Effects of Tax Incentives on Sales of Eco-Friendly Vehicles: Evidence from Japan

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Abstract

This study examines the effects of economic incentives on the sales of eco-friendly vehicles in Japan. We focus on the Tonnage and Acquisition Tax Cuts for Eco-Friendly Vehicles and the two waves of Eco-Car Subsidies implemented in Japan. We use the monthly sales data of 10 vehicles from April 2006 to March 2013. We find that the effects of the tax incentives were more significant than the effect of gasoline price. This is in contrast to results from the United States and Canada, where gasoline prices have had a larger effect on increasing the adoption levels of hybrid electric vehicles. The difference is due to the structure of the tax cut. Japan's policy of taxes paid upon purchase was more effective compared to the policies in the United States and Canada, where certain tax cuts were on income taxes.

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1. Introduction

The Tonnage and Acquisition Tax Cuts for Eco-Friendly Vehicles and the Eco-Car Subsidy were introduced in Japan in April 2009.[1] The purpose of these policies is to mitigate climate change by reducing greenhouse gas emissions. The government plans to achieve these goals by increasing the market share of eco-friendly vehicles and decreasing that of combustion engine vehicles. These policies also aim to support automobile industry sales, given that the Japanese automobile industry was hit by a drop in demand from foreign markets due to the appreciation of the Japanese yen.

This study estimates the effect of these policies on the sales of eco-friendly vehicles. Many other factors might affect the sales of eco-friendly vehicles. These include changes in gasoline price, the price of vehicle models, and household incomes. In particular, the gasoline price might play a significant role in vehicle purchase decisions, since eco-friendly vehicles consume less fossil fuels. Thus, one of the goals of this study is to compare the effects of the tax incentives and the change in the gasoline price on the sales of eco-friendly vehicles.

A growing number of studies have examined the impact of policy incentives on the sales of eco-friendly vehicles. Gallagher and Muehlegger (2011) studied various policies designed to increase the adoption rates of hybrid electric vehicles in the United States across federal, state, and local government levels. The types of policies they studied included tax waivers, income tax credits, and non-tax incentives such as high occupancy lane priority incentives. Sales tax waivers contributed to more than 10 times the increase in hybrid electric vehicle sales compared to income tax credits. They also found that the effect of rising gasoline price on the increase in adoption rates of hybrid electric vehicles was higher than that of the tax incentives. Diamond (2009) analysed the impact of government incentives on hybrid electric vehicles in the United States. He found a strong relationship between gasoline price and hybrid electric vehicles adoption rates, while a weaker relationship existed between adoption rates and tax incentives. He also found that policies that provide direct incentives, such as upfront payments upon

[1] An eco-friendly vehicle is a vehicle that emits fewer greenhouse gases than a conventional vehicle. Thus, it is considered to be beneficial to the environment. The question of which particular vehicle may be considered as eco-friendly or otherwise depends on the country and the context. The definition of an eco-friendly vehicle, as per Japanese policy, is based on fuel economy and exhaust gas emissions.

the purchase of a new vehicle, tend to be the most effective. Chandra et al. (2010) examined the impact of a tax rebate policy for hybrid electric vehicle sales in Canadian provinces. They estimated that 26% of the hybrid electric vehicles sold during the period of the tax rebate program could be attributed to the program itself. On the other hand, they also noted that the program subsidised consumers who were planning to buy a hybrid electric vehicle in any case. There was a decrease in the market share of combustion engine models and an increase in the market share for hybrid electric vehicles. Beresteanu and Li (2011) studied hybrid electric vehicle demand and the effects of the income tax credit incentives and gasoline price in the United States. They estimated that in 2006, the government incentive program was responsible for 20% of hybrid electric vehicle sales, while the increase in gasoline price from 1999 levels contributed to a 37% increase in hybrid electric vehicle sales.

While most of the previous studies suggest that the effect of gasoline price is important, there is reason to believe that these effects would have less impact than a tax cut policy. First, the change in gasoline price is uncertain. Even if consumers face rising gasoline prices, it might be a temporal phenomenon and could recede in the near future. Second, most of the effects of gasoline prices occur in the future. Consumers may largely discount the future cost savings of energy-efficient goods, so much so that sometimes, the discount rate may be considerably higher than the market interest rate. Third, cost savings through policy instruments are typically announced at the time of purchase of a new car, and consumers can easily recognize such an opportunity.

