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The consequence of EU regulations for car emissions

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Report 2022.07

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european trade union institute

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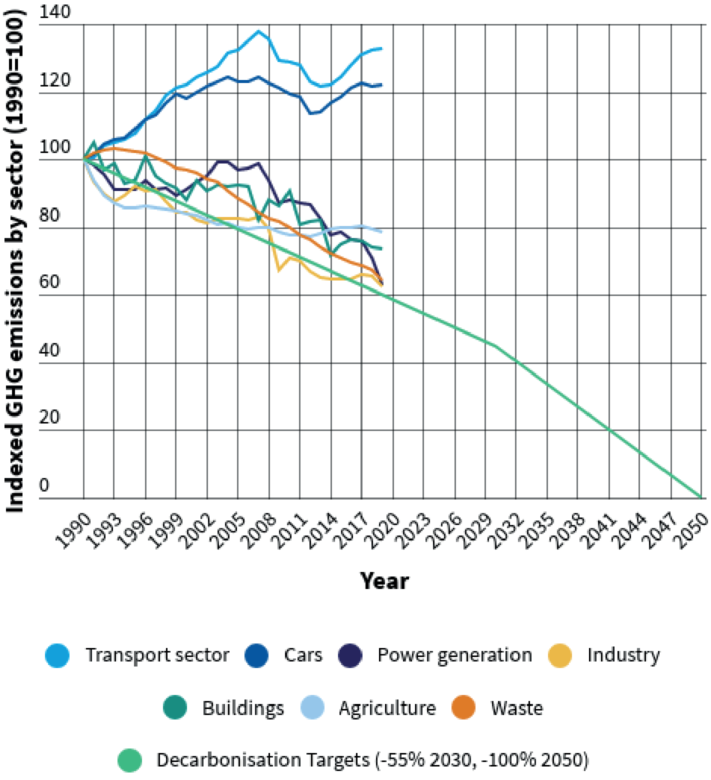
Introduction

Between 1990 and 2019, the European transport sector was expected to reduce its CO_2 emissions by 40 per cent to keep track with the 100 per cent CO_2 reduction target on the 1990 level set by the European Commission for 2050. But, in fact, the transport sector has increased its CO_2 emissions by 32 per cent during these last 30 years, with passenger cars representing 43 per cent of total CO_2 emissions from the transport sector (see Figure 1).

Figure 1 **Greenhouse gas emissions by sector, 1990-2020**



Source: T&E 2022.

This growing divergence between the historical trajectory of CO_2 emissions of passenger cars in Europe and where they were supposed to go to reach carbon neutrality in 2050 is the main reason why the European automotive sector

is now facing the most radical and potentially disruptive transformation of its history. Rapid and widespread electrification appears today as the only possible technological solution to reconcile this diverging path with the EU Green Deal. In the EU Green Deal the short-term objective is to reach, by 2030, a 55 per cent reduction in CO_2 emissions (on 1990) in all economic sectors – the 'Fit for 55' package. For passenger cars the proposal made by the European Commission in 2021 foresees not only a 55 per cent reduction of the CO_2 emissions of new cars by 2030 but a 100 per cent reduction by 2035. In other words, in slightly more than ten years, the internal combustion powertrain that has been at the core of this industry for more than a century, and which concentrates around 25 per cent of the value added and 40 per cent of the total employment of the European automotive industry, will be phased out.

Most of the current debate, reports and publications about this fast-track electrification of the European automotive industry concentrates on its potential positive and/or negative effects – on national economies, on automotive car manufacturers and suppliers, on employment and on CO_2 emissions (Verhaeghe 2021; Falck et al. 2021; T&E 2021; Strategy& 2021; BCG 2021) – while less attention is being paid to the role of the regulatory framework.

This report focuses on the central role played by the European regulatory framework (on CO_2 emissions, but also on vehicle type approval and on competition and trade policies within the Single Market) in shaping the industrial landscape as well as its responsibility for pushing the industry towards heavier, more powerful and more expensive cars (what we call regulatory upmarket drift) precisely at a time when the imperative of reducing CO_2 emissions should have required lighter, less powerful and more affordable cars. We show how this paradox was at the origin of the Dieselgate scandal and is today one of the main causes of the accelerated process of electrification.

We also highlight the contradictions that arise by combining this pre-existing upmarket drift with accelerated electrification. The result is quicker upmarket drift that significantly reduces the environmental benefits of electrification while making its economic, social and political costs much higher.

The report is organised in six sections.

The first section provides a historical review of different environmental regulations and policies and their contradictions, highlighting also strong path dependencies. It reconstructs the political struggle that occurred in the 1990s between premium and generalist brands in Europe to define the emergent European regulatory framework for the Single Market and for its greening trajectory. We look at the elaboration of technical and environmental standards but also at the definition of the trade and competition rules of the Single Market and at the (increasingly subordinated) place of industrial policy.

The second section focuses on the making of the EU regulatory framework to reduce CO_2 emissions for cars and vans in the 1990s and 2000s.

The third section analyses the consequences of this EU regulatory framework on the supply of new cars in the Single Market. We will see in detail how this regulation resulted in cars that are structurally more, rather than less, polluting.

The fourth section analyses the consequence of the Dieselgate scandal both on the European regulation of CO_2 emissions, which has become stricter, and on upmarket drift which has increased during this period, driven by the need to electrify very heavy and powerful cars, making these cars even heavier, more powerful and more expensive.

The fifth section delves into the consequences of combining regulatory upmarket drift with the electrification that has accelerated it, looking into the environmental, economic, social and political consequences of such a process. We see that heavier electric vehicles (EVs) are structurally much less green than lighter EVs and that weight and engine power are even more important for EV performance (driving range and recharging time) and production costs (size and weight of the battery and of the vehicle) than for equivalent internal combustion engine (ICE) vehicles.

The sixth and last section analyses the 'Fit for 55' proposal made in 2021 by the European Commission to increase the CO_2 reduction target for new cars in 2030 from 37.5 per cent to 55 per cent and to introduce a 100 per cent reduction target for 2035. We discuss the implications of such a hardening of the target in terms of upmarket drift and its foreseeable impact on work, employment and consumers.

In the conclusion, we summarise our findings by stressing how much the combination of regulatory upmarket drift with accelerated electrification can be disruptive and unsustainable for the European automotive industry, for the EU Green Deal and for the green transition. But we also argue that combining electrification with regulatory downmarket drift could open up much more sustainable scenarios for the future of the automotive industry and for the capacity of the European Union to achieve carbon neutrality in 2050.

1. Historical background: air quality or fuel economy?

Historically, the European Union lagged behind in the introduction of environmental standards and regulations for the transport sector. The United States started to regulate the air pollutants emitted by cars in 1966 with the Clean Air Act. In 1970, the US Congress passed an amendment to the Act that called for 90 per cent reductions of hydrocarbons and carbon monoxide emissions to be achieved by 1975. Before the end of the decade, unleaded petrol and the three-way catalytic converter, required to achieve these drastic reductions in air pollutants, were made mandatory by US standards. It had been the European premium car manufacturers that had first developed these technologies for the US market (Bergquist and Näsman 2021), but it took more than a decade before similar environmental standards were introduced in the European market. Furthermore, even when the Euro norm for air pollutants was finally made into European law in 1991, it still lagged behind US standards by several years, in particular concerning diesel engine emissions.

There are several reasons for this delayed introduction of environmental standards in Europe. The first difficulty concerns the interplay between national and European standards. The second difficulty was posed by the costs of adopting US environmental standards in Europe, as the cost of catalytic converters represented on average 5 per cent of the total cost of a premium model but between 15 and 22 per cent of the total cost of a small/compact car (Moguen-Toursel 2004).

Another reason was that, at a time when the reduction of fuel consumption had become a national and European priority after the two oil shocks of 1973 and 1981, introducing a technology that would increase fuel consumption by 5-15 per cent appeared problematic.

The trade-off between stricter air pollutant standards and higher fuel consumption is of the greatest importance in understanding the almost opposite historical patterns taken by the environmental regulation of car emissions in the United States (for a description of the US regulation, see the longer version of this paper on the ETUI website) and in Europe.

1.1 Europe: fuel economy and diesels

While the US maintained strict air pollution standards and paid less attention to fuel economy (and CO_2 emissions), in Europe the historical configuration was almost reversed. Here, the focus since the 1970s has been on fuel consumption regulated at national level with high petrol prices and fiscal policies that have favoured low consumption cars for economic rather than environmental reasons. The 1980s were characterised by the increasing market penetration of small and compact cars that contributed to reducing average fuel consumption as well as the average real price, weight and size of European cars (Freyssenet et al. 1998; Loubet 2001; Moguen-Toursel 2004). The introduction of US standards for air pollutants was expected to raise the acquisition and ownership costs of these entry-level market cars as well as national fuel consumption and oil imports. The focus on fuel economy also concerned German premium car manufacturers that, during this period, significantly increased the share of diesels in their sales – from 13 per cent to 23 per cent between 1980 and 1985 – mainly to professionals, in particular taxi drivers and sales representatives who were demanding more fuel efficient large cars.

As a result of this trend that favoured fuel consumption over air quality, when the Euro norm for air pollutants was finally introduced in 1992 it was much less demanding than the equivalent US standard. The Euro norm was not calculated on average fleet sales, as was the case for the US standard, but only as a series of limit values for air pollutants per vehicle category that were, on average, 30-40 per cent weaker than those set by the US standard. Also, starting with the Euro 2 norm, introduced in 1996, diesel engines benefited in Europe from weaker limits for NOx than petrol engines, while this was not the case in the US (Blumberg and Posada 2015). Finally, US standards were regulated by the EPA that carried out random tests each year on 15 per cent of the models on sale to check if their emissions corresponded to those certified by their car manufacturers, while the Euro norm was managed by the European Commission Directorate General (DG) in charge of Enterprise and Industry (not by the DG in charge of Environment). Furthermore, its application was delegated to Member States with no ex post verification by any autonomous European authority. While weaker environmental regulation benefited the generalist manufacturers, it also opened the way towards more diesel.

As we will see later, this weaker regulatory infrastructure created loopholes that could be exploited by car manufacturers to manipulate test results without any real control by a European-wide regulator. In terms of trajectory, it also opened up the possibility to make more systematic usage of diesel engines when the European Union increased its requirements in terms of fuel economy.

In the 1990s, diesel engines were no longer confined to large cars for professional use: they became the main technological solution to meet the voluntary CO_2 target in 2008 (set at 140 CO_2 gr/km), agreed by the European

Automobile Manufacturers' Association (ACEA) in 1998, and then the mandatory EU targets of 2015 (set at 130 CO_2 gr/km for average new car sales). When Dieselgate erupted in 2015, diesel models represented more than half of the total sales of European new cars and more than 40 per cent of the total fleet.

Because of this historical interplay between different environmental standards and company strategies, Europe was on a unique trajectory in comparison with any other major market for cars. In the US and China, diesel cars were almost non-existent, with market shares below 2 per cent.

1.2 Premium vs. generalist: the political struggle over the Single Market rules in the 1990s

In the previous section we saw how both the European and the US markets for new cars were characterised by specific trajectories in terms of product mix and technological choices. In both cases, our analysis shows that the role of consumer preference, often evoked to justify these divergent trends, and the inherent transformations of markets towards larger and more powerful/polluting cars was much less important than generally assumed. In the US case, when stricter Corporate Average Fuel Economy targets and high petrol prices became the norm in the 1970s, consumers rapidly shifted their preference towards smaller and fuel efficient compact cars whose market penetration could only be stopped by freezing the market shares of Japanese car manufacturers over four years (between 1981 and 1985).

We propose to introduce the notion of 'conception of control' to characterise what happens and what is at stake in this type of regulatory struggle. We then use this notion to understand the genealogy of the European regulatory framework for new cars that emerged with the creation of the Single Market in 1992 and the institutional causes of both Dieselgate and of the current accelerated transition towards electrification.

The idea of 'conception of control' was developed by the economic sociologist Neil Fligstein (Fligstein 2001; Fligstein and McAdam 2012; Fligstein 1990). It refers to the cultural framing of how companies are supposed to behave and compete in any given market so that competition does not disrupt the market structure but rather reproduces it. Conceptions of control are historically defined by the dominant actors in a given market and are reflected in its institutions and therefore also in its environmental regulation. Once established, conceptions of control are resilient but can occasionally be destabilised in times of crisis. During these historical conjunctions, 'challengers' – smaller firms with different types of products or services, foreign competitors and 'invaders' from other sectors – may try to establish a different conception of control in the market. When this happens, political struggle follows over the definition of the regulatory framework. 'Incumbents' try to re-establish the status quo via government intervention; while 'challengers'

try to institutionalise new conceptions of control. Once these struggles are resolved either way, a new phase of stability follows, characterised again by strong institutional and cultural path-dependency.

In the case of the 1970s crisis in the US, the ‘challengers’ were the Japanese car manufacturers that sold compact cars whose price, quality and fuel economy could not be matched by US car manufacturers. The political response was to re-establish the status quo by creating the light trucks protected market and bringing back fuel prices to pre-crisis levels. Eventually, the Japanese ‘challengers’ dropped their alternative conception of control in the 1980s when they started to produce larger cars and light trucks in North America.

In Europe the structuring of a conception of control was more complex because, before the creation of the Single Market from 1992, two different conceptions of control co-existed in the Common Market and had been institutionalised in different national markets (Jullien et al. 2014). The battle over environmental standards for air pollutants illustrates the two blocs that challenged each other and their respective conceptions of control.

On the one hand, there were the producers of large and luxury cars in Sweden, but mainly in Germany, that were pushing for the highest technological solution – the three-way catalytic converter and the use of unleaded petrol. On the other hand, there were the producers of small and compact cars from Italy and France that were looking for alternative low cost solutions – improving fuel quality, using lead traps, developing cleaner compact engines and also introducing a European harmonised speed limit to reduce air pollution (Moguen-Toursel 2006, 2004).

1.3 From the Common Market to the Single Market

With the creation of the Single Market, Europe had to choose between the two conceptions of control and decide how to regulate the market for new cars in each and all Member States. These political decisions (and struggles) concerned the harmonisation of technical regulations, including environmental standards, and the definition of supranational trade policies and competition rules.

1.3.1 Technical standards: towards an international upmarket harmonisation

Before the creation of the Single Market, French and Italian generalist car manufacturers managed to contain the pressure towards higher technical standards (in line with US standards) exerted mainly by German car manufacturers (Ramirez Pérez 2010). Their arguments in favour of affordability both in terms of acquisition cost and usage cost (fuel economy) carried weight not only within their own governments but also at European

level (Jullien et al. 2014). In addition, the absence of EU type approval for motor vehicles meant that each Member State retained a form of national control over technical regulations. With the creation of the Single Market, the need to harmonise European technical regulations towards unique standards and avoid any disruption of the free circulation of goods meant that the coexistence of the two conceptions of control became problematic. The introduction of the Euro norm in 1992 marked a victory for the premium conception of control. It also established a cultural hegemony of premium car manufacturers over European technical and environmental regulations as tools for promoting and diffusing technological innovation (Moguen-Toursel 2004; Ramirez Pérez 2010; Bergquist and Näsman 2021).

1.3.2 Trade policies: from the European fortress to free trade

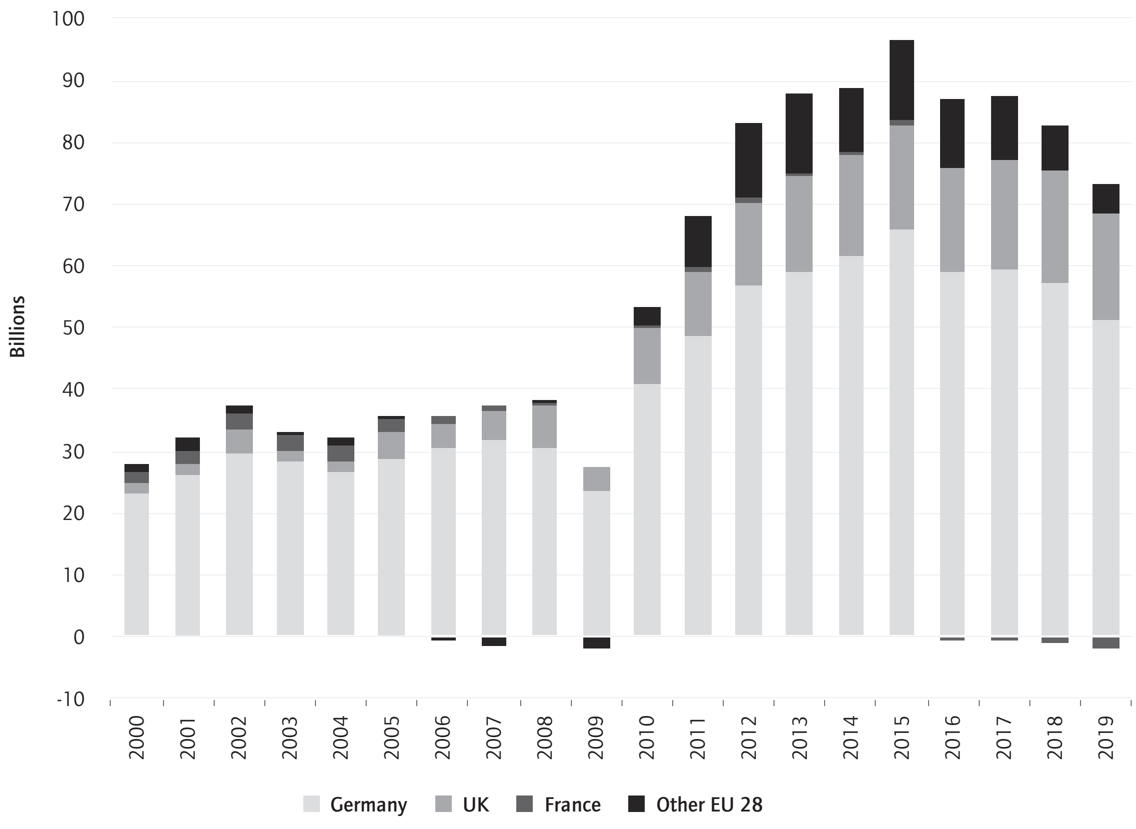
Premium car manufacturers had relatively small shares of their domestic markets (due to the high price of their models) and were therefore historically dependent on exports to achieve economies of scale. Generalist car manufacturers had large market shares in their domestic markets (over 70 per cent in the case of France and Italy) and their priority was to protect these markets against direct price competition from foreign importers. The process of European integration represented a middle ground between these two conceptions of control. The Common Market had provided premium car manufacturers with more opportunities for exporting their high margin cars than for generalist car manufacturers but it still protected the domestic market shares of the latter (Jullien et al. 2014; Pardi 2010).

