

Pricing greenhouse gas emissions in the German traffic sector

I. Introduction

The world has committed itself in the Paris Climate Agreement to reducing the average temperature increase to 2°C compared to the pre-industrial age. However only few countries have taken decisive action until now. Many countries did even not elaborate concrete plans for combatting climate change in the different most polluting sectors of their countries.

Germany is one of these countries since its effort has stalled in recent years so that it will not be able to hold on to the promises given for 2020 to the fellow partners. Especially when it comes to the key sectors of the German economy, sectors to which Germany are emotionally attached and which assure a high number of jobs, the German government and the German people are more hesitating to make important reforms. One of these sectors is the traffic sector, actions against which would hurt the car industry.

The German government minister responsible for traffic and digital infrastructure has so far not presented a plan on how to reduce CO₂ – emissions in the traffic sector, while other ministries presented solutions to reduce greenhouse gas emissions in the sectors they are responsible for (The ministry for environment for example recently presented so the abolishment of coal power plants until 2038).

As a consequence of this lack of ideas and clear problem description, this paper wants to make a contribution to the debate of how to best decrease CO₂- emissions in German traffic by first describing the problem, which includes at looking which progress has been made since 1990 using the data of the Umweltbundesamt of the German government. Afterwards this paper will explore the technical advance car makers made concerning CO₂-emissions in recent years by comparing current car models with previous generation. As a last step of the problem description, the paper will include the development of the number of newly licensed cars in the Federal Republic of Germany since 1960 and comparing it to the development of the population since the same year. The necessary data were provided by Statista and the Bundeszentrale für politische Bildung.

To find a solution, this paper will propose a tax which is measured according to the CO₂-emission of the car possessed and disposable income and as a second solution a Chit-System, which would link the prices of cars to the prices of cars to an amount of greenhouse gas emissions previously defined which can be sustainably emitted. To discuss both solutions concerning their acceptability for the German public, there will be a detailed analysis of data acquired by a German wide survey on the willingness to pay for climate change.

II. Description of the problem

Figure 1 shows the development of CO₂- emissions in million tons from 1990 to 2016 calculated by the Umweltbundesamt, a German government agency. While in 1990 the traffic sector was responsible for 163 million tons of CO₂- emissions this amount grew to 166 million tons in 2016 according to Estimations of the same agency. That means that CO₂- emissions caused by the traffic sector did not decrease in the last 30 years, but that there was a contradicting development. Although emissions have been higher in 2000, the emissions seem to stagnate at approximately between 160 million tons and 170 million tons and even increased slightly since 2010.

