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Social Reactions to the Climate Debate in Germany and Switzerland

Abstract: In this contribution we take a look at the development of environmental concern and mobility behavior of the population in Germany and Switzerland. The proportion of survey participants who express concern about the state of the natural environment is high in both countries. However, this proportion did not increase during the last two decades despite the ongoing public debate about environmental issues. At the same time the demand for private transportation did increase in Germany by almost 20% (in Switzerland by 2.5%). However, fuel consumption per capita decreased in Germany by 6.5% and in Switzerland by 2.2%. Our time series analyses of these trends suggest that this reduction is due to the price increase of gasoline which was substantial in both countries and not due to any change in attitudes. We argue that further price increases are appropriate means to reduce fuel consumption. However, our analyses also show that the price elasticity for fuel is low.

1. Introduction

The debate about climate change has been on the public agenda at least since the Intergovernmental Panel on Climate Change (IPCC) was founded in 1988. So far, the IPCC has published four reports that document climate change and in which it projects future developments. Thus according to the latest report the global average temperature has raised during the last hundred years (1906 to 2006) by 0.74 degrees and it will further raise by 4 to 6 degrees Celsius by the end of this century if CO₂ emissions will not be reduced. This projection and the associated consequences have led many governments to announce drastic CO₂ emission reductions. Particularly the European Union (EU) has taken the warnings seriously and committed itself to a 20% reduction by 2020 with respect to the level of 1990. Furthermore, the EU has announced to increase its reduction efforts if other countries will do likewise (Commission of the European Communities 2008). Meanwhile the G8 countries and also the G5 agreed at least in principle to reduction goals of 50% until 2050 and even the US aims at reducing CO₂ emissions by 17% (see declaration of G8 countries from the 10th of July 2009).

Putting these political goals into practice will demand great adjustments of citizens and economies and it will therefore also demand the continuous sup-

port of voters. One goal of environmental sociology is therefore to observe the development of environmental attitudes and the willingness to make behavioral adjustments. In this contribution we will take a look at some developments in Germany and Switzerland during the last 15 years. Germany conducts environmental surveys biannually and thus offers a relatively good data basis for longitudinal observations. Switzerland participated in the International Social Survey Programme (ISSP) in 1993 on environment and repeated the survey in 2000. The ministry of environment conducted another survey in 1997 as the Institute of Sociology at the ETH Zurich did in 2007. Therefore, we have four measurements in Switzerland to assess a trend. We also take a look in both countries at the development of individuals' mobility behavior. Motorized mobility is one area that contributes major quantities of CO₂ emissions. It is also an area that is often subject of public debates. Thus, it's relevance to the climate debate is known to most citizens. Furthermore, the mobility sector is one in which individuals can make behavioral adaptations relatively easily by switching to more fuel efficient vehicles, changing to public transportation or simply by driving less. The mobility sector is also an area for which data on fuel consumption and oil prices are documented comparably reliably. Therefore we can observe trends in mobility related behavior comparably easy for similar time periods as are covered by the surveys. Hence, these trends can be described and compared to each other. Moreover, the trend data allow conducting time series analyses. Such analyses allow us to calculate whether changes of the trends in environmental attitudes are related in any way to behavioral changes. More particularly, we are interested in finding out whether environmental attitudes matter with respect to mobility behavior or if such changes are more likely related to changes in prices. If the latter turns out to be the case, we also provide an estimation of the price elasticity of gasoline.

The remainder of this contribution is organized into three chapters. Chapter two describes the surveys and the measurement of environmental attitudes in Germany and Switzerland. We will investigate whether attitudes have changed during the last decade and compare the trends in the two countries. In the third chapter we take a look at the development of mobility behavior in both countries and compare the trends of changes in environmental attitudes with those in the mobility behavior and related trends. The chapter contains also a time series analysis and estimates of the price elasticity of gasoline. Finally, the last chapter summarizes and concludes our analyses.

