Final Report

Update and Extension of Vehicle Emissions Modelling

Prepared for

Ministry of Transport

September 2007

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Executive Summary

This report examines the emissions impacts of the proposed policy to restrict used vehicle imports. It updates and extends our earlier work on import restrictions, and incorporates the latest emissions standards proposed in *Land Transport Rule: Vehicle Exhaust Emissions [2007]*.[1]

Previous Work on Emissions Policies

This report represents the third phase of a wider study on vehicle emissions. The first phase, which was completed in 2005, examined the social and economic impacts of a then-proposed in-service vehicle emissions screening programme: a requirement for the emissions of vehicles to be tested as part of the Warrant of Fitness (WoF) or Certificate of Fitness (CoF) test.[2]

That study examined the effects of the vehicle testing regime in terms of financial costs, and also the possibility of social exclusion caused by losing a vehicle. The analysis suggested that the communities at greatest risk were young and old people, particularly those of Maori and Pacific descent. Solo parents were also identified as high risk, especially solo Maori or Pacific Island mothers. These household groups tend to have lower-than-average household incomes and relatively high daily living costs. Large families, and disabled people, were also identified as being at risk.

In June 2005, subsequent to the release of the phase 1 report, the Minister of Transport announced the introduction of emissions control policies to be put in place by the end of 2006. These would comprise a visual smoke test as part of the WoF/CoF test to target the worst emitters, and prohibition of removal of (or tampering with) a vehicle's emissions control technology.

In 2006, the Ministry then asked us to examine the effects of an alternative emissions policy – this time focused on restricting the entry of used imported vehicles at the border. This report updates and extends that second report, and analyses the recently-proposed set of emissions standards.

Policy Impact

Our first task in this report was to gauge the potential impact of the proposed emissions standards by comparing the effective age limits they impose with the age distribution of last year's used imports. This told us the proportion of last year's used imports that would have been banned if similar restrictions were in place at the time.

According to our analysis, the proposed rules could effectively ban up to 90% of used petrol imports and 96% of diesel imports based on last year's import profile.

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[1] Although these rules embody manufacturing standards from Australia, Europe, Japan and the United States, we confine our attention to only the Japanese standards. This is because around 97% of used vehicles imported into New Zealand are built to the Japanese standards.

[2] Covec (2005) Vehicle Fleet Emission Screening Programme Social and Economic Impact Assessment Phase I. Final Report to the Ministry of Transport

Methodology & Data
In our previous report, we developed a spreadsheet model to calculate the potential fuel and emissions impacts of the then-proposed emissions standards. In this report, we replace that model with a new, improved version. The new model incorporates updated information on the fleet, the rate and composition of imports, and the rate and composition of vehicle scrappage. It also incorporates updated fuel economy data and includes estimates of emission opacity, which are proxies for PM emissions.

Baseline Projections
Before presenting our estimates of policy impacts, we first present our baseline projections (*i.e.* business as usual). These suggest that, in the absence of any other policy:

- petrol imports will increase from 214,000 in 2007 to 231,000 by 2016 – an average annual increase of 0.8%, while diesel imports will increase from 45,000 to 51,000 – an average annual increase of 1.3%.

- the number of registered petrol vehicles will climb from 2.47 million in 2007 to 2.90 million in 2016 – an average annual increase of 1.8%, while the number of registered diesel vehicles will increase from 449,000 in 2007 to 644,000 in 2017 – an average annual increase of 4.1%.

- both fleets – petrol and diesel – will age slowly over time. By 2017, the average age of petrol vehicles will be nearly 12 years, and the average age of diesel vehicles will be around 11.5 years.

- petrol VKTs will increase from 31.1 billion in 2007 to 36.1 billion in 2016 – an average annual increase of 1.7%, while diesel VKTs will increase from 7.3 billion to 10.2 billion – an average annual increase of 3.8%.

Policy Scenarios
In this report, we model the emissions impacts of five policy scenarios. We then test the sensitivity of our results to changes in scrappage rates and aggregate travel demand (VKT).

Scenario Results
The estimated emissions impacts of the five policy scenarios vary greatly. They range between a 6.9% increase (for CO) and a 3.9% decrease (for CO_2). The only consistent theme was reductions in opacity and CO_2 emissions – these occurred in each scenario.

The main lessons from our modelling seem to be that:

- The effects of the policy are ambiguous – they depend quite strongly on policy design and on consumer reactions.

- A 5-year rolling age ban provides the best outcomes for opacity and CO_2 - the two pollutants presumably of most interest to the Ministry.

- The emissions effects of the policy operate not only through changes in fleet composition, but also through changes in VKT. In fact, our modelling suggests that changes in VKT are as important – if not more important – than changes in fleet composition for curbing emissions. This, in turn, suggests that travel demand management should be considered as part of any policy package.

- Our modelling also suggests that reductions in the rate of scrappage falls as a result of the policy will cause policy benefits to diminish. Thus, complementary scrappage programmes should also be considered.

- Finally, our analysis implies that delaying the introduction of petrol standards decreases the emission of CO, HC and NO, but increases the emissions of opacity and CO_2 (relative to no delay).

Industry Impacts

This report also considers potential effects of the policy on the motor vehicle industry itself. It finds that the proposed rules could reduce the GDP of used vehicle sales by up to 75% (up to $2.3 billion per annum). Of course, these will be offset by increased spending in other sectors of the economy, so the overall economic impact is unclear.

Flow-On Effects

This report also considers flow-on effects of the policy. Those most likely to be affected include automotive repairers, crown revenues (from reduced annual licensing fees) and vehicle insurers. All elements of the import supply chain – shipping companies, ports and vehicle inspectors, and so on – will also be affected.

Social Impacts

Finally, this report considers potential social impacts. Overall, these are expected to be fairly minor, particular compared to the originally-proposed in-fleet emissions policy.

1. Introduction

1.1. Background

This report represents the third phase of an ongoing evaluation of vehicle emissions policies. It updates and extends our earlier work on import emissions standards, and incorporates the most recent rules proposed by the Ministry.

1.2. What's new in this report?

The key differences between this report and our previous report are:

- A new modelling framework has been developed to calculate the fuel and emissions impacts of the proposed rules.[3]
- A new set of emissions standards has been analysed.
- Updated data (on the fleet, the level and composition of imports, and the level and composition of scrappage) have been used to calibrate the model, as has updated data on fuel economy.
- Deeper consideration is given to the industry impacts of a possible downturn. This includes estimating the potential GDP impacts.

1.3. Structure of Report

The basic structure of the report is as follows.

- *Section two* outlines the proposed rules underlying this report, and estimates the proportion of used imports potentially affected.
- *Section three* describes the methodology and data used to construct the fuel and emissions model.
- *Section four* presents baseline projections against which the policy is assessed.
- *Section five* defines the scenarios used for modelling.
- *Section six* presents the estimated fuel and emissions impacts for each scenario, and tests sensitivity to key parameters.
- *Section seven* discusses the current state of the motor vehicle industry and estimates any potential downturns.
- *Section eight* summarises the assessment of social impacts from our last report

[3] The new model is dynamic, whereas the previous model was static. This simply means that the fleet evolves from one year to the next in the new model, rather than being frozen in time (as in the previous model). The new model also tracks emissions changes (and places them in context of baseline emissions) more accurately than before.

2. The Proposed Rules

Because the Government had not yet announced its policies, our previous emissions report modelled only one policy scenario – a 7 year rolling age ban. Since that time, the Government announced its proposed standards in *Land Transport Rule: Vehicle Exhaust Emissions [2007]*. This report therefore updates and extends our previous report by analysing the effects of a number of scenarios based on the recently-proposed rules.[4]

2.1. Petrol

The following table lists the proposed manufacturing standards for Japanese petrol vehicles. The rightmost column shows the effective age limit on imports each year. For example, in 2010, New Zealand will adopt the Japanese 2005 manufacturing standard, which will effectively limit imports to vehicles aged 5 years or younger.

Table 1: Proposed Standards for Petrol Vehicles

Year	Standard	Introduced	Max. Age
2008	Japan 00/02	2000	8
2009	Japan 00/02	2000	9
2010	Japan 2005	2005	5
2011	Japan 2005	2005	6
2012	Japan 2005	2005	7
2013	Japan 2009	2009	4
2014	Japan 2009	2009	5
2015	Japan 2009	2009	6
2016	Japan 2009	2009	7
2017	Japan 2009	2009	8

2.2. Diesel

The proposed manufacturing standards for Japanese diesel vehicles are set out below.

Table 2: Proposed Standards for Diesel Vehicles

Year	Standard	Introduced	Max. Age
2008	Japan 02/04	2003	5
2009	Japan 02/04	2003	6
2010	Japan 2005	2005	5
2011	Japan 2005	2005	6
2012	Japan 2005	2005	7
2013	Japan 2009	2009	4
2014	Japan 2009	2009	5
2015	Japan 2009	2009	6
2016	Japan 2009	2009	7
2017	Japan 2009	2009	8

[4] Although these embody manufacturing standards set in Australia, Europe, Japan and the United States, we confine our attention to only the Japanese standards. This is because around 97% of used vehicles imported into New Zealand are from Japan and are assumed to comply with their standards.

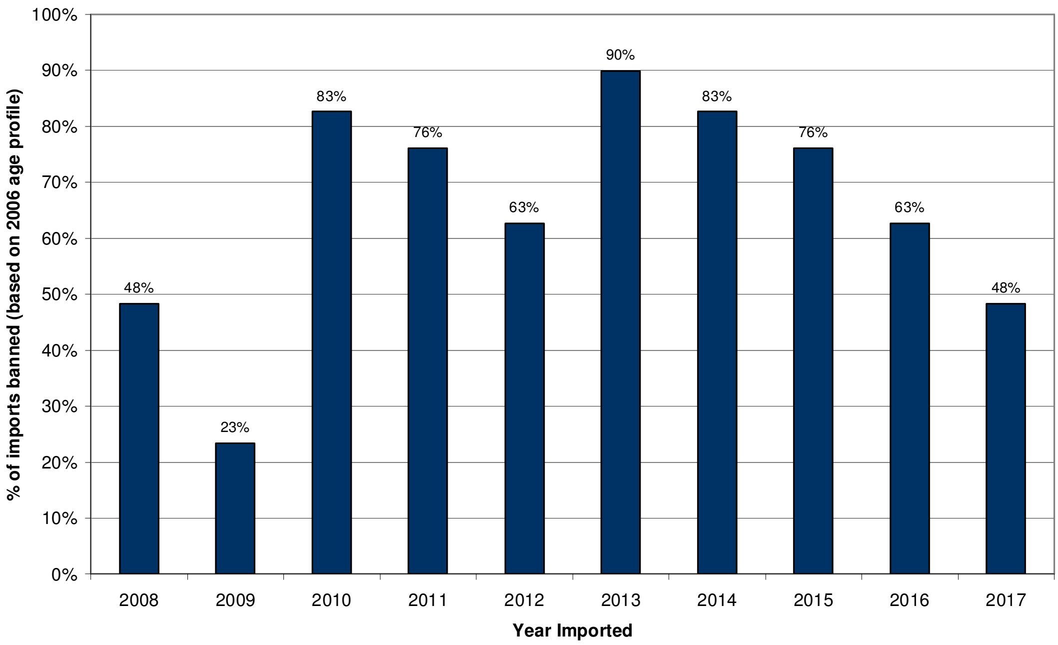
2.3. Restrictiveness of the Proposed Standards

By themselves, these standards tell us very little about potential policy impacts. This is because impacts depend – primarily - on the restrictiveness of standards. The more restrictive the standards, the greater the policy impact (everything else held constant).

In order to gauge the restrictiveness of the proposed standards, we overlaid them on historic import age distributions to see the proportion of historic imports that would have been banned if similar restrictions were in place at the time. The results are presented below.[5]

As one might expect, the results of this exercise depend on the specific import age distribution that is used. Since the industry is in a state of change, and because we do not know how it shall evolve from here, we use the most recent data. This is considered more reflective of future trends than older data. The following two charts therefore compare the proposed rules against the age distribution of used imports in 2006.[6]

Figure 1: Proportion of *Used* Petrol Imports Banned under Proposed Rules



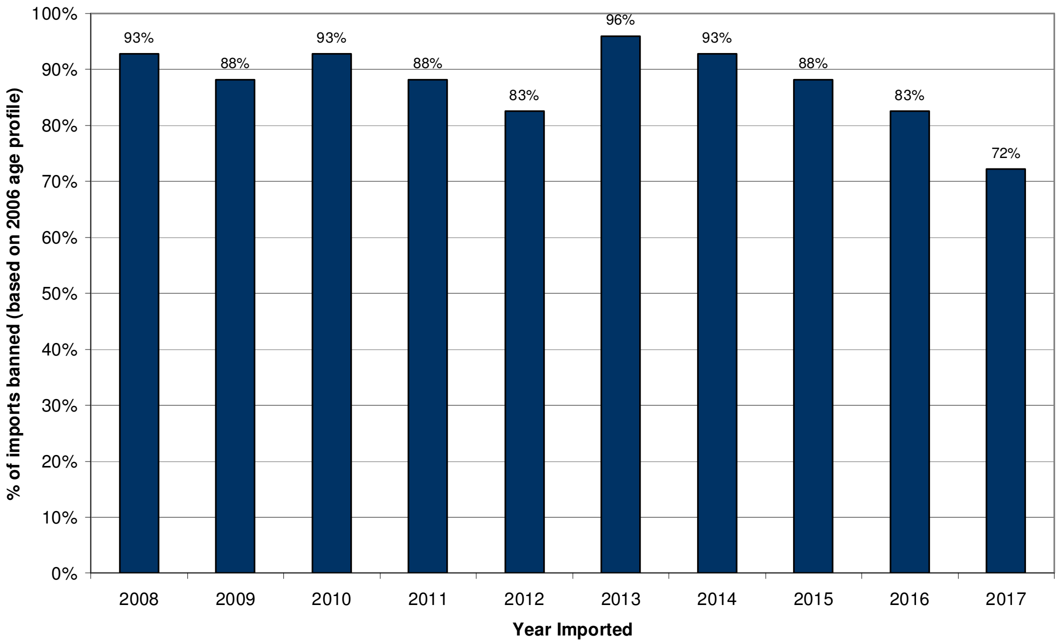
[5] It is important to note that this graph, and the remainder of the analysis, works with calendar years. In some cases, this may distort the results, because vehicles built in a certain calendar year may not meet prevailing standards. Conversely, some vehicles meet future standards before they are even introduced. For instance, over 60% of the vehicles built in 2000 were not built to the Japanese 2000/02 standard, while around 35% of vehicles built in 2004 were built to the 2005 standard (before they were legally required to). Since we have no way of predicting the extent to which this will happen in the future, we simply work with calendar years, and assume that all vehicles built in a given year meet the current standard. This is roughly equivalent to assuming that the number of vehicles failing current standards equals the number of vehicles exceeding future standards.

[6] Using age profiles from other years would provide different – but materially similar – results.

Figure 1 shows that policy stringency varies significantly from one year to the next. For instance, in 2009, only 23% of used imports would be banned, while in the following year 83% would be banned. The policy is most restrictive in 2013, at which point 90% of used petrol imports will be banned.

The diesel standards are even more restrictive, as shown in Figure 2. For instance, in the first year of policy operation (2008), 93% of used imports will be banned. This increases to 96% in 2013.

