Fuel Economy Fiscal Measures - Feebate Tool Training

Zifei Yang
Researcher

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Overview

- Fiscal measures to improve vehicle fuel efficiency
- Highlight of the day - feebate program
- Feebate benefits
- Introduction of Feebate Tool
  - Case study using China 2014 data
- Summary - Feebate best practices
Fiscal measures to improve vehicle fuel efficiency

- **Vehicle tax/fee**
  - Based on CO$_2$ emissions or fuel efficiency
  - One-time (e.g. at registration) or annually (e.g. circulation tax)

- **Incentive schemes for very fuel-efficient vehicles**

- **Feebate - a mix of fees/tax and rebate/incentives**

- **Fuel tax**

- **Infrastructure support, e.g. charging stations, discounted electricity**
What is a feebate program

- **Feebate** – Higher efficiency vehicles receive rebates, lower efficiency vehicles pay fees
Feebate program in various forms

- Non-continuous feebate program

- Step-wise feebate program (example of France)
The design of the rebate influences how manufacturers respond

- Tax-optimized vehicles

Link to the report: Optimizing to the last digit: how taxes influence vehicle CO2 emission level
http://www.theicct.org/sites/default/files/publications/Tax_Step_Analysis_201510.pdf
Why feebate system

- Can be used as an alternative to establishing fuel economy standards
- Modest amount of data & expertise
- Could provide fiscal incentives to go beyond fuel economy standards
- Bolsters FE in consumer decision making
- Establishes an explicit price for efficiency
- Enables revenue-raising or -neutral
- Easy to maintain if properly constructed
Feebate system compare to other measures

- Compared to fuel economy standards:
  - Effective at improving efficiency of imported vehicles
  - Requires less expertise and information
- Compared to separate tax and incentives:
  - Budget neutral, more sustainable
  - Perceived more positively by consumers
Feebate Tool*

Tool designed to educate, inform, and allow experimentation

- User-friendly: Excel-based system with front-end
- Preloaded default data and helps the user input new data
- User selection of multiple design parameters
- Menu-driven system with clear boundaries
- Layered complexity for different types of user
- Integrated with user guide

* Developed by ICCT & UNEP for GFEI
**Feebate Tool: Control Panel**

### Feebate Function Control Panel

#### Quick Start
- Current country: **Australia**
- Start year: **2015**
- Run
- View Results
- Change country or upload new data

#### Pivot Point Control
- Annual adjustment based on observed changes
- Revenue neutral system
- Revenue to the government (mUSD/year): **0**

#### Metrics
- **CO₂ Emissions**
  - Update
- **UNITS**
  - Update

#### Rebate Function Shape Control
- Shape examples: **Linear**
- Pivot Point = **202**
- How many sections: **1**
  - Section limits, g of CO₂ / Kilometer: **384**
  - Shape of the individual sections: **SLOPED**
  - Rebate/fee value: **N/A**
  - Rate USD per g of CO₂ / Kilometer: **50**

![Graph](image-url)

**icct**

**INTERNATIONAL COUNCIL ON CLEAN TRANSPORTATION**
To get started…

- What data is needed?

- What decision should be made?
Prepare for the input: new vehicle registration record

<table>
<thead>
<tr>
<th>Reg. Year</th>
<th>Make</th>
<th>Model</th>
<th>Model year</th>
<th>Body Type</th>
<th>Condition</th>
<th>Segment</th>
<th>Fuel type</th>
<th>Price</th>
<th>gCO₂/km</th>
<th>Power</th>
<th>L/100 km</th>
<th>Weight</th>
<th>Size</th>
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<tr>
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<td>BMW</td>
<td>316i</td>
<td>1989</td>
<td>S. WAGON</td>
<td>Used</td>
<td>a</td>
<td>b</td>
<td>c</td>
<td>176</td>
<td>d</td>
<td>e</td>
<td>7.5</td>
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<td>SALOON</td>
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<td>a</td>
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<td>c</td>
<td>145</td>
<td>d</td>
<td>e</td>
<td>6.2</td>
<td>f</td>
</tr>
</tbody>
</table>