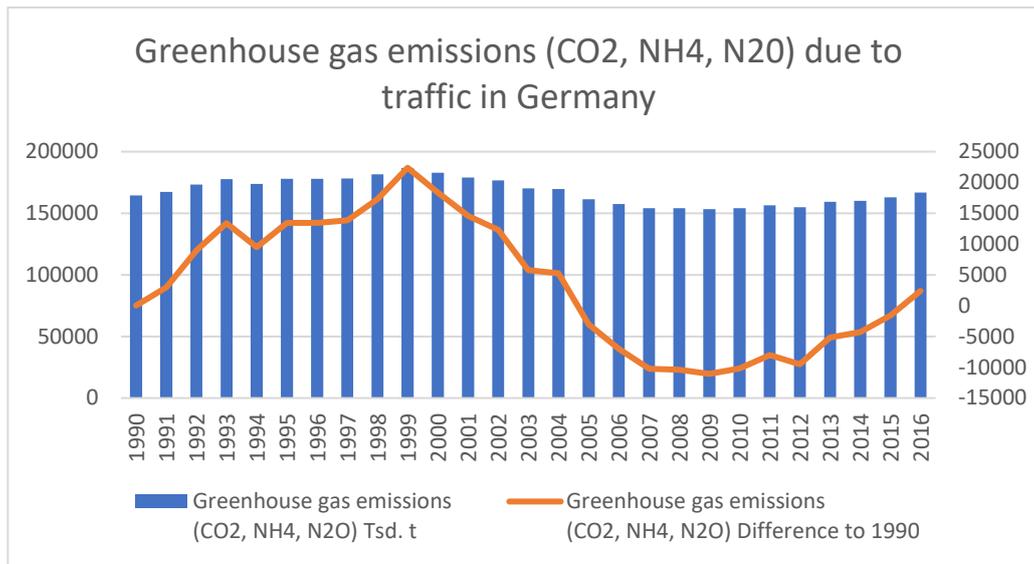


Figure 1 Greenhouse gas emissions, source: Umweltbundesamt

Consequently, it must be assumed, that there was no policy or at least no successful policy in the traffic sector to reduce emissions of CO₂ in Germany even in 2016, the year the Paris climate accord was signed. On the contrary, the recent scandal of betrayal concerning Diesel cars, might even have a counterproductive effect on CO₂-emissions in Germany. While NO_x may be harmful for health if concentrated too much, Diesel cars emit far less CO₂ than cars, which use petrol driven or electric cars, taking into consideration the current energy production, which despite the agreement that coal power plants shall not be used any more from 2038, heavily relies on the latter.

However, to properly analyse the problem, those who are responsible for CO₂ emissions within the traffic sector have to be identified to find solutions for the problem. That is why Figure 2 shows the repartition of CO₂ - emissions in the traffic sector for different means of transportation.

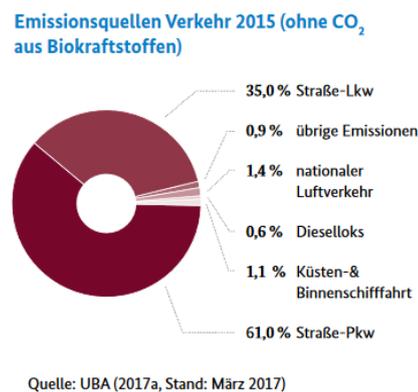


Figure 2 Source of emissions in the traffic sector source: Umweltbundesamt, online: <https://kurzlinks.de/sxc1>

Surprisingly, air traffic only counts for 1,4 % of the emissions in the traffic sector, even though kerosene is not taxed in Germany. The low part of emissions of air traffic might partly be due to the fact that the Umweltbundesamt, which created the statistics only counted “national” air traffic, which means that planes, which land in Germany coming from Barcelona for example are not included in the data, but only those flights who arrive at a German airport coming from a German airport.

Nevertheless, the – by far - two greatest causes for CO₂- emissions are trucks and cars on German streets, underlining the fact that Germany is not only a nation of car producers, but also a nation of car drivers. The most astonishing fact about the statistic is probably that it is not even cars transporting goods for the German economy, but cars transporting persons, which account for two thirds of the CO₂- emissions in the traffic sector. Especially if one takes into

consideration that the production of cars causes also greenhouse gas emissions, the devastating effects of the use of cars for the environment becomes clear.

Figure 1 and Figure 2 therefore underlined the fact, that there is a lot of work to do to reduce greenhouse gas emissions within the traffic sector and that the problem does not consist primarily of reducing commercially related transport of goods. Taking into consideration that according to research of the Manager Magazine 50% of the newly licensed cars in Germany are purchased by private customers and the other 50% by companies for their workers, it also becomes clear that private and commercial car use within Germany must be reduced in order to seriously combat the problem and reducing emissions in the traffic sector.¹ Therefore a solution must include offering alternatives for car use for commercial and private users.

Even though, many politicians and scientists argue that instead of reducing the number of cars, technical advance has to ensure that CO₂- emissions are reduced so that the individual consumer, whose opinion we will discuss later, does not suffer from the measures taken for climate change. However, Figure 3 shows that in the last 20 to 30 years, in which the development of CO₂- emissions in the traffic sector was regarded, the CO₂ emission of the different middle class cars produced by German car makers already reduced significantly, which means that the emissions were either reduced by a half or one third of the initial emissions which is why one would therefore suspect that emissions as a whole significantly reduced in the last 20 to 30 years due to technical advance.

