated positive effect of emissions of volatile organic compounds (VOC) and carbon dioxide (CO_2) are puzzling. It seems that these categories of emissions are correlated in specification (I) with unobserved time-varying SWD-enhancing mobility factors. After controlling for traffic and congestion in specifications (III) and (IV), the statistical significance of carbon dioxide vanishes.

With respect to our measures of traffic and congestions we find a positive effect for the car-road ratio, and a robust negative effect for the truck-road ratio. It seems that citizens value their personal mobility (in terms of having a car) quite highly, and even accept a large car-road ratio (i. e., a higher likelihood of congestion). By contrast, they perceive heavy truck traffic to be unpleasant and they favor governmental regulations to reduce it. Especially the latter result is plausible, given the significant amount of public discussion of this topic in some countries. (See, for example, the transit traffic conflict between the Austrian government and the EU).

In summary, the results on environmental quality are not as strong as those on environmental policy and provide only weak evidence in favor of *Hypothesis 2*. Citizens may be less informed about environmental quality (captured, for example, by emissions) and/or may hold the domestic political system less responsible for environmental protection within this domain, since they perceive it as a more global phenomenon where national action is less effective.

[Insert Table 5 about here]

3.4 Life satisfaction

Our equivalent analysis of the effect of environmental policy on LS is summarized in the upper panel of Table 6, while the results for environmental quality are summarized in the lower panel.

For environmental quality, we obtain, overall, the same patterns as for SWD. As for policy, we can see that the summary measure of environmental policy also has a statistically significant positive effect on LS. However, this effect is somewhat smaller and less robust than found previously. In specifications (I) through (III) the estimated effect is highly statistically significant, and suggests that an increase of the summary measure by one standard deviation increases LS by up to 0.079 standard deviations. In specification (IV), where we include environmental taxes and expenditures as additional covariates, however, statistical significance vanishes and the estimated effect is basically zero. Likewise, we find a smaller (and less significant) effect of public environmental expenditures on LS. The average marginal effect is about 0.025. Environmental taxes turn out not to be a significant determinant of LS. Overall, we interpret these results as evidence that SWD and LS are related but distinct concepts. In our context we find a stronger relationship between SWD and (environmental) policy measures. This finding seems plausible since SWD refers to the current political situation, while LS is an all-encompassing evaluation of individuals' current life conditions.

[Insert Table 6 about here]

3.5 Heterogenous effects

To operationalize causal heterogeneity with respect to the impact of environmental measures on SWD, and to test *Hypotheses 3a*, *3b* and *3c*, we split the sample along the dimensions of age, parenthood, and educational attainment.

With respect to age, we distinguish between young (below 34 years of age) and old (at least 55 years of age) citizens. Unfortunately, the *Eurobarometer* does not include a specific question on parenthood. However, respondents are asked (in 90 usable country-years) ‘*How many children under 15 are there living at home?*’.¹⁴ Given that, in almost all cases, mothers obtain (physical) custody after divorce (or separation) this question can be used to construct valid information on parenthood for women. Therefore, when we refer to parents we distinguish between female parents and female non-parents. To explore the effect among poorly and highly educated citizens we compare estimations based on a sample of citizens with 15 years of formal education or less, and citizens with at least 16 years of formal education.¹⁵ Since we cannot control for income in our full sample, educational attainment incorporates not only the effect of education but (potentially) also the effect of income.

Table 7 provides the results. Consider first the upper panel, where the first two columns show the effects of environmental measures on SWD for young and old citizens. A comparison of the standardized estimates (and their significance) indicates that younger citizens care comparably more about environmental policy. For instance, an increase in the summary measure by one standard deviation, increases the SWD of young citizens by 0.070 standard deviations, and those of older citizens by only 0.056 standard deviations. The next two columns differentiate between

¹⁴To be precise, in a subset of waves the survey differentiates further between younger (below 8 years of age) and older (above 8 and below 15 years of age) children.

¹⁵The data allow us to consistently distinguish between citizens who are still studying (8.9%), those who have up to 15 years (29.04%), between 16 and 19 years (37.68%) and 20 or more years (24.37%) of formal education.

parents and non-parents. While the estimated effect of our summary measure of environmental policy is not statistically significant (at conventional levels) in either sample, it is remarkable that the estimated coefficient is three times larger for parents and has a smaller standard error. With respect to environmental expenditures we find that in the case of parents each standard deviation increase in these expenditures increases SWD by 0.105 standard deviations. This effect is highly statistically significant. The equivalent effect for non-parents is only 0.066 standard deviations. Comparing poorly and highly educated citizens, we find a comparatively stronger effect of the summary measure in the latter sample (0.092 versus 0.029).¹⁶ We find similar patterns in an equivalent analysis of LS (not shown).

Overall, we interpret these findings on heterogeneous effects as broadly, though not extremely strongly, supportive for *Hypotheses 3a* through *3c* as far as environmental policy is concerned. By contrast, our analysis of heterogeneous effects of environmental quality on SWD (and LS) does not yield important differences between the sub-groups of citizens under consideration.

[Insert Table 7 about here]

4 Conclusions

This paper investigates satisfaction with democracy in the presence of an especially important and topical collective action problem, the environment. Our first set of new results shows that, overall, a focus on environmental policy is associated with greater SWD in statistically and economically important ways in our sample of 16 European countries across a period of up to 25 years. Larger public expenditures on the environment tend to increase an average citizen's satisfaction score, while environmental taxes *ceteris paribus* reduce it. The findings for environmental quality are more ambivalent. Broadly speaking, parents, young citizens and those with high levels of educational attainment worry significantly more about appropriate environmental policy than do non-parents, older citizens, and those with fewer years of schooling. These results are intuitive and should be of interest to scholars (including those studying collective action problems other than those problems related to the environment) and policy-makers alike.

Although our paper thus makes progress on the important question of how the environment matters for citizens' SWD, it also has its limitations. Perhaps the primary drawback is that we are not offering a theoretical framework that neatly pins down exactly which variables should play a role in SWD and which should not. This issue is partly addressed by our panel data setup that allows us to control for unobserved time-invariant heterogeneity. But even that approach does not completely exclude the possibility that time-varying omitted variables are driving some of our results. Further theoretical and conceptual work on SWD can, therefore, be fruitfully conducted.