Figure 2: Proportion of *Used* Diesel Imports Banned under Proposed Rules



3. Methodology and Data

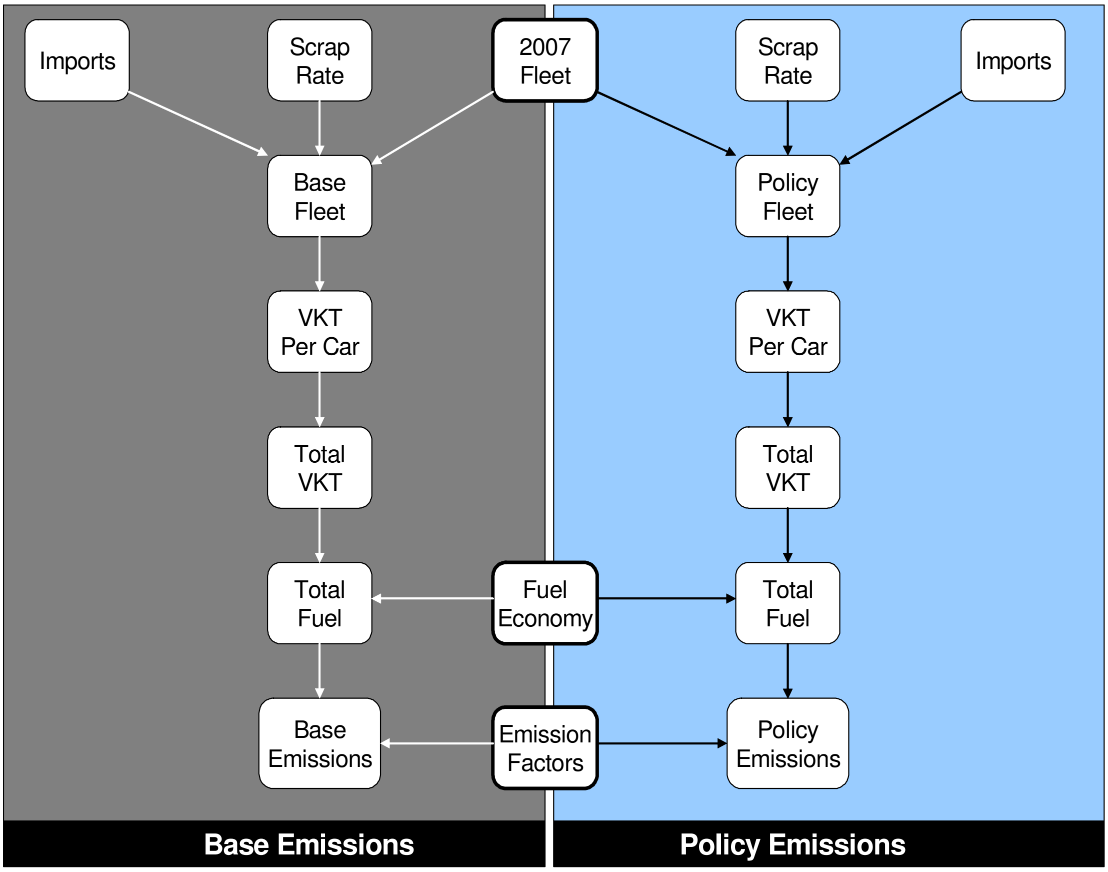
In this section, we describe the methodology underlying the new fuel and emissions model.

3.1. Model Dimensions

The first step in designing the fuel and emissions model was to determine the relevant dimensions. This involves identifying the vehicle attributes that most significantly affect emissions. Somewhat surprisingly, our analysis revealed that year of manufacture and fuel types were the main drivers, and that other factors (such as engine size and gross vehicle mass) were secondary drivers. The two main dimensions of the model are therefore year of manufacture and fuel type.

3.2. Model Schematic

Following is a schematic overview of the fuel and emissions model.



The left-hand side of this diagram depicts the calculation of emissions under business as usual, while the right-hand side depicts the calculation of emissions under the proposed policy. The three boxes straddling the white line represent shared inputs to the model. The common starting point for each side of the analysis is thus the 2007 fleet. This was disaggregated by fuel type and year of manufacture, as were all the other inputs to the model.

The first step in calculating emissions impacts is to derive fleet projections. Starting from 2007, the fleet in each successive year is found by simply adding imports and subtracting scrappage. This is repeated until a 10-year fleet projection is obtained. Next, VKT estimates are overlaid on the fleet projections to yield annual VKT projections. Estimates of fuel economy are then used to convert annual VKTs to estimates of annual fuel consumption. Finally, emissions factors – grams of pollutant per litre of fuel – are used to convert annual fuel estimates to annual emissions.

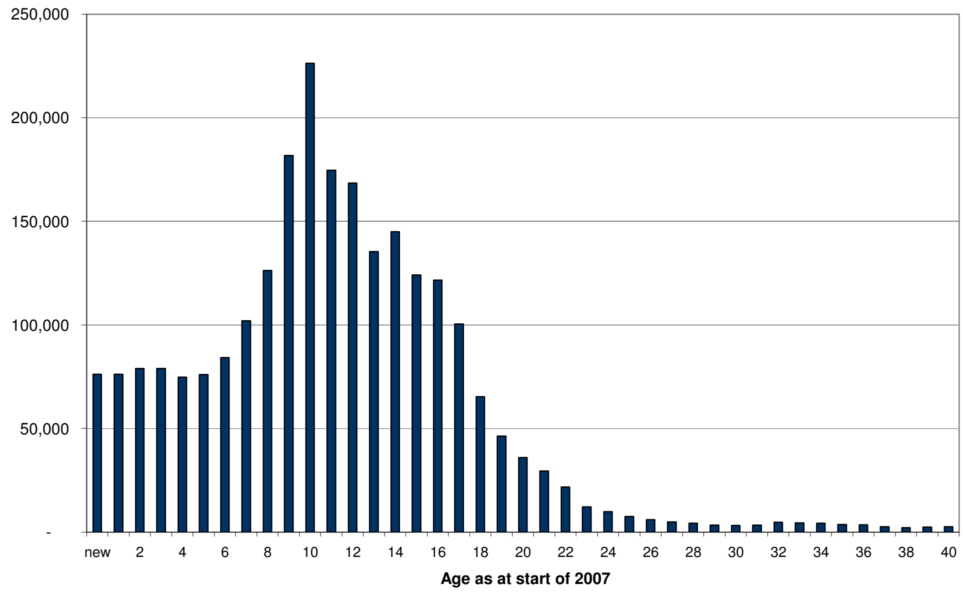
3.3. Base Components of the Model

In the remainder of this section, we provide further information on the *base* components of the model. A discussion of policy-specific inputs and parameters follows.

3.3.1. The 2007 Base Fleets

As noted earlier, the starting point for the analysis is the fleet as at the start of 2007. Figure 3 and Figure 4 show the age distributions of the base petrol and diesel fleets, respectively.

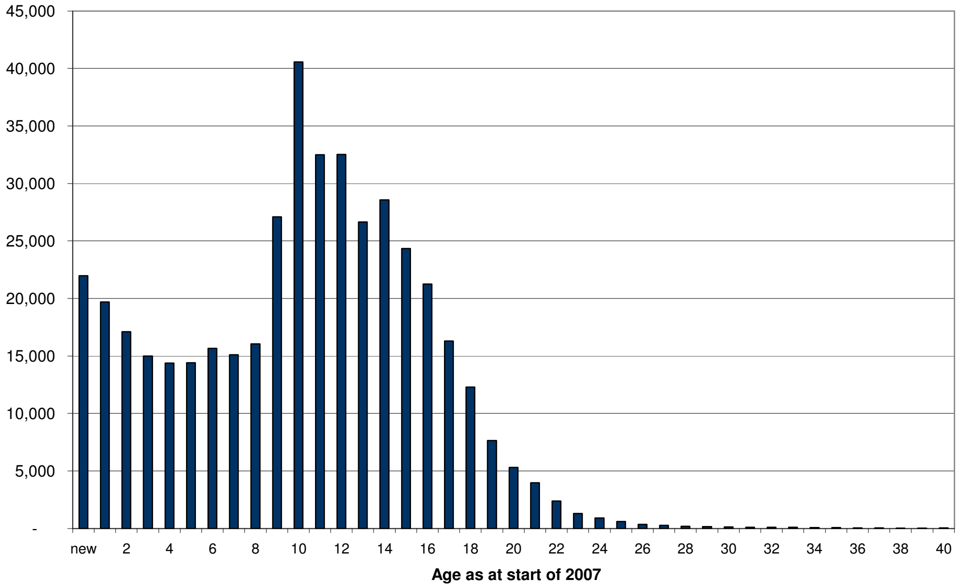
Figure 3: Age Distribution of Base Petrol Fleet



The age distribution for petrol vehicles is quite heavily right-skewed. This is shown by the long tail on the right hand side. The average age of light-duty petrol vehicles was just over 11 years at the start of 2007, while the median was closer to 10 years.

The age distribution for light-duty diesels is similar to that for petrol, but with a greater emphasis on newer vehicles (those aged 0-3 years). The diesel distribution is also right-skewed, but less so than petrol. The average age for diesel vehicles – as well as the median - was just over 10 years at the start of 2007.

Figure 4: Age distribution of base diesel fleet



3.3.2. Imports

There are two sets of import inputs for each fuel type: (i) annual import volumes, and (ii) import age distributions. We start with import volumes.

Import Volumes

The first task is to infer the likely level of future imports based on historic volumes. Historic volumes for petrol vehicles are set out below.

Figure 5: Petrol Import Volumes 2000 - 2006

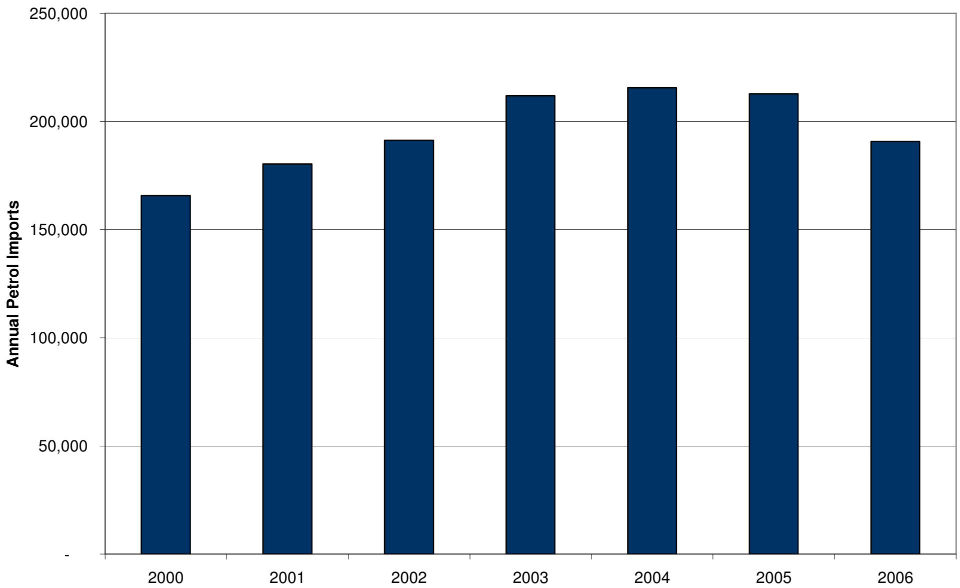
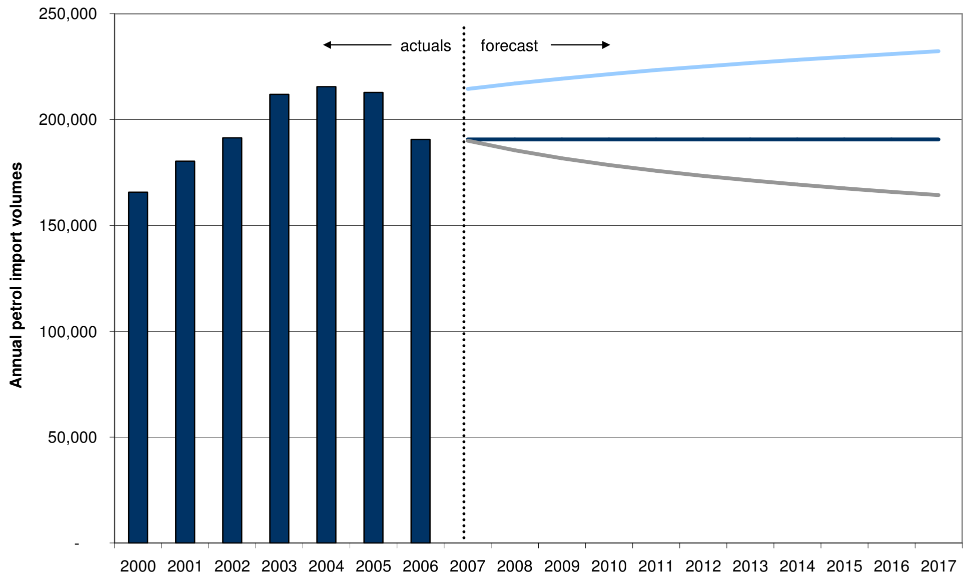


Figure 5 shows that petrol import volumes grew steadily from 2000 to 2004, but fell away thereafter. This makes projections difficult; is the recent drop temporary or permanent? In order to accommodate this uncertainty, we derived three baseline import scenarios:

1. Low scenario – where import volumes continue to fall each year
2. Mid scenario – where volumes remain constant at the 2006 level, and
3. High scenario – where import volumes rise each year

The chart below shows how these scenarios compare for petrol vehicles.

Figure 6: Petrol Import Volume Scenarios



Under the low scenario, import volumes fall 14% between 2006 and 2017, with only around 164,000 vehicles imported in 2017. Under the high scenario, by comparison, import volumes increase 22% between 2006 and 2017, reaching over 230,000. Under the mid scenario, imports remain static at about 190,000 vehicles per year.

Next, we repeated the exercise for diesel vehicles.

Figure 7: Diesel Import Volumes 2000 - 2006

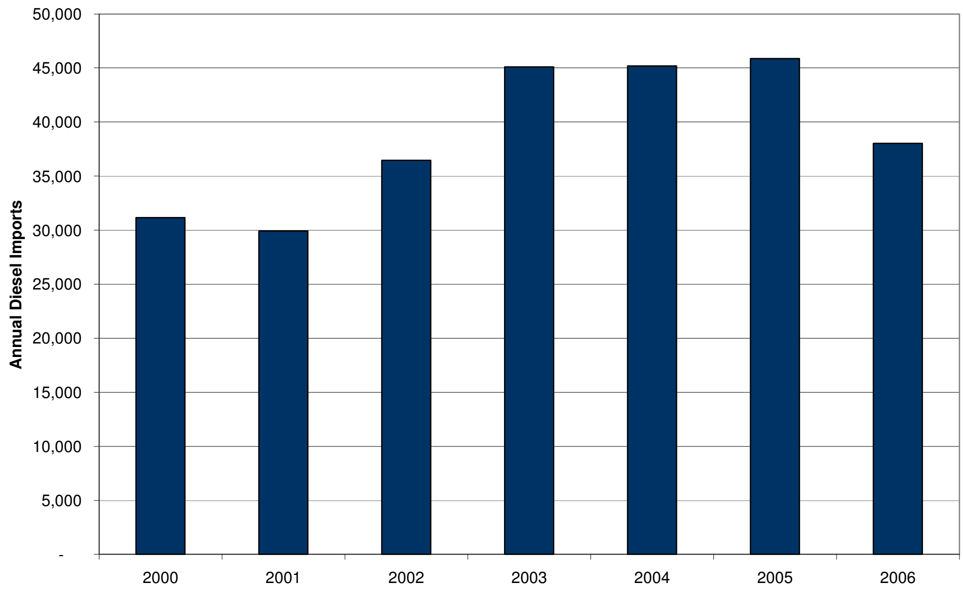
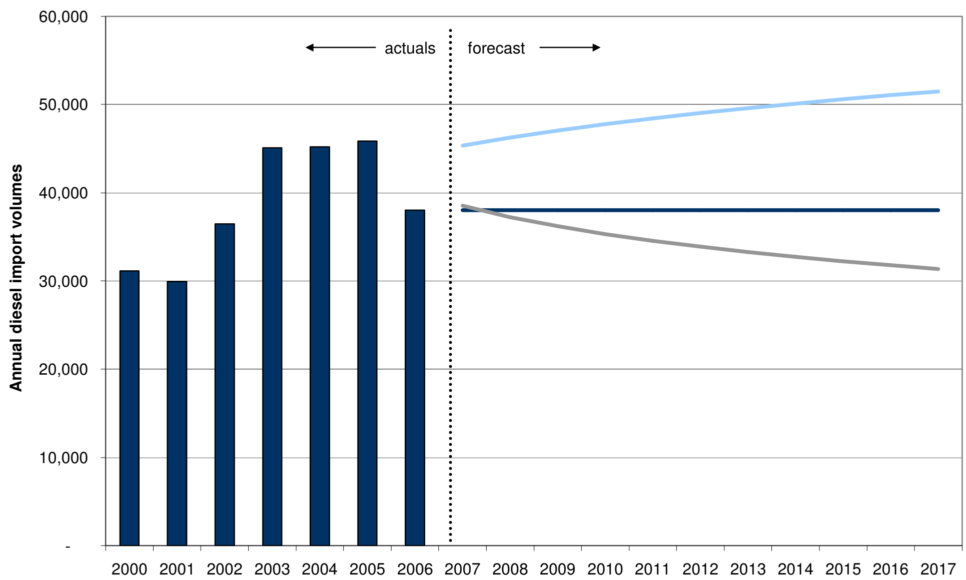


Figure 7 shows that diesel volumes followed the same basic trend as petrol, but with a more-pronounced drop in 2006. This, again, raised questions over future import volumes. The same solution was used as for petrol imports – three baseline scenarios were used. The figure below presents these scenarios for diesel vehicles.

