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Environmental policy and the European automotive industry

Abstract

This paper deals with a global public badly and evaluates environmental policy options in order to internalize externalities. With a focus on the Commission's proposal on reducing CO_2 emissions from passenger cars, regulation will distort competition and constrain consumer sovereignty. Public Choice considerations are taken into account to identify additional problems. The authors come to the result that a demand side approach is highly recommendable. Two important lessons can be derived from our discussion. First, market based instruments applied on the demand side (taxes or certificates) seem to be optimal to tackle the problem of CO_2 emissions generated by private transportation. Second, different voting rules applied on different environmental instruments may distort political decisions towards the direction of non-market based instruments.

Keywords: emission reduction, private transport, environmental regulation, European policy, sustainability, individual preferences.
JEL Classification: O32, Q58, R41.

Introduction

Based on the assumption of citizens maximizing personal utility an externality arises when private marginal costs for the use of fossil fuels are smaller than social marginal costs. This argument also holds for private transportation as long as the costs related to climate change (because of the CO_2 emissions related to the use of fossil fuels) are not completely integrated into the fuel prices. Since climate change has global impacts, the individual decision to use fossil fuels can generate global damages. As described the problem holds for all citizens who consume the non-renewable energy source generating externalities a social dilemma is present. Following IPCC (2007) and Stern (2007), we treat climate change as a global public bad. Private transport (due to the fact that the use of fossil fuels has a positive impact on CO_2 concentration in the atmosphere) contributes to this global public bad.

This paper aims to derive a solution for the policy proposed by the EU to regulate the automotive industry by combining the *sustainability* approach with two normative criteria, *consumer sovereignty*, on the one hand, and a *high degree of competition*, on the other hand. As these two criteria seem to have played a minor role when developing the directive for the automotive sector, the outcome's result may be *miserable*, and a certain *degree of disorder* is possible[1]. The paper is structured as follows. Section 1 starts by explaining the rationality behind delegating global environmental problems to the responsibility of the European Union. In a proceeding step we look at the rules applied on environmental policy in order to be able to understand the decisionmaking process. The directive coming from the European commission intended to regulate the automotive industry is discussed in a next step. In Section 2 we define three criteria which we consider minimum requirements for the policy measure aimed to solve the problem in question. In Section 3 the supply and demand for automotives is analyzed with a focus on specialization patterns of automotive manufacturers. In order to evaluate the impact of the Commission's proposal on consumer preferences environmental aspects are taken into account. In Section 4 we try to find the optimal policy instrument that is able to internalize the externalities generated by private transport. We come to the result that market based instruments, namely certificates or a Pigouvian-tax, seem to be adequate. As both instruments can be applied on the supply and demand side, we also take public choice considerations into account. In a next step international problems are evaluated. The last Section concludes.

1. Environmental policy in the European Union

1.1. Decision-making on the European level. Environmental policy is a political topic, which increasingly receives political attention and is, therefore, imbedded on the political agenda of policymakers. Especially environmental initiatives from the European Commission have increased a development which began with the signature of the Treaty of Maastricht (Lévêque, 1996a, p. 9). One reason for this can be found in the rules implemented by the Treaty (as mentioned in footnote 1). It is foreseen that in the case of environmental regulation qualified majority has to be applied to ratify a proposal coming from the European Commission.

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[1] The line of argumentation is based on the voting procedures that influence decision making at the European level until today. Under the Treaty of Lisbon a reform of the voting procedures is foreseen. However, the new voting procedure does not enter into force before 2014 and therefore the problems discussed in the paper so far have been still political relevance.

Two major exceptions limit the power of the European regulating "fabric of environmental regulation" (Lévêque, 1996a, p. 9). On the one hand, the principle of subsidiary[1] and, on the other hand, article 130 of the Maastricht Treaty. The following three cases define exceptions with respect to the qualified majority:

- Provisions primarily of fiscal nature.
- Measures concerning town and country planning, land use and management of water resources.
- Measures significantly affect a member state's choice between different energy sources and the general structure of its general supply.

In the case the European Commission requests a proposal concerning market based instruments, e.g. harmonization of the carbon tax, unanimity rule is applied and decisionmaking requires the agreement of *all members* of the community. For regulations which are neither limited due to the principle of subsidiary nor part of one of these three categories, the decision is done with a *qualified majority*. Thus, the European Commission has certain power with respect to industrial regulation targeting environmental policy. All directives from the European Commission can enter the national level, if the European Council decides with a *qualified majority*. On the national level the legal political process has to be used to transform the directive into national law (Lévêque, 1996b). These considerations have to be taken into account when evaluating the Commission's proposal on regulation of the automotive industry.

1.2. European regulation on the automotive industry. The European Commission established a framework to improve fuel efficiency in order to reduce CO_2 emission from passenger cars by environmental regulation (COM, 2007a). The framework builds upon three main pillars:

1. *Voluntary commitments of the Automobile Manufacturers Association.* A cornerstone of this strategy is the voluntary commitment of the associations of European (ACEA), Japanese (JAMA), and Korean (KAMA) automobile manufacturers. As negotiated in 1998, the European Automobile Manufacturers (ACEA) committed to reduce average CO_2-emission of newly registered cars to 140 g/km by 2008[2].
2. *Guidelines on labelling and the supply of information to consumers.* While the EU relies in part on the commitments of the Automobile Manufacturers, consumers need to be informed about the importance of fuel efficiency of passenger cars.
3. *Tax measures that favor vehicles with light fuel requirements.* According to the strategy (COM, 2007a, p. 3), fiscal measures such as national taxes should establish a direct relationship between tax level and CO_2 performance to improve incentives for consumers to buy cars fulfilling the requirements of low fuel consumption and CO_2 emission.

Moreover, the Commission published a proposal for reducing CO_2 emission from private automobiles that set allowable emissions depending on the mass of the vehicle. The core of the strategy is the so-called *limit-value-curve* relating the vehicle mass to a CO_2 emission limit (COM, 2007a, Article 4 and annex I) which in turn set that the average CO_2 emission level of 130 g/km of the newly registered car fleet on the European market should be achieved by an automobile manufacturer. The draft of the new directive states that CO_2 emission increase is allowed with the vehicle mass. The permitted specific CO_2 emission shall be determined in accordance with the following formula:

$$CO_2 \ emission = \ 130 + 0.0457(M - 1289),$$

where M is the vehicle mass in kilograms and the mass of 1289 kilograms reflect the current sales-weighted average (COM, 2007b, p. 5). While the slope-parameter of the formula seems arbitrary and remains without any justification, the *limit-value-curve* is such that a disproportional reduction of CO_2 emission is requested. The slope parameter is below the actual slope parameter of CO_2 emission – weight of the car – relation. With regard to the parameter 0.0457 it should be obvious that manufacturers of heavier vehicles must achieve higher percentage reduction in emission than manufacturers of lighter vehicles. It is required that the goal should have been achieved by 2012. Additionally, article 7 of the proposal states that penalty payments will be claimed for newly registered automobiles which exceed the average emission target (COM, 2007a, p. 21)[3]. It is foreseen that the fines start in 2012 with 20€ for each additional gram of CO_2. It is scheduled that from 2013 until 2015 the specific fines are increasing to 35, to 60, and finally to 95€ (COM, 2007a, p. 21). Despite the aim of the Commission's proposal to reduce CO_2 emission from passenger cars, the regu-

[1] As stated in article 3b of the Maastricht treaty, the community will only take action if the objectives of the proposed action cannot be sufficiently achieved in the member states. Subsidiarity in general means, that political action should be undertaken on the lowest level of decision making which can be assumed to be able to make decisions on a specific problem efficiently.

