GOING GREEN TO SELL BROWN?

QUANTIFYING THE SPILLOVER OF GREEN PRODUCTS ON CONSUMER ATTITUDES AND UMBRELLA BRAND SALES

A THESIS SUBMITTED TO
THE GRADUATE SCHOOL OF BUSINESS
OF
ÖZYEĞİN UNIVERSITY

BY

BASAR OZCAN

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR
THE DEGREE OF DOCTOR OF PHILOSOPHY
IN
THE DEPARTMENT OF BUSINESS

JUNE 2017

Approved by:

Prof. Dr. Koen Pauwels _____
(Thesis Advisor)

Prof. Dr. Aysegul Ozsomer _____
(Thesis Advisor)

Asst. Prof. Dr Emre Soyer _____

Asst.Prof.Dr. Nukhet Harmancioglu _____

Asst.Prof.Dr. Remzi Gozubuyuk _____

June 2017

To my dear wife and family for their constant and unconditional support

ABSTRACT

Despite growing consumer attention to the environment, it is still unclear how and how much companies benefit from their large investments in 'green' products. This paper quantifies the positive spillover of sustainable green products on the umbrella brand's other ('brown') product sales. The conceptual framework builds on halo effects, signalling and umbrella branding to develop hypotheses on attitude spillover and its conversion to higher brown product sales. The author tests this framework with data on Toyota Prius' first eight years of marketing mix, attitude metrics and sales. The vector autoregressive model shows significant improvement from incorporating green product attitude metrics in the sales forecasts for Toyota's other products. Not all brown products benefit from gains in Prius attitudes, only the less expensive brands do so. These results suggest interesting trade-offs between substitution effects and positive spillover effects of green products in an umbrella brand's portfolio.

ÖZET

Tüketicilerin büyüyerek çevreye yönelen dikkatlerine rağmen, firmaların büyük miktardaki yeşil urun (çevreci) yatırımlarından nasıl ve ne kadar fayda gördükleri hala net değildir. Bu calisma, surdurulebilir yesil urunlerin semsiye markanin kahverengi urunlerine ne miktarda pozitif tasma etkisi yaptigini belirlemektedir.

Çalışmanın kavramsal çerçevesi, hale etkisi, sinyal ve şemsiye marka teorileri üzerine inşa edilerek davranış taşmasının daha yüksek kahverengi urun satısına dönüşmesi olgusu üzerine hipotezler geliştirilmiştir. Yazar, bu kavramsal cerceveyi Toyota Prius'un ilk sekiz yillik pazarlama karmasi, davranis metrikleri ve satis datasi ile test etmistir. Vektör oto regresyon modeli, Toyota'nın diğer ürünlerinin satışları tahmin edilirken yeşil urunun (Prius) tutum metriklerinin eklenmesi ile anlamlı gelişim göstermektedir. Bütün kahverengi ürünler değil, sadece daha ucuz ürünler Prius kaynaklı tutum kazanımlarından fayda görmektedir. Bu sonuçlar, şemsiye marka portföyü içindeki yeşil urun için, yerine koyma etkisi ve pozitif taşma etkisi arasında enteresan ödünleşimler önermektedir.

ACKNOWLEDGMENTS

First of all, I am grateful to Prof.Dr. Koen Pauwels, my thesis Advisor, for his close coaching, deep interest in my research, and displaying high levels of ownership of my work and me. I would not have been able to complete my thesis without his continuous motivation, high levels of energy, and patience. He made it possible for me to succeed on this long journey by always guiding me and showing me how to overcome obstacles along the way. I benefitted tremendously from his internationally acknowledged, deep expertise and knowledge throughout the research process. I gained first hand experience by observing him on his approach to scientific research and innovation. But equally importantly, he has been a role model on how to be a scientist within a master-apprentice relationship, which has been an important part of science since ancient Greece.

The co-advisor of my thesis Prof.Dr.Aysegul Ozsomer has been another tremendous supporter. She has been a true source of inspiration for me from the first moment I sat in her class. It has been my privilege to observe her approach to science, and learn from her to think innovatively in the face of adversity. I am grateful to have had the chance to observe and be inspired by the key behavioral drivers of her outstanding reputation among the Marketing Science community. It will be my honor to complete our research on Brand Love and Consumer Innovativeness together.

Asst.Prof.Dr Emre Soyer, the youngest member of my thesis follow up committee, has been another key source of inspiration and motivation for me. Every time we come accross during the long nights at the office or over a cup of coffee, his passionate questions, and excitement has provided me with renewed energy. His questions, comments, and ideas during the thesis review have been highly beneficial for me. I am following his work and research with a strong appreciation.

I would also like to thank Asst.Prof Nukhet Harmancioglu and Asst.Prof. Remzi Gozubuyuk for taking the time out of their very busy agendas to be part of the Jury for my Thesis defense. I am grateful for their comments and support for this thesis.

Asst.Prof.Dr. Nukhet Harmancioglu has been one of the few critical people who encouraged me to pursue my dream of Ph.D. It has been invaluable for me that she put aside the time to get to know me, and to guide me at the very onset of my journey. I have not had the opportunity to work with her during my Ph.D education, however, I sincerely hope to work together on a subject related to innovation.

Last but not least, I would like pass my gratitude, respect and gratefulness to all my professors at Bogazici University Chemical Engineering B.Sc and M.Sc, Executive MBA at Koc University, and Ph.D at Ozyegin University. Their direct or indirect contributions have been very instrumental to the completion of this dissertation.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

QUANTIFYING THE SPILLOVER OF GREEN PRODUCTS ON CONSUMER ATTITUDES AND UMBRELLA BRAND SALES

1.1 Introduction

"Forget the Porsche, drive a Prius if you want to impress the ladies" Greene, April 22nd 2014

"[The Prius is] affordable because Toyota sells it at a loss, and it can afford to sell it at a loss because it is selling twice as many gas-guzzling pickup trucks of the sort our president detests" George Will, May 5th 2009.

With over half of Americans concerned about the environment (Newport 2017) companies are launching thousands of new green products a year (Makower 2009). Companies market green products not only to help the environment, but also to increase competitive advantage by tapping large and growing markets (Olson 2013). However, when the price differential with standard (a.k.a. 'brown') products is high, sales and profits of such green products often remain low (e.g. Bezawada and Pauwels 2013). A prominent example in the car industry is the Toyota Prius, launched June 2000 in the U.S. Toyota spent over $235M in Prius media communication, achieving 83% awareness and 55% 'excellent opinion' by June 2009. While Prius sales were considered a success *for a hybrid car* (reaching 7% of total Toyota sales), it is unclear whether Prius profits compensated for the large costs of developing and marketing the green product (Smith 2008, Will 2009). Likewise, with the Leaf only after years starting to make operational profit, Nissan's big bet on the electric vehicle had much to do with boosting its overall corporate image (Cole 2014). Similar to other 'halo cars' (Moore and James 1978), managers may hope for spillovers from green products to their brown products. But do launching and marketing a green product substantially

increase sales of the company's other products? If so, through which consumer mindset metric?

Previous literature is rich on the conceptual and practical benefits of sustainable products for companies (e.g. Hult 2011, Kumar and Christodoulopoulou 2014). These benefits include operational efficiencies, penetration of green markets, internalized environmental values, innovation and early-mover competitive advantages (Bansal and Roth 2000, Johnson 2009, Norcia and Tigner 2000, Porter and Van der Linde 1995, Stafford and Hartman 1998). Moreover, a firm's green performance is associated with higher return on assets and less idiosyncratic risk (Russo and Fouts 1997, Bansal and Clelland 2004). However, it is unclear whether this relation is causal and whether it occurs through the performance of the green products or a halo effect on the firm's brown products. While Brown and Dacin (1997) show that consumer knowledge about a firm's social responsibility affects her evaluation of a new product, we know little about the opposite effect of a green product affecting consumer opinions about the firm and on its impact of sales of the other brown products.

To address this knowledge gap, our research questions are (1) does marketing a green product increase consumer attitudes towards the firm's umbrella brand, and (2) to what extent do such changes increases the sales of the umbrella brand's other (brown) products? We combine three research streams to shed light on our research question: *halo effects* (Thorndike 1920), *signaling* (Erdem and Swait 1998) and *umbrella branding* (Wernerfelt 1988, Erdem and Sun 2002, Montgomery and Wernerfelt 1992). We postulate that a green product can signal environmental consciousness, thus create a halo effect on consumer opinion and purchase of other, brown products under the same umbrella brand. In analogy to Han's (1989) country image effects, we

hypothesize that consumers' attitude through the green product increases not just the green product's sales but also the sales for brown products under the umbrella brand.

Our empirical analysis uses U.S. automobile market data from GfK, which reports consumer attitude metrics, marketing (incentives and media spending), sales and gas prices. For the period between January 1999 and December 2008, we analyze six different brands of umbrella brand Toyota, including its green product, the Toyota Prius. Our methodology explicitly tests for Granger causality and relates marketing, mindset metric and sales for the different brands in a dynamic system (multiple-equation) approach. Our results reveal support for our hypothesis that Prius media spending increased sales of other Toyota vehicles through attitude spillover from Prius to the Toyota umbrella brand. Importantly, not all brown products benefit from gains in consumer opinion about Prius, only the less expensive products do.

Our findings have important implications for marketing theory and practice. Theoretically, we combined three research streams (halo effect, signaling and umbrella branding) to develop and validate a conceptual framework that can be used by other researchers to build on. Practitioners can also use the framework and the demonstration of long term spillover effect in order to justify green product investments with additional sales volume that can come from other products. This will reduce "internal" barriers to green product projects. For policy makers and society at large, the demonstrated spillover enriches the issue of the overall environmental impact of green products introduced by for-profit companies. This impact may be less due to the spillover, or even more positive if the benefiting cheaper products are still greener than the vehicles consumers would otherwise have bought.

1.2 Research Background

The main goal of our paper is to contribute to the literature on sustainability and green products by bringing in research streams on halo effects. To this end, we first review the sustainability literature and then combine three research streams to shed light on our research question, halo effects, signaling and umbrella branding.

1.2.1 Sustainability and Green Products

Sustainability "meets the needs of the present without compromising the ability of future generations to meet their own needs*"* (World Commission on Environment and Development 1987, p. 8). Sustainability has been the subject of many studies, most of them conceptual and/or leveraging consumer surveys as their primary empirical evidence. Two recent special issues on sustainability offer a detailed review of market-focused sustainability (Hult 2011, Kumar and Christodoulopoulou 2014). The most relevant insights for our study concern the multiple benefits of green innovations for companies (Cronin et al. 2011). These include financial gains as the result of increased market share (Menguc and Ozanne 2005) and increased firm performance (Pujari et al. 2003) as a result of increased capabilities (Baker and Sinkula 2005). Combining sustainability and branding activities should increase firm performance both directly and indirectly through enhanced brand value (Kumar and Christodoulopoulou 2014)

But do these expected sustainability benefits actually materialize for companies? The combination of positive consumer attitudes towards green products and government incentives (including environmental taxes on brown products) has led

to ‘green marketing myopia’ (Huang and Rust 2011) such that markets myopically focus on the greenness of their products over the broader expectations of consumers (Ottman et al. 2006). Green marketing myopia raises the criticism that marketers should have the profit objectives of their firms foremost in mind (e.g. Hult 2011). This goal conflict has been addressed in previous literature by pointing out the other firm benefits of pursuing green technologies such as operational efficiencies, penetration of green markets, internalized environmental values, innovation and early-mover competitive advantages (Bansal and Roth 2000, Johnson 2009, Norcia and Tigner 2000, Porter and Van der Linde 1995, Stafford and Hartman 1998).