Car	CO ₂ emission past in gr/km	CO ₂ emission present in gr/km	Difference in gr/km
Audi A 4	223 ² (year: 1996)	120 - 113 (year: 2019)	103
Mercedes C -Klasse	262 (year: 2001)	113 - 107 (year: 2019)	149

Figure 3 Comparison of CO₂ emissions in the past and present for two models

Of course, this astonishing advance gives reason for hope that greenhouse gas emissions will reduce significantly also in the years to come and that therefore the solution for Germany's traffic problem consists of waiting for technical advance. However, the current debates about a change in technology lets suspect that the scope for scientific progress in the years to come will be limited concerning Diesel and petrol cars. The industry is sceptical about being able to quickly change to production of electric or hydrogen cars. And, one shall not forget that the CO₂-emissions for present cars concerns those cars, which are newly released by car makers. The average German car is used up to 9 to 10 years³, meaning that it will probably be too late for saving the climate when consumers decide to buy new and more environmentally friendly cars.

Most importantly CO₂- emissions per car presented in Figure 3 contradict the trend described in Figure 1, that greenhouse gas emission increased globally since 1990. If the CO₂-emissions per car decreases, but overall greenhouse gas emissions in the traffic sector stagnate also due to cars, German consumers must simply purchase to many cars, which is presented in Figure 5. The diagram clearly shows that since 1990 there were two periods in which the number of newly licensed cars increased: The first period starting even before 1990 but being especially

¹ Winzen, Ulrich (2016): "Wie Autobauer and der Statistik drehen und Kunden an günstige Neuwagen kommen" Manager Magazin, Online: <https://kurzelinks.de/fzpo> (last access: 30/04/2019)

² Sources for all data on emissions of specific cars can be found in the Excel Document to make the text more accessible

³ Kraftfahrtbundesamt (2019): "Zahlen zum 1. Januar im Überblick" Online: <https://kurzelinks.de/2zgo> (last access: 12/05/2019)

accelerated during the 1990s, which ends with the economic crisis in 2008. The second period is characterised by weaker but also constant growth and started just after the little pause in 2008 and continues until today. The data suggest that the only event reducing the number of cars was the economic crisis. That is why car purchases seem to be a sign of welfare in Germany but not necessary goods because during crisis cars are among the first products which are not bought any more. This analysis is also supported by the data before 1990 because especially the 1960s are the time of the so-called Wirtschaftswunder which caused welfare for the different strata of German society.

In order to make sure that the extreme increase in car purchases is not due to population growth, the diagram also includes a graph showing the development of the population, which stagnates approximately since 1995 and can therefore explain at best for the enormous increase before the 90s but not since then.

