Energy Saving Trust
21 Dartmouth Street
London SW1H 9BP
www.est.org.uk

Modelling the impact of VED: A new approach

Executive Summary

Vehicle Excise Duty (VED) has, to date, done little to persuade car buyers to choose a lower-carbon model. However, there is not currently robust evidence on how reformed VED would influence car buyers. This paper provides a new approach to modelling the impact of VED reform by analysing how the tax affects the cost of owning a new car.

We obtained data from CAP, the leading supplier of residual value data which quantifies the value that customers place on fuel efficiency when they purchase a used car. We then used this result to model the impact that increased VED would have on the costs of owning a new car.

The paper provides an extremely useful analytic approach to estimating the impact of VED reform on the new car market in the UK, and derives the following robust results:

- Faced with two comparable three-year-old cars, customers place a higher value on the car with better fuel efficiency.

- The factors varied by model and doubtless reflected that some diesels are more refined and more popular than others, but **the average was a factor of 1.8. That is to say that for every potential saving in fuel costs of £100, the market was, on average, prepared to pay £180**.

- Using this factor, **a VED increase of just 1% of the purchase price can increase the cost of ownership of a new car by 12%.**

- This increased cost would, in many cases, be high enough to move buying patterns from high CO_2 cars to lower CO_2 cars.

- This result means even a reasonably modest rise to £500 per annum in the top band could have a significant impact on choices in the company car market, which accounts for over half of new car sales.

Authors:

Alex Veitch, Transport Strategy Manager, Energy Saving Trust
Nigel Underdown, Head of Transport Advice, Energy Saving Trust

1. Introduction

The Energy Saving Trust is a leading advocate of fiscal policies that support low-carbon choices in both household energy efficiency and road transport. We have conducted numerous studies on car and fuel taxation, and made various policy recommendations[1].

1.1. The need for VED reform

VED has, to date, had a very limited impact on car buyer behaviour. This is in stark contrast to company car tax, which has incentivised the purchase of lower-carbon vehicles. This disparity of incentives is demonstrated by the fact that since 2003/4, the average CO2 emissions of cars sold to private consumers has been higher than that of cars sold to companies (see chart 1 and table 1). Changes introduced in the 2006 budget[1], though welcome, did not significantly increase the differentials between VED bands, and therefore there is a case for further reform[2].

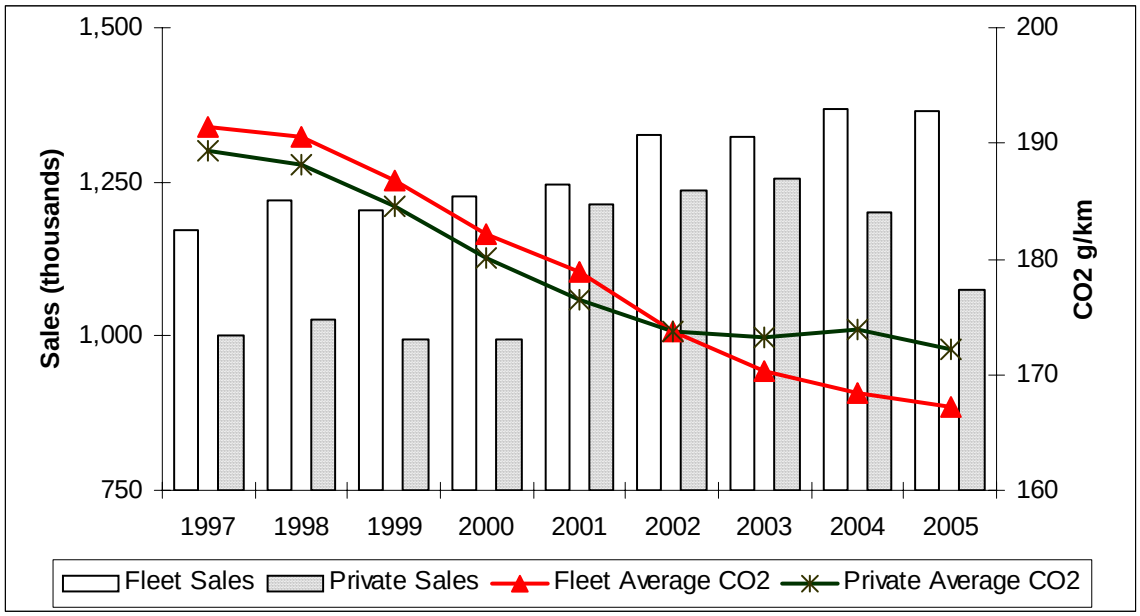
1.2. Why is more research needed?