2. The Measurement of Environmental Attitudes

Environmental concern is usually defined as the insight that humans endanger the natural environment combined with the willingness to protect nature (Ester/van der Meer 1982; Dunlap/Jones 2002). The definition consists of two components, the cognitive component of having the rational insight and the conative component of being willing to do something about it. In environmental sociology the emotional reaction is also taken into consideration as a third component

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- 1.) If we continue like this, we will have an environmental catastrophe in the future.
 - 2.) I am worried about the environmental living conditions of my children and grandchildren.
 - 3.) I am often upset and angry when I hear about environmental problems in newspapers or see them on TV.
 - 4.) I think politicians are still not doing enough for environmental protection.
 - 5.) I think that many environmentalists exaggerate environmental problems.
 - 6.) In order to protect the environment we should all be willing to constrain our way of living.
 - 7.) There are limits to growth that industrial societies have reached or even crossed.
 - 8.) At the moment it is still true that most people rather harm than protect the environment.
 - 9.) We should protect the environment even when that means that jobs get lost.
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Table 1: The measurement of environmental concern by Preisendörfer (1999).

(Preisendörfer/Franzen 1996). Thus, individuals react in three distinct ways to environmental problems: By having rational insight into the problem, by being willing to act and by being emotionally affected by environmental destruction. Various authors have suggested different items in order to measure individuals' environmental concern in general population surveys and by paying attention to the three components (e.g. Diekmann/Preisendörfer 1992; Preisendörfer 1999; Schahn 2001). For example Preisendörfer (1999) has suggested a scale that consists of nine items (see Table 1).

Usually such a list of items is read to survey participants who then have the option to agree or disagree to the items on a five point scale (strongly agree, agree, partly agree/partly disagree, disagree, strongly disagree). The stronger respondents agree the higher their environmental concerns. Generally, measurement instruments should fulfill three criteria. The measurement should be objective, reliable and valid. The first two criteria are relatively easily tested by comparing the results of different interviewers or different studies or by conducting repeated measurements or statistical tests (such as calculating Cronbach's alpha). Different analyses using this scale have confirmed that it is objective and reliable. Assessing validity is more challenging. However, inspection of the items suggests that their formulation is close to the definition. They also seem to address all three components. Items one, seven and eight relate to the cognitive component. Items two, three, and five address emotional issues. Items four, six and nine relate to the conative component. Therefore, the scale has content validity. Empirical analyses have also shown that members of environmental groups agree more often with the statements. Hence the scale has also external validity. Furthermore measurement scales should be practically. They should not be too long and time consuming to answer and respondents have to be able

to comprehend them easily. Also these criteria are rather well tested with the above scale.

In Germany the ministry of environment is commissioning since 1991 an environmental survey called 'Environmental Concern in Germany'. During the first years (1991 to 1994) the survey was conducted annually and thereafter biannually. From 1991 to 1994 the survey was conducted through telephone interviews (CATI) only in West-Germany. Since 1996 interviews are done face to face in all parts of Germany.¹ Environmental concern was measured from 1996 to 1998 with the nine items shown in Table 1. Unfortunately, the surveys before 1996 do not contain any of the items and offer no comparable measurement. After 1998 some items were deleted from the list in Table 1 and in the newest survey from 2008 the answering scales of the items left were reduced from five to four answer categories.² Thus, in order to construct a trend we are restricted to use the available data between 1996 and 2006. The four items that can be used for the time trend are items number one, two, five, and seven. An explorative factor analysis shows that this subscale is still one-dimensional, and has a reliability coefficient between 0.57 and 0.70 (depending on the year). The correlation between the subscale and the whole scale in 1996 and 1998 is 0.87 and 0.88. Therefore it seems justifiable to use the subscale for measuring general environmental concern. Table 2 displays the proportion of respondents that strongly agree or agree to the four items between 1996 and 2006.