Table-1: Effects of Sustainability Activities on Firm Performance

Benefits of Sustainability Efforts to firm	**Authors**	**Methodology**	**Key Findings**
Increased Market share	Menguc B. and Ozanne L (2005)	Survey	Higher order construct of natural environmental orientation-NEO is positively and significantly related to profit after tax and market share
Increased capabilities	Baker et al. (2005)	Survey	Based on the RBV enviropreneurial marketing activities end with increased firm capabilities.
Increased Firm Performance	Pujari et al. (2003)	Survey	Environmental based NPD activities result with increased firm performance
Increased Firm Performance	Kumar and Christodoulopoulou (2014)	-	Combining sustainability and branding activities should increase firm performance both directly and indirectly through enhanced brand value
Increased “Brown” Products Sales	This Study	VAR Modeling	Marketing of an innovative green product, increase consumer attitudes towards the firm’s umbrella brand. This

			will result with increased sales of umbrella brand's other (Brown) products.

What is missing from this list is an empirical demonstration that marketing green products enhances sales (and profits) of the firm's other products as well (Table-1). Indeed, a few studies have shown that a firm's green performance is associated with higher return on assets and less idiosyncratic risk (Russo and Fouts 1997, Bansal and Clelland 2004). However, it is unclear whether this relation is causal and whether it occurs through the performance of the green products or a halo effect on the firm's brown products.

1.2.2 Benefits of Green Products for the Umbrella Brand's Brown Products: Halo and Signaling

Empirically, the relation between specific products and corporate image has mostly been studied in the related context of corporate social responsibility (CSR). Brown and Dacin (1997) show that consumer beliefs both about the firm's abilities and social responsibility influence their opinion about a new product, but do not investigate how a new (green) product changes consumer perceptions about the firm and its non-green products. Likewise, Luo and Bhattacharya (2006) show that CSR activities directly increase customer satisfaction and ultimately firm market value. They do not investigate how these activities for some of the firm's products change sales for the firm's other products.

Conceptually, the most relevant theories relating a sub-brand's attributes to corporate image are *halo effects* (Thorndike 1920), *signaling* (Erdem and Swait 2001) and *umbrella branding* (Wernerfelt 1988, Erdem and Sun 2002, Montgomery and Wernerfelt 1992). Psychologists have been aware of presence of *halo effects* for over 90 years. (Thorndike 1920). Marketing academicians also incorporated halo effects into their studies. Focusing on the automobile industry, More and James (1978) showed halo effects are especially prevalent for affective attributes (i.e. new styles, new innovations) and when consumers have little knowledge (i.e. new fuel, including hybrid technology). In line with these findings, the automotive industry used the terminology of "Halo Cars" to define specific brands with in the category (i.e. very stylish and sportive) that can create halo effect. Generally, these cars are not very profitable but (because they are expensive, luxurious and rare) can create halo to economical brands within their brand portfolio. Such halo cars combine a low sales share with high media spending and R&D investment. For instance, Prius was the first four door hybrid car with ULEV (Ultra Low Emission Vehicle) rating from the US EPA agency and showed better fuel efficiency compared to old-technology "brown cars" (EPA 2003). Han (1989) showed that both the country-of-origin image and technical advantage favor Japanese (Toyota) cars over U.S. (Chevrolet) cars. He also validated the idea that country image functions as a halo effect. In his halo model he showed that country image affects customer beliefs, which in turn affects their attitude towards the brand. As the familiarity with the country product or brand increases then positive beliefs drive country image and then brand attitude. In line with these findings we propose that Prius created halo igniting positive beliefs at consumers' minds and lifting Toyota

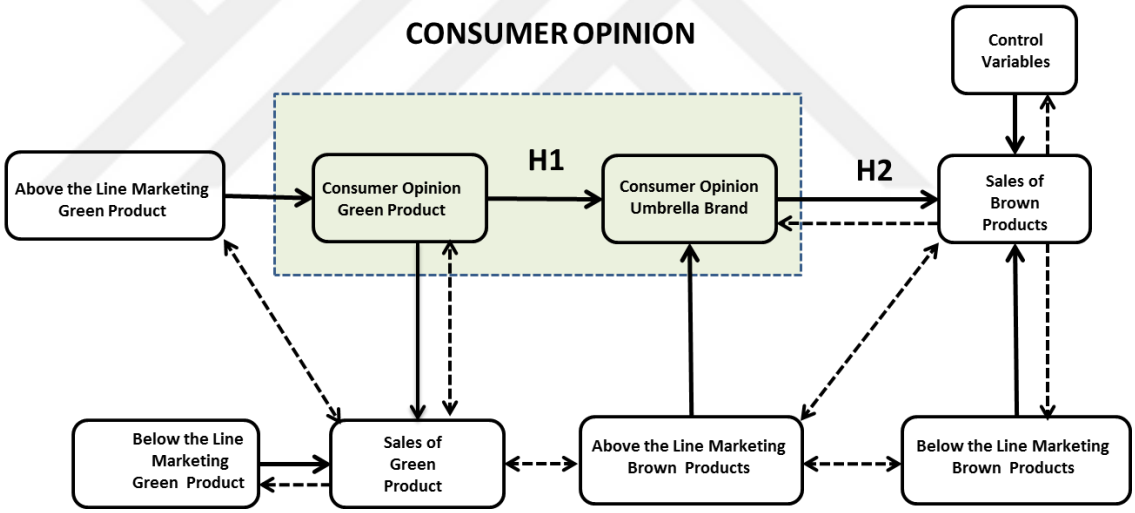
Company`s image and this mechanism resulted with increased Toyota Brand (Umbrella brand) attitudes (excellent opinion).

Signaling has been a key interest in information economists, studying quality signals such as price (Stiglitz, 1987), advertising (Nelson 1974) and both (Kihstrom and Riordan, 1984; Milgrom and Roberts, 1986). In marketing, Erdem and Swait (1998) established the link between brand equity and signaling. Building on signaling theory, *umbrella branding* has become an important research stream since Wernerfelt (1988). Umbrella branding saves in marketing costs (Lane and Jacobs 1995; Tauber 1981, 1988), enhances marketing effectiveness (Rangaswamy et al. 1993), creates spillover effects of advertising (Erdem and Sun 2002) and reduces perceived risk (Montgomery and Wernerfelt 1992). Most signaling studies focus on the benefits of signaling and umbrella branding on the new product introduced, few consider the reciprocal effect (Knapp et al 2014). To the best of our knowledge, no empirical studies have investigated the opposite effect for high involvement product; i.e. signaling and spillover effect of the newly introduced brand to the other brands under the same umbrella. Thanks to its distinctively different and affective attributes, Prius launch is an example of high-quality extension. Strong signal implied by the introduction and success of Prius possibly initiated updating of consumer quality perceptions for Toyota umbrella brand and sub-brands. Erdem (1998) revealed that, signaling theory of umbrella branding suggests high-quality umbrella brands have high-quality-extensions vice versa. Risk reduction effect of umbrella branding is stronger for markets and products with higher prices (high-involvement products) (Montgomery and Wernerfelt. 1992). From this token a high-quality product extension can act as a strong risk-reduction signal for umbrella brand and sub-brands.

1.3 Conceptual Framework and Hypotheses

Our conceptual framework relates marketing actions for the green product with its consumer opinion, the consumer opinion for the umbrella brand and the sales of the umbrella brand's brown products as visualized in Figure 1.

Figure-1 Conceptual Framework



Our focus in this figure is how (marketing-induced) increases in green product's mindset metrics lift the consumer opinion for the umbrella brand **(H1)** and convert into higher sales of the umbrella brand's brown products **(H2).** As shown in the figure, we account for above-the-line and below-the-line marketing for the brown products and industry-specific control variables that are likely to drive brown product sales.

Moreover, we acknowledge and explicitly model the many other potential interactions and feedback loops among our variables, as indicated by the dotted lines in Figure 1.

Consumer Opinion metrics are periodic measures of consumer attitudes, typically collected in surveys (Srinivasan et al., 2010). For the advertised product or brand, some of these mindset metrics are both responsive to marketing communication and convert into higher sales (Keller and Lehman 2006, Srinivasan et al. 2010, Hanssens et al 2014). We maintain this expectation for our application to green products.

The key premise of our research is that increased consumer opinion for *the green product* lifts the mindset metrics *for the umbrella brand*. Media spending for the green product does not only reach consumers that will ultimately buy the green product, but also (potential) consumers of the firm's existing products. When a green product is introduced by a firm that is known for something else (e.g. reliability in Toyota's case), consumers have to categorize not just the new product but also need to re-categorize their opinion about the umbrella brand. They will update their opinion of the umbrella brand towards the newly introduced attribute of being green. Two theories support this opinion update: categorization theory and associate network theory. We discuss these in turn.

Categorization theory and its extension and implications in marketing research (brand extension, spillover and halo-effect) explains this opinion-update mechanism happening in consumers mind often treated as "Black Box" by most empirical modelers (Srinivasan et al. 2010, Hanssens et al. 2014). Originally, Rosch and Mervis (1975) held that categorizations are relatively stable in consumers' minds. Later research instead revealed a flexible dynamic process. Building on categorization theory, Aaker

and Keller (1990), studied consumer's attitudes towards brand extensions. They concluded that categorization process involved in the perception and the evaluation of brand extensions are flexible and context dependent. They proposed that consumers evaluate band extensions in one of two ways, by piecemeal processing (green product) or by category-based processing (brown product) of brand extension.

Applied to our research question, piecemeal processing would result in a higher opinion about green product. Then, category based processing may combine the excellent opinion for the green product with the existing previous knowledge and memories about the umbrella brand to result in a better opinion about the umbrella brand (Figure-1).

The opinion update process is also explained in associative network theory (Bower 1981). Accordingly, a human brain retains memories in nodes, which it then connects these with associated other memories. There are two types of nodes. **Semantic** (straightforward meaning of memory, e.g., product attributes: hybrid car with low CO2 emission) or **affective** (with emotional meaning, e.g., being environment friendly, excellent opinion) (Sirsi, Ward, and Reingen 1996). Consumers that are evaluating a new green product possibly compared current and combined information's and product and branding signals with the ones that are existing in their memories. Their minds can use these complex node-connections to come up with a knowledge structure and at the end an opinion or a decision.