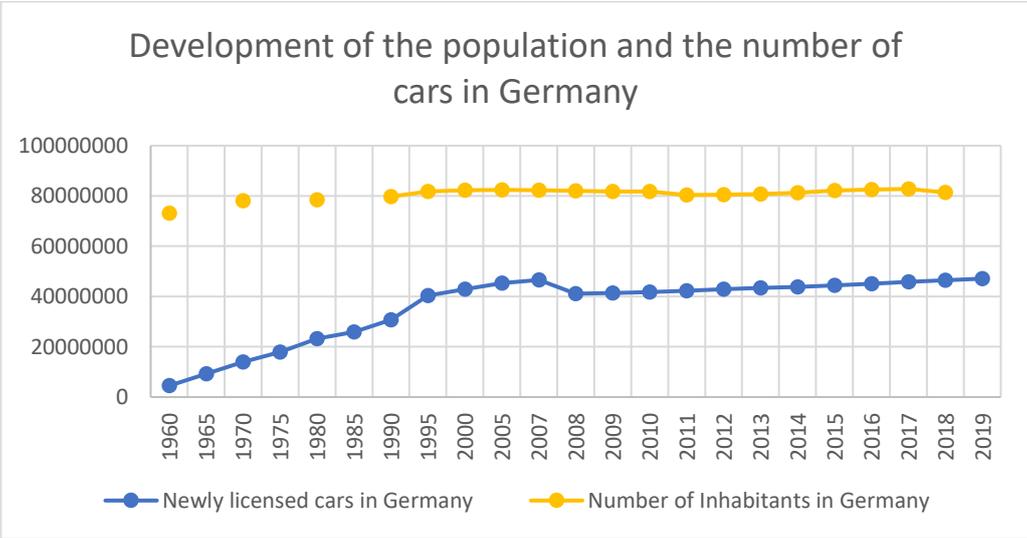


Figure 4 Development of the population and the number of cars in Germany, source: Statista, Kraftfahrtbundesamt, BPB

That is why the data underline the fact that since the 1960s, where approximately a seventh of the German population and therefore a minority possessed a car, the share of car owner grew to more than a half in 2018. Consequently, not only the number of cars in Germany has increased but also the number of cars per person. Especially taking into consideration that the data presented includes also people who are not allowed to drive cars, which means below 18, the ratio of cars per person may even be higher.

The issue presented constitutes a serious challenge for the German policy as well as for German economy. At first, as argued before the increased number of cars constitute a threat to the German government’s declared aim to reduce greenhouse gas emissions in order to combat climate change in the next years. Technical advance was only insufficiently able to limit the consequences of the increased desire of Germans to buy and drive cars in the last years, should the trend continue as before, the goals set in the Paris Climate Agreement will be unachievable.

Apart from putting human survival at risk on the long term, increasing greenhouse gas emissions or those, which stagnate at such as high level will have two eminent and more short-term consequences for German politics.

On the one hand, there will be further public unrest, especially among the young generation within Germany. The Fridays for Future demonstrations have shown that a youth, which was

believed to be apolitical, is determined to defend its interest which is to reduce the effects of climate change the best possible. Especially the current rhetoric during these demonstrations, which clearly is aimed at accusing “adults” of doing nothing or not acting determined enough to encounter this challenge is the possible start of a generation conflict between old and young, putting peaceful social coexistence at risk. Of course, the paper does not argue that solving the traffic problem within Germany will mean entirely solving the problem of climate change; however, weakening the believed almighty car industry in Germany would be an important sign to the German and European youth, that their concerns are taken seriously.

On the other hand, too high greenhouse gas emissions will potentially charge the German budget with costs that could be avoided. The European Union requires it states to purchase certificates from one another in the case that one country has higher greenhouse gas emissions than agreed. According to a scenario developed by the Federal Ministry of Finance which suggests that there will only be little progress on combatting climate change, the costs will amount up to 5 to 30 billion Euro so that the purchase of the certificates would require 8% of the total spending in the German federal budget.⁴ These expenditures could be invested in different future oriented projects, especially given that economists such as DIW-President Marcel Fratzscher regularly diagnose an investment deficit in Germany.

Finally, action by the government could help the car industry instead of weakening it. Many European countries such as France and Great Britain have announced to only allow CO₂-neutral cars to drive on their streets in the near future. At the moment the German car industry did not find appropriate answers to this development. If there would be more strict regulations on the home market, the industry would be forced to increased spending in research to produce the cars of the future with the technologies of the future.

That is why the German government has various economic, social and fiscal reasons to act against the trend that German consumers buy so many and especially so many CO₂ emitting cars. The next two parts will make one proposal each on which action exactly the German government should take in order to make sure that greenhouse gas emissions are reduced effectively.