Overall, the survey results indicate that respondents express a relatively high concern for the environment. Almost two thirds of the Germans believe that we are on the edge of an environmental catastrophe or are worried that their children might have to live under difficult environmental conditions. Also items five and seven show high rates of agreement or disagreement. The table also shows that environmental concern has remained rather stable since 1996. Additionally there are only minor differences between the western and eastern part of the country. Finally the last row in Table 2 shows the result if we are not only using the proportion of agreeing but if all item categories are added and standardized between 0 and 100. Hence, also this more detailed measure confirms the reported finding that environmental concern has been basically constant over the last 10 years in Germany.

Next we will take a look at the development in Switzerland. The country did not institutionalize environmental surveys on a regular base. However, some research done at the University of Bern in 1993 and 1997, by the Swiss Foundation of Social Research (FORS) in 2000, and at the ETH Zürich in 2007 still allows constructing a trend. In 1993 the Institute of Sociology in Bern conducted a large random sample based survey with about 3000 participants in all three parts of the country (the German-, French-, and Italian speaking part). The survey was done in cooperation with the International Social Survey Programme (ISSP). The Ministry of Environment commissioned a survey related to environmental issues in 1997 that was supervised by one of the authors. This survey contains

¹ Detailed analysis of the surveys from 1991 to 1998 is contained in Preisendörfer 1999.

² There were several reasons for these changes. On the one side the scientific board of the survey changed and on the other side also the focus of the survey.

Answer categories	1996	1998	2000	2002	2004	2006
1) strongly agree, 2) agree	(N=2163)	(N=1903)	(N=1892)	(N=2214)	(N=2017)	(N=1907)
3) partly agree/partly disagree	W=1027	W=1148	W=1533	W=1650	W=1637	W=1553
4) disagree 5) strongly disagree	E=1136	E=755	E=359	E=564	E=380	E=354
(1) If we continue like this, we will have an environmental catastrophe in the future. (percentage agreement)	66% W: 65% E: 68%	56% W: 56% E: 57%	62% W: 63% E: 60%	55% W: 57% E: 48%	58% W: 58% E: 55%	62% W: 61% E: 67%
(2) I am worried about the environmental living conditions of my children and grandchildren. (percentage agreement)	74% W: 74% E: 72%	65% W: 65% E: 63%	68% W: 70% E: 64%	62% W: 63% E: 61%	66% W: 66% E: 63%	66% W: 66% E: 65%
(5) I think that many environmentalists exaggerate environmental problems. (percentage disagreement)	55% W: 56% E: 44%	47% W: 48% E: 44%	53% W: 54% E: 46%	46% W: 48% E: 40%	46% W: 49% E: 37%	50% W: 53% E: 41%
(7) There are limits to growth that industrial societies have reached or even crossed. (percentage agreement)	57% W: 57% E: 51%	50% W: 50% E: 47%	59% W: 60% E: 57%	56% W: 57% E: 51%	58% W: 60% E: 52%	57% W: 58% E: 57%
Additive index standardized to a range between 0 and 100	68.7 W=68.7 E=68.2	64.3 W=64.4 E=63.5	67.0 W=67.8 E=64.2	63.2 W=65.0 E=61.8	66.4 W=66.3 E=65.1	66.1 W=14.6 E=14.4

Table 2: Environmental concern in Germany.³

³ Own calculations using the survey Environmental Concern in Germany. Numbers denote the proportions of respondents who strongly agreed or agreed to an item for all of Germany (first row), and separated for West-Germany (W) and East-Germany (E).

Response categories:	1993 (N=2303)	1997 (N=1875)	2000 (N=845)	2007 (N=2490)
1) strongly agree, 2) agree, 3) neither agree nor disagree, 4) disagree, 5) strongly disagree.				
(1) Modern science will solve our environmental problems with little change to our way of life. (disagree)	55%	45%	55%	58%
(2) People worry too much about human progress harming the environment. (disagree)	56%	51%	60%	49%
(3) I do what is right for the environment, even when it costs more money or takes more time. (agree)	78%	73%	74%	51%
(4) We worry too much about the future of the environment and not enough about prices and jobs today. (disagree)	54%	44%	56%	44%
(5) And how willing would you be to accept cuts in your standard of living in order to protect the environment? (agree)	69%	66%	60%	68%
Additive index standardized to a range between 0 and 100	64,4	62,4	63,5	63,6