[2] The Japan and Korean Automobile Manufacturers Association made a commitment to fulfil the level of 140 g/km by 2009.

[3] Moreover, "excess emission is the number of grams per kilometre by which the manufacture's average specific emissions exceeded its specific emissions target" (COM, 2007b, p. 21).

lation with regard to the penalty payment is induced to set considerable incentives for manufacturers to develop fuel-saving technologies. It is reasonable to argue that consumers will bear the cost imposed on automobile manufacturers resulting from the fines or from technological upgrading to avoid them as the payment will be incorporated in the price structure of automobile manufacturers (with a relatively high CO_2 emission level).

We conclude from the previous discussion that the Commission's proposal to reduce CO_2 emission from passenger cars very likely will fail to be an optimal strategy to achieve environmental protection. It will also fail to set efficient incentives for automobile manufacturers to develop fuel-saving technologies.

2. Sustainability vs. consumer sovereignty and competition

2.1. Environmental problems and the constitutional setting. Complex models are able to predict possible developments of the climate using long term forecasts (Nordhaus, 1994; Nordhaus and Boyer, 2000). It seems to be clear that doing nothing would be very risky and can destabilize the whole ecosystem. The most important approach applied to cope with environmental problems is the normative argument of sustainability[1]. As we treat climate change as a global public bad (IPCC, 2007, Stern, 2007), we argue that a first best solution for the internalization of the externality would require international policy coordination. However, the problems related to the negotiations on a follow up agreement on the Kyoto-Protocol which took place in December 2009 in Copenhagen (a short overview is given by Macintosh (2010) and Nicoll et al. (2010)) show that international policy coordination is difficult. From this perspective it is understandable that the European Union starts its own initiatives.

If one thinks about policy measures aimed to reduce the problems related to global warming, it is challenging to find the appropriate political instruments. The major concern is that climate change arguments (or more generally the criteria of sustainability) can easily be used to justify policy measures which contradict basic economic principles guaranteeing the functioning of a liberal market order (Gerken and Renner, 1996).

As our aim is to derive policy recommendations we now define two criteria which can be considered as minimum requirements that have to be fulfilled. The policy measures on CO_2 emission reduction for private transport proposed by the directive of the European Commission should be in line with our minimum requirements in order to be considered as desirable.

2.2. Minimum criteria imposed on policy measures. The following discussion motivates the two minimum requirements for policy measures by focusing on potential conflicts between sustainability, non-discrimination between competitors, open market access and consumer sovereignty. Since the EU directive is formulated in a way that all automobile manufacturers are treated the same, it seems that different specialization patterns as well as a variety of consumer preferences or needs of the citizens are somehow overlooked. By defining an average emission goal for each automotive manufacturer it seems that each firm shall generate the same average emissions per produced car in the long run. Therefore, the variety of preferences with respect to product characteristics (like speed, size or functionality) will be distorted and consumer sovereignty does not play a major role anymore. As emissions are linked to the utilization of the product (e.g. measured in km per year), it cannot be said that a car which generates high emissions per definition also does so in reality[2]. The preferences with regard to a passenger car may differ for a family and a single household. As a result, higher costs are imposed on social groups which have not been the initial target group of the resulting cost increases[3]. Based on the main critique on the first directive coming from the Commission we derive the first criterion that should be fulfilled:

Criterion 1: High degree of consumer sovereignty under the condition that the externality will be internalized.

The second point is related to competition between automobile manufacturers. As stated above, specialization patterns are desirable from an economic perspective. The actual proposal coming from the commission bears the potential threat that automotive manufacturers which are highly specialized in car segments of higher classes have disadvantages compared to those automotive manufacturers that produce a higher variety of automobiles. Mergers between automotive producers seem to be likely, forcing the concentra-

[1] The United Nations Commission on Sustainable Development has defined in its Brundtland report sustainable development as a "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Hauff, 1987, p. 46).

[2] It might be that so called "sports cars" are only driven on Sundays and therefore the burden they will impose on the environment is rather low compared to small cars which are used all days for a distance which could easily be covered by public transport.

[3] Of course, this will enter the political debate afterwards such that the state has to think about compensation of social groups. Anyway, it seems to be clear that the initial idea of regulating passenger cars will request further state intervention.

tion on the market for passenger cars even further. It is also possible that car producers enter into different segments (e.g. producers of big cars offer also small cars) which will increase competition within the segments of cars. Nevertheless, there is also the risk that such a development leads to disinvestment, in the sense that investments in a market entry strategy into new segments of passenger cars could have been better invested into new technologies reducing CO_2 emissions. Hence, the second condition considers competition and different specialization patterns explicitly:

Criterion 2a: Minimisation of distortions with respect to competition on the European level.

Even though it is possible to develop a concept for regulation in a way that the distortions in competition on the EU level are minimized, it is likely that such a reform goes hand in hand with entry barriers for potential foreign competitors. Due to the export orientation of European automobile manufacturers lobbying in favor of entry barriers is not very likely in the short run. However, the question is whether the regulation will increase international demand for cars produced in Europe or whether it reduces comparative advantages. If the former case will be true, regulation increases competitiveness of European car producers. If the letter is the case then with respect to the loss of international market shares entry barriers become likely. Therefore, the third criterion is defined as follows:

Criterion 2b: Minimisation of distortions with respect to competition on the international level.

The criteria are a first step in order to construct a theory of what should be done to reduce CO_2 emissions generated by private transport. So far, nothing has been said on the implementation of policy measures. The European commission has focused on the supply side. Nevertheless, an alternative would be to implement policy measures on the demand side. What follows is a positive analysis on market structures in order to evaluate policy measures with regard to demand or supply side from a normative perspective.

3. Supply and demand patterns in the automotive industry

This Section puts the European automotive industry into perspective. The first part sheds some light on the supply side while the second part concentrates on the automotive demand at the home market. Consumer preferences play an important role in the international market for automotives. One of the major challenges for the automobile manufacturers is the rising importance of environmental issues set up by the Kyoto Protocol which will be considered in the chapter as well.

3.1. Automotive supply and demand. Automotive production is highly concentrated in the EU-15. Germany alone accounting for nearly a half of total value added (European Commission, 2004)[1]. Table 2 (see Appendix) shows that German automotive producers offer employment opportunities for more than one third of the employees directly related to the European automotive industry. Many studies conclude that European Enlargement has been beneficial to the automotive industry (Radosevic and Rozeik, 2005; European Commission, 2004). According to Table 2, the rising importance is revealed by a doubling of employment share in the new member states in the last six years which outbalances the drop in automotive employment in the entire member states. Automotive employment remains fairly stable. One third of world production of passenger cars is located in Europe, of which Germany alone accounts for one third of the European automotive production (VDA, 2008). Detailed data on German automotive manufacturing for the year 2007 are presented in Table 3 (see Appendix). With production location around the world, half of passenger cars are produced in Germany itself, but only around 30 per cent of motor vehicle sales are earned at the home market. The highest share of automotive sales is related to global demand on international markets[2]. Moreover, in 2007, 4.3 million passenger cars were exported from Germany. Due to the high export activities automotive producers face a variety of consumer preferences in different countries. The trade structure of important European automotive producing countries (Germany, UK, Italy, France and Spain) is shown in Table 4 (see Appendix). The majority of automotive trade occurs within the European Union, intra EU-25 trade accounts for around 70 per cent on average. According to Heitger et al. (1999), the Grubel-Lloyd-Indicator, measuring the share of intra-industry trade in total trade, is around 80 for the German bilateral automotive trade with France, Italy and the United Kingdom in the year of 1996[3]. Thus, consumer preferences and economies of scale and scope explain specialization pattern of the European automotive industry as trade of differentiated (automotive) products occur (in

[1] According to the latest data of the German Federal Statistical Office, available in 2007, the manufacturing of transport equipment contributes about 17 per cent to total manufacturing employment as well as to value added in 2006 (Statistisches Bundesamt Deutschland 2008a; 2008b). According to the German Classification of Economic Activities (WZ 2003), the automotive sector is DM/(34 + 35).