Previous studies of car buyer behavior with respect to VED have given contradictory results. A survey by MORI found that if VED differentials were increased by £150, then 55% of people would move to a vehicle in a lower VED band[2]. In contrast, a survey for the RAC Foundation found that annual costs would have to increase by at least £1,100 before private car drivers would consider switching to an alternative fuel or smaller engine car[3]. Clearly, more research is needed to better understand the impact of reforming VED.

1.3. Objective of this paper

This paper adds to current understanding of how reformed VED could impact upon the new-car market by examining the role that VED plays in determining the costs of leasing a new car.

Chart 1: Car sales and sales-weighted average CO2 by sales type



[1] See publications at www.est.org.uk/fleet/Informationcentre/StrategicPolicypapers/

[2] A new Band "G" was introduced to better differentiate between vehicles with higher CO2 emissions, and there were modest rises in the top rates. Band A was set to zero.

2. VED and car leasing

A point frequently made about VED is that it is a small amount to pay compared to the price of a new car. However this misses the important point that over half of all new cars are sold to businesses (see table 1). Fleet buying decisions are almost invariably made on the basis of "cost of ownership" or leasing cost (generally over three years) and the largest cost is depreciation. Factors which affect depreciation, such as brand value, build quality and running costs are used to forecast the residual value of the car at the end of the lease. This in turn has a significant impact on the monthly rate charged to a lease customer.

Table 1: Statistics on new car sales 1997-2005

	1997	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
Fleet Sales ('000)	1,170	1,219	1,204	1,228	1,246	1,327	1,324	1,367	1,363
% Fleet Sales	54%	54%	55%	55%	51%	52%	51%	53%	56%
Fleet Ave CO2g/km	191	191	187	182	179	174	170	168	167
Private Sales ('000)	1,000	1,028	994	994	1,213	1,237	1,255	1,200	1,077
% Private Sales	46%	46%	45%	45%	49%	48%	49%	47%	44%
Private Ave CO2g/km	189	188	185	180	177	174	173	174	172

VED is paid annually, and as such is one of the many costs incurred in owning and running a car, along with fuel, maintenance, and depreciation. Our analysis therefore began with an examination of how running costs effect residual values. We aimed to establish whether a car with low running costs would hold its value better than a comparable car with high running costs.

2.1. Calculating the Diesel premium

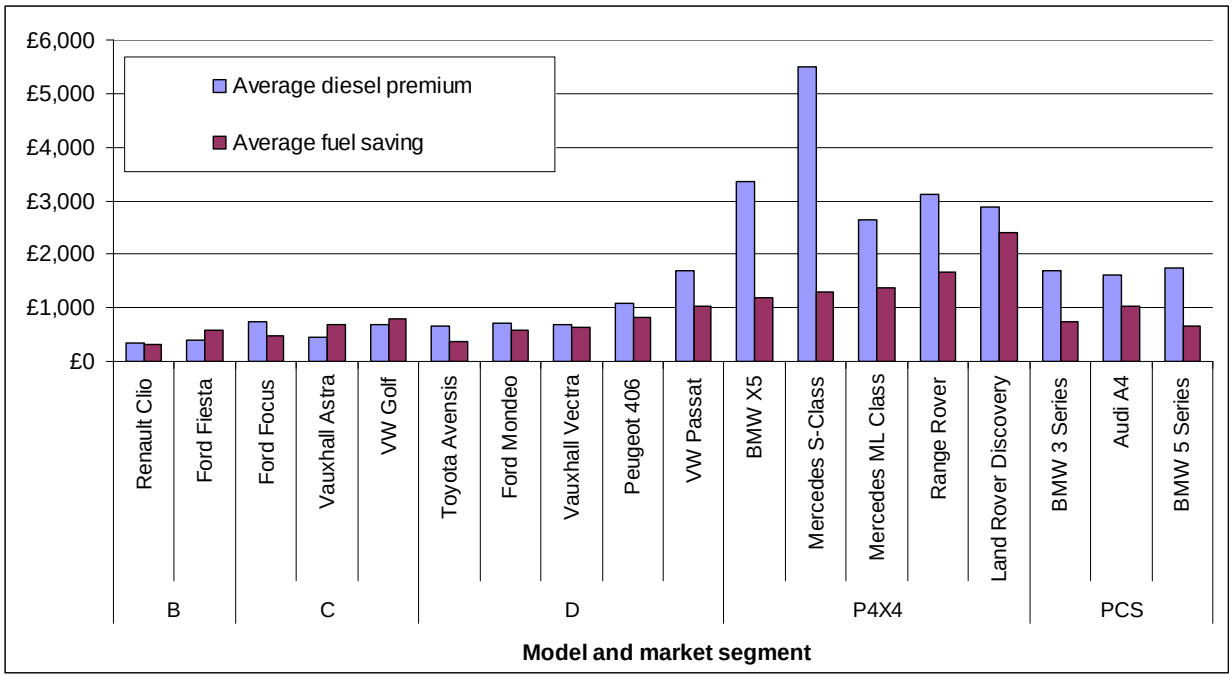
Our first step was to commission CAP, the market leaders in residual value data, to analyse a wide range of popular models and compare the second hand premium which diesel cars held compared with their petrol counterpart. We obtained residual values after 3 years and 60,000 miles (a typical lease period and mileage for a company car). The models selected were chosen to give as near as possible a match between petrol and diesel equivalents with equal specification and, where possible, similar power outputs. A full list of models used in the analysis can be found in the appendix.