¹⁶If we redefine the group of highly educated citizens to comprise those with 20 or more years of formal education (instead of 16 or more years), the effect of the summary measure increases to 0.131.

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Data appendix

The information on the **individual-level** variables satisfaction with democracy, life satisfaction, age, sex, family status, education, labor market status, and children is from the *Mannheim Eurobarometer Trend File, 1970-2002*. This dataset is prepared by the *Zentralarchiv für Empirische Sozialforschung* (Hermann Schmitt and Evi Scholz) and, for instance, available as *ICPSR Study No. 4357*. We start with all observations for which a measure of satisfaction with democracy is available (see Table 1). In our estimation analysis, however, we cannot exploit the full set of observations, since information on some covariates is missing. Information on age enters into the estimations based on binary variables for six age-groups (15 to 24, 25 to 34, 35 to 44, 45 to 54, 55 to 64, and over 65 years) where the youngest group serves as the base group. Family status is captured by a binary variable equal to one if the respondent is married, and zero otherwise. Educational attainment is incorporated based on binary variables capturing if a respondent is still enrolled in school, has below 15 years of formal education (base group), between 16 and 19 years, or more than 20 years. With respect to labor market status we distinguish between respondents who are employed (base group), self-employed, unemployed and out of the labor force.

The information on the **country-level covariates** is from different sources. First, information on real GDP per capita (in constant prices), the real GDP growth rate (percentage change from previous year), the inflation rate (measured as the annual percentage increase in the prices of consumption goods), openness (exports plus imports divided by real GDP per capita; all measured in constant prices), and population size (in thousands) is from the *Penn World Tables (version 7.0)*. Further information is provided by <http://pwt.econ.upenn.edu/>. Second, the information on tax receipts (total tax receipts of government as a percentage of GDP), the annual budget deficit (government primary balance) as a percentage of GDP, and the index of electoral fractionalization of the party-system (following Rae 1968), green parties' percentages of total cabinet posts (weighted by days) are from the *Comparative Political Data Set I, 1960-2008* provided by Klaus Armingeon, Sarah Engler, Panajotis Potolidis, Marlène Gerber and Philipp Leimgruber; see http://www.ipw.unibe.ch/content/team/klaus_armingeon/comparative_political_data_sets/index_ger.html.

Our measures of **environmental policy** are from two different sources. First, information on the existence of a quota for electricity from renewable energy sources, an energy/CO₂ tax, a packaging rules, a sustainability council, a subsidy for electricity from renewable energy sources, energy efficiency labels, an environmental plan, ecolabels, an environmental office, an environmental expert council, a general environmental act, environmental reporting rules, a waste disposal act, environmental protection as a constitutional goal, a nature conservancy act, and a soil protection act is collected from Binder (2002). We obtained the information by reading them from the graphs. The graphs are fortunately of the quality that they allow the unambiguous identification of all cases. Second, data on revenues from environmental taxes and government expenditure on environment protection (both measured as percentages of GDP) are from the database of *Eurostat*. (Data were retrieved on 2011/04/18.)

Our measures of **environmental quality** are from two primary sources. Firstly, information on emissions of SO_x, NO_x, CO, VOC and CO₂ from energy use is collected from the *OECD*

Environmental Data, Compendium 2004. Secondly, the information on the road network (total length of road networks, length of highways) and on the stock of road vehicles (total number of passenger cars in use, total number of other motor vehicles in use) is obtained from the *OECD Environmental Data, Compendium 2006/2007*.

Table 1: Number of available observations for satisfaction with democracy per country and year^a

	AT	BE	DE	DK	ES	FI	FR	GB	GR	IE	IT	LU	NO	NL	PT	SE
1973		1,195	1,933	1,179			1,925	1,899		1,172	1,880	295		1,323		12,801
1976		919	986	945			1,197	1,261		919	1,016	251		1,113		8,607
1977		1,654	1,934	1,894			2,035	2,596		1,862	2,123	608		1,908		16,614
1978		1,680	1,891	1,889			1,945	2,541		1,839	2,139	576		1,984		16,484
1979		1,689	1,893	2,003			1,772	2,528		1,844	2,298	574		2,011		16,612
1980		863	946	978			880	1,334	978	950	1,089	295		1,071		9,384
1981		820	891	964			877	1,260	931	896	1,041	486		952		9,118
1982		1,781	2,064	1,908			1,721	2,429	1,836	1,783	2,016	577		1,996		18,111
1983		1,811	1,956	1,910			1,818	2,437	1,846	1,851	2,003	551		1,962		18,145
1984		1,959	1,954	1,886			1,847	2,592	1,878	1,879	2,097	567		1,971		18,630
1985		1,895	1,955	1,915	896		1,837	2,658	1,848	1,886	2,113	560		1,947	875	20,385
1986		1,880	1,996	1,930	1,788		1,772	2,499	1,887	1,857	2,126	560		1,905	1,784	21,984
1987		1,875	1,886	1,933	1,854		1,857	2,465	1,890	1,872	2,027	548		1,877	1,820	21,904
1988		949	978	990	961		931	1,262	955	921	999	268		977	887	11,078
1989		3,703	4,330	3,931	3,687		3,827	4,641	3,802	3,655	3,998	1,137		3,908	3,610	44,229
1990		1,845	1,045	1,979	1,912		1,877	2,559	1,944	1,882	2,032	551	977	2,048	1,846	22,497
1991		1,972	4,147	1,977	1,933		1,919	2,585	1,936	1,907	2,032	871	982	1,987	1,907	26,155
1992		2,947	6,112	2,988	2,911		2,897	3,828	2,922	2,823	3,019	1,427	1,958	2,932	2,857	39,621
1993		1,946	4,179	1,990	1,954	1,944	1,970	2,586	1,973	1,905	2,013	964	1,936	1,950	1,920	29,230
1994		3,010	6,206	2,982	2,910	1,916	2,949	3,888	2,968	2,910	3,102	1,542	1,973	3,015	2,863	42,234
1995	964	1,015	2,075	995	963	991	981	1,304	998	952	1,043	470	972	987	946	16,650
1997	1,953	1,964	3,977	1,985	1,895	1,977	1,947	2,490	1,989	1,828	1,942	1,139		2,005	1,863	1,923
1998	961	960	1,973	994	939	1,004	1,007	1,237	998	925	963	584		1,018	939	995
1999	1,901	1,989	3,934	1,984	1,935	2,055	1,934	2,380	2,009	1,862	1,960	1,106		1,988	1,901	1,947
2000	1,917	2,028	3,942	1,989	1,946	1,924	1,926	2,450	1,988	1,854	1,939	1,122		1,919	1,886	1,967
2001	1,903	1,924	3,870	1,978	1,880	1,889	1,898	2,398	1,969	1,790	1,896	1,125		1,920	1,870	1,926
	9,599	46,273	69,053	48,096	30,364	13,700	47,546	62,107	39,545	45,824	50,906	18,754	8,798	48,674	29,774	9,752
																578,765