The main focus of this study is to compare the effect of tax incentives versus that of gasoline price on eco-friendly vehicle sales. While previous studies found that gasoline price had a larger effect than tax incentives on hybrid electric vehicle sales in both the United States and Canada, this may not be the case for Japan because of the difference in policy design. Our result suggests that while the gasoline price has a considerable effect on sales of eco-friendly vehicles in Japan, tax incentives have a significantly larger effect.

The contribution of this study is twofold. First, this study includes not just hybrid electric vehicles but all types of eco-friendly vehicles. The nature of Japan's tax incentives facilitated such a study, as the policy also includes vehicles (other than hybrid electric vehicles) that emit fewer greenhouse gases. Second, many studies used

data from the United States, where the tax cut is not offered directly at the point of purchase. The tax cut policy in Japan is more direct and easy to understand; it is essentially a reduction in the taxes consumers pay upon purchasing an eco-friendly vehicle and upon paying taxes during the mandatory vehicle inspection. The benefits or reductions in taxes are reaped quickly without complications. Conversely, the tax cut policies in the United States are indirect and complicated. For example, the United States employs an income tax credit scheme to implement tax incentives for hybrid electric vehicles. This scheme provides income credits to consumers who buy hybrid electric vehicles, which can be used to reduce the income tax collected from them. Therefore, the benefits are not directly related to the taxes paid upon purchase; instead, they are related to other taxes, such as income taxes, paid by the consumer. This distinction is very important in terms of differing consumer reactions to tax policies in Japan compared to those in other countries.

Section 2 provides an overview of the Tonnage and Acquisition Tax Cuts for Eco-Friendly Vehicles and the Eco-Car Subsidy, and changes in the demand trends for some vehicles in reaction to changes in gasoline price. In Section 3, we list the data sources used in this study, explain our choice of this particular dataset, and detail the method used in the analysis of the effects of the tax cut policy on eco-friendly vehicle sales. Finally, in Section 4, we interpret the estimated results from the analysis and discuss their implications.

2. Incentives for Purchasing Eco-Friendly Vehicles

The Japanese government introduced the Tonnage and Acquisition Tax Cuts for Eco-Friendly Vehicles and the Eco-Car Subsidy in April 2009 as a part of the FY 2009 Tax Reform legislation,[2] a document produced every fiscal year by the Tax Bureau of the Ministry of Finance. The policy was originally proposed by the Japanese Automobile Workers' Union[3] and later passed by the Ministry of Finance. The tax cut was supposed to end by March 2012, but it was extended until April 2015. The decision

[2] The FY 2009 Tax Reform document was retrieved from http://www.mof.go.jp/english/tax_policy/tax_reform/fy2009/tax2009a.pdf.
[3] The original request (in Japanese) for the policy can be found at http://www.meti.go.jp/main/downloadfiles/zeisei24/youbou_165.pdf.

for the extension of this policy is documented in the FY 2012 Tax Reform legislation.[4] A part of the reason for the extension was the appreciation of the yen, which negatively affected global demand for Japanese automobiles. The program was extended in order to support automakers and help them make up their losses in the global market by increasing sales in the domestic market.

Table 1 details the Tonnage and Acquisition Tax Cuts for Eco-Friendly Vehicles. Depending on its level of greenhouse gas emissions, a vehicle be considered eco-friendly and may enter the program. There are three levels of tax cuts: 50%, 75%, and 100%. The more eco-friendly the vehicle, the higher the tax cut. Hybrid electric vehicles and electric vehicles are eligible for a 100% tax cut, which means that the acquisition tax at the time of purchase and the tonnage tax at the vehicle's first inspection are waived completely for these vehicles. For example, the Toyota Prius, a hybrid electric vehicle, avails a 100% tax cut, while the Honda Fit, which is not hybrid but eco-friendly, avails a 50% tax cut. The tax cut is applicable to two taxes: the acquisition tax and the tonnage tax. Acquisition tax is the tax paid upon the purchase of the vehicle, while tonnage tax is the tax paid during its first mandatory inspection, which should take place within three years from the time of vehicle purchase and once every two years thereafter.