[2] Noteworthy, with production locations around the world about the half of the motor vehicles are produced in Germany itself.

[3] See Grubel and Lloyd (1975) and Fontagne and Freudenberg (1997) for methodological issues on intra-industry trade.

terms of quality). Based on the "love of variety" approach consumer preferences play an important role in the automotive market when exporting differentiated products to international markets[1]. With respect to automotive demand in Europe, Table 5 (see Appendix) shows that the European passenger car fleet registered in 2006 is highly concentrated in five main markets (Germany: 20.3%, Italy 15.4%, France: 13.3%, UK: 13.0%, Spain: 9.0%). Registrations of new passenger cars in 2007 follow the same ranking, with Germany ahead. Evaluated in population measures, next to Italy, Germany ranks second with a car density of 57 cars per 100 inhabitants. In the following, to evaluate demand by car type German passenger car registration data Figure as an example for European automotive demand. In Germany, nearly 70 percent of registered cars since 1990 are classified as compact car and lower-middle and middle-sized cars (Figure 1, see Appendix). While demand for mini cars is declining in terms of market share, SUVs and Vans gain market share in new registrations in 2007. It seems to be obvious that demand for passenger cars may follow a trend-setting phenomenon to a more or lesser extent as the automotive industry may stimulate demand by offering new types of passenger cars. Due to the asymmetrical supply of new passenger cars by segments, the supply of passenger cars available to the consumers will also be asymmetrical over time[2]. When market research reveals changing preferences in time, one can argue that changing consumer demand will result in new supply which will be offered by the automobile manufacturers several years later. However, comparing the structure of the registered car fleet over time may be more valuable in terms of fundamental changes in demand. In 2007, demand for compact cars (in terms of new registrations) is increasing in terms of market share compared to the car fleet as a whole (Figure 1). In contrast, registration of passenger cars in the middlesized car segment is declining. Rather, there is a shift in demand of passenger cars from the middlesized type to passenger cars of the compact-type, on the one hand, and vans and SUVs, on the other hand. The change in automotive demand has important implications for the overall CO_2 emission level of the car fleet on European markets.

3.2. Environmental perspective. The transport sector, besides the electricity generation, is one of the largest sources of greenhouse gas emission in Europe. In 2005, it was responsible for about 20 per cent of CO_2 emission in the European Union (EEA, 2007, p. 64). Moreover, the use of passenger cars accounts for about 12 per cent of overall European CO_2 emission (COM, 2007c, p. 2). Despite the fact that road traffic is one of the few sectors in which emissions have further increased (26 per cent from 1990 to 2005) (EEA, 2007, p. 65), emissions from the average new car sold on the EU-15 Market reached 163 g CO_2/km in 2004, which is 12.4 per cent below the 1995 starting point of 186 g CO_2/km (COM, 2007c, p. 7). The proposed directive of the Commission is more or less motivated by the failed average CO_2 emission level of 140 g CO_2/km to be achieved by 2008 which is based on voluntary commitment of the European Automobile Manufacturers Association.

Table 6 (see Appendix) reveals demand structure of new passenger cars registrations by automotive brands[3] with their average CO_2 emission level[4]. On the aggregated level, the weighted average CO_2 emission of newly registered German brands (172 g CO_2/km) is still higher than all European brands on average (168,7 g CO_2/km), while newly registered cars of Italian, French and Czech brands are still below the European weighted average level of CO_2 emission[5]. A more detailed analysis on automotive demand by segment is presented in Table 7 (see Appendix). In general, German brands have an above average market share in nearly all passenger car segments except the mini, compact and mini-van-segment, where German brands account for around 40 per cent on average. These segments reveal a relatively higher consumer demand of passenger cars of French, Italian and Japanese brands compared to other passenger car segments. In contrast, middle-sized, upper-middle-sized, premium and roadster segments, which are dominated by German brands, contribute to the highest CO_2 emission on average (middle-sized: 174.9 g CO_2/km, upper-middle: 201.0 g CO_2/km, premium: 250.4 g CO_2/km, roadster: 232.5 g CO_2/km). Registered cars in these segments have a relatively low share on total passenger registration (except the middle-sized passenger car segment with 17 per cent). According to the first part of Table 8 (see Appendix), it is interesting to

[1] See Dixit and Stiglitz (1977), Krugman (1979; 1980), Dixit and Norman (1980).

[2] Additionally, as new passenger cars seem to be added to the segments without any published classification criteria by the KBA, comparing registration data by segments over time should be done very carefully.

[3] While the production of automotive producers is spread over various countries in the value chain, the brands are more or less considered to reflect some kind of national identity. We calculate the demand of each brand according to European Commissions (2004).

[4] Although, the passenger car registration data in Germany do not represent the overall consumer demand on the European market as the data are biased towards German brands, the focus lies on the presence of European brands in each passenger car segment and on the specialization pattern of the automotive producers, assumed that this is determined by consumer demand in Germany.

[5] The low average level of CO_2 emission of newly registered passenger cars of American brands is due to the fact that registered cars from America are to a higher extent present in the mini-segment.

note that German brands perform on average better in terms of CO_2 emission level within segments (lower-middle: 155.4 g CO_2/km, upper-middle: 199.4 CO_2/km, premium-vans: 172.5 g CO_2/km, and roadster: 224.2 g CO_2/km) in which they are specialized (in terms of relatively high market share) compared to their foreign counterparts which are an indication for technological advantage[1]. Despite the fact that Japanese brands are demanded in all segments to a higher (mini, mini-van and SUVs) or lesser extent (lower- and upper-middle-sized cars), in segments with a relatively low average CO_2 emission level (mini-class: 124.8 g CO_2/km and compact-class: 143.7 g CO_2/km) Japanese brands perform still better (mini-class: 109 g CO_2/km, compact-class: 134.4 g CO_2/km) than the European brands respectively (mini-class: 125.7 g CO_2/km, compact-class: 144.3 g CO_2/km) (last part of Table 8, see Appendix)[2]. As a result, German brands compete in markets where Japanese brands are more or less absent and vice versa.

