

KEY DRIVERS AND SLOWERS OF PASSENGER CAR TRANSPORT (ENERGY) DEMAND IN THE EU-27

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ABSTRACT

In the scope of the EU project ALTER-MOTIVE funded within the Intelligent Energy-Europe (IEE) programme we have analysed historical developments regarding car ownership, travel activity, fuel intensity and energy consumption as well as implemented policy measures in the EU-27 countries.

The core objective of this paper is to present the major results of this analysis as well as impact of various parameters such as changing fuel price, households income and investment costs of cars on the overall demand for passenger car energy and mobility demand for the period 1980 to 2007.

1. INTRODUCTION

Passenger car transport, which is almost completely based on fossil fuels, is continuously increasing causing various problems, such as energy supply insecurity, increasing air pollution and greenhouse gas emissions. Energy use in transport is dominated by road transport, especially passenger car transport, see Figure 1.

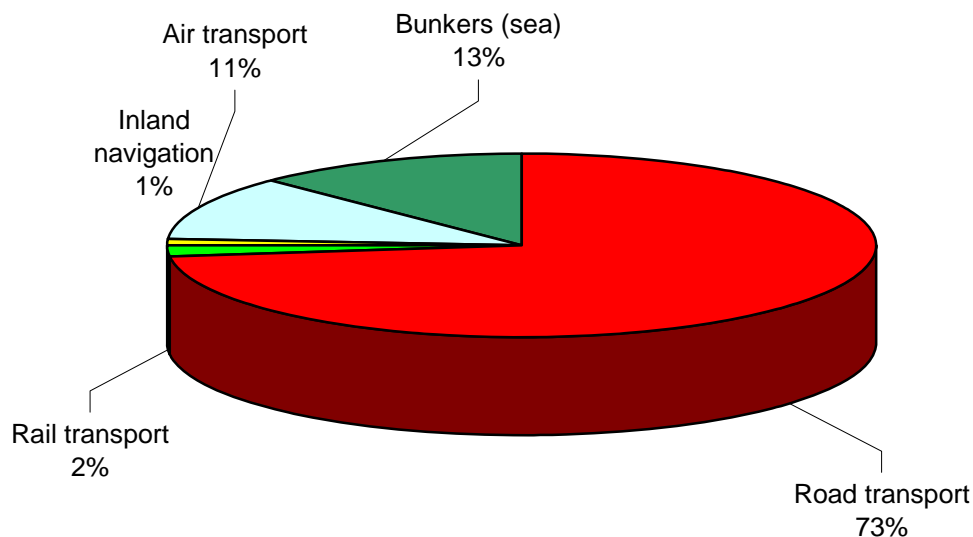


Figure 1. Transport final energy consumption by mode, 2007 [1]

To alleviate these problems by introducing proper policies it is important to know the key drivers and slowers of passenger car transport. In the scope of the EU project ALTER-MOTIVE funded

within the Intelligent Energy-Europe (IEE) programme we have analysed historical developments regarding car ownership, travel activity, fuel intensity and energy consumption as well as implemented policy measures in the EU-27 countries [2]. A number of parameters like growth in personal income and fuel costs are drivers of the demand for energy service in individual passenger road transport.

The core objective of this paper is to present the major results of this analysis as well as impact of various parameters such as changing fuel price, households income and investment costs of cars on the overall demand for passenger car energy and mobility demand for the period 1980 to 2007. In the paper the most important historical and current developments and features in car transport in different European countries are provided.

In detail the development of the following features is documented:

- car ownership
- fuel intensity
- travel activity
- fuel price.

2. METHOD OF APPROACH

The method of approach is based on analyses of time series for energy and service consumption, energy prices, fuel intensities, GDP, and car stock development in passenger car transport. A major feature in this context is the decomposition of energy consumption into service and intensity, see e.g. Horwath and Schipper (1991) [3] and Schipper and Haas (1997) [4].

Moreover, relations between fuel prices (considering indirect tax policy effects, see e.g. Sterner (2007) [5]) and passenger travel activity as well as energy consumption in individual passenger transport, are analyzed for different EU countries.

This analysis is conducted mainly based on original information provided by the ALTER-MOTIVE project partners in different countries as well as existing studies and database (e.g. ODYSEE, ACEA, IEA EP&T, OECD National accounts, IEA Energy balances).