^aAT: Austria, BE: Belgium, DE: Germany, DK: Denmark, ES: Spain, FI: Finland, FR: France, GB: United Kingdom, GR: Greece, IE: Ireland, IT: Italy, LU: Luxembourg, NL: Netherlands, NO: Norway, PT: Portugal, SE: Sweden.

Table 2: Pairwise correlations of environmental policy measures^a

	Summary measure	Environ. taxes	Environ. expend.	Share of greens
Summary measure	1.000 - <i>N</i> = 320			
Environmental taxes	0.340 (0.001) <i>N</i> = 261	1.000 - <i>N</i> = 261		
Environmental expenditures	-0.002 (0.979) <i>N</i> = 123	0.133 (0.152) <i>N</i> = 118	1.000 - <i>N</i> = 123	
Share of greens	0.281 (0.001) <i>N</i> = 302	-0.245 (0.001) <i>N</i> = 261	0.2021 (0.025) <i>N</i> = 123	1.000 - <i>N</i> = 302

^a Correlation coefficients and P-values in parentheses below. For details on the measures see Figure 2.

Table 3: Summary of environmental quality measures^a

	Emissions in tons per 1,000 capita				Traffic and congestion measures		
	SOx	NOx	CO	VOC	CO ₂ ^b	Car road ratio ^c	Truck road ratio ^d Share of highways
Austria	5.14	23.04	113.51	24.98	80.02	37.03	7.78 1.53
Belgium	25.69	33.20	119.69	28.61	115.06	27.81	2.91 1.13
Denmark	22.55	48.73	133.82	28.68	108.27	22.63	4.40 0.98
Finland	18.76	49.42	94.86	34.79	114.04	25.69	3.91 0.59
France	16.81	29.10	148.95	33.84	64.19	27.08	5.19 0.85
Germany	28.45	25.29	89.28	30.31	120.86	58.28	3.33 1.72
Greece	49.07	28.67	117.34	26.02	68.46	45.53	19.27 0.70
Ireland	44.74	32.83	90.27	27.92	94.68	9.65	1.49 0.05
Italy	21.89	30.07	116.37	33.26	70.89	32.52	3.05 0.77
Luxembourg	22.71	49.65	292.04	40.93	236.26	34.17	3.57 1.52
Netherlands	8.89	33.22	56.00	23.17	107.82	44.03	4.58 1.76
Norway	9.15	50.80	183.29	76.19	71.37	18.22	3.91 0.09
Portugal	32.23	28.12	82.69	30.34	47.87	33.52	10.42 1.07
Spain	46.61	33.90	86.46	29.84	60.70	82.96	17.46 4.19
Sweden	7.45	30.28	105.32	38.34	54.47	27.90	2.64 1.01
United Kingdom	-	-	-	-	-	55.62	8.27 0.83
Average	24.01	35.09	121.99	33.82	94.33	35.13	6.26 1.20

^a Details on all measures are provided in the Data appendix. ^b CO₂ emissions are of energy use only and measured as emissions in tons per ten capita. ^c Cars per 1,000 kilometers of total road network. ^d Trucks per 1,000 kilometers of total road network.

