

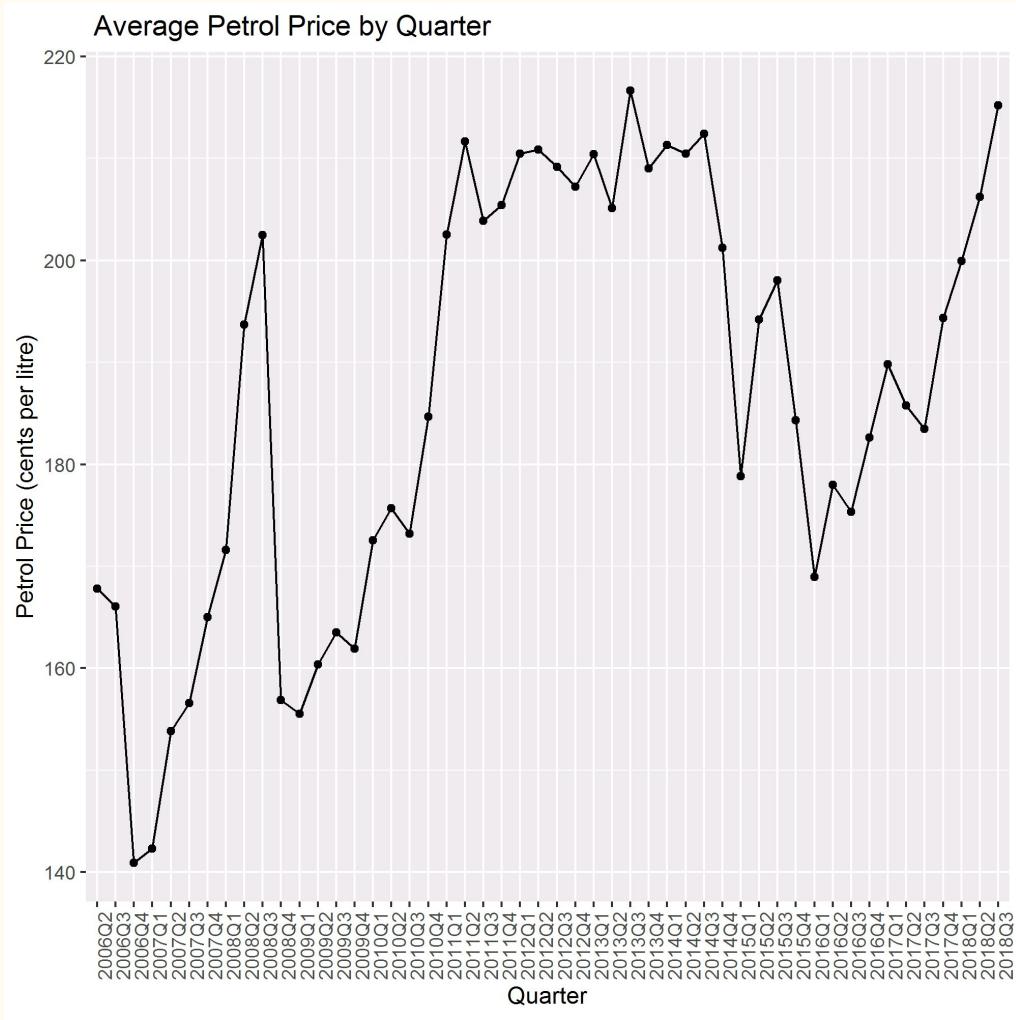
Cars and Us

Lucrezia
William
Patrick

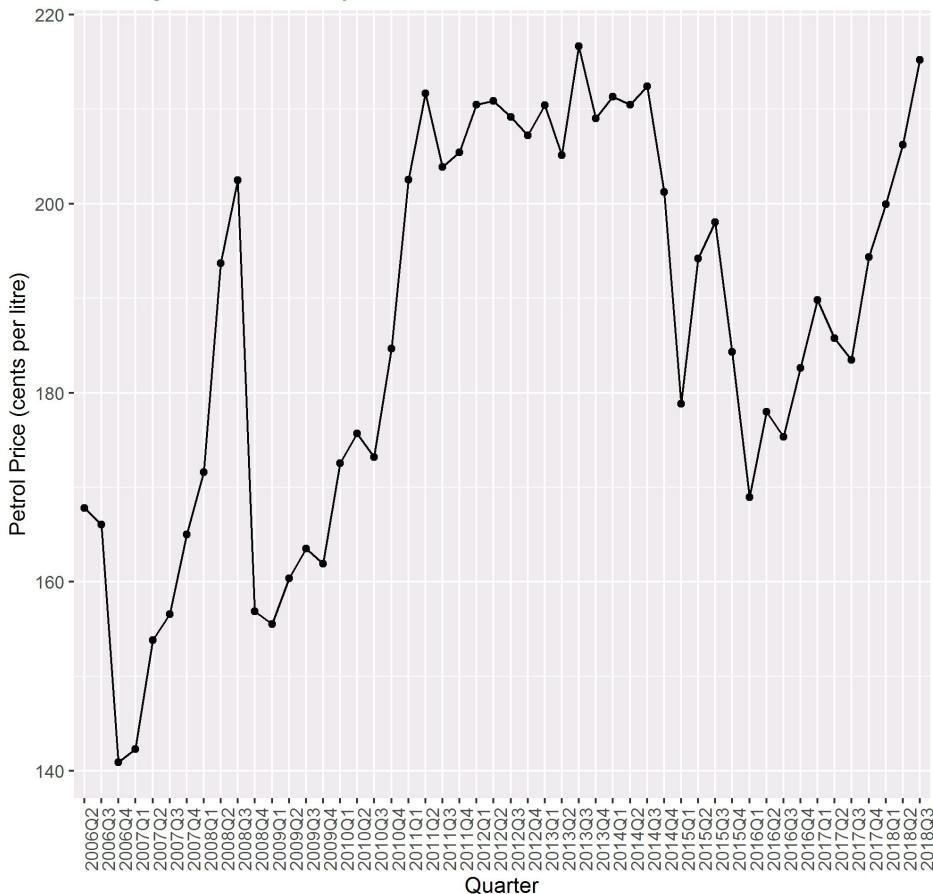
Truck convoy descends on Auckland CBD to protest petrol prices