The links between these nodes contains relational ties between these concepts. After exposure to messages at new green products above the line activities (advertisement), affective nodes for the green product in association to affective nodes for the umbrella brand might be primed and this process might end up with opinions

about green product and brown products of Toyota under the same umbrella brand. This affect spillover or opinion updating process that we explained with categorization theory and associated network theory is also supported by some other research findings from brand extension research. Umbrella branding both increases expected quality (Wernerfelt 1988) and reduces consumer risk (Montgomery and Wernerfelt 1992). Consumers experience in one product category needs to affect their perceptions of quality in another product category for umbrella branding to serve as a credible signal of a new-experience product's quality. In line with this notion, Erdem and Sun (2002) find evidence for advertising and sales promotions spillover effects for umbrella brands. In another study, Erdem (1998) also finds spillover effects of marketing mix strategies from one category to another in adjacent FMCG categories. In addition to studies on forward spillover effects, some researchers investigated reciprocal (backward) spillover effects, where a new product benefits the existing products under the umbrella (Balachander and Ghose 2003). There they argued that advertising of brand extensions should also have a positive spillover effect on sales of existing products.

H1: Consumer Opinion of the green Product increases consumer opinion of the umbrella brand

How does a higher opinion of the umbrella brand affect sales of its non-green (aka ‘brown’) products? As explained previously at halo effect section, the positive emotion about the umbrella brand may lead consumers to judge the attributes of its brown products more positively – this is known as the halo effect (Hardie and Fader

1993). In line with this idea excellence opinion about the green product should increase consumer opinion of the corporate umbrella brand evaluation of consumers in favor of the corporate umbrella brand, this then in turn lifts sales of its brown products. A green product can create a positive halo effect on the umbrella corporate brand.

Attitude-behavior consistency theory (Fishbein and Ajzen 1975) also supports this notion that once the opinion/attitude updating occurred for umbrella brand it can be expected that related purchasing behavior can also be affected. As the final outcome of structural hierarchical relation at consumers' mind, above the line marketing of green product would increase not just the green product's minds set metrics and sales but also the sales for the "brown products" marketed under the same umbrella brand.

Later building on hierarchy-of-effects model of advertising (Palda 1966), Vakratsas and Ambler (1999), Srinivasan et al (2010), Hanssens et al (2014) demonstrated that increasing consumers mind-set-metrics, (awareness, excellence opinion etc.) can increase sales of brand. They have added explanatory value and should be included at sales response models.

H2: Consumer opinion of the umbrella brand increases its brown product sales.

1.4 Data

Toyota Prius is a mid-size hatchback hybrid car manufactured by Toyota Motor Corporation. It is sold in over 70 countries, and the third generation Prius has sold more than 1million units by September 2011. Toyota Prius was the first mass-produced hybrid vehicle in Japan in 1997. Its origins go back to the Kyoto Protocol: Toyota's

initial objective was to increase fuel efficiency by 50% and being eco-friendly (lowest Carbon dioxide emission) at the same time (Al 2008). In US market, Toyota Prius was launched in June 2000. U.S. media spending on Prius amounted to $ 235M in the 10 years between January1999 and July 2009. By July 2009, Prius had achieved 83% "consumer awareness" and 55% "excellent opinion" attitude score (GfK 2010). However, Prius only reached 7 % market share in that same period.

We use data from GfK, which reports the metrics that we are interested for monthly periods. For the period between January 1999 and December 2008, we analyze six different brands of Toyota: the green product Prius and the 'brown products' Camry, Corolla, Highlander, Rav4 and Avalon. For the marketing mix, our data includes Customer incentives for each brand, and total spending on advertising budget of each brand. JD Powers' key mindset metric for consumer opinion of a product or brand is 'excellent opinion', measured as the % of respondents indicating the top two boxes on a seven point scale.

We also created monthly seasonal dummies in order to capture the effect of seasonality on sales. An important control variable is gas prices, which are in $/gallon in terms of December 2008 dollars to control for inflation. We also include a step dummy each for new hybrid introductions by competitors and by Toyota, respectively. We also controlled for the consumer confidence index in order to capture effects of economy fluctuations.

Table 2-A shows descriptive statistics and Table 2-B shows correlation of all variables used in the model.

Table 2-A: Descriptive Statistics For Variables Used in the Analysis

	Mean	Median	Standard Deviation
Excellent Opinion Prius	24,82	27,00	17,63
Excellent Opinion Toyota	41,00	39,00	7,64
Consumer Incentive for Avalon	423,46	276,00	388,75
Consumer Incentive for Camry	975,00	1073,00	427,86
Consumer Incentive for Corolla	842,85	871,00	303,44
Consumer Incentive for Highlander	955,26	1029,00	857,52
Consumer Incentive for RAV4	430,87	315,00	317,97
Consumer Incentive for Brown Prod.	3627,47	3612,00	1188,88
Consumer Incentive for Prius	143,68	45,00	300,82
Media Spending for Avalon	2.168.875	1.835.900	2.929.048
Media Spending for Camry	15.309.446	13.700.500	7.867.165
Media Spending for Corolla	6.356.359	4.771.000	6.705.449
Media Spending for Highlander	3.411.446	2.337.200	4.368.622
Media Spending for RAV4	3.290.283	1.623.000	5.206.638
Media Spending Prius	1.443.877	671.000	2.399.023
Media Spending Toyota	49.116.572	52.907.000	23.801.974
Sales of Avalon	5924,46	5724,00	2131,13
Sales of Camry	36003,93	35789,00	5458,37
Sales of Corolla	25886,02	25088,00	7087,58
Sales of Highlander	7831,20	9063,00	4524,53
Sales of RAV4	8019,87	6864,00	3690,32
Sales of Brown Products	134830,30	132130,00	24721,70
Sales of Prius	5871,95	4085,00	5731,07
Gas Price	2,23	2,06	0,65

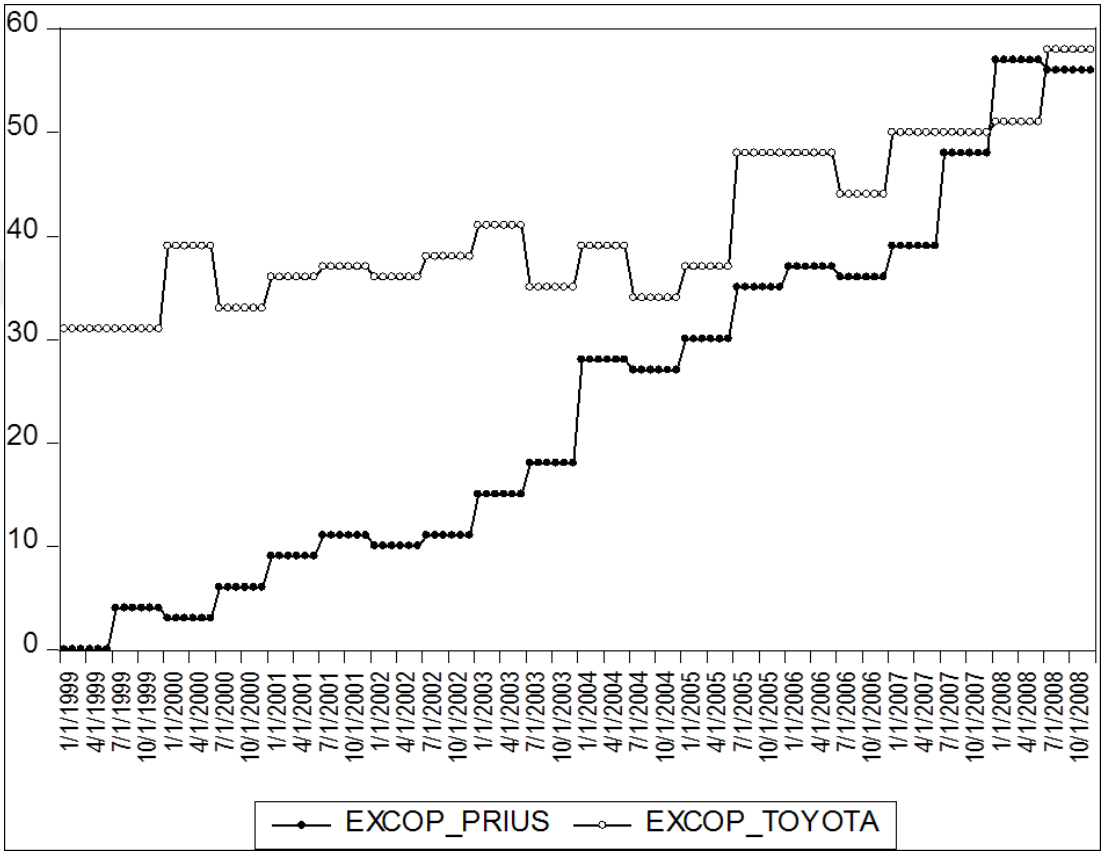
Table 2-B: First Differences Correlation Table for Variables Used in the Analysis

	d(CI_BP)	d(CI_PRIUS)	d(EXCOP_PRIUS)	d(EXCOP_TOYOTA)	d(MEDIA_PRIUS)	d(MEDIA_BP)	d(SALES_PRIUS)	d(SALES_BP)
d(CI_BP)	1							
d(CI_PRIUS)	0,09	1						
d(EXCOP_PRIUS)	0,17	-0,27	1					
d(EXCOP_TOYOTA)	0,02	0,09	0,26	1				
d(MEDIA_PRIUS)	0,08	0,13	-0,02	0,03	1			
d(MEDIA_BP)	-0,02	-0,07	0,08	-0,03	-0,07	1		
d(SALES_PRIUS)	0,01	0,13	-0,18	-0,09	0,13	-0,28	1	
d(SALES_BP)	-0,08	0,27	-0,16	-0,02	0,45	-0,14	0,37	1

Abbreviations :CI si Consumer Incentive, Excop is Excellent Opinion, Media is Media Spending, BP is Brown Products

The time series behavior of 'excellent opinion' shows interesting patterns, as visualized in Figure 2 for both Prius and umbrella brand Toyota.

Figure 2: Excellent Opinion Metric for Prius and Toyota Brands



New product Prius starts low in excellent opinion, but catches up with umbrella brand Toyota on the former and even exceeds it after nine years.

While Toyota gave Prius plenty of marketing support, it by no means neglected its other brands, which each were given a higher budget than Prius on media spending (Figure 3) and incentives (Figure 4).

