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PASSENGER CAR EMISSIONS IN TURKEY

A BASELINE ANALYSIS OF CURRENT VEHICLE TAXATION POLICIES IN TURKEY AND THEIR IMPACT ON NEW AND USED PASSENGER CARS

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EXECUTIVE SUMMARY

The Turkish automotive industry is the fifth largest in Europe and critical to Turkey's economic stability. Passenger car taxes in Turkey are higher than in almost all of Europe. The largest portion comes from the vehicle registration tax (ÖTV), which is tied to engine size, or displacement. The tax nearly doubles for engine displacement above 1,600 cm^3 and triples for engine displacement above 2,000 cm^3. As a result, consumers overwhelmingly purchase new cars with smaller engines. Ninety percent of vehicles on the road have an engine displacement below 1,600 cm^3 and almost no vehicles have an engine displacement above 2,000 cm^3 (Figure ES-1).

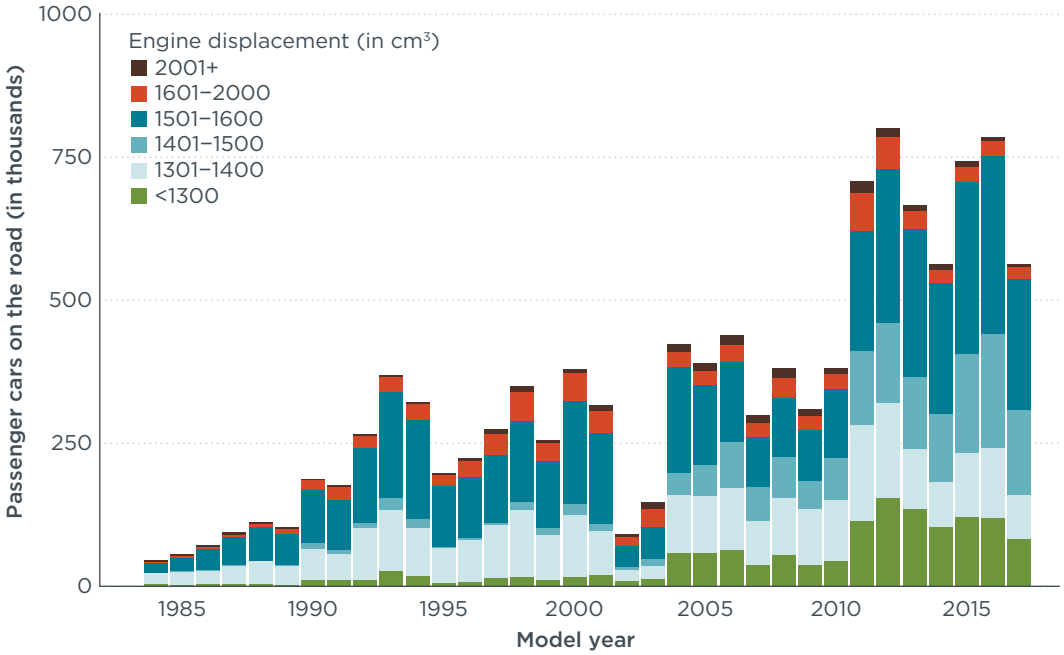

Figure ES-1: Passenger cars on the road in Turkey, differentiated by model year and engine size. Data source: TurkStat

Smaller engines do not necessarily produce the lowest emissions, however. Even though vehicles in Turkey have a 7% smaller engine displacement than those in other European countries, weigh 3% less, and have 13% less engine power, the average CO_2 emission levels of new cars in Turkey since 2015 have equaled or have been slightly higher than those in the EU. Turkey's ÖTV does not take into consideration vehicle emission levels for cars with combustion engines. Lacking tax incentives, buyers do not opt for low-emission vehicles.

There are some tax incentives for hybrid-electric (HEVs) and battery-electric vehicles (BEVs), but these cars—including plug-in hybrid electric vehicles (PHEVs)—account for less than 1% of new sales in Turkey. At the same time, hybrid and electric vehicles are becoming increasingly popular in the European Union (EU), where they have reached almost 5% of the market share.

In addition, tax incentives in Turkey favor older, higher-emission cars. The annual ownership tax (MTV) is lower for older cars, which relieves the financial pressure on second-hand or third-hand owners, who tend to be less wealthy than new car buyers. As with the ÖTV, the MTV does not provide strong fiscal incentives for cars with low emissions. On the contrary, it encourages owners to keep their vehicles as long as possible, even though vehicles tend to have high emission levels. Passenger cars older

than 16 years produce about 40% of the total CO_2 and 67% of the total nitrogen oxide (NO_x) emissions in Turkey, but contribute less than 10% to the total MTV revenue.

Going forward, the Turkish government should consider reforming the ÖTV and MTV system for passenger cars. An emissions-based structure that encourages consumers to buy more fuel-efficient cars would help reduce the country's CO_2 emissions, fuel consumption, and dependence on oil imports. Moreover, it would help secure the long-term competitiveness of the Turkish automotive industry at a time when conventional combustion engine vehicles are losing popularity in the EU, the main export destination of Turkish car manufacturers.

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ABBREVIATIONS

ACEA	European Automobile Manufacturers' Association
BEV	battery-electric vehicle
CO_2	carbon dioxide
cm^3	cubic centimeter
EU	European Union
EV	electric vehicle
g	gram
HEV	hybrid-electric vehicle
km	kilometer
kW	kilowatt
l	liter
LPG	liquefied petroleum gas
MTV	Motorlu Taşitlar Vergisi (annual vehicle ownership tax in Turkey)
NEDC	New European Driving Cycle
NO_x	nitrogen oxides
ODD	Automotive Distributers' Association (Turkey)
OECD	Organization for Economic Co-operation and Development
OICA	Organization of Motor Vehicle Manufacturers
OSD	Automotive Manufacturers' Association (Turkey)
ÖTV	Özel Tüketim Vergisi (special consumption tax in Turkey)
PHEV	plug-in hybrid electric vehicle
PM	particulate matter
TL	Turkish lira
VAT	value added tax

1. INTRODUCTION

Despite the Turkish currency and debt crisis of 2018, the country remains one of the fastest growing economies in Europe, with a 7.4% annual growth rate in 2017 (The World Bank, 2018). Turkey's automotive industry is the fifth largest in Europe (OSD, 2018a; OICA, 2018) and, as a leading exporter, a key driver of the country's growth. There are 15 vehicle manufacturers with production facilities in Turkey that produce more than 1.7 million vehicles domestically and employ about 400,000 people (OSD, 2018a; TurkStat, 2018).

Passenger cars account for the majority of vehicle production and sales in Turkey. More than 1.1 million cars were produced domestically and 80% of those vehicles were exported in 2017 (OSD, 2018a). With the exception of the Toyota C-HR hybrid-electric vehicle (HEV), all new passenger cars produced domestically in Turkey in 2017 were equipped with a conventional combustion engine (ODD, 2018). At the same time, there is a global trend toward lowering fuel consumption and carbon dioxide (CO_2) emissions and toward increasing the share of electrified vehicles (International Energy Agency, 2018). The European Union (EU), Turkey's main export destination, recently mandated that new cars reduce their CO_2 emission levels by 37.5% between 2021 and 2030 (Mock, 2019). In the case of plug-in hybrid-electric (PHEV) and battery-electric vehicles (BEV), sales in Turkey in 2017 were around 0.01%, while at the same time the market share in the EU had already reached 1.8% (Tietge, 2018). Similarly, the average CO_2 emission levels of all new cars were nearly equal or slightly higher in Turkey, at 120 grams per kilometer (g/km), than in the EU, which averaged 119 g/km. These higher emission levels are produced despite the fact that new cars in Turkey are, on average, lighter and equipped with less powerful engines than those in the EU (ODD, 2018; ICCT, 2018).

In light of the global trend toward innovative vehicle technologies, the current structure of auto production in Turkey, with its focus on conventional combustion engine vehicles, could put the industry at risk in future markets. Also, fuel consumption and CO_2 emissions of a vehicle are directly linked to each other. Therefore, transitioning Turkey's domestic vehicle production toward low-emission vehicles is not only key from a global competitiveness point of view, but would also enable Turkey to become less dependent on oil products imported from abroad. As an energy-importing country, the imports of mineral fuel and oil to Turkey add up to $40 billion annually, with the transportation sector consuming 20% of the total fuel (The World Bank, 2014; TurkStat, 2018).

Turkey also has one of the oldest passenger car fleets in Europe, with an average age of more than 12 years (TurkStat, 2018; ACEA, 2017). These older vehicles tend to have higher CO_2 emissions and higher fuel consumption than modern vehicles, further driving up fuel use and the resulting emissions (Yang, 2014).

Taxes have a strong influence on the passenger car market structure. This is particularly true in Turkey, which has one of the highest vehicle tax rates across Europe. However, vehicle emissions do not influence Turkey's level of taxation, and incentives for replacing older cars with new ones with low emission levels are weak (Mock, 2016).

This paper analyzes the Turkish passenger car market and the effect of the existing tax system on both vehicles on the road and newly registered cars. It builds on a previous paper (Mock, 2016), but adds new data from additional sources, including historical time-series data. The aim of this paper is to provide a report for the most recent developments in the Turkish passenger car market and to create a basis for further research on optimizing the tax system. Section 2 provides an overview of the current passenger car tax system in Turkey. Section 3 focuses on the effect of vehicle taxes on passenger cars on the road. Section 4 focuses on the effect of taxes on newly registered cars. Section 5 concludes and provides recommendations for how the Turkish government could spur low-emission vehicles.

2. CURRENT STRUCTURE OF PASSENGER CAR TAXES IN TURKEY

Like in most European countries, Turkish car owners are charged taxes at two different stages: acquisition and ownership taxes. The total amount of these two different tax types though is higher than in most of the European countries.

Figure 1 illustrates this point by comparing the total amount of taxes for two selected passenger car models produced domestically in Turkey. One of them is the Fiat Egea, which was the top-selling combustion engine model in Turkey in 2017. For the comparison, we used the 1.3 liter (l) diesel engine, the most popular configuration of this model, with a CO_2 emission level of 110 g/km. The second car model is the top-selling hybrid-electric vehicle model in Turkey, the Toyota C-HR, equipped with a 1.8 l hybrid-electric engine and a CO_2 emission level rated at 87 g/km. Due to special tax incentives for hybrid cars in Turkey (see next section), the registration tax rates are similar for the two vehicles and allow for a side-by-side comparison.

For both vehicles, net prices (prices before taxes) are taken from the Turkish market (Toyota, 2018; Fiat, 2018). We then assume that both vehicles are available and net prices of the cars are the same in all other countries. In a next step, we apply the respective taxes of each of the selected countries. Finally, the results are converted to Turkish Lira (TL).[1] To show ownership tax estimations from a customer's perspective, annual taxes are calculated for a holding period of four years, in line with the approach taken for previous ICCT research (Mock & Yang, 2014; Wappelhorst, Mock, & Yang, 2018). The outlined methodology allows for comparison of the differences in tax levels across countries, while leaving aside potential differences in net prices.

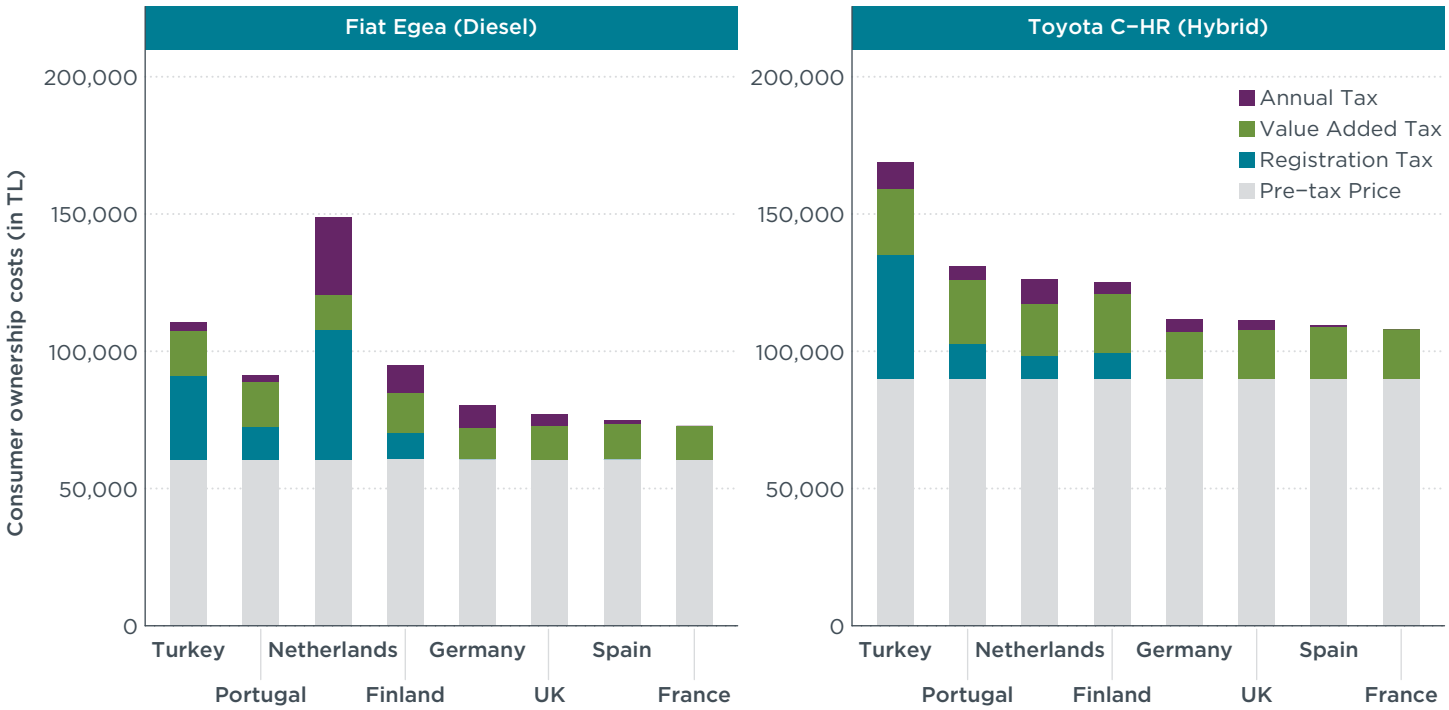

Figure 1. Comparison of tax levels of the Toyota C-HR (1.8 l, hybrid-electric) and Fiat Egea (1.3 l, diesel) vehicle models across selected countries. Net prices are assumed to be identical in all countries and annual tax is calculated for a four-year holding period

1 The currency rate has been taken as 1 Euro = 6 TL (August 1, 2018).

As it can be seen from Figure 1, the tax level for a Fiat Egea-like model is higher in Turkey than in any other country, with one exception: the Netherlands. The reason is that in the Netherlands there is a particularly high tax applied for diesel cars, in the form of a one-time registration and an annual ownership tax (Wappelhorst, Mock, & Yang, 2018). For the hybrid-electric vehicle model, the price difference is even more pronounced, with Turkey being by far the most expensive place to buy a hybrid-electric model. The especially high registration tax for hybrid-electric cars causes this price difference.