3. CURRENT AND HISTORICAL DEVELOPMENTS IN CAR TRANSPORT

Energy consumption of car passenger transport is continuously increasing. In the EU-15 in 2007 overall energy consumption of car transport amounted to about 7 EJ. Largest part of this consumption was covered by fossil fuels (55% gasoline, 41% diesel), which resulted in more than 500 million tones CO₂ emissions in 2007.

The reduction of carbon dioxide emissions and energy consumption in transport sector is an important goal in all European countries. Therefore across the EU there are a lot of implemented governmental measures such as targets for CO₂ reduction, taxes on fuels and cars, and different fuel economy improvements programs.

3.1. Car ownership

The car ownership level in all European countries is continuously increasing as shown in Figure 2.

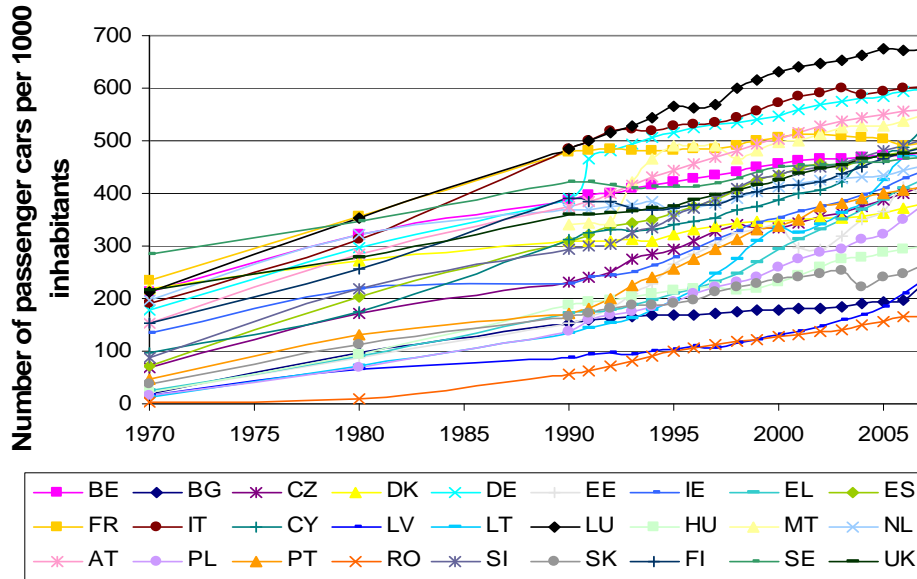


Figure 2. Development of car ownership per 1000 capita in EU- 27, 1970 – 2007

Car ownership level in European countries in 1970 was ranging between 2 cars per 1000 inhabitants in Romania and 280 cars per 1000 inhabitants in Sweden. In 2007 car ownership level is significantly higher, between 164 (Romania) and 675 (Luxemburg) cars per 1000 capita. However, the average car ownership level in Europe is still low comparing to the United States. Many European countries have currently same car ownership level as United States 30 years ago.

Car ownership level is correlated with GDP per capita, see also Ajanovic et al, 2009 [6]. With increasing income in all European countries higher car ownership level could be noticed. However, this correlation can be affected by car prices and car taxis.

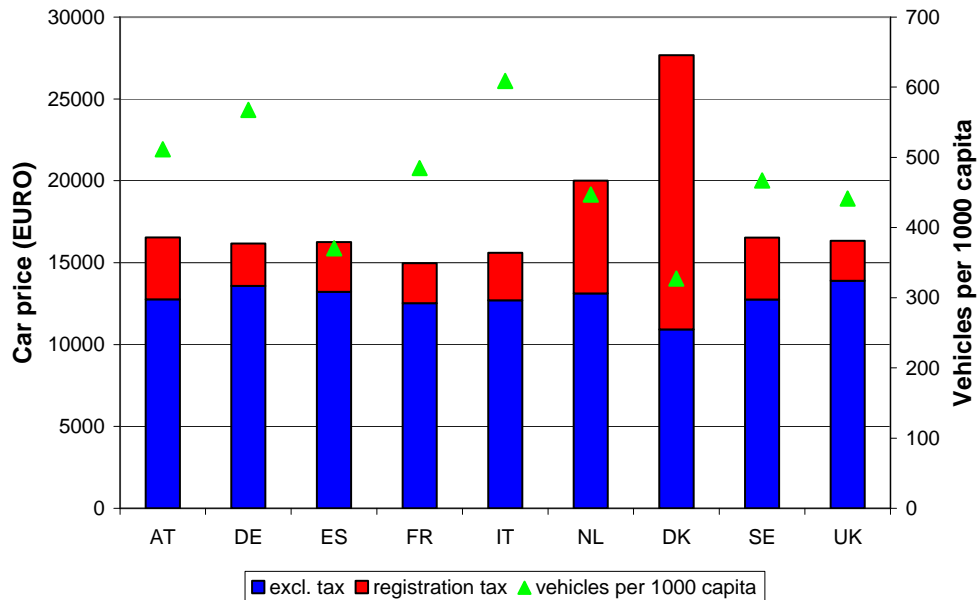


Figure 3: Car price including tax - Volkswagen Golf, 2009 [7]

