Applicant Income and

After-Rebate Vehicle Price Trends

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Background and Summary

California is promoting large-scale adoption of zero-emission vehicles to engender environmental and economic benefits including reductions in air pollution and greenhouse gas emissions.[1] The Clean Vehicle Rebate Project (CVRP) promotes clean vehicle adoption by offering rebates for the purchase or lease of new zero-emissions vehicles including plug-in hybrid electric vehicles (PHEVs), battery electric vehicles (BEVs), range-extended battery electric vehicles (BEVx vehicles) and fuel-cell electric vehicles (FCEVs) across the state. Here we investigate the relationships between the price that the consumer paid for the vehicle after any CVRP rebates (the "after-rebate" purchase price) and the gross annual income of CVRP applicants that purchased BEVs, BEVxs and PHEVs between January 2017 and July 2020. We find that there is a positive relationship between applicant income and the after-rebate vehicle price, but this relationship has varied strongly across time. Indeed, the income-price relationship was strong in 2018 but has been nearly non-existent since 2019. The strong relationship in 2018 was primarily due to the introduction of the Tesla Model 3 into the market and a greater propensity for higher income applicants to purchase Model 3s relative to other vehicles, but these differences in propensity have since equalized. The $60,000 MSRP cap that limits eligbility based on a vehicle's price that was implemented in 2019 is also likely affecting the income-price relationships, but to a lesser degree. Improving understanding of after-rebate purchase price points across income segments can inform targeted outreach and marketing camapigns and result in increased program efficiencies.

Approach

We investigate the relationship between verified annual incomes[2] and vehicle price for CVRP applicants that purchased or leased (for simplicity, henceforth we use "purchased" to describe both leased and purchased vehicles) their vehicles from January 2017 and July 2020. We restrict the analysis to applications with incomes that were verified by the program administrator since applicant reported incomes were often inaccurate (e.g., 20% of reported incomes were +/- 50% of their respective verified incomes). Of the applications with verified incomes, we only used applications that were randomly

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[1] California Air Resources Board (November 2017). California's 2017 Climate Change Scoping Plan. Retrieved from https://ww2.arb.ca.gov/sites/default/files/classic//cc/scopingplan/scoping_plan_2017_es.pdf

[2] Individual gross annual income is verified for standard rebate applicants whereas gross annual household income is verified for low-and-moderate income applicants.

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selected for income verification.[3,4] The vehicle price is the final negotiated price of the vehicle between the applicant and the dealer minus any CVRP rebates applied. Records corresponding to FCEVs and ZEMs were dropped due to their low numbers and different price points. The final sample included 16,626 application records.

Results and Discussion

Applicant Income

The median verified applicant income across the study period was approximately $136,500 with just over half of the incomes between $86,000 and $200,000 (Figure 1). The lack of incomes above $300,000 is due to the income cap implemented by CVRP in 2017.[5] The median income peaked at $139,400 in 2018 (primarily due to Tesla consumers) but has decreased to $129,600 thus far in 2020 (Figure 1). In addition
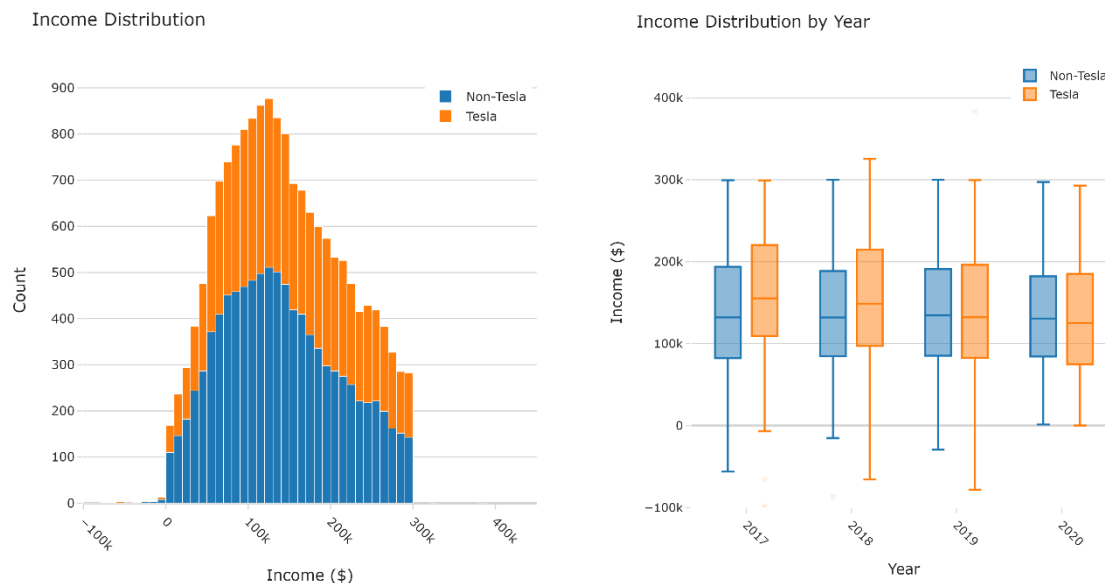