Table 2 explains the Eco-Car Subsidy. The first wave of the subsidy was implemented from April 2009 to September 2010, and the second wave, from December 2011 to September 2012. The first wave of the program encouraged the retirement of old vehicles. If a consumer replaced a combustion engine vehicle owned for 13 years or more with an Eco-Car (an environmentally friendly vehicle), he/she would either receive 250,000 yen for buying a hybrid vehicle or 125,000 yen for buying a light motor vehicle. When a consumer chooses to buy an Eco-Car without the aforementioned vehicle replacement, he/she is eligible to receive 100,000 yen while buying a hybrid vehicle or 50,000 yen while buying a light motor vehicle. The second wave of the program did not encourage the retirement of old vehicles and simply offered a consumer 100,000 yen for buying a hybrid vehicle or 70,000 yen for buying a light motor vehicle.

[4] The FY 2012 Tax Reform document was retrieved from http://www.mof.go.jp/english/tax_policy/tax_reform/fy2012/tax2012a.pdf.

According to the data used in this study, there was a sizable increase in the sales of eco-friendly vehicles after the implementation of the tax incentives, especially for hybrid electric vehicles such as the Toyota Prius. Figure 1 shows the sales of the Toyota Prius and the average price for regular gasoline in Japan from April 2006 to March 2013. We can see that after the implementation of the tax incentives, there was a sharp rise in sales. The sharp decline in Prius sales in April and May 2011 can be attributed to the 2011 East Japan Great Earthquake and Tsunami.

While Figure 1 suggests a relation between the tax incentives policy and the rise in Toyota Prius sales, different vehicle models might have a different reaction to the tax incentives and changes in gasoline prices. Figure 2 shows the sales data for the Toyota Vitz and gasoline prices from April 2006 to March 2013. We can see that there is no sudden increase in Vitz sales after the introduction of the tax incentives, unlike the case of the Prius. Therefore, we need to consider the different impact of the tax cuts on different vehicle models.

3. Data and Method

3.1. Data

Our data set contains the monthly sales of 10 vehicles in Japan that fall under the Tonnage and Acquisition Tax Cuts for Eco-Friendly Vehicles and the Eco-Car Subsidy. The vehicles are Toyota Prius, Honda Fit, Toyota Vitz, Toyota Corolla, Nissan Serena, Toyota Passo, Honda Step Wagon, Toyota Voxy, and Mazda Demio. All these vehicles were among the top selling 30 vehicle models from April 2006 to March 2013.

Table 3 shows the 10 vehicles with the corresponding tax cut percentage and manufacturer information. Data for monthly sales numbers from April 2006 to March 2013 for each vehicle are sourced from the monthly sales statistics for new passenger cars, released by the Japan Automobile Dealers Association.[5]

[5] The official title of the source is *Shinsha Jouyousha Hanbai Daisu Rankingu* (New Passenger Car Sales Ranking). Source: http://www.jada.or.jp/contents/data/ranking/index.php.

Vehicle prices in Japan are sourced from the Manufacturer's Suggested Retail Price (MSRP) list, which is typically posted on the manufacturer's website.[6] The data set covers the MSRP prices for all 10 vehicles from April 2006 to March 2013.

Average monthly prices of regular gasoline in Japan are obtained from the website of the Institution of Energy Economics Japan, specifically from the Oil Information Center. The website is updated on weekly and monthly bases for the prices of different types of gasoline across Japan.[7]

We use the monthly average income per capita as a proxy for the household budget constraint. The data are sourced from the Family Income and Expenditure Survey,[8] which appears monthly on the websites of the Statistics Bureau and the Director General for Policy Planning of Japan.

Table 4 shows a summary of the descriptive statistics for the datasets. Since the tax incentives were introduced in April 2009, we require data before and after the implementation of the tax incentives to conduct our study and to compare the difference in sales numbers with and without the tax incentives. Thus, the time period of the data spans from April 2006 to March 2013.

