Game Changers: Evidence from Tesla Model 3 Unveiling Announcement

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Abstract

On March 31, 2016, a technologically innovative electric sedan -- Tesla Model 3, which targeted mass-vehicle markets in the U.S, was unveiled. As a game changer, the arrival of Model 3 significantly affected the sedan and hatchback cars rather than cars with other body types. Using eBay used car auction data, we examine how and to what extent the announcement of Model 3 impacts on probability of sale and final price of the used combustion engine sedan and hatchback cars. We find robust evidence of a significant decrease in the buyers' willingness to pay, approximately 6 percent. This price drop can be interpreted as the buyers lowering their expectations on future residual values of the cars.

Introduction

The arrival of Tesla Model 3, which was the first electric sedan that most people would be likely able to afford and the batteries can last for reasonably long-travelling distances, has substantially been changing the existing passenger car markets. At the end of the second quarter of 2021, the Tesla Model 3 had surpassed 1 million cumulative sales. Model 3 has led a popularity of electric vehicles in the car markets. By the start of 2022, sales of electric vehicles rose to 5 percent of total U.S car market share, and moreover, the process in the US is accelerating. In this paper, we shed light on such disruptive changes triggered by the arrival of a technologically innovative product by analyzing the unveiling announcement of Tesla's new model -- Model 3 -- and its impacts on the eBay used car auction market. Model 3 was unveiled by Tesla on March 31 2016, which is a compact and purely battery-powered sedan. Before that, gasoline- or diesel-powered vehicles had dominated the U.S passenger car markets, see Bushey (2023), Randall (2023). Investigating how and to what extent the arrival of a game changer impacts on the existing market will not only deepen our understandings of market evolution, consumers' responses to technological innovations, and impacts of entry of new products, but also provide relevant policy and regulation implications.

Methods and Materials

We use the following difference-in-differences specification to estimate the impact of the Tesla Model 3 unveiling date in the determination of the probability of sale and the auction final price of the sedan and hatchback car group in the used car auction market.

$$Y_{it} = \beta_0 + \beta_1 \text{Unveiling}_t + \beta_2 SH_i + \beta_3 \text{Unveiling}_t \times SH_i + \text{Controls}_{it} + FEs + \epsilon_{it},$$

where i indexes a specific auction listing and t indexes listing time. Unveiling_t is a dummy variable that equals one if the ending time is after the unveiling date (March 31, 2016) for Tesla Model 3; otherwise, equals zero. SH_i is also a dummy variable that equals one if the car's body type is either sedan or hatchback, accounting for possible differences between the treatment group (sedan or hatchback) and control group (SUV, Coupe and Convertible, and Van and Truck). The interaction term $\text{Unveiling}_t \times SH_i$, which we are interested in, becomes one for the sedan and hatchback cars after the unveiling date and its coefficient β_3 measures by how much the probability of sale and the final price varied when the Tesla Model 3 was unveiled. The dependent variable Y_{it} denotes (a) whether auction listing i is successfully sold at time t, and (b) the natural logarithm of the final price, ln (P_{it}), for auction listing i, conditional being sold at time t. In the equation, we have an extensive set of controls (Controls_{it}), which includes the buyer covariates, the seller covariates, and the characteristics of the car and of the auction listing. FEs includes the year and month fixed effects, the seller-geographic (state level) fixed effects, and the car-make fixed effects to control for unobserved heterogeneity among sellers as well as car manufacturers. Standard errors are clustered at the car-make level.

To further investigate the effect of the unveiling announcement on the quantity, we consider the following difference-in-differences specification, in which we first aggregate the numbers of the individual transactions of different body types (SH and non-SH groups) by each week and then use the weekly unit listings and sales as the dependent variable.