Values were obtained for every month available, for example the diesel premium for two comparable Ford Fiesta models was obtained in every month from January 2001 to January 2007. For other models, which have had shorter lifetimes in the market, less data were available. See Appendix for charts displaying detailed results for all models. A mean average was taken to give a single figure for the diesel premium or each pair of cars. Our data shows, for a representative sample, the extent to which diesel cars hold their value over comparable petrol models. The average results are shown in chart 2, and data for each model can be found in the appendix.

2.2. Calculating fuel savings

Our next objective was to look at the market from the point of view of a private customer buying a three-year-old car, to try to understand the value this customer might place on fuel efficiency. We estimated the fuel costs that the customer would incur over a typical period of ownership (three years with an annual mileage of 10,000 per year) for both the petrol and diesel models, using official fuel consumption figures and actual fuel prices from the same month as the residual value data. The average results are shown in chart 2, and data for each model can be found in the appendix.

Chart 2: Average diesel premium and cost savings, all models



3. Results and conclusions

3.1. Discussion of results by market segment

In the *B sector* the premium paid for diesel over petrol is similar to the perceived fuel savings. This could well be due to the relatively economical nature of petrol engines at this size. Buyers see little benefit in selecting the diesel variants: the average sector mark up is just £365 which is lower that the average estimated fuel saving of £452.

The position of diesel cars improves slightly with *C sector* cars where the average mark up between the two fuel types is £619, compared to an average estimated fuel saving of £656. As with B sector cars, petrol cars in the C sector are generally considered to be economical.

D sector cars show a different result, with the average diesel premium being higher that the potential fuel savings at £972 compared to £685. This was a surprising result, since the large influx of used D sector diesel cars into the market over recent years might have been expected to

decrease the premium for diesel over petrol versions. The diesel premium has however proved to be extremely robust and has actually been increasing on the majority of models.

The *Compact Prestige Saloon (CPS)* is extremely popular with many fleets and BMW and Audi have significantly increased sales into this sector. As with D sector cars, diesel cars outnumber petrol in the CPS sector, because of the influence of CO2 based company car taxation. In the used market the diesel premium for CPS cars is £1649, nearly double the average estimated fuel saving of £878.