III. Solution One: A Chit system

Comparing the growth of car purchases in Germany, revealing that prizes seem to be more than acceptable for consumers, to the effects this car growth has on the environment, there seems to be a serious disproportion, because too many consumers buy cars than would be environmentally sustainable. That is why car purchases in Germany are a classic case of an externality, which means that the private marginal costs are lower than the public marginal costs. Private marginal costs are lower than public marginal costs because the price for environmental pollution caused by the production of the cars and the use of the cars are not internalised by the market, because greenhouse gas emissions at least for car owners have no price in Germany. That means practically that – at the moment – the public gives the consequences of the greenhouse gas emissions as a present to car drivers. However, because of the devastating consequences of climate change for the whole world the general public is not any more able to free car drivers from the costs. That is why, in order to make private marginal costs equal public marginal costs again (to return to an economic vocabulary), the

⁴ Schlandt, Jakob and Zarembo, Nora Marie (2018): “Klimapolitik wird zum Milliardenrisiko für Bundeshaushalt“ Tagespiegel. Online: <https://kurzelinks.de/fx4s> (last access: 23/04/2019)

costs of greenhouse gas emissions must be internalised by the market. Such an act requires some form of state interference in the market.

The idea is based on the Chit-system Joseph Stiglitz proposed for discouraging trade surpluses between EU-countries.⁵ He argues for the implementation of trading chits in Greece. A country wanting to import goods to Greece would have to pay the average tariffs and in addition to that a certain number of trading chits. The price of the trading chits, which themselves are traded on a free market, depends on the number of chits available which again is dependent on the value of the Greek exports to other countries. In the example Stiglitz stated that by using these chits Greece could avoid deficits because the government decides on the number of chits on the market and can therefore influence their price.

Parallely to the system Stiglitz proposed for Greece, the German car-owner would have to buy a certain number of chits every two years depending on the kilometres the person wants to drive in the next two years and on the emission class of the respective car. Since the number of chits available on the market would be reduced to the amount, which would be in accordance with the goals of the German government concerning climate change, the chits would become more expensive the more people would be interested. For the German government this chit system would be the easiest way to control greenhouse gas emissions in the traffic sector.

However, the chit system would also mean that the people directly would have to pay for climate change and the money would not be taken from existing government revenue. In a survey published by Leibniz Institut für Sozialwissenschaften a majority of Germans spoke out against paying for climate change.

Even if the confidence intervals are calculated in order to respect a certain effect of insecurity which is due to the fact that not every single German citizen was questioned but just a small number, the result remains clear. It gives the range between which the result of such a referendum would be with a security of 95%. The lower bound of the confidence interval of the people answering that they would not be willing to pay is superior to the upper bound of those indicating that they would be willing to pay (Figure 5). Therefore, it is possible to predict that in a referendum a majority of Germans will speak out against such a referendum

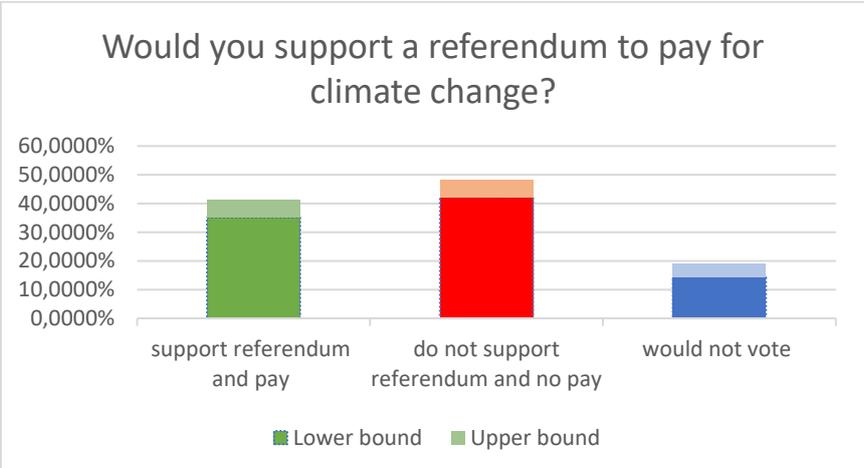


Figure 5 Willingness to pay for climate change, Source: Leibniz Institut für Sozialwissenschaften