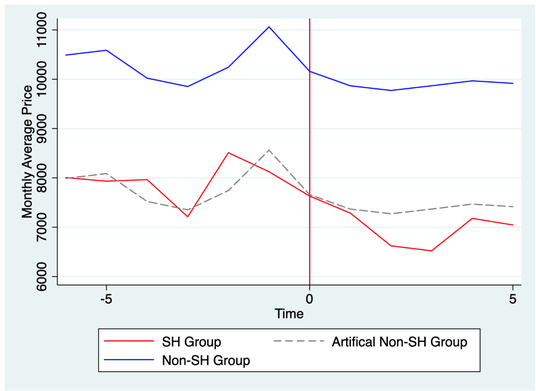

Figure 1. Monthly Average Transaction Prices of the Sold Auction Listings.

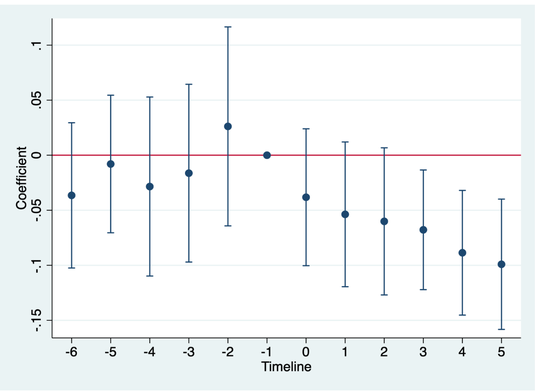

Figure 2. The Impact of the Unveiling Announcement Over Time.

Table 1. The Impacts of the Unveiling Announcement.

	Prob. Of Sale	ln(Price)	ln(Listings)	ln(Sold Listings)
Unveiling × SH	0.004	-0.057***	-0.240	0.038
	(0.00)	(0.02)	(0.23)	(0.35)
Unveiling	0.001	-0.053**	0.087	-0.266
	(0.01)	(0.03)	(0.14)	(0.21)
SH	-0.005	-0.201***	-0.365	-0.589
	(0.00)	(0.05)	(0.75)	(0.36)

Results

Figure 1 presents monthly average transaction prices of successfully sold car auction listings over the sample period. Overall the empirical findings suggest that (a) the unveiling announcement does not affect the probability of sale; (b) the transaction price of the sedan and hatchback group in the used car market was negatively and significantly affected by the announcement of the Tesla Model 3; (c) the coefficients of the inter-action term are statistically insignificant, thereby indicating that the event of the Tesla Model3 unveiling announcement does not affect the listings of and the transactions of the sedan and hatchback car group in the used market. (d) Figure 2 illustrates the impacts of the unveiling announcement on the auction prices (and the corresponding 95 percent confidence intervals) for the sedan and hatchback car group across month periods.

Discussion

Our analysis above regarding the quantities of car listings implies that short-run supply of used cars was not affected by the unveiling announcement, in other words, there is no shift in supply side. In the used car market, the supply of the used cars is reasonably assumed to be fixed and inelastic. Therefore, the equilibrium effect should be almost entirely driven by the downward shift of the demand curve, which explains the observed drop in the short-run equilibrium price and no significant change in the short-run equilibrium quantity of the sedan and hatchback car group. Moreover, all the transactions are through the second-price auction format, where buyers submit their willingness to pay as their bids. This feature implies that the change in the equilibrium price reflects the change in the buyers' willingness to pay directly, see Jia (2008), Farronato and Fradkin (2022), Forsythe et al. (2023).

The unveiling announcement is unlikely to affect the utility of using a used sedan and hatchback, as it mainly depends on the buyer's purpose of purchase. Buyers would expect that the market of the combustion engine cars with the body type of the sedan and hatchback will become smaller and even vanish, replaced by the electric vehicles in the future. As a response, the buyers would lower their expectations on the residual value of the sedan and hatchback car group. Therefore, the estimated drop in the equilibrium price reflects a reduction in the expected residual value of the buyers' willingness to pay.

Conclusions

We find a significant drop in the final auction price (approximately 6 percent) of the sedan and hatchback group after the introduction of the Tesla Model 3. We interpret this reduction in willingness to pay as a lowered buyer expectation on the future residual value of the sedan and hatchback group.

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