High prices new normal: Here's how petrol could hit \$3 a litre •

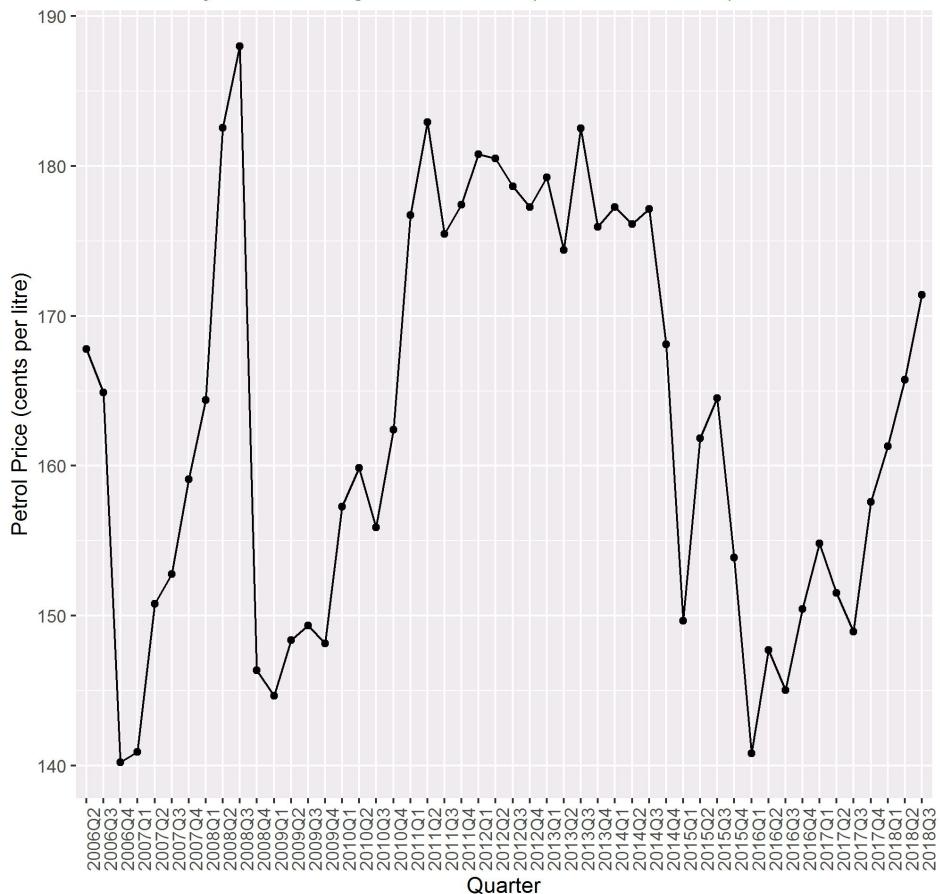
Climate target not viable for NZ economy - expert