2.1 TAXES ON VEHICLE ACQUISITION

In Turkey, there are two different types of acquisition taxes for vehicles in place: a registration tax, or ÖTV (Special Consumption Tax, a type of tax for luxury goods), and a value-added tax, or VAT.

ÖTV rates are applied to a vehicle's net price and vary between 3% for a battery-electric car and 160% for a conventional combustion engine car with an engine displacement larger than 2.0 l. The VAT rate in Turkey is 18%. As VAT is applied after ÖTV, ÖTV rates can indirectly reach 190% of the cars' net price. Table 1 lists the six ÖTV categories for passenger cars equipped with a conventional combustion engine.

Table 1. ÖTV rates for passenger cars equipped with a conventional combustion engine

Engine displacement	Vehicle net price (TL)	Tax rate[2]
≤ 1.6 l	≤ 70,000	45%
≤ 1.6 l	70,000–120,000	50%
≤ 1.6 l	> 120,000	60%
1.6–2.0 l	≤ 170,000	100%
1.6–2.0 l	> 170,000	110%
> 2.0 l		160%

As seen in Table 1, engine displacement and net price of a car are the only determinants of the ÖTV tax groups. Engine displacement is the main determinant, and for cars with an engine displacement larger than 1.6 l, an ÖTV rate of at least 100% applies. In addition to engine displacement, the net price of a car further increases the tax rate from 100% to 110%, in the case of a 1.6–2.0 l engine.

In 2017, 70% of the cars on the market in Turkey were imported and the local content rates of domestically produced vehicles were between 20% and 65% (Ministry of Industry and Technology, 2018; ODD, 2018). As a result, prices of cars on the market and their classification into one of the ÖTV tax categories were strongly dependent on foreign currencies. That same year, the Turkish government introduced a new tax system and established fee thresholds tied to three vehicle net price levels: 40,000 TL, 70,000 TL, and 100,000 TL. Since then, the Turkish lira lost almost 50% in value against the U.S. dollar and vehicle prices have sharply increased (BloombergHT, 2018). Tax thresholds went up only 15% by early 2018, but by September 2018, the Turkish government had increased those thresholds again (Revenue Administration, 2018).

In recent years, the Turkish government announced some tax incentives to promote hybrid-electric (HEV) and battery-electric (BEV) vehicle sales. It is noteworthy that those incentives were introduced at the same time as the domestic production of the corresponding models began. ÖTV for BEVs went down in 2011, just before the

2 In November 2018, the Turkish government announced a temporary ÖTV reduction, to be in place until 2019. For cars in the first two tax groups, the ÖTV rates are reduced from 45% to 30% and from 50% to 35% (Revenue Administration, 2019).

production of the Fluence Z.E., the first BEV produced in Turkey (EV World, 2014; Revenue Administration, 2011). Production was phased out in 2014. Moreover, a reduction in ÖTV for HEVs with 1.6 l–1.8 l engines was introduced in 2016, the same year as domestic production of the Toyota C-HR hybrid, which was equipped with a 1.8 l engine (Revenue Administration, 2019; Toyota, 2018).

HEVs qualify for a lower ÖTV, if they fall into any of the tax groups shown in Table 2. For example, in the case of a 1.6–1.8 l engine displacement and an electric engine with more than 50 kilowatt (kW) of power, the ÖTV rate is reduced to 45–60%, instead of applying the regular rate of 100–110%.

Table 2. ÖTV exemptions for passenger cars with hybrid-electric engines

Combustion engine displacement	Electric engine power	Vehicle net price (TL)	Tax rates for hybrid-electric vehicles[3]	Tax rates for conventional vehicles
1.6–1.8 l	> 50 kW	≤ 85,000	45%	100%
1.6–1.8 l	> 50 kW	85,000–135,000	50%	100%
1.6–1.8 l	> 50 kW	> 135,000	60%	110%
2.0–2.5 l	> 100 kW	≤ 170,000	100%	160%
2.0–2.5 l	> 100 kW	> 170,000	110%	160%

For BEVs, tax rates are significantly lower than for HEVs or cars with conventional combustion engines. Depending on a car's engine power, tax rates vary between 3% and 15% (Table 3). Unlike for other vehicle types, ÖTV rates for BEVs do not change with vehicle price.

Table 3. ÖTV rates for battery-electric passenger cars

Electric engine power	Tax rate
< 85 KW	3%
85–120 KW	7%
> 120 KW	15%

In June 2018, the Turkish government announced a scrapping scheme program to decrease the share of old cars on the roads. Approximately one third of the cars in Turkey today are 16 years old or older (TurkStat, 2018). During the time period from June 2018 until the end of 2019, customers scrapping a vehicle 16 years or older will benefit from tax exemptions up to 10,000 TL, depending on the ÖTV category of the new car (Official Gazette, 2018). However, only cars of the lowest tax group are eligible for the maximum tax incentive, a situation regarded as inadequate by the car industry (KPMG, 2018). Table 4 presents the amount of ÖTV exemptions as part of the current scrapping scheme program for different tax categories.

Table 4. ÖTV exemptions of the scrapping scheme program

Engine displacement	Vehicle net price (TL)	ÖTV reduction
≤ 1.6 l	≤ 46,000	10,000 TL
≤ 1.6 l	46,000–80,000	8,000 TL
≤ 1.6 l	> 80,000	3,000 TL

3 In November 2018, the government announced a temporary ÖTV reduction until 2019. For the cars in the first two tax groups, the ÖTV rates reduced from 45% to 30% and 50% to 35% (Revenue Administration, 2019).

2.2 TAXES ON OWNERSHIP

Motor Vehicle Tax (MTV) is the annual ownership tax in Turkey. Engine displacement, age of a car, and as of 2018, net price, are the main determinants of MTV. Figure 2 illustrates how the annual fee changes with engine displacement and the age of a car. The tax sharply decreases for older vehicles, especially if the engine displacement is high. In the case of a vehicle with more than a 2.0 l engine displacement, for example, the average tax amount due per year decreases from 10,715 TL for a new car to 915 TL for a vehicle 16 years or older.

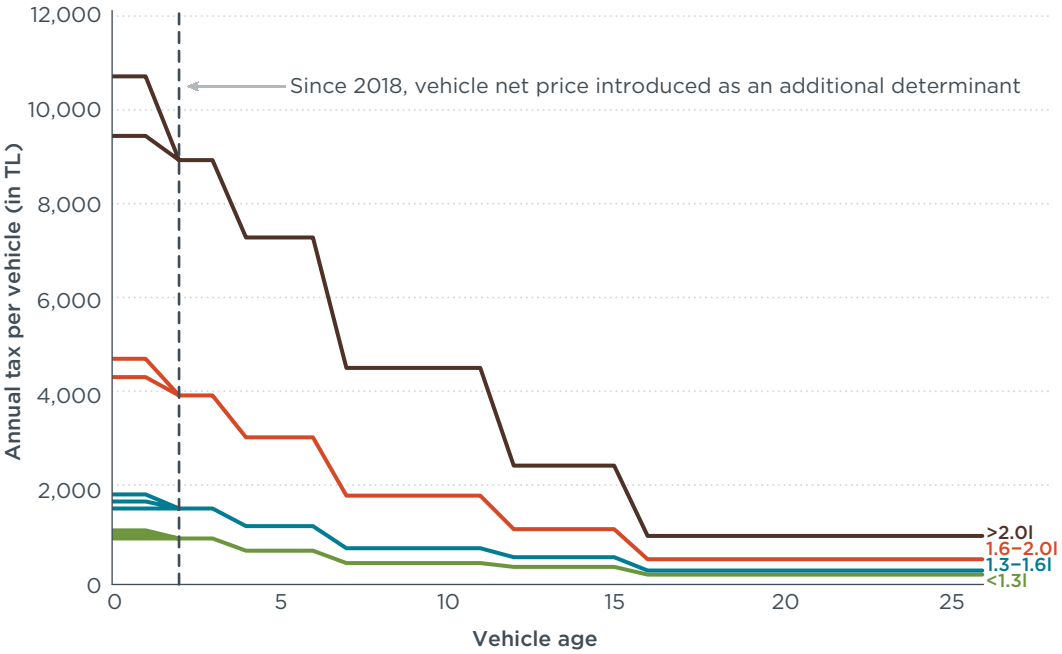

Figure 2. Annual tax system for passenger cars in Turkey, differentiated by engine displacement and, since 2018, net price category[4] (Revenue Administration, 2019)

There is no difference in the annual tax for diesel, gasoline, or hybrid-electric cars. Until February 2018, BEVs were exempt from the annual tax. However, since February 2018 BEVs fall into one of the annual tax groups, differentiated by their electric engine power. The tax rates for battery-electric vehicles remain relatively low though, at only 25% of the tax amount of a comparable combustion engine vehicle.

4 There are nine different categories for annual taxes in Turkey. For a better overview, we aggregated as follows: 1.6-2.0 l shows the sales weighted average of 1.6–1.8 l with 1.8–2.0 l and > 2.0 l shows the sales weighted average of 2.0–2.5 l, 2.5-3.0 l, 3.0–3.5 l, 3.5-4.0 l, and +4.0 l cars.

3. PASSENGER CARS ON THE ROAD

There are more than 12 million passenger cars on the road in Turkey as of 2018, of which 2.8 million are being driven in Istanbul (TurkStat, 2018). Turkey is the seventh largest market in Europe in terms of cars on the road (ACEA, 2017). At the same time, Turkey also has a larger population than most European countries. For example, there are 81 million inhabitants in Turkey but only 17 million in the Netherlands, while the number of cars on the road is about the same in both countries (ACEA, 2017; The World Bank, 2018).

Figure 3 presents an overview of the absolute number of passenger cars on the road, as well as cars per 1,000 inhabitants in selected European countries. It can be seen that Turkey has the lowest car density of all countries shown (right-hand axis). Comparably high passenger car taxes (see Section 2) and an average individual income that is about a third of that in the EU (The World Bank, 2018) makes the affordability of vehicles worse in Turkey than in other European countries.