Table 4: Satisfaction with democracy and environmental policy^a

	(I)		(II)		(III)		(IV)	
	β_k	$\{\Delta\text{Pr}(\text{SWD} = m \bar{x})/\Delta x_k\}$	β_k	$\{\Delta\text{Pr}(\text{SWD} = m \bar{x})/\Delta x_k\}$	β_k	$\{\Delta\text{Pr}(\text{SWD} = m \bar{x})/\Delta x_k\}$	β_k	$\{\Delta\text{Pr}(\text{SWD} = m \bar{x})/\Delta x_k\}$
	(s.e.)	$[\beta_k^{(I)}]$	(s.e.)	$[\beta_k^{(II)}]$	(s.e.)	$[\beta_k^{(III)}]$	(s.e.)	$[\beta_k^{(IV)}]$
Environmental policy measures:								
Summary measure	0.036*	(0.022) [0.072]	0.045**	(0.019) [0.090]	0.045**	(0.019) [0.090]	0.052*	(0.031) [0.068]
	$\{-0.014/-0.020/0.023/0.011\}$		$\{-0.018/-0.025/0.029/0.013\}$		$\{-0.018/-0.024/0.029/0.013\}$		$\{-0.012/-0.021/0.023/0.009\}$	
Env. taxes as % of GDP							-0.203**	(0.086) [-0.073]
							$\{0.012/0.022/-0.025/-0.010\}$	
Env. expenditure as % of GDP							0.458**	(0.194) [0.062]
							$\{-0.011/-0.019/0.021/0.009\}$	
Share of greens in cabinet					0.009	(0.013) [0.015]	-0.042*	(0.025) [-0.068]
Country-level covariates:								
Real GDP growth rate								
Real GDP			0.045***	(0.014) [0.048]	0.047***	(0.014) [0.050]	-0.008	(0.015) [-0.008]
Inflation			0.001***	(0.001) [0.232]	0.001***	(0.001) [0.232]	0.001	(0.001) [0.013]
			0.006**	(0.003) [0.064]	0.007**	(0.003) [0.071]	0.010**	(0.005) [0.095]
Annual deficit as % of GDP			-0.020**	(0.010) [0.033]	-0.020**	(0.010) [0.033]	-0.002	(0.017) [-0.002]
Tax receipts as % of GDP			-0.025***	(0.009) [-0.088]	-0.024***	(0.009) [-0.086]	0.005	(0.016) [0.017]
Openness			-0.008**	(0.004) [-0.150]	-0.008**	(0.004) [-0.154]	-0.012*	(0.007) [-0.277]
Population (in thousands)			-0.001***	(0.001) [-1.716]	-0.001***	(0.001) [-1.726]	-0.001**	(0.001) [-3.018]
Elective fractionalization			-0.002	(0.008) [-0.009]	-0.004	(0.008) [-0.015]	-0.012	(0.016) [-0.037]
Individual-level covariates:								
Female	-0.024***	(0.008) [-0.013]	-0.025***	(0.008) [-0.013]	-0.025***	(0.008) [-0.013]	-0.043***	(0.012) [-0.022]
Married	0.101***	(0.009) [0.053]	0.096***	(0.009) [0.050]	0.096***	(0.009) [0.050]	0.113***	(0.013) [0.058]
<i>Age-groups:</i>								
Between 25 and 34	-0.089***	(0.012) [-0.047]	-0.090***	(0.013) [-0.047]	-0.090***	(0.013) [-0.047]	-0.090***	(0.019) [-0.046]
Between 35 and 44	-0.089***	(0.015) [-0.047]	-0.090***	(0.015) [-0.047]	-0.090***	(0.015) [-0.047]	-0.140***	(0.025) [-0.071]
Between 45 and 54	-0.120***	(0.017) [-0.063]	-0.124***	(0.017) [-0.065]	-0.124***	(0.017) [-0.065]	-0.167***	(0.030) [-0.085]
Between 55 and 64	-0.129***	(0.019) [-0.068]	-0.131***	(0.019) [-0.069]	-0.132***	(0.019) [-0.069]	-0.170***	(0.032) [-0.087]
Over 65	0.018	(0.022) [0.010]	0.015	(0.022) [0.008]	0.015	(0.022) [0.008]	-0.014	(0.037) [-0.007]
<i>Education:</i>								
Still enrolled	0.244***	(0.027) [0.128]	0.243***	(0.028) [0.127]	0.243***	(0.028) [0.127]	0.389***	(0.041) [0.198]
Between 16 and 19 years	0.064***	(0.014) [0.034]	0.066***	(0.015) [0.034]	0.066***	(0.014) [0.035]	0.101***	(0.022) [0.052]
20 years or more of	0.164***	(0.022) [0.086]	0.166***	(0.021) [0.087]	0.166***	(0.021) [0.087]	0.205***	(0.030) [0.104]
<i>Labor market status:</i>								
Out of the labor force	-0.007	(0.011) [-0.004]	-0.010	(0.011) [-0.005]	-0.010	(0.011) [-0.005]	-0.090***	(0.019) [-0.046]
Unemployed	-0.533***	(0.026) [-0.280]	-0.532***	(0.024) [-0.279]	-0.531***	(0.024) [-0.278]	-0.561***	(0.043) [-0.286]
Self-employed	-0.041***	(0.015) [-0.022]	-0.040***	(0.016) [-0.021]	-0.040***	(0.016) [-0.021]	-0.107***	(0.024) [-0.055]
Country and year fixed effects	Yes		Yes		Yes		Yes	
No. of observations/country-years	526,350/302		518,813/288		518,813/288		187,304/109	

^a The dependent variable is a four-point scale measure of satisfaction with democracy (SWD). The method of estimation is an ordered logit model. β_k denotes the estimated coefficient with standard errors (s.e.) in parentheses next to it. In brackets we report for binary variables the *standardized coefficients* that gives the estimated *ceteris paribus* standard deviation increase in SWD when the respective binary covariate switches from zero to one, and for non-binary variables the *fully standardized coefficients* that gives the standard deviation increase in SWD due to a one standard deviation increase in the respective non-binary covariate; in both cases all other covariates are held constant. For the variables of primary interest we report in addition in curly brackets the predicted probabilities of being 'not at all satisfied' ($m = 1$), 'fairly satisfied' ($m = 2$), 'very satisfied' ($m = 3$) and 'very satisfied' ($m = 4$) due to a discrete change in the respective covariate by half of a standard deviation, holding all other covariates at their mean (\bar{x}). *, ** and *** indicate statistical significance at the 10% level, 5% level, and 1% level.