As shown in Figure 3, total car prices across EU countries are very different. The difference is mostly caused by registration tax. Registration tax is paid once by each vehicle owner. Criteria for registration tax are different across the EU Member States. Most of criteria are based on fuel consumption (e.g. Austria), on cylinder capacity (e.g. Belgium), CO2 emissions (e.g. Spain, France) and price (e.g. Finland, The Netherlands).

The share of registration tax in total car price is in range from 13% (in Luxemburg) to 60% (in Denmark), see Figure 4.

Additional to registration tax in all EU countries VAT (Value Added Tax) has to be paid. This tax is in range from 15% (in United Kingdom, Luxemburg and Cyprus) to 25% (in Denmark, Hungary and Sweden).

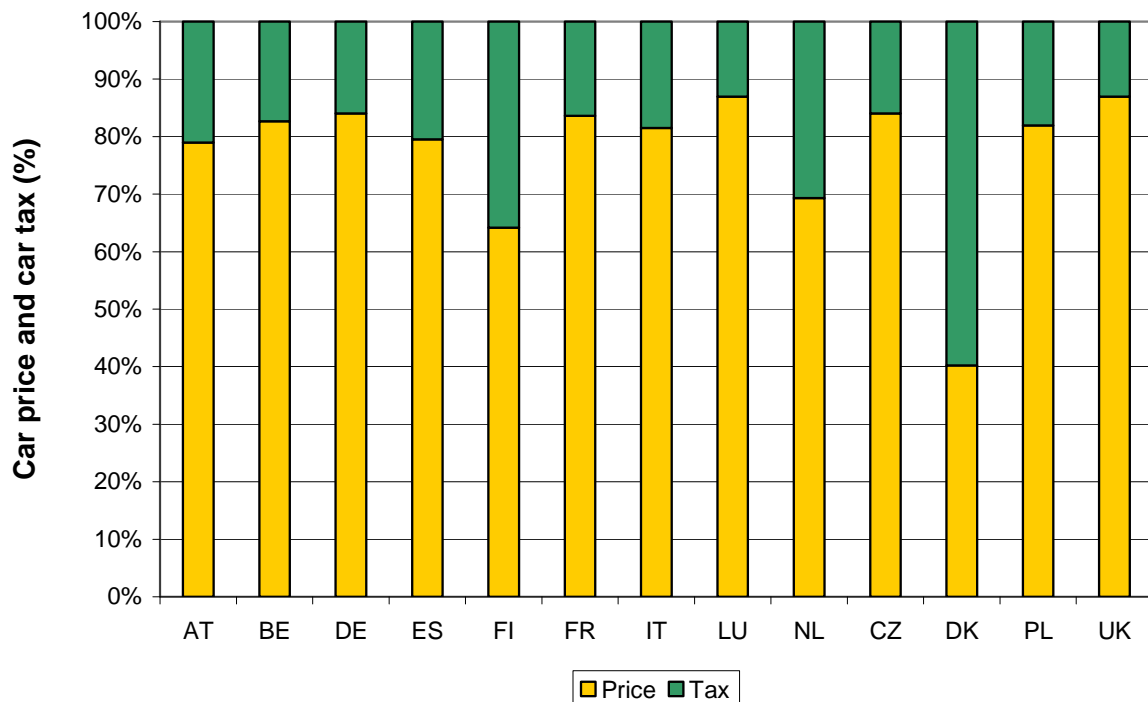


Figure 4. Share of acquisition tax in total car price [7]

3.2. Fuel intensity

In 1980 passenger cars in European countries have had on-road fuel intensity in range of about 9 - 12 liter per 100 kilometres. In 2007 fuel intensity was significantly lower, mostly between 6.5 and 8.2 liter per 100 kilometres. The fuel economy improvement in new cars in Europe between 1980 and 2006 according to tests, was in range of 18% - 30%. These improvements were mainly due to the voluntary agreements to improve fuel economy, but currently agreements in Japan and Europe are expected to be both tighter and mandatory [8]. The EU proposes to strengthen their “Voluntary Agreement” to become a mandatory target with goal of 120 g/km CO2 emissions from tests of new cars, which corresponds to roughly 5.5 l/100 km [9].