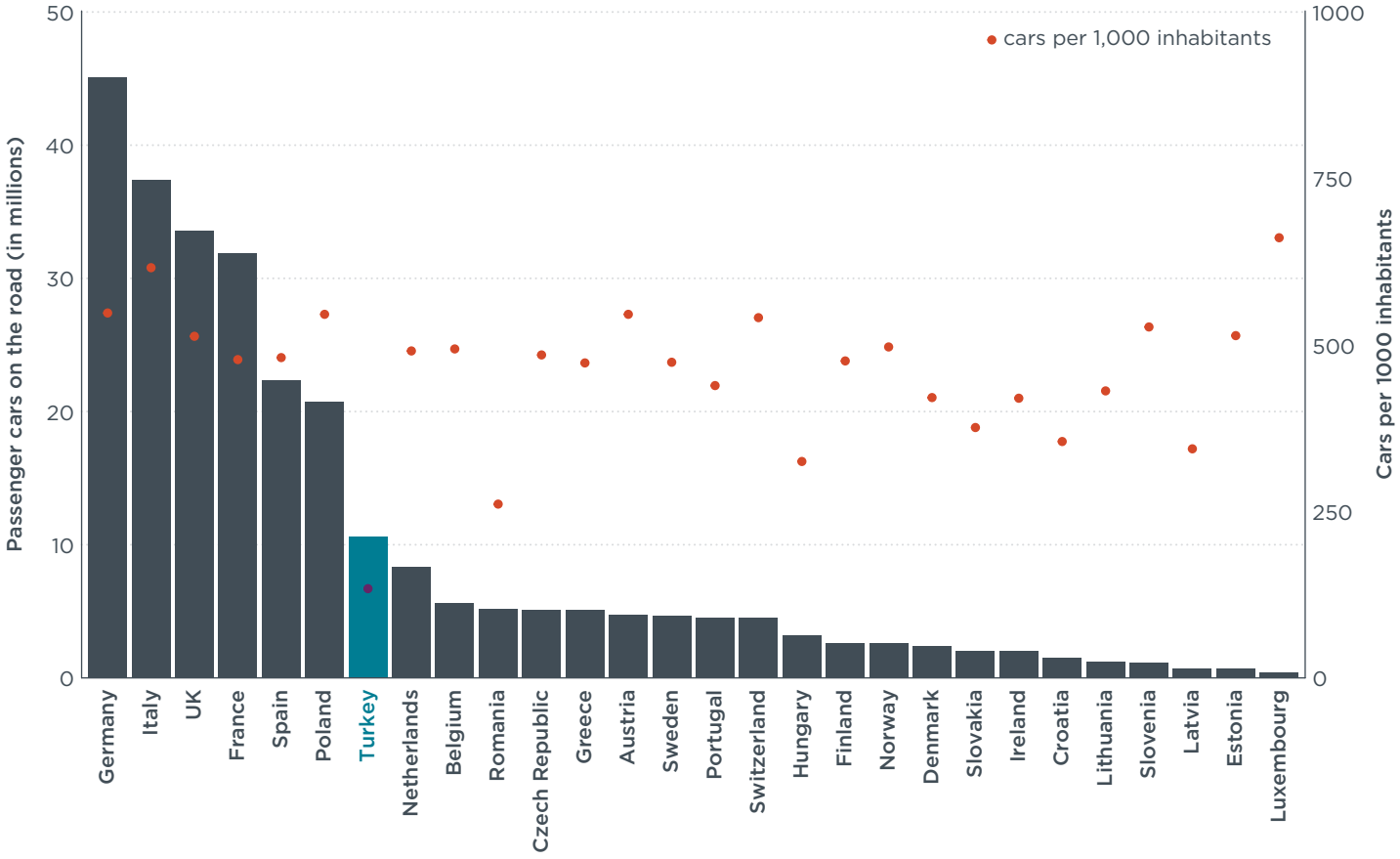

Figure 3. Absolute number of passenger cars on the road as well as cars per 1,000 inhabitants in selected European countries (ACEA, 2017)

3.1 VEHICLE FUEL TECHNOLOGY

As explained in Section 2, annual ownership tax amounts in Turkey are the same for diesel and gasoline. Nevertheless, consumer choice surveys indicate that fuel type is the third most important criteria for Turkish car buyers when deciding for a vehicle (Yavas et al., 2014). On average, more than a third of all cars on the road in Turkey are diesel vehicles (Figure 4). Of vehicles six years and younger, 62% of them have diesel engines. Gasoline vehicles account for 32% of cars age six years and younger, but they typically

get converted to run on liquefied petroleum gas (LPG) a few years after purchase. About 80% of vehicles that are 16 years and older have been converted to LPG at some point during their lifetime.

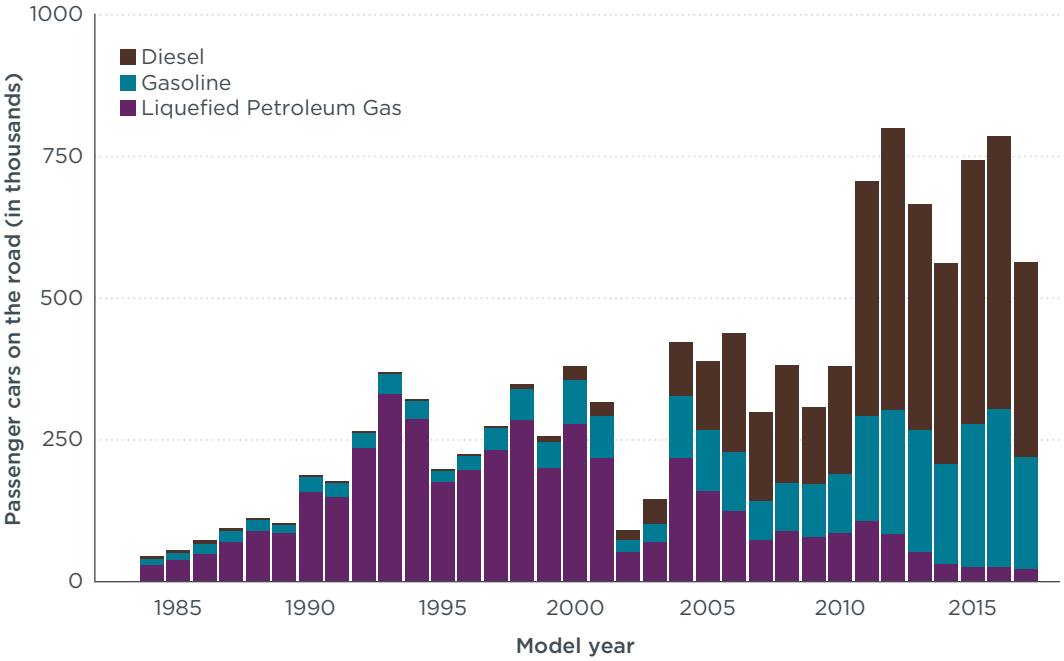

Figure 4. Passenger cars on the road in Turkey differentiated by model year and fuel type (TurkStat, 2018)

Consumer choice in Turkey for a specific vehicle fuel technology is strongly driven by fuel price and, indirectly, fuel tax, rather than by the annual vehicle tax. Current fuel price levels per liter are at about 5.82 TL for gasoline, 5.63 TL for diesel and 3.52 TL for LPG (Shell, 2019).

ÖTV does not only apply to vehicle price, but also to fuel price. Out of the total fuel price per liter, ÖTV, as of this writing, accounts for 2.38 TL for gasoline, 1.79 TL for diesel, and 0.89 TL for LPG[5] (Revenue Administration, 2019). ÖTV rates strongly fluctuate for diesel and LPG fuel. For example, between September 2018 and January 2019, ÖTV doubled for diesel fuel and increased more than six times for LPG fuel (Revenue Administration, 2018). This is due to the fact that the Turkish government has been using ÖTV in order to balance out currency and global oil price fluctuations in an effort to keep fuel prices constant for consumers (Kaya, 2018; Karanfil, 2018).

The average price for one liter of gasoline fuel is equal to 5.2% of the average daily income in Turkey. In most European countries, the price is between 1% and 2% of the average daily income (Bloomberg, 2018). Consequently, the affordability of fuel in Turkey is comparably poor, which explains why Turkish customers are particularly sensitive to fuel price levels and why they opt more often for diesel and LPG-fueled vehicles that tend to offer lower running costs than gasoline vehicles (Mock, 2016). As a result of this, the LPG share of passenger cars on the road is 39% in Turkey, while the same share is 2% in the EU (TurkStat, 2018; ACEA, 2017). These reasons partly explain why car ownership rates in Turkey are lower than in European countries.

5 ÖTV is 1.78 TL per kilogram of LPG. For a rough conversion, we apply a factor of 0.5 kg/l.

3.2 VEHICLE AGE AND EMISSION LEVELS

The average age of a passenger car in Turkey is 12.2 years, in comparison to 10.7 years in the EU (TurkStat, 2018; ACEA, 2018). More than a third (34%) of cars on the road in Turkey are 16 years and or older, while in Germany, for example, only 19% of cars are that age (TurkStat, 2018; Kraftfahrt Bundesamt, 2017). As explained in Section 2, the annual vehicle tax in Turkey decreases with the age of the vehicle, which serves as an incentive to keep older vehicles on the road, rather than replace them with newer, lower-emitting models.

Figure 5 groups passenger cars on the road in Turkey into five age categories and shows the share of each of those groups, as well as the contribution to the annual vehicle tax (MTV) revenue. The estimated contribution of each of the age categories to the total emissions of carbon dioxide (CO_2), nitrogen oxides (NO_x), and particulate matter (PM) of the passenger car fleet is shown.

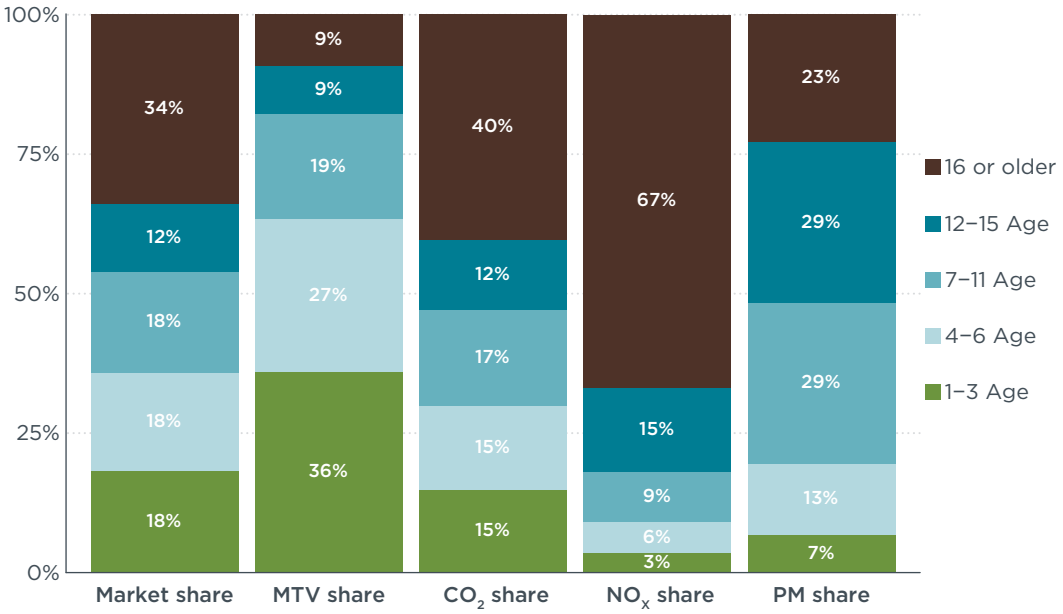

Figure 5. Passenger cars on the road in Turkey, grouped by vehicle age and differentiated by market share, contribution to MTV tax revenue, overall CO_2 / NO_x, and PM emissions from passenger cars[6]

Revenue generated from the largest group of vehicles on the road in Turkey, those age 16 years and older, is low. Although these passenger cars account for 34% of the fleet, they generate only 9% of MTV revenue. At the same time, those vehicles are estimated to be responsible for about 40% of CO_2 emissions, 67% of NO_x, and 23% of PM emissions. On the other hand, new cars age three and less account for only 18% of vehicles, but 36% of MTV revenue. This vehicle age group contributes 15% of total CO_2 emissions of the fleet, 3% of NO_x, and 7% of PM. Clearly, the current annual vehicle tax system in Turkey does not apply a charge that is in alignment with the emission levels produced by each vehicle age category.

6 Underlying data for calculating market share and contribution to MTV tax revenue is from TurkStat. Data for 2007–2017 vehicle CO_2 emission levels is from ODD. For estimating CO_2 emission levels for vehicles with registration year 2006 and older, we used a backward time series analysis (Hyndman & Athanasopoulos, 2018). For NO_x and PM emission levels, we assumed that each vehicle was in compliance with the respective Euro standard emission limit in place when first registered. It should be noted that emission levels under real-world conditions deviate from those limit values, a fact that is not taken into account here (Bernard et al., 2018; Tietge et al., 2017).

3.3 VEHICLE ENGINE DISPLACEMENT

Passenger cars with an engine displacement of 1.3–1.6 l dominate the Turkish market. About 78% of all vehicles belong to this engine size category. Also, 12% of the vehicles have engines sizes 1.3 l and smaller. This is related to the fact that both the vehicle acquisition as well as the annual tax in Turkey depend on engine size. The annual tax decreases with vehicle age enough that eventually, engine size makes little difference. For example, the difference in annual tax for a new car with an engine size smaller than 1.3 l and a car of the same age with an engine size between 1.3 and 1.6 l is 639 TL. If these vehicles were 16 years or older, the difference in tax would be only 87 TL.

Market statistics confirm that vehicle engine size tends to be smaller for newer cars. The share of cars with engines smaller than 1.3 l is 5% for cars older than 16 years and 17% for cars younger than 6 years (Figure 6). This trend most likely is not only due to differences in tax levels, but also due to innovations in engine technology. For example, turbocharging and downsizing nowadays allow extraction of more power from the same or even lower engine size (Isenstadt et al., 2016).