3.2. Method

We regress the sales numbers of eco-friendly vehicles on various explanatory variables using the fixed effects model. We use the following equation:

$$lnVehicleSales_{tm} = \alpha + \beta_1 lnPrice_{tm} + \beta_2 lnGasoline_t + \beta_3 lnIncome_t + \beta_4 TaxCut100_{tm} + \beta_5 TaxCut75_{tm} + \beta_6 TaxCut50_{tm} + \beta_7 SubsidyOne_t + \beta_8 SubsidyTwo_t + \beta_9 lnEarthquake_t + \beta_1 lnFixedEffects_m + \varepsilon$$

The fixed effects model was chosen over the pooled ordinary least squares (OLS) model on the basis of the F-test. The dependent variable $lnVehicleSales_{tm}$ represents the log of sales for month *t* and vehicle *m*. The independent variables contain economic

[6] We took the average of MSRP for each model of each vehicle being sold at the same period. The data of the past editions of the vehicles are obtained from the archived catalogues posted on the website.
[7] The official title of the source is *Kyuyusho Gasorin Keiyu Toyu Shujichosa* (Weekly Survey on Prices of Gasoline, Light Oil, Kerosene). The data are retrieved from http://oil-info.ieej.or.jp/price/price.html.
[8] The data are retrieved from http://www.stat.go.jp/english/index.htm.

factors that may affect sales. The first variable is $lnPrice_{tm}$, the logged MSRP for vehicle model *m* in month *t*. The second variable is $lnGasoline_t$ is the logged average regular gasoline price in Japan in month *t*. The third variable is $lnIncome_t$, the log of average income per capita in Japan in month *t*.[9] $TaxCut100_{tm}$ is a dummy variable that indicates whether the vehicle model is included in the 100% tax cut program for vehicle model *m* in month *t*, where 1 indicates that it is part of the tax cut program and 0 indicates otherwise. The corresponding variables for vehicle models in the 75% and 50% tax cut program are $TaxCut75_{tm}$ and $TaxCut50_{tm}$ respectively. $SubsidyOne_t$ and $SubsidyTwo_t$ are dummy variables that indicate that the period of the first wave and that of the second wave of the subsidy were in effect, respectively. $Earthquake_t$ is a dummy variable for April and May 2011 and is added to consider the impact of the 2011 East Japan Great Earthquake and Tsunami. $FixedEffects_m$ is a dummy variable that allows capturing the time-invariant effects of each vehicle model. ε is the error term.

4. Results and Implications

4.1. Results

The estimated results are shown in Table 5. All the estimated coefficients, except for $lnTaxCut50$, are in line with the expected sign. Model 1 includes the earthquake dummy, and Model 2 excludes it; however, the estimated results between the models are not so different. Model 3 includes an additional variable, $lnTotalSales_t$ which is the log of the total number of sales for all vehicles for month *t*. Regarding Model 1, $lnPrice$ and $SubsidyTwo$ are significant at the 5% level, $TaxCut75$ and $TaxCut50$ are significant at the 10% level, and the remaining coefficients are significant at the 1% level.

The coefficient of $TaxCut100$ indicates the effect of the tax cut policy on eco-friendly vehicle sales with full tax exemption. The estimated coefficient is 0.872 and is significant at the 1% level. The tax cuts at the 100% level contributed to 87.2% of the

[9] The average income level in Japan for a specific month is calculated by taking the average income data for all prefectures for that specific month and averaging them.

rise in eco-friendly vehicle sales. Note that the 100% category includes only hybrid electric vehicles. The only hybrid electric vehicle in this study is the Toyota Prius.

The estimated coefficient of $TaxCut75$ is 0.086 and is significant at the 10% level. Therefore, the tax cuts at the 75% level contributed to 8.6% of the rise in the sales of eco-friendly vehicles in the 75% category. On the other hand, the coefficient of $TaxCut50$ is estimated as -0.075 and is significant at the 10% level. Thus, the tax cuts at the 50% level contributed to a 7.5% decrease in the sales of eco-friendly vehicles in the 50% category. The negative sign suggests that the tax cut caused an unfavourable effect on vehicle sales in this category. This might be due to the shift in demand from this category of eco-cars to the other categories, namely those eligible for either the 100% or the 75% tax cut.

The coefficient of $SubsidyOne$ is positive and significant at the 1% level. The estimated coefficient means that the subsidy contributed to 21.5% of the rise in eco-friendly vehicle sales. The coefficient of $SubsidyTwo$ is also positive and significant at the 5% level. The coefficient of the second wave of the subsidy is 0.107 and smaller than that of the first wave. This is reasonable since, as explained in Section 2, the second wave of the subsidy was less generous than the first.