However, the fact is that important technical improvements have been made to engine and other cars components, but these have been mostly outweighed by heavier, larger and more powerful cars.

In Figure 5 is shown average specific consumption of gasoline cars for selected European Member States for period 1980 – 2007. In 2007 the average fuel intensity of gasoline cars was mostly between 6.5 and 9 l/100 km.

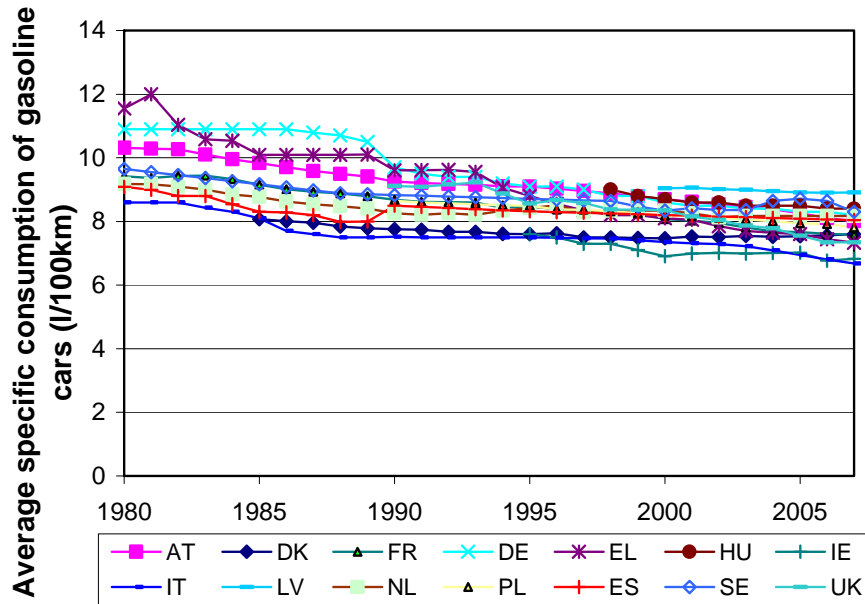


Figure 5. Gasoline fuel intensities over time for selected countries 1980-2007

The average specific fuel intensity of diesel cars in 2007 was predominantly between 5.8 and 7 l/100 km, see Figure 6.

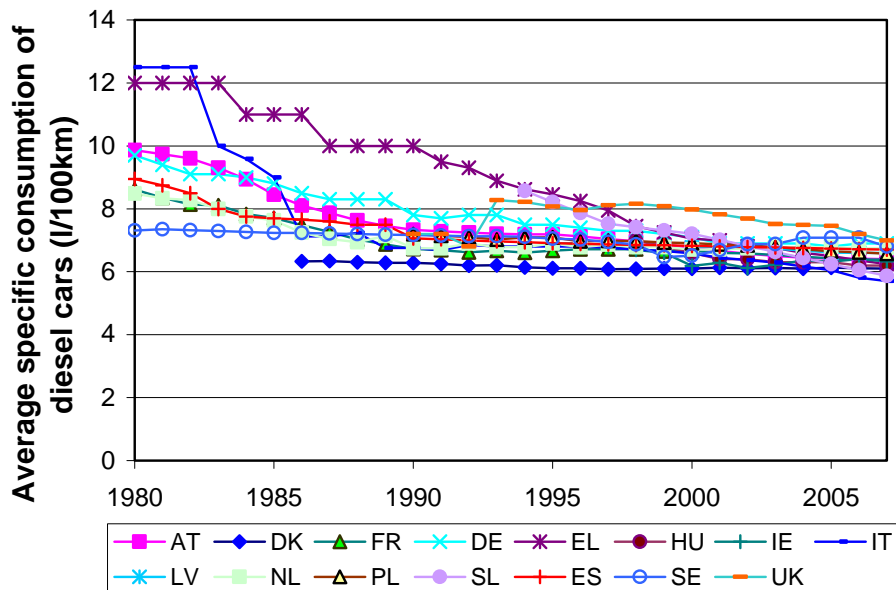


Figure 6. Diesel fuel intensities over time for selected countries 1980-2007

Lower energy consumption is one of the reasons for increase of share of diesel cars in the EU. In 1980 the share of diesel cars in total vehicle stock in EU 15 was 3%, and in 2007 32%. In some

European countries it is higher than share of gasoline cars, e.g. in Austria, Belgium, France, see Figure 7.