Figure 8: Diesel Import Volume Scenarios



Under the low scenario, import volumes fall 18% between 2006 and 2017, with only 31,000 vehicles imported in 2017. Under the high scenario, by comparison, import volumes increase 35% between 2006 and 2017, reaching over 51,000 by 2017. Under the mid scenario, imports remain static at about 38,000 vehicles per year.

Import Age Distributions

Next, we needed to determine the age distribution of future imports. These, too, have changed over time. Figure 9 documents recent age distributions for petrol imports, while Figure 10 repeats this for diesel.

Figure 9: Petrol Import Age Distributions 2000-2006

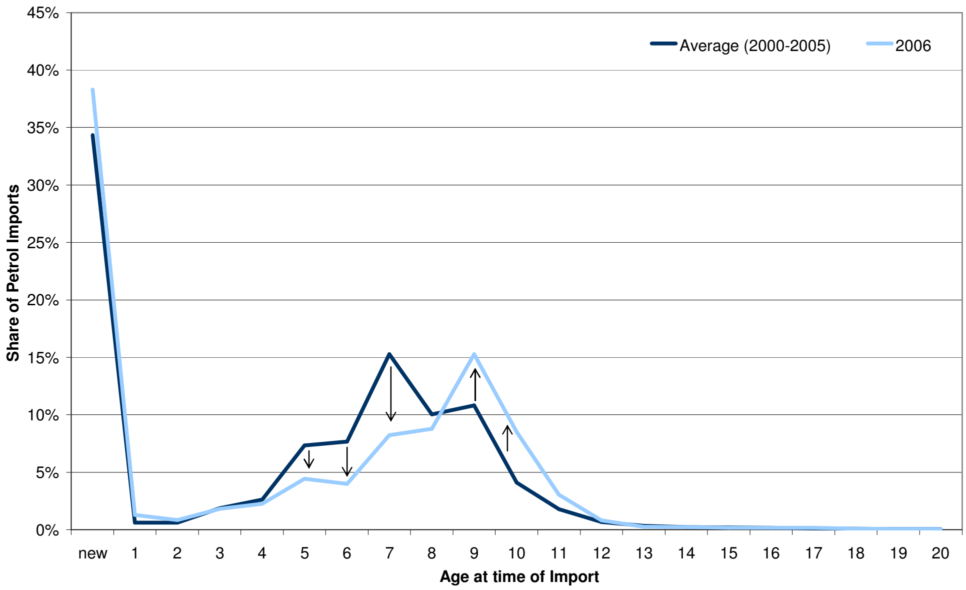
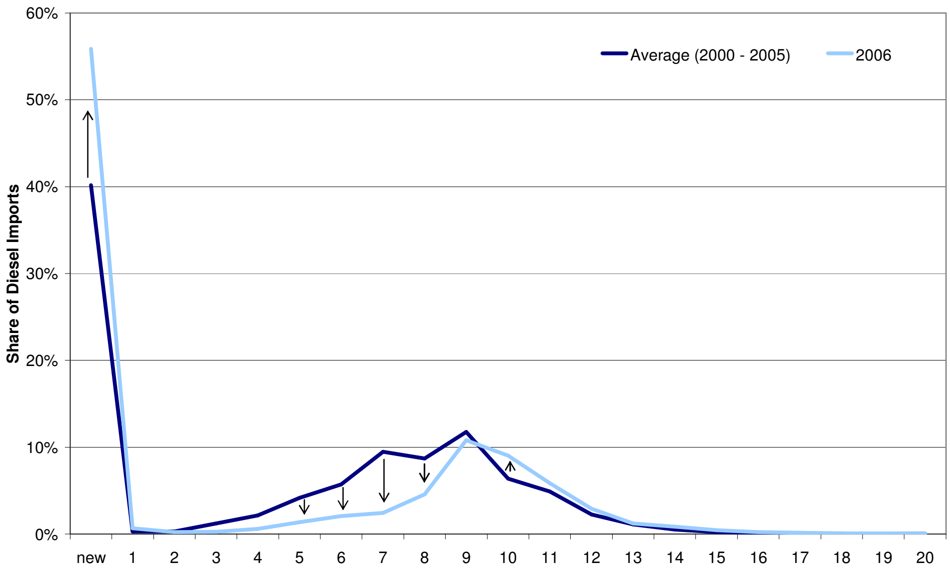


Figure 10: Diesel Import Age Distributions 2000-2006



As one might expect, the age distribution of future imports has a discernible effect on the future composition of the fleet, and thus future emissions. Given the significance of this input parameter, we consulted with the Ministry on the most appropriate profile to use. A consensus was reached, and the 2006 profiles were selected for both petrol and diesel imports.

3.3.3. Scrappage

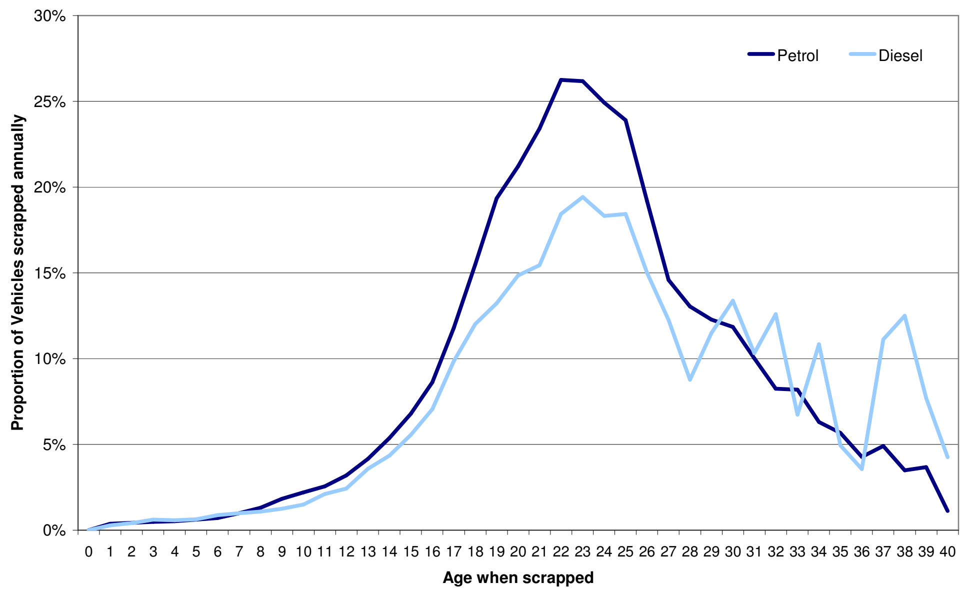
Scrappage refers to the removal of licensed vehicles from the fleet (and is normally taken to represent the permanent decommissioning of vehicles). Intuitively, the rate of scrappage tends to increase with age, because older vehicles are less economic to repair.

For the purposes of modelling, scrappage is defined in terms of mortality. Mortality is simply the proportion of vehicles (of different ages) scrapped in any given year.

As with the age distributions of imports, mortality distributions have also shifted over time. In particular, the average age of scrapped vehicles has increased.

Since the assumed rates of scrappage also have a material influence on future emissions, we again consulted with the Ministry to select the best input data. The 2006 scrappage profiles were considered to be the best measure of future scrappage, and so were adopted in the model. These are depicted together - for petrol and diesel - in the chart below

Figure 11: Assumed Mortality Functions



3.3.4. VKT per Vehicle

In order to translate annual fleet profiles into annual VKTs, we needed to know the average VKTs of vehicles by age and fuel type. These were sourced from the Ministry's MVR odometer-reading project, and are presented in the following chart.

Figure 12: Annual VKTs by Fuel Type and Age

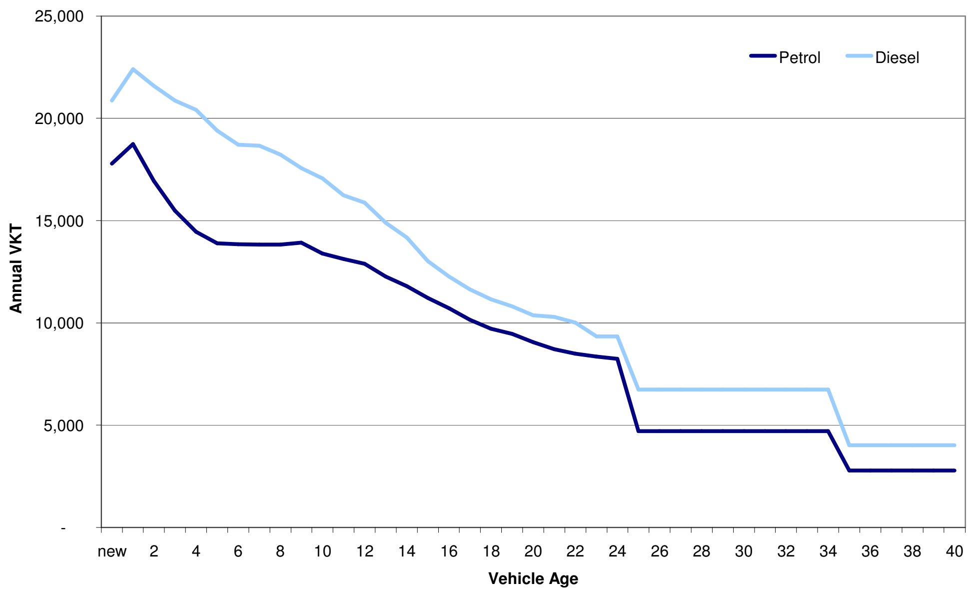


Figure 12 shows that VKT falls as vehicles age, and that diesel vehicles travel further than petrol vehicles (on average).

3.3.5. Fuel Economy

Next, we needed estimates of fuel economy. These convert estimates of annual VKTs to estimates of annual fuel consumption.

For a number of reasons - such as congestion, driver behaviour and terrain – on-road fuel consumption differs from that claimed in manufacturers' marketing materials. This means that we cannot simply rely on manufacturer's information, and must derive fuel economy via empiric means (in which actual fuel and VKT data are used).

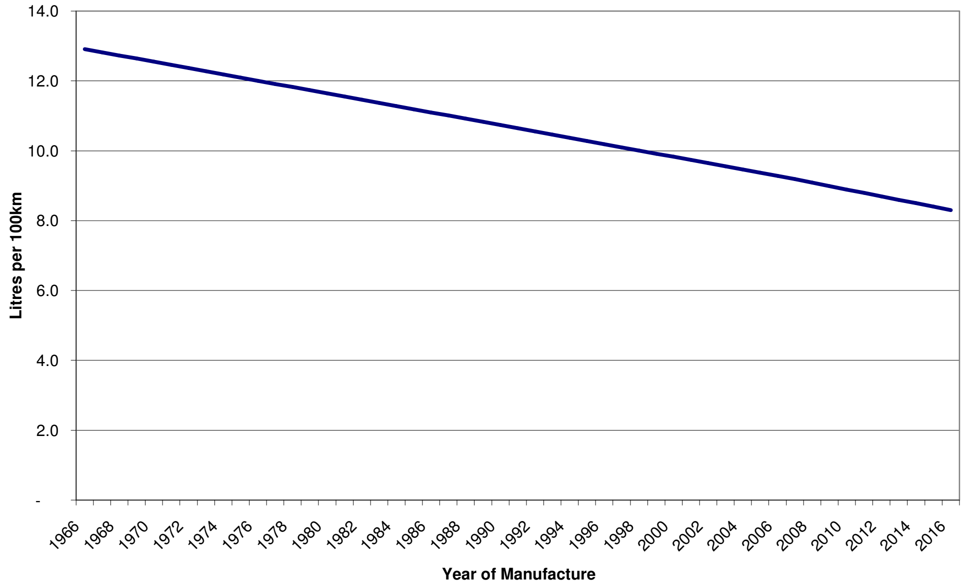
Unfortunately, reliable data on road transport diesel use is notoriously difficult to source, because diesel has so many other uses. Petrol, on the other hand, is used almost exclusively to power light vehicles. This led us to focus on petrol fuel economy in the first instance.

Using an estimate of total petrol consumption for 2005 (from the Energy Data File), along with our VKT estimates above, and drawing on earlier work for the Ministry that estimated annual improvements in fuel economy, we derived the following fuel economy profile for petrol vehicles.[7] According to this series, average fuel economy is around 8.3 litres per 100km for vehicles manufactured in 2016.[8]

[7] We assume that 7% of petrol use is for off-road purposes, and exclude this from our calculations.

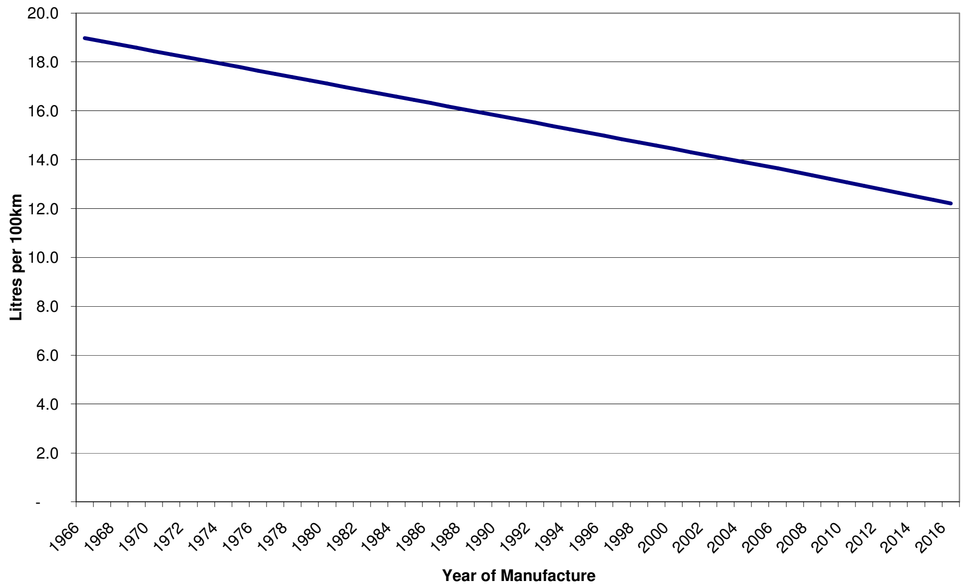
[8] It should be noted that these figures are based on the absence of any other initiatives that improve fuel economy.

Figure 13: Fuel Economy Estimates for Petrol Vehicles



Given the scarcity of reliable data on light vehicle diesel use, we used the VFEM to infer the fuel economy of diesel vehicles relative to petrol ones. This suggested that, on average, diesel vehicles consumed 47% more fuel than petrol vehicles per 100 kilometres.[9] Applying this scalar to the petrol series in Figure 13, we derived the following fuel economy series for diesel vehicles.

Figure 14: Fuel Economy Estimates for Diesel Vehicles



[9] Note that this simply reflects the fact that New Zealand's light diesel vehicles are much larger than its petrol vehicles (on average), and therefore consume more fuel. It does not mean that diesel vehicles are less fuel efficient. Conversely, for any given vehicle size, diesel engines are generally *more* fuel efficient.

According to this series, diesel vehicles manufactured in 2016 will consume around 12.2 litres of fuel per 100 km.

3.3.6. Emission Factors

The final data required for the model were emissions factors. These show the number of grams of each pollutant emitted per litre of fuel. The emissions factors used in this report were sourced from the same data as used in our previous report – ARC's remote sensing study.

In order to better understand the harmful effects of particulate emissions from diesel vehicles, we also attempted to source PM emissions factors. These provided difficult to find, however. As a workaround, we sourced opacity data from the remote sensing project. These are not perfect quantitative indicators of PM emissions, but are reasonable qualitative indicators.[10]

3.4. Policy-Specific Inputs and Parameters

Following are brief descriptions of the policy-specific inputs and parameters in the model.

3.4.1. Import Restrictions

The first (and most obvious) policy-specific parameters are the import restrictions themselves. These are described in section 2.

3.4.2. Age Distribution of Imports

The introduction of import restrictions alters the composition of imported vehicles. This is handled by altering the age distribution of future imports. The specific shape of the age distribution depends on the scenario under consideration.