Table 5: Satisfaction with democracy and environmental quality^a

	(I)	(II)	(III)	(IV)
	β_k { $\Delta\text{Pr}(\text{SWD} = m \bar{x})/\Delta x_k$ }	β_k { $\Delta\text{Pr}(\text{SWD} = m \bar{x})/\Delta x_k$ }	β_k { $\Delta\text{Pr}(\text{SWD} = m \bar{x})/\Delta x_k$ }	β_k { $\Delta\text{Pr}(\text{SWD} = m \bar{x})/\Delta x_k$ }
	(s.e.) [β_k^{Sf}]	(s.e.) [β_k^{Sf}]	(s.e.) [β_k^{Sf}]	(s.e.) [β_k^{Sf}]
Emissions:				
SOx emissions	-0.001 {0.001/0.002/-0.002/-0.001}	-0.001 {0.001/0.002/-0.002/-0.001}	0.001 {-0.001/-0.001/0.001/0.001}	-0.001 {0.001/0.001/-0.001/-0.001}
NOx emissions	-0.032** {0.027/0.045/-0.051/-0.020}	-0.032** {0.027/0.045/-0.051/-0.020}	-0.023* {0.019/0.032/-0.037/-0.015}	-0.025* {0.021/0.035/-0.040/-0.016}
CO emissions	-0.003 {0.013/0.022/-0.025/-0.010}	-0.003 {0.013/0.022/-0.025/-0.010}	-0.002 {0.012/0.020/-0.023/-0.009}	-0.003 {0.013/0.022/-0.026/-0.010}
VOC emissions	0.043*** {-0.039/-0.065/0.074/0.030}	0.043*** {-0.039/-0.065/0.074/0.030}	0.047*** {-0.042/-0.070/0.080/0.032}	0.045*** {-0.041/-0.06/0.077/0.031}
CO2 emissions	0.010* {-0.034/-0.055/0.063/0.025}	0.010* {-0.034/-0.055/0.063/0.025}	0.008 {-0.025/-0.042/0.048/0.019}	0.009 {-0.031/-0.051/0.059/0.024}
Traffic and congestion				
Car road ratio		-0.044*** {0.086/0.118/-0.139/-0.065}	0.033** {-0.064/-0.104/0.119/0.049}	0.036** {-0.071/-0.114/0.131/0.054}
Truck road ratio		0.038 {-0.022/-0.031/0.036/0.016}	-0.223*** {0.137/0.201/-0.233/-0.105}	-0.208** {0.126/0.189/-0.219/-0.097}
Share of motorways		20.375** {-0.020/-0.029/0.034/0.015}	14.860 {-0.016/-0.027/0.031/0.012}	10.632 {-0.012/-0.019/0.022/0.009}
Other covariates:				
Share of greens in cabinet	No	No	No	Yes
Individual-level covariates	Yes	Yes	Yes	Yes
Country-level covariates	Yes	Yes	Yes	Yes
Country and year fixed effects	Yes	Yes	Yes	Yes
No. of observations/country-years	251,251/143	459,702/253	251,251/143	251,251/143

^a See notes to Table 4.

Table 6: Life satisfaction and environmental policy and quality^a

	(I)		(II)		(III)		(IV)	
	β_k	(s.e.)	$[\beta_k^{S_f}]$	β_k	(s.e.)	$[\beta_k^{S_f}]$	β_k	(s.e.)
PANEL A: ENVIRONMENTAL POLICY ESTIMATIONS								
Policy measures:								
Summary measure	0.034**	(0.014)	[0.064]	0.042***	(0.014)	[0.079]	0.006	(0.028)
Env. taxes as % of GDP							0.080	(0.055)
Env. expenditure as % of GDP							0.268*	(0.144)
No. of observations/country-years	468,935/228			462,534/270			165,972/109	
PANEL B: ENVIRONMENTAL QUALITY ESTIMATIONS								
Emissions:								
SOx emissions	-0.003	(0.004)	[-0.025]	-0.002	(0.004)	[-0.016]	-0.002	(0.004)
NOx emissions	-0.017**	(0.007)	[-0.076]	-0.019**	(0.009)	[-0.085]	-0.019**	(0.009)
CO emissions	-0.002**	(0.001)	[-0.053]	-0.003**	(0.001)	[-0.070]	-0.002**	(0.001)
VOC emissions	0.043***	(0.007)	[0.214]	0.043***	(0.007)	[0.213]	0.043***	(0.007)
CO2 emissions	0.005*	(0.003)	[0.091]	0.007*	(0.004)	[0.122]	0.007*	(0.004)
Traffic and congestion								
Car road ratio				-0.009	(0.006)	[-0.084]	0.030***	(0.008)
Truck road ratio				0.001	(0.019)	[0.004]	-0.122***	(0.043)
Share of motorway				3.761	(5.858)	[0.018]	2.500	(8.807)
No. of observations/country-years	224,366/143			413,494/237			224,366/143	
Other covariates: ^b								
Share of greens in cabinet		No			No			Yes
Individual-level covariates		Yes			Yes			Yes
Country-level covariates		Yes			Yes			Yes
Country and year fixed effects		Yes			Yes			Yes

^a This table summarizes regressions of life satisfaction on environmental policy measures (panel A) and environmental quality measures (panel B). The dependent variable is a four-point scale measure. The method of estimation and structure of the table is equivalent to Table 4; see notes there. ^b Applies to estimations in both panels.

Table 7: Heterogeneous effects of environmental policy on SWD^a

	Young citizens			Old citizens		
	β	(s.e.)	$[\beta_k^{S^f}]$	β	(s.e.)	$[\beta_k^{S^f}]$
PANEL A: Age						
Summary measure	0.054*	(0.030)	[0.070]	0.042	(0.037)	[0.056]
Env. taxes as % of GDP	-0.215**	(0.084)	[-0.074]	-0.130	(0.111)	[-0.048]
Env. expenditure as % of GDP	0.490**	(0.211)	[0.066]	0.470**	(0.201)	[0.064]
Share of greens in cabinet	-0.054**	(0.026)	[-0.086]	-0.035	(0.028)	[-0.057]
Individual-level covariates	Yes	Yes		Yes	Yes	
Country-level covariates	Yes	Yes		Yes	Yes	
Country and year fixed effects	Yes	Yes		Yes	Yes	
No. of observations/country-years	65,158/109			56,850/109		
PANEL B: Parenthood						
	β	(s.e.)	$[\beta_k^{S^f}]$	β	(s.e.)	$[\beta_k^{S^f}]$
Summary measure	0.017	(0.039)	[0.022]	0.053	(0.042)	[0.069]
Env. taxes as % of GDP	-0.220*	(0.129)	[-0.079]	-0.295***	(0.107)	[-0.100]
Env. expenditure as % of GDP	0.487**	(0.216)	[0.066]	0.775***	(0.185)	[0.105]
Share of greens in cabinet	-0.038	(0.037)	[-0.061]	-0.037	(0.032)	[-0.060]
Individual-level covariates	Yes	Yes		Yes	Yes	
Country-level covariates	Yes	Yes		Yes	Yes	
Country and year fixed effects	Yes	Yes		Yes	Yes	
No. of observations/country-years	49,037/90			26,005/90		
PANEL C: Education						
	β	(s.e.)	$[\beta_k^{S^f}]$	β	(s.e.)	$[\beta_k^{S^f}]$
Summary measure	0.022	(0.044)	[0.029]	0.070**	(0.029)	[0.092]
Env. taxes as % of GDP	0.006	(0.110)	[0.002]	-0.298***	(0.083)	[-0.114]
Env. expenditure as % of GDP	0.506**	(0.228)	[0.065]	0.439**	(0.180)	[0.062]
Share of greens in cabinet	-0.059*	(0.032)	[-0.095]	-0.031	(0.024)	[-0.051]
Individual-level covariates	Yes	Yes		Yes	Yes	
Country-level covariates	Yes	Yes		Yes	Yes	
Country and year fixed effects	Yes	Yes		Yes	Yes	
No. of observations/country-years	54,402/109			116,224/109		