The change of automotive demand shown by Figure 1 will be affected by the CO_2 emission level set by the Commission as it plays an increasing role in the consumer's choice of a passenger car type. If smaller passenger cars will be demanded by an increasing share of consumer, this will also impact the specialization pattern of automotive manufacturers. While French, Italian and Japanese automotive manufacturers are mainly presented in smaller segments, German manufacturers are more specialized in car production of higher classes. According to the *limit-value-curve* proposed by the Commission, manufacturers that are specialized in car segments with higher emissions on average have to achieve higher percentage reductions in CO_2 emissions relatively to the weight of the car compared to manufacturers of lighter vehicles. It is also proposed by the Commission that penalty payments will result for each gram CO_2 exceeding the required average level of the car fleet; Frondel et al. (2008) state that the abatement cost that emerge from the penalty structure shown in Section 2 are substantial. They calculated CO_2 abatement costs by about of 200€ per ton in the case that the automobile is driven 100,000 kilometres. As a benchmark, Böhringer and Löschel (2002) estimated average abatement costs within the ETS by about 30€ per ton CO_2[3]. It seems reasonable to assume that the per kilometre CO_2 emission limit will have effects on the differentiated market segments of the automobile industry in a way that the competitive position of manufacturers will change relative to the current situation. As the penalty payments are induced to set incentives for technological innovations to further reduce CO_2 emission from passenger cars, it seems questionable whether incentives will be placed into the right direction. As shown by the analysis in Table 7, German automotive manufacturers are among the best performing brands in terms of CO_2 emission in passenger car segments with high abatement cost respectively. Due to the specialization pattern it is not surprising that the German automotive industry lobbies against the Commission's proposal. In order to internalize the externality, alternative policy options exist and will be discussed in the next Section. As it is of high interest to explain why the Commission proposal goes into the direction of regulating the automotive industry, political instruments will be evaluated based on the minimum criteria developed in Section 4.4.

4. Search for an optimal political instrument

This Section aims to show an upcoming conflict when economic policy is used discretionary to tackle environmental problems[4]. The reason for this can be found in the lack of political consistency. We start with the description of policy instruments which we consider to have the potential solving the environmental problem related to the emission reduction in private transport. Previous results have shown that the automotive industry is quite important from an industrial perspective and, therefore, has quite a lot of lobbying power. Different aspects related to this are discussed from a public choice perspective. We extent this discussion to an international perspective. We then bring the different aspects together and come up with policy recommendations at the end of the Section.

4.1. Environmental instruments. Three different policy instruments will be discussed: emission trading with certificates, the Pigouvian tax and negative rules (Hayek, 1945). We restrict our discussion to these three instruments as other political instruments do not seem to be helpful to internalize the CO_2 emissions generated by private transport[5]. Regulation in form of command and control policy, like the

[1] These segments account for around 40 per cent of total passenger car registrations in 2007.

[2] Passenger car segments in which German brands are less demanded (mini, compact and SUVs) account for around 30 per cent of total passenger car registration in 2007.

[3] This comparison is somewhere misleading as Frondel et al. (2008) rather use an example of an automotive producer than calculating the average abatement cost for the automotive industry as a whole.

[4] One of the first contributions which show formally the weak performance of such an approach comes from Kydland and Prescott (1977).

[5] Beside the instruments proposed above, subsidies still remain an alternative, but should not be further discussed, because they are not relevant for emission reduction in private transport. Accountability on the social damage, as on of the constitutional principles of Eucken (1955), is also an alternative which seems not to be very convincing to be implemented on the international level. The praxis has shown that Moral Suasion for the problem in question did not lead to the desired outcome from the perspective of the EU. Ecologic labelling is also an alternative which seems to be promising for the internalization of externalities but does not seem to be helpful in the case of the automotive industry. From an international perspective they can also be abused for protectionism (Gerken and Renner, 1996, pp. 83).

Commission's proposal, is considered to be inferior compared to market based policies (c.f., Buchanan and Tullock, 1975).

One classic approach on how to react on externalities is the so-called Pigouvian tax (Pigou, 1924, pp. 129). The idea of Pigou was to tax negative externalities and to subsidize positive externalities[1]. Of course from a static perspective and under the assumption of complete information a Pareto efficient result is possible. One major critique on this approach is that the optimal tax is not known. Even though the Pigouvian tax is confronted with limitations, it is, nevertheless, in many cases considered to be an effective market based instrument. With some slight modifications it is also an applicable model (Baumol and Oates, 1971). Critique on the approach came, among others, from Coase (1960).

Coase (1960) demonstrates that private negotiations under the assumption that transaction costs are neglectable and property rights are adequately designed, will lead to a Pareto optimal outcome. According to Coase (1960), two major problems lead to market failure: not adequate defined property rights and the existence of transaction costs. One lesson to be drawn for political intervention is to create markets by defining property rights and, additionally, creating an infrastructure to reduce transaction costs.

The third alternative instrument proposed to internalize the externality comes from Hayek (1976b). Property rights should be limited in a way that the owner of the right is allowed to do whatever he wants with his own property as long as there is no interference with the protected sphere of the non-owners. The type of rules Hayek (1976b) proposes to tackle such problems are negative rules. The evolutionary approach on the selection of rules and the constitutional order has the advantage that it leaves enough room for private decisions and space for autonomous innovative creativity of firms. It is a consumer's decision on whether a product (or technique) is acceptable or not.

The limitations on this approach are the following. A framework which is based on negative rules needs to be stable, problems occur in those cases where rules have to be adjusted to the actual changing knowledge (Wegner, 1998, p. 221). Thus, we think that negative rules are not the optimal instrument to reduce CO_2 emissions generated by private transport. But also certificates are not without problems if they are implemented in reality. For trade with certificates, the overall quantity or the volume of the tradable certificates has to be defined. It can be seen as an advantage that this instrument is flexible in a way that it can be adjusted very quickly to the actual knowledge; nevertheless, it is also very likely that the overall quantity of certificates might be too big or too small with respect to its optimum. To summarise, we consider the definition of property rights and trade with certificates to be a first best solution for our problem. The Pigouvian tax is a kind of second best solution. Hayeks approach does not seem to be the optimal one for the problem of CO_2 emissions generated by private transport.

4.2. Public choice perspective. The previous discussion has highlighted pros and cons of environmental instruments. The European Commission opts in favor of regulating the supply side. The interaction between state activities, on the one hand, and private markets, on the other hand, is a critical issue and may impose additional problems. In the case of Europe, decisions on environmental regulation in the European Council are done with qualified majority vote. The sustainability approach serves as a key to initiate regulations on national levels. In cases where regulations are poorly defined they can get into conflict with the liberal market order. Due to the lack of knowledge, policy measures originally intended to increase welfare may rather lead to an overall decline in welfare. This threat seems to be present for the regulation on the automotive industry.

By constructing a scenario with basic public choice arguments it will become clearer. A developed directive which aims to tackle a specific problem is the starting point. *Sustainability* is the only normative criterion which is applied. Decision on the topic in question is made by simple majority vote. As the burdens of the regulative intervention will be regionally clustered, the industry in question starts with lobbying activities. If they are successful, governments will start to cooperate with the industry to reduce the burdens of the directive coming from the EU. In turn policy can enter a kind of intervention process (Mises, 1929)[2]. Interaction between state and industry may increase and the regulation, which was initially intended to generate structural change towards an environmental friendly technology, may

[1] Coase (1960) criticized by Pigou (1924) is the approach using an example on environmental damage caused by railway. Coase gives an example what kind of policy implementation would result from using the Pigouvian approach which he criticizes in the following sentence: "[…] *Pigou does not seem to have noticed that his analysis is dealing with an entirely different question. The analysis as such is correct. But it is quite illegitimate for Pigou to draw the particular conclusions he does. The question at issue is not whether it is desirable to run an additional train or a faster train or to install smoke-preventing devices; the question at issue is whether it is desirable to have a system in which the railway has to compensate those who suffer damage from the fires which it causes or one in which the railway does not have to compensate them"* (Coase, 1960, p. 141).