3.4.3. Scrappage

Because the policy causes the rate of imports to fall, the size of the fleet will also shrink unless the rate of scrappage falls to offset it. In the model, we accommodate this possibility by allowing model users to reduce the rate of scrappage.

Since newer cars are scrapped mainly because they have been irreparably-damaged, the model assumes that any changes in the rate of scrappage apply only to older vehicles. The effects of this assumption can be seen in the following diagram.

[10] *What is being discharged from that tailpipe? Modelling versus measurement*. Presentation to the 27th Australasian Transport Research Forum by Jeff Bluett and Gavin Fisher.

Figure 15: Policy Scrappage Distribution (Petrol Vehicles)

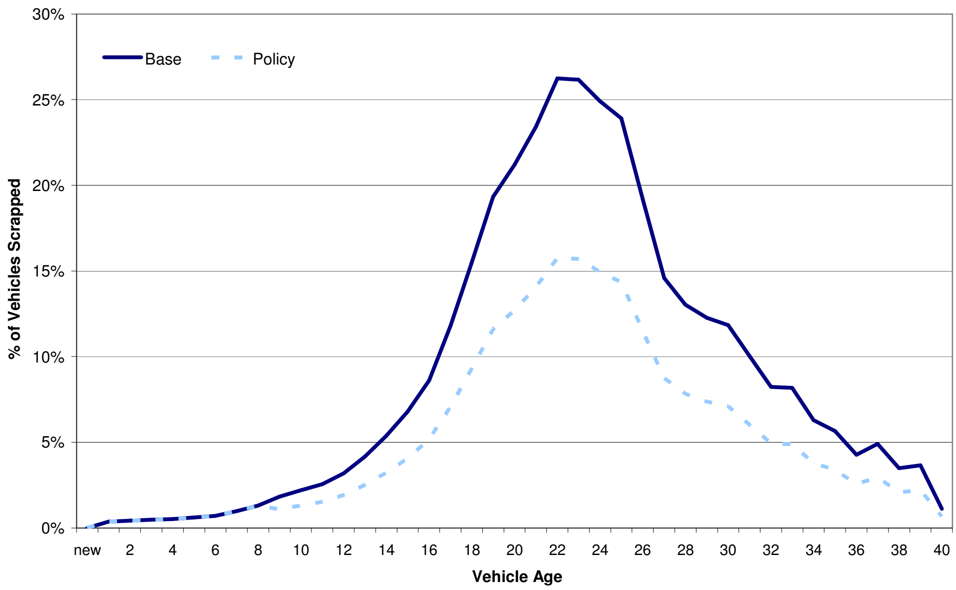


Figure 15 shows that the policy scrappage distribution matches the base scrappage distribution up to nine years of age, beyond which it changes. This reflects our assumption (based on analysis of historic scrappage rates) that scrappage decisions become more discretionary from nine years onward.

3.4.4. VKT per Vehicle

As noted previously, the VKT per vehicle data used to calculate baseline emissions was sourced from the Ministry's MVR odometer-reading project. By default, the same values are used in the calculation of policy emissions. However, because the model allows users to set limits on the extent to which aggregate VKT may fall, these default VKT figures may sometimes be over-written.

For example, suppose the policy causes the fleet to shrink by 10%, but we stipulate that aggregate VKT falls by no more than 5% relative to the baseline. The model will detect that aggregate VKT will fall below the 5% limit (because the fleet has shrunk so much) and so scales-up VKT per vehicle to satisfy the 5% constraint.

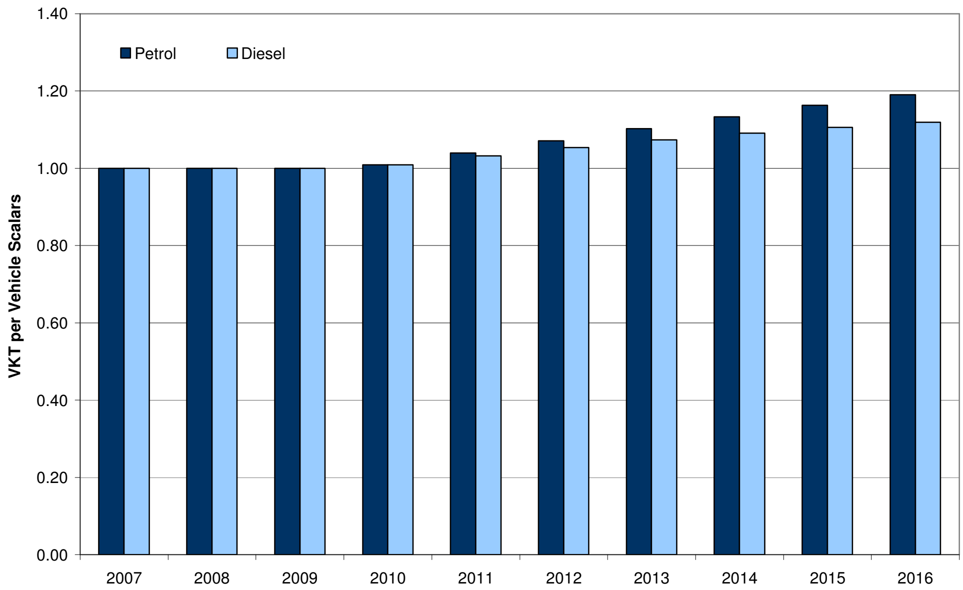
The reason for designing the model this way is to capture the possibility that each vehicle gets used more as the fleet shrinks (relative to the baseline). For example, suppose a family would own two cars and travel 20,000 kilometres without the policy, but only own one car and travel 15,000 kilometres with the policy. In this example, the family's aggregate VKT has fallen 25%, but their VKT per vehicle has increased by 50%. This is the kind of consumer response that the model is designed to handle.[11]

[11] To put it slightly differently, if we assumed that VKT per vehicle remained constant as the fleet shrank in response to the policy, we would be implicitly assuming that consumers could not react to changes by simply using their vehicles more. We consider that an implausible assumption.

So, to what extent does VKT per vehicle change in the model? Figure 16 plots the VKT scalars used in the most aggressive policy scenario (a 5-year rolling age ban - scenario 1).

Figure 16 shows that, in the early years of the policy, fleet shrinkage is small enough to not warrant any VKT scalars. However, over time, as policy-induced fleet attrition become more noticeable, VKT per vehicle gradually increases. By 2017, each petrol vehicle is travelling 19% more than business-as-usual and each diesel vehicle is travelling 12% more. These contrast with 16% and 13% reductions in total fleet size, respectively. The overall effect is that aggregate VKT falls by only as much as 5% (*i.e.* the user defined limit) in any given year relative to the baseline.

Figure 16: VKT Scalars for 5 year Rolling Age Ban



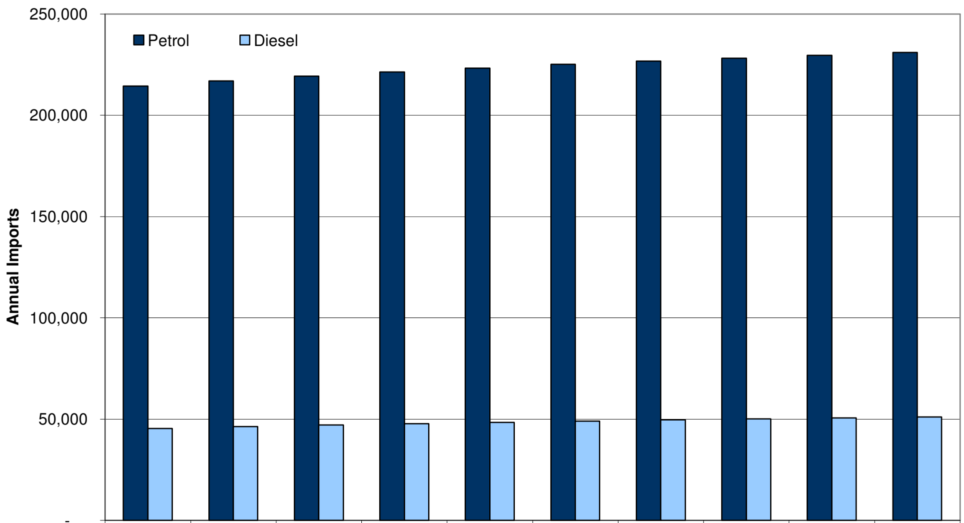
4. Baseline Projections

In this section, we present the baseline projections underlying our calculation of policy impacts. Please note that these are not official Government forecasts, and are merely extrapolations of recent historic data. These projections have also been derived in the absence of any other Government policies that might influence the fleet.

4.1. Import Volumes

Figure 17 presents baseline import projections for petrol and diesel vehicles over the period 2007 to 2016. These are based on the high import scenario described in section 3.3.2. The high scenario is more representative of long-term trends, while the low and mid scenarios are more heavily influenced by last year's downturn. We consider the latter scenarios too pessimistic over the longer term.

Figure 17: Baseline Import Volumes 2007 - 2016



	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Petrol	214,404	216,991	219,304	221,397	223,308	225,065	226,692	228,207	229,625	230,956
Diesel	45,341	46,233	47,031	47,753	48,412	49,018	49,580	50,102	50,591	51,050

Under the assumed base case, petrol imports are forecast to increase from 214,000 in 2007 to 231,000 by 2016 – an average annual increase of 0.8%, while diesel imports are forecast to increase from 45,000 to 51,000 – an average annual increase of 1.3%.[12]

4.2. Fleet Size

Figure 18 depicts our assumed baseline fleet sizes for petrol and diesel vehicles. These are derived from the following mathematical equation:

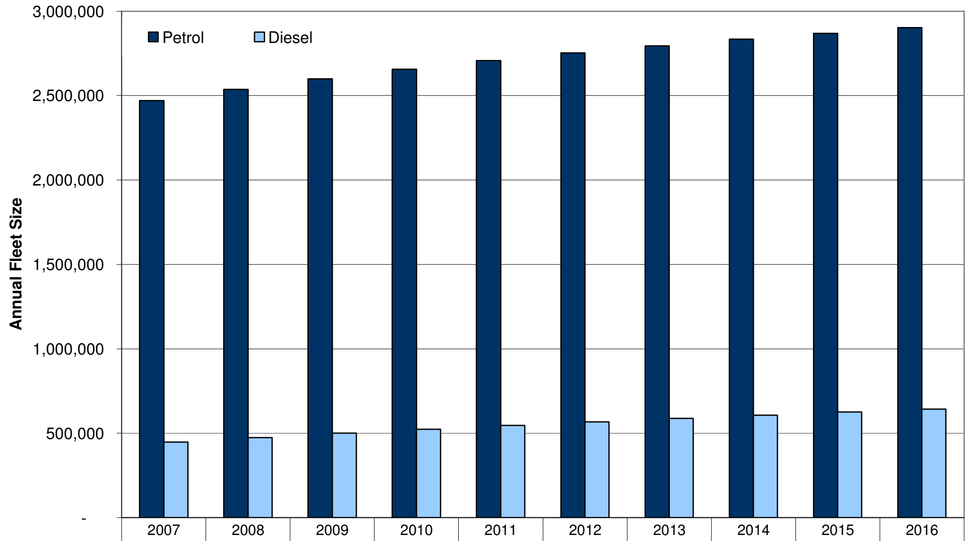
[12] We acknowledge that supply-side constraints may hinder future import volumes, but did not have sufficient information to model them here. For example, Russian demand for used Japanese vehicles has grown phenomenally over the last few years, making it more difficult for New Zealand firms to source stock.

$$Fleet_t = Fleet_{t-1} + Imports_{t-1} - Scrappage_{t-1}$$

This equation states that the fleet in any given year is equal to last year's fleet plus imports less scrappage. The fleet as at the start of 2007 was fed into this equation, along with the import projections above and our estimates of scrappage (as calculated by the mortality function in section 3.3.3.) to derive baseline fleet projections.

The forecasts show the number of petrol vehicles climbing from 2.47 million in 2007 to 2.90 million in 2016 – an average annual increase of 1.8%. They also show the number of diesel vehicles increasing from 449,000 in 2007 to 644,000 in 2017 – an average annual increase of 4.1%. This growth is fairly consistent with long-run trends in vehicles per capita.[13]

Figure 18: Baseline Fleet Sizes 2007 -2016



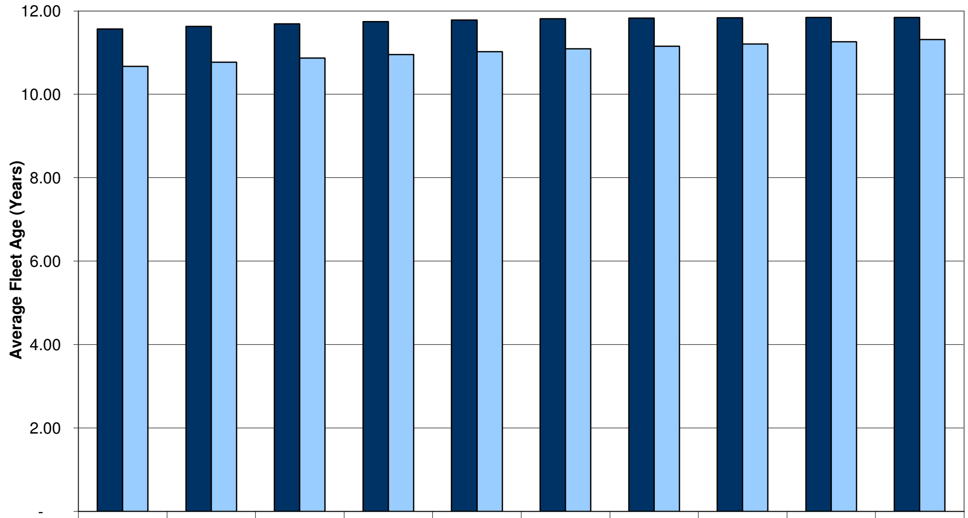
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Petrol	2,470,184	2,536,921	2,598,644	2,655,314	2,706,687	2,753,260	2,795,479	2,833,671	2,868,884	2,902,953
Diesel	448,973	475,391	500,463	524,164	546,558	567,729	587,784	606,909	625,418	643,544

4.3. Average Fleet Ages

The fleet turn-over equation described in the preceding subsection was also disaggregated by fuel type and year of manufacture. This allowed the rates of import and scrappage to vary by age and, therefore, the age of the fleet to change over time. Starting from fleet as at 1 January 2007, and applying last year's import and scrappage age distributions, we derived the following projections of fleet age.

[13] The low and mid import scenarios caused vehicle saturation to decrease over the medium term. This is inconsistent with historic trends and was a contributing factor in selecting the high import scenario.

Figure 19: Baseline Average Fleet Ages



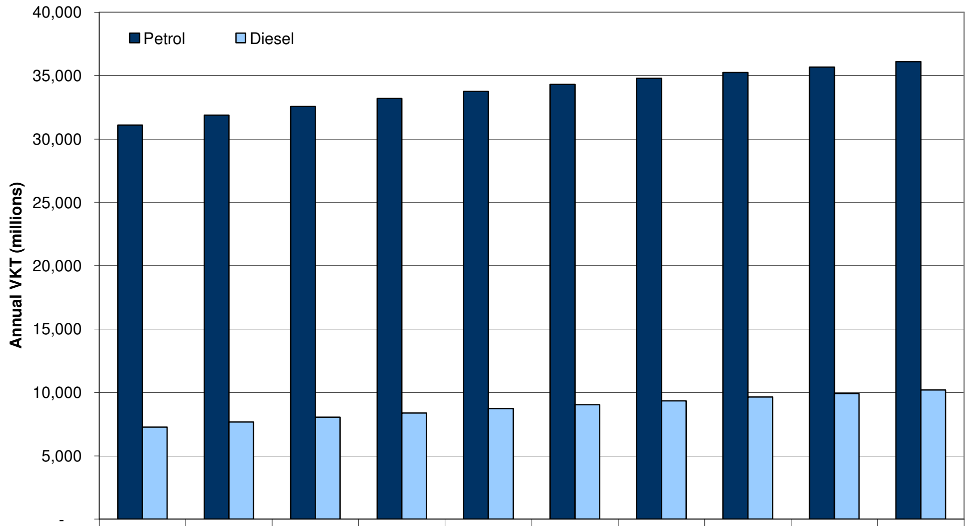
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Petrol	11.57	11.63	11.69	11.74	11.78	11.81	11.83	11.84	11.84	11.85
Diesel	10.67	10.77	10.87	10.95	11.03	11.09	11.15	11.21	11.26	11.32

The fleet age projections generated by the model show the petrol fleet tipping nearly 12 years by 2017, and the diesel fleet nearing 11.5 years.