**Most important data**

- **Reg. Year**: 2005
- **Make**: BMW, CHEV
- **Model**: 316i, NULL
- **Model year**: 1989, 2005
- **Body Type**: S. WAGON, SALOON
- **Condition**: Used, New
- **Segment**: a, b, c
- **Fuel type**: Petrol, diesel, gas/LPG; (hybrid/petrol, hybrid/diesel, electric, flexible, natural gas, ethanol-petrol mix, fuel cell, unspecified)
- **Price**: Any currency (require exchange rate, reported in USD)
- **Power**: Any unit (reported in the same unit)
- **Weight**: Any unit (reported in the same unit)
- **Size**: Any unit (reported in the same unit)

**Formats compatible for the tool**

- **Segment**: A, B, C, D, E, F, SUV
- **Fuel type**: Petrol, diesel, gas/LPG; (hybrid/petrol, hybrid/diesel, electric, flexible, natural gas, ethanol-petrol mix, fuel cell, unspecified)
- **Price**: Any currency (require exchange rate, reported in USD)
- **Power**: Any unit (reported in the same unit)
- **Weight**: Any unit (reported in the same unit)
- **Size**: Any unit (reported in the same unit)
Flexibility of input data

- New vehicle vs. second-hand vehicle
  - Assumption for used vehicles FE value: same as new vehicles, or apply a “discounting” rate
- Individual vehicle vs. aggregated dataset
  - Individual vehicle: micro-dataset provides more reliable results
  - Aggregated dataset allows the tool run faster

There is default fleet database of several countries in the Feebate Tool that you could use to generate results directly
Design the feebate system- pivot point control

- Pivot point and fleet structure determine the revenue of government
  - **Adjustment based on observed change** provides steady revenue flow
  - **Adjustment with fixed percentage** provides clear policy indication
  - **Lagged adjustment based upon trigger** minimizes potential confusion to consumers, and still provides steady revenue flow
Design the feebate system- rebate function shape control

- Rebate function shape control
  - Allows the user to increase rebates for advanced technology vehicles and/or increase fees for the worst vehicles.

- Others that users could decide
  - Government revenue
  - Metrics and units in the output

There is default design in the Feebate Tool that you could use to generate results directly
Results- figures with statistics

Policy summary

Evolution of the pivot point over time

Rate: 50 USD gCO₂/km

Pivot point

Fixed shift: 1% annually

Emissions

Average emissions from newly registered cars (left scale)

Budget

Governmental balance

Rebates

Fees

Manufacturers contribution (right scale)

Consumers contribution (right scale)
Advanced design options (1 of 2)

- **Budget control**
  - Point of administration
    - Manufacturer/Distributor level
    - Consumer level
  - Administrative cost (% of average fees and rebates)

| Point of Administration | Administrative Costs [% of average Fees and Rebates] | Pivot Point adjustment based on:
<table>
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<tbody>
<tr>
<td>Manufacturer/Distributor Level</td>
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<td>Observed changes or Lagged adjustment</td>
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<td>Consumer</td>
<td>?</td>
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</tr>
<tr>
<td>2</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Pivot Point adjustment based on: Observed changes or Lagged adjustment | Fixed criteria or Manual control
---|---
1 | 0.5
2 | 1
Advanced design options (2 of 2)

- Manufacturer behavior - react to feebate or not
- Consumer behavior
- Attribute adjustment
  - Size, weight, power

<table>
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<tr>
<th>Size</th>
<th>Weight</th>
<th>Power</th>
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<tr>
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<tr>
<td>Flat rate= 0.6</td>
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</tbody>
</table>

Adjusting for size targets the feebate at the level of technology on the vehicle;
No adjustment also incentivizes smaller vehicles
Tool demonstration
backup slides

Case study
China 2014 fleet data
Open the Feebate Tool

First: ENABLE Macros
Start to design the feebate system!