[2] Due to the local concentration of certain industries and the incentive of politicians to maximize votes (Schumpeter, 1987b) the political power of industries is at least explained in certain regions. Additionally, due to the regulation it is also possible that the devaluation of private capital will increase capital costs for the automotive industry. As a result, necessary investments into future technologies will not be undertaken.

be hindered as the creative destruction described by Schumpeter (1987a, b)[1] is not driven by market forces (Wegner, 1998, p. 225). The major costs imposed on citizens can be summarized as follows: (1) higher consumption costs; (2) costs for the adjustment of production processes; (3) costs of the lobbying activities[2]; (4) an additional loss of consumer sovereignty; (5) additional costs due to distortions; and (6) costs if a conflict with open market access occurs.

It is clear that the benefits with respect to climate protection remain to be an asset. On the other hand, it is also highly questionable, because European policy cannot tackle the problem of climate change alone, if climate change is a global problem. Of course, these arguments cannot be taken as a blueprint for doing nothing against the topic of climate change, but the example shows how necessary it is to follow a clear defined rule based approach which puts enough emphasis on the protection and functioning of the market. Looking at the topic from an international perspective supports an even more sceptical view.

4.3. International perspective. With respect to climate change it is important to mention relevant issues related to international markets and prices. If reduced demand for fossil fuels as a result of energy efficiency improvements also decreases international prices, the positive impact of the EU on the world climate would be redundant if total demand would remain constant (Sinn, 2008)[3]. Further it has to be taken into account that an increase of wealth in other countries will raise automotive demand and consumption of petrol even further. Beside this critique it is unclear whether the so-called "rebound effect" is so strong that European policy will be without any positive global impact. Due to increasing demand in fossil fuels, industries have to adapt to changing consumption patterns anyway. Further, it has been stated that the high carbon tax in Germany is one of the main reasons why German technology with respect to car production is relatively more efficient (according to Table 7) than in countries with lower carbon taxes (Kunert, 2002, p. 440). This shows that demand has some effects on supply of a product and positive spillovers can be assumed when the technology is exported (compare also Freytag and Wangler, 2008). Therefore, if policy instruments are applied appropriately, welfare gains can be expected. In contrast to this, if European standards are wrongly designed and go hand in hand with decreasing comparative advantages of the automotive industry, then it becomes likely that European car producers lobby in favor of import barriers. The "voluntary" commitments of JAMA and KAMA to agree on Europeans regulation can also be interpreted into this direction that the fear to lose market access is present. But then, what is the consequence of the directive for car producers outside Japan and Korea? It seems that not fulfilling the requirements very likely bears the potential to be accompanied by import restrictions (e.g. for car producers in emerging economies).

If the focus lies on emission reduction apart from the transport sector, than the Kyoto protocol allows the developed countries to achieve emissions reduction abroad by joint implementation, clean development mechanism and international emission trading. This enables the EU to improve the cost-effectiveness of emissions reduction as reducing emissions in another country may be cheaper than in the EU itself. Several papers state that the marginal cost of emission reductions vary among the countries (Kram and Hill, 1996). Since global warming is caused by greenhouse gas emission at the international level, it does not matter where it is reduced. Developing countries have a relatively large potential for emission reductions through energy efficiency improvements compared to industrialized countries (Halsnaes and Olhoff, 2005). The results which can be derived so far can be summarized as follows. Taking the global nature of climate change into account, more emphasis on global policy coordination seems to be desirable. Nevertheless, it is difficult to judge about the net impact of policy measures intended to have global impact. The resulting partial equilibrium may turn out to set wrong incentives on the global level and the resulting general equilibrium might differ. In the worst case the investment will yield low positive spillovers and there is a risk that high standards on the European level are used to implement import barriers on car producers outside Europe.

4.4. Competition, consumer sovereignty and the adequate policy instrument. For the following discussion two different approaches have to be distinguished: market based approaches applied on the supply side or internalization of the externality by market based approaches applied on the demand side. So far these two approaches seem to be the most adequate to reduce CO_2 emissions by passenger cars. If the question is whether the policy instruments should be applied on the supply side or on the demand side, we opt in favor of a demand side ap-

[1] Creative destruction means that the dynamics of a market order will always generate winners and losers. Due to technology innovations which destroy old ones, new opportunities arise such that creative destruction can be seen as one of the major driving forces behind growth leading to an increase in welfare.

[2] For a discussion about the costs of lobbying compare Krueger (1974).

[3] Of course, this view is far too easy because there is no evidence to assume that the so-called "rebound effect" will be translated 1:1 to a price decrease.

proach[1]. Regulation seems to be inferior to market based approaches and, therefore, does not seem to be optimal for CO_2 emissions reduction by passenger cars. What has to be kept in mind is that in the case of non-market based approaches like regulations, qualified majority is the voting rule in the European Council. For market based approaches like taxes, unanimity rule is applied[2]. This leads us to derive the first result.

In cases where different useful instruments are available to reach the same target; application of the same voting rule would reduce distortions.

We justify this result because of the public choice considerations[3]. Industrial regulations are a sensible topic and in case of CO_2 emissions generated by passenger cars may be problematic. To underline our arguments we rank the policy measures from first best to fourth best. A ranking of the four alternatives based on the previous discussion and our two criteria looks as follows:

- First best (demand side – a): tradable certificates.
- Second best (demand side – b): pigouvian tax.
- Third best (supply side – aa): segment specific emission targets (small, medium, big) implemented by using tradable certificates[4].
- Fourth best (supply side – ab): segment specific emission targets (small, medium, big) implemented by using penalty payments.
- Fifth best (supply side – ba): the same emission targets on all automobile manufacturers implemented by using tradable certificates.
- Sixth best (supply side – bb): the same emission targets on all automobile manufacturers implemented by using penalty payments.

The directive coming from the European Commission might result in a different order. We hypothesize that this inefficient result is due to the two different voting mechanisms. The different voting rules for taxes and regulations might have generated a kind of bias in favor of non-market based instruments.

The distinction between the first best and second best definition can be questioned. Even though theoretically emission trading with certificates is considered as first best, it does not seem too unrealistic that it is possible to calculate the externality which results of each litre of fossil fuels consumed (compare also Baumol and Oates, 1971). Therefore, it might be that the definition of property rights and the installation of a tradable certificate system is difficult to be implemented and that the tax solution might be effective and applicable (Raux and Marlot, 2005). This leads to the second result of the paper:

Market based instruments (taxes or certificates) are adequate instruments to be applied in the case that private mobility shall contribute to CO_2 emission reduction[5].

The instruments we propose seem to be the best to cope with emissions generated by private transport and come close to the criteria we have defined:

- High degree of consumer sovereignty under the condition that the externality will be internalized.
- Minimization of distortions with respect to competition on the European level.
- Minimization of distortions with respect to competition on the international level.

It is difficult to take for granted that the best result will also turn out to be the best alternative for the European commission if the same voting rule would be applied on regulations and taxes. Under the Treaty of Lisbon it is foreseen that in 2014 a double majority will be applied on most of the decision[6]. However, even though one can expect less discrimination between regulation and market based instruments politicians tempt to favor regulation over market based instruments in general (Buchanan and Tullock, 1975). One possibility could be that the Commission buys the accord from the automobile industry by offering additional rents[7]. Nevertheless, it would be more difficult to impose regulations if other options have to be valued more seriously and it becomes more difficult to *use regulation as an instrument to intervene on private markets only because they are "easier" to be installed.*

Without rules on limiting the regulative power of the European Union, the initial notion of a "strong state" on the national level (Eucken, 1955) may be undermined with the argument of the *sustainability* approach. Obviously, this is not optimal and in some cases it may even be problematic.