4.4. VKT

Figure 20 presents our baseline estimates of VKTs. These are based on the fleet projections in section 4.2 and the VKT data in section 3.3.4.

Figure 20: Baseline VKT 2007 - 2016



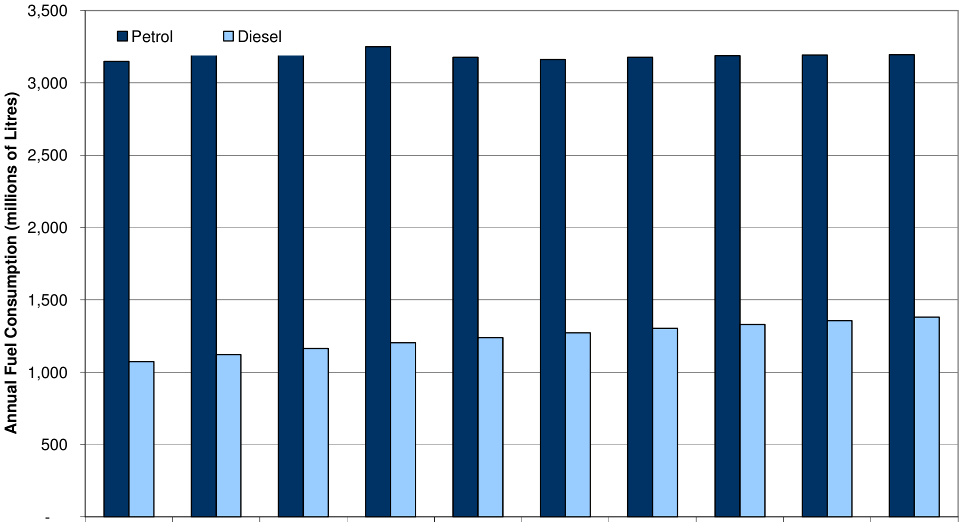
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Petrol	31,089	31,867	32,549	33,176	33,754	34,289	34,780	35,231	35,664	36,087
Diesel	7,263	7,661	8,031	8,381	8,711	9,029	9,335	9,630	9,916	10,192

According to Figure 20, petrol VKTs are forecast to increase from 31.1 billion in 2007 to 36.1 billion in 2016 – an average annual increase of 1.7%, while diesel VKTs are forecast to increase from 7.3 billion to 10.2 billion – an average annual increase of 3.8%.

4.5. Fuel

Finally, Figure 21 shows that, over the period 2007 to 2016, petrol consumption is forecast to increase 0.2% per annum, while diesel consumption is forecast to increase 2.9% per annum. These projections are based on the VKT projections above and the fuel economy projections from section 3.3.5.

Figure 21: Baseline Fuel Consumption Forecasts



	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Petrol	3,147	3,202	3,242	3,250	3,176	3,162	3,177	3,186	3,192	3,194
Diesel	1,072	1,121	1,164	1,204	1,239	1,272	1,303	1,331	1,357	1,381

5. Modelling Scenarios

As always, the effects of the policy depend on a number of factors, such as the response of consumers, and the final design of the policy itself. In this report, we model five scenarios in which these two key parameters vary.

In each scenario, we allow the rate of scrappage to fall to partially offset fleet shrinkage. In particular, we assume that the rate of scrappage falls 40% relative to the baseline. In addition, we restrict VKT reductions caused by shrinkage of the fleet. Specifically, we assume that annual VKT falls by no more than 5% in any given year (relative to the baseline). This is achieved by increasing the rate of VKT per vehicle, as required.

5.1. 5 Year Rolling Ban

In the first scenario, we model a 5-year rolling age ban on used imports. We assume that people displaced from buying their preferred (now-banned) import do not upgrade to a better import, and instead either (i) purchase a vehicle from the domestic fleet, or (ii) retain their existing vehicle. These assumptions alter both the rate - and composition - of imports. In particular, they cause used petrol import volumes to fall 75% and used diesel import volumes to fall 85% over the next 10 years. Overall, the fleet is 15% smaller than the baseline by 2016.

5.2. 5 Year Rolling Ban with Partial Volume Recovery

Scenario two mirrors scenario one, except this time we assume some displaced consumers *do* upgrade to a better import. Specifically, we assume that the rate of import of the oldest allowable vehicles doubles. This is tantamount to assuming that 9% of affected petrol buyers, and 3% of affected diesel buyers, upgrade to better imports.[14]

Overall, import volumes fall by 69% for used petrol vehicles and 82% for used diesel vehicles over the next 10 years, and the fleet is around 13% smaller than the baseline by 2016.

5.3. Staggered Restrictions

Scenario three models the latest rules actually proposed by the Ministry of Transport in *Land Transport Rule: Vehicle Exhaust Emissions [2007].*[15] Like scenario one, we assume that people displaced from buying their preferred import do not upgrade to a better vehicle, and instead either (i) purchase a vehicle from the domestic fleet, or (ii) retain their existing vehicle.

Overall, import volumes fall by 60% for used petrol vehicles and 80% for used diesel vehicles, and the fleet is around 11% smaller than the baseline by 2016.

[14] While increases in excess of these amounts may be feasible from a demand perspective, they are likely to be less feasible from a supply perspective.

[15] See section 2 for the details of these proposed rules.

5.4. Staggered Restrictions with Partial Volume Recovery

Scenario four is the same as scenario three, except this time we allow the rate of import to double on the oldest allowable vehicles. This is equal to assuming that around 15% of affected petrol buyers, and 4% of affected diesel buyers, upgrade to better imports.

Overall, import volumes fall by 50% for used petrol vehicles and 76% for used diesel vehicles, and the fleet is around 7% smaller than the baseline by 2016.

5.5. Delayed Restrictions with Partial Volume Recovery

The final scenario is the same as scenario four, except with a delay in the implementation of the petrol standards. There are no changes to the diesel standards. The following table shows the petrol standards modelled under this scenario.

Table 1: Changes to Petrol Standards

Year	Baseline	Scenario
2008	Japan 00/02	-
2009	Japan 00/02	-
2010	Japan 2005	Japan 00/02
2011	Japan 2005	Japan 00/02
2012	Japan 2005	Japan 2005
2013	Japan 2009	Japan 2005
2014	Japan 2009	Japan 2005
2015	Japan 2009	Japan 2009
2016	Japan 2009	Japan 2009
2017	Japan 2009	Japan 2009

Because delaying the introduction of these standards permits a higher rate of petrol imports than the preceding scenarios, we had to alter our assumptions about scrappage. Specifically, we assumed that the rate of petrol scrappage fell only 20% in this scenario (compared to 40% for all the previous scenarios) to prevent the fleet *growing* as a result of the policy. The rate of scrappage for diesel vehicles was unchanged.

6. Scenario Impacts

In this section, we present the estimated impacts of each scenario on fuel and emissions. These are measured relative to the fuel and emissions levels associated with the baseline (business-as-usual) projections presented in section 4.

6.1. 5 Year Rolling Ban

Figure 22 and Figure 23 present the emissions and fuel impacts of scenario one, respectively. The results for emissions are mixed. The models suggests a 5-year rolling age ban could cause a 6.9% increase in CO, a 1.1% increase in HC, and a 2.5% increase in NO. Offsetting these is a 3.0% fall in opacity and a 3.7% fall in CO_2 emissions.

Figure 22: Scenario 1 - Emissions Impacts (% Change over 10 years)

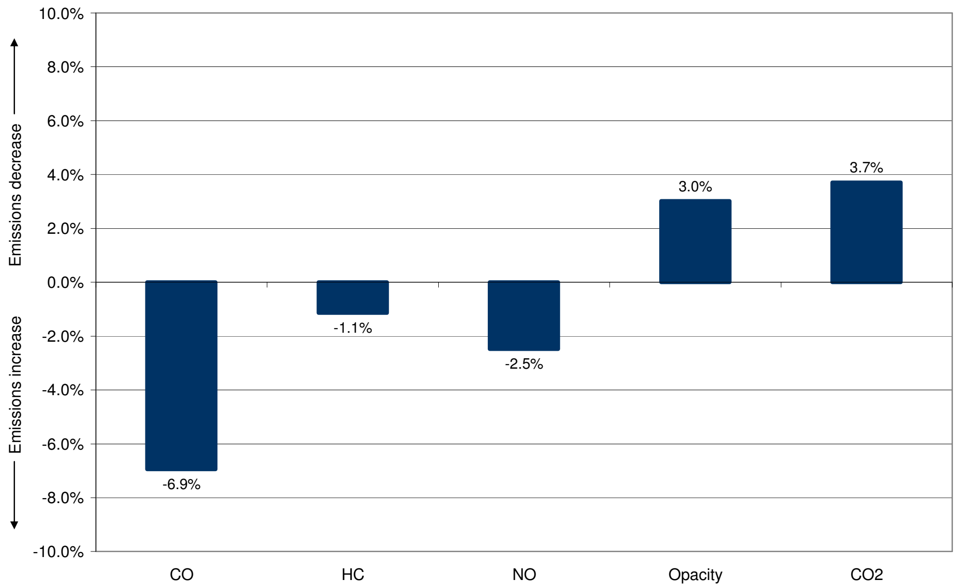
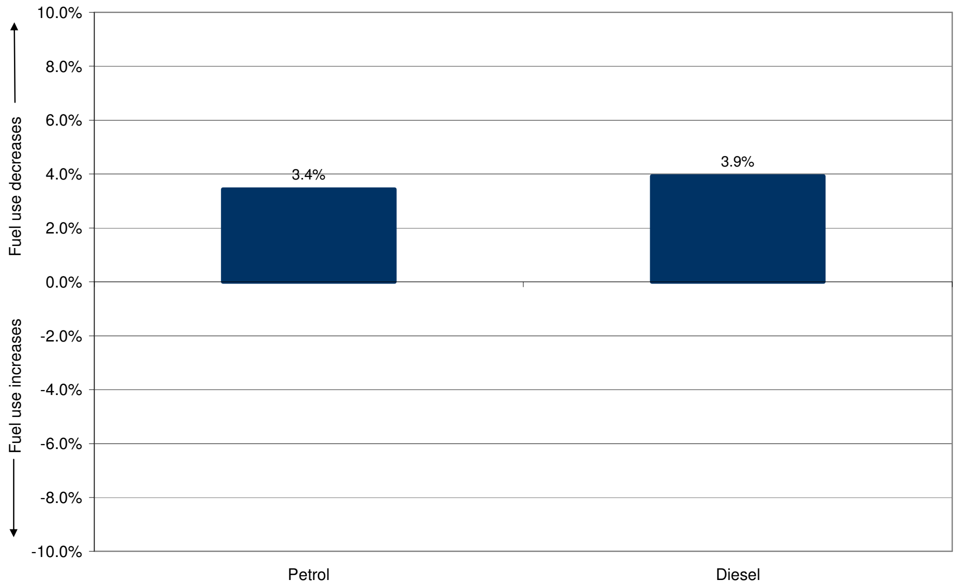


Figure 23: Scenario 1 – Fuel Impacts (% Change over 10 years)



A rolling 5-year age ban is expected to decrease petrol consumption by 3.4%, and diesel consumption by 3.9% (both over a 10 year period).

6.2. 5 Year Rolling Ban with Partial Volume Recovery

Figure 23 shows that, relative to the previous scenario, an increase in the import of the oldest allowable vehicles improves the emissions of CO, HC, NO, but has little effect on opacity and CO_2. The effects on fuel are also indiscernible.

Figure 24: Scenario 2 - Emissions Impacts (% Change over 10 years)

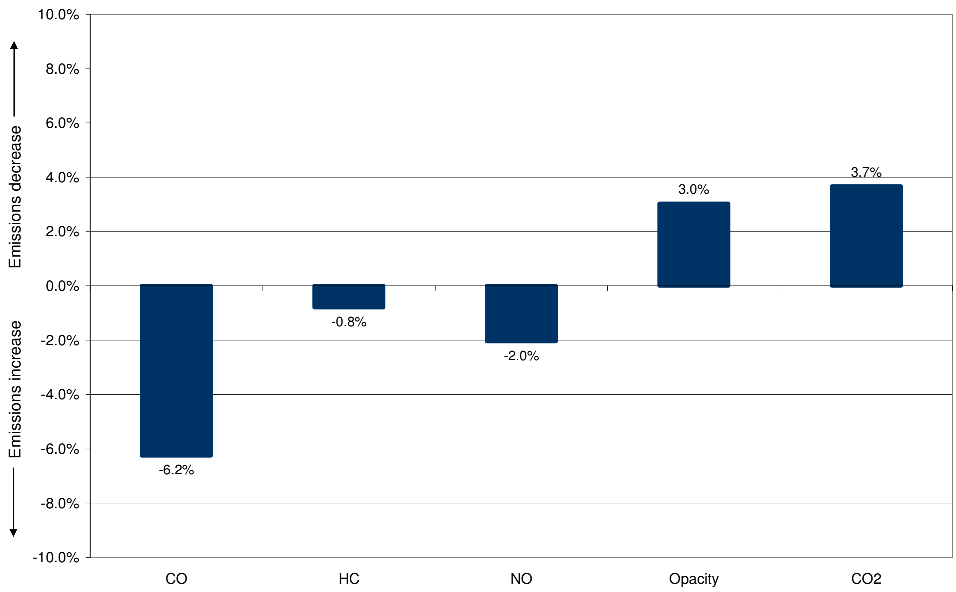
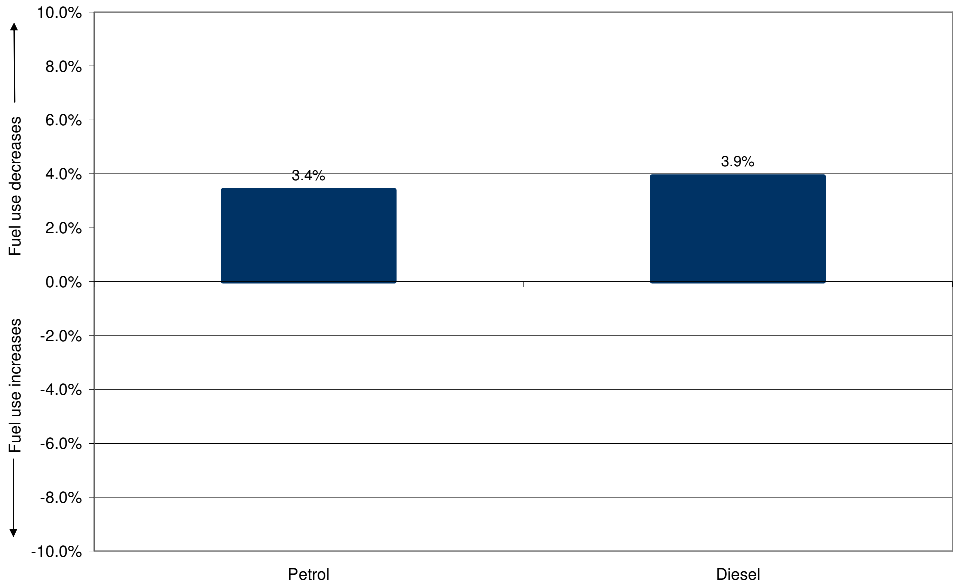


Figure 25: Scenario 2 - Fuel Impacts (% Change over 10 years)



6.3. Staggered Restrictions

Implementing the various standards published in the most recent land transport rules also has a mixed effect on emissions (at least under the assumptions modelled here). Specifically, CO increases by 6.7%, HC increases by 1.5% and NO increases by 2.6%. Opacity, on the other hand, decreases by 2.5% and CO_2 decreases by 3.1%.