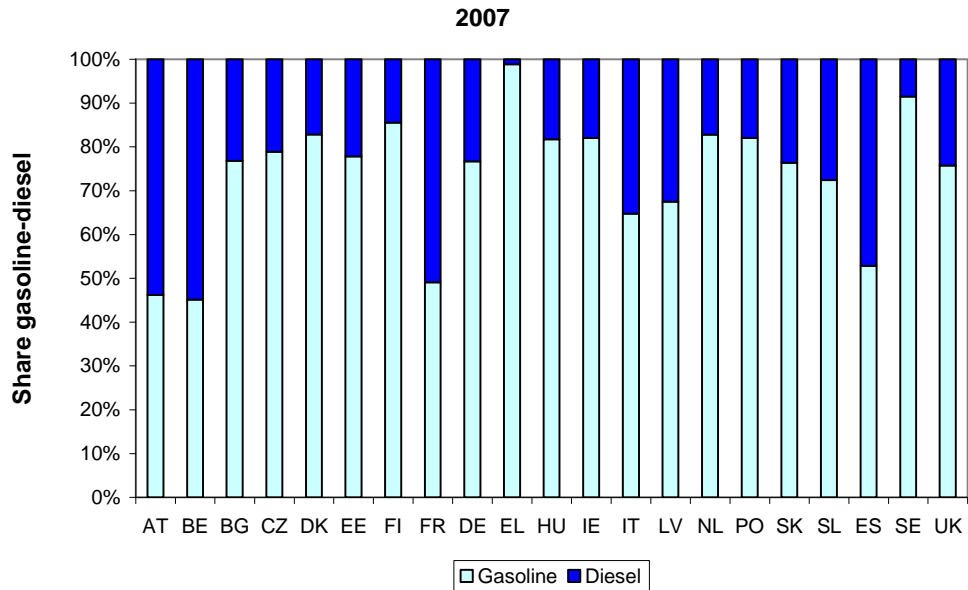


Figure 7. Share of gasoline and diesel cars in selected EU countries in 2007

3.3. Travel activity

Figure 8 shows transport as well as GDP growth in EU 27 in the period 1995-2008.

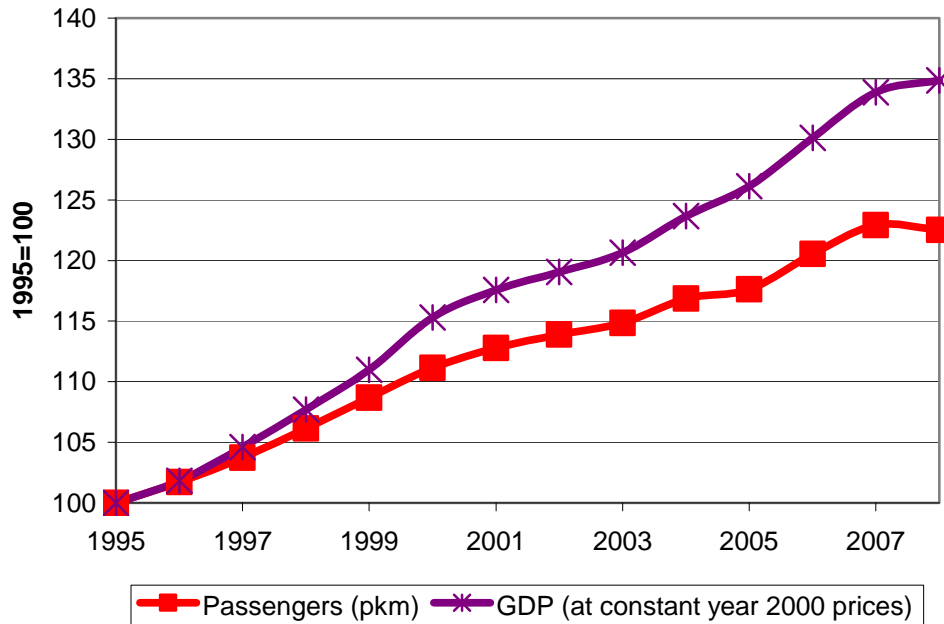


Figure 8: Transport growth EU 27, [10]

In 2008, total passenger transport activities in the EU 27 by any motorized means of transport are estimated to have amounted to 6 527 billion pkm or on average 13.138 km per person. This figure includes intra-EU air and sea transport but not transport activities between the EU and the rest of the world. Passenger cars accounted for 72.4% of this total, powered two-wheelers for 2.4%, buses & coaches for 8.4%, railways for 6.3% and tram and metro for 1.4%. Intra-EU air and intra-EU maritime transport contributed 8.6% and 0.6% respectively [10].

