Estimating the impact of monetary incentives on PEV buyers

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Goal: A better understanding of incentive impacts

• We employ a stated preference (survey based) modeling approach using a comprehensive survey dataset of over 10,000 respondents

• Provides a more nuanced view of incentives than would normally be available through market-based revealed preference data

• Our analysis focuses on changes in purchase intention due to the presence of incentives
CVRP based surveys 2015-2017 N=14,000
Likert Scale and Slider Bars: Estimating the Importance of Incentives

In the next set of questions we will ask about the decision you made when buying/leasing your car. Please try to answer the following questions based on the knowledge you had when making your car purchase.

Plug-in cars are eligible for different local, state, and federal incentives. How important were those incentives in your decision to buy the TESLA MODEL S? (If the incentive was not available for you please move the slider bar to “Not Applicable”)

**Federal Tax Credit**

Not Important | Important | Not Applicable | No answer

What is the dollar value of this incentive for your household? $7500

**State Rebate**

Not Important | Important | Not Applicable | No answer

What is the dollar value of this incentive for your household? $1000

**Local Rebate**

Not Important | Important | Not Applicable | No answer

What is the dollar value of this incentive for your household? $3000
Design Game web survey (SP survey)
Importance of Incentives
Claims for federal credits varies widely

- The line indicates what a respondent should have received.
- The downward bias is likely a result of individuals who are unable to claim the full tax credit.
- Incorrect claims (particularly upward biased) may still be processed unless audited by the IRS.
What are the two most importance incentives?

• Respondents rate the importance of a number of incentives to their purchase decision

• The graph depicts respondents’ top two incentives

• The federal tax credit, CVRP, and HOV access account for 95.7% of top two incentives
Distinct clusters of incentive importance

- Only HOV are important
- All incentives are important
- Monetary and HOV are important

Incentives vs Demographics
Purchase Intentions
Understanding purchase intentions via MNL analysis

Removing an incentive can affect purchase decision in the following ways:

- No change
- Not to buy/lease a vehicle at all
- Instead purchase a conventional vehicle
- Instead purchase a non plug-in hybrid
- Instead purchase another plug-in vehicle
- Other

How do these decisions change across factors of:

- % discounted from incentive
- Buyer generation
- PEV Type
- Demographics: age, income, education, household size

The following slides display graphical summaries of large scale models that incorporate all of the mentioned factors.
The federal tax credit affects various PEVs differently

The discount percentage has a very large difference in purchase behavior:

- $7,500 is only 7% of a Tesla Model S:
  - 65% - “No change”
- $7,500 is 23% of a Nissan Leaf:
  - 40% - “No change”,
  - 20% - “Won’t buy/lease a car”,
  - 15% - “Buy conventional vehicle”
Age appears to be an important determinant

- Even controlling for income, older respondents are substantially less likely to change their minds without the incentive compared to younger respondents.
- Substitution between conventional vehicle and not buying a car switches at older age ranges.

<table>
<thead>
<tr>
<th>Change in purchase decision</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>A conventional vehicle</td>
<td></td>
</tr>
<tr>
<td>A hybrid, non plug in vehicle</td>
<td></td>
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<tr>
<td>Another plug in vehicle</td>
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<tr>
<td>Not to buy lease a vehicle at all</td>
<td></td>
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<tr>
<td>No change</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
</tr>
</tbody>
</table>

![Graph showing probability change in purchase decision with age]

*UC Davis Plug-In Hybrid & Electric Vehicle Research Center*

*of the Institute of Transportation Studies*
Slight differences by PEV type

- There are significant differences between PEV decision types when removing the incentive
- PHEVs are more likely to buy a hybrid vehicle and a conventional vehicle
- BEVs are more likely to not buy/lease a vehicle at all
Incentives are more important for new generation of buyers

- Newer generations of buyers are more likely to change their decision about purchasing a PEV without the federal tax credit
- Respondents are increasingly likely to “buy a conventional vehicle” or “not buy/lease a vehicle at all” as time passes
Incentives are becoming more important over time.

For Leaf/Volt:
- ~25% discount for Leaf/Volt, take the incentive away:
- In 2010 50% don’t change their minds.
- In 2016 35% don’t change their minds.

For conventional vehicles:
- In 2010 15% don’t buy a car.
- In 2016 25% don’t buy a car.
Other findings of interest

• Unsurprisingly, the federal tax credit has substantially greater influence on purchase decisions than the CVRP

• When removing either the federal credit or CVRP:
  • PHEVs are more likely to switch to conventional vehicles or hybrids
  • BEVs are more likely to forego purchasing/leasing a vehicle

• Neither household size or education provide much variation in purchase decision changes
Discussion and take-aways

• The importance of incentives is growing over time. When can we expect it to change?
  • What is the impact of lower MSRP?
  • Larger PEVs?
  • Lower income household who buy PEVs?
• Do we need to incentivize BEVs more than PHEVs?
Thank you