When in 1989 the European Commission started to negotiate the conditions of access to the Single Market for Japanese car manufacturers, a fierce struggle began between the partisans of the two conceptions of control (Jullien et al. 2014; Seidenfuss and Kathawala 2005). French and Italian car manufacturers wanted to preserve the European fortress – they were acting as 'incumbents' pleading for the reestablishment of the status quo. What they wanted was to establish a renewable quota that would freeze imports and regulate or even prevent Japanese direct investment in Europe. The German car manufacturers, but also a majority of European countries, including now the UK, were only ready to accept a temporary EU quota on Japanese sales. Such a quota was meant to give the European automotive industry time to modernise and become more competitive without compromising the expected benefits of the Single Market to spur competition and increase efficiency in the automotive sector (Jullien et al. 2014). Eventually, after two years of intense negotiations, a quota on Japanese sales was negotiated, fixing at 16 per cent of the Single Market the maximum market penetration of Japanese brands in 1999 from a starting point of 11 per cent in 1992 (Gandillot 1992).

The temporary and exceptional character of the Japanese quota also meant that EU trade policies were now evolving towards greater trade liberalisation and less protection. After the expiry of the quota the European Commission began to negotiate a fast-increasing number of free trade agreements in the

2000s and 2010s, including with countries such as Mexico, Korea and Japan that were amongst the main global exporters of motor vehicles and auto parts. These policies have been generally considered a success in the automotive sector as the EU trade surplus in motor vehicles significantly increased from an average of around 30 billion euros in the 2000s to more than 80 billion euros in the 2010s. Yet, almost the entirety of this surplus came from Germany and was made by premium car manufacturers (72 per cent of the EU28 total and 95 per cent without the UK in 2020) while generalist car manufacturers in France and Italy rather suffered from these measures: not only did they eventually run trade deficits with non-European countries in automotive vehicles (see Figure 2 below) but also the sale of foreign brands in Europe steadily increased from 16 per cent in 2000 to 25 per cent of the EU market in 2020.

Figure 2 **Extra EU28 trade balance in motor vehicles, 2000-2019, in billions of euros**



Source: Eurostat.

1.3.3 Competition policy and industrial policy

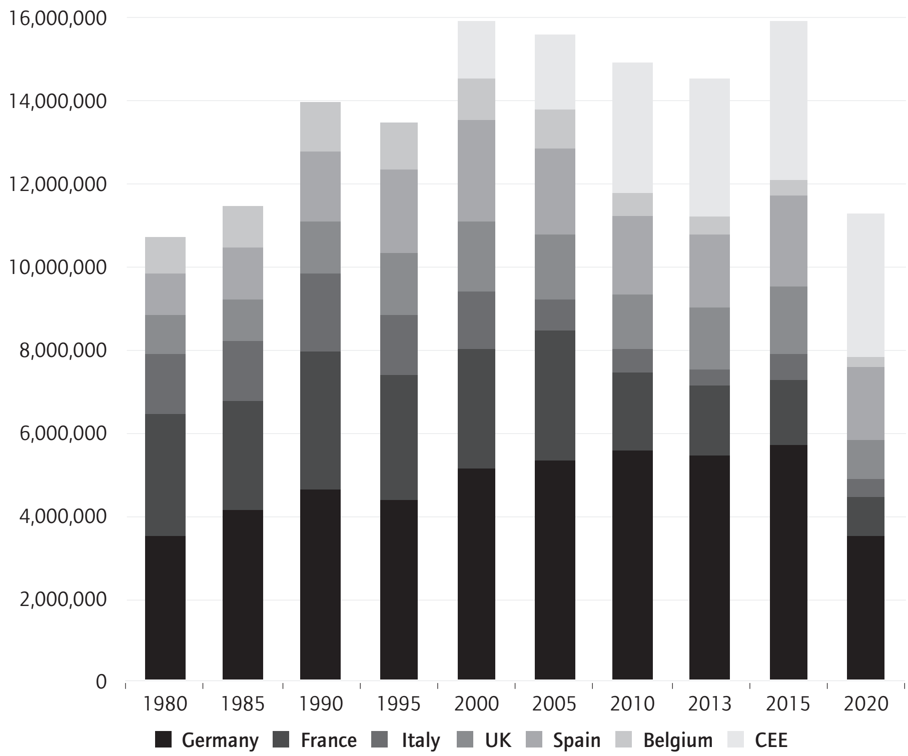
A third key contested ground between the generalist and premium conceptions of control in Europe was the articulation between competition policy and industrial policy. The competition policy of the European Union was historically shaped by German ordo-liberalism and promoted as such by DG Competition (Warlouzet 2008). Ordo-liberalism confers a strong role on the state in order to guarantee market competition, but the state should only act as arbiter and not intervene in the economy to develop or protect any industrial sector. Industrial policy, in contrast, pushes the state to intervene in the economy for either social reasons (protection of employment, development of lagging regions) or strategic ones (supporting and developing key economic sectors).

In the 1970s and 1980s, in a context of economic crisis marked by the two oil shocks, generalist car manufacturers in France, Italy and also the UK were greatly reliant on industrial policies that supported their national champions via state aid, recurring currency devaluations and different kinds of protectionist measures including nationalisations when key companies like British Leyland or Renault had almost gone bankrupt. But with the signature of the Single European Act in 1986 the pressure from Germany and other northern European countries, now including the UK under Margaret Thatcher, to reinforce supranational competition policy and limit the level of state intervention in southern economies increased. The push for stronger European competition policies occurred in an ideological context marked by the diffusion of neoliberal ideas that wanted to limit the role of the state and let the economy be driven only by the free market (Warlouzet 2008). Eventually, the Maastricht Treaty of 1992 placed the Single Market under the control of DG Competition and drastically reduced the scope of vertical industrial policies (and the influence of DG Enterprise and Industry) (McGowan 2007; Kassim 1996): it banned direct state aid to individual companies; it limited annual state deficits to 3 per cent of GDP; and it set the stage for the introduction of the Euro currency in 1999 that would take away the exchange rate as a tool to restore cost competitiveness in manufacturing.

As we can see in Figure 3, the relative national shares of the EU production of passenger cars remained fairly stable through the 1980s and 1990s despite several crises and increasing import penetration.

With the new institutional order established by the Single Market, premium car manufacturers gained market shares (increasing by 48 per cent between 2001 and 2020) and increased production in their host countries, particularly in Germany as well as in central and east European countries where new capacities were installed during this period. On the other hand, the market shares of generalist car manufacturers came under strong pressure (declining by 37 per cent between 2001 and 2020) and production collapsed in their host countries (Jullien et al. 2014; Pardi 2017).

Figure 3 **European production of passenger cars by country, 1980-2020**



Source: CCFA, ACEA, OICA.

The Single Market and its new institutional order offered generalist car manufacturers new opportunities to compensate for their declining market shares and margins. These consisted in reducing production costs, labour costs in particular, by relocating manufacturing to the low wage Member States of central and eastern Europe, integrated in the European Union since 2004, and to ultra low wage countries (such as Morocco, Algeria, Turkey or Ukraine) integrated in the EU customs union during the same period (Pavlínek et al. 2017; Jullien and Pardi 2013).

Premium car manufacturers also reduced production costs in their domestic bases by shifting the manufacture of lower value added sub-assembly parts to these countries (Fana and Villani 2022).

These massive processes of relocation in both automotive assembly and sub-assembly have structured a European regional value chain in which the new Member States have been integrated as low wage and low value added assemblers and suppliers for western and global transnational original equipment manufacturers (OEMs) (Pavlínek 2020; Pavlínek et al. 2017).

The comparison with the integration of Spain and Portugal in 1986 can be useful here to highlight what changed between these two periods of European enlargement.

1.3.4 European enlargement: from market seeking to efficiency seeking

Spain and Portugal were both low wage countries with an early specialisation in automotive manufacturing and could have been used by transnational car manufacturers to relocate production and drive down labour costs in Europe. But this did not happen. In the fifteen years following their integration in 1986, automotive production doubled in Spain and Portugal while the sale of new cars tripled, contributing to the overall growth of European automotive production and sales during this period (see Figure 3 above). Wages also significantly increased during this period and caught up with those of the Italian automotive industry.

In contrast, while central and east European countries also benefited from access to the Single Market via structural funds and FDI, they were not able to retain vertical industrial and trade policies to protect and develop their domestic industries and markets.

Without the possibility of deploying sectoral industrial policies, their economies became completely dependent on the investments and strategic decisions made by foreign transnational companies: the average rate of foreign ownership of automotive industries in central and east European countries is well above 90 per cent against 80 per cent for Spain and Portugal and between 10 per cent and 20 per cent for France, Italy and Germany (Pavlínek 2022, 2018).

Low production costs became a condition for keeping FDI flowing. Moreover, the industrial relations systems in these automotive industries could not be institutionalised at national level: collective bargaining takes place at company level with very weak and scattered union representation (Drahokoupil and Myant 2016; Beblavy et al. 2011). As shown by Fana and Villanni (2022), between 2005 and 2015 the share of profit in the value added imported by western European automotive industries from central and east European countries significantly increased: in France, for instance, the share of imported profit in total profit increased from 34.3 per cent to 52.5 per cent. Much of the productivity gains generated by FDI and the modernisation of automotive production in central and east European countries in the 2000s and 2010s were not distributed to workers.

Finally, the early attempts by central and east European governments to protect and develop their domestic markets for new cars were systematically shut down by the European Commission (DG Trade and DG Competition) and by the European Court of Justice (Pardi 2018).

As a result of this neoliberal form of European enlargement (Drahokoupil and Horn 2008), in the fifteen years following the integration of central and east European countries, the production of new cars in these countries exploded as a result of massive FDI, growing by 160 per cent; while the sale of new cars increased by only 30 per cent from post-Soviet levels.

2. From the Single Market to the Dieselgate scandal: the role of CO_2 emissions regulation in the 2000s

At the beginning of the 2000s the premium ordo-liberal conception of control was almost fully endorsed by the European Commission. When in 2006 the Commissioner for Enterprise and Industry, Günter Verheugen, addressed the European Parliament on the topic of the restructuring of EU industry, his speech 'Competitiveness – the answer to restructuring and competition' sounded like an ordo-liberal manifesto, emphasising the need for a strong industry in Europe, but no longer supporting 'non competitive' European national champions.[1]

The European Commission also created in 1995 a 'high-level' group called CARS 21 whose purpose was to provide the technical groups and committees of the Commission with a consensual view of the regulations that would 'boost the competitiveness of the European automotive industry' (Klüver 2013). The CARS 21 report, published in 2012, endorsed the upmarket drift of European cars as the only solution to the crisis of the sector. It advocated the German model based on premium cars, high technology and exports to emerging countries for the whole of Europe.[2] The influence of the German automotive industry over the shaping of EU regulations for the automotive sector during this period and beyond has been well established in the literature (Klüver 2013; Gössling et al. 2016; Haas and Sander 2019; Batho 2016; Katzemich 2018; Nowack and Sternkopf 2015).

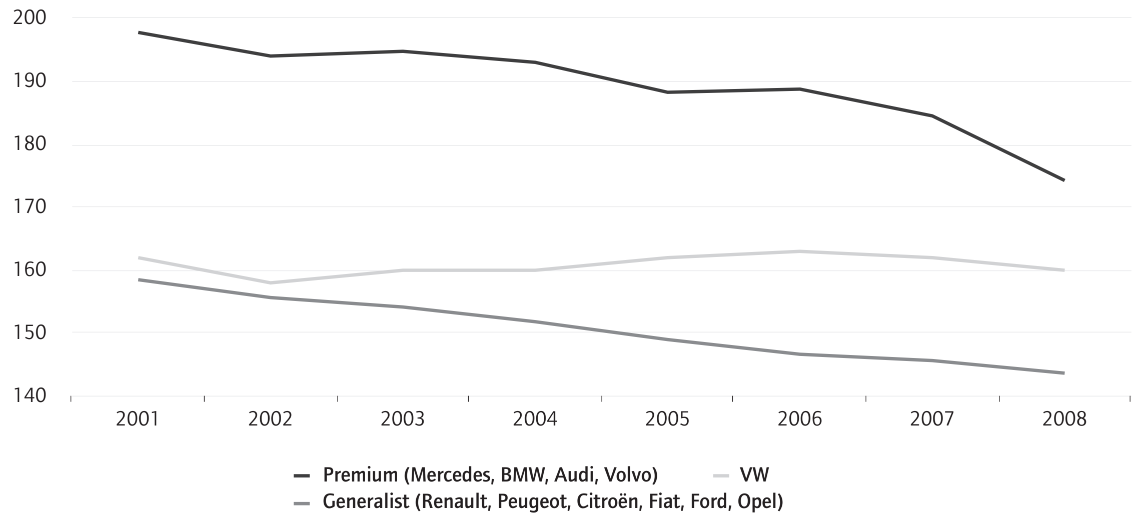
However, if the premium German manufacturers clearly emerged from the 1990s as the 'incumbents' with strong cultural and political influence over EU regulators, they were also confronted with a significant disruptive threat to this new institutional order. The ACEA had agreed in 1998 to a voluntary CO_2 target of 140 CO_2 gr/km for 2008 and of 120 CO_2 gr/km for 2012. But by 2005 it had become clear that the European car manufacturers would not reach the target. The issue concerned almost exclusively the German premium car manufacturers and Volvo.

1. Debate in the European Parliament on the restructuring of EU industry, Brussels, 4 July 2006, quoted by Houben (2016: 228).
2. See also: https://gerpisa.org/node/1526.

2.1 The emerging structural contradiction between premium cars and CO_2 emissions reduction

As we can see in Figure 4 below, generalist car manufacturers made the required efforts to reduce their CO_2 emissions and were on their way to achieving the voluntary target of 140 gr/km. By 2008, Fiat, Citroën, Peugeot and Renault had succeeded in bringing their average CO_2 emissions to or below 140 gr/km; Opel (149 gr/km) and Ford (151 gr/km) had failed, but by a much smaller margin than VW (160 gr/km) and the premium brands (174 gr/km).

Figure 4 **Average CO_2 emissions (gr/km) of new cars sold by groups of European brands, 2001-2008**



Source: EAE, ICCT.

On 7 February 2007, the European Commission published the results of the review of the CO_2 reduction strategy. The Commission found that the agreed, but voluntary, target of 120 CO_2 gr/km 'will not be achievable by 2012' (European Commission 2007: 7). The new proposal consisted of making the 120 CO_2 gr/km reduction target binding by 2012. This represented a major threat to premium car manufacturers.

Ten years earlier, when the targets had been negotiated, German manufacturers tried to have the target expressed in terms relative to existing emissions (a 25 per cent reduction) whereas French companies agreed that the voluntary target should be expressed in grammes per kilometre (Wagner 2009: 277).

As we have seen before, the producers of heavier and more expensive premium cars had a clear advantage when it came to reducing air pollutants. The expensive technology they had pioneered for both petrol and diesel engines – the catalytic converter – consisted in filtering the pollutants so that their actual volume was not a factor. In contrast, the volume of CO_2 depends on the

amount of fuel consumed: heavier and more powerful cars, which structurally consume more fuel, also emit more CO_2.

The reason why premium brands had failed to reach the 2008 voluntary target was quite straightforward: their average car sold in 2008 weighed 1622 kg, 100 kg more than in 1998 and 328 kg more than the average car sold by generalist brands. Even if they sold more diesel models (69 per cent of their sales) than generalist brands (53 per cent) this was not enough to compensate for the extra weight and engine power. On average, a 10 per cent increase in weight leads to a 7 per cent increase in fuel consumption (IEA 2019). Furthermore, heavier cars need more powerful engines that also lead to higher fuel consumption: on average, a 10 per cent increase in engine power leads to a 5 per cent increase in fuel consumption (ICCT 2017; Tietge et al. 2019).

This trend highlights a fundamental contradiction between, on the one hand, upmarket drift – towards more expensive, more sophisticated, more powerful and heavier cars – and, on the other, the institutionalisation of a regulatory-driven reduction of CO_2 emissions by the European Commission to fight global warming and climate change from 1998.

As we have started to see, in Europe the delayed introduction of stricter air pollutant standards allowed for the diffusion of a different technological solution: the diesel engine. Diesels were perfectly coherent with the premium conception of control because they improved the fuel economy of large cars. Nevertheless, they presented two major problems, in particular if they had to diffuse to the other segments of the market:

1. Their 27-37 per cent fuel economy over equivalent petrol engines (IEA 2019: 46) came at the price of ten-twenty times more NOx emissions and, while catalytic converters had temporary solved the issue for the first lax Euro norms (1 and 2), it was clear that, with the expected evolution of these towards stricter standards (see Figure 7), it would become much more difficult and expensive to homologate diesel cars, in particular in the lower-medium segments;
2. Diesel engines were more complex and expensive than petrol engines so that diesel models cost on average between 9 per cent and 21 per cent more than equivalent petrol models (IEA 2019); being more expensive, they also tended to be heavier and more powerful, offsetting most of their fuel economy (T&E 2017).

The dieselisation of European sales thus implied a trade-off between CO_2 reduction and air pollution that was not compatible with the evolution of Euro norms towards stricter standards (it would eventually result in real emissions of NOx being, on average, five times higher than the Euro 6 limit – see Figure 7 below). At the same time, dieselisation did not resolve the contradiction between the premium conception of control and the reduction of CO_2 emissions as it pushed the European supply of new cars further upmarket.

2.2 The French-German political struggle over weight-based standards

The creation of the high-level CARS 21 group in 2005 was meant to build consensus inside the ACEA and the Commission on new regulatory standards, in particular on new environmental standards compatible with the premium conception of control. The group notably argued for the introduction of weight-based CO_2 targets. These targets would still be expressed in grammes per kilometre, as proposed by the Commission, but with adjustments in respect of the average weight of the cars sold by each brand. French and Italian manufacturers were not ready to make concessions on this as weight-based targets meant that the producers of lighter cars would have more demanding CO_2 targets than the producers of heavier ones. An intense political battle followed with the Verband der Deutschen Automobilindustrie (VDA; a trade coalition), Volkswagen and the German government progressively bypassing the ACEA, which had been paralysed by the conflict (Beez and Richter 2011: 161; Scharte 2010: 140), and directly lobbying the Commission to shift its position on CO_2 emissions targets towards the German premium conception of control.