Figure 3: Toyota media spending on 6 car brands (cumulative from January 1999 to December 2008)

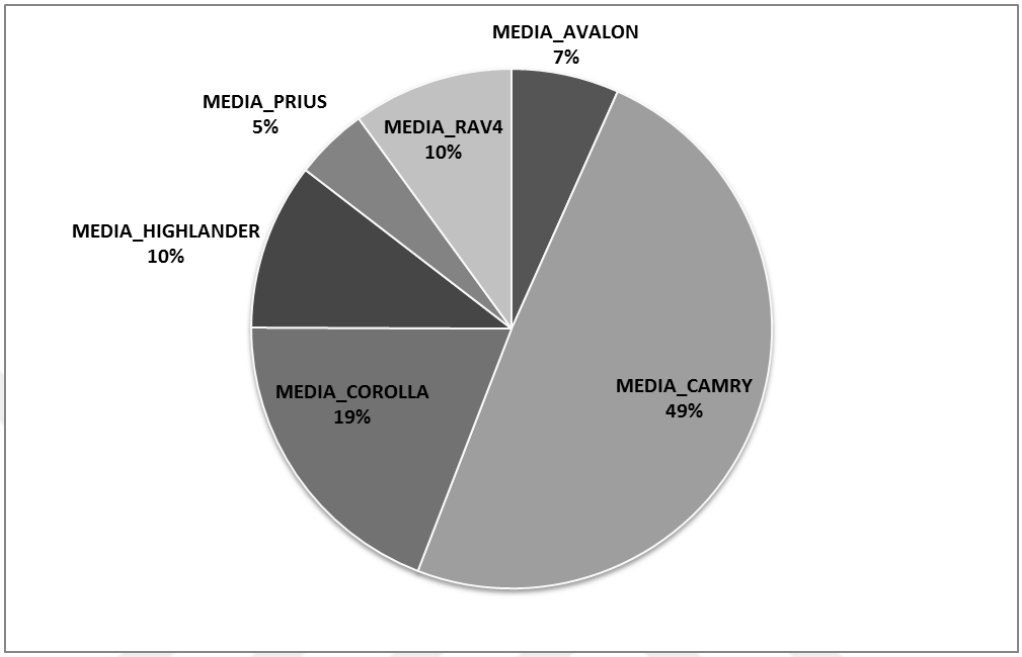
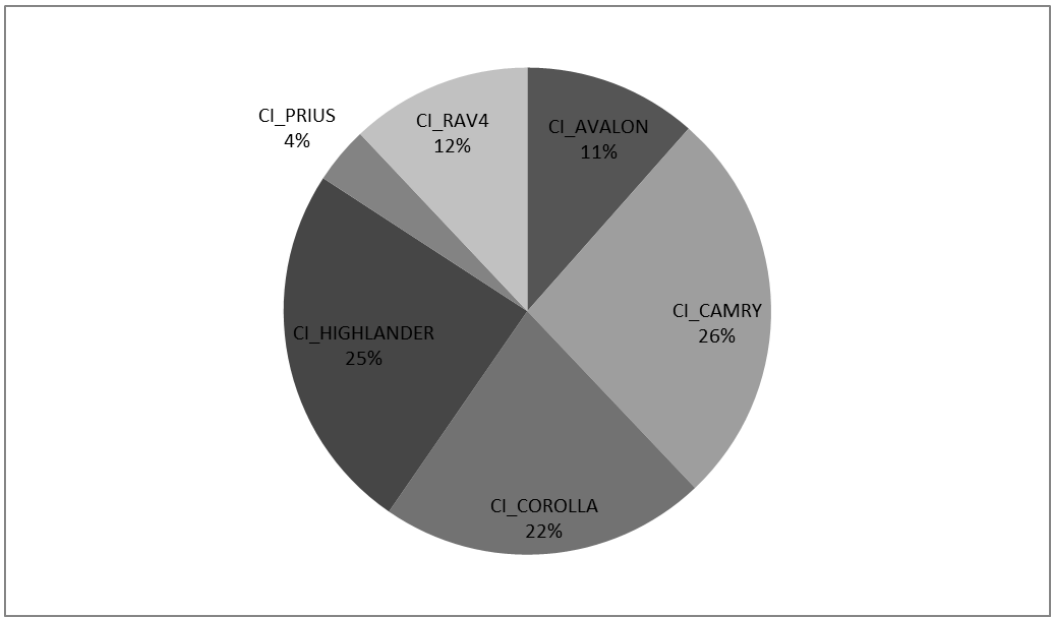
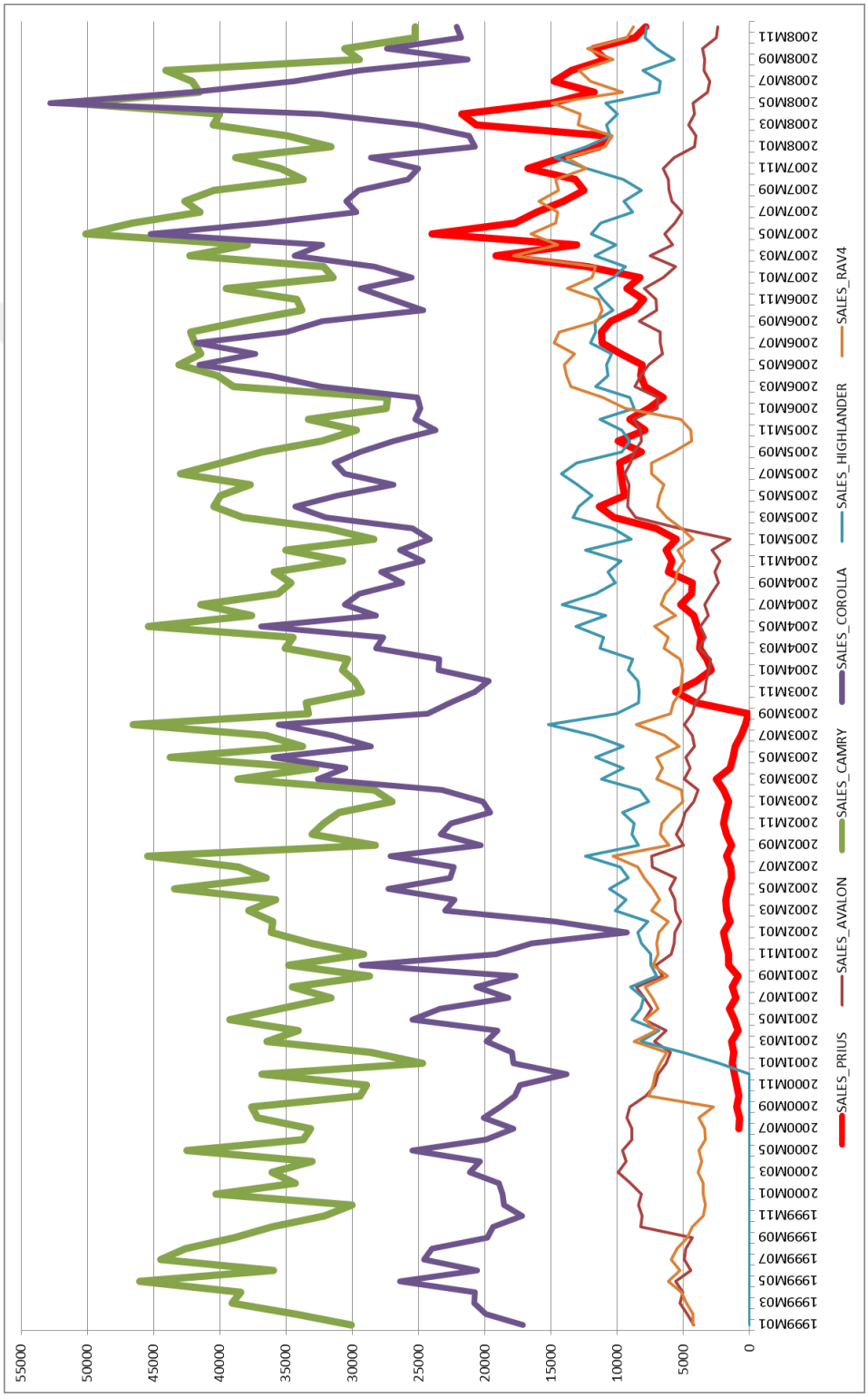


Figure 4: Toyota Incentives on 6 car brands (cumulative from January 1999 to December 2008)



Finally, sales increase over time for Prius, but also for Corolla, Highlander and RAV4 (figure 5). Camry and corolla are highest selling brands of Toyota. Consistent with the dynamic buildup of its awareness and excellent opinion, Prius sold more over the years and exceeded sales of some brown brands (Avalon, Highlander and RAV4) of Toyota (after January 2007).

Figure 5: Sales of the 6 Toyota brands from January 1999 to December 2008



Overall, this data set with temporal duration of more than eight years, the introduction and growth in sales of green product and five different brown products of varying sizes of the same umbrella brand, existence of marketing mix and consumer mind set metric, is suited to address the research questions of our interest. Note that the Toyota recalls (analyzed by e.g. Borah and Tellis 2015) occur past the ending of our data set and therefore present no confound for our analysis. Likewise, the Great Recession of 2009 occurs after the end of our data. In the car industry, the main external influences in our data period were gasoline prices, and hybrid introductions and consumer confidence index for which we control in our analysis.

1.5 Methodology

Our longitudinal data and conceptual framework suggest a dynamic time series model to assess the hypotheses. The methodology should allow for the possibility of capturing the combined effect of marketing actions and mindset metric on sales. Indeed, direct, indirect effects together shape the long-run impact of marketing actions and mindset metric on sales of other brands. Finally, the possibility of feedback loop and non-hypothesized relations among the variables of interest (the dotted lines in Figure 1) calls for a flexible approach to allow for such dynamic interactions. Therefore, we choose a system (multiple-equation) approach that adequately captures the various channels of influence that lead to this ultimate effect.

Our empirical analysis proceeds in three steps. First, we verify the hypothesized causal chain in Figure 1 by Granger causality tests between Media Prius, Excellent

Opinion Prius, Excellent Opinion Toyota, Gas Price and Incentives Brown products, Media Brown Products and Sales Prius, Sales Brown Products (i.e. Sales from other Toyota brands). Second, we estimate the dynamic interactions among sales of other brands, excellent opinion of brand, customer incentives, media spending of brand using Vector Autoregressive (VAR) / Vector Error Correction (VEC) models, while including gas prices, seasonality, own and competitor hybrid introductions and consumer confidence index variables as exogenous variables. Third, from the model estimates, we derive Generalized Impulse Response Functions (GIRF) to quantify the long-term effects of marketing and mindset metrics on sales, and Forecast Error Variance Decomposition (FEVD) to quantify the relative influence of brand excellent opinion, customer incentives and media spending on sales and to quantify the long-term effects of marketing and mindset metrics on sales.

First, we test for pairwise Granger causality between variables at different lags (1 to 12 months), and display those for 1, 3 and 10 lags.

Second, we decide on our dynamic model specification by means of unit root and cointegration tests. Unit root test indicate whether each variable is evolving or stable within the data period. Our results are displayed in Table 3.