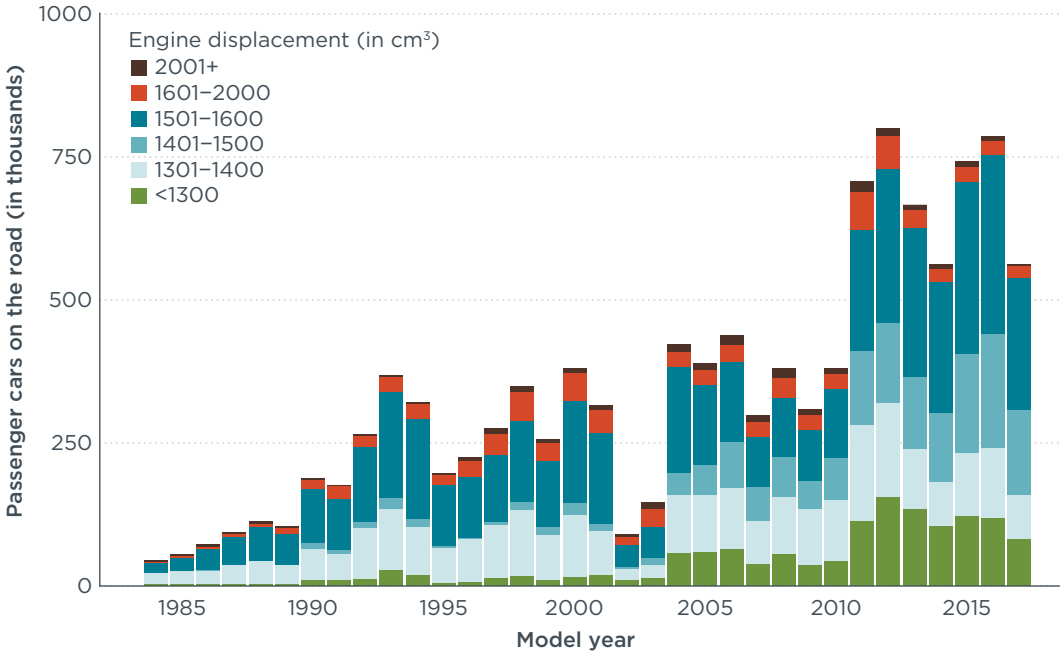

Figure 6. Passenger cars on the road in Turkey differentiated by model year and engine size (TurkStat, 2018)

4. NEWLY REGISTERED PASSENGER CARS

New passenger car registration numbers in Turkey are lower than in the top-5 EU markets (Germany, UK, France, Italy, and Spain), but higher than, for example, in Belgium. And they have increased, from about 300,000 in 2008 to more than 700,000 in 2017 (Figure 7).

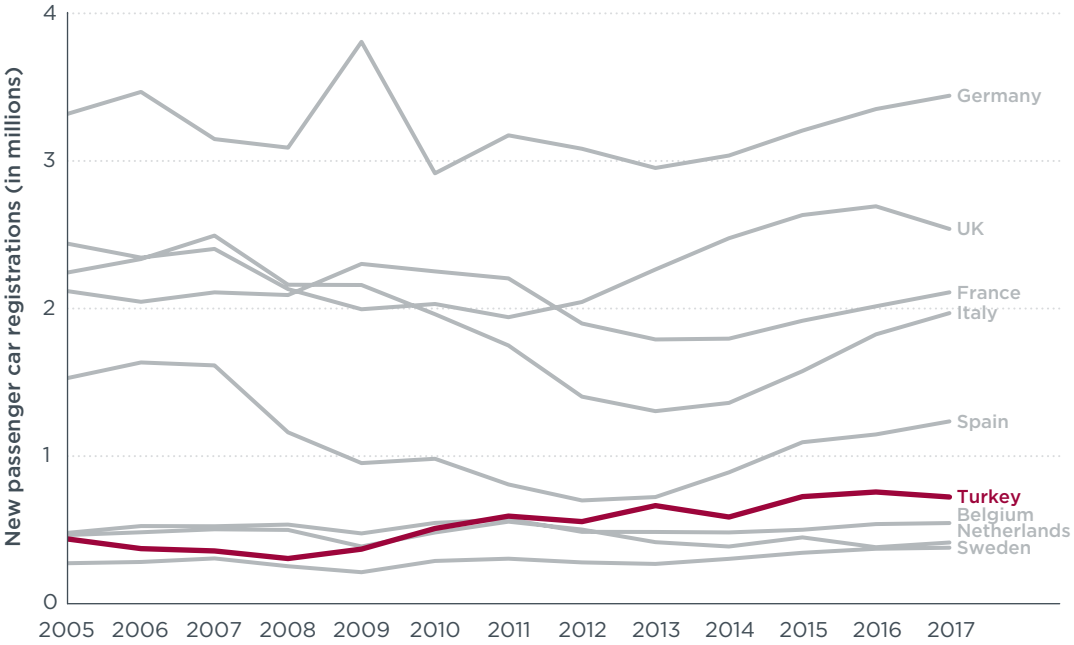

Figure 7. New passenger car registrations in Turkey over time in comparison to selected top-selling markets in the EU (OICA, 2018)

As a result of the combination of relatively high taxes and a pressured currency, Turkish households, on average, not only purchase fewer new vehicles per households than their European counterparts but also spend more of their income on vehicle purchases. In 2016, a typical Turkish household spent about 4.5% of its expenditures on vehicle purchases (Demiroğlu & Yüncüler, 2016). In the same year, an average household in the EU spent only about 3.8% of total expenditures on vehicle purchases (OECD, 2018). Although Turkish households spend a greater percentage of their income on vehicles, the cars are cheaper. For example, the average price of a new passenger car is about €29,000 in the EU but only €26,000 in Turkey (ICCT, 2018). That includes taxes, which are significantly higher in Turkey than in the EU, i.e. net prices excluding tax are notably lower in Turkey.

New car sales figures in Turkey fluctuate notably with changes in currency value, given that 70% of the cars on the market in Turkey are imported and given that the local content rates of domestically produced cars are between 20–65% (Ministry of Industry and Technology, 2018; ODD, 2018). In 2018, passenger car prices increased strongly when the value of the Turkish Lira dropped from $0.26 to $0.15 within a year (Çelik, 2018; BloombergHT, 2018). In parallel, passenger car sales dropped by about 30% (ODD, 2018).

4.1 MARKET STRUCTURE

The leading car manufacturing groups in Turkey include Renault-Nissan (with its brands Renault, Dacia, and Nissan), which has a market share of about 26%. The Volkswagen Group (Volkswagen, Škoda, Audi, and Seat) is in second place, with a market share of about 21%. Group PSA, having acquired the Opel brand in 2017, is now in third place with a market share of 12% (Figure 8).

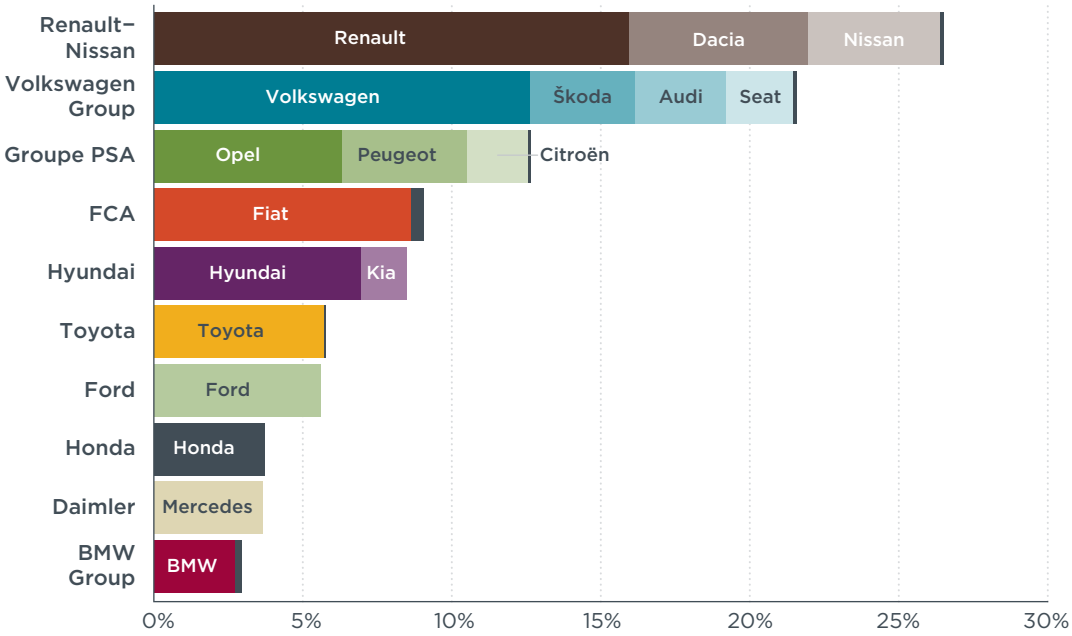

Figure 8. New passenger car registrations in Turkey in 2017 by manufacturer brand and manufacturer group (ODD, 2018)
Note: Grey areas represent other brands within the manufacturer groups.

Figure 9 details the evolution of manufacturer group market shares in Turkey over time. Volkswagen successfully increased its annual new car sales from 42,000 in 2007 to 152,000 in 2017, and thereby doubled its market share. The market share of PSA doubled from 2016 to 2017, after the company acquired the Opel brand. Also notable is the momentarily strong increase in Hyundai's market share in 2009. This is due to the strong domestic demand for the Hyundai Accent Era that year, which allowed the company to secure an 18% market share for one year[7] (ODD, 2018). Premium brands with more expensive vehicles, such as BMW and Mercedes-Benz, are struggling with decreasing sales figures in Turkey, following the 2016 decision of the Turkish government to base the new vehicle acquisition tax partly on vehicle price (Revenue Administration, 2019). On the other hand, manufacturers of more inexpensive models, such as Renault-Nissan and FCA, benefitted from this policy move and were able to increase their market shares in the years since (Özpeynirci, 2016).

7 The Accent Era model got manufactured in Turkey until Hyundai phased out production in 2012.

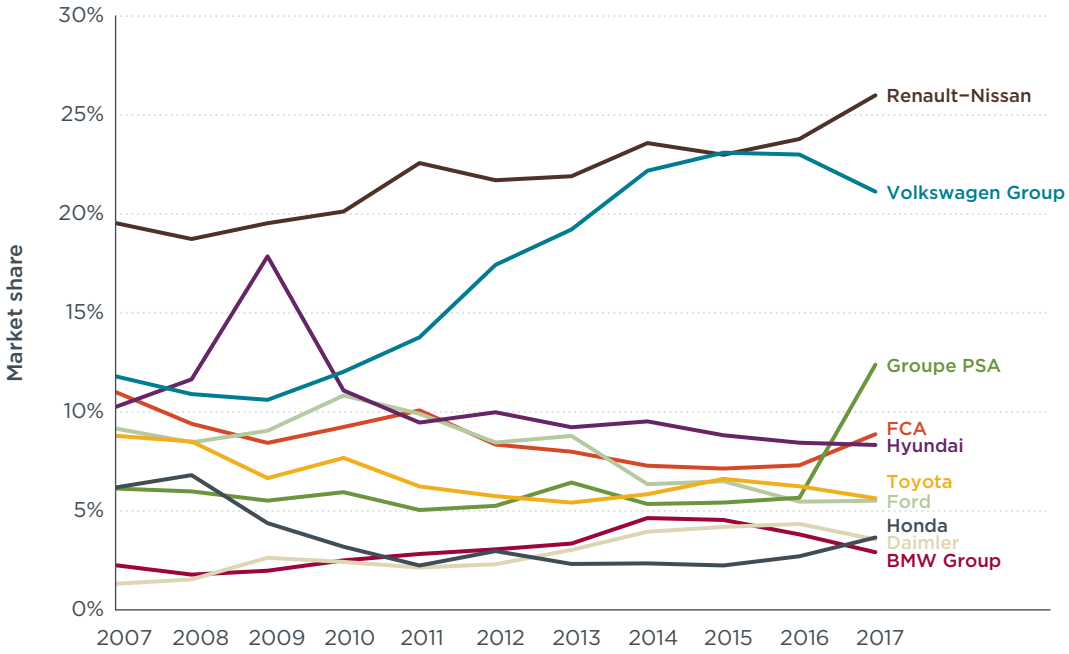

Figure 9. New passenger car registrations in Turkey over time by manufacturer group. Groupe PSA sales for 2017 include the Opel brand (ODD, 2018)

4.2 VEHICLE CO_2 EMISSION LEVELS

The average CO_2 emission level of newly registered cars has been decreasing steadily in Turkey, from more than 145 g/km in 2007 to 120 g/km in 2017 (Figure 10). Prior to 2010, the average CO_2 emission levels of new cars in Turkey were comparably lower than those in the EU. Since 2015, however, they have nearly equaled or have been slightly higher than new cars in the EU.