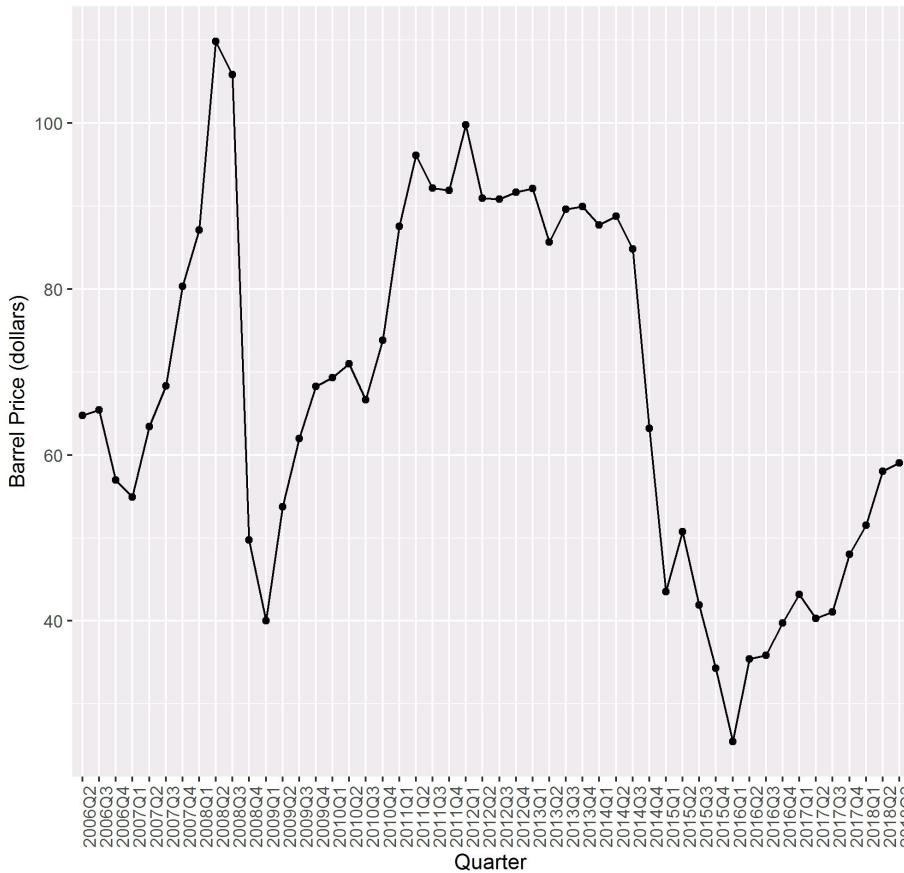
Average Petrol Price by Quarter



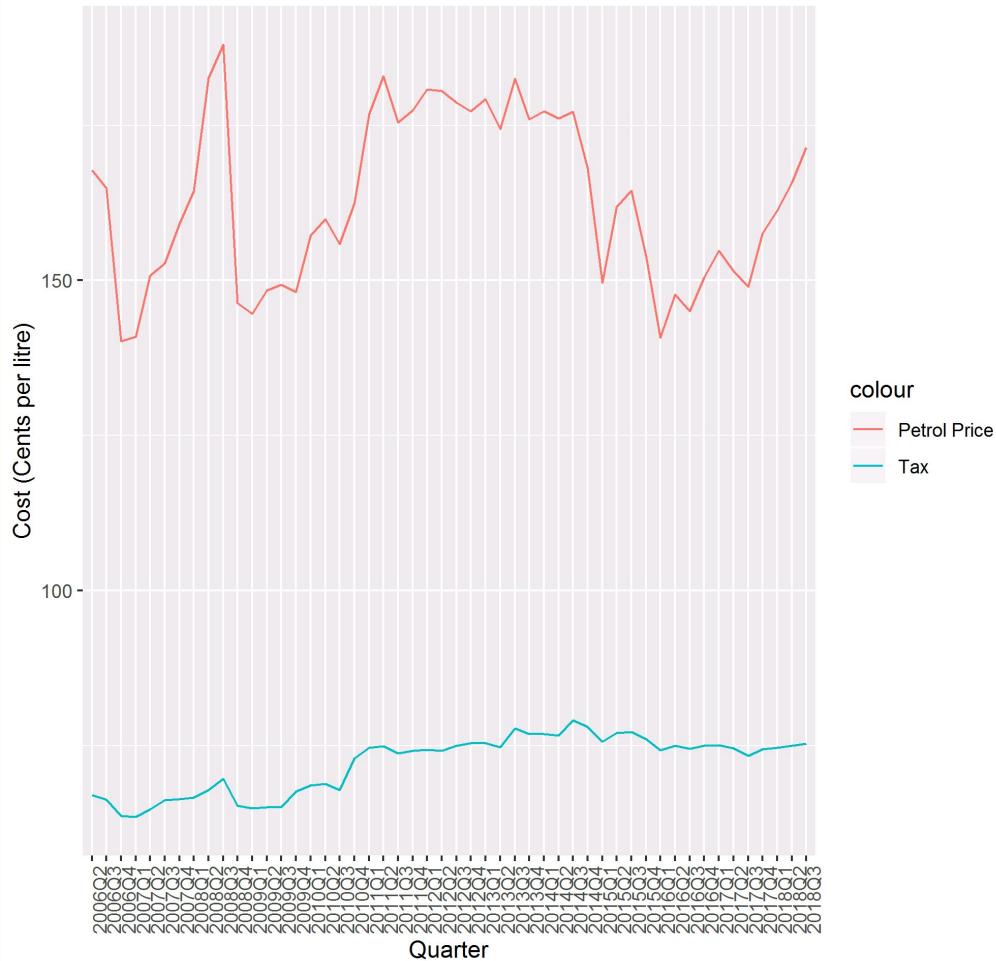
Inflation Adjusted Average Petrol Price (base is 2006 Q2)



Inflation Adjusted Average Barrel Price (base is 2006 Q2)



Inflation Adjusted Price and Tax (base is 2006 Q2)



Topics

Vehicle Population

- Data source
- Original data
- Clear data
- Transforming and mapping data
- Finding

Fuel Consumption

- Usage
- CO2 emission
- Price

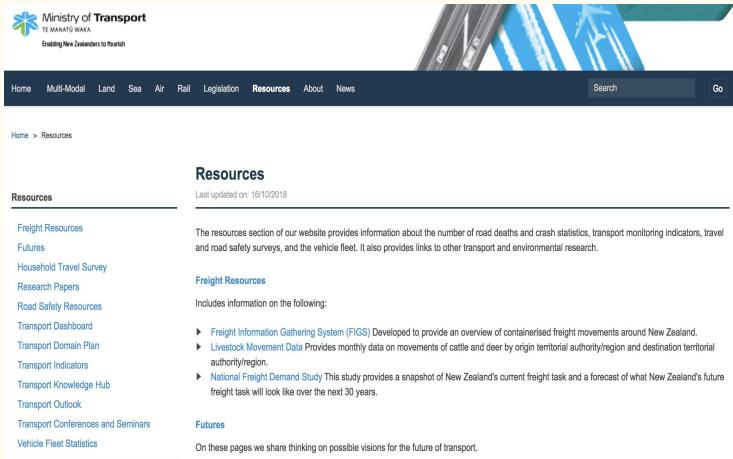
Vehicle Safety

- Fatal

Data Source

Vehicle Data from

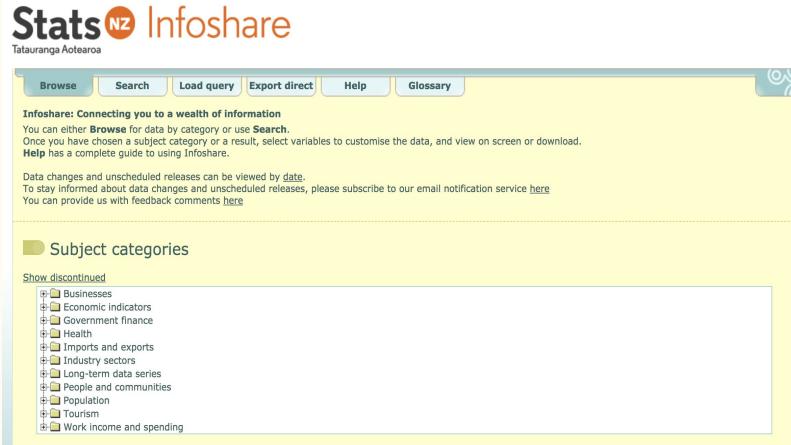
<https://www.transport.govt.nz/resources/>



The screenshot shows the Ministry of Transport website's Resources page. At the top, there is a navigation bar with links for Home, Multi-Modal, Land, Sea, Air, Rail, Legislation, Resources, About, and News. Below the navigation bar, there is a search bar with a 'Search' button and a 'Go' button. The main content area has a heading 'Resources' and a sub-section 'Freight Resources'. It includes a paragraph about the resources section and a list of freight-related studies like Freight Information Gathering System (FIGS), Livestock Movement Data, and National Freight Demand Study. There is also a 'Futures' section with a note about possible visions for the future of transport.