Table-3 Unit Root Tests

	t-value	p-value	
Excellent Opinion Prius	0,15	0,9685	*
Excellent Opinion Toyota	-0,74	0,8307	*
Consumer Incentive for Avalon	-4,39	0,0005	
Consumer Incentive for Camry	-2,99	0,0300	
Consumer Incentive for Corolla	-3,97	0,0020	
Consumer Incentive for Highlander	-2,45	0,1200	*
Consumer Incentive for RAV4	-3,30	0,0160	
Consumer Incentive for Brown Prod.	-2,56	0,1032	*
Consumer Incentive for Prius	-4,78	0,0001	
Media Spending for Avalon	-8,58	0,0000	
Media Spending for Camry	-3,31	0,0000	
Media Spending for Corolla	-3,75	0,0004	
Media Spending for Highlander	-4,65	0,0002	
Media Spending for RAV4	-5,69	0,0000	
Media Spending Prius	-7,83	0,0000	
Media Spending Toyota	-7,54	0,0000	
Sales of Avalon	-2,39	0,1464	*
Sales of Camry	-2,60	0,0960	*
Sales of Corolla	-0,89	0,7869	*
Sales of Highlander	-2,13	0,2313	*
Sales of RAV4	-2,89	0,0488	*
Sales of Brown Products	-1,14	0,6950	*
Sales of Prius	-7,83	0,0000	
Gas Price	-2,21	0,2021	*

* sign indicate p-value>0,05 thus Unit Root exist for variable and it is evolving.

We next ran cointegration tests among the evolving variables. The unrestricted cointegration Test (Maximum Eigenvalue) indicates one cointegration equation at the 0.05 significance level. Therefore, we estimate and compare a Vector-Error Correction model and a Vector Autoregressive model for each brand (Umbrella brand and individual brand models), as detailed below.

The first model explains the performance of the Toyota umbrella brand. Based on the unit root tests, our VAR model is specified in equation (1) as:

$$\begin{bmatrix} d(CI_{BP})_t \\ CI_{PR_t} \\ d(EO_{BP})_t \\ d(EO_{PR})_t \\ MS_{PR_t} \\ d(MS_{BP})_t \\ d(S_{BP})_t \\ d(S_{PR})_t \end{bmatrix} = \begin{bmatrix} a_{0,CI_{BP}} + \sum_{S=2}^{13} a_{0,CI_{BP}} SD_{s,t} + \alpha_{CI_{BP}} GPI_{t-1} + \beta_{CI_{BP}} TNHI_{t-1} + \gamma_{CI_{BP}} TNHI_{t-2} + \delta_{CI_{BP}} CNHI_{t-1} + \theta_{CI_{BP}} CNHI_{t-2} + \mu_{CI_{BP}} CCI_{t-1} + \pi_{CI_{BP}} CCI_{t-2} \\ a_{0,CI_{PR}} + \sum_{S=2}^{13} a_{0,CI_{PR}} SD_{s,t} + \alpha_{CI_{PR}} GPI_{t-1} + \beta_{CI_{PR}} TNHI_{t-1} + \gamma_{CI_{PR}} TNHI_{t-2} + \delta_{CI_{PR}} CNHI_{t-1} + \theta_{CI_{PR}} CNHI_{t-2} + \mu_{CI_{PR}} CCI_{t-1} + \pi_{CI_{PR}} CCI_{t-2} \\ a_{0,EO_{BP}} + \sum_{S=2}^{13} a_{0,EO_{BP}} SD_{s,t} + \alpha_{EO_{BP}} GPI_{t-1} + \beta_{EO_{BP}} TNHI_{t-1} + \gamma_{EO_{BP}} TNHI_{t-2} + \delta_{EO_{BP}} CNHI_{t-1} + \theta_{EO_{BP}} CNHI_{t-2} + \mu_{EO_{BP}} CCI_{t-1} + \pi_{EO_{BP}} CCI_{t-2} \\ a_{0,EO_{PR}} + \sum_{S=2}^{13} a_{0,EO_{PR}} SD_{s,t} + \alpha_{EO_{PR}} GPI_{t-1} + \beta_{EO_{PR}} TNHI_{t-1} + \gamma_{EO_{PR}} TNHI_{t-2} + \delta_{EO_{PR}} CNHI_{t-1} + \theta_{EO_{PR}} CNHI_{t-2} + \mu_{EO_{PR}} CCI_{t-1} + \pi_{EO_{PR}} CCI_{t-2} \\ a_{0,MS_{PR}} + \sum_{S=2}^{13} a_{0,MS_{PR}} SD_{s,t} + \alpha_{MS_{PR}} GPI_{t-1} + \beta_{MS_{PR}} TNHI_{t-1} + \gamma_{MS_{PR}} TNHI_{t-2} + \delta_{MS_{PR}} CNHI_{t-1} + \theta_{MS_{PR}} CNHI_{t-2} + \mu_{MS_{PR}} CCI_{t-1} + \pi_{MS_{PR}} CCI_{t-2} \\ a_{0,MS_{BP}} + \sum_{S=2}^{13} a_{0,MS_{BP}} SD_{s,t} + \alpha_{MS_{BP}} GPI_{t-1} + \beta_{MS_{BP}} TNHI_{t-1} + \gamma_{MS_{BP}} TNHI_{t-2} + \delta_{MS_{BP}} CNHI_{t-1} + \theta_{MS_{BP}} CNHI_{t-2} + \mu_{MS_{BP}} CCI_{t-1} + \pi_{MS_{BP}} CCI_{t-2} \\ a_{0,S_{PR}} + \sum_{S=2}^{13} a_{0,S_{PR}} SD_{s,t} + \alpha_{S_{PR}} GPI_{t-1} + \beta_{S_{PR}} TNHI_{t-1} + \gamma_{S_{PR}} TNHI_{t-2} + \delta_{S_{PR}} CNHI_{t-1} + \theta_{S_{PR}} CNHI_{t-2} + \mu_{S_{PR}} CCI_{t-1} + \pi_{S_{PR}} CCI_{t-2} \\ a_{0,S_{BP}} + \sum_{S=2}^{13} a_{0,S_{BP}} SD_{s,t} + \alpha_{S_{BP}} GPI_{t-1} + \beta_{S_{BP}} TNHI_{t-1} + \gamma_{S_{BP}} TNHI_{t-2} + \delta_{S_{BP}} CNHI_{t-1} + \theta_{S_{BP}} CNHI_{t-2} + \mu_{S_{BP}} CCI_{t-1} + \pi_{S_{BP}} CCI_{t-2} \end{bmatrix} +$$

$$\sum_{k=1}^{K} \begin{bmatrix} \beta_{1,1}^k & \cdots & \beta_{1,8}^k \\ \beta_{2,1}^k & \cdots & \beta_{2,8}^k \\ \beta_{3,1}^k & \cdots & \beta_{3,8}^k \\ \beta_{4,1}^k & \cdots & \beta_{4,8}^k \\ \beta_{5,1}^k & \cdots & \beta_{5,8}^k \\ \beta_{6,1}^k & \cdots & \beta_{6,8}^k \\ \beta_{7,1}^k & \cdots & \beta_{7,8}^k \\ \beta_{8,1}^k & \cdots & \beta_{8,8}^k \end{bmatrix} \times \begin{bmatrix} d(CI_{BP})_{t-k} \\ CI_{PR_{t-k}} \\ d(EO_{BP})_{t-k} \\ d(EO_{PR})_{t-k} \\ MS_{PR_{t-k}} \\ d(MS_{BP})_{t-k} \\ d(S_{BP})_{t-k} \\ d(S_{PR})_{t-k} \end{bmatrix} + \begin{bmatrix} \varepsilon_{CI_{BP,t}} \\ \varepsilon_{CI_{PR,t}} \\ \varepsilon_{EO_{BP,t}} \\ \varepsilon_{EO_{PR,t}} \\ \varepsilon_{MS_{PR,t}} \\ \varepsilon_{MS_{BP,t}} \\ \varepsilon_{S_{BP,t}} \\ \varepsilon_{S_{PR,t}} \end{bmatrix}$$

Equation-1

In this equation there is a 8× 1 vector of the *endogenous* variables where Customer Incentive and Media Spending of Prius (CI_{PR} and MS_{PR}) are stationary, Customer Incentive Brown Products (CI_{BP}), Excellent Opinion Prius and Toyota (EO_{PR} and EO_{BP}), Media Spending Brown Products (MS_{BP}) and Sales of Brown Products and Prius (S_{BP} and S_{PR}) are all evolving thus in their first differences.

There is also a vector (8x1) of five exogenous control variables: (a) monthly dummy variables to account for seasonal fluctuations in sales or any other endogenous variable (SD) (b) gas price of the last month(GPI) (as suggested by Granger causality tests) (c) Hybrid introductions of Toyota (TNHI) (2 lags) (d) Hybrid introductions of Competitors (CNHI) (2 lags) (e) the Customer Confidence Index(CCI) (2 lags). ε is the matrix of the error terms (8x1 matrix) with respect to the long-term equilibrium. We use a stepwise procedure to determine the appropriate lag-length k and to eliminate redundant parameters (e.g. Nijs et al. 2007).

After estimating and interpreting the umbrella brand model to assess our hypotheses, we provide more specific insights by building five different models for five individual Toyota 'brown product' sub-brands: Avalon, Camry, Corolla, Highlander and RAV4. In each individual brand model, the variables are identical to the umbrella brand model, except that *Customer Incentive, Media spending and Sales* are brand-specific variables.

Our comparison, the VEC model, is identical to equation (1) but includes the adjustment towards a long-term equilibrium.

Based on the model parameters, we derive Generalized Impulse Response functions to simulate the net result of a "shock" to marketing actions and consumer opinion (Pauwels et al. 2002; Nijs et al. 2001; Srinivasan et al. 2004). Also derived from the model, the Forecast Error Variance Decomposition (FEVD) estimates to investigate whether, and to what extent, mindset metrics and marketing mix actions explain sales performance beyond the impact of mindset metrics and marketing mix actions. FEVD quantifies the dynamic explanatory value on sales of each endogenous variable. Akin to a 'dynamic R^2', FEVD provides a measure of the relative impact over time of shocks initiated by each of the individual endogenous variables, without the need for the researcher to specify a causal ordering among these variables (Pesaran and Shin 1998; Nijs et al. 2007). The FEVD attributes 100% of the forecast error variance in sales to either (a) the past values of the other endogenous variables or (b) the past of sales itself, also known as 'purchase inertia'.