Figure 26: Scenario 3 - Emissions Impacts (% Change over 10 years)

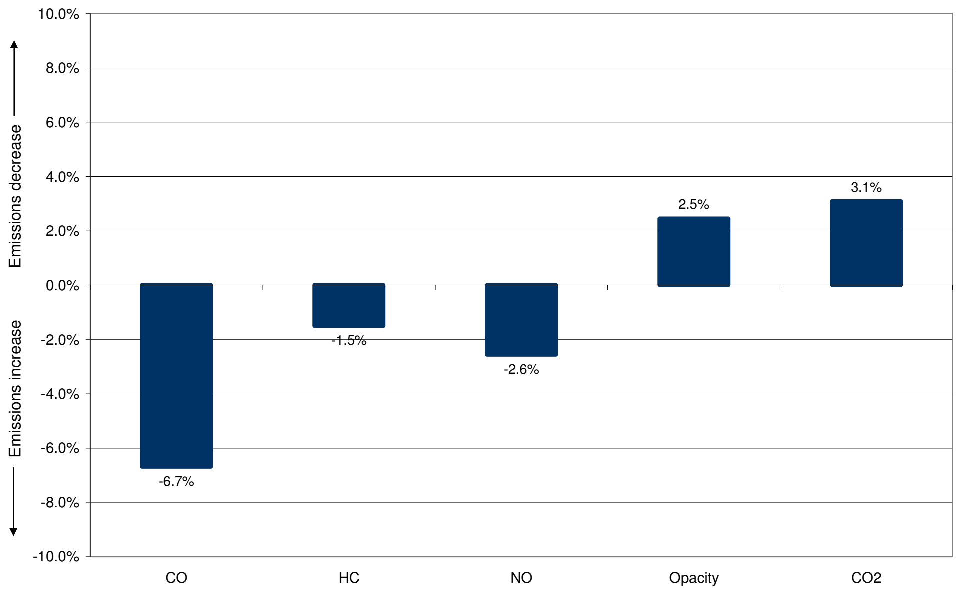
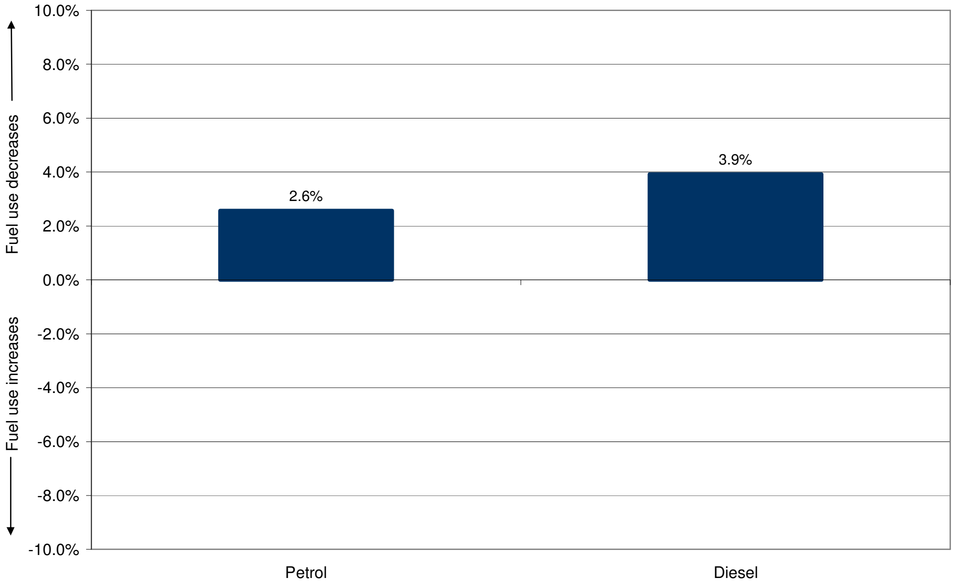


Figure 27: Scenario 3 - Fuel Impacts (% Change over 10 years)



The proposed rules also generate savings in fuel consumption, but less so than a 5-year rolling age ban (at least for petrol).

6.4. Staggered Restrictions with Partial Volume Recovery

Assuming an increase in the import of the oldest allowable vehicles has only marginal impacts on emissions and fuel consumption (relative to the previous scenario).

Figure 28: Scenario 4 - Emissions Impacts (% Change over 10 years)

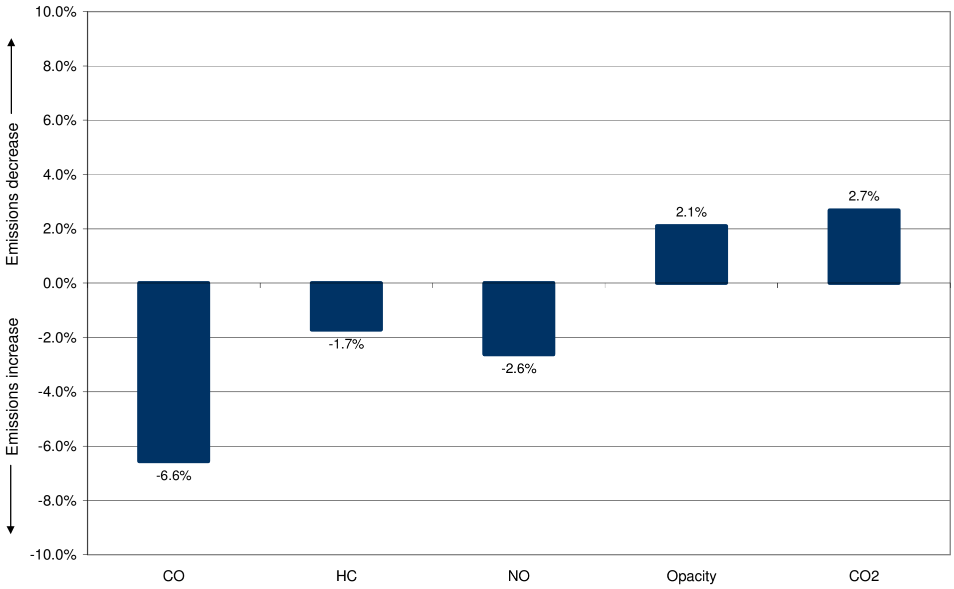
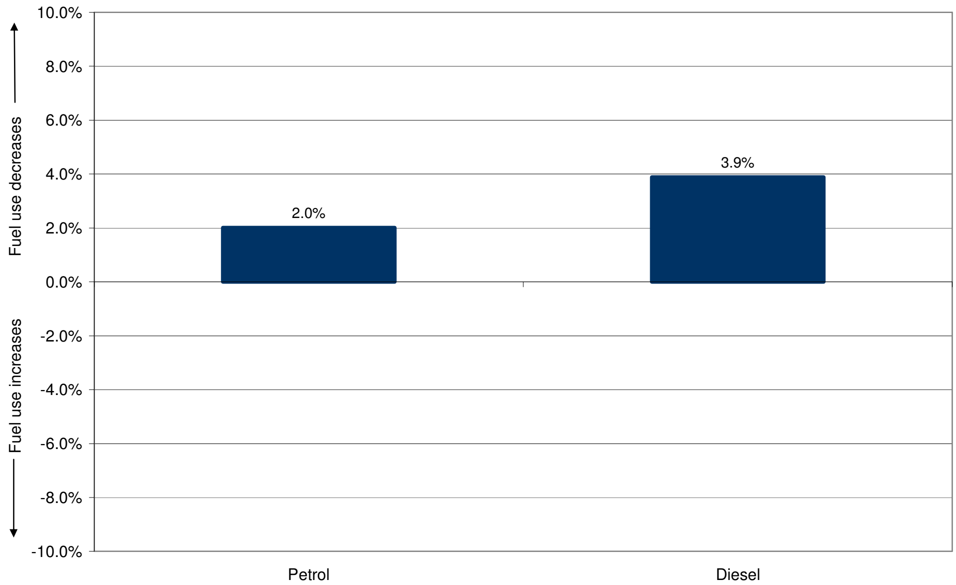


Figure 29: Scenario 4 - Fuel Impacts (% Change over 10 years)



6.5. Delayed Restrictions with Partial Volume Recovery

Figure 30 suggests that delaying the introduction of petrol standards has positive effects on CO, HC and NO emissions (relative to the previous scenario), but negative effects on opacity and CO_2. Delays also seem to erode petrol savings, but have no effect on diesel savings.

Figure 30: Scenario 5 - Emissions Impacts (% Change over 10 years)

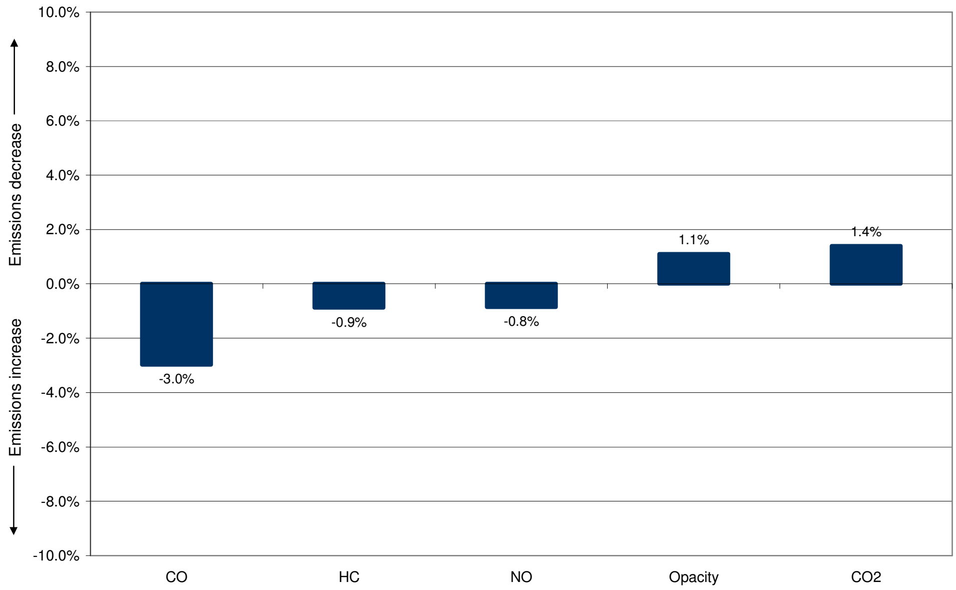
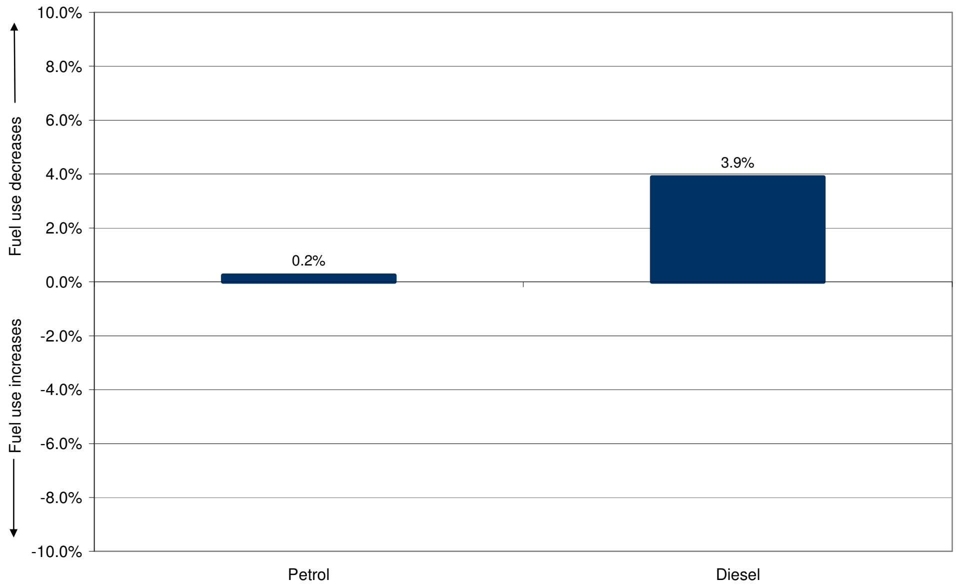


Figure 31: Scenario 5 - Fuel Impacts (% Change over 10 years)



6.6. Sensitivity Analysis

The fuel and emissions effects estimated above are based on a number of assumptions. Here we examine the sensitivity of those results to changes in these assumptions. In particular, we test the sensitivity of the fifth scenario – delayed restrictions – to changes in VKT and the rate of scrappage.

For each sensitivity test, we re-analyse scenario 5 (just as in the section 6.5) but either:

- assume that the rate of scrappage does not change as a result of the policy, or
- assume that aggregate VKT does not change as a result of the policy.

Each sensitivity test helps understand the extent to which the estimated effects in section 6.5 were driven by changes in fleet composition as opposed to shrinkage of the fleet and/or lower VKT.

6.6.1. No Change in Scrappage Rates

In scenario 5 (and in all our scenarios above), we assumed that consumers react to import restrictions by reducing the rate of scrappage. This helps offset the dampening effect that reduced import volumes have on fleet size. Now, we re-run that scenario but assume that the rate of scrappage does not change. The effects are presented in the following diagrams, where the dark blue bars are scenario 5 and the light blue bars are the sensitivity tests.

Figure 32: Emissions Impacts (% Change over 10 years)

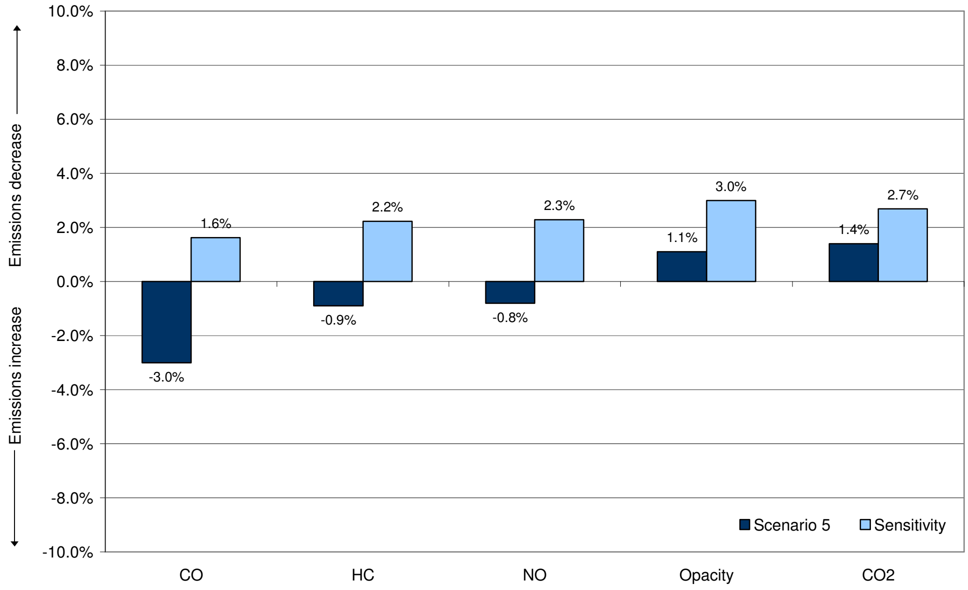
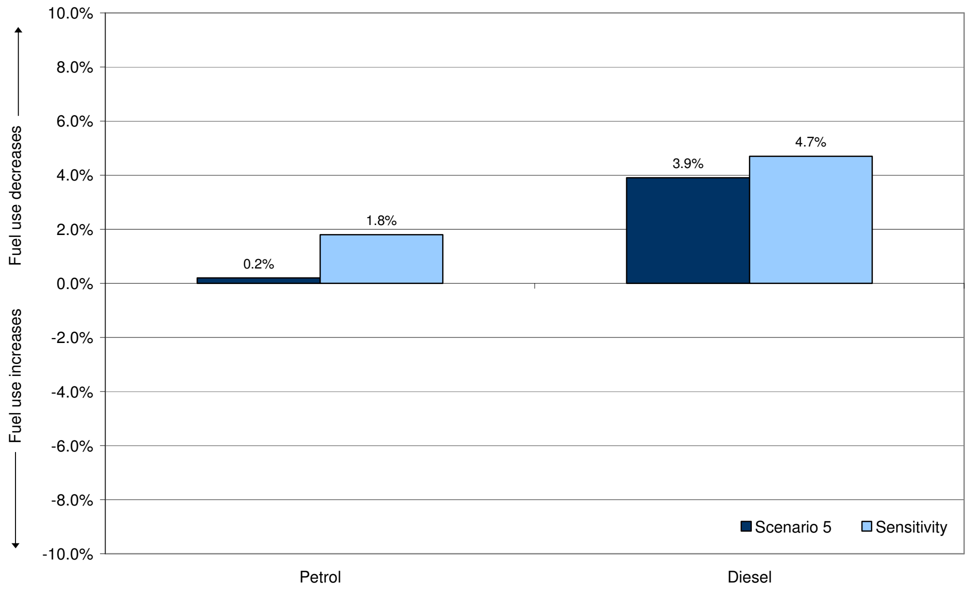


Figure 33: Fuel Impacts (% Change over 10 years)



The charts above imply that, if the rate of scrappage does not fall as a result of the policy, there will be large additional savings in petrol consumption (and thus CO, HC and NO emissions) compared to if the rate of scrappage *does* fall. There will also be modest additional savings in diesel, opacity and CO_2.