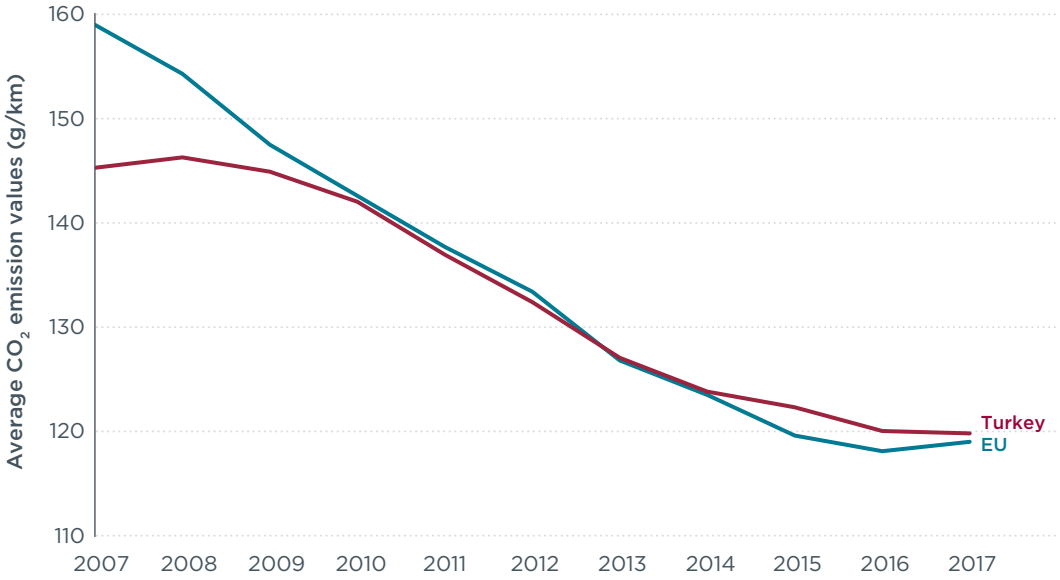

Figure 10. Average CO_2 emission levels of new passenger car registrations in Turkey and the EU over time. All values provided are measured according to the New European Driving Cycle (NEDC). Emission levels under real-world driving conditions tend to be higher (ODD, 2018; EEA, 2018)

In the EU, most member states have switched to an emissions-based vehicle taxation system since 2007, and thereby now provide an incentive for consumers to buy—and for

manufacturers to produce—lower-emission vehicles (ACEA, 2018; Wappelhorst, Mock, & Yang, 2018). The Turkish vehicle taxation system, on the other hand, does not include any direct link to vehicle emission levels, at least for cars with combustion engines. The system is mostly based on engine displacement. Although there is a correlation between engine displacement and CO_2 emissions, this correlation has become lower over time due to the introduction of turbocharging and other advanced technologies. A modern vehicle with a larger engine size can, at the same time, have lower CO_2 emission levels than a vehicle with a smaller engine (Mock, 2011). For example, the CO_2 emission level of a Mercedes-Benz E class 220d, equipped with a 1,950 cm^3 diesel engine, is 105 g/km, but the CO_2 emission level of a Fiat 500l Rockstar, equipped with a 1,248 cm^3 diesel engine, is 109 g/km (ODD, 2018). Both vehicles are imported to Turkey from abroad. But in Turkey, the ÖTV rate is higher (110%) for the E-class than it is for the Rockstar (50%). The MTV for the Rockstar is 4,000 TL less than the E-class, thereby providing an incentive for customers to opt for the vehicle that produces more emissions.

Average CO_2 emission levels vary by fuel type and, in Turkey, are currently about 20% lower for diesel vehicles than for gasoline vehicles. Average emission levels from HEVs are another 20% lower than for diesel cars (Figure 11). While CO_2 emission levels of diesel cars, at least in the past, tend to be lower than for comparable gasoline vehicles, their NO_x levels are about six times higher under real-world driving conditions (Bernard et al., 2018). As a result of increased public awareness as well as policy measures to reduce air pollution from diesel cars, market shares of diesel cars are rapidly declining in most of the EU markets. The effect on fleet CO_2 emission levels remains negligible though, given that modern gasoline vehicle technology makes it possible for comparable diesel vehicles to achieve similar CO_2 emission levels at similar cost (Tietge & Mock, 2018).

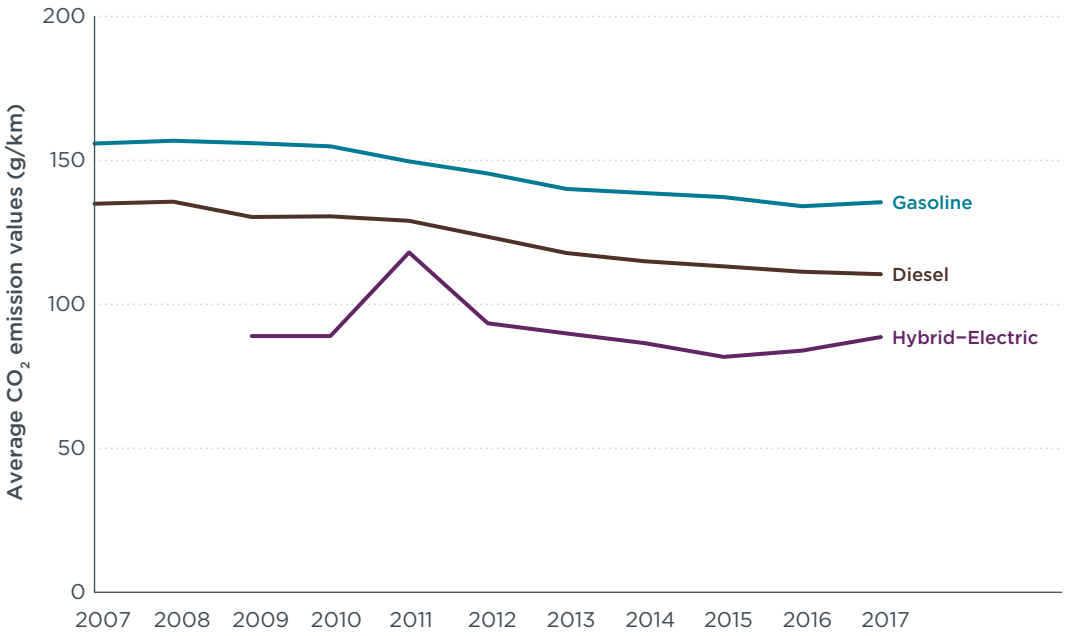

Figure 11. Average CO_2 emission levels of new passenger car registrations in Turkey over time, by fuel and vehicle type.[8] All values provided are measured according to the New European Driving Cycle (ODD, 2018)

Renault-Nissan has the lowest average CO_2 level (109 g/km) (Figure 12). Top-selling models of Renault-Nissan in Turkey are diesel versions of the Mégane (100 g/km CO_2)

8 In 2011, only 33 HEVs were sold in Turkey: 22 were Honda CR-Zs (117 g/km CO_2), 3 were VW Touaregs (193 g/km), and 2 were Mercedes-Benz S class (191 g/km) (ICCT, 2018)

and the Clio (95 g/km). Before PSA acquired the Opel brand in 2017, the PSA new car fleet had the lowest CO_2 level (108 g/km), but then it increased to 123 g/km in 2017. The emission levels of BMW (131 g/km) and Daimler (125 g/km) are relatively close to the Turkish market average and have decreased steadily in recent years. Of all manufacturers operating in Turkey, Honda and Hyundai have the highest CO_2 fleet levels (147 g/km and 139 g/km, respectively). In both cases, emission levels have decreased very little (11% for Honda) or even increased (7% for Hyundai), between 2007 and 2017. Honda's top-selling model in Turkey is a gasoline version of the Civic, which has a CO_2 level of 151 g/km.

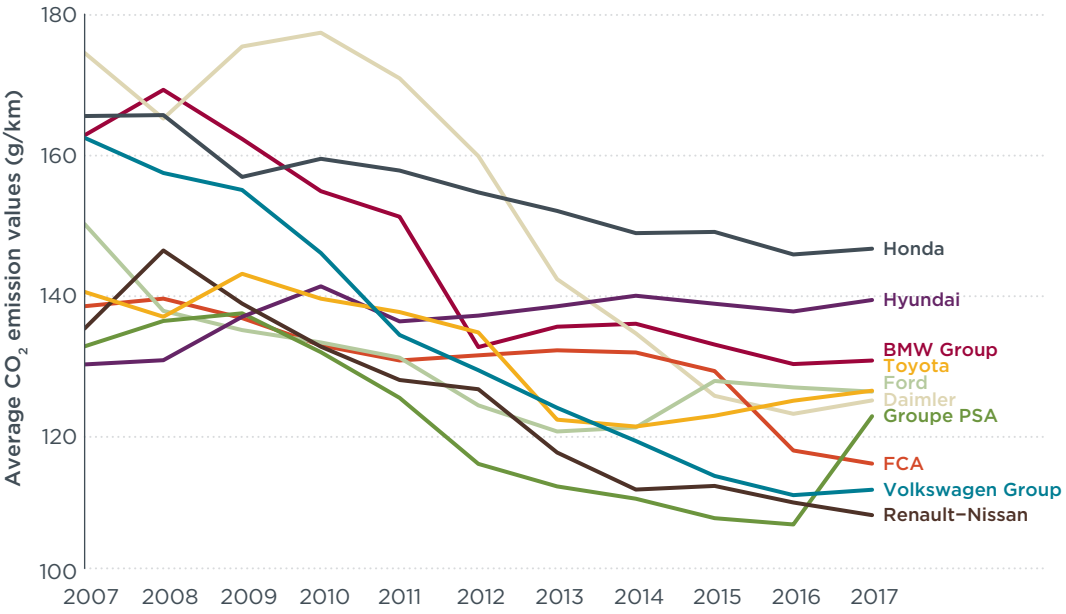

Figure 12. Average CO_2 emission levels of new passenger car registrations in Turkey over time, by manufacturer group. All values provided are measured according to the New European Driving Cycle. Groupe PSA sales for 2017 include the Opel brand (ODD, 2018)

When comparing CO_2 emission levels of manufacturer groups in Turkey and the EU side by side, differences between their respective portfolios become more obvious (Figure 13). The CO_2 emission levels of Renault-Nissan are below average in both markets, but slightly lower in Turkey (109 g/km) than in the EU (112 g/km). Volkswagen and FCA fleets tend to be very close to the average emission level in the EU (122 g/km and 120 g/km) but are slightly lower in Turkey (112 g/km and 116 g/km). CO_2 emissions levels of PSA (123 g/km), and in particular from Toyota (127 g/km), are notably higher in Turkey than in the EU (112 g/km vs. 103 g/km, respectively). The same is true for BMW (131 g/km vs. 122 g/km), Hyundai (139 g/km vs. 122 g/km) and Honda (147 g/km vs. 127 g/km). In summary, average new car CO_2 emissions in Turkey are higher for a majority of the manufacturer groups, with the exceptions of Renault-Nissan, Volkswagen, FCA, and Daimler.

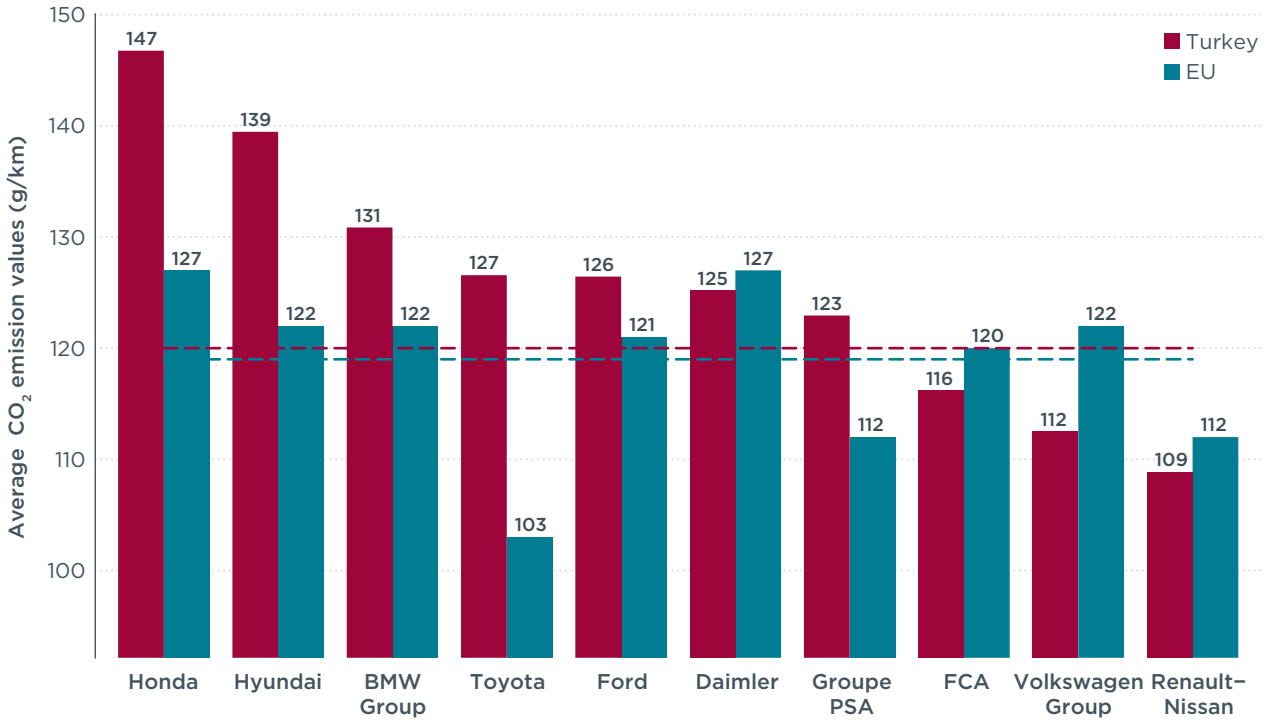

Figure 13. Average 2017 CO_2 emission levels of new passenger car registrations in Turkey and the EU by manufacturer group. Dashed lines indicate the sales weighted averages for the entire market in Turkey and the EU. All values provided are measured according to the New European Driving Cycle (ODD,2018; EEA, 2018)

4.3 DIESEL, HYBRID-ELECTRIC, AND BATTERY-ELECTRIC VEHICLES

The market share of diesel versus gasoline cars has remained largely constant in Turkey since the year 2011, at about 60% (diesel) and 40% (gasoline). HEVs and BEVs account for less than 1% of new car sales. LPG technology is only relevant for older vehicles, typically as a retrofit solution (Figure 14).