With the increasing car ownership overall travel activity is continuously increasing in all European countries and the range of vehicle kilometre per capita in 2007 was between 3 200 and 8 600, see Figure 9. From analyzed countries the highest travel activity is in Finland and Italy, and the lowest in Slovakia and Czech Republic. The low travel activity per capita reflects low car ownership and utilization rates.

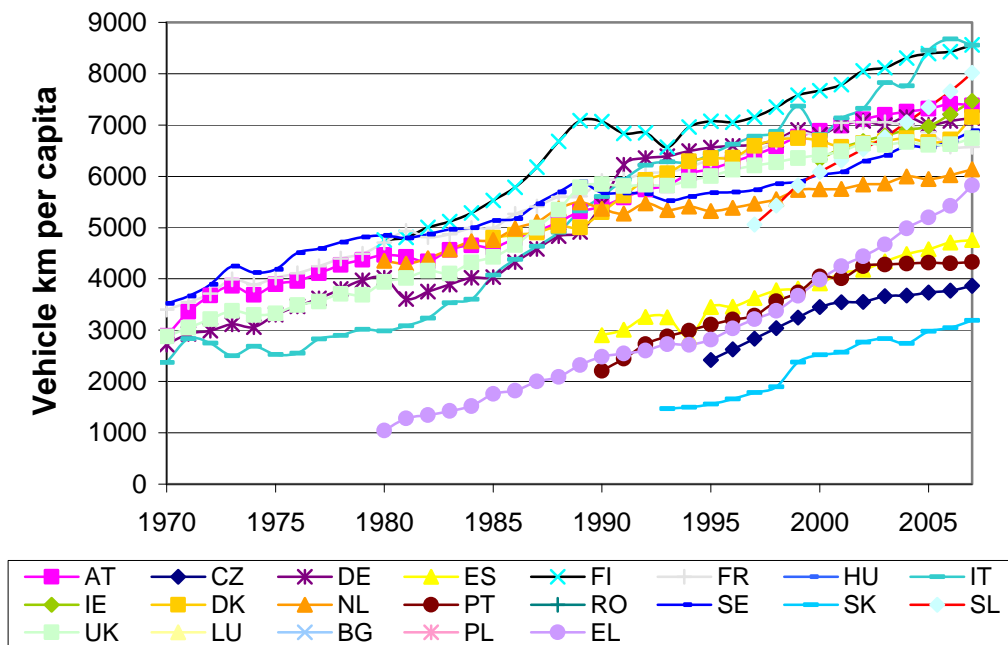


Figure 9. Increase in vehicle-km per capita in selected EU-countries, 1980 – 2007

3.4. Fuel prices

Fuel prices have a significant impact on travel activity and fuel intensity. Clear correlation between total energy consumption as well as car ownership with fuel price cannot be noticed, for detail see Ajanovic et al, 2009 [6].

In the period between 1980 and 2006 fuel prices have been volatile and very different across the EU. The range of fuel prices in 2007 was between 0.44 and 1.2 EUR per litre, see Figure 10.

Major parts of fuel prices are taxes - VAT as well as excise taxes.

The share of tax on fuel is very different across the EU countries ranging from 42.6% to 62.6% of the total gasoline price. The share of tax in total gasoline price in 2008 is shown in Figure 8. The highest tax on gasoline was in the Netherlands, 0.94 EUR per litre of gasoline. On the second

place was Finland followed by Sweden. The lowest tax on gasoline was in Bulgaria 2.3 times lower than in the Netherlands.