The coefficient on $lnGasoline$ is 0.446 and is significant at the 1% level. Thus, a 1% rise in the price of gasoline would increase eco-friendly vehicle sales by 0.446%. Because eco-friendly vehicles do not consume as much gasoline as combustion engine vehicles, it is natural that people would buy vehicles that do not require a lot of gasoline when gasoline prices are high. The rise in eco-friendly vehicle sales by 0.446% indicates that Japanese consumers are fairly sensitive to the gasoline price.

The coefficient of $lnPrice$ is -0.488 and is significant at the 5% level. This means that a 1% increase in the price of eco-friendly vehicles leads to a -0.488% decrease in their sales numbers. The direction of the relation in $lnPrice$ fits the theory, because demand falls when the price rises.

The coefficient of $lnIncome$ is -0.198 and is significant at the 1% level. This means that as income rises, the demand for eco-friendly vehicles decreases slightly (a 1% rise in demand decreases the sales of eco-cars by 0.198%). This is somewhat odd but can be interpreted as follows: as people gain more income, they will be able to

afford more gasoline, and they would not have to buy vehicles that have better fuel efficiency (namely, eco-friendly vehicles).

In model 3, we found that a 1% increase in $lnTotalSales$ increases sales by approximately 1%. Also $lnGasoline$, $lnIncome$, $TaxCut50$ and $SubsidyTwo$ coefficients were not significant. Other than that the results in model 3 are not so different from model 1.

Table 6 shows a different specification of the same models in Table 5 but with the tax cut dummy variables lumped together into one dummy variable. The significance of the variables and the sign are the same as those in the separated tax cut levels model, but the benefit of this specification is that it is easier to compare the effects of the tax cuts and gasoline price without concern about the different levels of tax cuts.

4.2. Implications

The estimated result suggests that the demand for eco-friendly vehicles is affected by gasoline price positively. The coefficients on the gasoline price variable are 0.446: a 1% rise in the gasoline price would cause a rise of 0.446% in sales. This is sizable effect since it is almost similar to the estimated effect of the decrease in vehicle prices (0.488%).

In our result, the Tonnage and Acquisition Tax Cut for Eco-Friendly Vehicles affected sales positively and more than gasoline price. The coefficient on the tax cuts in the 100%, 75%, and 50% categories suggest that because of the tax cuts, demand rose by 87.2% and 8.6% and fell by 7.5% respectively. We can see that the positive effect of the tax cuts is clearly larger than their negative effect, mainly due to the tax exemptions for hybrid electric vehicles. Comparing the coefficients clearly shows that the tax cuts had a larger effect than gasoline price in increasing the adoption rate of eco-friendly vehicles in Japan. In addition, using the results in Table 6, we can compare the lumped tax cut dummy coefficients (0.159) with the logged gasoline price coefficients (0.395) respectively. The interpretation here is that tax cuts increased sales by approximately 16%, and a 1% rise in the gasoline price increased sales by approximately 0.4%. In other words, to have the same impact as tax cuts, gasoline price should be increased by 40%.

According to Gallagher and Muehlegger (2011), gasoline price affected the rise in the demand for hybrid electric vehicles more than the tax incentives. Similar results were found by Diamond (2009). The directness and simplicity of the Japanese tax cut differentiates it from other tax cut policies being implemented with similar purposes in the United States and Canada. The tax cut policy for hybrid electric vehicles in the United States and Canada is not the biggest factor affecting the rise in hybrid electric vehicle sales, because the tax cuts were not immediate. The consumer does not obtain the subsidy the moment he/she buys the car; instead, it is provided in the form of an income tax credit or a tax rebate. Another reason for tax cut policies not playing a big role in the United States and Canada is that they are difficult for consumers to understand, which discourages people from attempting to apply for the tax cut programs. These two characteristics are not relevant to the Tonnage and Acquisition Tax Cuts for Eco-Friendly Vehicles in Japan, as it offers immediate benefits and is easy to understand. Providing tax incentives on acquisition or consumption taxes is more effective in increasing the demand for eco-friendly vehicles than implementing those cuts on income tax.

The other tax incentive is the Eco-Car Subsidy. It was a large factor in increasing sales; the first wave increased sales by 21.5%, and the second wave, by 10.7%. The impact of the Eco-Car Subsidy was less than that of the 100% tax cut but more than that of 75% and 50% tax cuts, and gasoline price. In the lumped tax model the subsidy had a comparable effect to that of the tax cut.