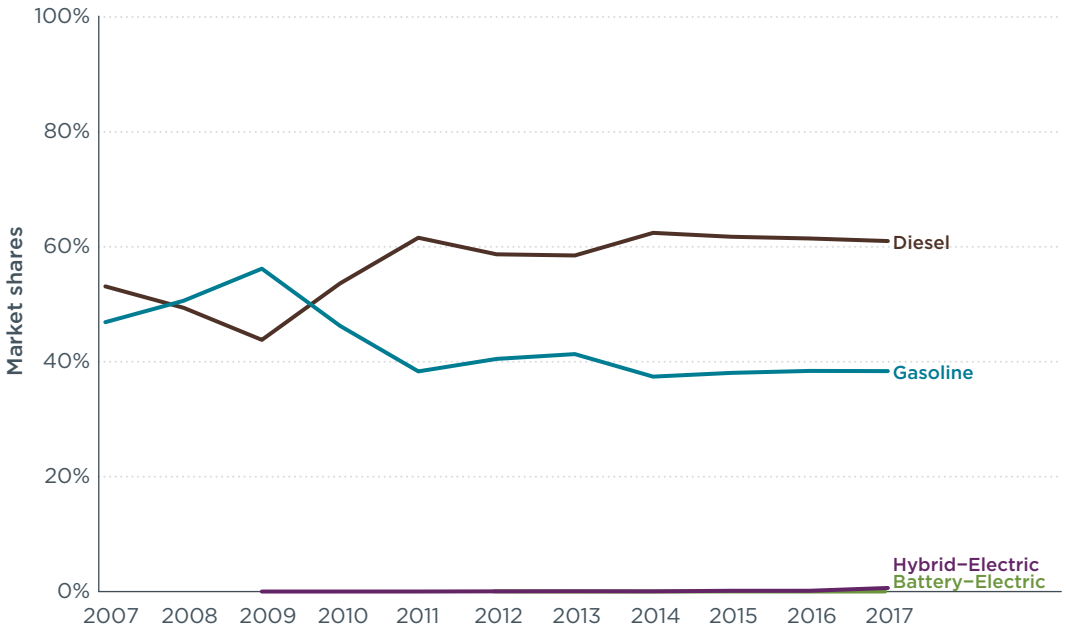

Figure 14. New passenger car registrations in Turkey over time by market share of fuels and technologies (ODD, 2018)

While the diesel market share in the EU used to be as high as in Turkey, near 55% in 2012, it decreased to 44% by 2017, and continues to decline (ICCT, 2018). This is a direct result of more and more EU member states switching to an emission-based vehicle taxation scheme. In the aftermath of the Dieselgate scandal, cities threatened to restrict access of diesel cars to inner-urban areas (ACEA, 2018; Mock & Tietge, 2018). In Turkey, on the other hand, vehicle taxes are not differentiated between gasoline and diesel vehicles, and no policy measures were taken in response to Dieselgate (Mock, 2015).

Renault-Nissan, FCA, Ford, and PSA have much higher diesel shares in Turkey (69–84%) than they do in the EU (40–45%). BMW, on the other hand, sells only about a quarter of its new cars in Turkey equipped with a diesel engine, compared to 60% in the EU (Figure 15).

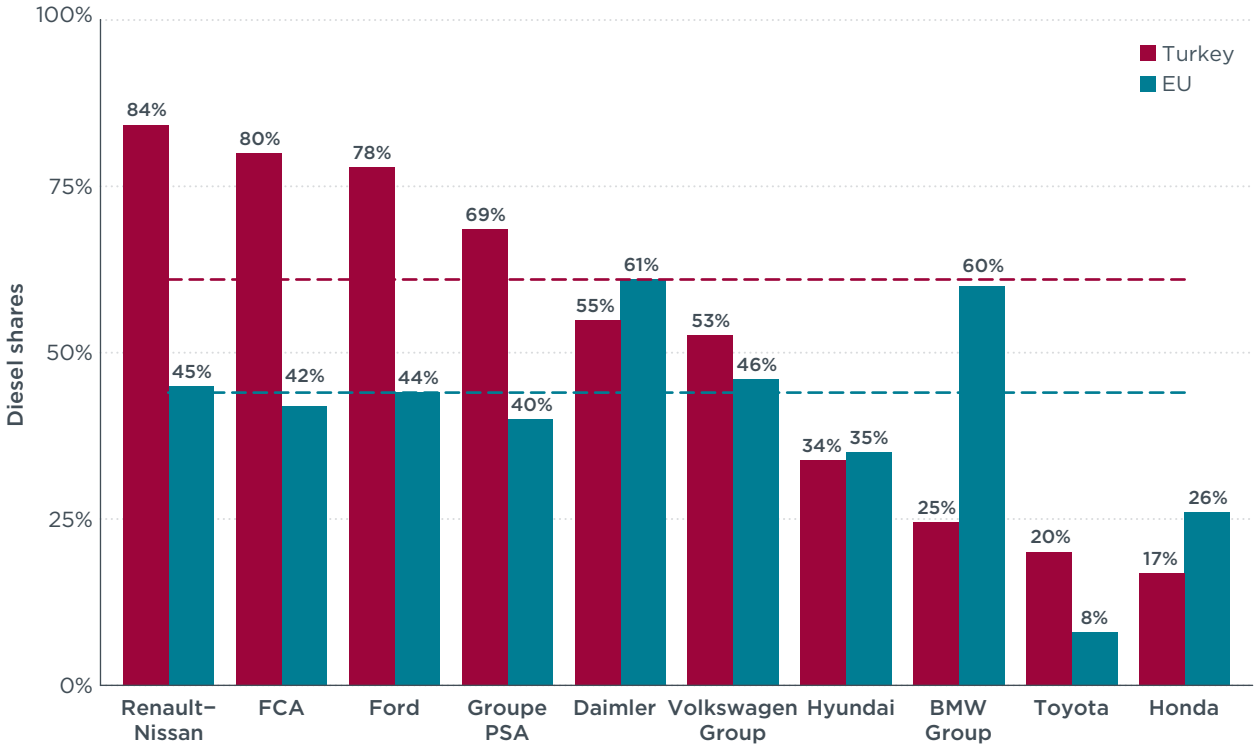

Figure 15. Diesel share of new passenger car registrations in Turkey and the EU in 2017 by manufacturer group. Dashed lines indicate the sales weighted averages for the entire market in Turkey and the EU (ODD, 2018; ICCT, 2018)

Sales of HEVs, plug-in hybrid vehicles (PHEVs), and BEVs still account for less than 1% in Turkey, with the vast majority being HEVs (ODD, 2018). This is despite more than a fourfold increase in HEV sales between 2016 and 2017 (Figure 16). For comparison, in the EU, the total share of HEVs, PHEVs, and BEVs reached almost 5% in 2017 (Tietge, 2018). About 92% of the total number of HEVs registered in 2017 in Turkey were Toyota vehicles. At the same time, HEVs accounted for only about 10% of total Toyota sales in Turkey. In that same year, 51% of the new cars Toyota sold in the EU were HEVs. For BEVs, Renault-Nissan and BMW are currently the only manufacturers offering those vehicles in Turkey. Total registrations of BEVs did not even reach 100 cars in 2017, though. In the EU, on the other hand, Renault-Nissan and BMW sold 1.5% and 1.8% of their new cars as BEVs. (Tietge, 2018). Hybrid cars sold in Turkey only benefit from the tax system if they have an electric engine with at least 50 kW engine power (see Table 2). Sales of PHEVs, which have electric engines less powerful than that, are not incentivized by the current system. As a result, manufacturers do not market PHEVs in Turkey, while in the EU, PHEVs account for about 1% of sales (Tietge, 2018).

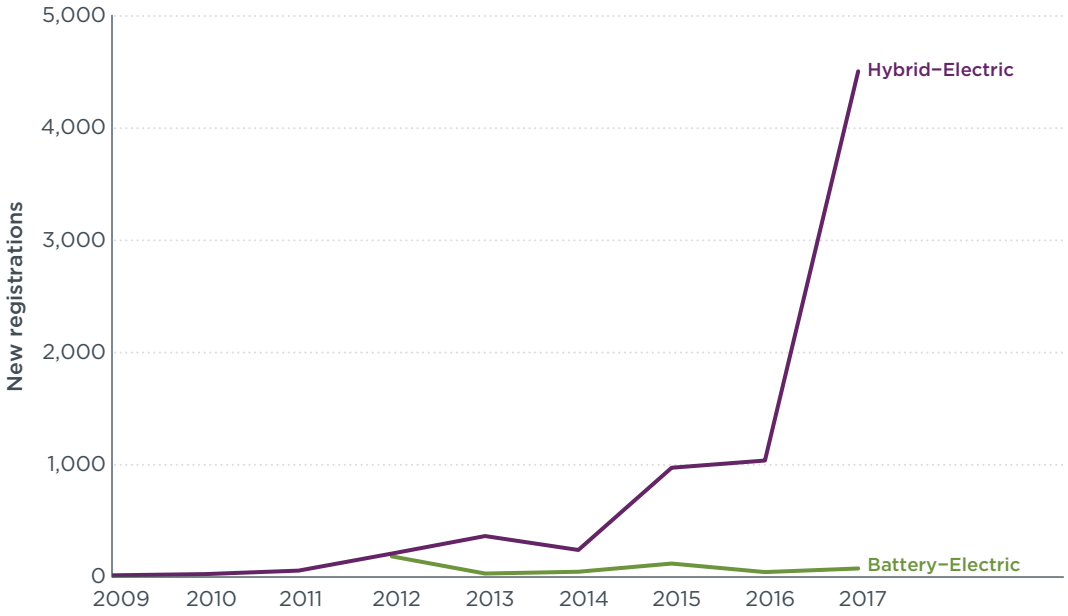

Figure 16. New hybrid-electric and battery-electric passenger car registrations in Turkey over time (ODD, 2018)

Taking a closer look at HEV sales, the top-selling hybrid vehicle until 2016 was the Toyota Yaris model. But at the end of 2016, Toyota began producing an HEV, the C-HR, in Turkey. With its 1.8 l engine, the C-HR matches exactly the thresholds necessary to benefit from the tax incentive for HEVs that the Turkish government introduced in 2016 (see Section 2). Compared to a conventional combustion engine vehicle with the same engine size, the ÖTV for the C-HR is reduced by 50%. Other manufacturers have followed, introducing new HEV models (such as the Kia Niro and Hyundai Ioniq) to the Turkish market. Between 2016 and 2017, sales of HEVs, and in particular the C-HR model, have increased in Turkey, going from a level of about 1,000 new car sales in 2016 to about 4,500 in 2017 (Figure 17). In the group of vehicles with an engine size larger than 1,600cm^3 engines, the share of HEVs reached 15% in 2017, with the Toyota C-HR hybrid being the top-selling model.

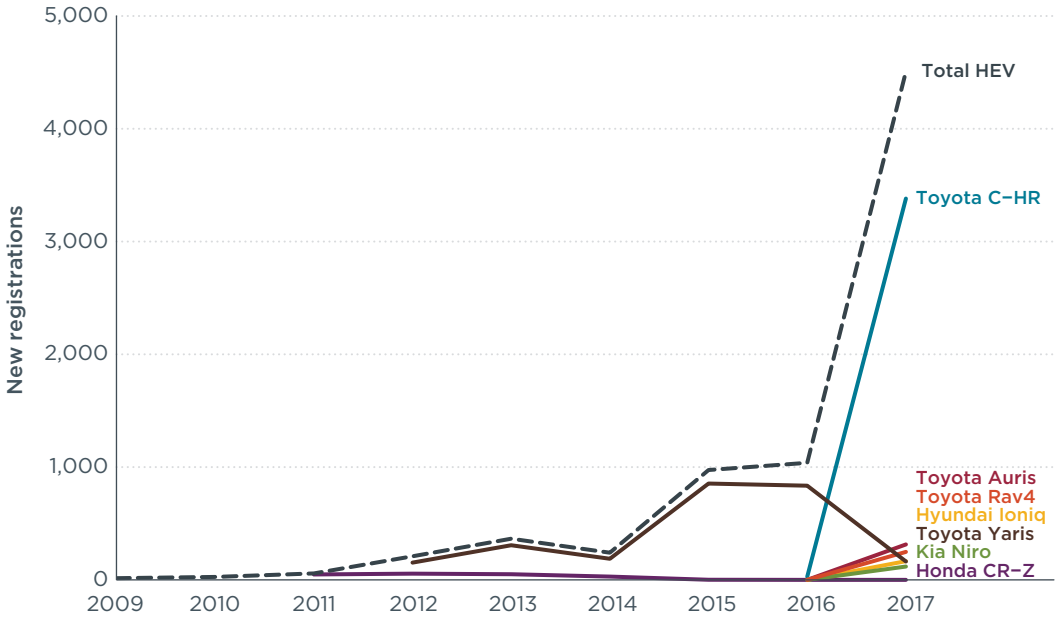

Figure 17. Hybrid-electric (HEV) new passenger car registrations in Turkey over time by vehicle model (ODD, 2018)

Unlike in most other markets, sales numbers of BEVs are currently lower in Turkey than they used to be a few years ago. While in 2012, there were still almost 200 battery-electric vehicles sold, this number dropped to less than 100 in 2017 (Figure 18). In 2012, the Renault Fluence Z.E. model was particularly attractive for Turkish consumers, given that it was produced domestically in Turkey and exported from there to the rest of the world (Wired, 2009; Renault, 2012). From 2014 onwards, Renault-Nissan phased out the production of its Fluence Z.E. model, mainly due to the bankruptcy of its partner Better Place, and replaced it with the Zoe model (EV World, 2014). However, with the Zoe being produced in France rather than Turkey, the model did not gain much popularity in Turkey. The same is true for the BMW i3, the second BEV currently available for sale in Turkey.