[1] The main argument is that a demand side approach leaves the decision on the adequate technology to the automotive industry.

[2] For a more detailed discussion on the features of the majority rule and unanimity rule compare Buchanan and Tullock (1962).

[3] Because consumers have to bear the costs of the externality anyway a tax would be transparent and the state as such would be safe from lobbying activities coming from the automotive industry.

[4] We think that segment specific regulations would lead to less distortion related to different specialization patterns of automotive manufacturers.

[5] If a carbon tax would be implemented that it is very likely that the price level will not be set on the optimal stage. Nevertheless, our proposition is that comparing the supply and demand side approach, the demand side approach is superior. On the demand side, because all citizens using and owning a car would be affected, the transaction costs argument is convincing to argue in favour of a carbon tax.

[6] Double majority means that 55% of the member states have to agree upon the issue which represents at least 65% of all people within the European Union.

[7] For example, the European Union has decided to subsidize the European car industry with 40 Billion Euro (see FAZ net http://www. faz.net/ f30/ common/Suchergebnis.aspx? term=+Autobranche &x= 0&y=0&allchk=1).

Conclusions

This paper focuses on the Commission's proposal to reduce CO_2 emission from passenger cars in order to find an optimal policy instrument to internalize the externality. While automotive demand shifts to smaller passenger car segments to a relatively high extent, the paper also shows specialization pattern of automotive manufacturers. It turns out that different specialization patterns exist. While German brands are among the best performers in terms of CO_2 emission in the respective segments, the Commission's proposal for regulation seems to be placed wrong. One further result is that *sustainability* is a quite powerful normative criterion if it is applied by policymakers in order to justify political interventions on market processes. We try to show that the real political process violates basic principles like consumer sovereignty and competition.

We were focusing on those points where we think that there is the weakest link and, therefore, the potential threat for the deterioration of the functioning of competitive private markets. Therefore, we have highlighted potential problems related to different voting rules applied on regulation and taxation in order to internalize externalities. While qualified majority can be applied on environmental regulations, a regulation of the industry seems to be easier to be installed than this would be the case for market based instruments. This approach can be criticized, because in the medium and long term the regulation bears the potential threat of further state interventions and further inefficiencies.

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Appendix

Table 1. Constitutional approaches and adequate policy instruments

Instruments \ Constitutional concept	Eucken	Hayek	Theory of political economy
Taxes	-	-	-
Subsidies	--	--	--
Certificates	+	+	+
Accounability law	++	++	++
General constitutional law	++	+	+
Essential constitutional law	-	-	-
Moral suasion	-	+	--
Transparency	++	++	0

Notes: (++) very useful, useful (++), (0) partially useful, (-) less useful, (--) not useful.
Source: Gerken and Renner (1996, p. 90), own illustration and translation.

Table 2. European employment directly related to the automotive industry

		2007		2001	
	% change 2001-2007	thsd.	in %	thsd.	in %
EU-15	**-4.7**	**1879**	**79.7**	**1970**	**89.0**
Austria	9.9	33	1.4	30	1.4
Belgium	-14.9	46	2.0	54	2.4
Denmark	3.0	7	0.3	7	0.3
Finland	-6.5	7	0.3	7	0.3
France	-9.4	288	12.2	318	14.4
Germany	-0.2	862	36.6	863	39.0
Greece	1.4	2	0.1	2	0.1
Ireland	10.1	4	0.2	4	0.2
Italy	-3.4	168	7.1	174	7.9
Luxemburg	n.a.	n.a.	n.a.	n.a.	n.a.
Netherland	-17.1	23	1.0	27	1.2
Portugal	2.7	24	1.0	23	1.1
Spain	-0.3	161	6.9	162	7.3
Sweden	2.2	79	3.4	78	3.5
UK	-21.3	173	7.4	220	9.9
New Member States	**95.1**	**477**	**20.3**	**245**	**11.0**
Bulgaria	-19.9	3	0.1	4	0.2
Czech Republic	47.7	125	5.3	85	3.8
Hungary	61.3	60	2.5	37	1.7
Latvia	n.a.	n.a.	n.a.	n.a.	n.a.
Lithuania	n.a.	n.a.	n.a.	n.a.	n.a.
Poland	n.a.	123	5.2	n.a.	n.a.
Romania	6.5	80	3.4	75	3.4
Slovakia	71.2	76	3.2	44	2.0
Slovenia	n.a.	11	0.5	0	0.0
EU-27	**6.4**	**2356**	**100.0**	**2215**	**100.0**

Notes: Direct employment counts for roughly 2.4 million jobs in the EU. Indirect employment represents another 10 million jobs in the EU. Include estimates for Denmark, France, Ireland, Netherlands, Sweden and Bulgaria for the year 2007.
Source: European Automobile Manufactures Association (ACEA, 2008) based on Eurostat, own compilation and calculations.

Table 3. German automotive manufacturers at a glance

	2007		Produced in			
Production	Germany				Rest of the world	
	Quantity	in %	Quantity	in %	Quantity	in %
Passenger cars	10,953,587	90,3	5,709,139	52.1	5,244,448	47.9
Utilities	1,175,520	9.7	486,522	41.4	688,998	58.9
Total	12,129,107	100.0	6,195,661	51.1	5,933,446	48.9
Sales	Mio. EUR	in %	Mio. EUR	in %	Mio. EUR	in %
Total motor vehicles	202,250	100.0	58,770	29.1	143,480	70.9
Total automotive industry	290,000	100.0	105,905	36.5	184,095	63.5
Passenger cars	**Total production**		**Exports from Germany**			
	Quantity	in %	Quantity		in %	
Europe	19,471,936	32.2	3,112,578		72.3	
Germany	5,709,139	9.4	-		-	
France	2,530,000	4.2	335,478		7.8	
Italy	930,000	1.5	462,440		10.7	
Spain	2,400,000	4.0	330,842		7.7	
UK	1,534,567	2.5	731,741		17.0	
Nafta	15,021,044	24.8	n.a.		n.a.	
USA	10,473,193	17.3	551,373		12.8	
Mercosur	3,310,553	5.5	n.a.		n.a.	
Brazil	2,797,321	4.6	n.a.		n.a.	
Asia	21,954,725	36.3	407,141		9.5	
China	5,400,000	8.9	190,542		4.4	
Japan	9,950,000	16.5	92,549		2.2	
Rest of the world	689,633	1.1	232,662		5.4	
Total	60,447,891	100.0	4,303,754		100.0	

Notes: Sales in Germany excluding VAT.
Source: Verband der Automobilindustrie (VDA) (2008), own compilation and calculations.