The purpose of these tax incentives is to increase the adoption rates of eco-friendly vehicles in order to reduce greenhouse gas emissions, which in turn would improve Japan's atmospheric environment. Another goal is to support Japan's automobile market, which was hit by a decreased in export demand because of the appreciation of the Japanese Yen. Our results imply that the policies were successful in increasing the adoption rates of eco-friendly vehicles.

5. Conclusion

This study estimated the impacts of the Tonnage and Acquisition Tax Cut for Eco-Friendly Vehicles and the Eco-Car Subsidy on the sales of eco-friendly vehicles in

Japan. In the United States, gasoline price played a larger role than tax incentives in increasing the sales of hybrid electric vehicles. The effect of the tax incentives in Japan is unlike that in the United States, and in fact, the tax incentives play a larger role in the increase of eco-friendly vehicle sales compared to gasoline price. This is because the Japanese tax incentives can be realised immediately and are easy to understand, while those in the United States are indirect and complicated.

The results of this study have implications for the design of policies for promoting eco-friendly vehicles. First, consumers react substantially to tax cuts and subsidies on automobile purchases when the cuts come in the form of direct cuts in taxes paid upon purchase. However, the budget used for the subsidy is huge so that the efficiency of the policy should be scrutinized. Second, consumers are not as sensitive as expected to the gasoline price, but it nevertheless is an important factor, with consumers preferring vehicles with better fuel efficiency when gasoline price rise. Last, but not least, while deciding on new vehicle purchases, the average Japanese consumer is more sensitive to tax incentives than gasoline price. This indicates that tax incentives and subsidies can encourage buying eco-friendly vehicles. Conversely, the effect of the rise in gasoline prices tends to be more uncertain; the opportunity of saving on gasoline use by buying an eco-friendly vehicle is not easy to understand.

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Figure 1: Prius Sales and Gasoline Prices