Population Data from

<https://archive.stats.govt.nz/infoshare/>



The screenshot shows the Stats NZ Infoshare website. At the top, there is a header with the Stats NZ logo and the text 'Tatauranga Aotearoa'. Below the header, there is a navigation bar with links for Browse, Search, Load query, Export direct, Help, and Glossary. The main content area has a heading 'Infoshare: Connecting you to a wealth of information'. It includes a paragraph about the service and a link to a complete guide. There is also a section titled 'Subject categories' with a list of categories such as Businesses, Economic indicators, Government finance, Health, Imports and exports, Industry sectors, Long-term data series, People and communities, Population, Tourism, and Work income and spending.

Data Format - Vehicle Fleet

- Original Data
 - Introduction of contents
 - Lots of tables
 - Missing value

Data Format - Vehicle Fleet

- Clear Data
 - Select used variables
 - Rename variables
 - Check data frame
 - Handle missing value
 - ✓ keep the missing value because they are harmless

```
Observations: 18
Variables: 14
$ Period           <dbl> 2000, 2001, 2002, 2003, 2004, 2005...
$ Light_passenger <dbl> 2147723, 2213694, 2292381, 2395163...
$ Light_commercial <dbl> 347206, 349773, 355373, 364051, 37...
$ Truck            <dbl> 95575, 97764, 101532, 106665, 1135...
$ Bus              <dbl> 4640, 4962, 5417, 5841, 6317, 6697...
$ Other            <dbl> 12326, 12526, 13139, 13777, 14429,...
$ Total_vehicles   <dbl> 2685414, 2757190, 2847817, 2968279...
$ Light_passenger_increasing_rate <dbl> NA, 0.03071672, 0.06735412, 0.1152...
$ Light_commercial_increasing_rate <dbl> NA, 0.007393305, 0.023522059, 0.04...
$ Trucks_increasing_rate          <dbl> NA, 0.02290348, 0.06232801, 0.1160...
$ Bus_increasing_rate            <dbl> NA, 0.06939655, 0.16745690, 0.2588...
$ Overall_increasing_rate        <dbl> NA, 0.01622586, 0.06595814, 0.1177...
$ Light_passenger_per_thousand    <dbl> 556.7222, 570.4662, 580.5701, 594...
$ Light_commercial_per_thousand   <dbl> 90.00104, 90.13606, 90.00203, 90.3...
```

Data Format - Population

- Original Data
 - Introduction of contents
 - Lots of tables
 - Missing value

Estimated de facto population ⁽²⁾	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9
1926	730500	699200	1429700	28500	2.03	104.5	722600	691200	1413700
1927	740500	709900	1450400	20700	1.45	104.3	735000	704000	1439000
1928	748600	718700	1467400	17000	1.17	104.2	743000	713000	1456100
1929	757800	728300	1486100	18700	1.27	104.1	751300	722100	1473400
1930	767900	738900	1506800	20700	1.39	103.9	761100	732000	1493000
1931	775600	747100	1522800	16000	1.06	103.8	771700	742500	1514200

Data Format - Population

- Clear Data
 - Rename variables
 - Check data frame
 - Handle missing value
 - ✓ Delete the missing value because they are not important
 - Select the variables we want to used

```
Observations: 92
Variables: 10
$ Year                  <dbl> 1926, 1927,
$ Men                   <dbl> 730500, 7405
$ Women                 <dbl> 699200, 7099
$ Total_population       <dbl> 1429700, 145
$ Absolute_increase     <dbl> 28500, 20700
$ Percentage_increase   <dbl> 2.03, 1.45,
$ Sex_ratio              <dbl> 104.5, 104.3
$ Year_average_male     <dbl> 722600, 7350
$ Year_average_female   <dbl> 691200, 7040
$ Year_average_total    <dbl> 1413700, 143
```

Year	Total_population	Year_average_total
1926	1429700	1413700
1927	1450400	1439000
1928	1467400	1456100
1929	1486100	1473400
1930	1506800	1493000
1931	1522800	1514200

New Dataset

- Join table
 - Inner join Vehicle Feet to Population by using “Period” = “Year”
 - Missing value

```
Observations: 18
Variables: 16
$ Period <dbl> 2000, 2001, 2002, 2003, 2004, 2005...
$ Light_passenger <dbl> 2147723, 2213694, 2292381, 2395163...
$ Light_commercial <dbl> 347206, 349773, 355373, 364051, 37...
$ Truck <dbl> 95575, 97764, 101532, 106665, 1135...
$ Bus <dbl> 4640, 4962, 5417, 5841, 6317, 6697...
$ Other <dbl> 12326, 12526, 13139, 13777, 14429, ...
$ Total_vehicles <dbl> 2685414, 2757190, 2847817, 2968279...
$ Light_passenger_increasing_rate <dbl> NA, 0.03071672, 0.06735412, 0.1152...
$ Light_commercial_increasing_rate <dbl> NA, 0.007393305, 0.023522059, 0.04...
$ Trucks_increasing_rate <dbl> NA, 0.02290348, 0.06232801, 0.1160...
$ Bus_increasing_rate <dbl> NA, 0.06939655, 0.16745690, 0.2588...
$ Overall_increasing_rate <dbl> NA, 0.01622586, 0.06595814, 0.1177...
$ Light_passenger_per_thousand <dbl> 556.7222, 570.4662, 580.5701, 594...
$ Light_commercial_per_thousand <dbl> 90.00104, 90.13606, 90.00203, 90.3...
$ Total_population <dbl> 3873100, 3916200, 3989500, 4061600...
$ Year_average_total <dbl> 3860200, 3886700, 3951200, 4027700...
```

Finding

Increasing Rate

Per Thousand people

- On different type of vehicle from 2000 to 2001
- Figure 1.1
- Vehicle ownership was changing on a per capita basis
- Figure 1.2

Figure 1.1

Overall, the increasing rate on Light passenger, Trucks and Light commercial were fastly growing after 2011 whereas increasing rate on Bus was steeply growing at all the time.