Figure 1. Historgram of applicant income (left) and box plots showing income distributions by year (right) for Tesla and Non-Tesla vehicles.

[3] Applications that were selected for income verification based on application responses (non-random) were dropped to avoid sampling bias.
[4] Income verification was performed on all applications for the Rebate Now program. Accordingly, we randomly selected a subset of applications from this program so that the proportion of sampled participants was consistent with overall program participation rates thereby ensuring that these participants were not overrepresented in the analysis.
[5] California Air Resources Board (2020). Income Eligibility. Clean Vehicle Rebate Project Retrieved from https://cleanvehiclerebate.org/eng/income-eligibility.

to general market changes, the decrease in the median income of applicants is possibly related to the $60,000 MSRP cap implemented in late 2019.

After-Rebate Purchase Price

The median after-rebate purchase price over the study period was approximately $37,500 with approximately half of the prices between $30,000 and $50,000 (Figure 2). However, after-rebate purchase prices have varied significantly across time with a median of $32,000 in 2017 increasing to $47,000 in 2018 before decreasing to approximately $39,000 in 2019 and 2020. The large price increase in 2018 was due to the introduction of the Tesla Model 3 into the market (which accounted for over 45% of vehicles in 2018 relative to less than 2% in 2017) which had higher prices relative to other high-volume models (Figures 1 and 3). The MSRP cap has likely contributed to the contraction in the upper extent of the price distribution in 2020 (Figure 3).
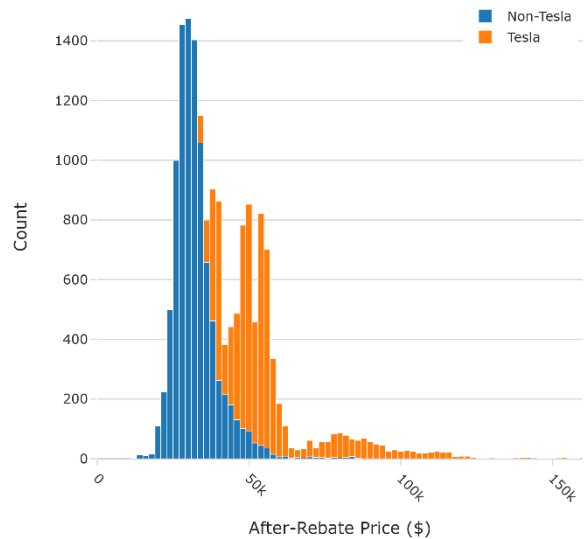