Table 3: Environmental concern in Switzerland.⁴

⁴ Source: Own calculation using the Swiss Environmental Survey 1994 (Diekmann/Franzen 1995); The BUWAL Survey 1997 (Franzen/Wild-Eck 1998); the ISSP 2000 (FORS); and the Swiss Environmental Survey 2007 (Diekmann et al. 2008).

also some items that were part of the ISSP in 1993. In 2000 the ISSP repeated its survey of 1993 with the focus on environment. Finally, the Institute of Sociology at the ETH in Zürich repeated the Swiss Environmental Survey in 2007. We took a close look at the four surveys and identified five items that were used in every survey. The five items stem from the ISSP in 1993 and are included in all four surveys. Table 3 displays the items and the proportion of respondents who strongly agree or agree with them. According to an explorative factor analysis the five items are two dimensional. Factor 1 consists of items 3 and 5, factor 2 of items 1, 2, and 3. Unfortunately the reliability of the scale is also lower than the one of the German counterpart and varies from 0.45 to 0.64 depending on the year. Hence, measurement of environmental concern appears to be less reliable.

However, the results of the surveys in Switzerland are rather similar to those in Germany. There is also a high level of environmental concern in Switzerland. Thus, two thirds of the population report that they would be willing to accept cuts in their standard of living in order to protect the environment. This proportion is as high as it was in 1993. There are some declines in agreement observable in some of the other items that relate to the emotional dimension. However, summing up the item categories and standardizing the resulting scale between 0 and 100 shows that the average environmental concern did also not change in Switzerland since 1993.

Since we had to use different items in both countries the level of concern cannot really be compared. However, a comparison of the 26 countries that participated in the ISSP 1993 and the ISSP 2000 shows that Germany takes a middle rank position next to countries like Great Britain and the USA. In contrast Switzerland belongs to the top ranks together with countries like the Netherlands and Japan (see Franzen/Meyer 2010; Franzen/Vogl 2010). The results of the ISSP surveys show also that there is hardly any significant change in environmental concern in the 26 ISSP countries. Thus, the results we obtained by using reduced scales and observing trends within the countries by using four or six measurements in each country confirm the results obtained by analyzing the ISSP data.

3. The Relation between Environmental Concern and Environmental Behavior

It is a well established finding in environmental sociology that attitudes do not transform directly into behavior. Quite to the contrary research shows that the discrepancy between attitudes and behavior can be large and depends on the cost intensity of the observed behavior. To use a quote by Diekmann/Preisendörfer (2003) "it is a long way from heads to hands". This way is particularly long and winding when it comes to mobility behavior since switching from private cars to public transportation or reducing driving or flying can be costly in terms of comfort. There are two basic reasons for this discrepancy. First, the environment is a classical public good. Individuals can profit from it without incurring the cost of contributing to it. Moreover, much of environmental quality is de-

terminated globally and a single individual has only a very infinitesimal impact. Thus, rational actors have no incentive to contribute to it. The decision situation corresponds to the problem of the Prisoners Dilemma. Theoretical and experimental research with the Prisoners Dilemma has demonstrated that endogenous cooperation is possible due to iteration, sanctions or due to reputation mechanisms (e.g. Axelrod 1984; Fehr/Gintis 2007; Willer 2009). However, such an endogenous cooperation is only possible in dyads or small groups of well-connected individuals. Environmental goods involve typically large numbers of actors and the anonymity induced by it leads often to the erosion of cooperation (Hardin 1968; Franzen 1995).

Second, individuals can utter freely their preferences in surveys without thinking of the immediate costs. The situation resembles asking individuals for their preferred meal, car or way of traveling. Most respondents would probably name the gourmet menu of a 19 Gault Millau point awarded restaurant, a fancy sport car and the first class traveling. However, when confronted with the cost of realizing the behavior it may be rational to choose more realistic options within the available budget. Similarly, participants in surveys may want a clean environment as long as costs are unknown or diffuse. But facing the real costs when it actually comes to making choices might lead to an adaptation of goals. Thus, the discrepancy between expressed preferences, goals and realized actions could also be connected to the missing cost awareness in the survey.

