Institute of Transport Economics
Norwegian Centre for Transport Research

Summary

The demand for new automobiles in Norway – a BIG model analysis

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Exploiting the BIG discrete choice model of Norwegian automobile demand, we derive direct and cross price elasticities of demand for gasoline, diesel, ordinary hybrid, plug-in hybrid and battery electric cars. Fairly precise estimates can be made thanks to the relatively high share of battery and hybrid electric vehicles in Norway as of 2016, the rapid uptake of which is explicable in terms of powerful fiscal and regulatory incentives applied by the government. The cross price elasticities of demand for gasoline cars with respect to the price of diesel cars, and vice versa, are estimated at 0.64 and 0.51. The 'cross' price elasticity of battery electric automobile demand with respect to the price of liquid fuel is estimated at 0.62. The apparent, fairly high degree of substitution between vehicle energy technologies means that fiscal policy measures affecting the prices of vehicles and fuel have a large potential for changing the long-term composition of the vehicle fleet and its energy consumption, climate footprint and general environmental impact.

Introduction

Unlike the situation in virtually all other countries, the market for electric cars in Norway has reached sufficient maturity for the five major vehicle energy technologies – gasoline, diesel, ordinary hybrid, plug-in hybrid and battery electric – to exhibit comparable market shares, with 29, 31, 11, 13 and 16 per cent, respectively, as of 2016.

Exploiting an unusually detailed and comprehensive, disaggregate discrete choice model of passenger car purchases, including virtually all 1.8 million new automobile transactions in Norway during 2002-2016, we derive direct and cross demand elasticities with respect to automobile retail prices as well as energy prices.

The rapid uptake of electric cars in the Norwegian market is explicable in terms of powerful fiscal and regulatory incentives. Of these, the most important are probably the CO_2-graduated one-off purchase tax and its exemption for battery or fuel cell electric cars, along with these vehicles' general exemption from value added tax (VAT).

Demand elasticities as of 2016 in Norway

Elasticities are derived with respect to the retail prices of cars as well as with respect to the net present value of their future energy costs. The former are exhibited in Fig. E.1 and the latter in Fig. E.2.

The direct price elasticity of demand for gasoline cars is calculated at –1.08 (Fig. E.1). That is, assuming that the prices of all gasoline car models in the market increase by one per cent, their sales would shrink by an estimated 1.08 per cent.

The cross demand elasticity of demand for diesel cars is estimated at 0.51. That is, in the event of a uniform one per cent increase in the prices of gasoline cars, the number of new diesel cars sold would go up by 0.51 per cent.

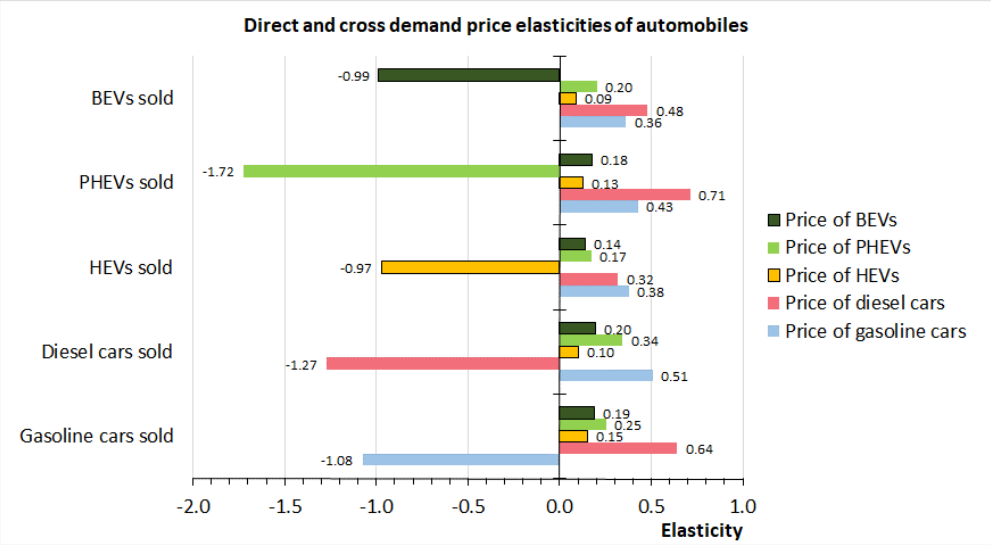

Fig. E.1. Price elasticities of demand for automobiles, by vehicle energy technology. Norway 2016.