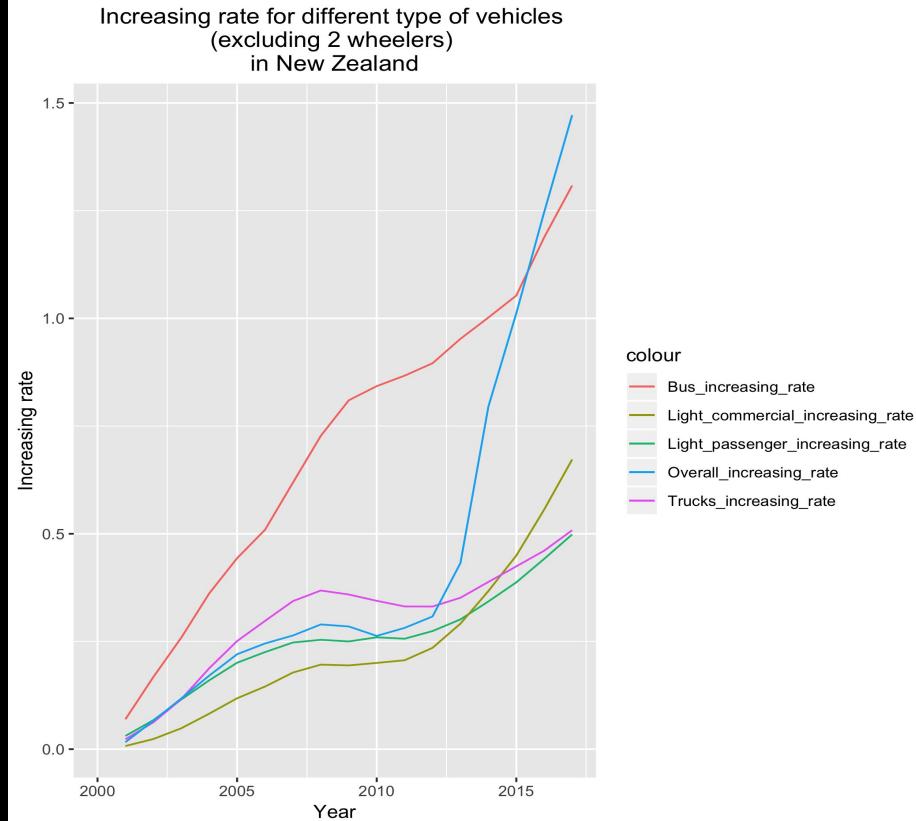


Figure 1.2

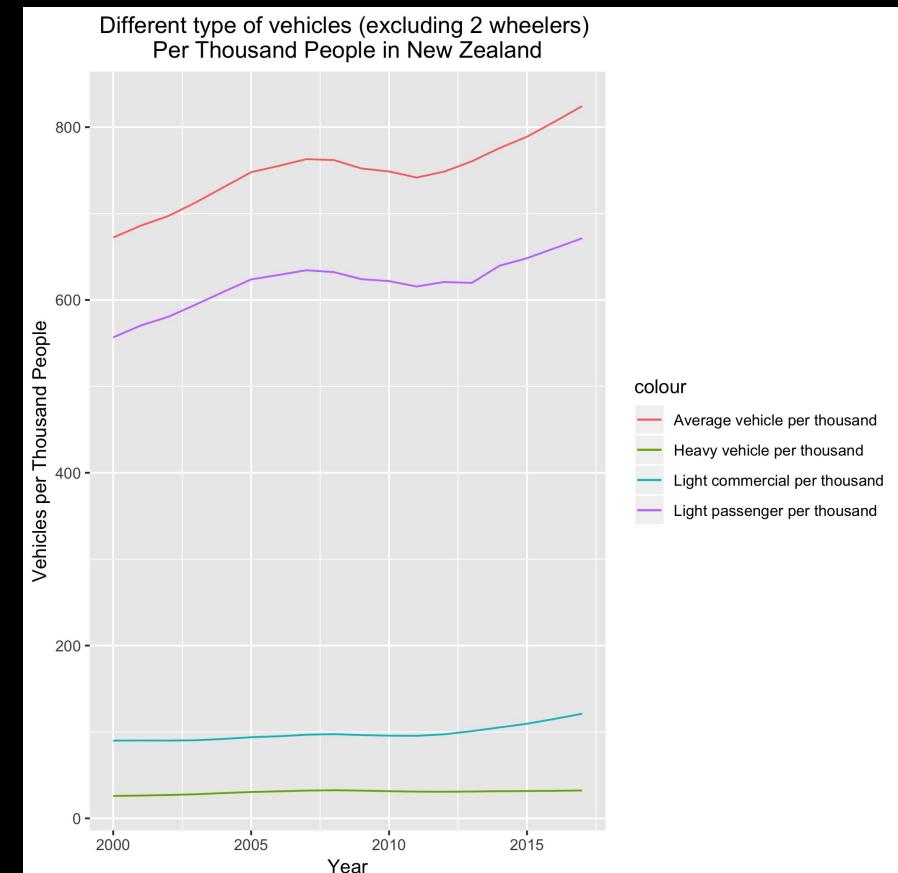
Overall, the every type of vehicle per thousands people was increasing by years.

However, we figured out some interesting pattern after we looked up the details about this plot.

Light passenger vehicle (per thousands people) was steeply increasing by years from 2000 to 2007 whereas deceased by years from 2008 to 2011. But it was increasing again after 2012 and reached the top around 760 vehicles for per thousands people.

Comparing with Light passenger vehicle, Light commercial vehicle was increasing steady and Heavy vehicle has slowly growth.

Some interesting reasons are waited to discover.