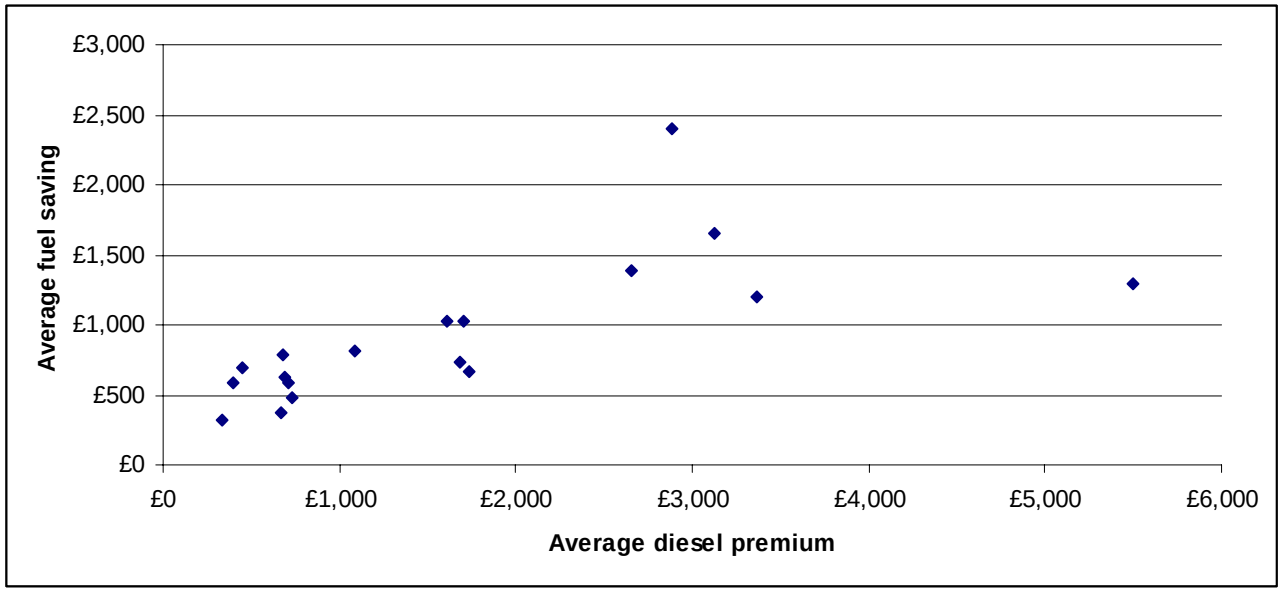
The largest overall premium is to be found in the *Prestige Saloon (PS)* sector, although unfortunately there are not many examples on which to base findings. The average is also greatly influenced by the inclusion of the Mercedes S Class saloon which has a large average diesel premium of £5500. Overall for the sector the premium is £3620 compared to a potential average fuel cost saving of £982.

In the *Prestige 4x4* sector, as with the Prestige Saloon sector, petrol cars are seen as extremely uneconomical, and there is a universally strong mark up for diesel versions despite many actually costing less when new. The average premium is £3009 compared to a perceived average saving of £1660.

3.2. The value of fuel efficiency

The scatter plot below (chart 4) demonstrates that there is a broadly proportional relationship between fuel savings and the diesel premium. **Put simply, we believe that there is evidence that a customer will, faced with a choice between two similar cars, put higher value on the model with better fuel efficiency**. The next section of this paper seeks to quantify this relationship and use it to model the impact of VED reform on car purchase decisions.

Chart 4: Plot of average diesel premium and cost savings, all models



3.3. Implications for VED

As noted above, our analysis indicates that customers faced with the choice of two comparable three year old cars appear to put a higher value on cars with lower running costs. This result can be applied to VED which, because it is paid regularly as a tax on ownership, constitutes a running cost. To do this we used the figures obtained in our analysis to quantify the value of running costs, by expressing the diesel premium as a factor of the estimated fuel savings – we dub this the *"residual factor"*.

The factors varied by model and doubtless reflected that some diesels are more refined and more popular than others, but **the average was a factor of 1.8. That is to say that for every potential saving in fuel costs of £100, the market was, on average, prepared to pay £180**.

Using this factor, **a VED increase of just 1% of the purchase price can increase the cost of ownership of a new car by 12%** (see example below**).** This increased cost would, in many cases, be high enough to move buying patterns from high CO_2 cars to lower CO_2 cars. It also disproves the argument that raising VED would have little impact since it is a low proportion of the purchase price of a vehicle.

Example: Modelling the impact of VED

In our example we take a new car costing £30,000, in VED band G. We assume that the first owner takes a three year lease deal, and that at existing VED rates he or she is paying £600 per month (which would be typical for a car of this value).

We assume for the sake of argument that VED for band G increases from the current rate of £210-£215 (for petrol and diesel cars respectively) to £510-£515, an increase of £300 per year (1% of the purchase price). Over three years this means an additional cost of £900.