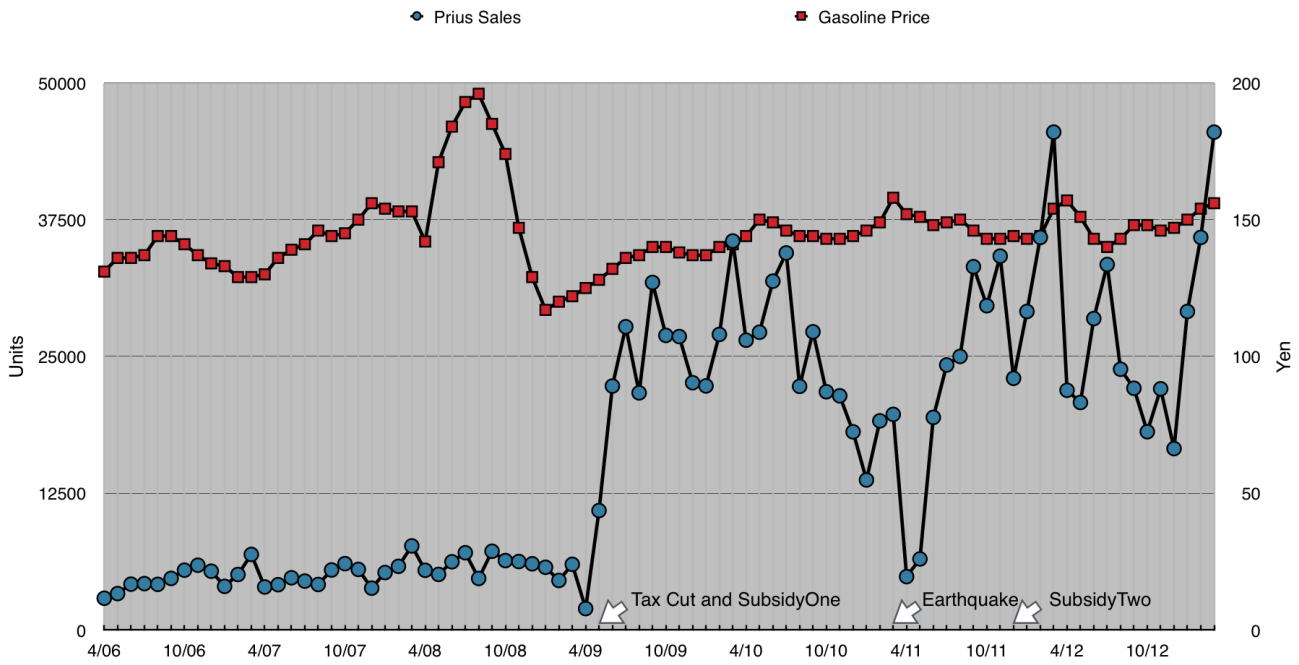

Figure 2: Vitz Sales and Gasoline Prices

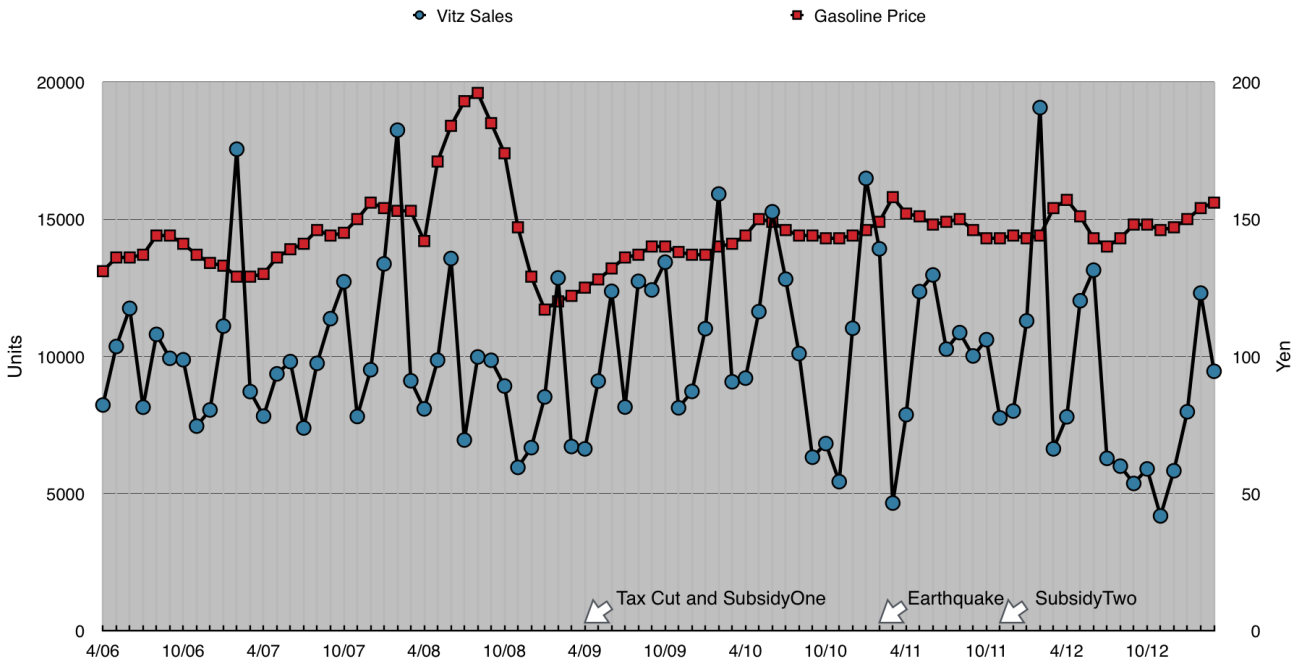

Table 1: Tonnage and Acquisition Tax Cut for Eco-Friendly Vehicles

	Hybrid Electric Vehicle	**Low-Emission Passenger Vehicles**	
		Exhaust emissions down by 75% from 2005 standards	Exhaust emissions down by 75% from 2005 standards
		Fuel efficiency 25% above 2010 standards	Fuel efficiency 15% above 2010 standards
Tonnage Tax Cut	100%	75%	50%
Acquisition Tax Cut	100%	75%	50%

Note: The effective period of the Tonnage Tax Cut was from 1 April 2009 to 30 April 2012 and that of the Acquisition Tax Cut was from 1 April 2009 to 31 March 2012. After March 2012, the fuel efficiency standards were revised to those for 2015.

Source: Japanese Automotive Dealers Association
http://jama-english.jp/asia/news/2009/vol36/index.html.