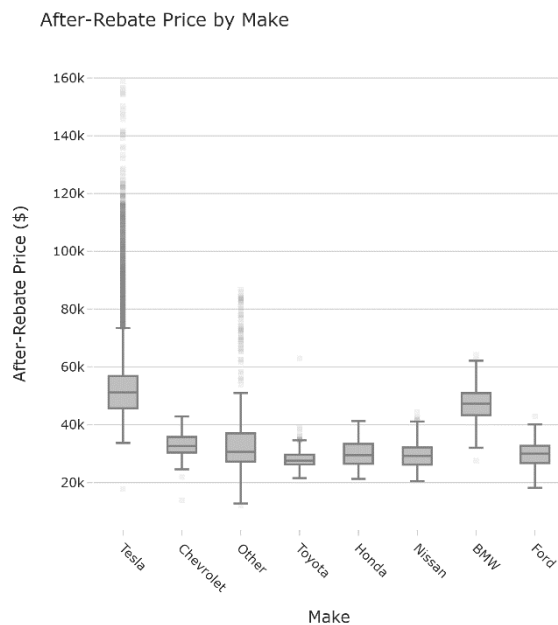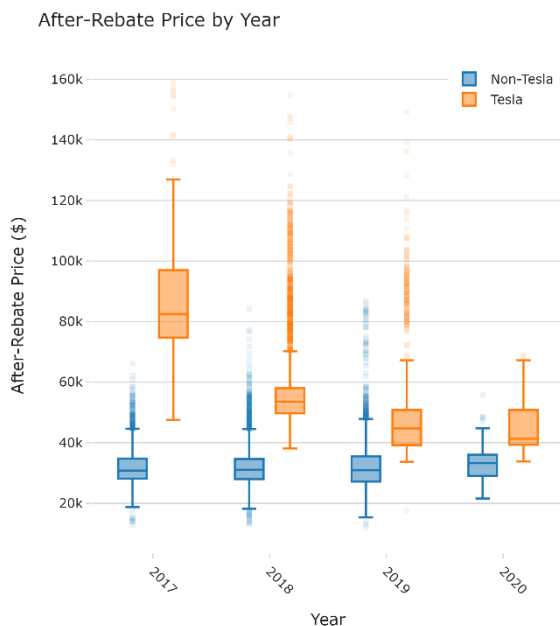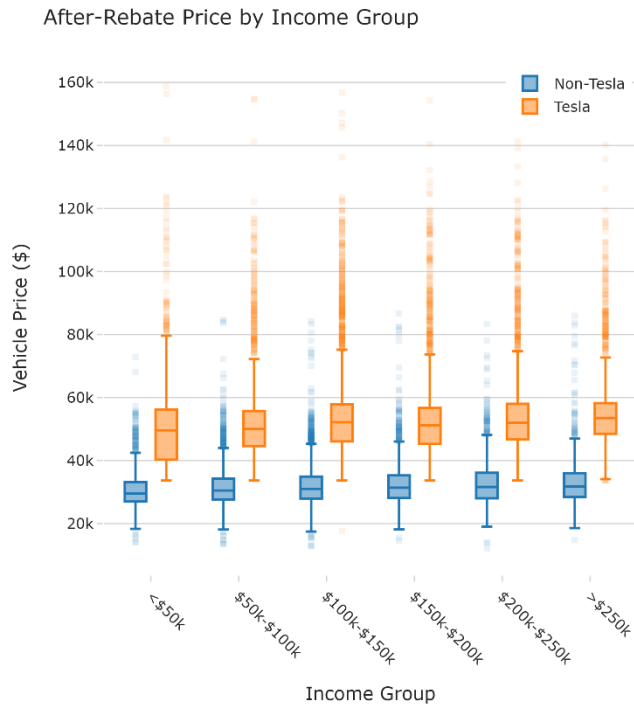*Figure 2. After-rebate purchase price distribution for Tesla and non-Tesla vehicles.*

Figure 3. Vehicle after-rebate purchase price distributions by year (left) and price distributions by make (right).

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After Rebate Purchase Price by Income

There is a positive relationship between applicant income and vehicle price (Figure 4). For example, the median vehicle price for the highest income group was approximately $5,000 greater than the median vehicle price for the lowest income group. This income-price relationship can primarily be attributed to a greater propensity for higher income groups to purchase Tesla models relative to lower income groups. Indeed, 48% of applicants earning more than $250,000 purchased a Tesla relative to only 38% of those earning less than $50,000 (Figure 4).