Our "residual factor" of 1.8 suggests that this increase in VED would reduce the residual value of the car by £1620.

The leasing company would account for this additional depreciation by increasing the monthly payments charged to the first customer. In this case, the additional depreciation of £1620 translates into 36 additional monthly payments of £45.

The customer would also be paying VED of £900 over the three year leasing period, which is another additional £25 per month.

Therefore the total impact of raising VED by £300 would be to increase monthly costs from £600 per month to £670 per month (an increase of 12%), with £45 per month incurred due to increased depreciation from the increased VED rate, and £25 per month incurred by actually paying VED.

3.4. Summary of Conclusions

The paper provides an extremely useful analytic approach to estimating the impact of VED reform on the new car market in the UK, and derives the following robust results:

- Faced with two comparable three-year-old cars, customers place a higher value on the car with better fuel efficiency.

- The factors varied by model and doubtless reflected that some diesels are more refined and more popular than others, but **the average was a factor of 1.8. That is to say that for every potential saving in fuel costs of £100, the market was, on average, prepared to pay £180**.

- Using this factor, **a VED increase of just 1% of the purchase price can increase the cost of ownership of a new car by 12%.**

- This increased cost would, in many cases, be high enough to move buying patterns from high CO_2 cars to lower CO_2 cars.

- This result means even a reasonably modest rise to £500 per annum in the top band could have a significant impact on choices in the company car market, which accounts for over half of new car sales.

3.5. Suggestions for future research

Market research could be used to test the price elasticity of lease customers. This could be combined with the methodology presented here to form the basis of a more detailed assessment of how VED reform could impact the market for new cars.

3.6. Limitations of the analysis

Diesel premium

In our analysis we have assumed that lower fuel costs are the only reason that customers place a higher value on diesel than comparable petrol cars. We have controlled this variable to a large extent by selecting comparable petrol and diesel models. In practice there may be other factors at work: diesel cars may have a reputation as cheaper to maintain, for example, which may bolster their residual values. A more complete discussion of the residual values of diesel versus petrol cars is beyond the scope of this paper.

"Residual factor"

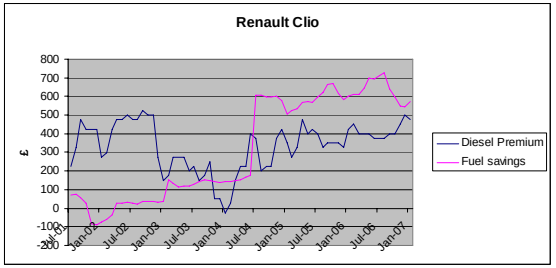
We obtained an extremely large data set for this analysis, since CAP obtain residual value figures from many thousands of car auctions. However in deriving the residual factor we simply took a mean average of the diesel premium figures, and divided this by the mean average fuel saving. This masks some significant variations in the residual value of these cars over time. Please see the appendix for charts showing the full data set for each model in the analysis.