**Step 1:** Choose country and start year

**Step 2:** Choose a pivot point and its adjustment

**Step 3:** Choose metrics and units of the system

**Step 4:** Choose and tune the shape for the rebate function

**Step 5:** Generate results!
Step 1(a): Choose country

- **Choose** a default country from the pull down menu
- Or **upload** your own data (the tool provides instruction as you click)
Use your own data - get the data ready

- 2014 sales of new vehicles
- Aggregated dataset
  - Aggregate for vehicle segments with a particular fuel type
- Prepared in a separated excel file
  - **Exactly match** with columns in Feebate Tool

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<th>Price (CNY)</th>
<th>Emission</th>
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<th>Weight (Kg)</th>
<th>l/100km</th>
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<td>1515.3</td>
<td>8.1</td>
<td>4.1</td>
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</tbody>
</table>
Upload data to Feebate tool is easy

- Copy and paste into "Input_Data" tab
- Click "Chose country or upload new data"
- Click "Refresh Selection", then the new country will show in the pull down menu
Input exchange rates (if needed)

Advanced Design Options → Budget Control → Type in exchange rates

**BUDGET CONTROL PANEL**

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<tr>
<th>Exchange rates:</th>
<th>Currency</th>
<th>Unit value in USD</th>
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<td>Germany</td>
<td>Euro</td>
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<td>Russia</td>
<td>Ruble</td>
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<tr>
<td>Georgia</td>
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<tr>
<td>South Africa</td>
<td>Rand</td>
<td>0.0946738</td>
</tr>
</tbody>
</table>

Must do! If not, the system will remind and guide you when you choose input data.
Options to deal with missing data points

- After choose country - automatic system warning

**Options:**

- Go back and estimate the missing cell, or
- Choose ignore or delete the problematic data points, or
- Go back and choose a default country

<table>
<thead>
<tr>
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<td></td>
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<tr>
<td>Power</td>
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</tr>
<tr>
<td>Weight</td>
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<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L/100km</td>
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<tr>
<td>Size</td>
<td>13</td>
<td>100</td>
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</tr>
</tbody>
</table>
Step 1(b): Choose start year

- Type in the **starting year** for your assessment
- Start to generate results with the default feebate system design by clicking **run**

- Or modify the default design and design your own feebate system following step 2-4
What is in the default design?

- Annual adjustment based on observed changes
- Revenue neutral system
- Tax on CO$_2$ emission, no attribute adjustment
- Rebate function is a linear line, 50 USD per gCO$_2$/km
Rebate function for China feebate system based on default design

Rebate function
Rate: 50 USD gCO2 /km

Prius 100g/km
Passat 194g/km
Total rebate paid at each emission level
Pivot point

Rebate (USD)
CO2 emissions (g/km)

Rebate paid based on actual fleet
(Million USD)
Step 2: Choose a pivot point and its adjustment

- **Annual adjustment based on observe changes**

- **Annual adjustment based on fixed criteria**

Subject to actual market response to the feebate system and the actual net revenue is uncertain.
Step 2: Choose a pivot point and its adjustment

- Lagged adjustment based on trigger

Manual pivot point control: go to Step 4
Step 3: Choose metrics and units of the system

- **Metrics**
  - CO₂ emission
  - Fuel economy
    - Fuel consumption (Volume/Distance)
    - Fuel efficiency (Distance/Volume)

- **Units (for fuel economy)**
  - Kilometer/mile
  - Liters/gallon

- **Must click “Update” after the change!**
Step 4: Choose and tune the shape for the rebate function

- **Linear (50 USD gCO\(_2\)/km)**

- **Linear piecewise (30-120 USD gCO\(_2\)/km)**
Step 4: Choose and tune the shape for the rebate function

- Step-based with uniform/uneven steps
  - By default, only feasible when “Manual Pivot Point Control” is chosen. Change pivot point manually.
  - Change default setting through “Advance Design Option”. The tool determines a pivot point that makes the balance as small as possible.