Data Format - Vehicle Fleet - Petrol Usage

- Original and Clear Data
 - Introduction of contents
 - Check data frame
 - No missing value

Observations: 17

Variables: 5

```
$ Year <dbl> 2001, 2002, 2003, 2004, 2005, 2006, 2...
$ `NZ Litres (million) (*)` <dbl> 2867.254, 2965.375, 3056.112, 3166.00...
$ `On road - min fuel estimate` <dbl> 2703.534, 2796.052, 2881.608, 2985.22...
$ `On road - max fuel estimate` <dbl> 2732.493, 2826.002, 2912.475, 3017.19...
$ `Km (million)` <dbl> 28672.11, 29467.01, 30096.85, 30576.8...
```

Data Format - Vehicle Fleet - CO2 emission

- Original and Clear Data
 - Introduction of contents
 - Check data frame
 - No missing value

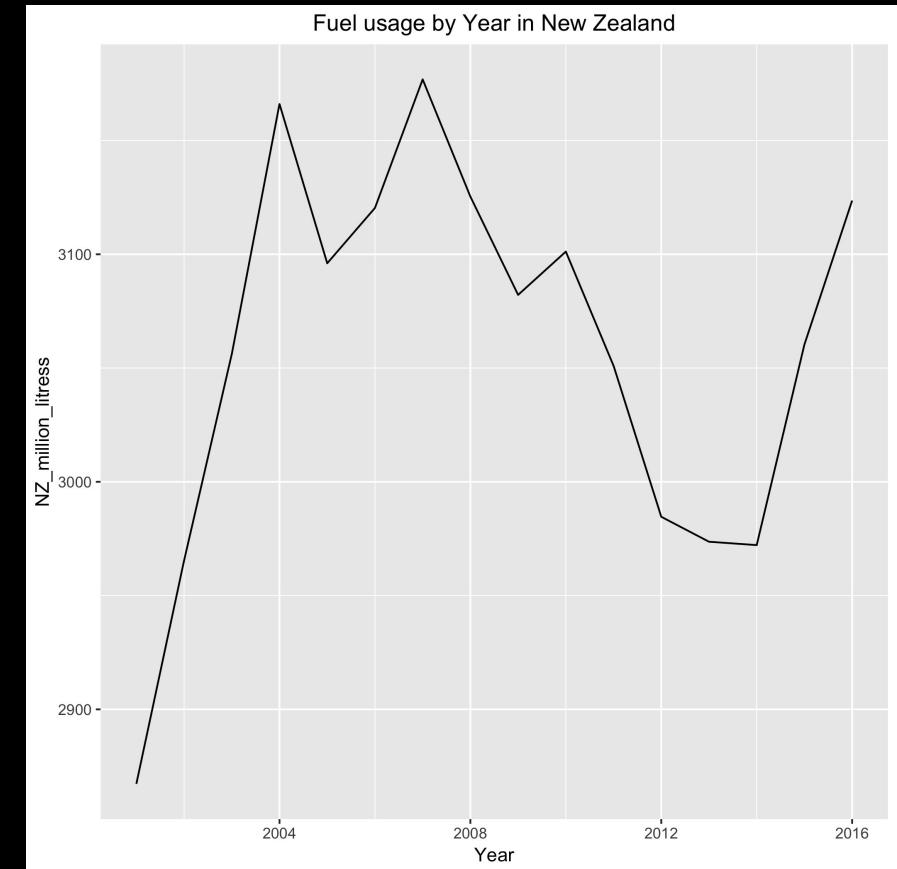
Observations: 16

Variables: 5

```
$ Year           <dbl> 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, ...
$ `Light passenger` <dbl> 6.846762, 7.146385, 7.456269, 7.751257, 7.623133...
$ `Light commercial` <dbl> 1.431631, 1.491567, 1.518686, 1.516918, 1.573049...
$ Motorcycle      <dbl> 0.02638895, 0.02650619, 0.02718043, 0.02827028, ...
$ `Heavy fleet`   <dbl> 2.381918, 2.561941, 2.625965, 2.639755, 2.843966...
```

Figure 2.1

- Increasing till 2004 and reached the peak
- Decreasing till 2014
- Increasing again till 2016 but less than the peak



DATA USED

```

Observations: 16
Variables: 11
$ Year           <dbl> 2001, 2002, 2003, 2004, 2005, 2006, 2007, ...
$ NZ_million_litres <dbl> 2867.254, 2965.375, 3056.112, 3166.000, 3...
$ On_road_min_fuel_estimate <dbl> 2703.534, 2796.052, 2881.608, 2985.222, 2...
$ On_road_max_fuel_estimate <dbl> 2732.493, 2826.002, 2912.475, 3017.198, 2...
$ million_Km        <dbl> 28672.11, 29467.01, 30096.85, 30576.89, 3...
$ Light_passenger_emission <dbl> 6.846762, 7.146385, 7.456269, 7.751257, 7...
$ Light_commercial_emission <dbl> 1.431631, 1.491567, 1.518686, 1.516918, 1...
$ Motorcycle_emission    <dbl> 0.02638895, 0.02650619, 0.02718043, 0.028...
$ Heavy_fleet_emission   <dbl> 2.381918, 2.561941, 2.625965, 2.639755, 2...
$ Total_population        <dbl> 3916200, 3989500, 4061600, 4114300, 41610...
$ Year_average_total     <dbl> 3886700, 3951200, 4027700, 4088700, 41360...