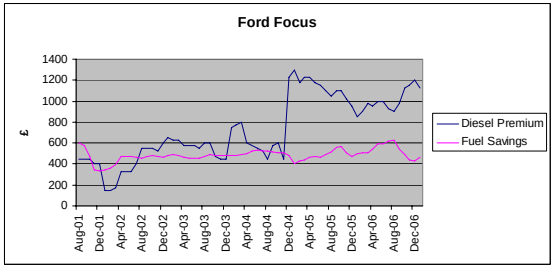
Appendix

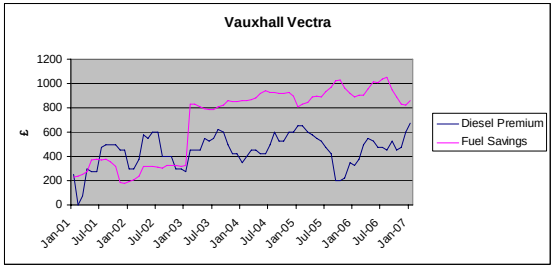
Data used in analysis

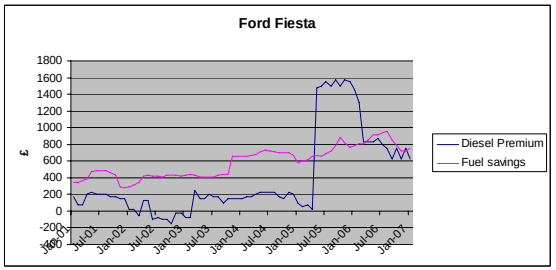
Class	Make/model	Diesel car details.	Petrol car details	Average diesel premium	Average fuel saving
B	Renault Clio	HATCHBACK, 1.9 D 5dr 15169	HATCHBACK, 1.2 5dr 15156	£333	£319
D	Toyota Avensis	SALOON GS/T2 4dr 14473	SALOON GS/T2 4dr 14448	£671	£376
C	Ford Focus	HATCHBACK 1.8 Tdi/TDCi LX 5dr 15778	HATCHBACK 1.6 LX 5dr 15767	£728	£485
B	Ford Fiesta	HATCHBACK LX TD 5dr 13157	HATCHBACK 1.25 LX 5dr 11024	£397	£585
D	Ford Mondeo	HATCHBACK, LX TD 5dr 13157	HATCHBACK, 1.8i LX 5dr 13152	£713	£585
D	Vauxhall Vectra	HATCHBACK, 2.0 DTi LS 5dr 16508	HATCHBACK, 1.8 LS 5dr 11797	£686	£631
PS	BMW 5 Series	SALOON 530d SE Auto 4dr 15530	SALOON 528/530 SE Auto 4dr 11512	£1,739	£671
C	Vauxhall Astra	HATCHBACK, 1.7 TD/DTi LS 5dr [AC] 14890	HATCHBACK, 1.4i LS 5dr [AC] 14852	£447	£689
PCS	BMW 3 Series	SALOON 320d SE 4dr 17152	SALOON 318i SE 4dr 15462,	£1,685	£727
C	VW Golf	HATCHBACK S/Match TDI 5dr 14129	HATCHBACK 1.6 S/Match 5dr 14120	£681	£793
D	Peugeot 406	SALOON LX/S 4dr 11292	SALOON 1.8 LX/S 4dr 11287	£1,090	£809
D	VW Passat	SALOON SE TDI 4dr 12489	SALOON SE 4dr 12460	£1,700	£1,023
PCS	Audi A4	SALOON 1.9 TDi 110/130 SE 4dr 11130	SALOON, 1.8 SE 4dr 9988	£1,612	£1,028
P4X4	BMW X5	ESTATE 3.0d Sport 5dr Auto 20885	ESTATE 3.0i Sport 5dr Auto 20244	£3,368	£1,195
P4X4	Mercedes S-Class	SALOON, S320 CDi 4dr Auto 17875	SALOON, S280 4dr Auto 16021	£5,500	£1,293
P4X4	Mercedes ML Class	SW, ML270 CDI 5dr Tip Auto 17496	STATION WAGON, ML320 5dr Tip Auto 17497	£2,656	£1,383
P4X4	Range Rover	ESTATE HSE 4dr Auto 16781	ESTATE HSE 4dr Auto 18054	£3,125	£1,655
P4X4	Land Rover Discovery	SW, 2.5 Td5 GS 7 seat 5dr Auto 15826	SW, 4.0 V8i GS 7 seat 5dr Auto 15836	£2,888	£2,405

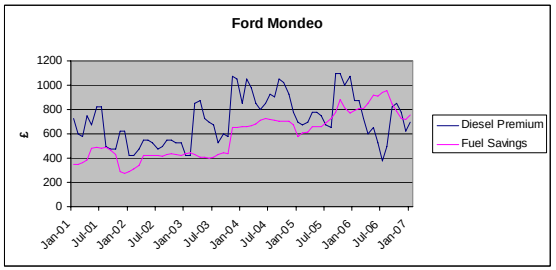
Diesel premium and fuel saving data for all models