Klüver (2013) analysed the lobbying activity that followed the publication of the initial proposal by the Commission in February 2007 and its effects on the final draft of December 2007. It showed that the most influential actor during this first phase was the VDA, whose demands were largely integrated by the Commission in the final draft of the regulation: the CO_2 target was weakened from 120 to 130 CO_2 gr/km; weight-based targets with a 60 per cent slope were introduced;[3] vans were separated from cars with milder CO_2 targets, again to compensate for their extra weight, the full implementation of the 130 CO_2 gr/km limit was postponed to 2015; and eco-innovations would now count up to an extra CO_2 reduction of seven grammes, almost exclusively available to German premium car manufacturers. Also, the amount of the penalty was significantly reduced for the first three grammes beyond the target, providing further flexibility for premium car manufacturers. With the only exception of the longer-term target of 95 CO_2 gr/km for 2020 being maintained, Regulation 443/2009 of 23 April 2009 'bore an unmistakeably German hallmark' (Haas and Sander 2019: 18).

As highlighted by the environmental NGOs involved in the negotiation, the introduction of weight-based CO_2 targets had crucial implications for the whole European automotive industry:

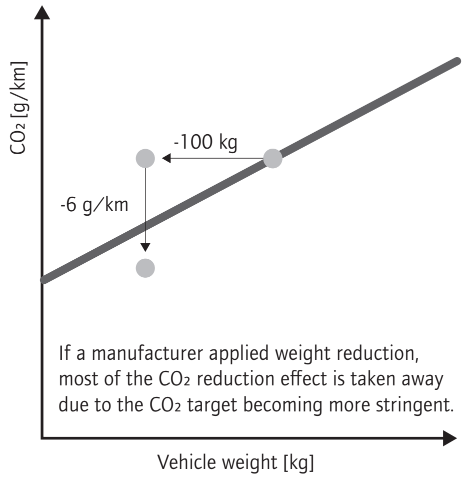
> Weight-based CO_2 standards for cars are a very bad idea for the following reason: they punish positive action. Carmakers who reduce their vehicles' weight (one of the most important paths to cutting CO_2 emissions) would be faced with a stricter CO_2 standard. Therefore, they do not help to break the trend towards ever-heavier vehicles, which is

3. VDA asked for an 80 per cent slope while French car manufacturers tried to negotiate one of 30 per cent (Nowack and Sternkopf 2015).

> one of the major reasons why car CO_2 emissions have not come down quickly enough in recent years. (T&E 2007)

Premium car manufacturers had thus obtained a CO_2 regulation that not only did not penalise the upmarket drift towards heavier and more powerful cars but which also penalised those car manufacturers that did not follow it (see Figure 5).[4] Regulation was therefore now pushing the entire industry in the exact opposite direction of what should have been the logical approach to increasing fuel economy: reducing the mass and the engine power of new cars (IEA 2019; Serrenho et al. 2017; ICCT 2017; T&E 2007).

Figure 5 **The weight-based target system**



Source: ICCT.

Upmarket drift, which was in clear contradiction to the 2008 CO_2 voluntary target, was now institutionalised as the only way of achieving the CO_2 binding targets for 2015 and 2020. Only more diesels, more direct injection petrol and more 'eco-innovations' could deliver the expected CO_2 reductions. However, all these expensive technologies contributed to increasing the price, weight and power of cars. It was an impossible equation. The contradiction that already existed between the premium conception of control and the reduction of CO_2 emissions was now enforced via the EU regulation on generalist car manufacturers as well, putting the whole European automotive industry against the wall of the Dieselgate scandal.

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4. 'The Regulation does include a modality to ensure that any overall increase in the weight of all vehicles sold does not weaken the overall target. However, this is done by lowering the targets of all companies uniformly, so that the penalty of increasing mass is shared across all carmakers, whether or not they sell heavier cars.' (T&E 2007: 23).

3. Regulatory upmarket drift: the 'wrong way' to reduce CO_2 emissions

Upmarket drift can be seen as the consequence of the growing regulatory pressure towards the most advanced and demanding technical and technological standards concerning safety, quality and pollution. This was historically advocated by premium German car manufacturers to harmonise EU standards with US ones and it has been progressively institutionalised at EU level since the creation of the Single Market.

The institutionalisation of this increasing regulatory pressure was coherent with the ordo-liberal regulation of two other key policy domains that shifted from national control to EU control since the Maastricht Treaty of 1992: trade policy, which favoured the export of high value added products; and competition policy, which provided the tools for reducing the production costs of these products inside the EU.

Upmarket drift has already been identified as one of the causes of Dieselgate (T&E 2017). But it has been mainly attributed to a combination of corporate greed – pushing higher value added products to increase margins and profits even though these cars were structurally higher polluting – and consumer preference for larger and more powerful cars (T&E 2018: 32).

When we look at car manufacturers, going upmarket is a natural strategy for premium brands, because they extract value from selling more expensive cars to wealthy consumers, but not for the generalist brands that have historically controlled the European market. These brands were successful in going downmarket by selling larger volumes of smaller, lighter, cheaper cars such as the Fiat Panda, the Renault Twingo, the Peugeot 205, the Opel Corsa and the Ford Fiesta on which the profitability of these car manufacturers depended in the 1980s and 1990s (Freyssenet et al. 1998; Loubet 2001; Volpato 2009; Tolliday 2003).

If generalist car manufacturers started to make heavier, bigger and more expensive versions of these models in the 2000s, it was because they had now to comply with a premium regulatory framework, notably reinforced by the 2009 regulation on CO_2. That they did so out of necessity rather than choice can be deduced in that the more they went upmarket, the more their sales declined (see Figure 11 below). By going upmarket, generalist brands were not only moving away from their customer base but they were also trying to squeeze expensive premium technologies into lower margin cars. They struggled to make profits and relocated most of their production to low

wage countries inside and outside the EU to reduce costs (Jullien et al. 2014; Pardi 2017, 2019).

Yet, almost all the generalist carmakers went through major crises during this period and have had to be rescued by their governments and/or merged with other carmakers to survive. Opel, Fiat and PSA merged under the control of PSA to create Stellantis in 2021; while Renault obtained a loan of 5 billion euros from the French state to survive the Covid-19 crisis but announced cuts of 15 000 jobs in 2020.

In contrast, during this same period, premium car manufacturers regularly increased their market shares and preserved profitability and employment.

When we look at consumers, we see that what changed with upmarket drift was not consumer preference but consumer composition. As the average European car became more expensive, sales shifted towards the wealthier northern European countries where consumers tend to buy larger and more powerful cars than consumers in southern European countries. Also, inside each national market, sales shifted towards wealthier and older households that tend to buy more premium large cars. Finally, households in general have seen their capacity to buy new cars in Europe decline, with most sales shifting towards company cars where, once again, premium models tend to be overrepresented because of their higher residual values.

3.1 The average European car between 2001 and 2020: heavier, more powerful, more expensive and more polluting than before

Figure 6 below shows the evolution of the main characteristics (mass in running order, engine power and CO_2 emissions in the homologation test and on the road) of the average car sold in the Single Market between 2001 and 2020.

Upmarket drift was initially linked with the dieselisation of sales that equally concerned all brands (see Figure 12 below). As diesel market share increased, from 36 per cent in 2001 to 53 per cent in 2007, mass increased by 9 per cent (110 kg) and engine power by 16 per cent (12 kW). As a result of this trend, the fuel economy generated by dieselisation was completely offset by the extra weight and power. While the tested CO_2 emissions (on the basis of the New European Driving Cycle (NEDC)) slowly diminished during this period in a late attempt to meet the 2008 voluntary target (a reduction of 6 per cent), this was due almost exclusively to test-oriented optimization practices[5], while

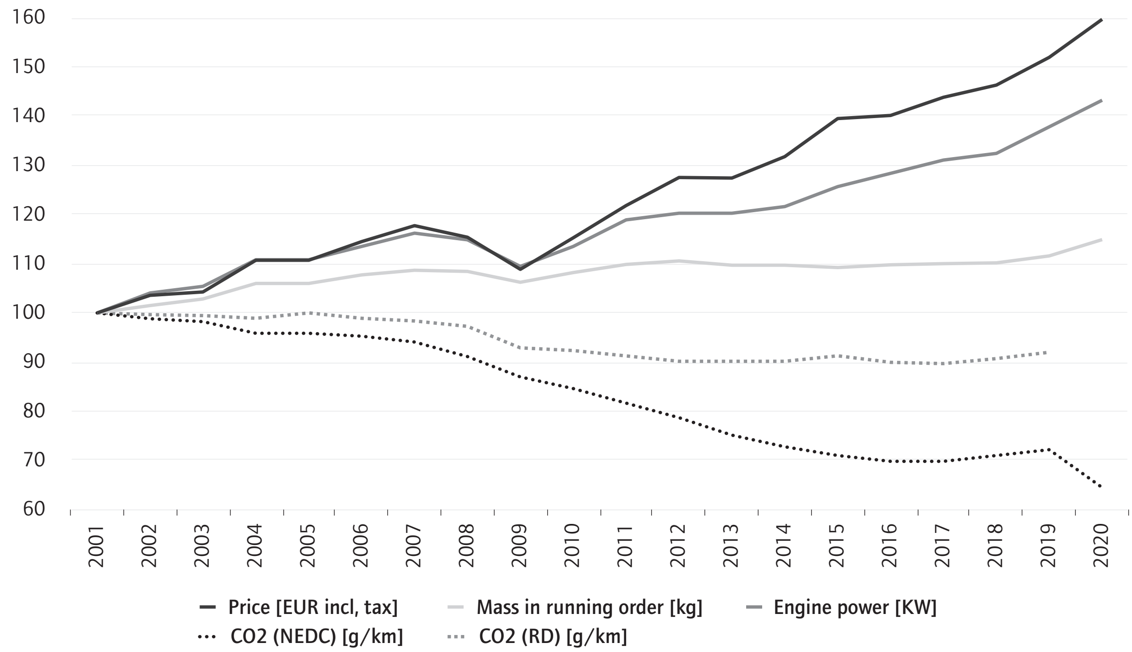
5. Test-oriented optimization builds on exploiting 'flexibilities' permitted by the NEDC in order to obtain favourable test results (as e.g. short test cycles, non-realistic vehicle preconditioning (Tietge et al. 2019)

Real Drive CO_2 emissions decreased by only 2 per cent. The optimisation of tests is measured by consumer associations that collect data on real fuel consumption from private owners of cars (a detailed presentation of this data is available in Tietge et al. 2019). According to these sources, during this period the optimisation rate doubled from 8 per cent to 16 per cent, mainly driven by premium brands and diesel models (Tietge et al. 2019).

The impact of the 2008-09 financial crisis temporarily reversed upmarket drift. Thanks to the generous scrappage schemes made available in all major European markets to sustain demand, and thanks also to the introduction of environmental bonuses for lower consumption cars, middle class owners of old second-hand cars were given the opportunity to buy (again) new cars. They massively opted for cars that were cheaper, lighter and less powerful than the average, and which were mostly petrol, pushing downmarket the average car sold in 2009: in one year, it became 1300 euros cheaper (6 per cent) and emitted 8 CO_2 gr/km less (according to Real Drive data) than in 2008.

The exceptional situation of 2009 shows how virtuous a downmarket drift of the European sales of new cars can be for environmental and social reasons. It also shows that upmarket drift had not been due to consumer preference but to consumer composition.

Figure 6 **The average new car sold in Europe (price, mass, engine power and CO_2 emissions), 2001-2020**



Source: EEA, ICCT, author's calculations.

After the establishment of binding CO_2 targets in 2009 for 2015, even with the advantage of weight-based targets that were coherent with the premium conception of control, premium car manufacturers still had to reduce their emissions significantly (from 168 gr/km to 138 gr/km – a drop of 17 per cent). But they could rely on further dieselisation (from 70 per cent of sales to 78 per cent) and the rapid increase in the share of direct injection petrol models (from 43 per cent to 92 per cent).[6]

For generalist car manufacturers the task was somehow less demanding (from 140 gr/km to 122 gr/km – a drop of 13 per cent) but it was much more difficult for them to expand dieselisation in a context of crisis (their share of diesel models actually declined from 53 per cent to 49 per cent) also due to the introduction of the Euro 5 norm in 2009 and Euro 6 in 2015. These lowered the emissions limits for NOx gr/km, significantly increasing the relative cost of homologating diesel models in the lower segments.

As a result of these different strategies, after again increasing rapidly between 2009 and 2012, the mass of the average European car stabilised at around 1400 kg before starting to rise again at the end of the decade. Nevertheless, upmarket drift did not otherwise stop: the average European car became longer (10 cm), wider (4 cm) and taller (2 cm) between 2008 and 2019, and also much more expensive (from 23 147 euros to 30 485; a rise of 32 per cent); the share in total sales of automatic transmission and four-wheel drive vehicles, which also add weight and CO_2 emissions, rose from 13 to 41 per cent and from 9 to 15 per cent respectively during this period; and engine power increased by a further 20 per cent.

As in the previous period, the net result of this contradictory trend was an increasing difficulty in achieving the anticipated CO_2 reductions. As remarked by Skeete (2017: 379), 'it would appear that part of OEMs' difficulty in hitting emissions targets is self-inflicted'. But this time the industry did not have the luxury of failure due to the binding nature of the targets. The industry's answer consisted of using new technologies further to optimise fuel consumption and CO_2 emissions in the homologation test in order progressively to meet the 2015 average target of 130 CO_2 gr/km.

As we can see in Figure 6 above, the optimisation rate of homologation tests (NEDC) by comparison with real drive conditions (RD), which had already doubled between 2001 and 2008 from 8 to 16 per cent, reached 40 per cent by 2015. This accelerated progression was the result of the diffusion of optimising technologies and techniques from premium to generalist car manufacturers via the introduction of new models (T&E 2018; Tietge et al. 2019). In general the optimisation rate remained much more important for the heavier cars of premium brands (46 per cent) and for diesel models (41 per cent) than for the

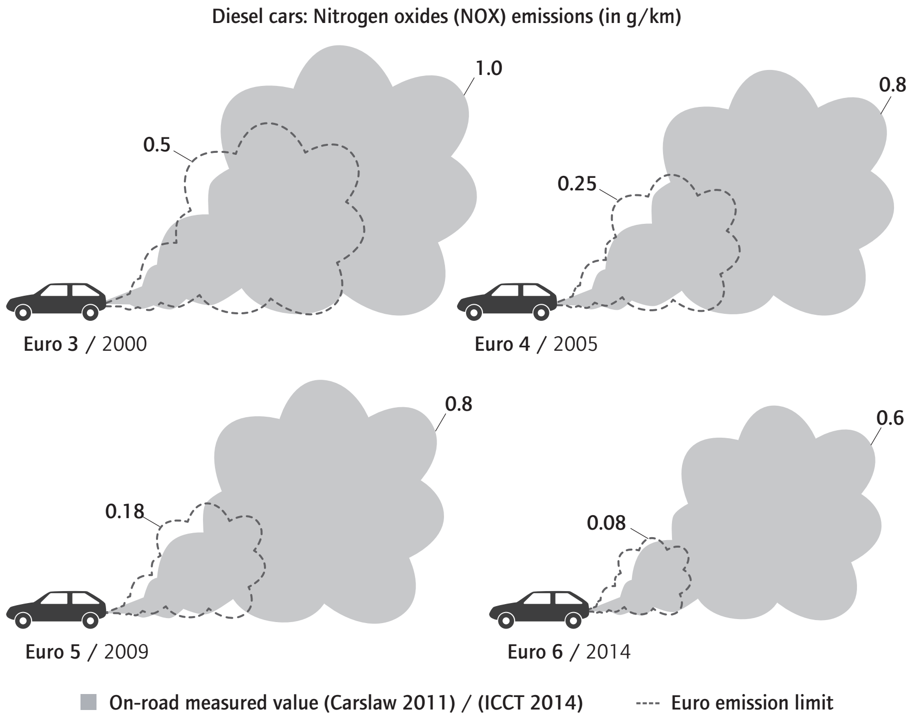
6. Direct injection petrol can reduce the CO2 emissions of petrol powertrains by up to 14 per cent.

lighter cars of generalist brands (37 per cent) and for gasoline models (35 per cent) (Tietge et al. 2019: 8-13, 33).

The fast increase of optimisation in this period was not the result of a progressive fine-tuning of the test procedure by the car manufacturers, as in the previous period, but the consequence of the deliberate introduction of new models equipped with 'cheating' devices capable of manipulating the test results. For instance, the average optimisation rate of CO_2 emissions of the VW Passat, one of the highest selling models in Europe, passed from 5 per cent to 33 per cent in just two years after the introduction of a new model in 2009 (Blumberg and Posada 2015: 22).

Generalist car manufacturers were not less 'guilty' than premium car manufacturers; they simply needed to optimise the tests less because their cars were structurally less polluting. In contrast, when it came to optimising the homologation tests for NOx to make their cheaper diesel models compliant with the Euro 5 and Euro 6 norms, they could not 'afford' the more sophisticated after-treatment technology used by premium brands (Klebaner 2019). Consequently they did not hesitate to optimise the tests, by more than 500 per cent on average and by up to 1200 per cent for the cheapest diesels available from Renault, Dacia and Fiat, versus 200-500 per cent for the German premium brands.

Figure 7 **Optimisation rate of NOx emissions in Euro 3, 4, 5 and 6 for average European diesel cars, 2000-2014**



Source: ICCT (Blumberg and Posada 2015: 20).

While there is no moral justification for the behaviour of the European automotive industry (including the foreign brands operating in Europe), it is also important to stress how this reprehensible outcome was the logical consequence of the institutionalisation by the European Union of upmarket drift.

Between 2001 and 2015, the average European car gained 10 per cent of mass and 26 per cent of engine power which was structurally equivalent to an increase of 21 per cent of CO_2 emissions. During the same period, the automotive industry was supposed to reduce CO_2 emissions by 20 per cent, from 169 gr/km to 135 gr/km (NEDC). This extra 21 per cent of emissions generated by upmarket drift meant that what was really demanded was a reduction of 41 per cent. Such a reduction would not have been possible even if the entire fleet of new cars had been made up of diesel models by 2015. Eventually, the net result was a reduction of 30 per cent in CO_2 emissions: two-thirds of the reduction compensated for upmarket drift and the rest accounted for the 9 per cent effective CO_2 reduction (RD). Unfortunately, this was less than half of what European car manufacturers were supposed to achieve.

The Dieselgate scandal would probably have erupted sooner or later, since these optimisation rates were already in the public domain in Brussels amongst experts, lobbyists and regulators (Blumberg and Posada 2015). But the Commission was, at the time, relegating the debate on the introduction of more realistic homologation tests to relatively obscure technical committees where the question could have hung on for several years before some compromise was found (Batho and Rohfritsch 2016). Yet, the trigger for the scandal came from the US.