The cross demand elasticities of demand for battery electric cars (BEVs), plug-in hybrid electric cars (PHEVs) and ordinary hybrid electric cars (HEVs) are estimated at 0.36, 0.43 and 0.38, respectively (light blue bars in Fig. E.1).

For diesel driven cars, the direct price elasticity comes out at –1.27. Cross price elasticities of demand for gasoline cars, BEVs, PHES and HEVs are estimated at 0.64, 0.48, 0.71 and 0.32, respectively (red bars in Fig. E.1).

HEVs and BEVs are slightly less price elastic than gasoline cars, exhibiting direct demand elasticities of 0.97 and 0.99. PHEVs, on the other hand, appear to be the most price elastic passenger car segment, with a direct elasticity of –1.72.

The cars buyer's choice of vehicle model variant depends not only on the retail prices, but also on energy costs. As revealed by our BIG discrete choice model, Norwegian automobile buyers appear to take full account of future energy costs, as would be expected from utility-maximizing 'economic men'. There is, in our data set, no sign of consumer 'myopia', as found in several previous studies of the markets for durable assets.

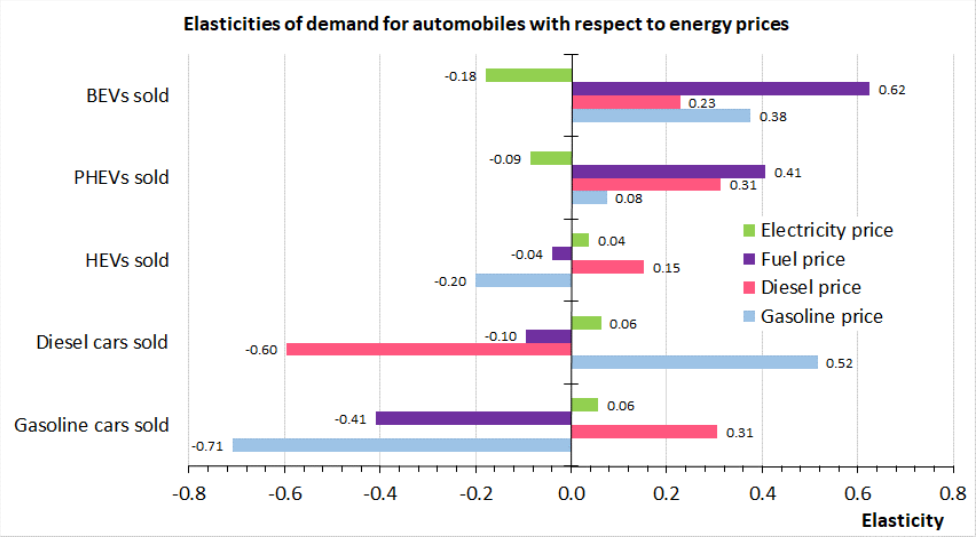

Fig. E.2. Elasticities of demand for automobiles with respect to energy prices, by vehicle energy technology. Norway 2016.

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A one per cent increase in the price of gasoline is found to reduce the demand for gasoline cars by 0.71 per cent. Diesel car demand goes up by 0.52 per cent and BEV demand by 0.38 per cent (light blue bars in Fig. E.2).

If, vice versa, the diesel price increases by one per cent, diesel car demand shrinks by 0.60 per cent, while gasoline car demand goes up by 0.31 per cent and BEV demand by 0.23 per cent (red bars in Fig. E.2).

In the case of a uniform one per cent increase in both gasoline and diesel prices, BEV demand would rise by no less than 0.62 per cent, and PHEV demand by 0.41 per cent. The demand for gasoline and diesel cars would drop by 0.41 and 0.10 per cent, respectively (violet bars in Fig. E.2). Since diesel cars are more energy efficient, they are less hardly hit than gasoline cars by a uniform fuel price surge.

Electricity prices have a lesser impact on vehicle demand. The 'direct' BEV elasticity of demand is estimated at –0.18. The 'cross' demand elasticities are even smaller in absolute value (light green bars in Fig. E.2). This result must be interpreted in light of the fact that BEVs are three to four times more energy efficient than internal combustion engines, and that electricity in Norway is much cheaper than liquid fuel, as reckoned per unit of energy (kWh).

Keen competition – good news for the environment

Our analyses reveal a fairly high degree of substitution and competition between vehicle energy technologies. This implies that fiscal policy measures affecting the prices of vehicles and fuel have a large potential for changing the long-term composition of the automobile fleet and its energy consumption, climate footprint and general environmental impact.

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