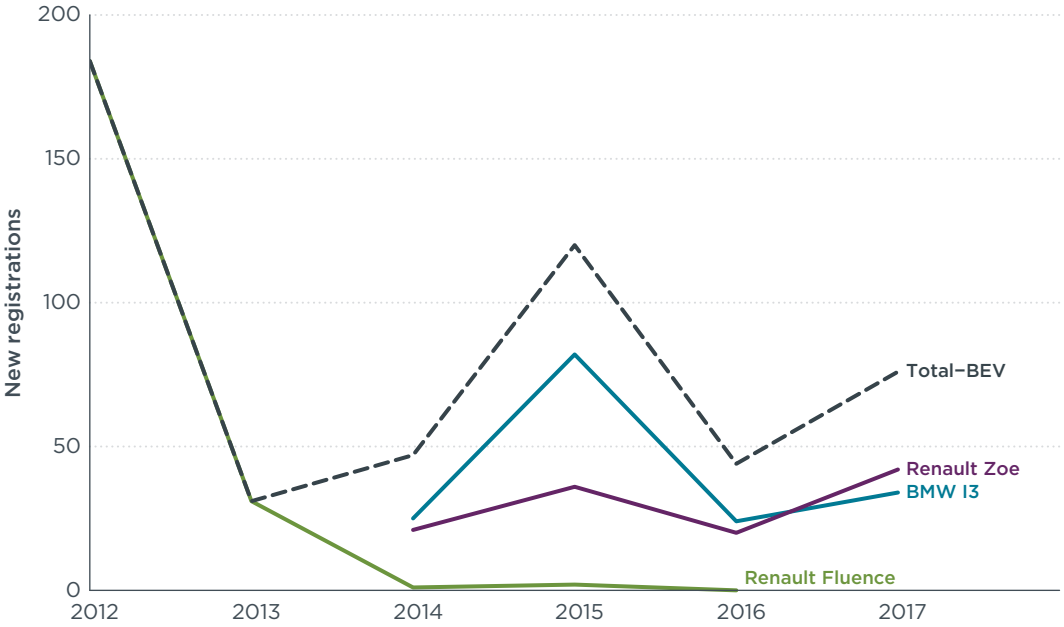

Figure 18. Battery-electric (BEV) new passenger car registrations in Turkey over time by vehicle model (ODD, 2018)

For BEVs, ÖTV rates are low, between 3% and 15%. Given that the ÖTV rates are at least 45% for other types of vehicles (Section 2), this tax incentive could act as a strong driver for sales of BEVs. However, BEVs remain relatively expensive compared to the Turkish consumers' income, which is nearly one-third of the EU average (The World Bank, 2018), Subsequently, new registrations for BEVs in Turkey to date are still below 100 vehicles per year. When it comes to promoting BEVs in a country with relatively low GDP per capita, China might serve as a good example. The GDP per capita in China is lower than in Turkey—USD 9,000 versus USD 10,500—yet China still managed to hold about 50% of the entire global electric car market share in 2017 (The World Bank, 2018; Hall, Cui, & Lutsey, 2018). A range of national and local taxation policies and other supporting measures, pushed electric car shares in China up to 10% in 2017 in some large cities, such as Beijing and Shanghai (Hall, Cui, & Lutsey, 2018).

4.4 VEHICLE ENGINE DISPLACEMENT

Average engine displacement of new cars in 2017 was 1,484 cm^3 in Turkey compared to 1,582 cm^3 in the EU—about 7% lower in Turkey. This has been the case in previous years, with hardly any change over time (Figure 19). With its strong focus on engine displacement (see Section 2), the Turkish vehicle taxation system provides a strong incentive for consumers to opt for cars with a smaller engine size, while this is not the case in most EU member states (Wappelhorst, Mock, & Yang, 2018).

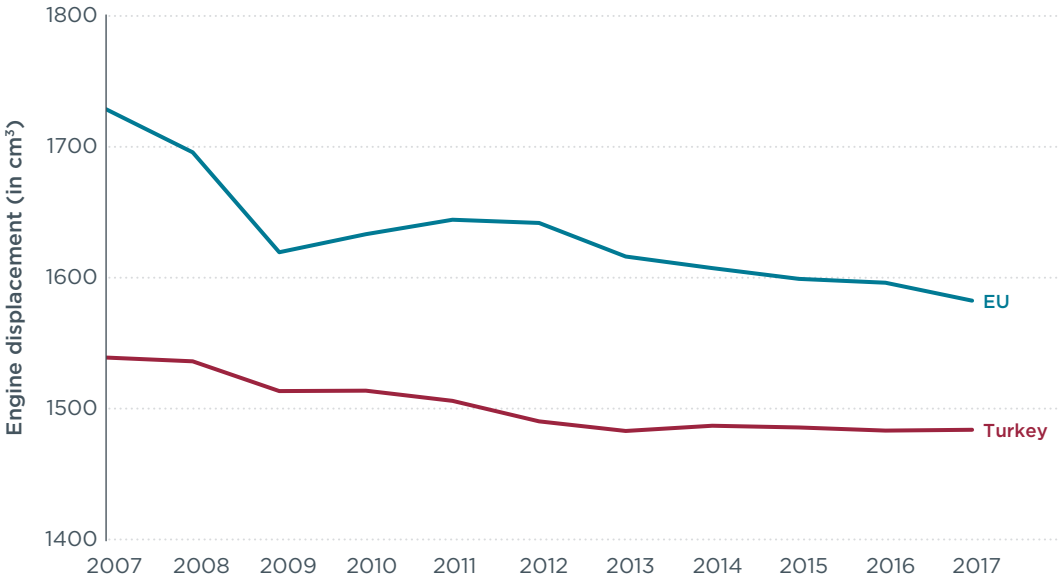

Figure 19. Average new car engine displacement in Turkey and the EU over time (ODD, 2018; ICCT, 2018)

From 2007 to 2017, ÖTV rates increased from 60% to 100–110% for cars equipped with 1,600–2,000cm³ engines and from 87–160% for cars with engines bigger than 2,000cm³. To accommodate the thresholds, manufacturers have made adjustments. This is particularly notable for BMW and Daimler, which have reduced the average engine displacement of their vehicles from more than 2,000 cm³ in 2007 to 1,600 cm³ (Figure 20). As a result, they are able to compete with other manufacturers that concentrate on building smaller engine vehicles and are less affected by the increased ÖTV rates.

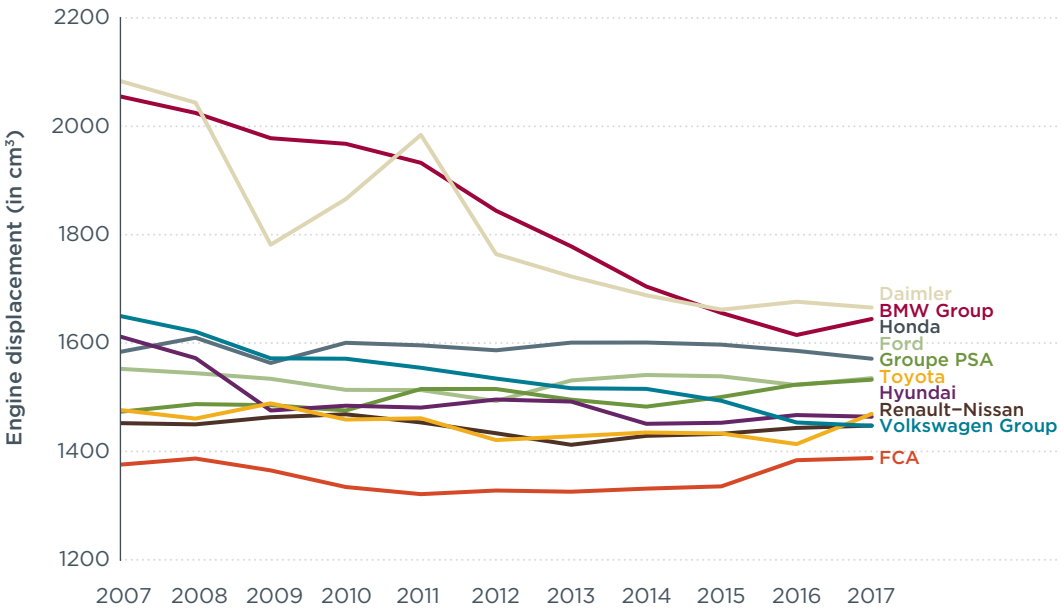

Figure 20. Average new car engine displacement in Turkey over time by manufacturer group. Groupe PSA sales for 2017 include the Opel brand (ODD, 2018)

Figure 21 further illustrates the differences in average engine displacement of new cars in Turkey and the EU, specifically for the year 2017. Most notable are BMW and Daimler, both of which typically sell vehicles with close to 2.0 l engine size in the EU, but have adapted their product strategy for the Turkish market. Similarly, Volkswagen and Toyota

sell vehicles in Turkey that, on average, have a significantly smaller engine size than in the EU, again being below the 1.6 l tax rate cutoff.

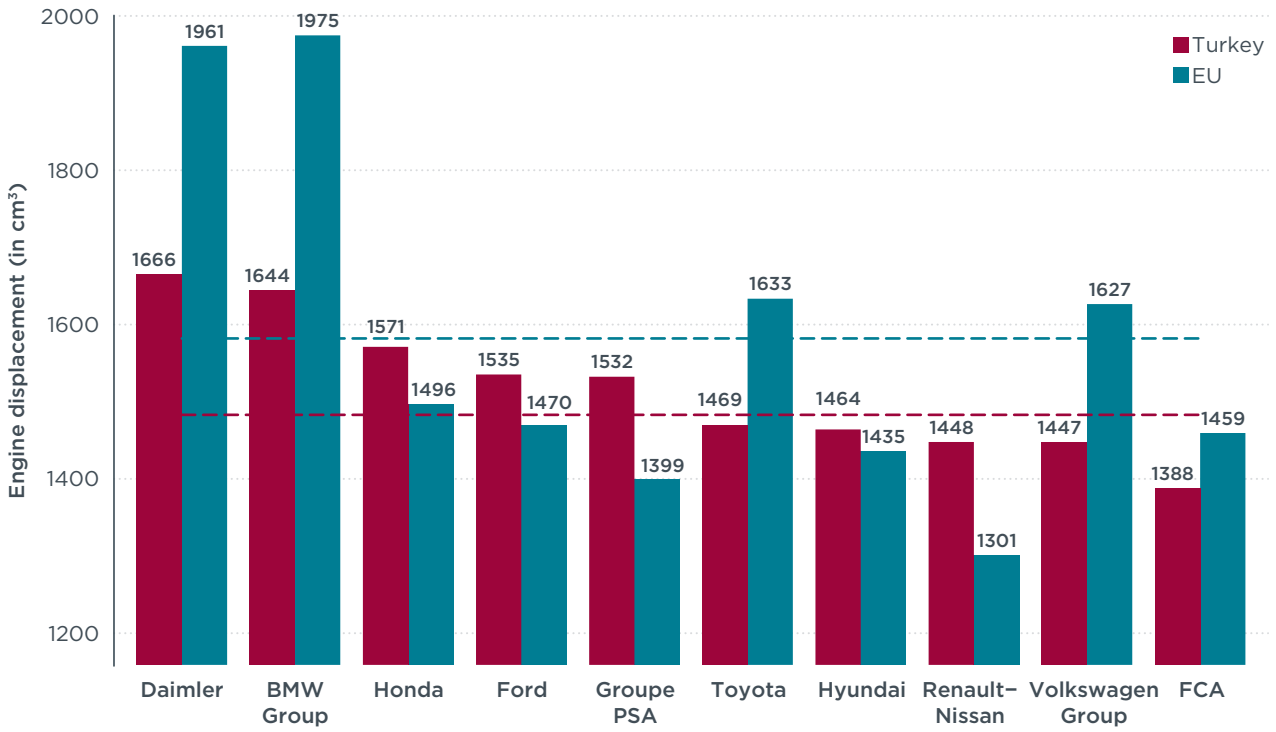

Figure 21. Average new car engine displacement in Turkey and the EU in 2017 by manufacturer group. Dashed lines indicate the sales weighted averages for the entire market in Turkey and the EU (ODD, 2018; ICCT, 2018)

4.5 VEHICLE ENGINE POWER

Not only is the average engine displacement of new cars notably lower in Turkey than in the EU, but so too is average engine power. Yet, engine power has been steadily increasing in Turkey since 2007, from a level of 75 kilowatt (kW) to 86 kW in 2017 (Figure 22). Engine power has been steadily increasing in the EU—with the exception of the economic crisis and scrappage programs in Germany and other major EU member states in the years 2008–09—but at a level that is about 10 kW higher than in Turkey.