Starting from 2009, Volkswagen successfully homologated in the US some of the same diesel vehicles that barely conformed in Europe to the Euro 5 norm. Yet, the US standards were twice as stringent. How this was possible was one of the questions that started the enquiry by ICCT in 2013 that established that this was indeed not possible and that, on average, these vehicles emitted between 10 and 20 times more NOx in RD conditions than those allowed by the US regulation (Baldino et al. 2017). The European Commission could no longer turn a blind eye to the growing optimisation rates and the whole automotive industry was now ‘in the dock’.

3.2 Dieselgate and its regulatory outcomes: stricter but not different

The Dieselgate scandal had two major consequences for the European automotive industry on its way towards the 2020-21 target of 95 g/km of CO_2 set by the 2009 regulation. The first was the hardening of the regulation with the introduction of a new, more realistic homologation test in 2017, the Worldwide Harmonised Light Vehicles Test Procedure (WLTP), coupled with a Real Drive emission test meant to cut optimisation rates below 10 per cent;

and the introduction of more severe penalties in cases of non-compliance – 95 euros for each gramme beyond the limit multiplied by the total number of cars sold. The second was the complete disqualification of the main technology developed and promoted since the 1990s to achieve CO_2 reductions: diesel. Starting from 2016, diesel sales plunged and, by 2019, had fallen below 30 per cent (from 52 per cent in 2015).

Under these conditions, it was clear that the only way the European automotive industry could achieve the 95 g/km of CO_2 average target in 2020 (on 95 per cent of sales) and in 2021 (on 100 per cent of sales) was by substantially increasing the sales of electric vehicles (battery electric vehicles (BEVs); and plug-in hybrid electric vehicles (PHEVs)). Not only would sales of BEVs and PHEVs substantially reduce average CO_2 emissions, since BEVs qualified as zero CO_2 g/km vehicles and PHEVs as around 40 CO_2 g/km ones, but they would also benefit from the super-credits introduced in 2013 for the sale of cars emitting less than 50 g/km of CO_2 (zero and low emission vehicles (ZLVEs)). These counted double in 2020; as 1.66 vehicles in 2021; and as 1.33 vehicles in 2022 (with an overall cap for the three years of 7.5 g/km per car manufacturer).

Until this moment, sales of BEVs and PHEVs in Europe had been marginal: 1.4 per cent in 2017 and 2 per cent in 2018. The question was now which market share of EVs would be required to pass the cap in 2020 and 2021; and whether it would undermine the premium conception of control destabilised by Dieselgate.

The battle that started in 2017 over the new EU regulation on CO_2 emissions for cars and vans showed that premium manufacturers were still trying by all means to defend the status quo and keep the market share of EVs as low as possible. The proposal made public by the European Commission in November 2017 'had the VDA's influence written all over it' (Haas and Sander 2019: 19). The new targets for 2025 and 2030 were still expressed in percentages, meaning that the weight-based targets would be preserved. Additionally, the targets were in line with the historical gradual decline of emissions, with a 15 per cent reduction for 2025 and a 30 per cent reduction for 2030 (T&E, the main environmental NGO, had been asking for a 60 per cent reduction). Finally, no compulsory quota for EV sales was demanded, only voluntary quotas of 15 per cent ZLEVs for 2025 and of 30 per cent for 2030, both associated with policy incentives but no penalties for the car manufactures that failed to achieve them.

This time, however, the Commission faced significant opposition from the European Parliament: a coalition of 19 EU Member States led by France, Italy and Spain pushed for more stringent targets for CO_2 reduction (20 per cent in 2025 and 40 per cent in 2030) and higher quotas of ZLEVs (20 per cent in 2025 and 35 per cent in 2030) associated with severe financial penalties. Once this counter-proposal had been officially backed by the European Parliament, both the VDA and the ACEA announced that 'it could spell the end of the European automotive industry' (Haas and Sander 2019: 20).

Despite being pushed by southern European countries, generalist car manufacturers did not act as ‘challengers’ and rather followed the VDA in its attempt to preserve the status quo. It is also interesting to note that even the environmental NGOs which had denounced the weight-based targets back in 2008 were now ready to accept them if the European automotive industry was ready to go electric in exchange. For instance, in its submission to the Commission, T&E declared its position on the ‘utility parameter’ (which refers to the weight-based standards) as ‘neutral’. ICCT, the US NGO, also suggested keeping the utility parameter but asked for it to be changed from a mass parameter to a footprint one in line with the US standards for CO_2.[7]

After an intense struggle and marathon negotiations between the Commission, the Parliament and the Council, the final result was a mild compromise that hardened the terms of the Commission proposal for 2030 (a 37.5 per cent reduction target rather than 30 per cent; and a 35 per cent ZLEV quota rather than 30 per cent). Nevertheless, the ‘spirit’ of the proposal was, given the circumstances, left intact (Haas and Sander 2019: 21-22): the weight-based targets and premium eco-innovations were preserved; no change was made to the weight-based slope to allow for weight reductions; and no penalties were to be associated with missing the ZLEV quotas for 2025 and 2030.

7. The advantage of a footprint utility parameter is that it does not penalise weight reduction, although it is structurally unfavourable to producers of micro and small cars.

4. From diesels to electric vehicles: towards accelerated upmarket drift

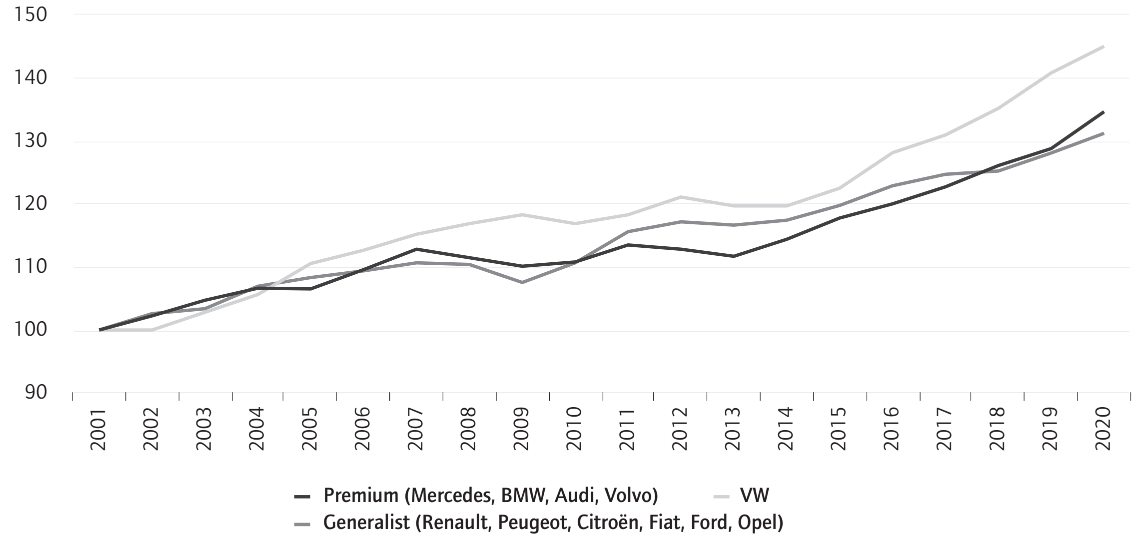
In this section we break down the data on new cars sold between 2001 and 2020 by two groups of brands: the premium group (German Mercedes, BMW and Audi (Volkswagen group), plus the Swedish Volvo), whose average car price in 2001 was €32 900; and the generalist group (French Renault, Peugeot and Citroën, Italian Fiat, US-German Ford Europe and Opel (plus Vauxhall in the UK)), whose average car price in 2001 was half of the premium price at €16 500. We consider Volkswagen separately for three reasons: it is a hybrid brand that shares platforms with a premium one (Audi); it has a price position closer to the generalist group, but substantially higher (€20 500 in 2001); and it is a brand which has gone strongly upmarket during the period studied.

We analyse first the impact on premium and generalist brands of the upmarket drift generated by the dieselisation of the 2000s and 2010s before shifting our attention to the recent electrification of new car sales in 2019 and 2020.

4.1 The divergent impact of dieselisation on premium and generalist brands

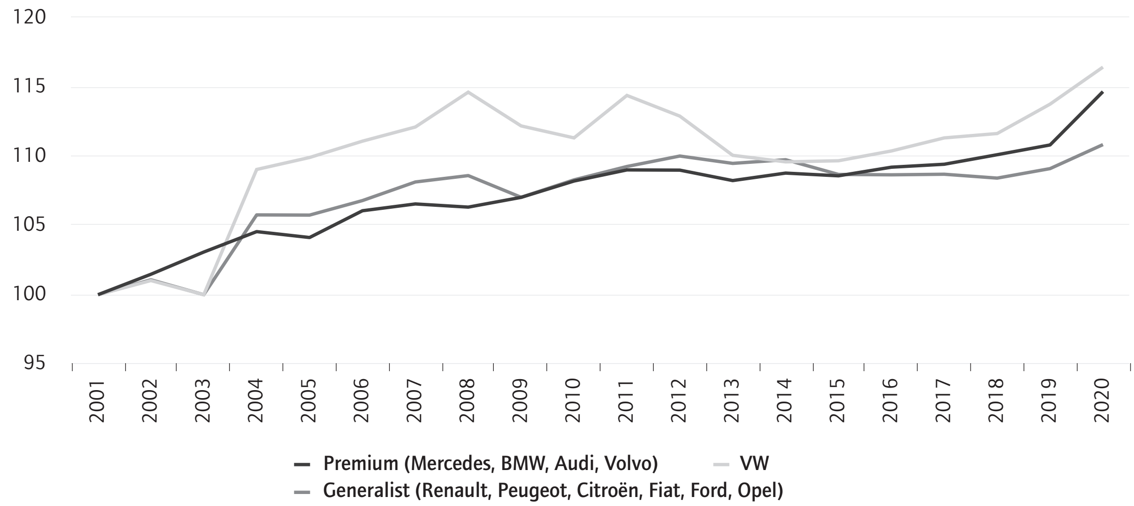
The first purpose of this analysis is to show that the generalist group has indeed played the upmarket game, following the premium group upmarket and increasing the weight and engine power of its average car sold in the European market in a similar proportion to the premium group. We can also see that, during this period, Volkswagen has gone more upmarket than the European average both in terms of weight and engine power.

Figure 8 **Average engine power (kW) of new cars by brands, 2001-2020**



Source: EEA, ICCT, author's calculations.

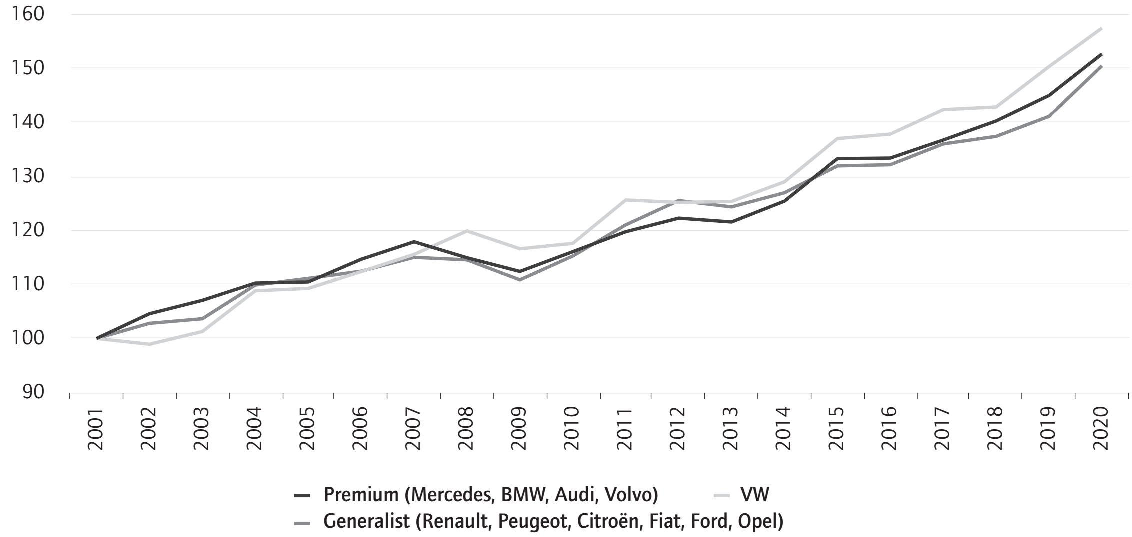
Figure 9 **Average mass in running order (kg) of new cars by brands, 2001-2020**



Source: EEA, ICCT, author's calculations.

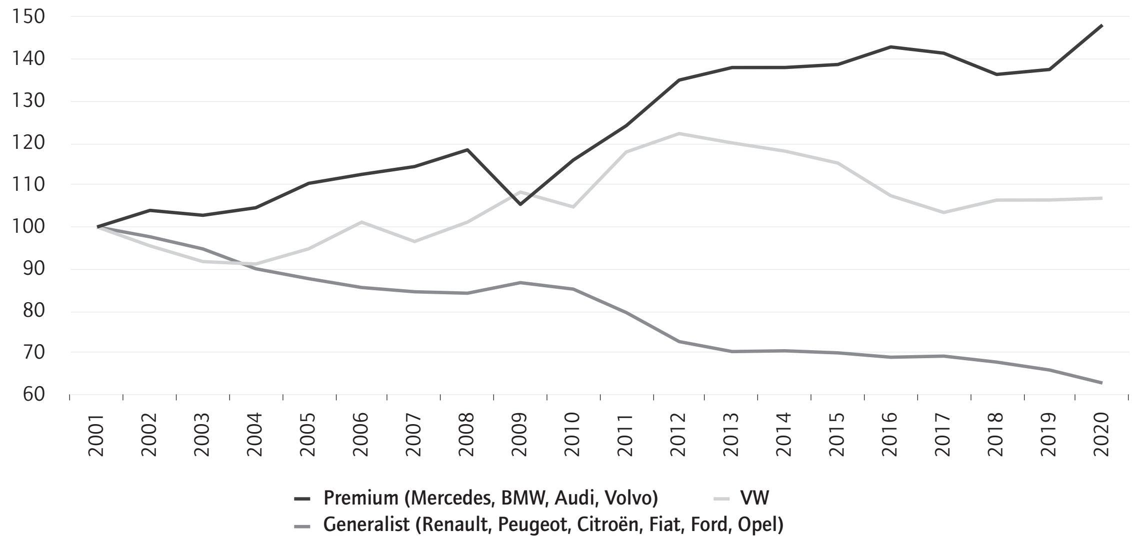
As a result of this common trend towards heavier and more powerful cars, the prices of the average cars sold by the two groups have also grown in similar proportion (see Figure 10 below). Prices grew by 50-53 per cent between 2001 and 2020 (and by almost 60 per cent for VW) when, during the same period, EU28 inflation (via the consumer price index) grew by 38 per cent. As we have mentioned before, and as we will see in more detail later, cars have become substantially more expensive during this period and much less accessible to the average European household.

Figure 10 **Average price (€) of new cars by brands, 2001-2020**



Source: EEA, ICCT, author's calculations.

Figure 11 **Sales of new cars (volume) by brand, 2001-2020**



Source: EEA, ICCT, author's calculations.

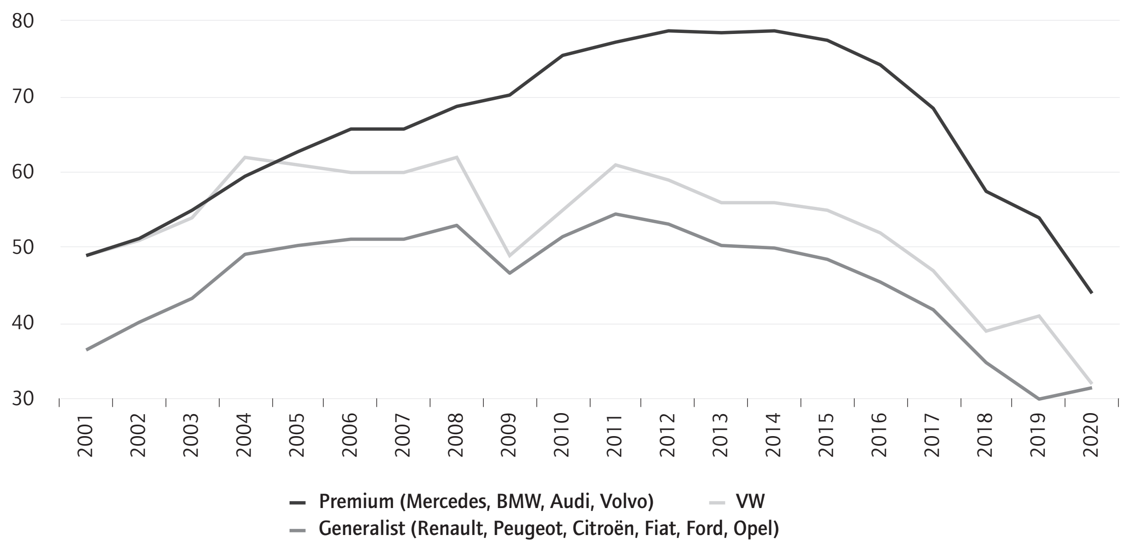
Upmarket drift has also significantly distorted competition between the two groups. The premium group's market share almost systematically increased as prices grew faster than average inflation, and only decreased when prices dropped in 2009 or in the aftermath of Dieselgate (see Figure 11). In total, the sales of the premium group grew by 48 per cent between 2001 and 2020. The Volkswagen brand also substantially gained market share across most of the period (an increase of 15 per cent between 2001 and 2015) and, despite the

impact of Dieselgate, its market share was still 7 per cent higher in 2020 than in 2001. In contrast, the generalist group's market share plunged during the same period by 37 per cent.

Why did the generalist group play this losing game? The answer is that it did not have the choice. The upmarket regulatory pressure described above prevented generalist car manufacturers from going downmarket to meet CO_2 targets and to protect their market shares by making more affordable cars. The Dacia brand of the Renault Group, developed and produced in Romania, the lowest wage country in the EU, and more recently in Morocco, can be seen here as an exception in that it successfully gained market share at the bottom of the market. However, Dacia was actually the brand that went most upmarket during this period precisely to comply with the EU regulatory framework (see text box 1, below).

