

An Agent-Based Model for Estimating Consumer Adoption of PHEV Technology

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Research Objective: To develop an agent-based model that can be used to guide policy decisions oriented toward accelerating market penetration of plug-in hybrid vehicles (PHEVs).

Abstract: This study presents a prototype of a dynamic, spatially-explicit agent-based model of the market penetration of plug-in hybrid electric vehicle (PHEV) technology under different types of governmental incentives, initiatives and regulations. The model entails heterogeneous agents which decide whether or not to buy a PHEV by weighing environmental benefits and financial considerations, based on their personal driving habits, their projections of future gas prices, and their susceptibility to various social influences. Proof-of-concept results have been obtained to illustrate how such a model might be used to examine sensitivity to different types of incentives and initiatives. For example, our results indicate that simple tools for helping consumers to more accurately estimate relative fuel costs could dramatically increase PHEV adoption.



Policy Options: What is the effectiveness of the following on market penetration of PHEVs?

- (1) Purchase Price Rebates
- (2) Tax Deductions
- (3) Battery Range Improvements
- (3) Gasoline Price
- (4) Consumer Information
 - Lifetime fuel costs
 - Maintenance costs

Does a **THRESHOLD** behavior exist for any of these parameters?

Which types of incentives, rebates, warranties, or consumer education could have the most influence?

Social Influence

➤ Agents in my social network may influence my environmental attitudes and ability to accurately estimate potential fuel savings.

Agent Decisions

➤ *Should I buy a new car this year?*

➤ *Should I consider a PHEV?*

- How many PHEVs in my spatial neighborhood +social network? Is this above my personal threshold?

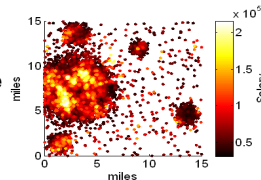
➤ *What is the relative net cost of a PHEV vs comparison vehicle?*

- Purchase price
- Gasoline cost estimate (How far into the future do I estimate this?)
- Electrical drive usage estimate

➤ *How much extra am I willing to pay for a PHEV?*

- Perceived environmental benefits
- How much do I care about environment?

Spatial and multivariate correlation in agent demographics



Agent Attributes (based on available data)

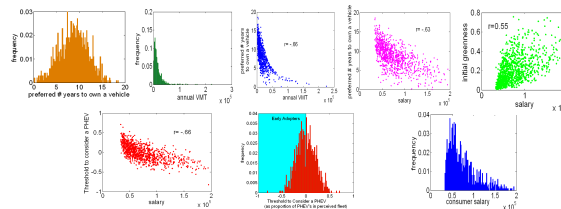
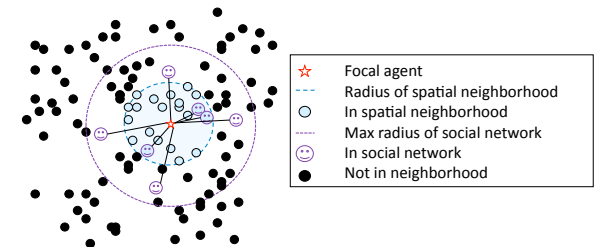
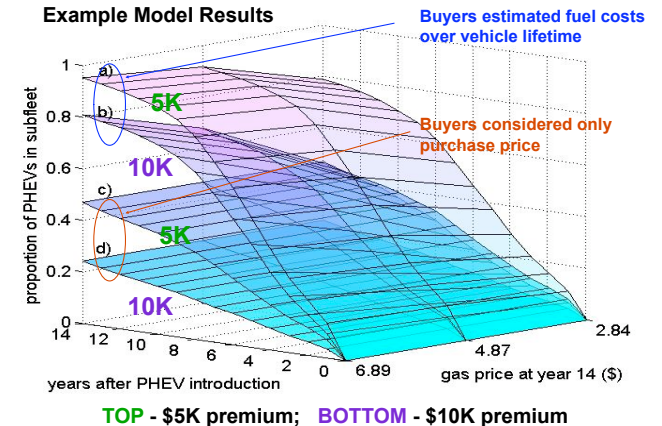


Illustration of Agent Social Network



Example Model Results



TOP - \$5K premium; BOTTOM - \$10K premium

Conclusion: An agent-based model has been developed for study of market penetration of PHEVs. The model assumes that the given vehicle is offered in both PHEV and "standard" options, and examines the conditions under which each option is purchased. The model considers both financial and environmental aspects in the purchase decision, as affected by agent demographics and social influence. The agent-based model is currently being used to examine the sensitive of PHEV market penetration to different types of governmental regulations and incentives.