Research in environmental sociology has demonstrated that the discrepancy between attitudes and behavior is not constant but depends on the cost intensity of the behavior. The correlation between pro environmental attitudes and e.g. recycling is generally high whereas it is low with respect to more costly behavior such as mobility decisions. We will demonstrate this by taking a look at some aggregate indicators of mobility behavior in Germany and Switzerland and compare these trends with the development of environmental concern. Figure 1 displays the trend of individual car use in Germany.⁵ From 1991 to 2008 the kilometers driven by car increased from 8888 kilometers per year and per capita to 10605 kilometers. Thus, individual car travel has increased by almost 20% during the last 18 years, despite the fact that public debates on the CO₂ emissions have intensified during the same period, and despite the fact that environmental concern has remained stable from 1996 onwards.

Hence, the trend or more accurately the constant high level of environmental concern had no seemingly impact on individual driving behavior.⁶ However, the impact of driving on the environment is not determined by the amount of kilometers driven but rather by the energy used. We therefore take also a look at the consumption of fuel. This consumption has dropped in Germany from 570 liters per year and capita in 1991 to 533 liters in 2008. Hence we observe a reduction in gas consumption by 6.5%.⁷ However, this more pro-

⁵ We use data provided by the Federal Ministry of Transport, Building and Urban Development (BMVBS 2009) and the Federal Statistical Office of Germany (Federal Statistical Office 2009).

⁶ Since environmental concern is only measured every second year we interpolated the data for missing years. We also have no measurement for 2007 and 2008 and therefore included values obtained from the survey in 2006.

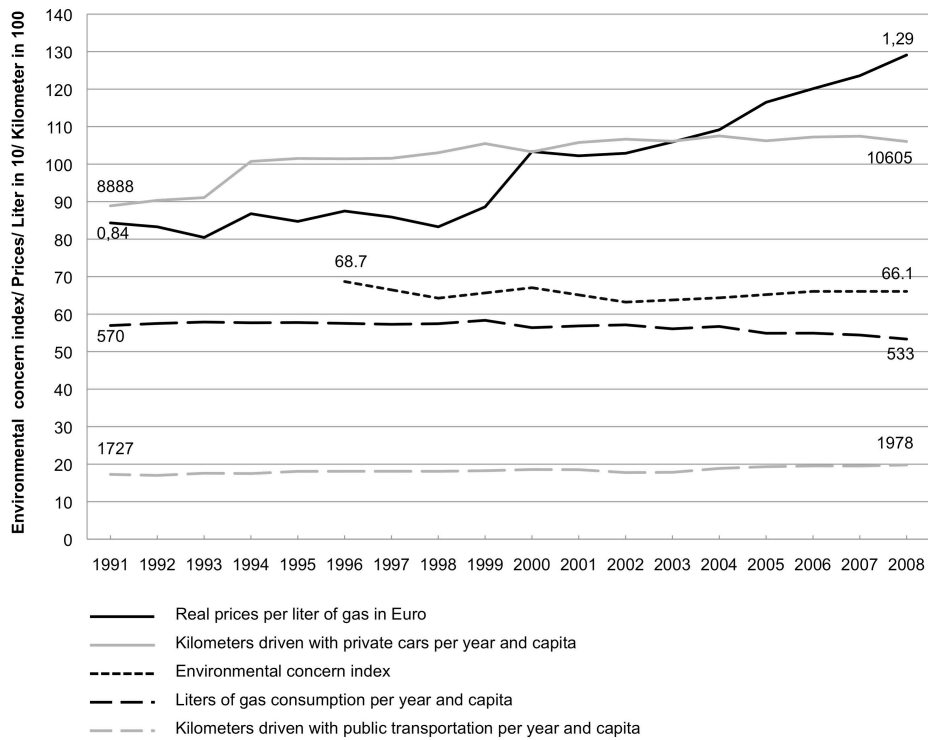


Figure 1: The development of environmental concern, the price of gasoline, and mobility in Germany.