Under the conditions set by the premium conception of control, only expensive technologies such as diesel engines and direct injection petrol could deliver to the generalist brands the CO_2 reductions required by the regulation. But squeezing these premium technologies into generalist small and compact cars was extremely difficult, requiring them to be made heavier, more powerful and more expensive. The transformation of these cars into SUVs was the strategic answer of generalist car manufacturers to deal with upmarket drift. Nevertheless, it reinforced upmarket drift and further shifted demand towards premium brands.

Figure 12 **Average diesel share of new cars by brand (%)**



Source: EEA, ICCT, author's calculations.

The Dacia brand: the exception that proves the rule

Dacia can be seen as the exception to the general decline of the generalist brands. Its market share increased almost continuously between 2004 (0.4 per cent of the EU28 market) and 2020 when it reached 3.4 per cent. When Renault took control of Dacia in 1999, the project was to develop a low cost brand for emerging central and east European markets. The Logan, to date the only low cost model below 7000 euros manufactured in Europe, was launched five years later on the Romanian market at a price of 5000 euros.

Romania was then not yet part of the European Union and it was not affected by the import of foreign used cars that were flooding the Polish market. Romania's integration into the EU in 2007, however, threatened to reproduce the Polish scenario. The Romanian government reacted by introducing a 'first registration tax' of around 140 euros for a new car and up to 8000 euros for an imported one, depending on its age. The Commission launched an infringement procedure in November 2007 on the grounds of violation of Article 90 of the EU Treaty. The Romanian government gave in, aligning the first registration tax for imported used cars with that for new cars. The consequence was a collapse of new car sales that, in 2019, were still 48 per cent below the 2007 peak (Jullien et al. 2012: 25).

Dacia survived the collapse of the Romanian market by shifting its market focus from east to west. The success of the Logan in western markets was initially a surprise, even for Renault. The buyers of the Logan came from among owners of very old cars who had been off manufacturers' marketing radar for years. Later, however, the new models in the Dacia range – the Sandero and the Duster compact SUV – targeted these markets more explicitly. At the time of its launch in western Europe, the Logan was sold at a base price of 6000 euros and the Duster was sold at an average price of 15 000 euros with some versions exceeding 20 000 euros. In 2016, a quarter of Dacia's European sales were made in France and a little over three-quarters in western European countries, confirming a de facto substitution of low-end Renault brand sales by low-cost Dacia brand models.

Because of this shift from east to west, and from low wage to high wage markets, the upmarket drift of the Dacia brand was the most pronounced amongst all brands. Between 2005 and 2011, the average Dacia sold in Europe gained 19 per cent in mass (198 kg) and 87 per cent in price (6177 euros). This upmarket drift was not only about making the Dacia brand more appealing to western European consumers, it was also the simple result of making the Logan, and then the rest of the Dacia entry range, compatible with European technical norms, at the same time further contributing to the collapse of potential markets for new cars in Romania and in other central and east European countries (Pardi 2018; Jullien et al. 2012).

4.2 Electrified SUVs as a way out?

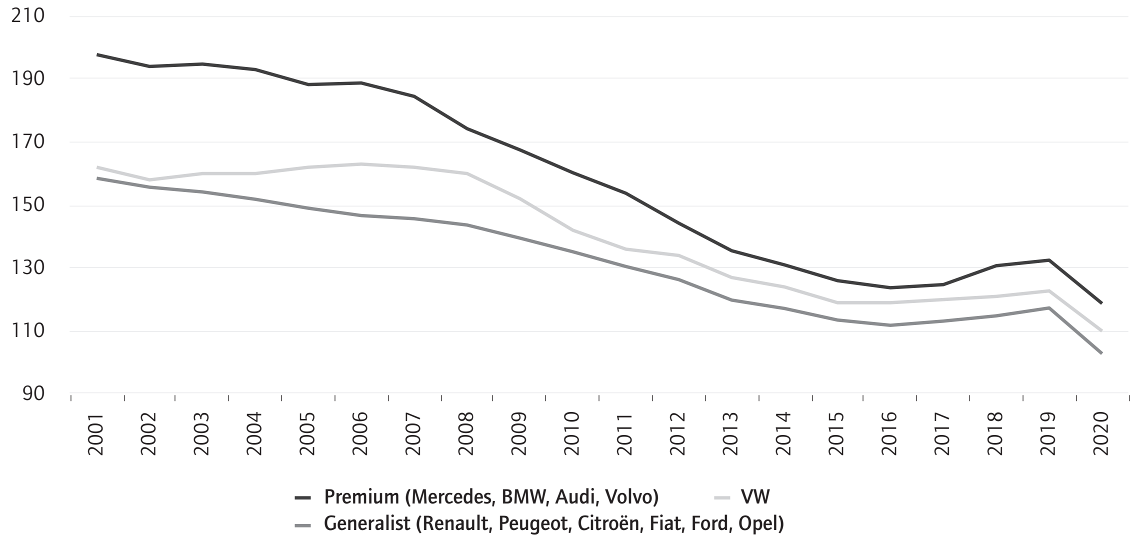
The paradox of the 2009 EU CO_2 regulation was that it contributed to upmarket drift and distorted competition in favour of cars that emitted more Co_2. By 2019 the average premium car, costing 47 640 euros, weighing 1690 kg (165 kg more than in 2001) and emitting 133 g/km of CO_2 in the laboratory (NEDC)

and 193 g/km of CO_2 on the road (RD), had increased its sales by 38 per cent; while the average generalist car, costing 23 213 euros, weighing 1300 kg (109 kg more than in 2001) and emitting 117 g/km of CO_2 in the laboratory (NEDC) and 160 g/km of CO_2 on the road (RD), had lost 35 per cent of its sales.

The other paradox is that, since 2009, the conversion of generalist cars to the premium conception of control made them less and less green in relative terms: practically no real progress was made in reducing CO_2 emissions on the road for the generalist car although the premium car achieved slightly better results thanks to the higher penetration of diesel and direct injection petrol models. This also explains the different attitude of generalist car manufacturers during the 2017 negotiations on the new CO_2 regulation: contrary to 2008, when they challenged the premium conception of control, this time they did not have any clear competitive advantage in terms of fuel consumption. Forced to play by the same rules as the premium brands, generalist car manufacturers were much more than before in the same boat as premium car manufacturers.

With the diesel market share declining since 2015, in particular for generalist brands, the net result of this trend was that, in 2019, the average European car emitted more or less the same amount of CO_2 on the road as in 2009: 170 g/km compared to 168 g/km. If we consider a maximum optimisation rate of the homologation test at 10 per cent (the Commission objective for 2023), such a level of CO_2 emissions would have resulted, in 2020, in 83 billion euros of penalties for the European automotive industry. Even the official optimised NEDC emissions, of 122 g/km in 2019, would have generated penalties amounting to 40 billion euros in that same year.

Figure 13 **CO_2 emissions (NEDC) by groups of brands, 2001-2020**

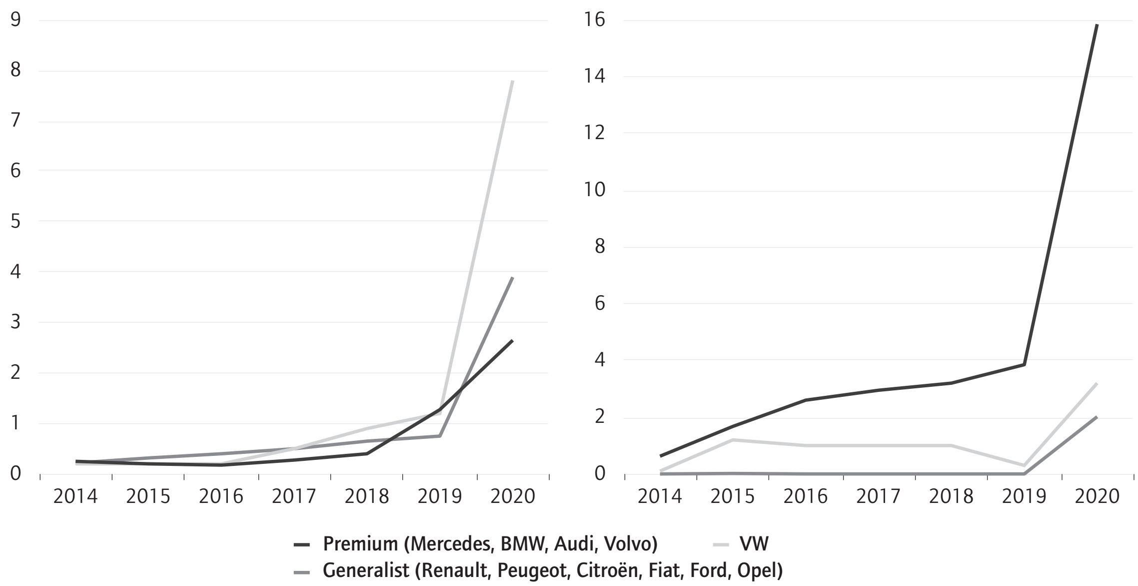


Source: EAE, ICCT.

Electrification was the only possible way of avoiding such a catastrophic scenario. It is important, however, to distinguish between BEVs, which do not have an internal combustion engine (homologated as zero CO_2 emissions vehicles) and PHEVs, where a rechargeable battery and an electric engine are added to a conventional ICE car (homologated as low emissions vehicles below 50 g/km of CO_2 – 40 g/km on average in 2020), even if both qualify as ZLEV in respect of the super-credits.

BEVs started to be introduced in the early 2010s by generalist car manufacturers in Europe, and in particular by Renault (1.7 per cent of its total sales in 2015) and Nissan (2.2 per cent). They were initially extremely light and compact, with low levels of autonomy and often associated in this early phase with the diffusion of new mobility services. The only premium car manufacturer that was already selling BEVs in 2015 was BMW, but in smaller numbers (0.6 per cent of its total sales). German premium car manufacturers were, in general, against electrification which they deemed as a non-mature technology viable only for small urban experimental vehicles (Hildermeier and Villareal 2012).

Figure 14 **Sales of BEVs (left) and PHEVs (right), % by groups of brands, 2014-2020**



Source: EAE, ICCT.

In contrast PHEVs were, from the beginning of their diffusion, perfectly compatible with the premium conception of control as they were structurally heavier and more expensive than conventional cars due to the extra battery and electric engine. Not surprisingly, premium brands took the lead in introducing PHEVs in Europe and mainly relied on them to make the 2020 95 g/km CO_2 target while generalist brands and VW pushed BEVs and improved their internal combustion engines.

However, premium brands were rapidly catching up with generalist brands on BEV sales. Indeed, not only PHEVs but also BEVs went rapidly upmarket in the second half of the 2010s as their average weight and price grew at a much faster rate than those of the average European car. As we will see in the next section, this upmarket drift of BEVs reflected a profound transformation of the meaning and direction of electrification.

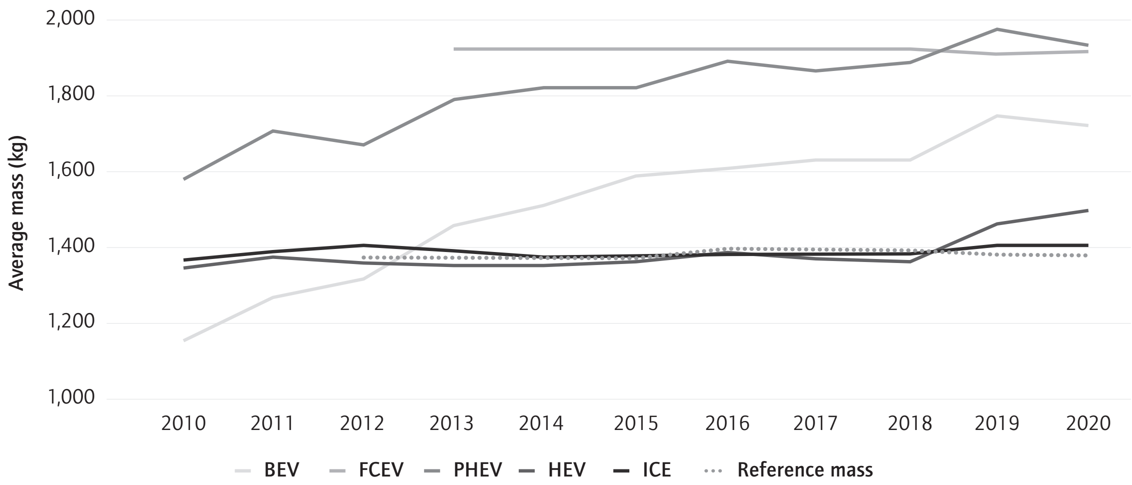
5. The environmental, economic and socio-political costs of upmarket electrification

Fifteen years ago, when the European automotive industry started to launch the first electric models on the mass market, it was clear that BEVs could not and should not be seen as conventional cars due to their limited range and long recharging time (Jullien and Pardi 2013). The transition towards BEVs was meant, instead, to transform the automotive paradigm from personal owned mobility to shared mobility, from multipurpose vehicles to dedicated vehicles based on service business models requiring a relatively dense networks of charging stations at home and at work (Villareal 2011; Fojcik and Proff 2014; Hildermeier 2016).

The 2009 Bolloré Bluecar used by the iconic Autolib car-sharing service in Paris was a perfect example of this first generation of BEVs (Vervaeke and Calabrese 2015). The Bluecar was extremely small and compact, with no paintwork and basic interiors, weighing 1170 kg, including the 300 kg of the 30 kW battery, and had a top speed of 120 km/h and an official range of 250 km. In comparison, the Tesla Model 3, which was the best selling BEV in Europe in 2021, weighed up to 790 kg more than the Bluecar; it was also 1.4 m longer, equipped with batteries of 54 kW up to 77 kW delivering a range of between 400 and 560 km and had a top speed of up to 260 km/h. Midway between these two extremes, the evolution of the Renault Zoe, launched in 2013 as an affordable car, shows the effects of upmarket drift on EVs in Europe. Between 2012 and 2019 its battery power more than doubled, from 22 kW to 55 kW, its range grew from 200 km to 400 km, its engine power increased from 65 kW to 80 kW, the vehicle gained 75 kg of weight and its price increased by 16 per cent.

Figure 15 shows how much the average BEV sold in Europe gained in mass between 2010 and 2020: from 1170 kg (i.e. the Bluecar) in 2010 to 1721 kg (i.e. the VW ID3), an increase of 47 per cent; which is higher than the PHEVs that gained 23 per cent in mass during the same period (from 1581 kg to 1951 kg).

Figure 15 **Average mass in running order (kg) by type of technology, 2010-2020**



Source: T&E 2021.

The almost 600 kg gained by the average BEV in Europe in these 10 years reflected a drastic change in the way of conceiving BEVs and their usage. Conventional cars tend to be over-dimensioned and over-powered for everyday usage because people historically bought them as multipurpose vehicles so that the dimensions and properties of the cars reflect the most extreme usages: i.e. the few times when the whole family goes on holiday via a motorway. But for most of the time (some 98 per cent of trips), this over-dimensioned and over-powered car transports only 1.3 people on average travelling less than 50 km a day at less than 60 km per hour: the extra room, the extra weight and the extra power does not serve any purpose but to consume more fuel, emit more CO_2 and air pollutants, and occupy more space in congested urban areas.

The BEV was conceived for everyday/average urban and peri-urban usage so that it would be both efficient (using less energy and requiring relatively small batteries) and affordable, because the weight of a car is the most important factor in determining the range of a BEV while the size of the battery is the most important factor in determining its price. Contrary to a conventional car, increasing the range and the size of an electric car for the most extreme usages is not only very expensive, but it also drastically reduces the energy efficiency of the car because it adds so much more weight than in the case of conventional ICE cars.

The European upmarket drift of BEVs reflected therefore a shift from them being conceived as new types of vehicle dimensioned for the average usage of people (with the parallel development of mobility services to cover for exceptional usages) to being conceived as electrified versions of already heavy and powerful multipurpose cars, making these cars even heavier and even more powerful.

Once again, this upmarket drift does not necessarily reflect consumer preference, technological constraints or technological progress (although in battery technology, energy density and efficiency improvements do matter). It is largely due to the historical result of the institutionalisation of a premium conception of control at European level in the 1990s and 2000s, and its preservation after Dieselgate despite clear evidence of a fundamental contradiction between upmarket drift and the green transition.

The comparison with China, the main world market for electrified vehicles, and in particular for BEVs, offers an instructive perspective. The average BEV in China weighs 210 kg less than an equivalent Chinese ICE car and 390 kg less than the average European BEV (IEA 2019: 53-54). The highest selling EV model (BEVs and PHEVs) in 2021 was the Saic-GM Wuling Hongguang Mini which has a basic range of 120 km, a top speed of 100 km/h, a mass of only 700 kg and a price below 5000 euros (without subsidies).

The heavier a BEV, the bigger the battery needed to propel it but, since the battery is also very heavy (and the most expensive component of the car – 40 per cent on average of the total cost), this adds further weight (and cost). In turn, this requires more technology (more efficient braking systems, a more powerful electric engine, more active and passive safety technology, more premium features to justify the price), all of which adds further weight (and also cost).

In other words, the upmarket drift of a BEV has increased its weight and price by a much higher proportion than the upmarket drift of a conventional car. The electrified versions of conventional cars are, on average, 400 kg heavier and 10 000 euros more expensive than their petrol versions and cannot be currently sold in Europe without generous state subsidies. In contrast, the battery electric Chinese mini-cars are already cheaper to buy than equivalent petrol cars and are the best sold BEVs in China without any subsidy.

Electric upmarket drift has multiple consequences – environmental (less efficient and more polluting vehicles); economic (more expensive vehicles further distorting competition between premium and generalist car manufacturers); and social (less affordable green mobility and the social exclusion of middle and working classes) and political ones (discrimination in favour of wealthier countries and households). We look at each of these in the following sections.

5.1 The environmental consequences of heavy electric vehicles

Adding 600 kg to a BEV and 400 kg to a PHEV in ten years has significantly reduced the environmental benefits of an electric vehicle. Doubling the average size of an EV battery has negative consequences for all its life cycle.

First, some of the materials needed to manufacture batteries, in particular cobalt and lithium, but also nickel, are rare and their extraction is itself polluting. By increasing the size of the average EV battery, the upmarket trend has contributed to increases in the prices of these materials and a reduction of their availability, potentially undermining the economic viability of batteries in car production, in particular in the case of an accelerated transition which sees 2035 sales as being made up of 100 per cent EVs (Jetin 2020). At the time of writing (March 2022), the cost of the raw materials required to manufacture the most popular lithium-ion batteries has increased during the last two years (since January 2020) by 326 per cent for nickel-cobalt-manganese (NCM) batteries and 708 per cent for lithium ferro-phosphate (LFP) ones.[8]

Second, battery production requires a lot of energy. Currently this production is mainly carried out in countries where energy production has high CO_2 intensity, like China which, in 2020, represented 75 per cent of the global production of batteries for cars.