These results suggest that the Ministry should consider complementary scrappage programmes to maximise the effectiveness of import restrictions.

6.6.2. No Change in VKTs

In scenario 5, we assumed that total VKT fell by as much as - but no more than - 5%. Now, we re-run that scenario but assume VKTs do not change in response to the policy. This is the same as assuming that VKT per vehicle increases or decreases by exactly enough to offset any changes in fleet size.

Figure 34: Emissions Impacts (% Change over 10 years)

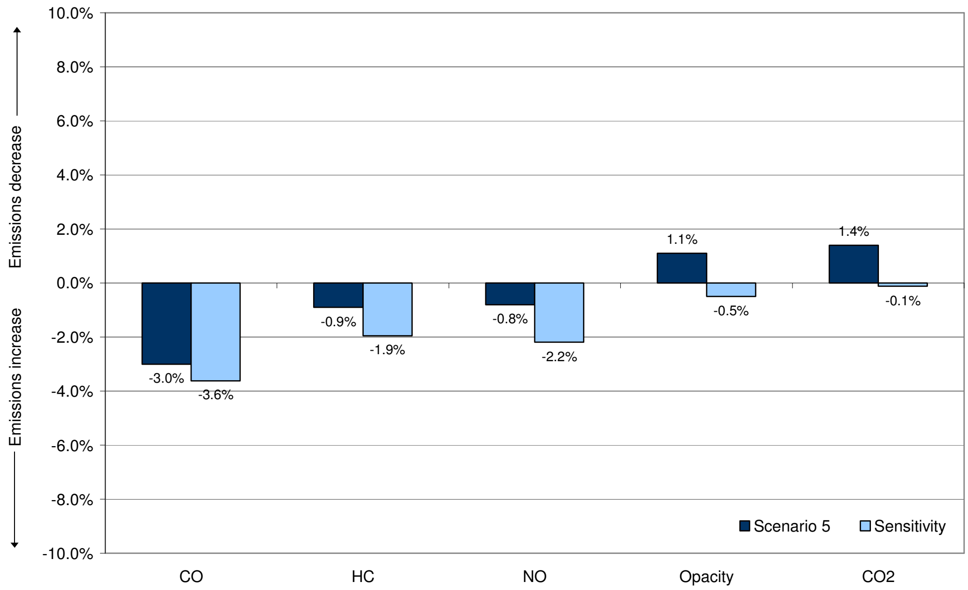
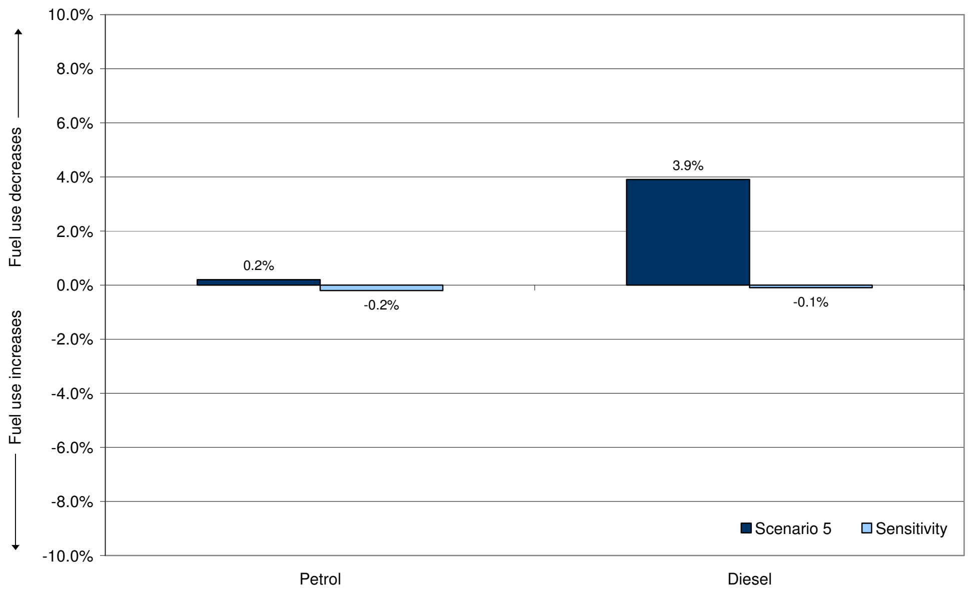


Figure 35: Fuel Impacts (% Change over 10 years)



The results of this sensitivity test show that changes in VKT (caused by shrinkage of the fleet) were a key driver of the diesel and opacity effects estimated in scenario 5. This is shown by the fact that, having now held VKT constant, the estimated savings in fuel, opacity and CO_2 have diminished.[16] The modelled increases in CO, HC and NO emissions have also worsened. These imply that changes in VKT are as important – if not more important – than changes in fleet composition for curbing emissions. This, in turn, suggests that travel demand management should be a key component of any proposed initiative.

6.7. Pollutant-by-Pollutant Scenario comparison

An interesting observation from the charts above is the variability of effects. In order to help the Ministry focus its policies on the most important pollutants, the following table shows scenarios that produced the best and worst outcomes for each.

Table 1: Best and Worst Scenarios by Pollutant

Pollutant	Best Scenario	Worst Scenario
CO	5	1
HC	2	4
NO	5	3 & 4
Opacity	1 & 2	5
CO2	1 & 2	5

Since PM is generally considered the worst culprit for emissions-related health effects, and because CO_2 savings contribute to Government's Kyoto commitments, it seems that a 5-year rolling age ban (as in scenarios 1 and 2) is most likely to help achieve the Government's objectives.

6.8. Summary

The analysis presented in this section has considered several policy scenarios, including a 5-year age ban and the implementation of staggered restrictions. It has also tested the sensitivity of results to changes in scrappage and VKT assumptions. The main lessons seem to be that:

- the effects of the policy are ambiguous – they depend quite strongly on policy design and on consumer reactions.

- A 5-year rolling age ban provides the best outcomes for opacity and CO_2 - the two pollutants presumably of most interest to the Ministry.

- The emissions effects of the policy operate not only through changes in fleet composition, but also through changes in VKT. In fact, our modelling suggests that changes in VKT are as important – if not more important – than changes in fleet composition for curbing emissions. This, in turn, suggests that travel demand management should be considered as a means of intervention.

[16] It is important not to place too much emphasis on these results. They are, of course, only simulation outputs. Any insights drawn from this analysis should be in general – rather than specific – terms.

- Our modelling also suggests that if the rate of scrappage falls as a result of the policy, policy benefits will be greatly diminished. Thus, complementary scrappage programmes should also be considered.

- Finally, our analysis implies that delaying the introduction of petrol standards decreases the emission of CO, HC and NO, but increases the emissions of opacity and CO_2 (relative to scenario 4 - no delay).

7. Industry Impacts

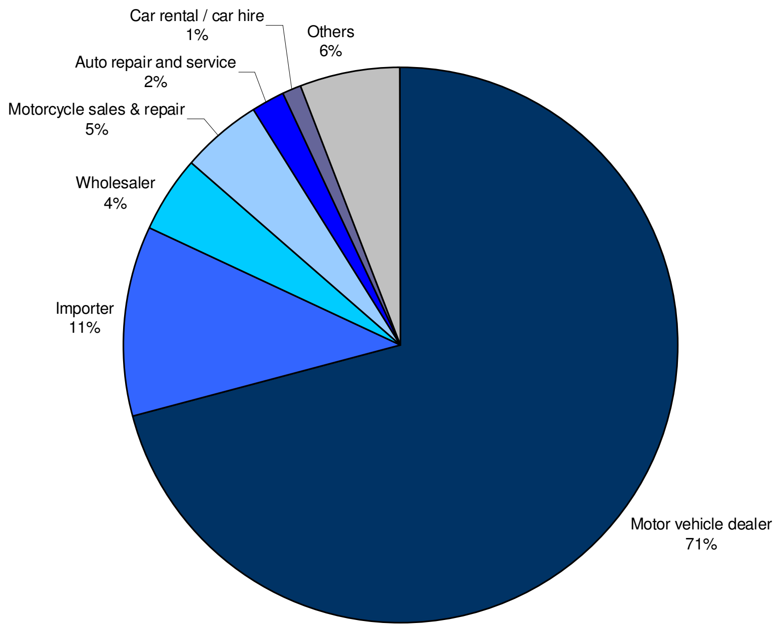
In this section, we examine potential impacts of the policy on GDP and employment.

The analysis is based on the premise that each imported vehicle – whether new or used – is eventually sold at the retail level. Thus, the value of imports in any given year is roughly equal to the value of retail sales (ignoring changes in inventory). [17]

Before calculating the size of these impacts, however, we first describe the current state of the retail arm of the industry to understand what is at stake.

7.1. Current Industry Structure

The Motor Vehicle Traders Register (MVTR) was established by the Motor Vehicle Sales Act 2003 (MVSA). It lists all the registered motor vehicle traders in New Zealand. In most cases, membership is compulsory. As at 30 June 2005, the composition of registered traders was as follows:



7.1.1. Dealers

In 2006, there were over 2000 motor car retailers in New Zealand, with a further 464 dealers selling motor cycles, trailers and caravans. The geographic spread of car retailers is tabulated below.

[17] Please note that the material presented in this section does not represent a definitive industry impact assessment. Rather, it is a ball-park evaluation. A proper industry impact assessment requires highly detailed information on a number of factors. It also requires a customized general equilibrium model with a specialized vehicle importing/wholesaling/retailing module. As far as we are aware, no such model currently exists in New Zealand.

Table 3: Size and Location of Car Yards

Region	Number of Yards	Regional Population	Yards per 100,000
Northland	57	148,470	38
Auckland	664	1,303,068	51
Waikato	176	382,713	46
Bay of Plenty	150	257,379	58
Gisborne	16	44,499	36
Hawke's Bay	83	147,783	56
Taranaki	55	104,124	53
Manawatu-Wanganui	128	222,423	58
Wellington	168	448,959	37
West Coast	8	31,326	26
Canterbury	333	521,832	64
Otago	85	193,800	44
Southland	46	90,876	51
Tasman	18	44,625	40
Nelson	36	42,891	84
Marlborough	23	42,558	54
Total	2,046	4,027,326	51

Sources: Business Directory 2006, Census 2006, Covec

Table 3 shows that roughly one-third of car yards are situated in Auckland. It also shows that there is significant variation in the number of yards per capita. For example, on the West Coast, there are only 26 yards per 100,000 people, while in Nelson there are 84. The national average is 51 yards per 100,000 people.

7.1.2. Employment

In 2006, car retailers employed over 12,000 people, with an average of six per yard.

Table 4: Size and Location of Car Yards

Region	Number of Employees	Number of Yards	Staff per Yard
Northland	380	57	6.7
Auckland	3,600	664	5.4
Waikato	1,310	176	7.4
Bay of Plenty	820	150	5.5
Gisborne	120	16	7.5
Hawke's Bay	480	83	5.8
Taranaki	330	55	6.0
Manawatu-Wanganui	770	128	6.0
Wellington	1,290	168	7.7
West Coast	55	8	6.9
Canterbury	1,660	333	5.0
Otago	530	85	6.2
Southland	310	46	6.7
Tasman	20	18	1.1
Nelson	210	36	5.8
Marlborough	130	23	5.7
Total	12,015	2,046	5.9

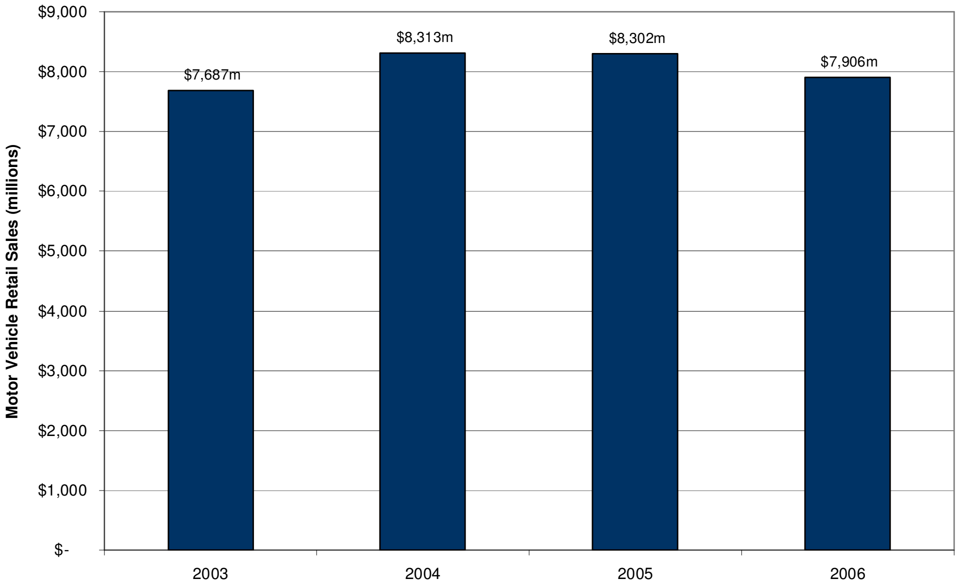
Sources: Business Directory 2006, Covec

Table 3 shows that the average size of car yards (*i.e.* the number of employees) varies significantly by region. For example, Wellington car yards employee almost eight people on average, while in Tasman each yard employs an average of only one person.

7.1.3. Retail Sales

In 2006, motor vehicle retail sales were just under $8 billion – a 5% drop from 2005. This works out to around $3.9 million sales per yard and $660,000 per employee.[18]

Figure 36: Motor Vehicle Retail Sales 2003 to 2006



7.1.4. Contribution to GDP

The retail sales presented in the previous subsection are now converted to GDP using GDP multipliers. These multipliers show the amount of GDP created for every $1 of retail sales. The standard multiplier for retailing (of which motor vehicle retailing forms part), is 1.17. Thus, every $1 of vehicle sales generates around $1.17 of GDP.[19]

Of course, not all this GDP is generated within the industry itself. Some is generated via trickle-down effects, wherein motor vehicle retailers stimulate other sectors of the economy by purchasing their outputs as inputs to their own businesses. The wages that motor vehicle retailers pay to their staff also generates induced demands for products and services, which further stimulates the economy. We call these the indirect and induced effects, respectively. According to our calculations, only around 42% of vehicle retailing GDP is generated directly, with the remainder generated via indirect and induced effects.

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[18] It should be noted that for every sale made by dealers, there are a further two private sales. Thus, the size of the 'industry' is much larger than these statistics suggest.

[19] We acknowledge that the multiplier for vehicle sales may differ from the retail average, but specific values are not available. We therefore default to the retail average.

Applying our GDP multiplier to the sales in Figure 36, we derived the following series for industry GDP (including the indirect and induced effects).

Figure 37: Motor Vehicle Retailing -Total Contribution to GDP

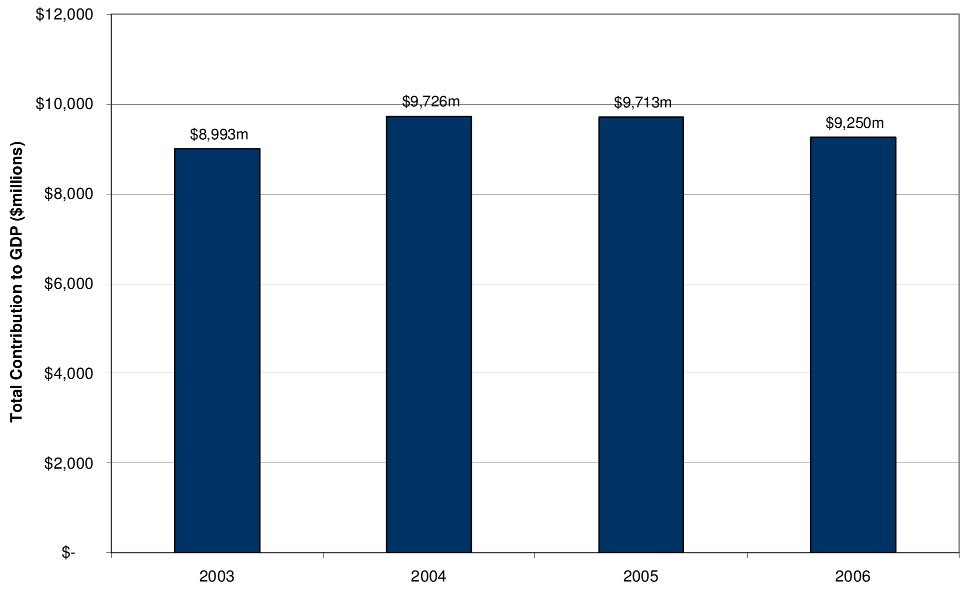

Figure 5 shows that the motor vehicle retailing industry contributes over $9 billion to national GDP. This is around 6% of the national total. Clearly, the vehicle retailing industry is a significant component of the New Zealand economy.