1.6 Findings

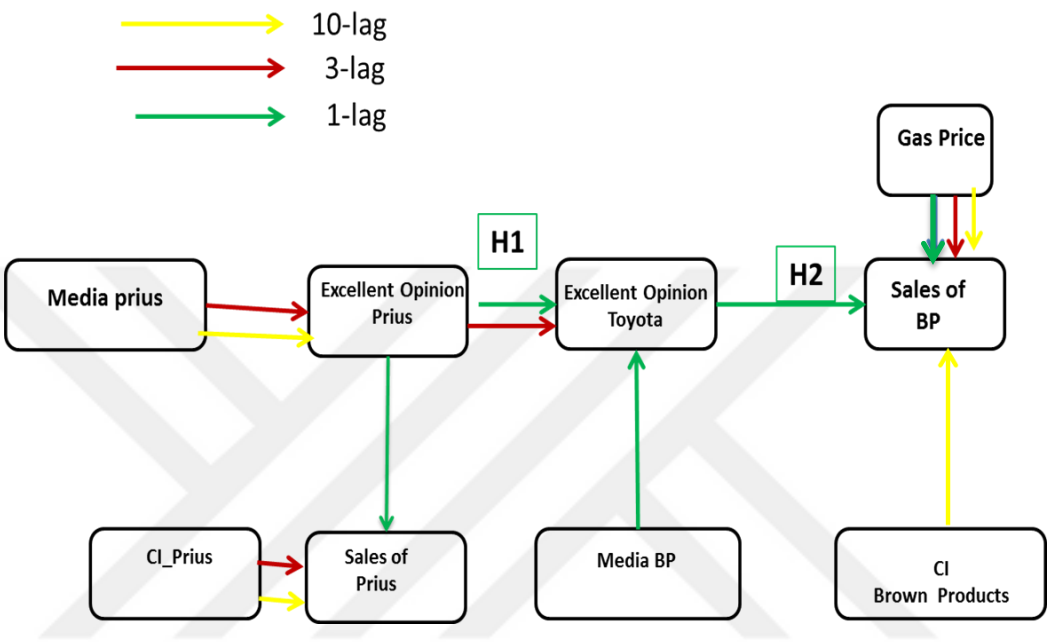
First, Table 4 and Figure 6 show the results of the pairwise Granger causality tests for lags 1, 3 and 10.

Table-4: Granger Causalities for 1, 3 and 10 Lags

	1-Lag		3-Lags		10 Lags	
	F-Statistics	P-value	F-Statistics	P-value	F-Statistics	P-value
Media Spending Prius does not Granger Cause Excellent Opinion for Prius	0,23	0,64	15,08	3,0E-08 *	6,84	8,0E-08 *
Excellent Opinion Prius does not Granger Cause Excellent Opinion Toyota	7,05	0,01 *	2,82	0,04 *	1,44	0,18
Excellent Opinion Toyota does not Granger Cause Sales of Brown Products	6,22	0,01 *	1,45	0,23	0,41	0,94
Media Spending Toyota does not Granger Cause Excellent Opinion Toyota	0,10	0,75	0,11	0,96	1,69	0,09
Gas Price does not Granger Cause Sales of Brown Products	6,84	0,01 *	4,15	0,01 *	2,96	2,9E-03 *
Consumer Incentive to Brown Product does not Granger Cause Sales of Brown Products	2,74	0,10	0,93	0,43	2,14	0,03 *

**** indicate values < p,0.05 and thus Granger Causality***

Figure-6 Indication of 1,3 and 10 Lag- Granger Causalities at Conceptual Framework



The Granger causality test results are consistent with our conceptual framework. Media investment on Prius drives excellent opinion of Prius, which in turn drives excellent opinion of the Toyota Umbrella brand, which drives brown product sales. As expected from consumer theory in high-involvement categories (Tellis 2004), media spending takes some time to affect consumer opinion: Granger causality is significant at 3and 10 lags, but not at 1 lag. Thus, the mindset metric of excellent opinion is responsive to media spending, but only after several months. In contrast, the transfer of Prius to Toyota excellent opinion and the conversion into Toyota brown product sales is also significant at 1 lag.

Next we estimate the VEC and VAR models, of which the fit and coefficient estimates (for the exogenous variables) are shown in Table 5. The VEC model has an

explanatory power (R^2) of 0.78 for Toyota brown product sales, while the VAR model has an explanatory power of 0.78 for the growth in brown product sales, 0.44 for Avalon, 0.74 for Camry, 0.61 for Corolla, 0.54 for Highlander and 0.6 for RAV4 growth in brand sales. Given the similar fit for the VEC and the VAR in differences, we proceed by discussing the estimates of the more parsimonious model (VAR in differences).

Table-5-A: Summary Values for Models

Model Type	Umbrella Brand VAR-Diff	Umbrella Brand VEC	Avalon VAR-Diff	Camry VAR-Diff	Corolla VAR-Diff	Highlander VAR-Diff	RAV4 VAR-Diff
Number of Lags	2	2	2	2	2	2	2
R2 (Sales of Brand)	0.78	0,78	0,44	0.74	0,61	0,54	0,6
Adj-R2(Sales of Brand)	0.68	0.68	0,22	0.64	0,44	0,35	0,45

Table-5-B Coefficient estimates and standard errors for the exogenous variables

	Sales of Prius	Sales of Toyota
Hybrid Introduction Toyota (1-Lag)	1561,76	7162,75
	(1299,34)	*(7128,42)*
	[1.15620]	[1.30817]
Hybrid Introduction Toyota (2-Lag)	349,71	4033,34
	(1298,43)	*(7123,40)*
	[0.00561]	[0.27449]
Hybrid Introduction Competitors (1-Lag)	-1259,45	-1574,81
	(824,76)	*(4524,83)*
	[-1.39948]	[-0.14119]
Hybrid Introduction Competitors (2-Lag)	2243,492**	-2484,59
	(893,75)	*(4903,29)*
	[2.63508]	[-0.12345]
Consumer Confidence Index (1-Lag)	-6,53	-157,29
	(37,71)	*(206,90)*
	[-0.34089]	[-0.82538]
Consumer Confidence Index (2-Lag)	16,62	178,62
	(38,98)	*(213,85)*
	[0.49994]	[0.82406]

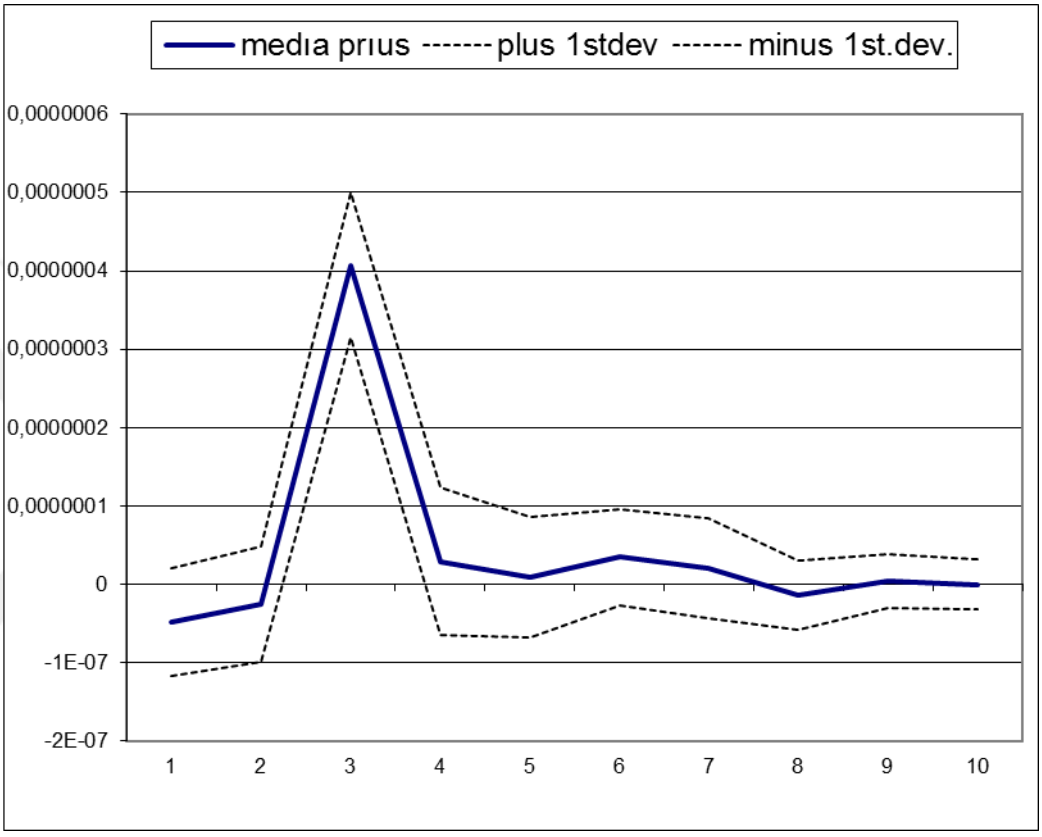
*( ) indicate standard deviation,[ ] indicate t-value and ** indicate p<0,05*

The impact of the exogenous variables is straightforward to interpret: consumer confidence has a cumulative positive impact on both Prius and Toyota's brown product sales, as does Toyota's hybrid introduction. Interestingly, the two month lagged effect of competitive hybrid introductions on Prius sales is positive and significant. This is consistent with the preference evolution model (Kardes et al. 1993) of positive competitive spillover benefiting the prototypical brand in the category, in this case Prius as the prototype of a hybrid car. The preference evolution model posits that when a pioneer is a discontinuous innovation, prior consumer preferences are likely to evolve over time through an anchoring and adjustment process (Kahneman, Slovic, and Tversky 1982; Kahneman and Snell `1992)

In our proposed model for umbrella band, the GIRF estimate is significantly positive for the effect of Media Prius on excellent opinion of Prius. Thus, Prius Media spending is effective at building its own excellent opinion. Figure 7 shows the timing of these effects. We observe that Prius media spending increases Prius Excellent Opinion with in the third month and stays positive for the next four months. Media effects also peak at the third month. This suggests that, some consumers evaluate and form excellent opinion third period whereas other consumers need some time to do so. These own-ad effects are in line with previous estimates of advertising lags (e.g. Tellis 2004).