⁵ Stiglitz, Joseph E. (2016): “The Euro and its treat to the future of the European Union”, Penguin Books

However, when analysing the data, two major elements have to be taken into account: Firstly, the survey institute questioned a disproportionately great part of Eastern Germans, which are - as elections results of the last election for the Bundestag show - more sceptical about parties defending interests of the environment, which is why the people who might be in favour to pay for climate change is lower than it would normally be in Germany. Apart from that the population in Eastern Germany also suffers disproportionately from poverty as a recent study found, which is why the outlook to have additional expenses for climate change might cause existential fears.⁶

Secondly, the interviews for the survey started in the 1980s, that is long before climate change was publicly discussed and became a major issue of politics. That is why the people interviewed in the 1980s might have not been aware of the effects climate change might have or thought that back then it was not time to take such drastic action. Taking these variables into account the public opinion might be more favourable to paying for climate change. However, it is unlikely that Germans would be enthusiastic about more expenditures especially because Germany has the second largest tax burden in the OECD.⁷

That is why on the one hand, the measure proposed here should go hand in hand with tax decreases in sectors which do not affect the environment. On the other hand, it also reveals the great strength of the proposal: A surplus drawn from selling chits can easily be retraced by media and monitored by the public in order to make sure that the government reinvests the money in substitute goods for cars.

Because of that the revenue made with the chit-system could be used to reduce the prices of train tickets. That is juristically possible because the Deutsche Bahn is still a state-owned and -financed company. Reducing ticket prices would mean that the state does not keep the money but directly gives it back to the people. The government would only decide to favour environmentally friendly behaviour.

This solution will mostly help inhabitants of cities and regions in which public transport is well developed. Especially families only having a low household income will be able to travel more often. Nevertheless, it must not be forgotten that the Public Transport network in Germany is not equally developed in the different regions. That is why people living on the countryside would have to pay an unsustainably high price for climate change protection and may be deprived of the chance to participate sufficiently in social life. However, the German Constitution demands equal conditions of life in all regions for all citizens.

To encounter this problem, the sale of the chits could be organised on state level in Germany. The federal government would then distribute the number of chits available to the different states according to variables such as the population and the quality of public transport so that states, in which public transport cannot yet function as a substitute good for cars get more chits and citizens living on the countryside can therefore purchase chits more cheaply than citizens living in regions where there is a qualitatively good public transport. As a consequence of that, by selling chits on state-level one can keep the effectiveness of the

⁶ Diekmann, Florian (2019): "Wo der Wohlstand wohnt", Spiegel Online, Online: <https://kurzelinks.de/8srl> (last access: 15/05/2019)

⁷ Eckert, Daniel (2019): "Deutsche Steuerlast gehört zur 'Weltspitze' – doch die Infrastruktur verfällt" Online: <https://kurzelinks.de/snx1> (last access: 12/05/2019)

measure while at the same times making sure that all people still are mobile and therefore can to a sufficient degree participate in social life.

At last attention has to be drawn to the fact that car drivers themselves have to buy the Chits instead of the costs being paid with buying petrol for example which at first seems to be the more practicable solution. However, if people are forced to buy the Chits themselves, they see exactly how much of their revenue vanishes for driving polluting cars. Consequently, they have to consciously decide to pay the money while having other decision possibilities, which make the burden to buy a higher number of these chits higher. That is why the measure does not only internalise the costs of greenhouse gas emissions but also has a psychological effect. To make sure that car drivers only drive as far as they are allowed by the number of their chits, the TÜV would compare the driven kilometres in the last two years to the allowed kilometres on the certificate. Without TÜV approval no German car is allowed to drive making it impossible for any car driver to circumvent the measure without committing a crime.