- Or “Design your own” to mix linear and step-based
Step 5 Generate results

You could generate results any time after Step 1
Results - Policy summary and pivot points

Policy summary

- Annual adjustment based on fixed criteria
- Revenue neutral system
- Shift in Pivot Point [% / period] 3
- Revenue to the government [mUSD/year] 0

Evolution of the pivot point over time

<table>
<thead>
<tr>
<th></th>
<th></th>
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<td>169.7</td>
<td>163.0</td>
<td>156.3</td>
<td>149.6</td>
</tr>
</tbody>
</table>

CO2 Emissions, grams of CO2 / Kilometer

Revenue to the government [mUSD/year]

<table>
<thead>
<tr>
<th></th>
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<td>255</td>
<td>151</td>
<td>99</td>
<td>48</td>
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</tbody>
</table>

Rebate, USD

<table>
<thead>
<tr>
<th></th>
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<td>212</td>
<td>255</td>
<td>151</td>
<td>99</td>
<td>14</td>
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</table>
Results - Emissions and reduction contributions

**Emissions**

Average emissions from newly registered vehicles (CO2 level)

<table>
<thead>
<tr>
<th></th>
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<td>154.8</td>
<td>150.1</td>
<td>145.6</td>
<td>141.1</td>
<td>136.7</td>
<td>132.3</td>
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Change in average emissions (year-on-year)

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<td>Change</td>
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<td>-3.4</td>
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Consumers contribution to year-on-year CO2 change

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<td>-1.4</td>
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<td>-1.7</td>
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Manufacturers contribution to year-on-year CO2 change

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</thead>
<tbody>
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<td>Change</td>
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<td>-2.2</td>
<td>-3.6</td>
<td>-3.5</td>
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<td>-3.0</td>
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<td>-2.7</td>
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</table>
Results – Monetary flow and government balances

Budget

Fiscal balance of the simulated feebate system, millions USD

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<tbody>
<tr>
<td>Rebates</td>
<td>-644.2</td>
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<td>-853.2</td>
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<td>-1428.6</td>
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<td>Fees</td>
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<td>577.5</td>
<td>504.8</td>
<td>432.2</td>
<td>371.2</td>
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<td>260.8</td>
<td>209.1</td>
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<td>Administrative costs</td>
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<td>-7.7</td>
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<td>-10.8</td>
<td>-12.5</td>
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<tr>
<td>Governmental balance</td>
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<td>-355.1</td>
<td>-586.2</td>
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<td>-1454.3</td>
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<td>Cumulative governmental balance</td>
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<td>-519.0</td>
<td>-1105.3</td>
<td>-1943.1</td>
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<td>-4515.6</td>
<td>-6355.4</td>
<td>-8640.1</td>
<td>-11438.9</td>
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</tbody>
</table>
Fiscal balance

- **Budget neutral** (e.g. pivot point shift as observed)

- **Net revenue > 0** (e.g. fix 3% shift of pivot point)

- **Net revenue < 0** (e.g. no shift in pivot point)
Best practices of feebate program

Prerequisite: A mechanism that collects fuel efficiency/CO₂ emission information on individual vehicles (e.g. a labeling program)

- A continuous and linear feebate rate line, without any breaks or discontinuities.
- The pivot point set to make the system self-funding and sustainable, and periodically adjusted to compensate for changing conditions.
- A linear metric, such as CO₂ emissions or fuel consumption per unit of distance.
- An attribute adjustment (if one is used) based on vehicle size, not any other metric.
More information…

- Feebate Simulation Tool and User Guide

- Best Practices for Feebate Program Design and Implementation

- Review and comparative analysis of fiscal policies

- Contact
  Zifei Yang, zifei.yang@theicct.org