Figure-7 GIRF of Excellent Opinion of Prius Responses to Media Prius

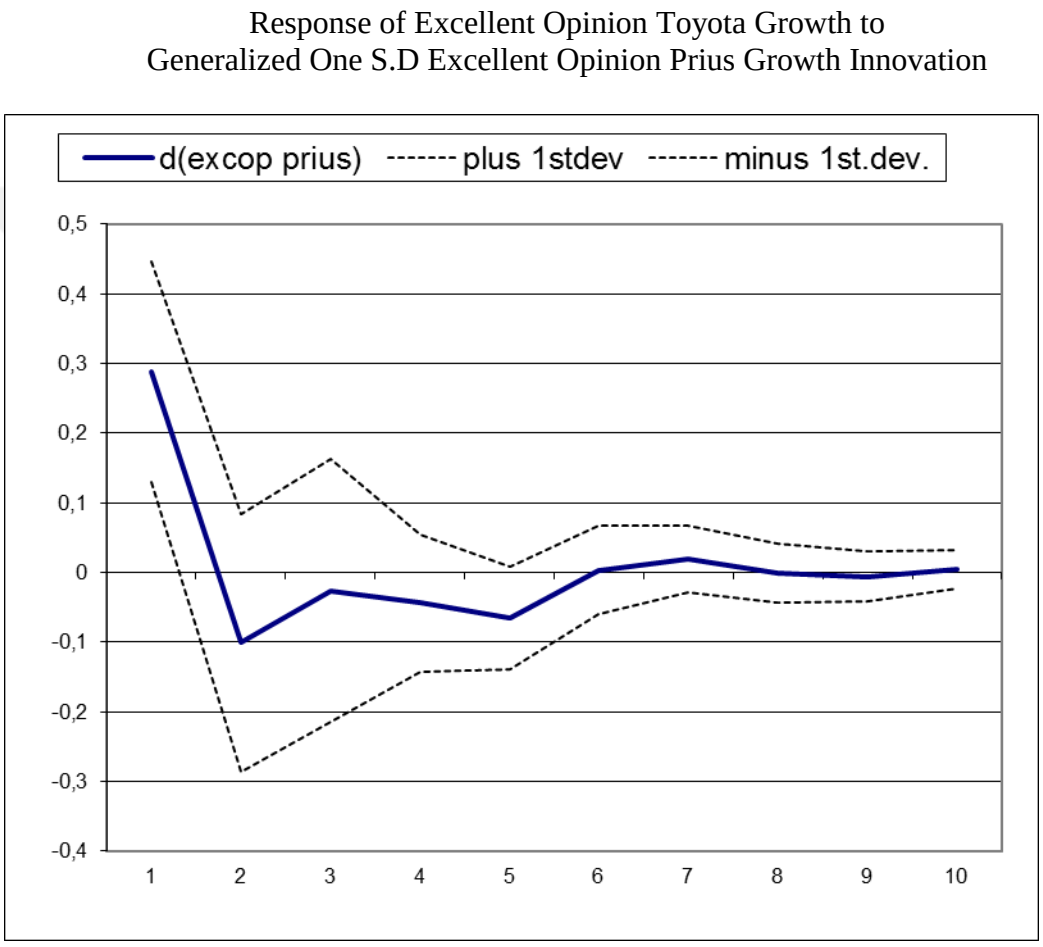
Response of Excellent Opinion Prius Growth to Generalized One S.D Media Prius Spending Innovation



Months

To assess H1, Figure 8 shows the positive effect of excellent opinion of Prius on Excellent opinion of umbrella brand in the first month.

Figure-8 GIRF of Excellent Opinion of Toyota due to Excellent Opinion Prius

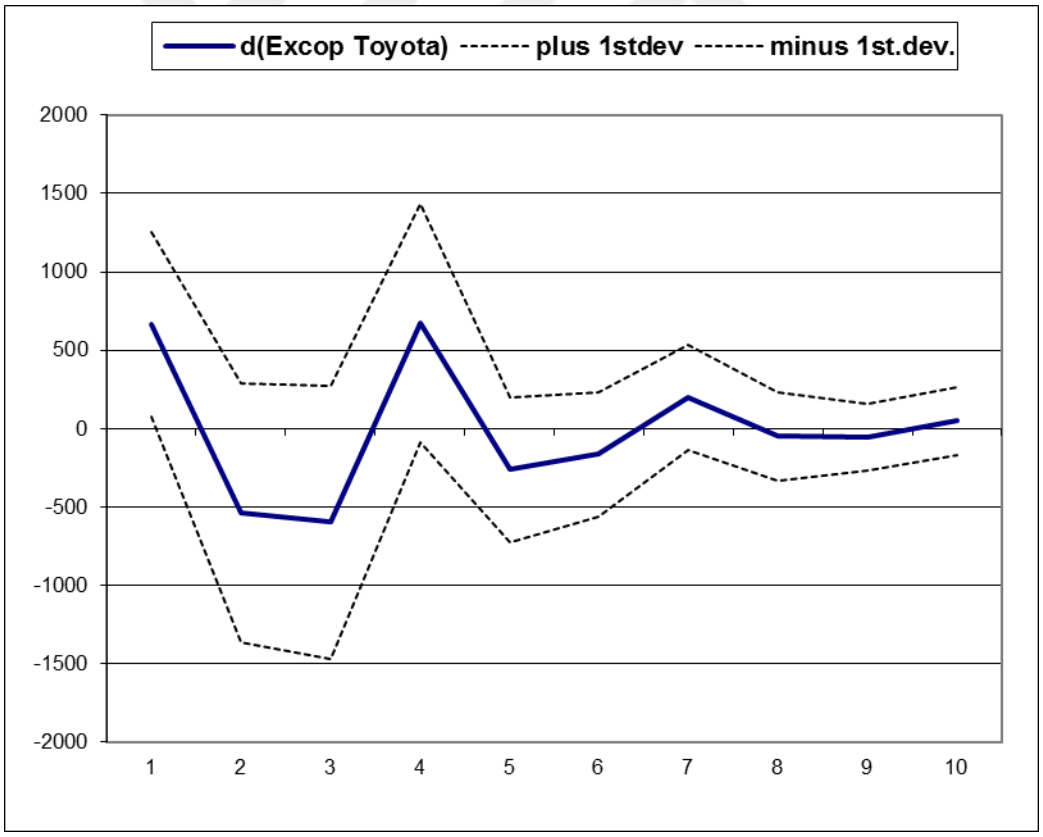


These findings are consistent with cue utilization theory (see our discussion section) and indicate that excellent opinion of Toyota (Umbrella brand) is significantly driven by excellent opinion of Prius as we proposed at our conceptual framework. So these findings are in *support of H1: consumer opinion for the green product increases consumer opinion for the umbrella brand.*

Does this spillover lift Toyota's brown product sales? Figure 9 shows that the effect of Toyota excellent opinion on its brown product sales is significantly positive in the first period. So our findings are in *support of H2: consumer opinion for the umbrella brand increases sales of its brown products.*

Figure-9 GIRF of Sales BP Responses to Excellent Opinion Toyota

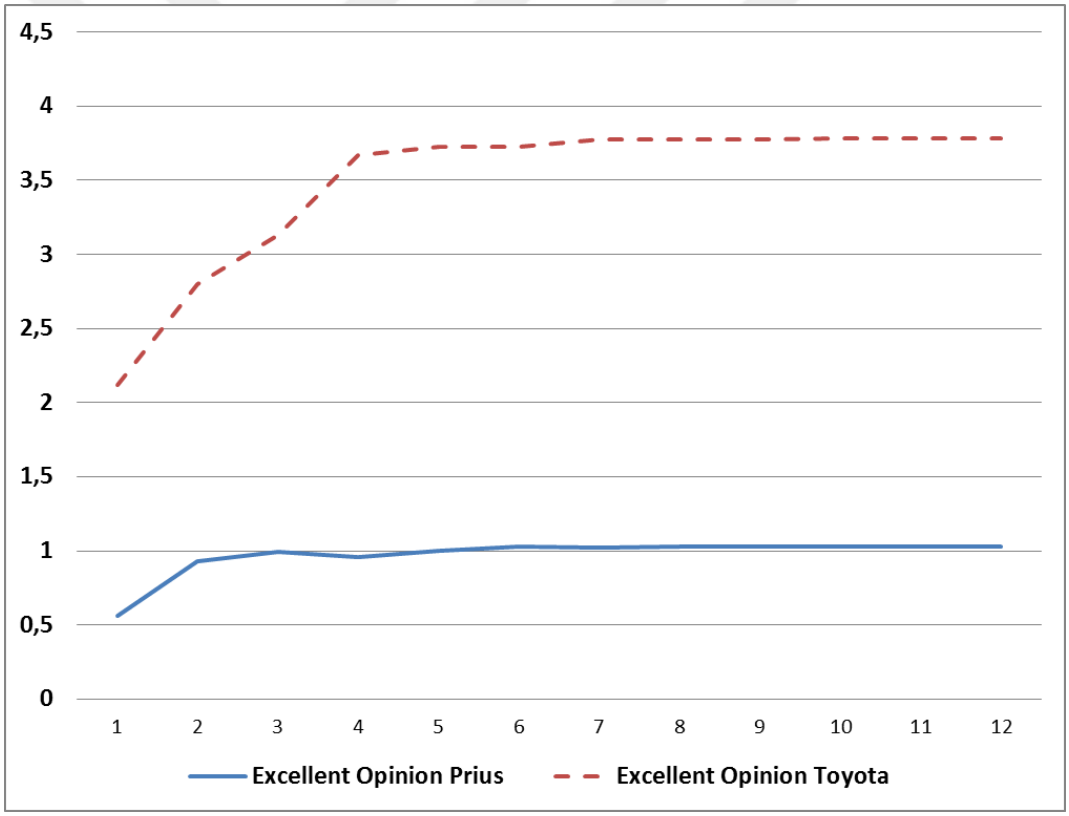
Response of Brown Product Sales to
Generalized One S.D Excellent Opinion Toyota Growth Innovation



Months

How important are Prius' excellent opinion as a driver of brown product's sales when compared with Toyota's excellent opinion? FEVD on the growth in brown product sales shows that the Excellent Opinion for Prius drives approximately one third of variance driven by Toyota excellent opinion (1.03% versus 3.78%).

Figure-10 FVED comparison due to Excellent Opinion Prius Growth Prius and Excellent Opinion Toyota Growth effect on Sales of Brown Product



How does the green product's (Prius) consumer opinion affect different brown product brands sales? Table 6 summarizes the first period directional findings for each sub-brand model, while the appendix shows the impulse response figures for each brand.

TABLE 6 **Sign of Impulses of Prius and Toyota Consumer Opinion on Brands own sales (based on generalized GIRF**

	Effect of Excellent Opinion Prius	Effect of Excellent Opinion Toyota
Sales of Avalon	Negative	Positive
Sales of Corolla	Positive**	Positive
Sales of Camry	Negative **	Positive**
Sales of Highlander	Negative **	Negative
Sales of RAV4	Negative **	Negative

*** Sign indicates significant effect*

Only Corolla significantly benefits from Prius Excellent Opinion. This model is less expensive than Prius, while others are more expensive. A plausible explanation (to be verified in future research) is that low-budget consumers are attracted to both good fuel economy and to sustainability, but cannot afford the Prius and thus settle for good fuel economy at a low price. In contrast, Prius excellent opinion has a substitution effect on the more expensive cars (Avalon, Camry and RAV4) and the gas guzzlers (Highlander), whose higher-budget (potential) customers have the money to switch to Prius and get greener & better fuel economy.

1.7 Discussion

The empirical findings of our analysis provide support for our hypotheses that media spending for a green product increases not only consumer opinion about itself, but also for the umbrella brand, which helps it sell its other (brown) products.