Table 4. Automotive trade of selected European countries in the year 2007

	Germany		UK		Italy		France		Spain	
Total exports	In mio. EUR / in % total exports									
Intra+extra EU-25	967830	100.0	319451	100.0	358633	100.0	403793	100.0	175861	100.0
Intra EU-25	617668	63.8	184288	57.7	208316	58.1	259646	64.3	121917	69.3
Extra EU-25	350162	36.2	135162	42.3	150317	41.9	144147	34.7	53945	20.7
781 Motor cars	In mio. EUR / in % total exports									
Intra+extra EU-25	139843	14.4	20994	6.6	8392	2.3	22541	5.6	20494	11.7
Intra EU-25	98705	16.0	12441	6.8	6406	3.1	18896	7.3	17863	14.7
Extra EU-25	41138	11.7	8553	6.3	1986	1.3	3645	2.5	2631	4.9
Exports of motor cars in mio. EUR / in % of Intra + Extra EU – 25 exports of motor cars										
Intra EU-25	98705	70.6	12441	59.3	6406	76.3	18896	83.8	17863	87.2
of which	Exports of motor cars in mio. EUR / in % of Intra EU – 25 exports of motor cars									
Germany	-	-	1221	9.8	1519	23.7	3134	16.6	2482	13.9
UK	14480	14.7	-	-	950	14.8	2726	14.4	2426	13.6
Italy	10563	10.7	1911	15.4	-	-	2895	15.3	1985	11.1
France	7463	7.6	886	7.1	1079	16.8	-	-	7484	41.9
Spain	7362	7.5	1731	13.9	835	13.0	3771	20.0	-	-
Rest EU-25	20215	20.5	6692	53.8	2024	31.6	6370	33.7	3485	19.5
Extra EU-25	41138	29.4	8553	40.7	1986	23.7	3645	16.2	2631	12.8
of which	Exports of motor cars in mio. EUR / in % of Extra EU – 25 exports of motor cars									
US	16879	41.0	3178	37.3	615	31.0	71	1.9	3	0.1
China	2478	6.0	313	3.7	42	2.1	41	1.1	13	0.5
Japan	2578	6.3	815	9.5	184	9.3	115	3.2	25	0.9

Table 4 (cont.). Automotive trade of selected European countries in the year 2007

Korea	771	1.9	65	0.8	6	0.3	22	1.2	6	0.2
Rest of the world	18443	44.8	4172	48.8	1138	57.3	3374	92.6	2583	98.2
Total imports	in mio. EUR / in % total imports									
Intra+Extra EU-25	772404	100.0	452079	100.0	368080	100.0	448908	100.0	271849	100.0
Intra EU-25	499539	64.7	244471	54.1	204472	55.6	308723	68.8	165863	61.0
	Germany		**UK**		**Italy**		**France**		**Spain**	
Total imports	In mio. EUR / in % total imports									
Extra EU-25	272865	35.3	207608	45.9	163608	44.4	140186	31.2	105986	39.0
781 Motor cars	In % of total imports									
Intra+extra EU-25	32211	4.2	31697	7.0	27469	7.5	25288	5.6	20853	7.7
Intra EU-25	23924	4.8	28116	11.5	24528	12.0	22652	7.3	16801	10.1
Extra EU-25	8287	3.0	3581	1.7	2940	1.8	2937	1.9	4052	3.8
Imports of motor cars in mio. EUR / in % of intra+extra EU – 25 imports of motor cars										
Intra EU - 25	23924	74.3	28116	88.7	24528	89.3	22652	89.6	16801	80.6
of which	Imports of motor cars in mio. EUR / in % of intra EU – 25 imports of motor cars									
Germany	-	-	12743	45.3	11025	44.9	8225	36.3	8223	48.9
UK	1329	5.6	-	-	1555	6.3	811	3.6	1286	7.7
Italy	1535	6.4	854	3.0	-	-	1041	4.6	933	5.6
France	4119	17.2	2759	9.8	3060	12.5	-	-	4079	24.3
Spain	2665	11.1	3532	12.6	2715	11.1	7460	32.9	-	-
Rest EU-25	14277	59.7	8228	29.3	6173	25.2	5114	22.6	2281	13.6
Extra EU-25	8287	25.7	3581	11.3	2940	10.7	2637	10.4	4052	19.4
of which	Imports of motor cars in mio. EUR / in % of extra EU – 25 imports of motor cars									
US	4454	53.7	339	9.5	285	9.7	75	2.8	196	4.8
China	33	0.4	132	3.7	75	2.6	23	0.9	18	0.4
Japan	436	5.3	1965	54.9	1054	35.9	783	29.7	1687	41.6
Korea	777	9.4	682	19.0	736	25.0	471	17.9	1202	29.7
Rest of the world	2587	31.2	464	13.0	790	26.9	1285	48.7	948	23.4

Source: Eurostat (2008a), own compilation and calculations.

Table 5. Passenger cars in Europe at a glance – cars in use and new registrations

	Cars in use 2006			**New registrations 2007**			**Population**
	Thsd.	In %	per 100 Pop.	Thsd.	in %	% growth	% of EU-27
EU-15	**198,552**	**86.7**	**52.5**	**14,364**	**92.2**	**0.0**	**78.4**
Austria	4,205	1.8	52.5	298	1.9	-3.4	1.7
Belgium	4,929	2.2	48.1	525	3.4	-0.3	2.1
Denmark	2,014	0.9	37.7	159	1.0	3.2	1.1
Finland	2,489	1.1	48.1	125	0.8	-14.0	1.1
France	30,400	13.3	50.0	2,065	13.3	3.2	12.6
Germany	46,570	20.3	56.6	3,148	20.2	-9.2	17.0
Greece	4,447	1.9	40.7	280	1.8	4.5	2.3
Ireland	1,779	0.8	46.7	186	1.2	4.4	0.8
Italy	35,297	15.4	62.0	2,493	16.0	7.2	11.8
Luxembourg	n.a.	n.a.	n.a.	51	0.3	1.0	0.1
Netherlands	7,413	3.2	46.5	506	3.2	4.5	3.3
Portugal	4,290	1.9	42.0	202	1.3	3.7	2.1
Spain	20,637	9.0	51.3	1,615	10.4	-1.2	8.4
Sweden	4,202	1.8	47.4	307	2.0	8.5	1.8
United Kingdom	29,880	13.0	50.7	2,404	15.4	2.5	12.2
	Cars in use 2006			**New registrations 2007**			**Population**
	Thsd.	In %	per 100 Pop.	Thsd.	in %	% growth	% of EU-27

Table 5(cont.). Passenger cars in Europe at a glance – cars in use and new registrations

	Cars in use 2006			New registrations 2007			Population
	Thsd.	In %	per 100 Pop.	Thsd.	in %	% growth	% of EU-27
New EU Members	**30,463**	**13.3**	**29.2**	**1,210**	**7.8**	**14.6**	**21.6**
Bulgaria	2,710	1.2	33.2	41	0.3	26.4	1.7
Czech Republic	4,109	1.8	40.0	174	1.1	11.3	2.1
Estonia	554	0.2	40.5	31	0.2	21.9	0.3
Hungary	3,120	1.4	30.6	172	1.1	-8.5	2.1
Latvia	822	0.4	34.6	33	0.2	28.1	0.5
Lithuania	n.a.	n.a.	n.a.	22	0.1	51.8	0.7
Poland	13,384	5.8	34.8	293	1.9	22.7	8.0
Romania	3,490	1.5	15.6	316	2.0	23.1	4.7
Slovakia	1,334	0.6	24.8	60	0.4	1.0	1.1
Slovenia	940	0.4	47.3	69	0.4	15.3	0.4
EU-27	**229,015**	**100.0**	**47.5**	**15,574**	**100.0**	**1.0**	**482,191**

Note: Due to data availability Malta and Cypres are excluded from the calculation.
Source: ANFAC (2008), ACEA (2008), Eurostat (2008b), own compilation and calculations.