However, there is substantial variation in the income-price relationship by year with the strongest trend observed in 2018 (Figure 5). In fact, the difference in the median after-rebate purchase price between the lowest and highest income group surpassed $13,000 in 2018 whereas this difference did not surpass $4,000 in any other year during the study period. The strong income-price trend in 2018 was driven by a greater increase in the market share of Tesla Model 3s in higher income groups relative to lower income groups (Figure 6). This trend moderated rapidly in 2019 as Telsa Model 3 prices decreased and the share of lower income applicants purchasing Tesla Model 3s approached levels observed in the highest income groups (Figure 6). Together, the
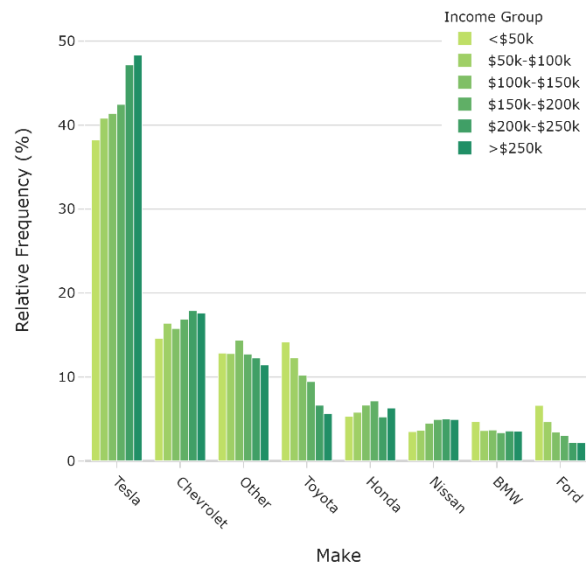

Figure 4. Box plots showing the distribution of vehicle price by income group (top). Share of applicants purchasing different makes by income group (bottom).

decrease in price and the increasing share of lower income groups purchasing Tesla Model 3s in 2019 decreased the median vehicle price by more than $10,000 for highest income group and increased it by over $3,000 for the lowest income group. As such, since the beginning of 2019 there is nearly no discernible difference in the median after-rebate purchase price of vehicles purchased across income groups (Figure 5).
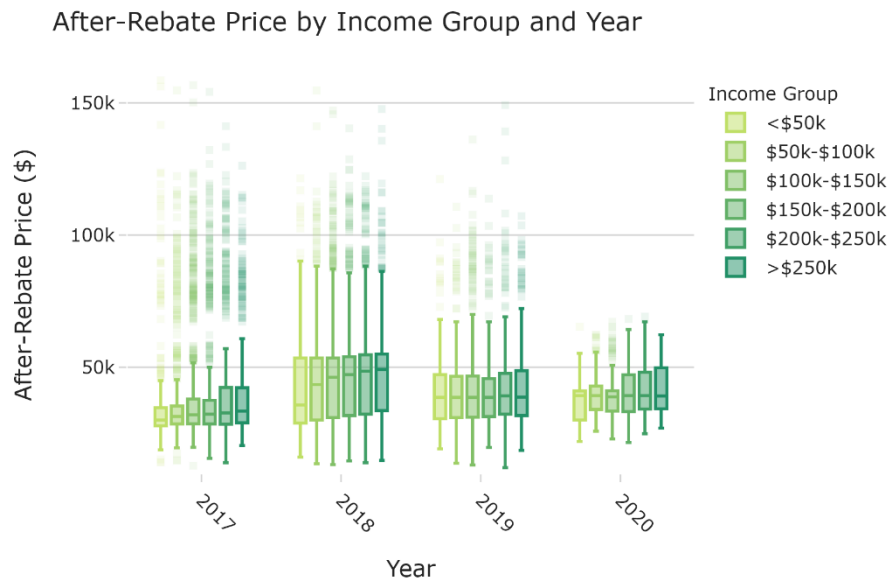

Figure 5. Box plots showing the distribution of vehicle prices by year and income group.

An interesting result of the income-price trend is that it indicates that lower income applicants are purchasing vehicles that are often a substantially greater share of their income than higher income applicants, especially for Tesla vehicles. For example, half of the applicants earning less than $50,000 per year purchased non-Tesla EVs that cost more than 100% of their annual income and, in the case of Teslas, more than 153% (Table 1). Alternatively, more than half of applicants earning more than $150,000 (presumably with more income to allocate to transportation) spent less than 20% of their annual income on non-Tesla vehicles and less than 30% on Teslas. This illustrates the continued need for the increased