^a This table summarizes regressions of satisfaction with democracy on environmental policy equivalent to those presented in Table 4 (see notes there), but does so for various sub-samples. In Panel A we distinguish between young (below 34 years of age) and old (at least 55 years of age) citizens, in Panel B between female non-parents and female parents, and in Panel C between poorly (15 years of formal education or less) and highly educated citizens (at least 16 years of formal education). *, **, and *** indicate statistical significance at the 10% level, 5% level, and 1% level.

Fig. 1: Satisfaction with democracy and life satisfaction in EU-member countries

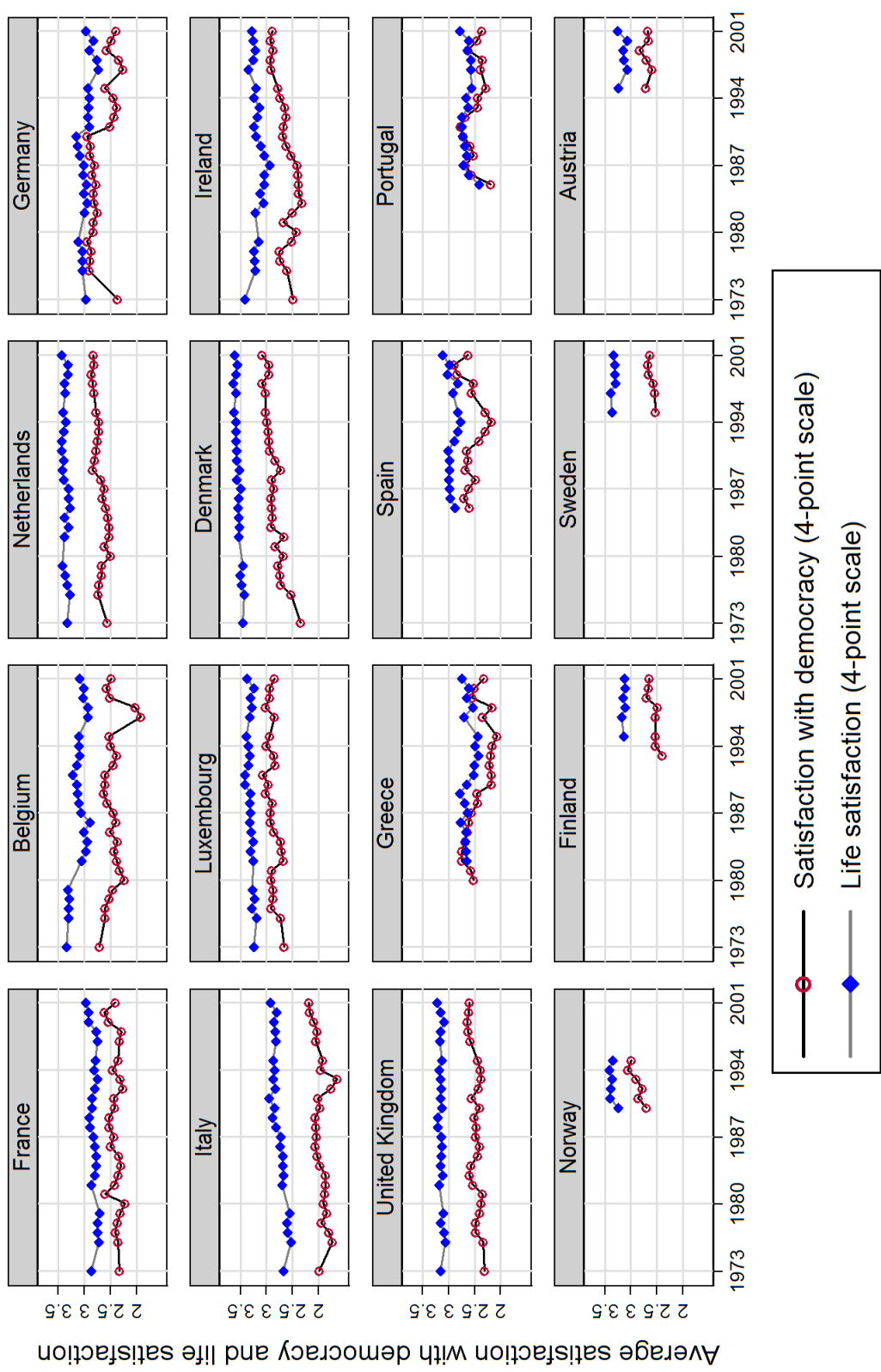
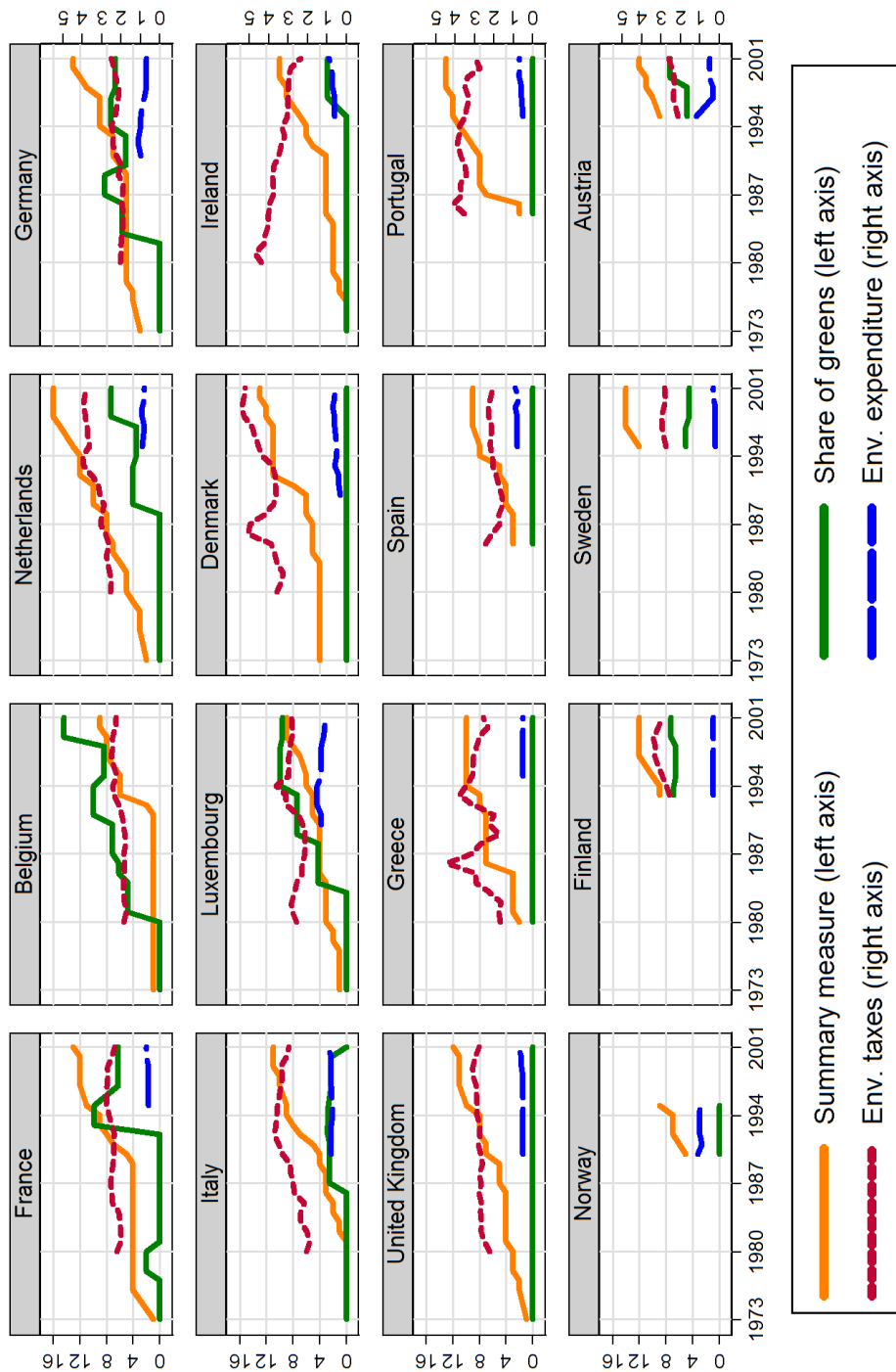
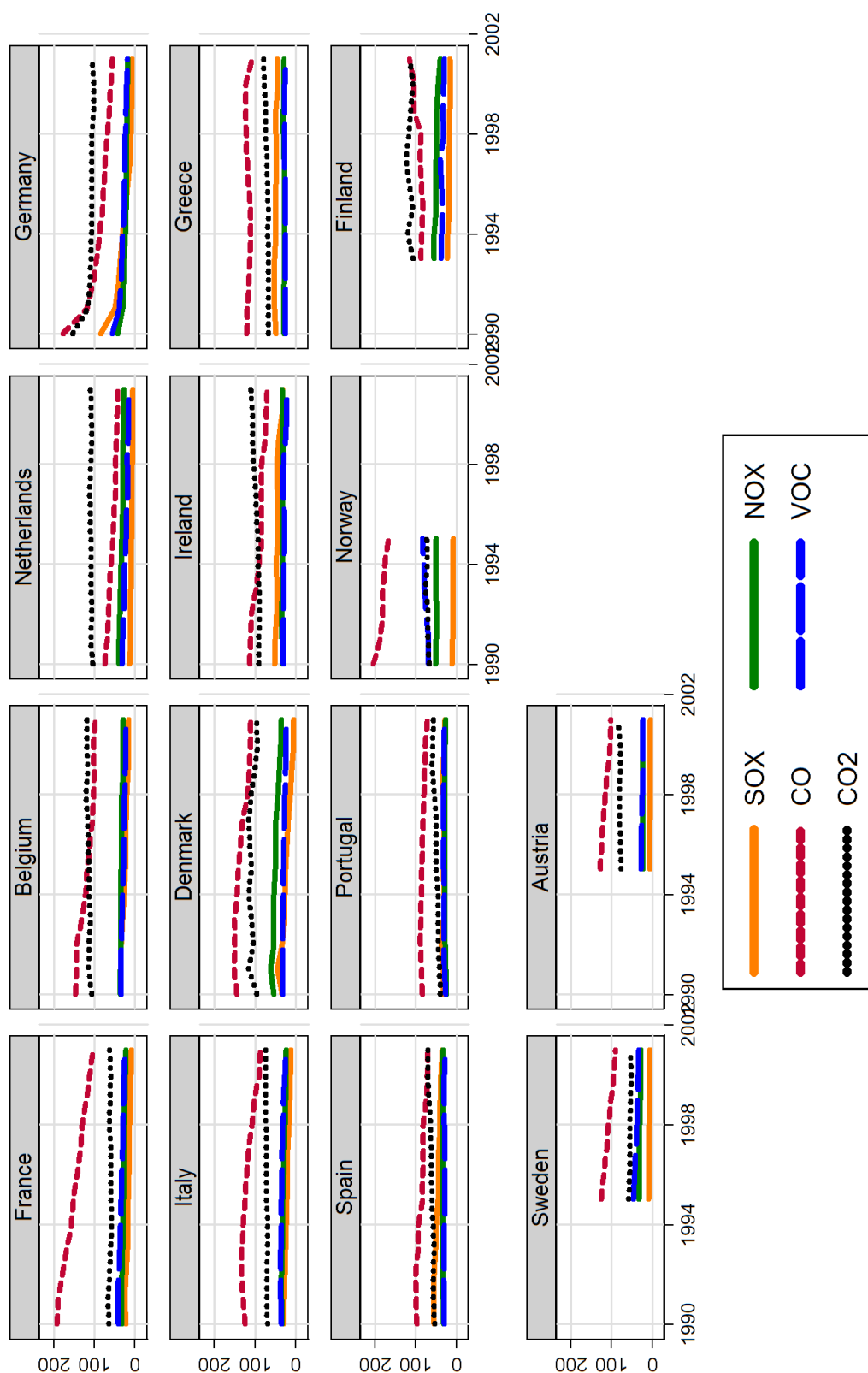