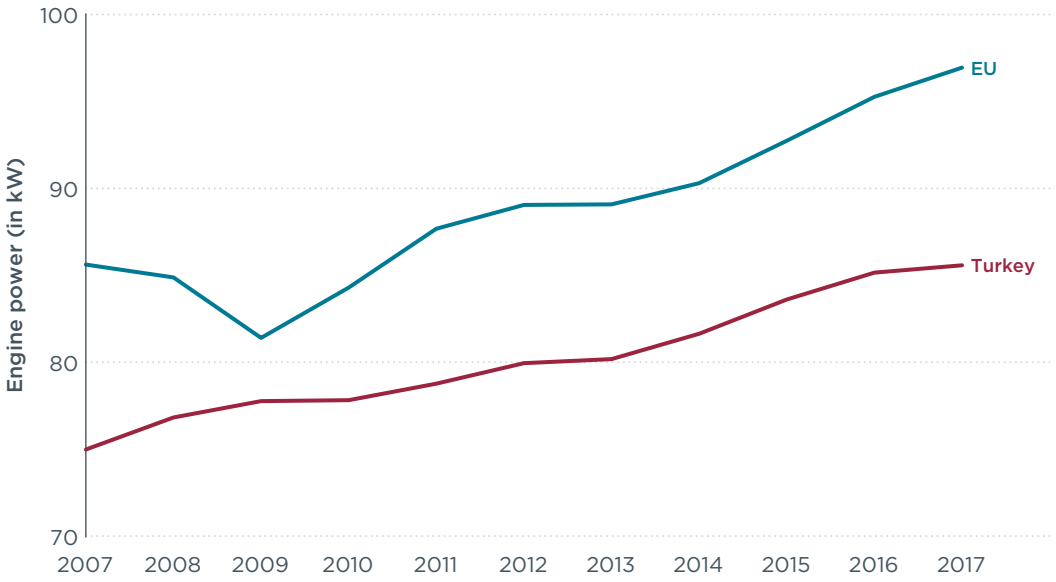

Figure 22. Average new car engine power in Turkey and the EU over time (ODD, 2018; ICCT, 2018)

BMW and Daimler are the manufacturers selling the most powerful engines on the Turkish market. Nevertheless, their average engine power is about 11% (BMW) and 14% (Daimler) lower in Turkey than in the EU (Figure 23). Similarly, Volkswagen and Ford typically sell 15% and 12% less powerful engines in Turkey than in the EU, with the remaining manufacturers offering a similar fleet in both markets, with respect to engine power.

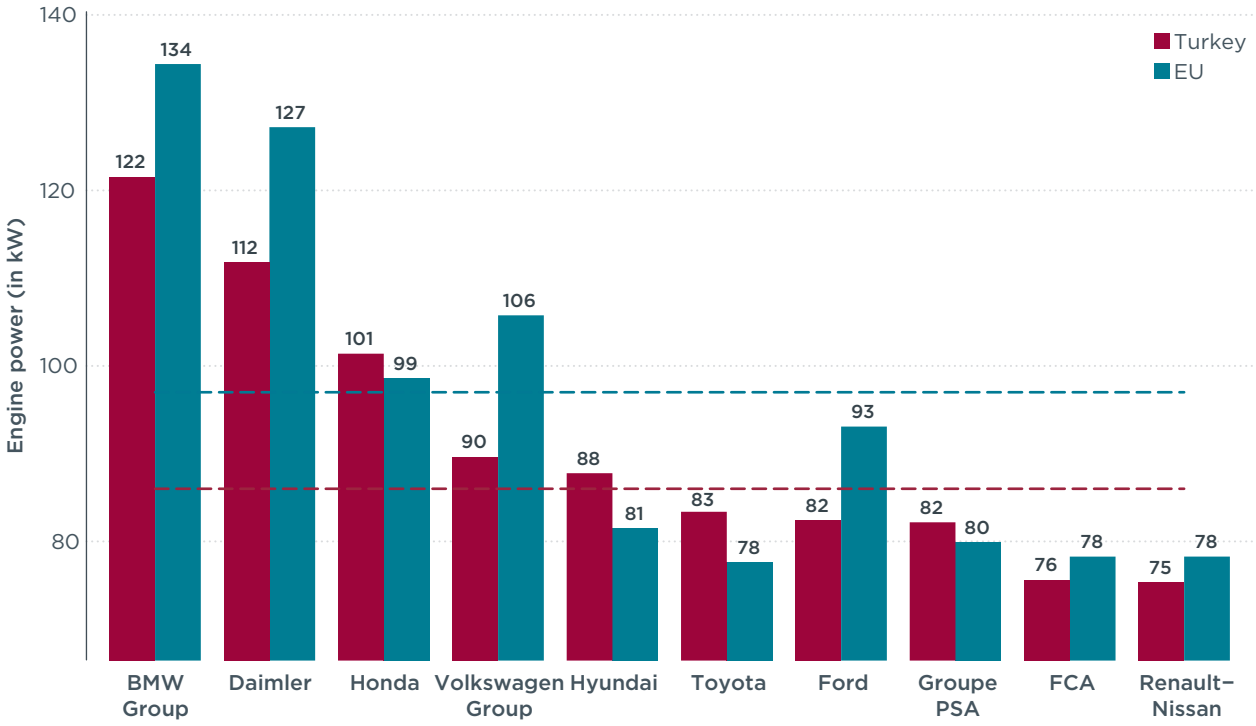

Figure 23. Average new car engine power in Turkey and the EU in 2017 by manufacturer group. Dashed lines indicate the sales weighted averages for the entire market in Turkey and the EU (ODD, 2018; ICCT, 2018)

4.6 VEHICLE MASS

Similar to engine power, the average vehicle weight tends to be about 3% lower for new cars sold in Turkey (1,350 kg) than in the EU (1,395 kg), with the exception of PSA and FCA (Figure 24). The difference is particularly remarkable for FCA, for which the average new car mass in Turkey is about 130 kg higher than in the EU. The reason can be attributed to the popularity of the Fiat Egea model, a vehicle that weighs about 30–40% more than the Fiat Panda and Fiat 500, the top-selling FCA models in the EU (ICCT, 2018).

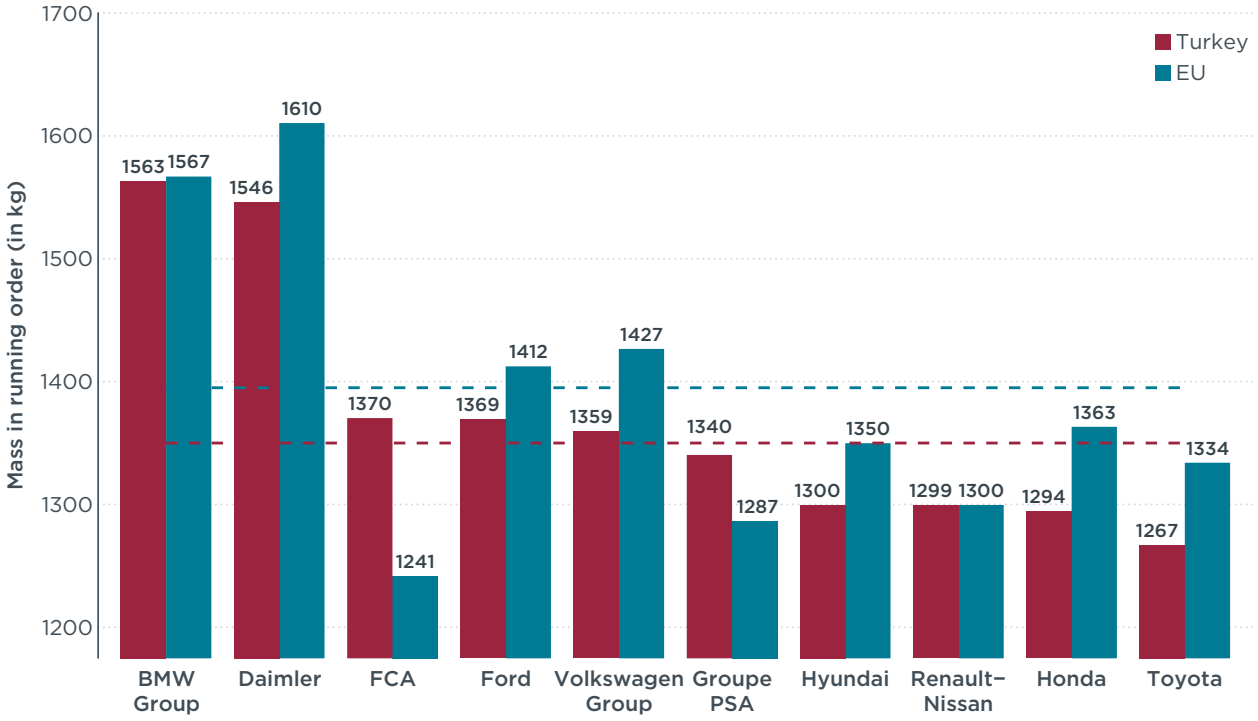

Figure 24. Average mass in running order of manufacturers in Turkey and in the EU (ICCT, 2018)

5. CONCLUSIONS AND OUTLOOK

Passenger cars in Turkey differ from their counterparts in the EU in terms of weight, engine power, and engine displacement. On average, vehicle mass is 3% lower in Turkey, engine displacement is 7% lower, and average engine power is 13% lower. Although new car CO_2 emissions in Turkey used to be lower than those in the EU, the levels since 2015 are now nearly equal to or slightly higher than those in the EU. Hybrid-electric, plug-in hybrid-electric, and battery-electric vehicles account for less than 1% of new sales in Turkey, while they are becoming increasingly popular in the EU, and by now have reached almost 5% market share.

Passenger car taxes in Turkey are higher than in almost all of the other European countries and strongly influence the Turkish passenger car market. Out of the newly registered cars, 96% have an engine displacement below 1,600 cm^3, the main threshold of the Turkish vehicle registration tax (ÖTV). The Turkish tax system essentially leaves manufacturers little choice but to adapt their product portfolio to the tax thresholds. BMW and Daimler, two manufacturers typically selling vehicles with above-average-size engines, have reduced the average engine displacement of their new cars in Turkey by 20% since 2007. Both companies sell vehicles in Turkey that have an average engine displacement 15% lower than cars they sell in the EU.

Another indication for the strong steering effect of the Turkish vehicle tax system is the impact it has on HEV sales. In 2016, the Turkish government announced the introduction of ÖTV incentives for HEVs. Total HEV sales jumped from around 1,000 to more than 4,000 in 2017. On the other hand, there is currently no incentive in place for PHEVs, and it is no surprise that there are virtually zero PHEVs sold in Turkey. Similarly, there is a tax incentive in place for BEVs, but considering the low purchasing power of Turkish consumers, the incentive is not sufficient to spur sales of those vehicles. Moreover, diesel cars are currently not subject to any extra tax in Turkey, unlike in most EU member states, where diesel cars typically incur an extra fee to account for their higher contribution to air pollution. That, in combination with lower fuel costs, drives a strong demand for diesel cars in Turkey, even as the diesel market in the EU shrinks.

The annual tax (MTV) in Turkey is lower for old cars, thereby relieving the financial pressure on secondhand or thirdhand owners, who tend to be less wealthy than new car buyers. However, the current system does not provide any fiscal incentives for cars with lower emissions. On the contrary, the current MTV system encourages owners to keep their vehicles as long as possible, even if they produce high emissions. Passenger cars older than 16 years are responsible for about 40% of the total CO_2 and 67% of the total NO_x emissions in Turkey, but they contribute less than 10% to total MTV revenue.

Going forward, the Turkish government should consider reforming the ÖTV system for passenger cars. A system that would encourage consumers to buy more efficient cars would help reduce CO_2 emissions, fuel consumption, and oil imports. Most of the EU member states have a vehicle registration tax system in place that is at least partly based on emission levels. In many cases, EU governments provide grants to consumers opting for a new vehicle with particularly low emissions. In France, for example, the new owner of a car with less than 20 g/km of CO_2 qualifies for a subsidy of €6,000 (Wappelhorst, Mock, & Yang, 2018). In the aftermath of the Dieselgate scandal, most EU member states also use their vehicle tax systems to reduce NO_x emissions by applying an extra tax to diesel cars, which on average emit about six times more NO_x emissions than gasoline cars. The current tax breaks in Turkey provide a benefit for some specific models of HEVs and BEVs, but are not sufficient to drive a significant uptake.

In addition to the ÖTV system, the Turkish government should further consider reforming the MTV system for passenger cars. All of the top passenger car markets in the EU encourage consumers to replace their old vehicles after a period of time to reduce emission levels by transitioning to more modern vehicles, boost new car sales, and reduce fuel consumption and oil imports. A challenge for Turkey will be to ensure affordability of vehicle replacements, especially for lower-income households. This challenge can be overcome, for example, by supplementing a reform of the MTV system with a scrappage scheme for old vehicles. The current scrappage system in Turkey, introduced in 2018, does not provide a strong incentive in this respect.

Turkey's automotive industry, as a leading exporter, plays a crucial role for the country's economy. But Turkey risks losing its competitiveness, as the share of electrified cars grows year by year in most key markets. Manufacturers have announced investments in battery-electric and plug-in hybrid cars worth more than $150 billion through 2025 (Lutsey et al., 2018). Generally, the domestic market is a strong indicator of where electric cars are being produced. Nineteen out of the 20 top-selling electric cars are produced in the same country where they are also being sold the most (Lutsey et al., 2018). As a developing country, Turkey aims to attract automotive manufacturers to increasingly produce new vehicles in Turkey. Yet, vehicles equipped with conventional combustion engines dominate the Turkish market. Sixty percent of domestically produced cars sold in Turkey are still diesel-fueled (ODD, 2018). This situation poses a risk for the future of the industry at a time when combustion engine vehicles, and in particular diesel cars, are losing popularity in the EU, the main export destination of the Turkish car industry (OSD, 2018b). An emissions-based vehicle tax system, which promotes innovative technologies, would not only help to reduce emissions and energy consumption but also serve long-term objectives of the Turkish automotive industry.

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