EU production of batteries remains at the start, but it is planned to grow substantially in the next years. Gigafactories tend to be located close to car assembly factories due to the high cost of moving the 300-600 kg batteries and also the general advantages of clustering and proximity for better integration of the battery in the car and in the manufacturing process. The problem is that most car assembly factories in Europe are located in relatively high CO_2 intensity countries (more than 200 g/kW of CO_2 on average and more than 300 g/kW of CO_2 for Germany, Poland and Hungary which, so far, concentrate 50 per cent of the total announced battery capacity for 2030).[9] Labour cost is another important factor for location choice, with most of the low wage countries with large automotive industries in the EU being heavily reliant on coal to produce their energy (Poland, Czechia and Romania, where around 15 per cent of the European production of cars is located).

Given the current locations of battery production, EVs come with a relatively high CO_2 debt when they start to be used and it takes several years before they emit less CO_2 than equivalent ICE cars. The debt is much bigger for heavier cars. For instance, for a Tesla S manufactured and used in China (550 g/kW of CO_2), the debt amounts to 15 tons of CO_2 and it takes 139 400 km to pay it off (Arval 2019: 67-86).

Third, while BEVs do not emit CO_2, they use energy whose production emits CO_2. In 2018 the EU energy sector emitted 3.3 billion tons of greenhouse gases. This is much less than the 4.3 billion tons emitted in 1990 but still more than the 0.9 billion tons emitted by the transport sector in 2018. Doubling the size of the battery to carry much heavier vehicles can amount to a doubling of the amount of energy used by BEVs and, therefore, their related CO_2 emissions (Berjoza and Jurgena 2017: 1391).

8. Source: https://www.benchmarkminerals.com/lithium-ion-battery-raw-material-index/
9. Source: https://www.eea.europa.eu/data-and-maps/indicators/overview-of-the-electricity-production-3/assessment

Fourth, cars generate harmful fine particles ($PM_{2.5}$ and PM_{10}) mainly through brake, tyre and road wear (on average 60 per cent of total PM emissions). This does not change with BEVs and PHEVs (AQEG 2019). Extra weight increases the wear, further contributing to air pollution. Bigger cars also take up more space, thus increasing urban congestion which also raises transport emissions.

Fifth, while all the previous points also concern PHEVs which, in 2021, represented half of the total European sales of electric vehicles, the extra weight carried by PHEVs means that, when they are propelled by their internal combustion engines, they emit much more CO_2 than their equivalent (much lighter) petrol and diesel versions. All recent reports by environmental NGOs, based both on consumer data and laboratory tests, have shown that the rate of optimisation of the homologation of recent PHEVs, in comparison with real drive consumption, is on average 220 per cent and can rise as high as 400 per cent (ICCT 2020).

Sixth, heavier BEVs and PHEVs are much more expensive that lighter BEVs and PHEVs and equivalent ICEVs. This lack of affordability is one of the major obstacles to the diffusion of such vehicles in Europe, in particular in southern European countries and in the new Member States that, during the last twenty years, have become the most important net contributors to the growth of CO_2 emissions in the transport sector.

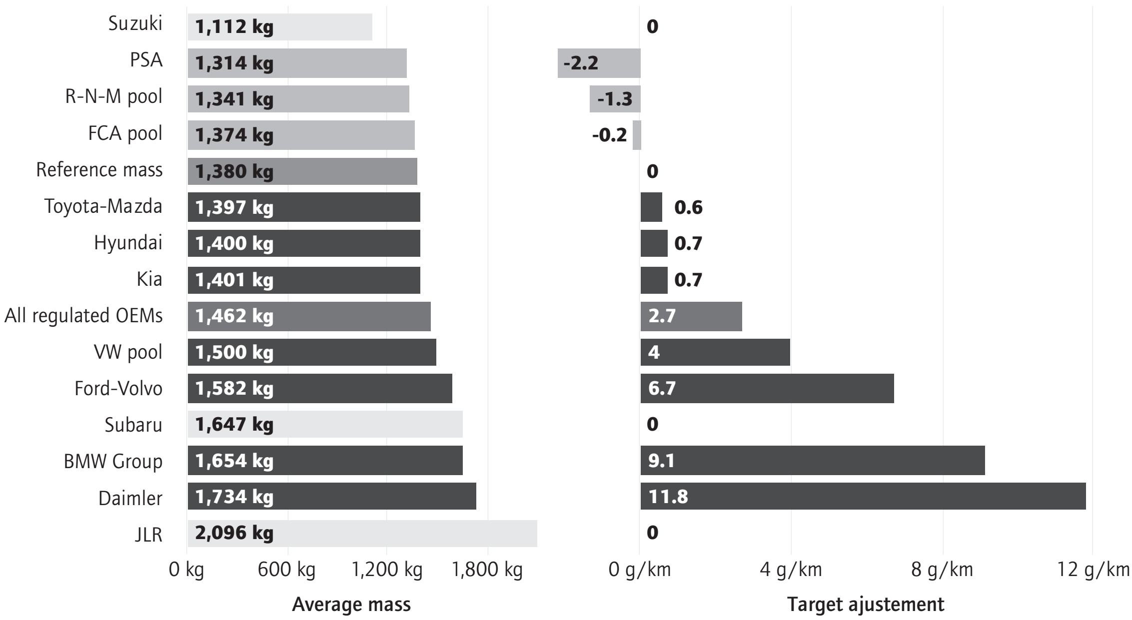
5.2 The economic consequences of accelerated upmarket drift

The upmarket trend on electrification is making the average European car once again (but much more quickly than before) heavier, more powerful and more expensive. In order to comply with the 2020 target of 95 g/km of CO_2 (on 95 per cent of sales), European car manufacturers increased the share of EVs from 3 per cent in 2019 to 11.9 per cent in 2020 (6 per cent BEVs and 5 per cent PHEVs). As a result of this higher share of EVs, the weight of the average European car increased (in one year) by 3 per cent, engine power by 4 per cent and price by 5 per cent (which is double the average annual rate between 2001 and 2019 – see Figures 8, 9 and 10 above).

In just one year of this accelerated upmarket drift, the premium group increased its market share by 7 per cent while the generalist group's share declined by 4 per cent with VW slightly increasing its share by less than 1 per cent (see Figure 11 above). The premium group also had a significant advantage in terms of meeting their CO_2 targets in 2020 and 2021 by combining higher sales of extremely heavy PHEVs with a proportional weakening of their weight-based targets. For 2021, T&E calculated that the mass adjustment of the premium car manufacturers represented on average 27 per cent of their compliance efforts (more than their increased sales of BEVs), while this figure was 17 per cent for VW. For the generalist group, mass adjustment had a

negative impact (making their target more stringent), as shown by Figure 16 (see also T&E 2021).

Figure 16 **Average mass and resulting target adjustment by car manufacturer in 2020**



Source: T&E 2021.

By distorting competition, the 'accelerated' upmarket drift brought about by the combined effects of electrification and the adverse effects of the CO_2 regulation that, as we have seen, favours structurally more polluting vehicles is bound to have significant socio-economic consequences.

The effects of the previous 'normal' upmarket drift on the production volume and localisation of the main European car manufacturers during 2000-2017 resulted in German premium car manufacturers (Volkswagen, Daimler and BMW) significantly increasing their production volume in Europe (by 2.2 million cars; an increase of 40 per cent), mainly in Germany (up 1.1 million; 30 per cent) and in central and east European countries (up 1 million; 180 per cent). In contrast, generalist car manufacturers, including the German ones (Ford and Opel), lost production volume (totalling 2.6 million cars, a drop of 29 per cent) in particular in their domestic bases[10] (2.3 million; 34 per cent) and in other high wage EU15 countries (1.6 million; 45 per cent), with a significant amount of this lost production being relocated to central and east European countries, Turkey and Morocco (an increase of 1.3 million cars; 160 per cent).

10. In the case of Opel-Vauxhall and Ford Europe we refer here to Germany as the domestic base.

The economic consequences of these massive production losses and relocations were particularly difficult for the national automotive industries in France and Italy where 108 000[11] direct jobs have been lost; while upmarket drift has helped the German automotive industry to preserve its hegemonic position in the European value chain.

Table 1 **The automotive industries of Germany, France and Italy in 2000 and 2019 (production, output, gross value added and employment)**

	Germany	France	Italy
Production (2019)	**5 030 351** (28% of EU28)	**2 202 460** (12% of EU28)	**854 000** (5% of EU28)
(2000-2019)	**-496 084** (-9%)	**-1 145 901** (-34%)	**-884 315** (-51%)
Output (2019) Billion €	**411** (42% of EU28)	**69** (7% of EU28)	**63** (6% of EU28)
(2000-2019)	**+193** (+89%)	**-1** (-2%)	**+16** (+33%)
Gross Value Added (2019) Billion €	**137** (54% of EU28)	**14** (5.5% of EU28)	**14** (5.56% of EU28)
(2000-2019)	**+80** (+144%)	**-4** (-22%)	**+2.5** (+22%)
Employment* (2019)	916 000	106 000	177 000
(2000-2019)	**+30 000** (+3%)	**-80 000** (-43%)	**-28 000** (-14%)

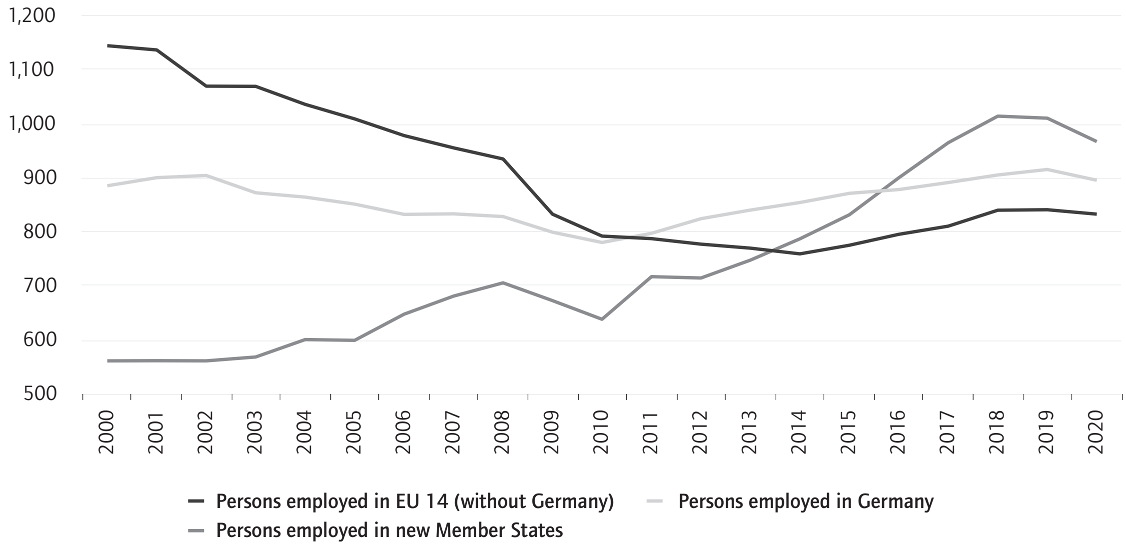
* Annual detailed enterprise statistics for industry.
Source: Eurostat.

We note in particular how the German automotive industry, despite a decline of 9 per cent in the production volume of motor vehicles between 2000 and 2019 (due mainly to the collapse of Opel), increased its output by 89 per cent (193 billion euros) and gross value added by 144 per cent (80 billion euros). In contrast, France and Italy have seen their production plummet (by 34 per cent and 51 per cent, respectively). Gross value added declined in France (22 per cent) but increased in Italy (22 per cent) due to its car parts sector (Manello et al. 2016).

This stark contrast in the evolution of the main premium automotive industry (in Germany) and of the two main generalist automotive industries (in France and Italy) within Europe highlights the considerable economic consequences that upmarket drift has had in terms of restructuring and deindustrialisation.

11. On the basis of data from Eurostat's annual detailed enterprise statistics for industry.

Figure 17 **People employed in the automotive sector in Europe in the EU14 (without Germany), in Germany and in the new Member States (EU13), 2000-2020**



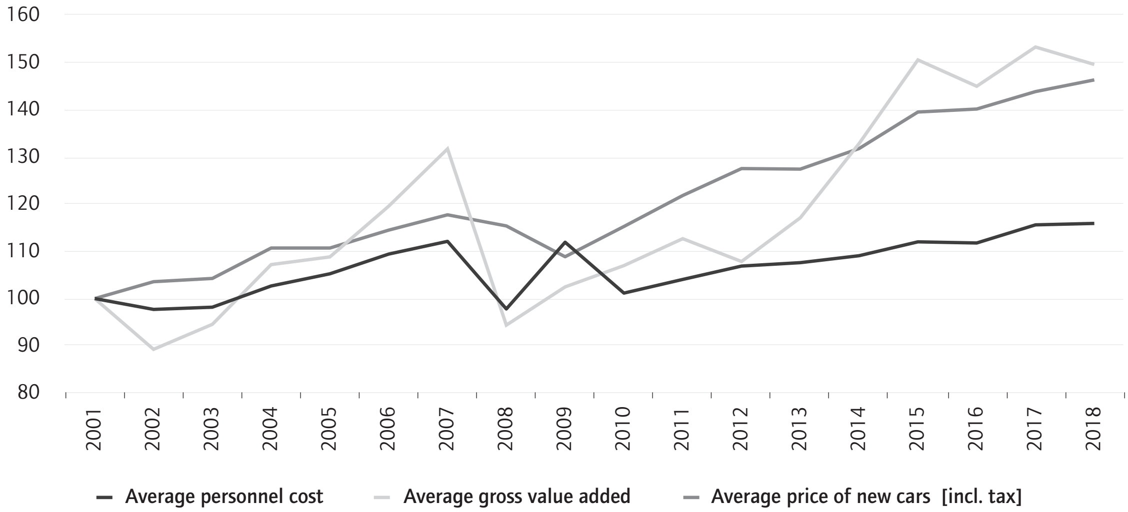
Source: Eurostat.

As Figure 17 shows, the combined effects of the waves of relocation of production towards central and east European countries and upmarket drift has been negative for employment for most of western Europe. With the only exception of Germany, where automotive employment has slightly increased during this period (by 30 000, 3 per cent), automotive employment in high wage EU14 countries has substantially decreased (by 312 000), while employment in the low wage new Member States has increased (by 406 000).

This trend, which is the direct consequence of the relocation of production from high wage to low wage countries, has generated a zero sum game where almost each job created in the new Member States corresponds to a job eliminated in the EU15. The competition here – for investment, products and projects – is not between different companies but between different factories and R&D facilities within the same transnational companies. In each of these 'beauty contests', the winner tends to be the group of workers, trade unions or national governments that make most concessions to reduce labour costs and workers' protection and to increase labour flexibility.

The aggregate result has been an increasing disconnection between productivity gains and wages (see Figure 18). Between 2001 and 2018, the average gross value added (per person employed) generated by the European automotive industry outside Germany increased by 50 per cent, propelled by upmarket drift, while average personnel costs increased by only 16 per cent. This was less than half the rate of European inflation during the same period (36 per cent), meaning that real average personnel costs in fact decreased by 20 percentage points.

Figure 18 **Average personnel cost, gross value added and the price of new cars in the European automotive industry (other than Germany), 2001-2018**



Note: EU28 without Germany.
Source: Annual detailed enterprise statistics for industry, Eurostat. Author's calculations.

It is interesting to note that, during the same period, the average price of new cars increased by 46 per cent, three times higher than average personnel costs, illustrating the disconnection of the Fordist link between mass car sales and high wages, and between consumers and workers.

It is still too early to measure the economic consequences of the acceleration in upmarket drift pushed by electrification. In particular, the Covid-19 crisis in 2020 and 2021 and the chip shortage crisis of 2021 and 2022 have created a very unusual economic environment in which most of the costs of these crises have been absorbed by government measures via temporary unemployment and subsidies for car sales.

What we do expect is a generalised intensification of the trends associated with upmarket drift: more relocation of lower added value activities in engineering, assembly and parts manufacturing towards low and ultra-low wage countries; more pressure on labour costs both in high, low and ultra-low wage countries; and faster and, in some cases, massive reduction of employment (collective redundancies) for low-skilled and semi-skilled workers. In other words, we expect the European automotive industry to 'digest' the costs of electrification in the next 5-10 years in the same way it has digested the costs of dieselisation during the last 15-20 years.

5.3 The social and political costs of even more expensive cars

When we compare the sales of new cars in the EU28 in 2001 and 2019, the figures appear static (up by 0.7 per cent) but, relative to the EU28 population, which has increased by 5.4 per cent, they have declined by 4.5 per cent. During this period the number of cars on the road in Europe kept on increasing: from 201 million to 265 million (an increase of 31 per cent in total and of 25 per cent when expressed per 1000 inhabitants).

Table 2 **New car sales and passenger cars per 1000 inhabitants in EU28 in 2000 and 2019**

	2000	2019	%
EU28 population (millions)	499	526	5.4%
New car sales	15 366 229	15 467 336	0.7%
New cars per 1000 inhabitants	30.7	29.4	-4.5%
Passenger cars per 1000 inhabitants	414	516	24.6%

Source: Eurostat, OICA, ACEA.

We can see in these contrasting figures some of the causes of the growing CO_2 emissions from the passenger car sector in Europe during this period (a rise of 22 per cent between 1990 and 2020) and of the failure of the EU CO_2 regulation to tame them.

On the one hand, the new cars that were expected to green the European car fleet during this period were not in fact much more green than the cars they were replacing: because they were structurally more polluting (heavier and more powerful), the benefits of their new technologies (diesel and direct injection petrol) were almost completely erased.

On the other hand, these new cars were also becoming more expensive which made it harder for the average European household to buy them, such that the rate of renewal of the car fleet slowed down (from 7.6 per cent to 5.8 per cent). But, at the same time, and in particular in the new Member States whose economies were growing much faster than the EU28 average, the need for cars was either growing (EU15) or booming (EU13). This unregulated need could not be satisfied by relatively less emitting new cars but by older cheaper second-hand ones. Consequently, the average age of the car fleet in Europe grew at a much faster pace than before (from 6.8 years in 2000 to 12 years in 2020).[12] The net result was much more cars (a rise of 25 per cent between 2000 and 2019) and much more relatively high polluting older cars

12. Source: ACEA: https://www.eea.europa.eu/data-and-maps/indicators/average-age-of-the-vehicle-fleet/average-age-of-the-vehicle-8

per 1000 inhabitants (an increase of 5.2 years on average), which inevitably resulted in more CO_2 emissions rather than less.