Fig. 2: Summary of environmental policy measures^a



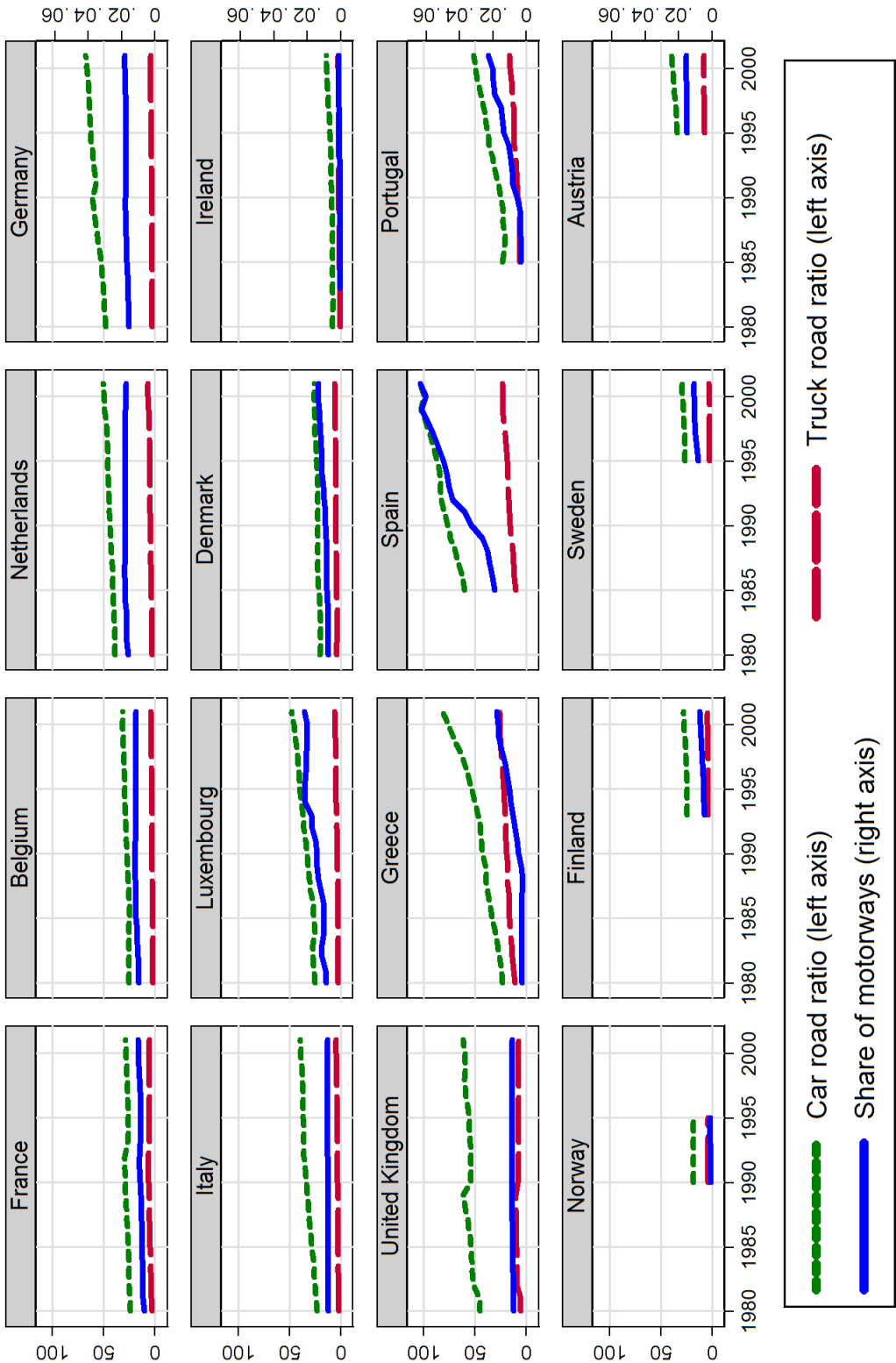
^a Summary measure is the number of all implemented environmental policy measures in a given year. These comprise the existence of a quote for electricity from renewable energy sources, an energy/CO₂ tax, a packaging rules, a sustainability council, a subsidy for electricity from renewable sources, energy efficiency labels, environmental plan, ecolabel, an environmental office, an environmental expert council, a general environmental act, environmental reporting rules, a waste disposal act, environmental protection as a constitutional goal, a nature conservation act, and a soil protection act. Environmental taxes are the revenues from environmental taxes as a percentage of GDP. Environmental expenditure are total government expenditures for environmental protection as a percentage of GDP. Share of greens represents the green parties percentage of total cabinet posts (weighted by days). Detailed information on all sources can be found in the Data appendix.

Fig. 3: Summary of emissions (in tons per 1,000 capita)



^a For definitions of the measures see notes to Table 3. The Data Appendix provides data sources and further details. Luxembourg has some exceptionally high emissions and is therefore excluded. For the United Kingdom no comparable data on emissions are available.

Fig. 4: Summary of traffic variables



^a For definitions of the measures see notes to Table 3. The Data Appendix provides data sources and further details.