environmental behavior must not be connected to environmental concern but may also be caused by increases in the price of oil. Inflation adjusted prices for gasoline have increased during the same period by 54% (see Figure 1). Therefore, this trend suggests that the reduction in fuel consumption was caused by the increase in price. This assumption is confirmed by a multivariate OLS regression in which we analyze the correlation between the various trends (see Table 4). Our dependent variable is the fuel consumption which might be linked to the trend in environmental concern on the one hand and to the trend of prices on the other hand. We use a simple statistical model by calculating the logarithm of the yearly differences in oil consumption as the dependent variable and the logarithm of the differences in prices as well as the differences in environmental concern as independent variables. The model we estimate can thus be written as

$$\Delta \log(\text{fuel consumption})_t = \beta_0 + \beta_1 \Delta \log(\text{prices})_t + \beta_2 \Delta(\text{environmental concern})_t + u_t$$

⁷ Data for gas consumption and fuel prices are based on calculations by the Federal Ministry of Transport, Building and Urban Development (BMVBS 2009). Prices are corrected for inflation through data from the Federal Statistical Office of Germany 2010.

The results (model 1) indicate that on the one hand prices significantly influence fuel consumption. Since we took the logarithm of prices the coefficient of -0.2 can be interpreted as the price elasticity. Thus, a one per cent increase in the price of fuel has led to a 0.2 per cent reduction in fuel consumption. On the other hand environmental concern is not significantly related to fuel consumption. Model 2 is a slight extension of model 1 by taking the development of Germany's gross domestic product (GDP) as a control into account. However, the trend in GDP is not related to fuel consumption in Germany and estimates between the two models do not differ substantially.

	Model 1	Model 2
Constant	0.002 (0.004)	0.002 (0.004)
Difference of GDP per capita		-0.08 (0.29)
Difference of fuel prices (log)	-0.22* (0.09)	-0.21* (0.09)
Difference of environmental concern	0.001 (0.03)	0.002 (0.004)
F-Test: F(3, 13 DF)	4.48 (p-value: 0.03)	2.81 (p-value: 0.08)
R-squared	0.39	0.39
Adjusted R-squared	0.30	0.25
Durbin-Watson Test	2.84	2.81

* p-value < 0.05, standard error in parentheses

Table 4: The determinants of fuel consumption in Germany.

The estimated coefficient of 0.2 implies that the demand for fuel has low price elasticity. It seems to be difficult for consumers in Germany to react to price increases of oil. In principle consumers have three options. One way of adapting is of course to reduce driving. Another way is to switch to public transportation and the third option is to switch to more fuel efficient vehicles. Obviously option one was not much considered by drivers. Quite to the contrary kilometers driven increased by 20%, as we pointed out. Option two was more popular. The demand for public transportation did increase from 1,727 kilometers per year and capita in 1991 to 1,978 in 2008 which is an increase by 15% (see Figure 1). Furthermore, individuals also switched to more fuel efficient cars and the car industry obviously reacted by offering more efficient models. In general price elasticity depends on the easiness of substituting one mode of transportation by another. Thus, it should be higher the better the infrastructure of public transportation or the better individuals can adjust their living situation (e.g. moving closer to their workplace). It is therefore interesting comparing the price elasticity of oil for different countries. Figure 2 displays the same trends for Switzerland that are displayed in Figure 1 for Germany.⁸

⁸ We use data provided by the Swiss Federal Statistical Office 2010 (stock of cars, driven