If we break down the Single Market into different groups of national markets we can see that important national differences exist behind this general trend and that upmarket drift did not only slow down the uptake of new greener cars but it also significantly widened inequalities in access to new and greener cars between the wealthier and the poorer European countries.

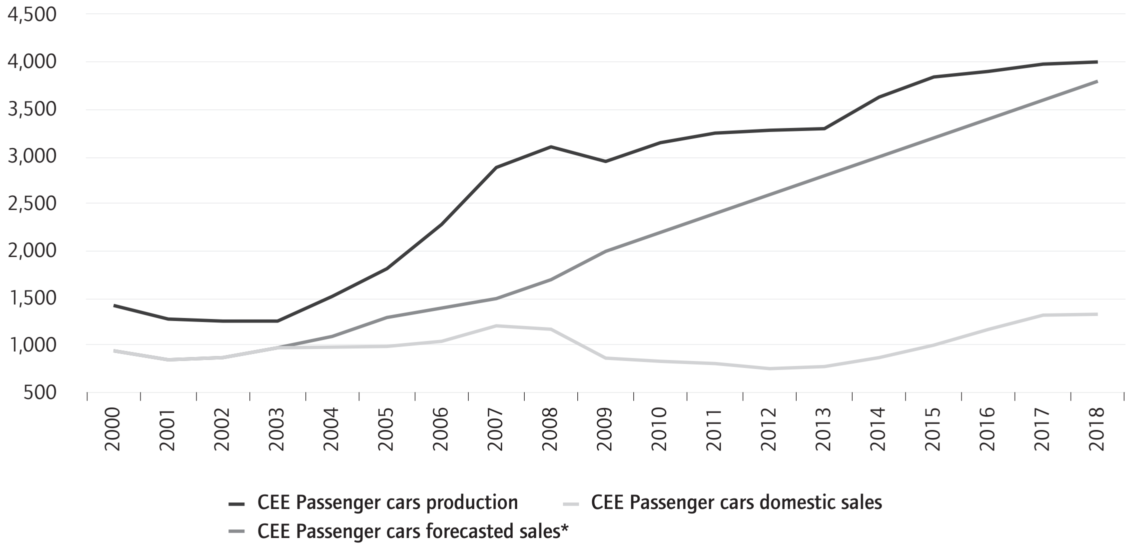
In northern European countries, the upmarket drift of the average new car sold (increase of 52 per cent in price and 11 per cent in mass between 2001 and 2019[13]) has not affected the sales of new cars which have fully recovered after the 2008-2010 crisis (overall increase of 5 per cent between 2001 and 2019). It was also here where most EVs were sold in 2020 (71 per cent of total sales of EVs in the EU28; a market share of 14 per cent for EVs). Their impact in terms of upmarket drift was clear (a rise of 7 per cent in price and of 5 per cent in weight in one year) but, thanks to widespread generous state subsidies, new car sales were little affected.

In southern European countries the impact of upmarket drift on new car sales was highly significant. When we look at the rate of increase in price (55 per cent) and weight (10 per cent) between 2001 and 2019, we do not see any difference with northern European countries, even though cars here were cheaper in absolute terms (29 per cent lower) as well as lighter (they weighed 8 per cent less). But, at these fast growing prices, southern European populations found it more and more difficult to buy new cars so they adjusted to upmarket drift by buying fewer of them: a drop of 52 per cent at the bottom of the crisis in 2013; and one of 17 per cent in 2019 in comparison with 2001. If electric uptake here was logically much slower than in northern European countries – a market share of only 4.8 per cent in 2020, 10 per cent of the total EU28 – its upmarket drift was more pronounced: an increase of 6 per cent in price and 3 per cent in weight in 2020.

For the 13 new Member States that joined the EU mainly between 2004 and 2007, upmarket drift was also strong but it only started in the different groups of countries after joining the European Union, highlighting the structuring role of the EU regulatory framework. Overall, between 2001 and 2019 the average mass of new cars grew by 24 per cent and the average price by 48 per cent. Sales, that were increasing rapidly before entering the EU, started to decline after EU entry before picking up again in 2014. Back in 2004, when these countries started to join the EU, European economic authorities anticipated the take-off of new car sales and justified the massive investment to create new production capacity on these grounds (Boillot and Lepape 2004).

13. Source: EAE, ICCT, author's calculations.

Figure 19 **Production of passenger cars and domestic sales in central and east European countries, 2000-2018**



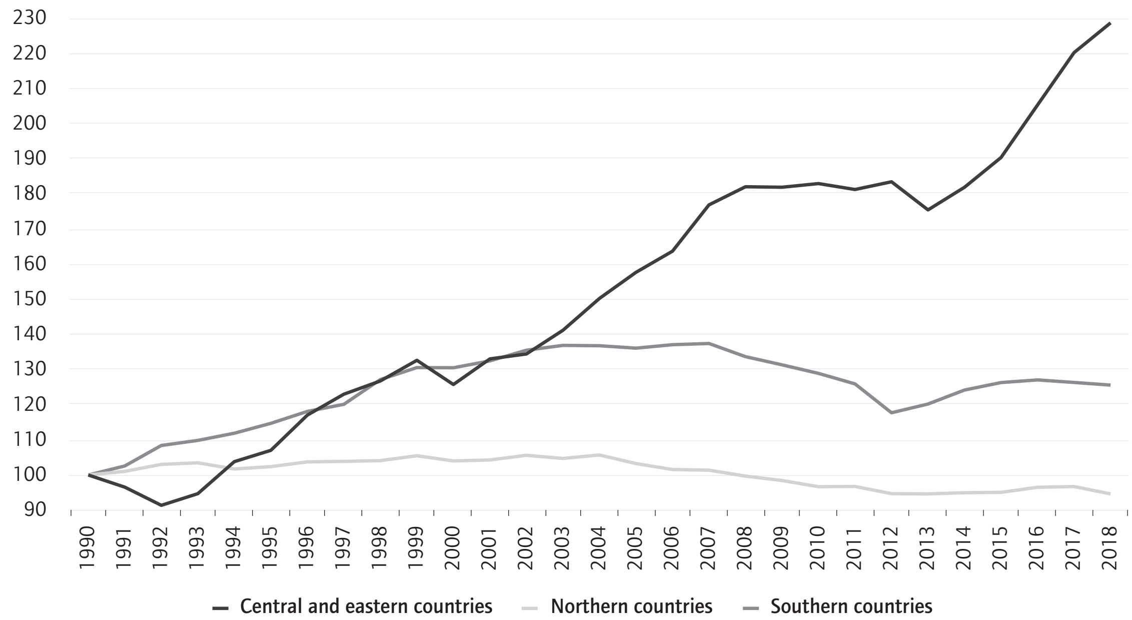
* As forecasted in (Boillot and Lepape 2004).
Source: OICA, ACEA.

As we can see from Figure 19, this take-off never actually took place. The combination of upmarket drift and of massive second-hand car imports killed the market for new cars while export-led automobile production rapidly increased and could only be justified in terms of the relocation of production from EU15 countries.

The competitive advantage of these production sites lay no longer in that they were located in high growth markets but, instead, in the presence of a cheap and flexible workforce to produce the compact and small cars that European car manufacturers would now relocate from their high wage countries: from market seeking, European integration turned into efficiency seeking.

It is very difficult to imagine how these countries could realistically board the Green Deal 'train' towards carbon neutrality in 2050 under these conditions: they have the oldest, most polluting, rapidly ageing and fast-growing car fleet in Europe (mainly via second-hand car imports); average annual per person revenues are still 63 per cent below the European average some 15-18 years after having joined the European Union, but the average new car price is only 21 per cent below the average European level. Moreover, this is increasing faster than average per person revenues. Even if we consider that the EVs sold in the EU15 will eventually flow as second-hand cars to these countries, in the current circumstances of accelerated upmarket drift it will take decades before this could realistically happen. In the meantime, social and political opposition to the EU Green Deal has been mounting in these countries where the degree of economic dependency on fossil fuels is extremely high (Gažo 2022).

Figure 20 **Greenhouse gases from fuel combustion in cars by groups of EU28 countries, 1990-2018**



Source: EEA, author's own calculations. Southern European countries include France. Central and eastern countries include Bulgaria, Czechia, Estonia, Latvia, Lithuania, Hungary, Poland, Romania, Slovenia and Slovakia.

Figure 20 illustrates that, in the case of central and east European countries, CO_2 emissions from cars, rather than diminishing by 40 per cent between 1990 and 2018 (in order to be on track with the 100 per cent reduction target by 2050 or with the most recent 55 per cent target for 2030), have more than doubled (an increase of 240 per cent). Most of this staggering growth occurred after integration in the European Union and was only temporarily slowed by the harsh effects of the financial crisis between 2008 and 2013.

Figure 20 also highlights the failure of upmarket drift to drive down CO_2 emissions everywhere else in Europe, including the northern European countries where emissions have stagnated despite relatively widespread access to new cars and quite active policies supporting the diffusion of greener electric mobility. In southern European countries, emissions were 25 per cent higher in 2018 than in 1990 and, if they have slightly declined since 2007, this was due almost exclusively to the long term impact of the financial crisis of 2008 and of the Eurozone crisis of 2009-2011, resulting in fewer kilometres being travelled by cars on average rather than from any greening of the car fleet.

6. The 'Fit for 55' EU proposal: towards ultra-accelerated upmarket drift in electrification

Following the launch of the European Green Deal plan by the European Union in 2019 to reach climate neutrality in 2050, and the publication in 2020 of an impact assessment on 'Stepping up Europe's climate ambition in 2030' to reach at least a 55 per cent reduction in CO_2 emissions by 2030 (compared to 1990), the European Commission proposed in July 2021 a 'Fit for 55' revision of the CO_2 regulation for new cars and vans. This entails a hardening of the CO_2 target for 2030 – from the 37.5 per cent reduction agreed in 2017 to a 55 per cent reduction target for cars and from 31 per cent to 50 per cent for vans; and a 100 per cent reduction target for 2035, marking the end of the internal combustion engine.

The 'Fit for 55' proposal is a lucid recognition of the failures of the CO_2 regulatory packages of the last 30 years. But it also keeps reinforcing the upmarket trend that has significantly contributed to these past failures and it does not challenge the premium conception of control behind it.

For instance, the emphasis is once again put on the development of the highest possible technology to push EVs towards greater range (larger batteries) and better connectivity (data management, automated cars). In the impact assessment annexed to the proposed regulation there is an explicit reference to Tesla as the model to follow by European car manufacturers (European Commission 2021: 15). Yet, in the chapter following this citation, 'affordability' is highlighted as the main obstacle to the uptake of EVs in Europe. It is noted that, while the price of batteries fell by 87 per cent between 2010 and 2019:

> … the average Battery Electric Vehicles (BEV) price increased by more than 40% between 2011 and 2019 as manufacturers were focusing on premium and larger mid-size cars, leaving very few offerings in the entry-level segments. (European Commission 2021: 16)

It is also noted that the average BEV sold in Europe in 2019 was 52 per cent more expensive than in China and 10 per cent more expensive than in the US. The impact assessment concludes that there is a high risk of failure to reach the target of climate neutrality in 2050 due to the lack of 'affordability' and that 'the risk is highest for lower income groups, as they also have less access to financing possibilities' (European Commission 2021: 17).

But nothing is proposed to mitigate this risk. Rather the contrary, since the weight-based CO_2 targets that have fuelled this upmarket drift towards

more expensive cars, and that are now playing an even bigger role in favour of premium brands due to the accelerated upmarket drift driven by electrification, are not questioned.

The ‘Fit for 55’ regulation is bound to lead to an ultra-acceleration of upmarket drift, but its impact assessment fails to make any sense of it. It argues that, in the end, neither consumers nor workers will be affected. It anticipates that ‘affordability’ problems would only concern the two lowest income groups (quintiles 1 and 2) when they buy in the ‘larger vehicle segments, mainly PHEV and FCEV [fuel cell EVs]’, while ‘BEV [will] remain or become affordable with time’ (European Commission 2021: 54). It also claims that these expectations are equally valid in all EU countries and that all EU consumers, and in particular those in lower income groups, will benefit from lower usage costs despite higher upfront costs (notably via access to second-hand cars).

Concerning workers, the impact assessment anticipates that only 4000 jobs will be lost in the European automotive sector by 2030 (a drop of 0.16 per cent), growing to 13 000 jobs lost by 2035 and 36 000 by 2040 (down 1.65 per cent), against a net gain of almost 500 000 jobs by 2040 across the whole economy. These forecasts are made on the assumptions that total sales of new cars will remain stable in the future and that the value added per car in the automotive industry will substantially increase with the shift from ICEVs to EVs.

We have seen before that, under the previous upmarket drift driven by dieselisation, sales declined and were, most of the time, significantly below their 2000-2005 level due to cyclical economic crises. This is despite the enlargement of the Single Market, the demographic growth of the European Union and the integration of emerging countries with a strong potential demand for new cars. How is it possible that, with the ultra-accelerated upmarket drift implied by rapid electrification, sales will remain stable or only slightly decline during the next 10-15 years?

This question was already pertinent before the Covid-19 crisis, the invasion of Ukraine by Russia and the surge in prices which is seeing forecast inflation for the Euro zone reach 7.5 per cent for 2022. But now it seems even more unlikely that sales of new cars will ever recover their pre Covid-19 crisis level as price inflation is particularly strong for all the raw materials used to manufacture electric cars and batteries, as well as for the energy used both to produce and to use them. As we have already stressed, the prices of the raw materials used by the most popular lithium-ion batteries have drastically increased since 2020: by 326 per cent for NCM batteries and 708 per cent for LFP ones.[14] This pushes the price of battery electric vehicles further up, making them less and less affordable.

14. Source: https://www.benchmarkminerals.com/lithium-ion-battery-raw-material-index/

Contrary to China, where electrification is shaped by different conceptions of control and where consumers can buy BEVs that are significantly cheaper to acquire and to use than ICEVs and PHEVs, such an option to counter the inflationary pressure on the automotive industry is not available in Europe. The combined effect of these generalised inflationary pressures and of ultra-accelerated upmarket drift in electrification will be that prices of new cars grow much faster than before; and we already have substantial evidence of this in 2021 and 2022.

All the consequences of upmarket drift and of its accelerated early-electrification version (for 2020) that we have identified above will inevitably be amplified. As prices grow and the market shrinks, competition will be further distorted in favour of premium brands. Electric cars will become heavier and more powerful, drastically reducing their positive environmental impact. The pressures to reduce costs, quantified in December 2021 by the CEO of Stellantis, Carlos Tavares, at 10 per cent per year,[15] probably now growing to 15 per cent per year, will further increase throughout the whole value chain affecting all countries. This will push further relocations in the lower segments of value chains; employment cuts at a much more rapid pace than anticipated, leading probably to redundancies and factory closures in particular in southern European countries; and generalised pressure on labour costs and wages while the cost of living is rising extremely quickly. The rate of renewal of the European car fleet will further slow, amplifying the divide between, on the one hand, the fewer wealthy owners and users of electrified vehicles who frequently benefit from generous state subsidies, fiscal advantages, free public parking, free access to city centres, preferential road lanes and lower usage costs due to relatively low energy and maintenance costs; and, on the other, the growing majority of European citizens excluded from the Green Deal who will have to bear the economic and social costs of holding on to ageing ICE cars whose negative externalities are and will be increasingly penalised and taxed.

This divide will also increase between the wealthier northern European countries and southern, central and east European ones. Inflation will eventually lead the European Central Bank to raise interest rates, increasing the cost of national debts (which have significantly grown during the Covid-19 crisis) as well as the ‘spread’ (the relative cost of the debt) between exporting countries with a trade surplus, like Germany, and importing countries with trade deficits, like Italy and France. Under these conditions the respective capacities of these countries to finance the green transition, decarbonise their economies and deal with the economic and social consequences of accelerated electrification will further diverge. How this divergence will translate in political terms remains to be seen, but there is no doubt that the risk of seeing more populist anti-EU parties taking power in Europe is very high.

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15. Source: 2021 Reuters Next Conference.

If such a scenario, which is unfortunately much more realistic than the optimistic narratives proposed by global consultant companies and by the European Commission, materialises in the near future, or even if only some parts of it do, then the already difficult path towards climate neutrality for 2050 will become even more difficult, if not impossible. Furthermore, its economic, social and political costs, which are already significant, will become even more important, if not unbearable.

Conclusion

In this report we have approached the electrification of the European automotive industry from a historical perspective. We have looked at the causes of the past failures in reducing CO_2 emissions in the transport sector in Europe. We have analysed how these past failures have translated into the current electrification of new car sales. And we have characterised from this perspective the foreseeable consequences of this fast track towards electromobility for national industries, automotive employment, citizens' access to mobility and, more generally, on the socio-political viability of the EU Green Deal and of the green transition towards a carbon neutral economy and society.

We have shown that the past failures in reducing CO_2 transport emissions can be traced back to the early capture by the premium automotive industry of the EU's technical and environmental regulations for new cars in the 1990s and 2000s. Rather than pushing the European automotive industry to reduce the mass and the engine power of new cars sold in the Single Market – the two most important factors affecting fuel consumption and CO_2 emissions – EU regulations have driven the industry in the opposite direction: between 2001 and 2020 the mass of the average new European car increased by 15 per cent, engine power by 43 per cent and price by 60 per cent.

We have seen how this regulatory upmarket drift has been shaped both by the harmonisation of all technical norms towards the highest possible international standards and by the weight-based CO_2 standards introduced in 2009, which de facto prevented generalist brands from going downmarket to reduce CO_2 emissions.

We then analysed the 2015 Dieselgate scandal as the logical outcome of upmarket drift that was aggravated by the asymmetry between fuel efficiency and pollution norms. By adding so much weight and power to the average new car, it became impossible for the European automotive industry to achieve the CO_2 targets set by the European Commission without cheating. Dieselgate revealed this structural contradiction and should have led to the deinstitutionalisation of the premium conception of control at European level, recognising that it was incapable of delivering the expected reductions in CO_2 transport emissions.

Yet, the total preservation by the European Commission of the premium conception of control meant that electrification has simply substituted

dieselisation, without any change in business models and product architectures. If in Europe, as stated by the EU's 'Fit for 55' impact study, BEVs are 52 per cent more expensive and almost 500 kg heavier than in China, it is because we are electrifying conventional multipurpose vehicles rather than creating new energy vehicles.

We have argued that what is particularly disrupting in the current process of rapid or ultra-rapid electrification, reflected by the 'Fit for 55' package, is not electrification per se but the combination of electrification and upmarket drift.