7.2. Potential Impacts on GDP

Having characterised the current state of the industry, we now consider the potential size of any industry downturn. This is done in several steps: first, we isolate the value of used car sales from total sales. Then, we calculate changes in the retail value of used vehicle sales based on policy-induced changes in volume (and composition). Finally, we convert changes in retail sales to changes in GDP using our GDP multiplier.

7.2.1. Isolating Used Car Sales

The first step is to isolate the value of used vehicle retail sales. While one might be tempted to do this pro-rata on the basis of sales volumes, this would overstate the true value of used vehicle sales because used cars sell for less than new cars, on average. Thus, information on vehicle prices is also required.

To this end, we derived a age-price distribution from the Turners auction data introduced in our last report. This showed how the *relative* price of vehicles differed by age.[20] The age-price distribution is plotted in the following chart.

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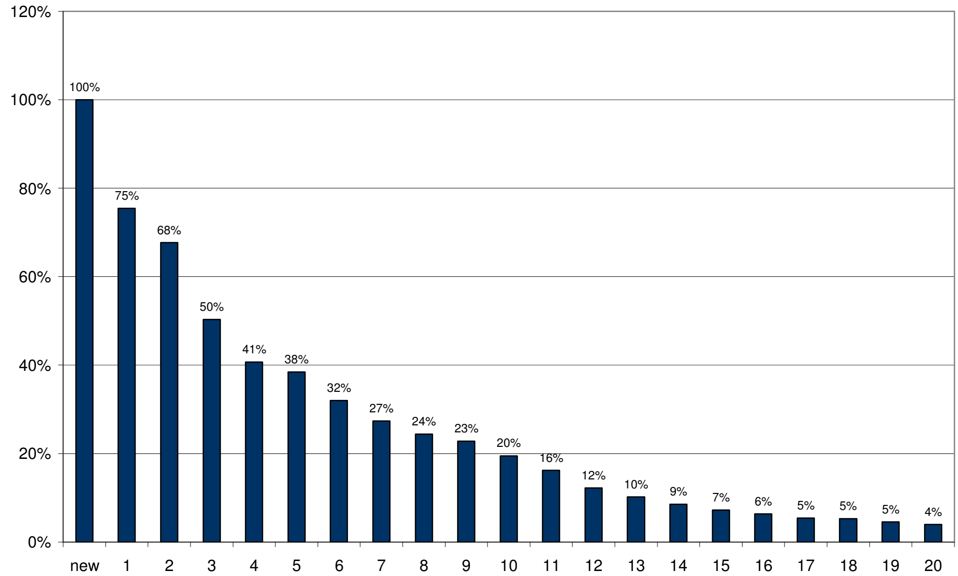
[20] As noted in our previous report, the prices gleaned from this data are more akin to wholesale prices than retail prices, but that does not matter. What matters is the relative price of vehicles by age, not absolute prices.

Figure 38: Relative Price of Vehicles by Age



The age-price distribution assigns a value of 100% to new vehicle prices, and expresses prices for all other vehicles in relation to this. Thus, on average, one year old cars sell for 25% less than new cars, and three year old cars sell for half the price of new cars. Put slightly differently, light vehicles lose half their value in the first three years, on average.

Having derived this price distribution, we then applied it to the composition of imports (read: sales) in 2006 to estimate the proportion that came from used vehicles versus new vehicles. According to our calculations, new vehicles accounted for $5.75 billion (73%) of retail sales in 2006, while used vehicles accounted for the remaining $2.16 billion (27%). This contrasts with volume shares of 41% for new vehicles and 59% for used.

7.2.2. Policy-Induced Changes in Retail Sales

Next, we infer changes in the value of used vehicle sales caused by the policy. Naturally, these depend on the policy in question. For the purposes of this exercise, we work with the fourth policy scenario (*i.e.* the rules set out in the most recent consultation document). The changes in used sales volumes associated with this scenario are set out below.

Figure 39: Effects on Used Car Sales Volumes

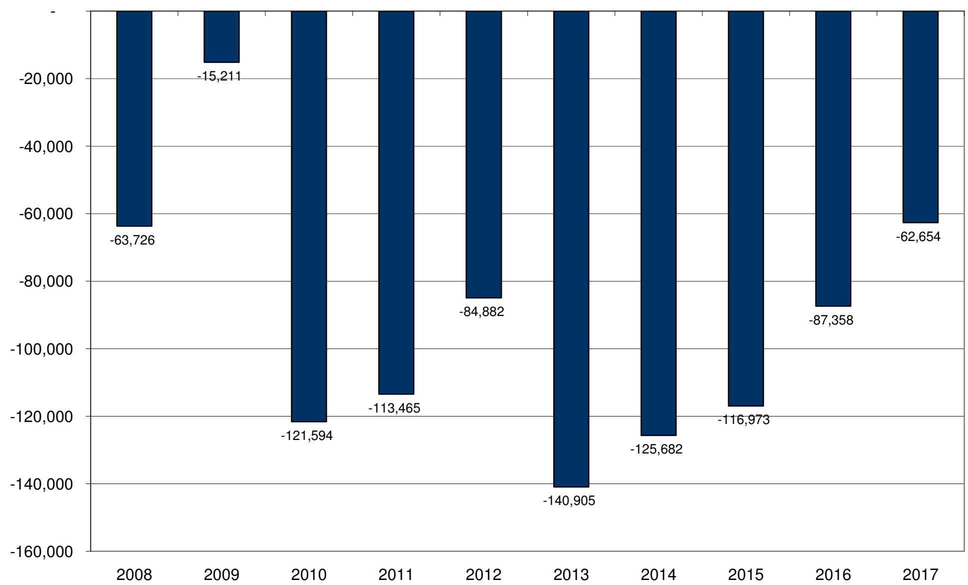
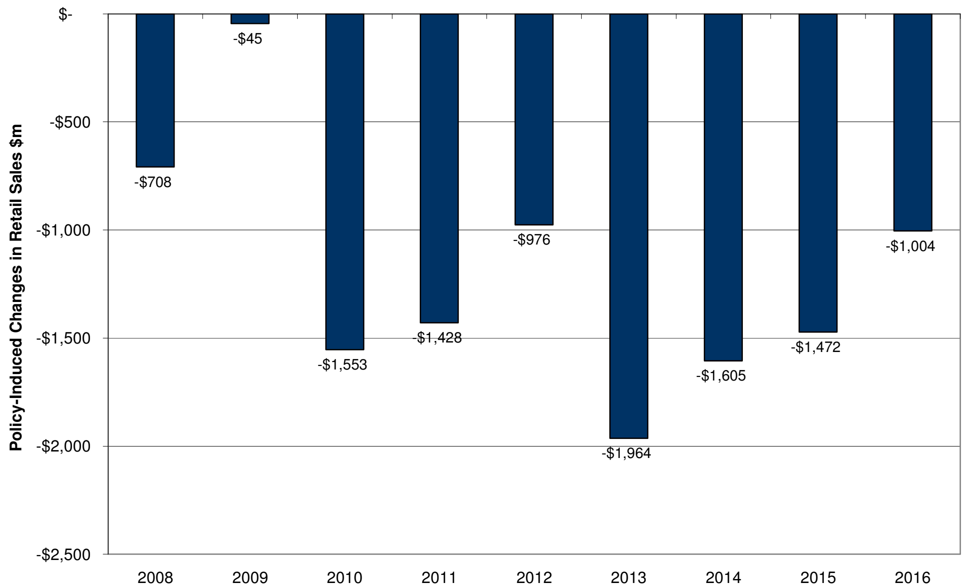


Figure 39 shows that the proposed policy will have massive effects on used vehicle imports (read: sales). For instance, sales are expected to fall by nearly 141,000 vehicles in 2013 alone.

Applying our age-price distribution to estimated changes in the volume and composition of used imports, we derived the following impacts on retail sales.

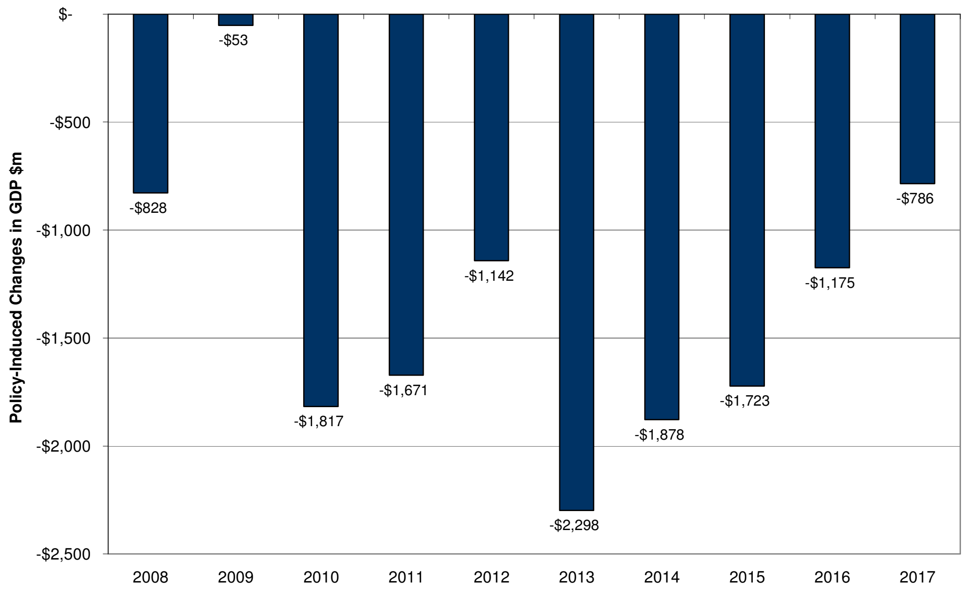
Figure 40: Impact on Used Vehicle Retail Sales



According to Figure 40, the proposed policy will also have huge impacts on the value of retail sales. For instance, retail sales in 2013 are forecast to fall almost $2 billion.

Finally, we applied our GDP multiplier to the change in retail sales (Figure 40) to gauge potential GDP impacts. These are set out below.

Figure 41: Estimated Losses in GDP from Used Vehicle Sales



According to Figure 41, the policy could reduce GDP from used vehicle sales by between $53m in 2009 to $2.3 billion in 2013. These equate to reductions of 2% and 75% in *industry* GDP (respectively) and 0.03% and 1.47% of *national* GDP (respectively). Of course, money that is no longer spent on used imported vehicles may now be spent elsewhere in the economy, and so the overall effect on national GDP (and consumer welfare) is unclear.

7.3. Impact on Industry Concentration

A significant reduction in import volumes, and therefore GDP, will cause the number of importers and dealers to fall. Importers and dealers that specialise in older vehicles (excluding classics) will be most at risk, as will smaller firms (due to lower scale economies) and firms that operate less efficiently.

The most resilient firms are likely to be larger ones, where scale economies are more pronounced and where supply chains are more diverse. Firms that specialise in newer vehicles will also be at lower risk, and may even prosper if the composition of imports shifts in their favour.

Overall, we expect volumes to fall in net terms, and for larger firms to account for increasing shares of industry output. To use the terminology of economics, this means we expect the industry to become more concentrated. This is not a problem *per se,* provided these larger firms do not use their market power to prevent new firms entering the market and competing for market share.

7.4. Industry Reactions

Naturally, the impacts on industry participants depend on the degree of adaptation. This is most likely to manifest as changes in the composition of used imports; in order to minimise losses, importers will seek cheaper imports that meet the standards. These are likely to be smaller, lower quality vehicles with fewer specifications and higher mileage. Whether these are better than the imports they replace - from an emissions perspective - is a matter for debate. So too is the ability of importers to source these vehicles.

Another means of adaptation might be for dealers to become more active in the sale and purchase of existing vehicles. According to a review of the Motor Vehicle Industry in 1998 by Statistics New Zealand, around 20% of all vehicle sales were *to* dealers. While many of these are likely to represent trade-ins, some will also represent dealers sourcing vehicles domestically. This trend may increase in the face of import restrictions. Dealers may more actively covet domestic vehicles for resale on their yards.

7.5. Flow-On Effects

The proposed emissions standards have the potential to cause dramatic changes not only in the vehicle importing and wholesaling/retailing industries, but also on related industries.

The industry most likely to be affected by the proposed rules is the automotive repair industry. As the rate of scrappage falls, there will be a direct increase in the need for repairs. Vehicles that would have been scrapped in the absence of the policy (and replaced with another) will now live longer and therefore need more repairs.

If the policy causes the fleet to shrink (relative to the baseline) there will be adverse effects on warrant of fitness inspection agencies (many of whom are also automotive repairers). The number of WOF inspections will fall in direct proportion to the size of the fleet. There will also be corresponding decreases in crown revenue from annual vehicle licence fees, and a smaller fleet will also mean lower revenues for vehicle insurers.

Finally, a reduction in import volumes will have direct effects on the entire vehicle import supply chain. This includes shipping companies, vehicle inspectors and the ports themselves.

8. Social Impacts

This section reproduces the social impact material from our phase two report. It looks at the extent to which the proposed import restrictions impose 'costs' on society.

8.1. Impacts facing At-Risk Consumers

The people most likely to be affected by the proposed policy are those that we have previously described as 'at-risk' consumers. These are people that can no longer purchase their preferred import as a result of the policy..

The social impacts borne by at-risk consumers depend on their responses, which range from:

- Upgrade to a better import (that meet the standards), or
- Purchase a vehicle from the domestic market, or
- Retain their existing vehicle (if they have one).

Following is a discussion of the social impacts associated with each response option.

8.1.1. Upgrade to a Better Import

Upgrading to a better import than originally intended means either:

- increasing expenditure to purchase a newer vehicle with similar features to the vehicle they hoped to purchase, and/or
- maintaining the intended level of expenditure and purchasing a vehicle of lower quality or with fewer features.

Both options erode 'consumer welfare': increasing expenditure to purchase a similar (but newer) vehicle reduces funds available to purchase other goods and services, while sacrificing features to contain expenditure means settling for second-best.

Unfortunately, it is difficult to say much further than this. The magnitude of welfare losses depends on individual budgets and preferences, both of which are unknown.

8.1.2. Purchase a vehicle from the domestic market

If consumers are able to purchase a similar vehicle from the domestic market (at a similar price), they will bear no direct impact.

However, to the extent that domestic vehicles substitute for imported ones, the demand for domestic vehicles increases. As demand increases, so too will prices, making domestic vehicle less affordable for other consumers (particularly those in lower socioeconomic groups). Such price pressures, however, are not likely to be significant.

8.1.3. Retain Existing Vehicle

The final option for at-risk consumers is to exit the vehicle market altogether. In most cases, this means holding on to an existing car for longer than planned. Alternatively, it means being without a car for longer than expected. Both scenarios involve social costs.

In both cases, there is a direct social cost from not being able to purchase the preferred vehicle. This is compounded in the latter scenario by the prolonged absence of personal transport, which may give rise to a number of serious social costs, such as social exclusion. See our earlier report for a detailed discussion on social exclusion.

8.2. Comparison with Previous Policy

This section compares the social impacts of this policy with those of the original (in-fleet) policy.

Impact Type	Previous Policy	This Policy
Increases in living costs	Potentially significant for owners of vehicles failing the test. Could be either an unexpected repair bill or the need to purchase another car.	Although car prices may increase slightly, people can opt retain their existing vehicle. Possibly minor impacts on first-time buyers.
Social Exclusion	Owners of failed vehicles unable to pay repair costs may be left without a vehicle. This may result in reduced social contact, particularly in areas with limited public transport. Overall this is most likely to affect rural drivers.	Since the policy will not cause any unexpected loss of vehicles, such effects are not contemplated. However, if first-time buyers can no longer afford a car (which seems unlikely), they may face some degree of prolonged exclusion.
Prevented from buying preferred vehicle	Not applicable	This will affect a fairly large number of people. However, it is likely that substitutes can be found at similar prices (possibly in the domestic fleet). Some will be deeply affected by this, no matter how trivial it may seem.
Forced to retain existing vehicle	Not applicable	This could potentially affect a number of consumers, but the consequences are fairly minor compared to sudden loss of a vehicle, which was possible under the previous policy.