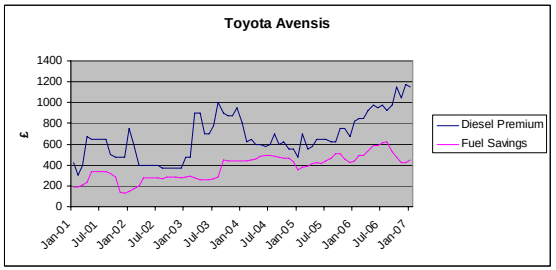


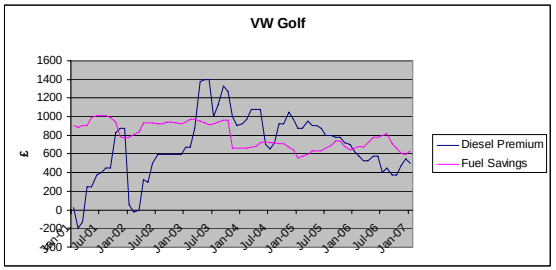


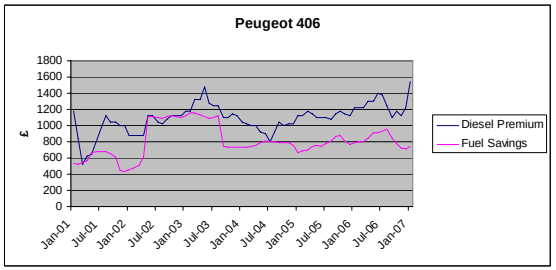


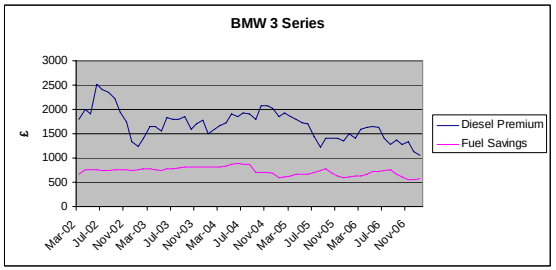


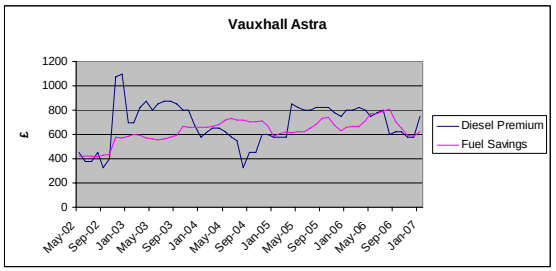


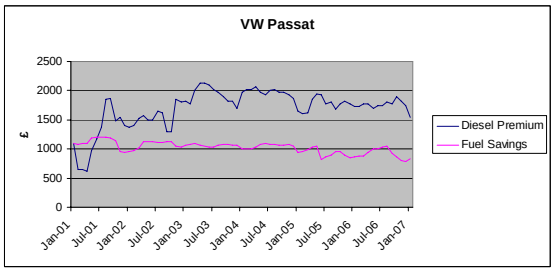


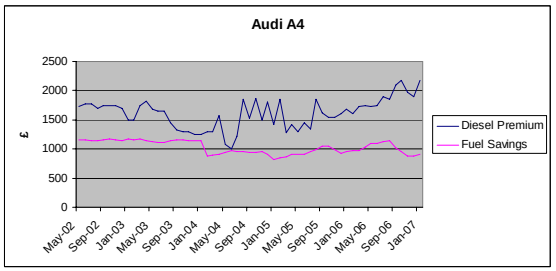


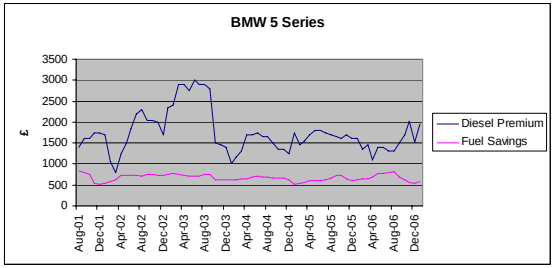


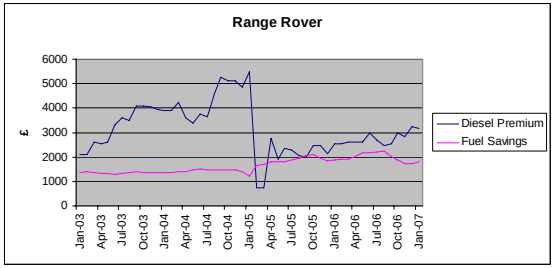


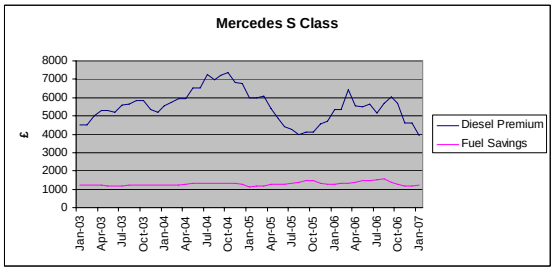


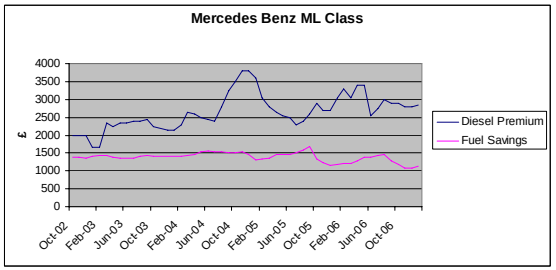


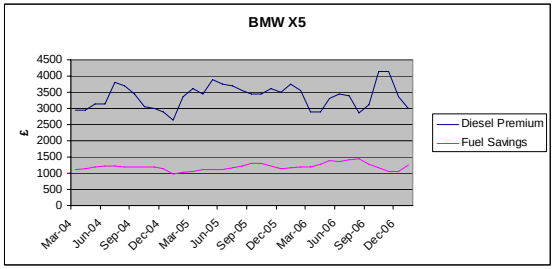


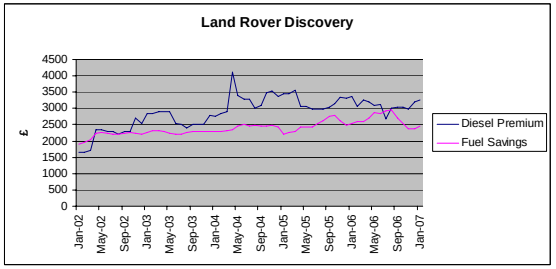

BMW 5 Series
£
3500
3000
2500
2000
1500
1000
500
0
Aug-01
Dec-01
Apr-02
Aug-02
Dec-02
Apr-03
Aug-03
Dec-03
Apr-04
Aug-04
Dec-04
Apr-05
Aug-05
Dec-05
Apr-06
Aug-06
Dec-06
Diesel Premium
Fuel Savings


Range Rover
£
6000
5000
4000
3000
2000
1000
0
Jan-03
Apr-03
Jul-03
Oct-03
Jan-04
Apr-04
Jul-04
Oct-04
Jan-05
Apr-05
Jul-05
Oct-05
Jan-06
Apr-06
Jul-06
Oct-06
Jan-07
Diesel Premium
Fuel Savings


Mercedes S Class
£
8000
7000
6000
5000
4000
3000
2000
1000
0
Jan-03
Apr-03
Jul-03