```

Year	NZ_million_litres	On_road_min_fuel_estimate	On_road_max_fuel_estimate	million_Km	Light_passenger_emission	Light_commercial_emission	Motorcycle_emission	Heavy_fleet_emission	Total_population	Year_average_total
2001	2867.254	2703.534	2732.493	28672.11	6.846762	1.431631	0.02638895	2.381918	3916200	3886700
2002	2965.375	2796.052	2826.002	29467.01	7.146385	1.491567	0.02650619	2.561941	3989500	3951200
2003	3056.112	2881.608	2912.475	30096.85	7.456269	1.518686	0.02718043	2.625965	4061600	4027700
2004	3166.000	2985.222	3017.198	30576.89	7.751257	1.516918	0.02827028	2.639755	4114300	4088700
2005	3096.046	2919.262	2950.532	30565.61	7.623133	1.573049	0.03075303	2.843966	4161000	4136000
2006	3120.356	2942.184	2973.700	30273.37	7.713956	1.612273	0.03631712	2.903354	4209100	4185300

```

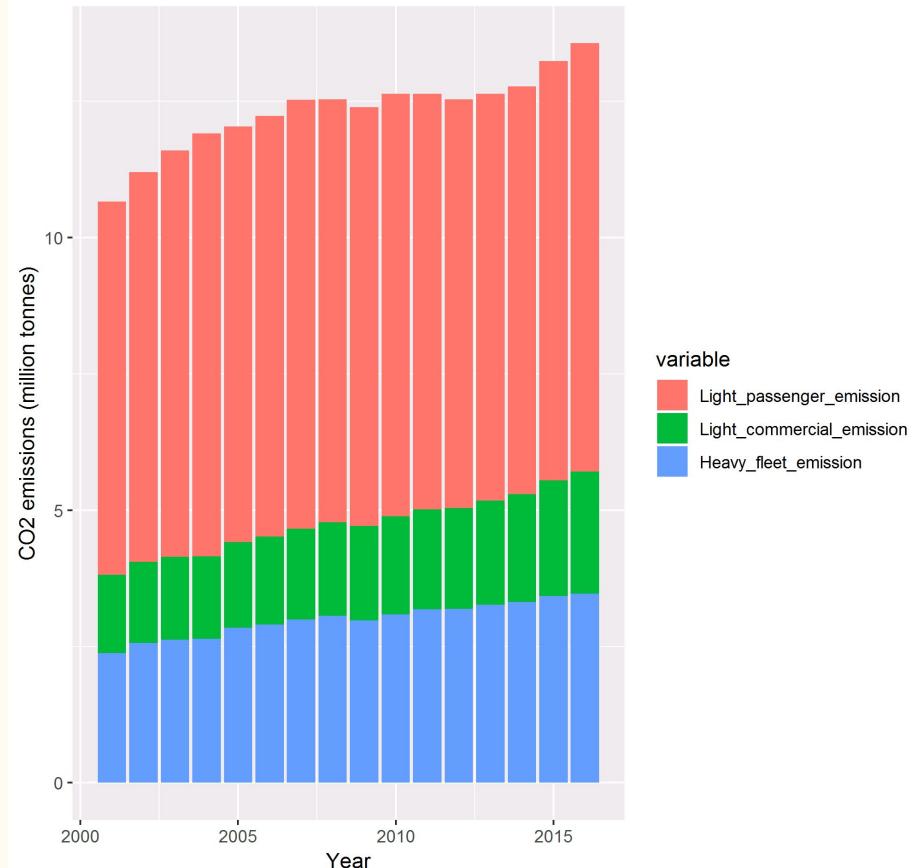
Observations: 67
Variables: 9
$ Year           <dbl> 1950, 1951, 1952, 1953, 1954, 1955, 1956, ...
$ Population_000 <dbl> 1927.6, 1970.5, 2024.6, 2074.7, 2118.4, 21...
$ Vehicles_000  <dbl> 402.2, 447.1, 494.2, 513.7, 553.5, 601.1, ...
$ Number_of_injuries <dbl> 6314, 6938, 7448, 7686, 7875, 8976, 9758, ...
$ Per_100000_people <dbl> 327.5576, 352.1000, 367.9000, 370.5000, 37...
$ Per_10000_vehicles <dbl> 156.9866, 155.2000, 150.7000, 149.6000, 14...
$ Number_of_fatal_crashes <dbl> 232, 292, 272, 313, 360, 333, 329, 384, 37...
$ Per_100000_people_fatal <dbl> 12.03569, 14.80000, 13.40000, 15.10000, 17...
$ Per_10000_vehicles_fatal <dbl> 5.768274, 6.500000, 5.500000, 6.100000, 6....

```

Year	Population_000	Vehicles_000	Number_of_injuries	Per_100000_people	Per_10000_vehicles	Number_of_fatal_crashes	Per_100000_people_fatal	Per_10000_vehicles_fatal
1950	1927.6	402.2	6314	327.5576	156.9866	232	12.03569	5.768274
1951	1970.5	447.1	6938	352.1000	155.2000	292	14.80000	6.500000
1952	2024.6	494.2	7448	367.9000	150.7000	272	13.40000	5.500000
1953	2074.7	513.7	7686	370.5000	149.6000	313	15.10000	6.100000
1954	2118.4	553.5	7875	371.7000	142.3000	360	17.00000	6.500000
1955	2164.8	601.1	8976	414.6000	149.3000	333	15.40000	5.500000

CO₂ emissions for each vehicle type

CO₂ emission in each type of vehicle



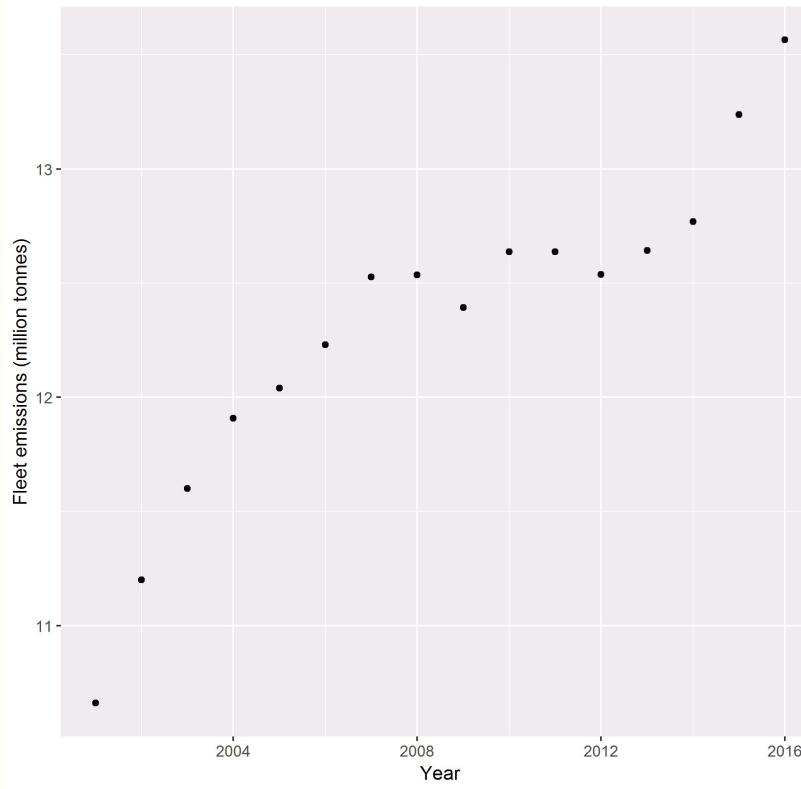
Year	Light_passenger_emission	Light_commercial_emission	Heavy_fleet_emission
2001	6.846762	1.431631	2.381918
2002	7.146385	1.491567	2.561941
2003	7.456269	1.518686	2.625965
2004	7.751257	1.516918	2.639755
2005	7.623133	1.573049	2.843966
2006	7.713956	1.612273	2.903354

```
library(reshape2)
new_fuel_CO2_update <-
melt(new_fuel_CO2,id.vars = "Year")
```