While there is no doubt that electrification will eventually reduce the environmental impact of upmarket drift, there is also no doubt that upmarket drift will also drastically reduce the environmental benefits of electrification. Even more than for ICEVs, heavier and more powerful BEVs and PHEVs drastically diminish the energy efficiency of these vehicles and sharply increase their cost and price.

The impact of the combination of electrification and upmarket drift on the European market is an acceleration in the latter. In 2020, the 8 per cent extra market share gained by BEVs and PHEVs doubled the speed at which the average mass, engine power and price of new cars in Europe had increased during the previous twenty years.

With the EU 'Fit for 55' proposal of phasing out ICEVs, hybrid EVs and PHEVs by 2035, combined with the introduction of the Euro 7 norm in 2026, the most probable outcome is an almost 100 per cent market share for BEVs in 2030. Judging by the announcements which have been made by European OEMs in terms of product development and platform strategies, almost all going towards a 100 per cent full electric range by 2030, it seems a fair assumption that we are moving in this direction. What we should be preparing for is ultra-accelerated upmarket drift whose impact in the short-term (2022-2030) will be much more disruptive than what we have documented for the period 2001-2019.

The road to carbon neutrality by 2050 is not an easy one. But if we move towards the technology of the future – electrification – with the same institutions and business models of the past, then it becomes an extremely difficult one. This is particularly the case when these institutions (the EU regulatory framework) and these business models (the premium conception of control) have been responsible for the rising CO_2 emissions in the European transport sector since 1990.

The main short-term challenges that are ahead of us are making BEVs affordable, in particular for households in southern and central and eastern Europe; and providing a sustainable way for these countries to be included in the EU Green Deal, also as producers of such vehicles. These challenges should be clearly recognised by the European institutions as the main priorities and should be taken up by the European generalist car manufacturers that, in

the past, were historically successful in going downmarket by innovating in product designs and technologies.

There is also a real risk that, if European generalist car manufacturers completely move away from the entry-level market, then Chinese generalist car manufacturers will take their place. The main non-trade barrier that has prevented Chinese car manufacturers – such as Geely, Byd, Chery and JAC – from entering the European market is the technology of the internal combustion engine. With battery technology, however, they have already leapfrogged European car manufacturers and are ready to attack their market shares.

To avoid such a scenario, and more generally the highly disruptive consequences of accelerated upmarket drift in electrification, we think that two relatively simple amendments to the CO_2 regulation in the 'Fit for 55' package could bring the European automotive industry back to a more sustainable path:

- First, as has also been requested by T&E (2021), the leading environmental NGO in Brussels, weight-based CO_2 standards should be phased out as soon as possible;
- Second, energy efficiency should be introduced as a key parameter for evaluating the actual contribution of electric vehicles to the reduction of CO_2 emissions and calculating the average CO_2 emissions of new car sales.

These two amendments would already be sufficient to push the industry finally to reduce the mass, the power and the price of the average European car.

It is clear, however, that such a radical shift in the direction of the European automotive industry (from upmarket to downmarket) would also imply other important institutional changes. Two in particular would be crucially important.

First, the technical regulation (whole vehicle type approval) should be adjusted to make such a downmarket shift possible. We could take example here from the Japanese regulations that have special rules and downgraded parameters for the micro 'key cars' that dominate the entry-level Japanese market and that have largely contributed to its greening.

Second, the competition rules of the Single Market should be made much more flexible so that market failures, such as the non-development of markets for new cars in the new Member States (but also the strong decline in southern European markets) could be addressed by ad hoc measures combining fiscal, environmental and industrial policies and regulations.

The current situation in which the average new car sold in the new Member States is just 20 per cent cheaper than the average European car, while average per capita revenues are 60 per cent lower than the European average,

is an economic, social and environmental constraint, in particular when we know that these countries have the oldest car fleets in Europe and that they are the most important net contributors to the growth of CO_2 emissions from cars in Europe.

Developing these markets would also allow a reconnection between their domestic automotive industries and the domestic markets themselves, putting an end to the 'race to the bottom' in working and employment conditions orchestrated by the constant competition between different high and low wage factories for the same products. It would also provide opportunities for real functional and social upgrading in these industries where new products for such new markets could ultimately be conceived, developed and manufactured.

To conclude, we have shown how the regulatory upmarket drift of the last twenty years has resulted in a process of rapid electrification that will be disruptive for the European automotive industry and could even jeopardise EU Green Deal objectives. But we have also argued that combining electrification with a regulatory downmarket drift could open up much more sustainable scenarios for the future of the automotive industry and for the capacity of the European Union to achieve carbon neutrality in 2050. The European level is decisive here and we call for ambitious, but also new and different, regulations and policies from those that have led us to these difficult choices.

Glossary

ACEA	European Automobile Manufacturers' Association
BEV	Battery Electric Vehicle(s)
CARS 21	Competitive Automotive Regulatory System high-level group
EC	European Commission
FCEV	Fuel Cell Electric Vehicles
FDI	Foreign Direct Investment
FTE	Full-time Equivalent
GHG	Greenhouse Gas
GWh	Gigawatt hour
ICE	Internal Combustion Engine
ICEV	Internal Combustion Engine Vehicle(s)
ICCT	International Council on Clean Transportation (NGO)
KWh	Kilowatt hour
OEM	Original Equipment Manufacturer
PHEV	Plug-in Hybrid Electric Vehicle(s)
T&E	Transport and Environment (NGO)
VDA	Verband der Deutschen Automobilindustrie
WLTP	Worldwide harmonized Light vehicles Test Procedure
ZLEV	Zero Low Emission Vehicles

References

AQEG (2019) Non-exhaust emissions from road traffic, Report from the Air Quality Expert Group to the Department for Environment, Food and Rural Affairs; Scottish Government; Welsh Government; and Department of the Environment in Northern Ireland.

Arval (2019) Le véhicule électrique est-il si vertueux ?, Arval and Eurogroup Consulting.

Baldino C., Tietge U., Muncrief R., Bernard Y. and Mock P. (2017) Road tested: comparative overview of real-world versus type-approval NOx and CO2 emissions from diesel cars in Europe, International Council on Clean Transportation.

Batho D. and Rohfritsch S. (2016) Rapport (...) sur l'offre automobile française dans une approche industrielle, énergétique et fiscale, Rapport parlementaire 4109, Assemblée nationale.

BCG (2021) E-mobility: a green boost for European automotive jobs?, Boston Consulting Group.

Beblavy M., Drahokoupil J., Draxler J. and Myant M. (2011) Labour relations in Central and Eastern Europe, NEUJOBS State of the Art Report 3/D6.1.

Beez F. (2011) Politikformulierung und Interessenvermittlung am Beispiel der Festlegung von CO2-Emissionsgrenzwerten für neue Pkw in der Europäischen Union, PhD Thesis, Rheinisch-Westfälischen Technischen Hochschule Aachen.

Bergquist A.-K. and Näsman M. (2021) Safe before green! The greening of Volvo cars in the 1970s–1990s, Enterprise & Society, 1–31. https://doi.org/10.1017/eso.2021.23

Berjoza D. and Jurgena I. (2017) Influence of batteries weight on electric automobile performance, Engineering for Rural Development, 1388–1394. https://doi.org/10.22616/ERDev2017.16.N316

Blumberg K. and Posada F. (2015) Comparison of US and EU programs to control light-duty vehicle emissions, International Council on Clean Transportation.

Boillot J.J. and Lepape Y. (2004) Le renouveau de l'industrie automobile en Europe centrale et orientale, Annales des Mines, novembre, 52–56.

Drahokoupil J., Horn L. and van Apeldoorn B. (2008) Contradictions and limits of neoliberal European governance: from Lisbon to Lisbon, Palgrave Macmillan.

Drahokoupil J. and Myant M. (2016) Dependent capitalism and employment relations in East Central Europe, in Delteil V. and Vassil K. (eds.) Labour and social transformation in Central and Eastern Europe: Europeanization and beyond, Routledge, 56-73.

European Commission (2007) Communication from the Commission to the Council and the European Parliament 6 Results of the review of the Community Strategy to reduce CO2 emissions from passenger cars and light-commercial vehicles {SEC(2007) 60} {SEC(2007) 61.

European Commission (2021) Commission Staff Working Document - Impact Assessment. Part 1. Accompanying the document Proposal for a Regulation of the European Parliament and of the Council amending Regulation (EU) 2019/631 as regards strengthening the CO2 emission performance standards for new passenger cars and new light commercial vehicles in line with the Union's increased climate ambition, SWD(2021) 613 final.

Falck O., Czernich N. and Koenen J. (2021) Auswirkungen der vermehrten Produktion elektrisch betriebener Pkw auf die Beschäftigung in Deutschland, IFO Institut. https://www.ifo.de/DocDL/ifoStudie-2021_Elektromobilitaet-Beschaeftigung.pdf

Fana M. and Villani D. (2022) Decomposing the automotive supply chain: employment, value added and occupational structure, Structural Change and Economic Dynamics, 62, 407-419. https://doi.org/10.1016/j.strueco.2022.04.004
Fligstein N. (1990) The transformation of corporate control, Harvard University Press.
Fligstein N. (2001) The architecture of markets: an economic sociology of twenty-first-century capitalist societies, Princeton University Press.
Fligstein N. and McAdam D. (2012) A theory of fields, Oxford University Press.
Fojcik T.M. and Proff H. (2014) Accelerating market diffusion of battery electric vehicles through alternative mobility concepts, International Journal of Automotive Technology and Management, 14 (3/4), 347–368. https://doi.org/10.1504/IJATM.2014.065297
Freyssenet M., Mair A., Shimizu K. and Volpato G. (eds) (1998) One best way? Trajectories and industrial models of the world's automobile producers, Oxford University Press.
Gandillot T. (1992) La dernière bataille de l'automobile européenne, Fayard.
Gažo P. (2022) The transformation of the Slovak and Czech automotive industries: stakeholders' perspectives and barriers towards an ecological mobility industry, International Journal of Automotive Technology and Management, 22 (2), 202-221.
Gössling S., Cohen S.A. and Hares A. (2016) Inside the black box: EU policy officers' perspectives on transport and climate change mitigation, Journal of Transport Geography, 57, 83–93. https://doi.org/10.1016/j.jtrangeo.2016.10.002
Haas T. and Sander H. (2019) The European car lobby, Rosa Luxembourg Stiftung.
Hildermeier J. (2016) Which role should the electric car play in Europe's cities? An analysis of publicly funded demonstration projects 2007-2013, International Journal of Automotive Technology and Management, 16 (1), 90–107.
Hildermeier J. and Villareal A. (2012) Shaping an emerging market for electric cars: how politics in France and Germany transform the European automotive industry, European Review of Industrial Economics and Policy, 3. halshs-00677752
Houben H. (2016) La désindustrialisation en Europe occidentale : le cas de l'automobile, Outre-Terre, 46 (1), 199–230.
ICCT (2017) Lightweighting technology developments, Technical Brief 6, International Council on Clean Transportation.
ICCT (2020) Real-world usage of plug-in hybrid electric vehicles: fact sheet Europe, International Council on Clean Transportation.
IEA (2019) Fuel economy in major car markets, International Energy Agency.
Jetin B. (2020) Who will control the electric vehicle market?, International Journal of Automotive Technology and Management, 20 (2), 156–177.
Jullien B., Lung Y. and Midler C. (2012) L'épopée Logan : nouvelles trajectoires d'innovation, Post-Print, HAL. https://EconPapers.repec.org/RePEc:hal:journl:hal-00798523
Jullien B. and Pardi T. (2013) Structuring new automotive industries, restructuring old automotive industries and the new geopolitics of the global automotive sector, International Journal of Automotive Technology and Management, 13 (2), 96–113.
Jullien B., Pardi T. and Ramirez Pérez S. (2014) The EU's government of automobiles: from 'harmonization' to deep incompleteness, in Jullien B. and Smith A. (eds.) The EU's government of industries: markets, institutions and politics, Routledge.
Kassim H. (1996) Chapter VI. Aerospace, in Kassim H. and Menon A. (eds.) The European Union and national industrial policy, Routledge.

Katzemich N. (2018) Dieselgate and the German car industry, in ALTER-EU (ed.) Corporate capture in Europe: when big business dominates policy-making and threatens our rights, 88–105, Alliance for Lobbying Transparency and Ethics Regulation.
Klebaner S. (2019) Managing regulations: the integration of the air pollutant emissions limits in the car manufacturers economic activities.
Klüver H. (2013) Lobbying in the European Union: interest groups, lobbying coalitions, and policy change, Oxford University Press.
Loubet J.-L. (2001) Histoire de l'automobile française, Seuil.
Manello A., Calabrese G.G. and Frigero P. (2016) Technical efficiency and productivity growth along the automotive value chain: evidence from Italy, Industrial and Corporate Change, 25 (2), 245–259.
Mc Gowan L. (2007) Industrial and competition policy, in Hay C. and Menon A. (eds.) European Politics, Oxford University Press.
Moguen-Toursel M. (2004) Strategies of European automobile manufacturers facing community environmental standards, Business and Economic History On-Line. http://www.thebhc.org/publications/BEHonline/2003/Moguen-toursel.pdf
Moguen-Toursel M. (2006) European standards: tool or barrier for European enterprise?, Paper presented at the XIV International Economic History Congress, Helsinki, 21-25 August 2006.
Nowack F. and Sternkopf B. (2015) Lobbyismus in der Verkehrspolitik, IVP-Discussion Paper 2/2015, Fachgebiet Integrierte Verkehrsplanung.
Pardi T. (2010) Entre déréglementation et contrôle du marché : la distribution automobile en Europe à partir du cas de Toyota, in Avril C., Lomba C. and Serry H. (eds.) Formes d'emploi et pratiques de travail, Presses universitaires de Vincennes, 21–37.
Pardi T. (2017) L'avenir du travail dans le secteur automobile : les enjeux de la (de) globalisation, Organisation internationale du Travail.
Pardi T. (2018) Une voiture low-cost pour les pays riches : Logan et l'intégration européenne, La Nouvelle Revue du Travail, 12. https://doi.org/10.4000/nrt.3544
Pardi T. (2019) The role of multinational company strategies in structuring global supply chains in the automotive industry, Research Department Working Paper 44, ILO.
Pavlínek P. (2018) Global production networks, foreign direct investment, and supplier linkages in the integrated peripheries of the automotive industry, Economic Geography, 94 (2), 141–165.
Pavlínek P. (2020) Restructuring and internationalization of the European automotive industry, Journal of Economic Geography, 20 (2), 509–541.
Pavlínek P. (2022) Relative positions of countries in the core-periphery structure of the European automotive industry, European Urban and Regional Studies, 29 (1), 59–84.
Pavlínek P., Aláez-Aller R., Gil-Canaleta C. and Ullibarri-Arce M. (2017) Foreign direct investment and the development of the automotive industry in eastern and southern Europe, Working Paper 2017.03, ETUI.
Ramirez Pérez S. (2010) Automobile standardisation in Europe: between technological choices and neo-protectionism, in Bouneau C., Burigana D. and Varsori A. (eds.) Les trajectoires de l'innovation technologique et la construction européenne : des voies de structuration durable ?, Peter Lang, 187–204.

Scharte B. (2010) Do domestic interests matter? Der Einfluss nationaler Interessengruppen auf die Position von Staaten zur Umweltpolitik auf EU-Ebene, PhD Thesis, Johannes Gutenberg-Universität.

Seidenfuss K.-U. and Kathawala Y. (2005) Voluntary Export Restraint (VER) without market restraints? The case study of the monitoring agreement (1991-1999) between the Japanese car manufacturers and the European Union, European Business Review, 17 (3), 217–231. https://doi.org/10.1108/09555340510596634

Serrenho A.C., Norman J.B. and Allwood J.M. (2017) The impact of reducing car weight on global emissions: the future fleet in Great Britain, Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences, 375 (2095), 1–16.

Skeete J.-P. (2017) Examining the role of policy design and policy interaction in EU automotive emissions performance gaps, Energy Policy, 104, 373–381.

Strategy& (2021) Electric vehicle transition impact assessment report 2020 – 2040: a quantitative forecast of employment trends at automotive suppliers in Europe, PwC network and CLEPA.

T&E (2007) Danger ahead: why weight-based CO2 standards will make Europe's car fleet dirtier and less safe, European Federation for Transport and Environment.

T&E (2017) Diesel: the true (dirty) story, European Federation for Transport and Environment.

T&E (2018) CO2 emissions from cars: the facts, European Federation for Transport and Environment.

T&E (2021) Electric car boom at risk: why the current EU CO2 rules will do little to accelerate the switch to zero-emissions mobility, European Federation for Transport and Environment.

Tietge U., Diaz S., Mock P., Bandivadekar A., Dornoff J. and Ligterink N. (2019) From laboratory to road: a 2018 update of official and 'real-world' fuel consumption and CO2 values for passenger cars in Europe, White Paper, International Council on Clean Transportation Europe.

Tolliday S. (2003) The decline of Ford in Britain: marketing and production in retreat, 1980-2003, in Bonin H., Lung Y. and Tolliday S. (eds.) Ford, 1903-2003: the European history, Éd. PLAGE, 73–117.

Verhaeghe O. (2021) Impacts des mutations de la construction automobile sur l'emploi et les compétences. observatoire-metallurgie.fr/sites/default/files/2021-04/Rapport%20final_1.pdf

Vervaeke M. and Calabrese G. (2015) Prospective design in the automotive sector and the trajectory of the Bluecar project: an electric car sharing system, International Journal of Vehicle Design, 68 (4), 245–264.

Villareal A. (2011) The social construction of the market for electric cars in France: politics coming to the aid of economics, International Journal of Automotive Technology and Management, 11 (4), 326–339.

Volpato G. (2009) Fiat Group Automobiles: an Arabian phoenix in the international auto industry, in Freyssenet M. (ed.) The second automobile revolution: trajectories of the world carmakers in the 21st century, Palgrave MacMillan, 287–308.

Wagner S.M. (2009) The automotive industry and environmental regulations: challenges to corporate political activities of multinational enterprises in the European Union, in Ibeh K. and Davies S. (eds.) Contemporary challenges to international business, Palgrave Macmillan, 269–284.

Warlouzet L. (2008) Europe de la concurrence et politique industrielle communautaire : la naissance d'une opposition au sein de la CEE dans les années 1960, Histoire, Economie & Société, 27 (1), 47–61.

Warlouzet L. (2017) Governing Europe in a globalizing world: neoliberalism and its alternatives following the 1973 oil crisis, Routledge.

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