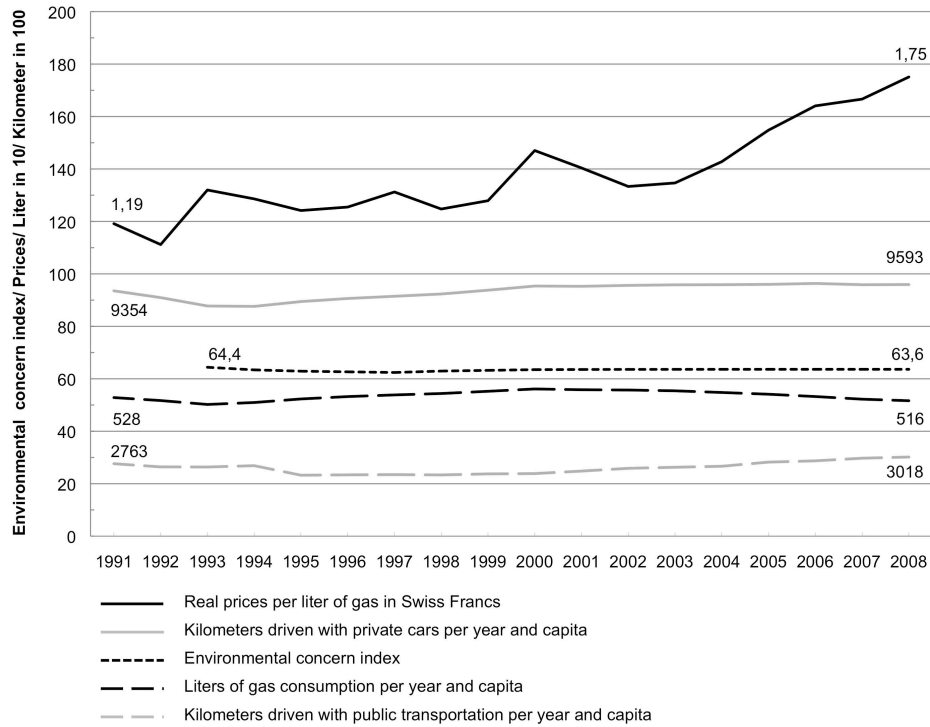


Figure 2: The development of environmental concern, the price of gasoline, and mobility in Switzerland.

As already observed environmental concern remained rather stable also in Switzerland. However, in difference to Germany the kilometers driven per year and capita did not change very much. In 1991 the average driven by cars per capita was 9354 kilometers and it increased to only 9593 by 2008. This is just a relative increase of 2.5%. In contrast public transportation increased from 2763 to 3018 kilometers per capita which amounts to 20%. Fuel consumption decreased from 528 to 516 liter per capita (2.5%). Thus, there are some differences between the mobility behaviors in Germany and Switzerland. The Swiss ride much more trains, trams or other public vehicles than Germans (about one thousand kilometers per capita more). Germans on the other hand drive more by car than the Swiss (also about one thousand kilometers per capita more). Taking public and private transportation together, Swiss and Germans travel on average the same distance per year (12600 kilometers). Plugging all trends into an OLS regression (and taking the logarithm of the differences) shows similar results as do the data for Germany. Also the Swiss data shows a decrease in

kilometers, fuel prices, population, national consumer price index) and the Federal Office for the Environment in Switzerland (average fuel consumption per car per year).

fuel consumption when prices increase. However, in Switzerland the estimated price elasticity is 0.06 and statistically not significant. Prices even have a lower impact on driving than in Germany. However, fuel consumption per capita was already on a low level in Switzerland as compared to Germany and public transportation is already an alternative that is heavily used by the Swiss. Hence the lower elasticity might be due to these ceiling effects.

	Model 1	Model 2
Constant	0.001 (0.004)	-0.001 (0.005)
Difference of GDP per capita		0.14 (0.23)
Difference of fuel prices	-0.06 (0.06)	-0.06 (0.06)
Difference of environmental concern	-0.01 (0.01)	-0.01 (0.01)
F-Test: F(3, 13 DF)	0.95 (p-value: 0.41)	0.72 (p-value: 0.56)
R-squared	0.12	0.14
Adjusted R-squared	-0.01	-0.06
Durbin-Watson Test	0.58	0.61

* p-value < 0.05, standard error in parentheses

Table 5: The determinants of the gasoline consumption in Switzerland.