Table 2: First and Second Waves of the Eco-Car Subsidy

	First Subsidy Wave		Second Subsidy Wave
Period	April 2009 to September 2010		December 2011 to September 2012
Conditions	Replace a combustion engine vehicle used for over 13 years with an Eco-Friendly Vehicle	Buy an Eco-Friendly Vehicle	Buy an Eco-Friendly Vehicle
Subsidy Amount	Passenger car: 250,000 yen	Passenger car: 100,000 yen	Passenger car: 100,000 yen
	Light-motor car: 125,000 yen	Light-motor car: 50,000 yen	Light-motor car: 70,000 yen
Budget	580,000 million		270,000 million

Source: http://www5.cao.go.jp/keizai3/2012/1222nk/keizai2012-2013pdf.html.

Table 3: Levels of Tax Cuts

Maker	Model	Maximum Tax Cut
Toyota	Prius	100%
Toyota	Corolla	75%
Toyota	Voxy	75%
Honda	Step Wagon	75%
Nissan	Cube	75%
Nissan	Serena	75%
Mazda	Demio	75%
Toyota	Passo	50%
Toyota	Vitz	50%
Honda	Fit	50%

Table 4: Descriptive Statistics

Variable	Mean	Std. Dev.	Max	Min	Observations
$lnVehicleSales$	8,146.643	6,102.125	45,496	1,357	840
$lnPrice$	1,966,677	591120.2	3,200,000	1,060,000	840
$lnIncome$	522,316.2	146990.5	968,846	413,506	84
$lnGasoline$	145.226	13.861	196	117	84
$TaxCut100$	0.071	0.2588	1	0	840
$TaxCut75$	0.127	0.334	1	0	840
$TaxCut50$	0.211	0.408	1	0	840
$SubsidyOne$	0.202	0.404	1	0	84
$SubsidyTwo$	0.119	0.326	1	0	84

Table 5: Estimation Results

Variable	Model 1	Model 2	Model 3
Const	16.129*** (3.349)	14.192*** (3.442)	4.719* (2.760)
$lnPrice$	−0.488** (0.218)	−0.377* (0.224)	−0.597*** (0.176)
$lnGasoline$	0.446*** (0.152)	0.406*** (0.156)	0.126 (0.123)
$lnIncome$	−0.198*** (0.057)	−0.158*** (0.059)	−0.054 (0.047)
$TaxCut100$	0.872*** (0.072)	0.848*** (0.075)	0.940*** (0.059)
$TaxCut75$	0.086* (0.047)	0.037 (0.048)	0.140*** (0.038)
$TaxCut50$	−0.075* (0.044)	−0.132*** (0.044)	−0.002 (0.035)
$SubsidyOne$	0.215*** (0.034)	0.235*** (0.035)	0.177*** (0.028)
$SubsidyTwo$	0.107** (0.047)	0.157*** (0.048)	−0.030 (0.039)
$Earthquake$	−0.654*** (0.090)	-	0.084 (0.081)
$lnTotalSales$	-	-	1.017*** (0.049)
Number of Observations	840	840	840
Adjusted R-squared	0.601	0.575	0.739

*** Significant at 1%; ** Significant at 5%; * Significant at 10%.
Numbers in parenthesis are standard errors.

Table 6: Lumped Tax Cut Estimation Results

Variable	Model 1	Model 2	Model 3
Const	28.971*** (3.368)	27.363*** (3.467)	17.435*** (2.881)
$lnPrice$	−1.362*** (0.218)	−1.275*** (0.225)	−1.463*** (0.182)
$lnGasoline$	0.395** (0.163)	0.350** (0.168)	0.075 (0.137)
$lnIncome$	−0.196*** (0.061)	−0.152** (0.063)	−0.052 (0.052)
$TaxCut$	0.159*** (0.035)	0.107*** (0.035)	0.225*** (0.029)
$SubsidyOne$	0.252*** (0.037)	0.276*** (0.038)	0.214*** (0.031)
$SubsidyTwo$	0.118** (0.051)	0.173*** (0.052)	−0.018 (0.043)
$Earthquake$	−0.708*** (0.096)	-	0.031 (0.090)
$lnTotalSales$	-	-	1.018*** (0.054)
Number of Observations	840	840	840
Adjusted R-squared	0.540	0.511	0.679

*** Significant at 1%; ** Significant at 5%; * Significant at 10% level.
Numbers in parenthesis are standard errors.