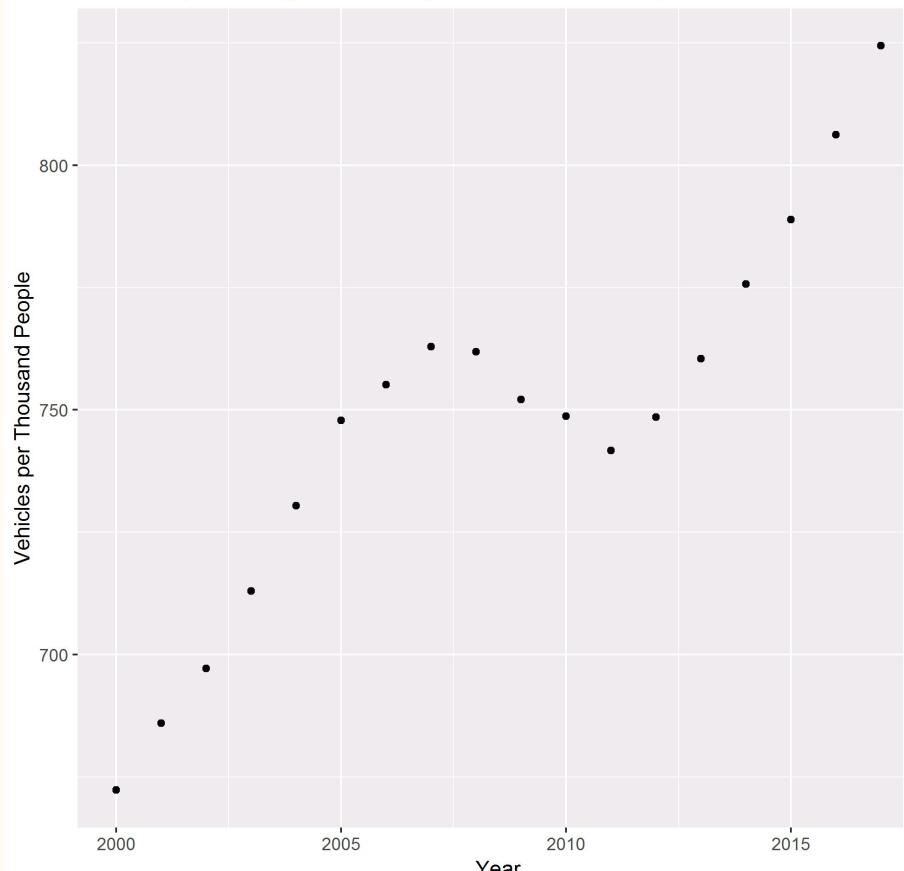
Year	variable	value
2001	Light_passenger_emission	6.846762
2002	Light_passenger_emission	7.146385
2003	Light_passenger_emission	7.456269
2004	Light_passenger_emission	7.751257
2005	Light_passenger_emission	7.623133
2006	Light_passenger_emission	7.713956

Light and heavy fleet CO₂ emissions

Light and heavy fleet CO₂ emissions in millions of tonnes in New Zealand

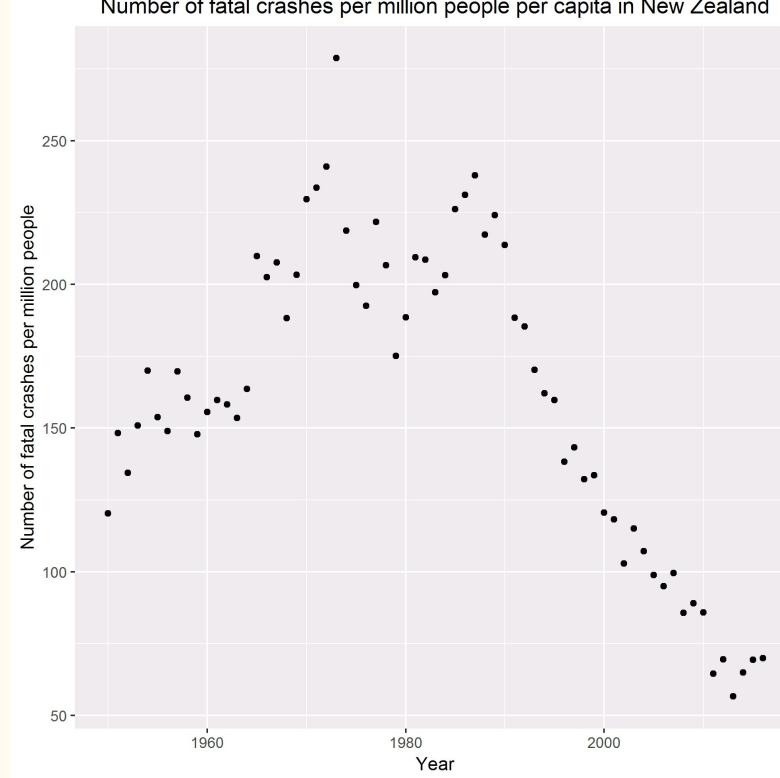


Vehicles (excluding 2 wheelers) Per Thousand People in New Zealand



Fatal crashes in New Zealand

Number of fatal crashes per million people per capita in New Zealand



Thank you for your time