4. Summary

This contribution is concerned with the question of how inhabitants in Germany and Switzerland react to the ongoing environmental debate. For Germany the trend in environmental concern was measured by using the survey Environmental Concern in Germany which collects data biannually via random sampling. For Switzerland we used data from different surveys, the ISSP 1993 and 2000, a survey which was conducted by the Ministry of Environment in 1997 and the Swiss Environmental Survey conducted by the ETH Zurich in 2007. The results from both neighboring countries are very similar. Comparison of the ISSP results suggests that concern is somewhat higher in Switzerland and that Germany takes a middle position. However, both countries did not experience any substantial change in environmental concern during the last 10 (German data) or 15 years (Swiss data), which is a surprising result. Despite the ongoing debate and media coverage of many environmental issues the pool of people who are concerned about the future condition of the environment seems to be exhausted in both countries.

We compared the trend in environmental attitudes with trends of mobility behavior. The data shows that Germans drive about one thousand kilometers more than the Swiss. The latter make much more (also one thousand kilome-

ters) use of public transportation. Taking the kilometers driven in private cars and public transportation together citizens of both countries cover on average the same distance per capita and year (12600 kilometers). Fuel prices have increased in both countries substantially by about 50% in real terms. In Germany this price increase did not lead to a reduction in kilometers driven by cars but it led to a reduction in fuel consumed per capita by 6.5%. However, the price elasticity is low (0.2). In Switzerland the higher prices did not lead to a statistically significant reduction in fuel consumption. However, the Swiss increased using public transportation by 20% whereas there was only a negligible increase in kilometers driven by car (2.5%). If the EU aims at reducing CO₂ emissions by 20% until 2020 and if they stick to the political decision that these reductions should be proportional in every area of consumption (private households, industry, and transportation) then our data suggests that fuel prices have to increase by 100% over the next 10 years. This conclusion applies to Germany and only under the *ceteris paribus* condition that all other circumstances remain unchanged. This probably implies that supply in public transportation must at the same time increase since capacity (and comfort) per traveler will reduce as more people switch to it. For Switzerland our results suggest that prices have not done much yet. This might change if prices continue to increase. It would probably help consumers to find substitutes to car driving if price increases are announced well in advance.

Note that we are not suggesting that taxing oil and other fossil fuels is the only or most efficient policy to reduce CO₂. We are just saying that the price mechanism works also with respect to mobility behavior. This is often denied by many participants of the climate debate. Most economists favor the disbursement and trade of CO₂ certificates (e.g. Böhringer 2010). However, both, certificates (that would have to be acquired by the oil industry) as well as taxes lead to price increases which will then encourage the change of consumers' behavior. Thus, both policies work by the same mechanism. Certificates though have the advantage that they treat all CO₂ emission the same way whereas taxing means to put separate taxes on all sources of CO₂. Certificates have also the advantage to cap the exact amount of CO₂ that should be allowed to enter the atmosphere while taxing does not limit CO₂ emissions explicitly but can reach a specific reduction goal by trial and error. Furthermore, a market for CO₂ certificates would allow cutting emissions where this is cost efficient. Therefore, we believe it would be best to include the mobility sector into the European Union Emission Trading System (EU ETS). It is then up to the market to decide where CO₂ reductions take place and whether the mobility sector's share will be 20% or something else.

Note also, that we are not suggesting that any country nor the EU should act on its own. An effective global reduction of CO₂ can only be accomplished if the price for fossil fuels increases globally. If Germany or the EU would be the only country or region that increases the price for oil (e.g. by CO₂ certificates) their reduced demand for oil could decrease prices globally so that other countries can afford more and compensate the reduction. Moreover, unilateral application of emission control could increase imports from other countries and could lead

to crowding out or displacement of domestic industries which would counteract CO₂ reductions. However, the EU could (and should) act as an example hoping that other countries will follow voluntarily within useful time. If they don't at least the EU and other cooperating nations could impose a carbon tax on imports from nations unwilling to be part of a coalition for avoiding the climate collapse.

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