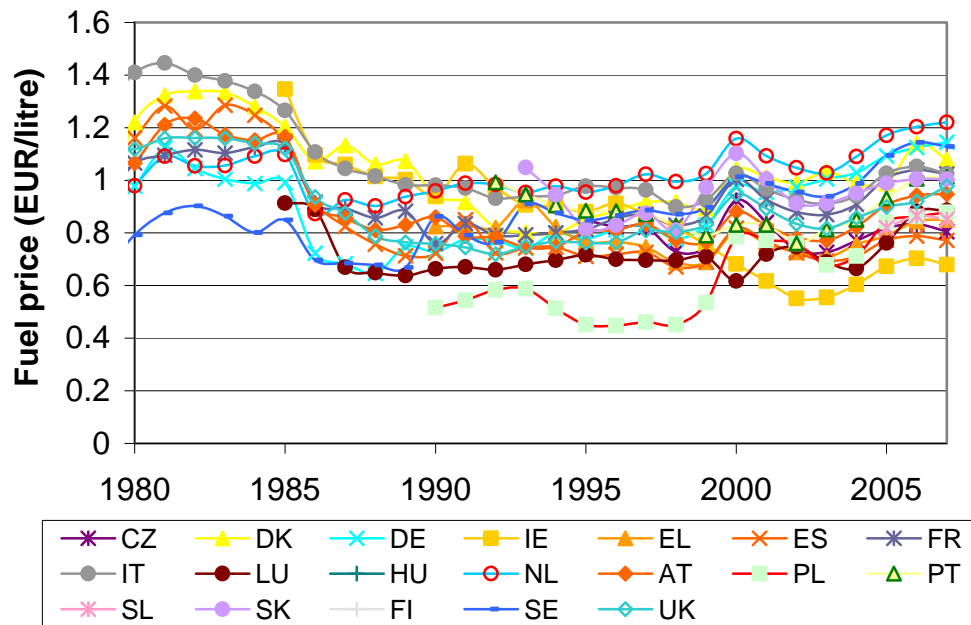


Figure 10. Fuel price (including all taxes) for selected countries 1980 – 2007

The share of tax in total diesel price in 2008 is shown in Figure 11. The highest tax on diesel fuel in 2008 was in United Kingdom, 0.83 EUR per litre of diesel. There was also high tax on diesel in Sweden, Slovakia and Denmark, in the range from 0.73 to 0.68 EUR per litre. Much lower tax on diesel was in Bulgaria, Cyprus, Latvia, Lithuania, Rumania and Malta, in the range from 0.38 to 0.42 EUR per litre.

The share of tax on diesel is a little bit lower comparing to tax on gasoline. In EU the share of tax on diesel is in range from 36.6% to 57.7% of the total diesel price, see Figure 12.

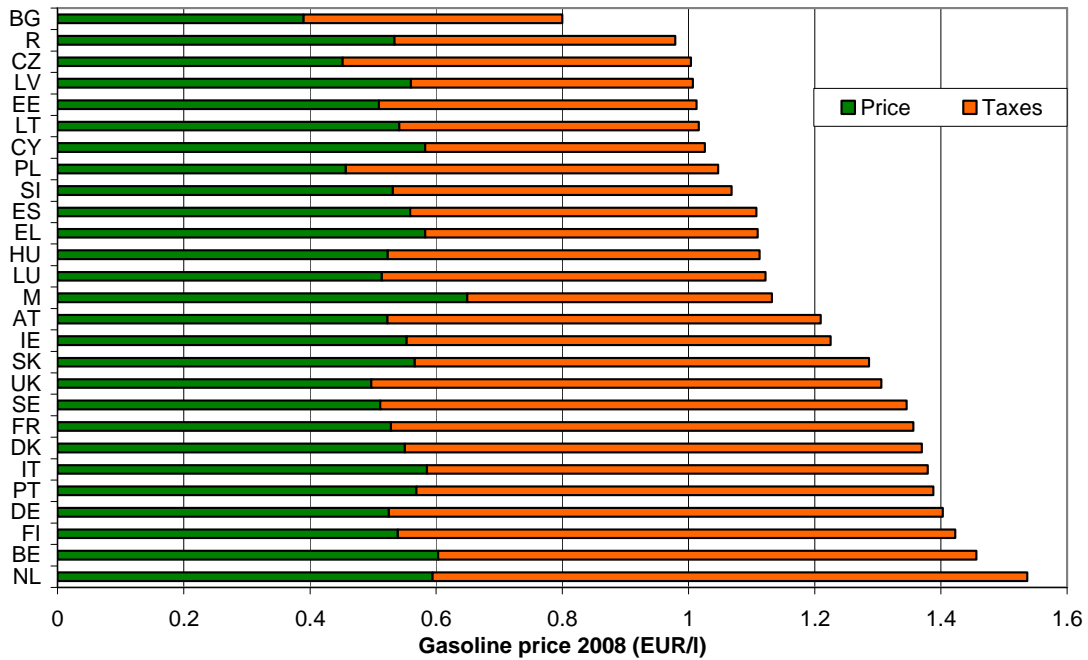


Figure 11. Gasoline prices in 2008 for all EU countries

Regarding fuel prices it is important to note that they vary considerably across EU countries. Fuel prices are an important driver of travel demand, mode choice and fuels intensity. Note, that the largest part of the total fuels costs are taxes the most of the EU countries.