Oct-03
Jan-04
Apr-04
Jul-04
Oct-04
Jan-05
Apr-05
Jul-05
Oct-05
Jan-06
Apr-06
Jul-06
Oct-06
Jan-07
Diesel Premium
Fuel Savings


Mercedes Benz ML Class
£
4000
3500
3000
2500
2000
1500
1000
500
0
Oct-02
Feb-03
Jun-03
Oct-03
Feb-04
Jun-04
Oct-04
Feb-05
Jun-05
Oct-05
Feb-06
Jun-06
Oct-06
Diesel Premium
Fuel Savings


BMW X5
£
4500
4000
3500
3000
2500
2000
1500
1000
500
0
Mar-04
Jun-04
Sep-04
Dec-04
Mar-05
Jun-05
Sep-05
Dec-05
Mar-06
Jun-06
Sep-06
Dec-06
Diesel Premium
Fuel Savings


Land Rover Discovery
£
4500
4000
3500
3000
2500
2000
1500
1000
500
0
Jan-02
May-02
Sep-02
Jan-03
May-03
Sep-03
Jan-04
May-04
Sep-04
Jan-05
May-05
Sep-05
Jan-06
May-06
Sep-06
Jan-07
Diesel Premium
Fuel Savings

References

[1] HM Treasury, Budget 2006, Chapter 7
http://www.hm-treasury.gov.uk/media/20F/1D/bud06_ch7_161.pdf

[2] MORI 2003, Assessing the Impact of Graduated Vehicle Excise Duty, DfT 2003

[3] RAC Foundation quoted in Lane, "Consumer attitudes to low carbon and fuel-efficient passenger cars", Low Carbon Vehicle Partnership March 2005