rebates that CVRP currently offers to eligible low-to-moderate income (LMI) households,[6] and explains lower EV market pentration in LMI populations.
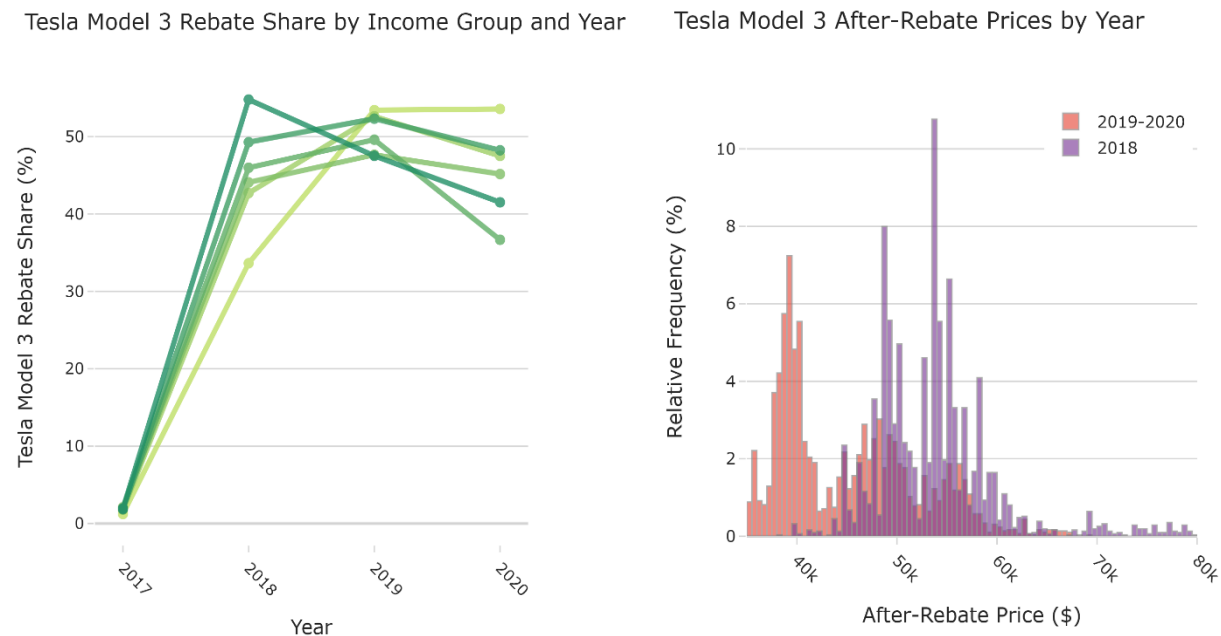

Figure 6. Share of applicants purchasing a Tesla by income group and year (left). Vehicle price distribution for Tesla Model 3 in 2018 and for 2019-2020 (right).

Income Group	All	Teslas	Non-Tesla
<$50,000	121%	153%	96%
$50k-$100k	50%	66%	41%
$100k-$150k	30%	42%	25%
$150k-$200k	22%	29%	18%
$200k-$250k	18%	23%	14%
>$250k	15%	19%	12%

Table 1. Median after-rebate purchase price relative to annual income by income group.

[6] California Air Resources Board (2020). Income Eligibility: Increased Rebate for Low-and-Moderate Income Consumers. Clean Vehicle Rebate Project. Retrieved from. https://cleanvehiclerebate.org/eng/income-eligibility

Conclusions

Although there is an overall relationship between applicant income and after-rebate purchase price, indicating that higher income individuals are more likely to pay more for an EV, this relationship has fluctuated across time due to program and—more importantly—market changes. Indeed, for three of the four years evaluated in this analysis the relationship between income and price was weak or negligible. The only period in which this relationship was strong was in 2018 due to a greater share of higher income applicants purchasing high-priced Tesla Model 3s relative to lower income applicants. Since this time, however, the share of applicants purchasing Model 3s has become relatively uniform across income groups resulting in the relationship between income and price to wane. It is somewhat surprising that the relationship between income and after-rebate purchase price is not more consistent and that many lower-income applicants purchase higher-priced vehicles. In fact, a large share of lower income applicants purchased vehicles that were 50% or even greater than 100% of their annual incomes after CVRP rebates were applied. As such, to better understand the LMI market, future analyses should focus on why some LMI consumers are choosing to purchase relatively high-priced vehicles. One possibility is that the limited number of desirable EVs in the market has caused LMI consumers to purchase vehicles that would typically be outside their price range. It is also possible that some LMI applicants have considerably more wealth than their income would suggest. Overall, a better understanding of the income-price relationship could result in improved forecasts of the market share of new models and inform targeted marketing and outreach activities thereby increasing program efficiency and spurring EV adoption. CSE is undertaking additional research to better understand LMI individuals' price sensitivity to purchase price and lease costs, reliance on other incentive programs to reduce their costs, and views on the perceived value of purchasing an EV.

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