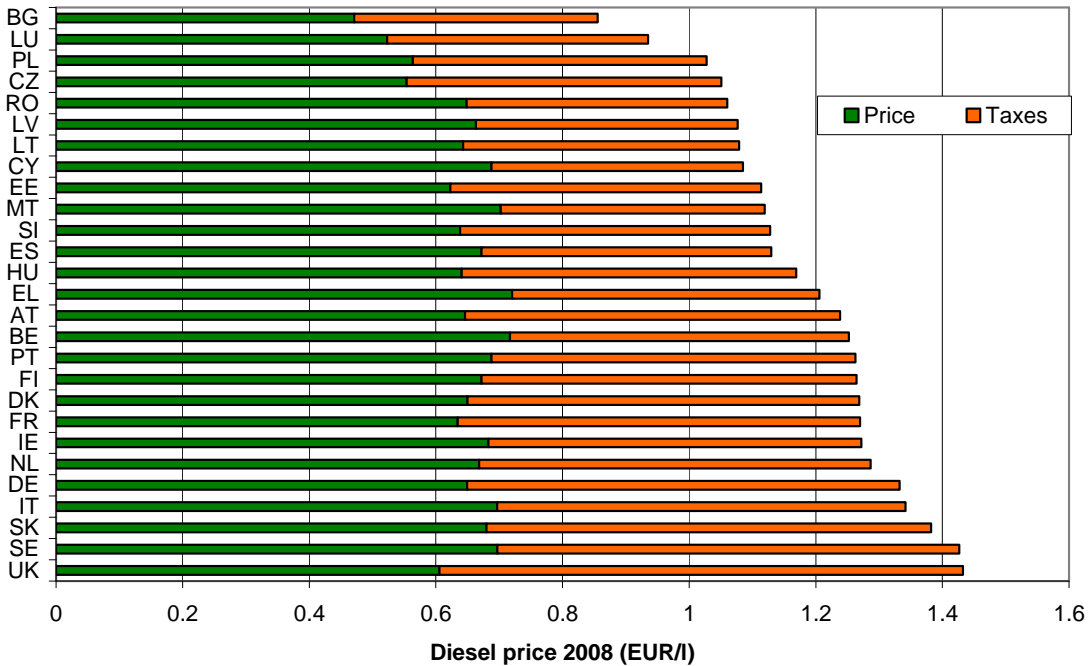


Figure 12. Diesel prices in 2008 for all EU countries

4. SUMMARY AND CONCLUSIONS

Overall energy consumption of passenger car transport in the EU-15 in 2007 amounted to about 7 EJ and this is an increase of 28% in comparison to the year 1990. The increasing energy consumption is caused by increasing travel activity and car ownership. Growth in car ownership is continuously increasing over time in all EU countries. Car ownership level in the EU countries in 1970 was ranging between 2 and 280 cars per 1000 capita, and in 2007 between 164 and 675 cars per 1000 capita. It can be noticed that number of vehicles per capita and GDP per capita are strongly linked and both increasing over time.

With the increasing car ownership, also overall travel activity is continuously increasing in all EU countries and the range of vehicle kilometres per capita is between 3 200 and 8 600 vehicle kilometres per capita. There is a strong correlation between travel activity and income.

Fuel prices may have a significant impact on travel demand and fuel intensity. The range of fossil fuel prices vary wide across EU countries. Between 1985 and 1998 oil prices have been generally decreasing in real terms. After 1998 they increased significantly in many countries mainly due to increases in world oil prices, as well as increases in fuel taxes mostly in European countries, as for example in Germany and UK. Energy use for cars is usually much higher in countries with low fuel prices. Moreover, fuel prices have a significant impact on fuel intensity.

The major conclusion of this analysis is that policy measures have a significant impact on the development in car transport. Due to the CO₂ targets in the transport sector in Europe, new car fuel intensity is significantly improved. Unfortunately, overall energy conservation effects are largely offset by increases in overall travel activity and a trend to larger vehicles.

Moreover, fuel prices are strongly correlated with fuel intensity and income with car ownership and travel activity. High registration taxes and fuel taxes led to lower vehicle stock and energy consumption.

However, in the future a broad portfolio of policy instruments (taxes, standards...) will be necessary to reduce energy consumption and straightforward CO₂ emissions.

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