Table 6. Germany: CO_2 emission level of new registered passenger cars by brand for 2007

	Thsd.	In %	CO_2 emission
European brands	**2390.2**	**76.5**	**168.7**
German	1936.4	62.0	172.0
French	214.6	6.9	150.8
Italian	47.4	1.5	143.1
Spanish	27.9	0.9	173.4
Swedish	21.0	0.7	187.3
British	1.6	0.1	264.7
Czech	115.1	3.7	153.7
Asian brands	**195.2**	**6.3**	**165.1**
Japanese	169.4	5.4	164.3
Korean	25.8	0.8	170.4
American	**10.4**	**0.3**	**145.2**
Other brands	523.8	16.8	175.8
Total	**3122.6**	**100.0**	**169.6**

Notes: German brands (VW: Audi, Porsche, BMW, Mini, Ford, Mercedes, Smart, Opel), French brands (Citroen, Peugeot, Renault, Dacia since 2007), Italian brands (Alfa Romeo, Ferrari, Fiat, Iveco, Lancia, Maserati), Spanish brands (Seat), Swedish brands (Saab, Volvo), British brands (Jaguar, Land Rover, MG Rover, Austin), Czech brands (Skoda), American brands (Chevrolet, Daewoo, Chrysler, Jeep, Dodge, General Motors), Japanese brands (Daihatsu, Honda, Mazda, Mitsubishi, Nissan, Subaru, Suzuki, Toyota, Lexus), South Korean brands (Hyundai, Kia, Ssangyong). Data on newly registered passenger cars contain top ten passenger cars by car segment. Weighted average CO2 emission per brand calculated with market share of each car type (in terms of quantity).
Source: Kraftfahrt-Bundesamt (KBA) (2008b, 2008c), own compilation and calculations.

Table 7. German consumer preferences and specialization pattern of car producers

Comparative advantage of German brands								
Top Ten	Quantity	%	CO_2/km		Top ten	Quantity	%	CO_2/km
Lower-middle	**824061**	**26.3**	**157.4**		**Roadster**	**60025**	**1.9**	**232.5**
European	633180	76.8	155.7		European	55198	92.0	225.2
German	**542776**	**65.9**	**155.4**		**German**	**54152**	**90.2**	**224.2**
French	42693	5.2	158.4		British	1046	1.7	280.7
Czech	47711	5.8	157.5		American	1053	1.8	246.7
Japanese	24341	3.0	171.9		Other brands	3774	6.3	339.9
Other brands	166540	20.2	161.8		**Premium-vans**	**177001**	**5.7**	**176.9**
Upper-middle	**183246**	**5.9**	**201**		European	152468	86.1	174.4
European	178586	97.5	200.2		**German**	**141332**	**79.8**	**172.5**
German	**162080**	88.4	**199.4**		French	5114	2.9	209.0
French	1751	1.0	224.2		Spanish	3404	1.9	183.2

Table 7 (cont.). German consumer preferences and specialization pattern of car producers

Comparative advantage of German brands								
Top Ten	Quantity	%	CO_2/km		Top ten	Quantity	%	CO_2/km
Swedisch	13524	7.4	204.8		Italian	2618	1.5	196.0
Japanese	664	0.4	233.3		Japanese	12001	6.8	183.3
American	2998	1.6	233.1		Korean	3588	2.0	185.0
Other brands	998	0.5	229.7		Other brands	8944	5.1	205.5
Comparative advantage of European brands								
Top Ten	Quantity	%	CO_2/km		Top ten	Quantity	%	CO_2/km
Middle	**518031**	**16.6**	**174.9**		**Mini-vans**	**214538**	**6.9**	**162.9**
European	430931	83.2	173.5		European	183087	85.3	161.8
German	415366	80.2	173.7		German	110274	51.4	159.8
French	8058	1.6	179.5		French	31154	14.5	163.5
Swedish	**7507**	**1.4**	**155.8**		Spanish	24556	11.4	172.0
Japanese	33182	6.4	174.1		**Czech**	**17103**	**8.0**	**157.5**
Other brands	53918	10.4	187.2		Japanese	20187	9.4	168.6
Premium	**29891**	**1.0**	**250.4**		Other brands	8293	3.9	167.8
European	29340	98.2	250.0		**Utilities**	**133138**	**4.3**	**200.9**
German	28688	96.0	250.2		European	117604	88.33	199.8
British	**592**	**2.0**	**236.3**		German	95378	71.64	209.7
Italian	60	0.2	247.6		**French**	**17483**	**13.13**	**157.1**
Japanese	417	1.4	261.2		Italian	4743	3.56	157.6
Other brands	134	0.4	319.3		Other brands	15534	11.67	203.2
Comparative advantage of Japanese brands								
Top Ten	Quantity	%	CO_2/km		Top Ten	Quantity	%	CO_2/km
Mini	**158353**	**5.1**	**124.8**		**Compact**	**593307**	**19.0**	**143.7**
European	**114034**	**72.0**	**125.7**		European	409521	69.0	144.3
German	63995	40.4	127.0		German	236055	39.8	142.8
French	34612	21.9	119.0		French	73749	12.4	145.7
Italian	15427	9.7	135.4		Czech	50328	8.5	148.9
Japanese	**16319**	**10.3**	**109.0**		Swedisch	24881	4.2	150.0
American	9337	5.9	133.7		Italian	24508	4.1	139.3
Korean	7978	5.0	131.5		**Japanese**	**29074**	**4.9**	**134.4**
Other brands	10685	6.7	128.2		Other brands	154712	26.1	143.9
					SUVs	**231022**	**7.4**	**229.7**
					European	86277	37.3	244.9
					German	86277	37.3	244.9
					Japanese	**33217**	**14.4**	**190.3**
					Korean	11228	4.9	191.9
					Other brands	100300	43.4	234.0

Notes: Top ten newly registered passenger cars in 2007, segment in per cent of total newly registered passenger cars, brand reveals market share in each segment (in per cent of quantity per segment), for brand by country see notes of Table 5. Weighted average CO_2 emission per brand calculated based on market share of each car type (quantity per segment).
Source: Kraftfahrt-Bundesamt (2008c), own compilation and calculations.

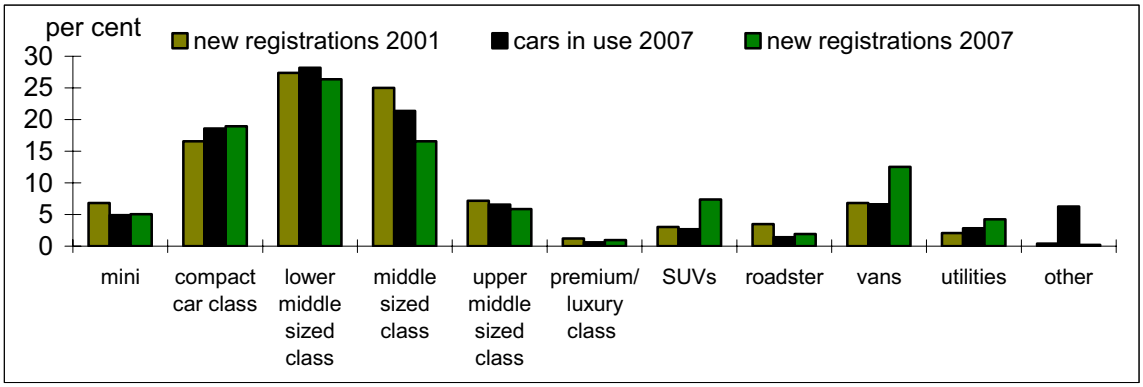

Fig. 1. Germany: Registration of passenger cars vs. cars in use

Source: Kraftfahrt-Bundesamt (KBA) (2008a, 2008b), own compilation and calculations.