IV. Solution Two: Taxing – but in the right way

The great disadvantage of the measure presented above is that it does only take to an unsatisfying degree social inequality into account and that it adds to the high tax burden from which German citizens suffer anyway. These concerns were also expressed in terms of protests in the survey on the willingness to pay for climate change used above. Figure 7 shows the 7 most frequent protests advanced against climate change. Among those are that money for protection from climate change shall be taken from existing government revenue (Protest 10) and that some people cannot afford additional expenditures (Protest 1).

In addition to that there is a $-0,93$ correlation between disposable household income and the frequency of raising Protest 1, showing that the greater income is, the more probable it is that Protest 1 will be raised. As $-0,93$ is close to -1 the correlation is extremely significant. Although there were too few people in the class with higher income to make the decisions of these classes statistically significant, the general tendency remains the same. That is why this analysis underlines the importance of social inequality when finding measures to fight climate change

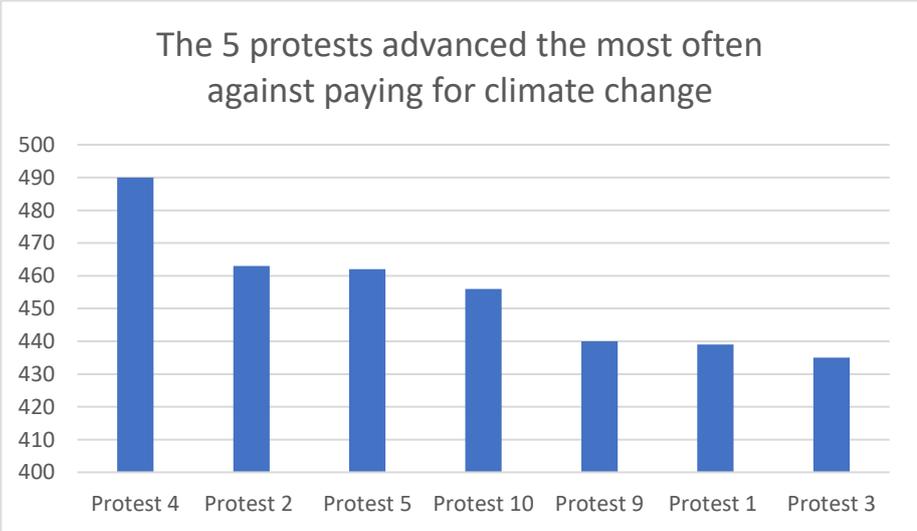


Figure 6 The five protests the most often advanced against climate change, Source: Leibniz Institut für Sozialwissenschaften

To encounter these protests the second proposal is to use an already existing tax to achieve a change in behaviour towards more environmentally friendly mobility. Since German reunification, Germans pay the so-called “Solidaritätszuschlag” (*Soli*) which is meant to achieve economic cohesion between East and West. Currently it is measured according to income tax. In order to make sure that it will achieve a reduction of environmental pollution in the car sector the main referential for its measure shall be the emission class of the car.

While that would not increase the tax burden in Germany and therefore could be a compromise for protest 10, the new *Soli* would still be regressive tax because mostly poorer households have older cars, which are more polluting than newer ones. That is why there shall be a second variable to measure the new *Soli* being the income of the respective persons owning the car. In this scenario the emission class of the car would make up 60% of the tax and the income 40% to make sure that the tax punishes behaviour defavourable for the environment. At the same time the effect on poorer households which are just not able to buy a new car is reduced.

In addition to that the revenue made with tax could be paid to households which want to act environmentally more friendly by buying a new (hydrogen) car, by renovating their apartment or by purchasing a solar system and earn less than median income. As a consequence of that the tax would not only punish but also serve as an incentive to behave more environmentally friendly taking into the limits of such behaviour due to social inequality.

Still, the protest advanced the most often against paying for climate change remains: “It does not help if Germany reduced its emissions if not all/other countries do” (Protest 4) remains. Of course, it is impossible for the German government to force other nations to adopt an environmentally friendly behaviour. Nevertheless, it is imaginable that on the long term such a tax could be levied not by a national German government but by the European Commission. That would make sure that German citizens do not have the impression that only they had to pay for climate change.

Furthermore, industries which heavily rely on transport within Germany would not be disadvantaged in comparison to other industries in other countries competing on the European single market. Especially in Germany where many of the goods are produced for export also by the so-called “hidden champions” these transport costs within Germany are important. Nevertheless, the current discussions within the European Union and the divide between Northern and Southern countries especially on fiscal policies and integration reflects that hopes for a European tax seem to be utopic

On the other hand, the protest which was the third most often advanced against making private people pay for climate change was that “The industry is doing far too little to protect the climate” (Protest 5) and that it is not fair that the costs of climate protection is to be borne on the households (Protest 2), which are quite similar because if the costs for protection against climate change are not to be borne by the households the industry must pay the bill. Currently the *Soli* must also be paid by partnerships because these companies also must pay income taxes as ordinary private people so that a part of the industry already is concerned by the measure.

On the other hand, taxing companies is counterproductive because the money these companies must pay will not be available for “green” innovation. That is why both citizens and the companies will profit more if the latter agree with the German government on an

investment target concerning Green investments which shall be controlled. This proposal does not reduce the responsibility of the companies but honours at the same time the progressive role they can take.

V. Conclusion

This paper did not aim at providing a general solution for climate change in Germany but focused on one specific sector of the German economy. Nevertheless, both solutions presented are transferable to other externalities. The number and length of flights for example could be taken into consideration for the measure of the new *Soli* as could other behaviour and variables.

Nevertheless, the traffic sector seems to be the one where the most action is needed from the part of the industry as well as from consumers. The car industry is a symbol of the German economy in the world but also for Germans. As a consequence of that, to attain real change concerning action for climate change, not only taxes are necessary, but also a paradigm shift in the way people think of mobility. The two solutions proposed here are the first steps, they describe the opportunities of the government to initiate this paradigm shift.

In an interview with the German economic journalist Gabor Steingart the German responsible for Uber argued that we had to newly think the concept of mobility.⁸ In the interest of his company he argued that private transport has to be overcome. In the important cities such as Munich or Berlin that might be possible, on the countryside or even in smaller cities it is not because there is a lack of public transport and private alternatives to one's own car. That is why this paper directly proposed reinvestments in the sense of a more just and a more sustainable mobility which makes it possible that also people in defavourable conditions can make their contribution to climate change without being in danger to lose the possibility to participate in public life.

And the third ambition of this paper was to propose solution which are in accordance with basic principles of market economy. The underlying believe of this paper is that environmental costs are not yet internalised by the market because the variable did not appear economic measure so far. That is why state measures aiming at internalising all costs are a means of strengthening the principles of market economy without contradicting economic freedom of the particular citizen.

In sum both solutions meet the criteria of these three challenges. However, and that was also emphasised in the main part of this paper, the second solution using a tax to reduce the greenhouse gas emissions gives more room for manoeuvre to the government especially regarding social inequality. Nevertheless, it has to be assured that in some way the money finds its way back to the people and therefore is not an additional state revenue but only a means of internalising the costs of greenhouse gas emissions. That requires trust from the German population, which must be built up.

That is why the most important conclusions that can be drawn from this paper are that to achieve a paradigm shift concerning thinking about climate change the state can initiate certain behaviour but in the end, there will have to be an entirely new way to thinking economy in a more ecologically sustainable way.

⁸ Steingart, Gabor (2019): "Der dritte deutsche Staat", Online: <https://kurzelinks.de/drf5> (last access: 15/05/2019)

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