Interestingly, we find these benefits only for the sub brand that is less expensive than the green product – more expensive brown products suffer from cannibalization. Beyond this model-based evidence for the directional effects, we also quantify the magnitude and the timing of such spillover. As to the latter, the peak effects at the same month and at 6-7 months suggest different consumer segments – in line with previous research on different cue utilization for different familiarity groups (Rao and Monroe 1988). As the familiarity increases, increasingly more customers are more knowledgeable about greater number of attributes. These customers more easily and quickly evaluate Prius and its attributes and spillover excellent opinion about Prius to umbrella brand rapidly (same period). Less familiar customers might need more time for excellent opinion spillover (6 to 7 months). Indeed, US automotive industry research has uncovered five different segments according to their environmental values and self-efficacy: True-Greens 25%, Low-Potency Greens 6%, Moderate Greens 28%, Modest Greens 26% and Non-Greens 14% (Oliver and Rosen 2010). It is probable that True and Low potency Greens develop excellent opinion for umbrella brand (via excellent opinion of Prius) with in the same period whereas remaining three green segments need more time (6 months). As to theory implications, our study demonstrates that categorization theory applies to green products in a marketing setting, and in some cases overcompensates for the substitution effect derived from economic theory. We find the expected halo effects, and quantify them for the first time in literature. Our major contribution to marketing metric literature is that mindset metrics do not only increase sales of the (advertised) brand, they also increase sales of other products under the umbrella brand. What our aggregate-level data cannot differentiate is how and why this effect occurs. From previous literature (Broniarczyk

and Alba 1994 a, b), we know that the halo effect is an associative process and thus more likely to occur for attributes that are closely associated with each other. Thus, we speculate that customers that have an excellent opinion of Prius environmental and innovative features, started to attribute similar features to other brands under the same Toyota.

Our model revealed the dynamic effect of own and competitor hybrid introduction. As expected, competitor hybrid introduction decreases umbrella (Toyota) brand sales at both one and two lags. Interestingly though, competitor hybrid introduction only hurts Prius sales for one month, but benefits it in two months. This finding is consistent with a 'competitive halo' effect (Janakiraman, Dutta, Sismeiro and Stern 2008), where competitive hybrid introductions prime consumers about the stereotypical exemplar, which is the Prius.

The effect of Prius Excellent opinion was positive for Corolla sales but negative for that of gas puzzlers (Avalon and Highlander) and expensive cars (Camry and RAV4). This result indicates that different customer categories might behave differently when come across with a strong signal of an environmental friendly vehicle. Potential customers of Avalon and Highlander Camry and RAV4 that belong to environmental friendly sub segments might get stuck at normative legitimization process (Coskuner-Balli 2013) and shift to more eco-friendly sub brands. Prius, as a successful Environmental -Halo car, may also mediate transfer between sub brands.

To what extent would our findings generalize to other cases of green product introductions? We believe likely boundary conditions include the substantial consumer involvement in the category (cars) and the rather high awareness and positive attitudes towards the parent brand. Working on movie adaptation of book brands (Knapp et al

2014) demonstrated that extension parent brand characteristics and backward integration (parent brands support for to connect introduced and umbrella brand) are important for post-extension parent brand success. Toyota is a well-known umbrella brand for its reliable products before introduction of Prius. So a well-known brand introducing an environmental friendly new product benefited from attitude spillover. We also know that Toyota did not neglect its major brands by means of media spending and incentive budget (Figure 3 and 4) supporting backward integration. Thus, our results in a high involvement category support Knapp et al. `s (2014) findings.

Finally, marketing, just like economics, has theories implying that, if variables are evolving, they should be in long-term equilibrium (Enders 2001, Kireyev et al. 2016). In our case, we indeed find a long-term equilibrium between excellent opinion of the umbrella brand and that of its green product. This implies that consumer evaluations for the company's green and brown products cannot move very far away from each other. In other words, if the umbrella brand's reputation is not very high, it is going to be very challenging for a green product to lift the umbrella brand. One example is the rather long time it took for the Leaf, the first fully electric vehicle on the US market, to benefit Nissan's fortunes (Cole 2014). Likewise, a drop in the umbrella brand's esteem (such as the Toyota recalls) may drag the reputation of its green product down with it.

1.8 Managerial implications

In some organizations, reducing the environmental impact is a foremost priority (e.g. Unilever). In others, it may be challenging to develop and launch green products

without showing sufficient financial returns. In this study we quantified the positive spillover of green product on the umbrella brand and brown products. Practitioners can use similar approach to better calculate total effect of green product (self and spillover) on the umbrella brand. We also validated that marketing a green product increases consumer attitudes towards the firm's umbrella brand. Thus, managers can leverage the green product's appeal through its marketing communication, thus selling more brown products as long as these are less expensive than the green product. Indeed, our rationale and findings imply the spillover benefits are greater for companies that have such less expensive products in their portfolio.

In this study we also demonstrated that attitude spill-over occurs for excellent opinion of brands. Managers can use these results to argue for a stronger focus on increasing excellent opinion rather than mere awareness. Once achieved, excellent opinion for the green product and the umbrella brand are gifts that keep on giving. We find that these drivers permanently increase brown product sales, while marketing the brown product directly only produces temporary sales boosts.

For automotive industry practitioners, this study demonstrated that halo effect exists for not only special design or special engine "designer sports cars" but also innovative and environmental friendly cars. Industry practitioners might benefit findings of study to convince top management for initiating radical new technology car projects and launches. Automotive consumer segments differ by their environmental consciousness and industry practitioners need differing strategies to convince this segments (Oliver and Rosen 2010).This study demonstrated that excellent opinion of a green car can spillover to umbrella brand resulting with increased umbrella brand sales. Our timing findings also indicate consumer heterogeneity in when these positive

spillover effects materialize. Managers could further investigate when and how they can best activate cue categorization mechanism for consumer segments with different category involvement and with different importance weight on sustainability. How should managers review their media spending for the green product? Although Prius media spending is only 5% of total media spending (research period and 6 brands) (Figure-3), Media spending for Prius explains 1.8% of Brown Product sales growth, compared 11.4% of media spending on the 5 studied brown products (Figure-A-6). In other words, while Prius gets the lowest media share of voice (5%), this created 14% of the sales growth by total media spending. Thus, green products media communication and spending can also act as an effective lever for brown product sales.

As to macro-economic factors, we also found that increasing the gas price has a positive effect on excellent opinion Prius and Toyota. We demonstrated that launching an innovative very low mpg vehicle lifted not only green brands but also umbrella brands excellent opinion. Consistent with association theory, we infer a relation between consumer beliefs regarding green product's and brown products' fuel efficiency. When gas prices increase, the umbrella brand's brown products benefit from this association.

1.9 Limitations and Conclusion

The current findings support the conceptual framework and hypotheses that launching and supporting a green product does not only raise its consumer attitude and sales, but also that of the umbrella brand and its brown products. Future research is needed to verify the boundary conditions of such spillover beyond our empirical setting of a well-known umbrella brand launching a successful green product in a high

involvement consumer product category. Moreover, future research could enrich the current data set with more detailed competitor data and observing their green product launches to analyze competitor spillovers. Finally, we lacked the data to assess the net environmental impact of the green product and its spillover effects. For policy makers and society at large, the demonstrated spillover enriches the issue of the overall environmental impact of green products introduced by for-profit companies. This impact may be less due to the spillover, or even more positive if the benefitting cheaper products are still greener than the vehicles consumers would otherwise have bought. In this research, we combined three research streams (halo effect, signaling and umbrella branding) to build and empirically validate a conceptual framework which other researchers can develop. Practitioners can also use the framework and the demonstration of long term spillover effect in order to justify green product investments with additional sales volume that can come from other products. This should reduce "internal" barriers to green product projects and, we hope, further strengthen the case for a win-win-win of green products for consumers, companies and the planet.

APPENDIX A

Figure-A1 GIRF of Sales Avalon Responses to Excellent Opinion Prius Growth

Response of Avalon Sales to
Generalized One S.D Excellent Opinion Prius Growth Innovation

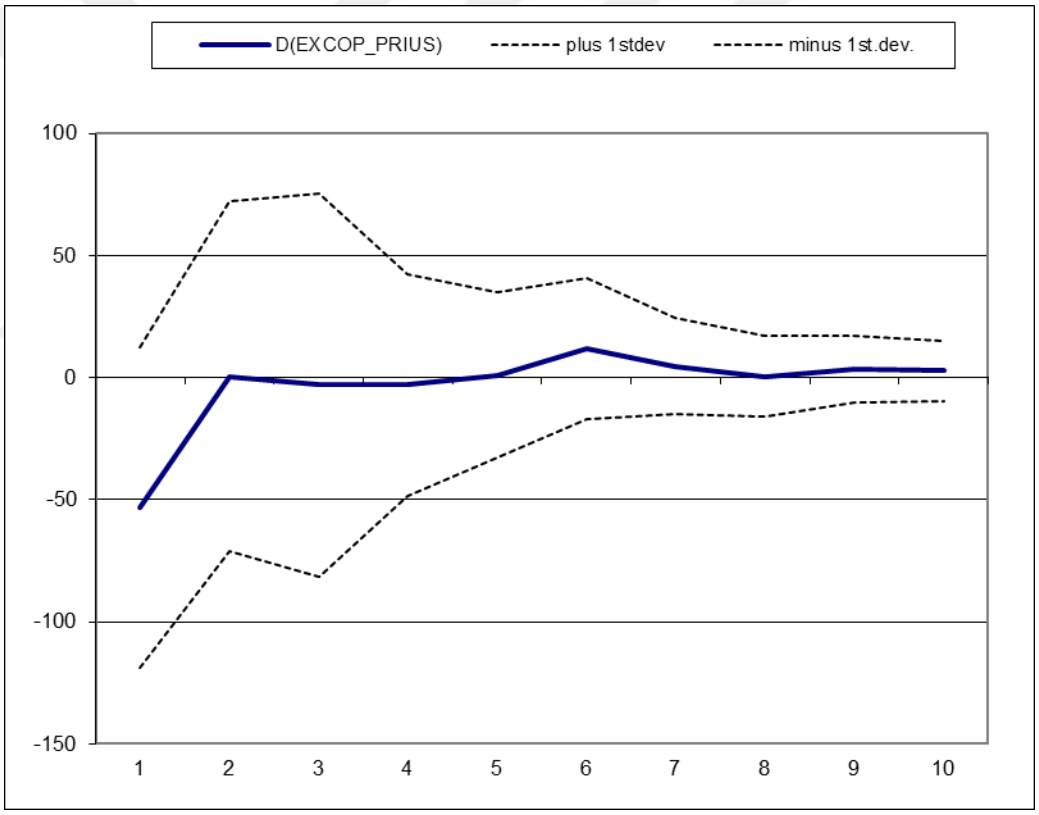


Figure-A2 GIRF of Sales Camry Responses to Excellent Opinion Prius Growth

Response of Camry Sales to
Generalized One S.D Excellent Opinion Prius Growth Innovation

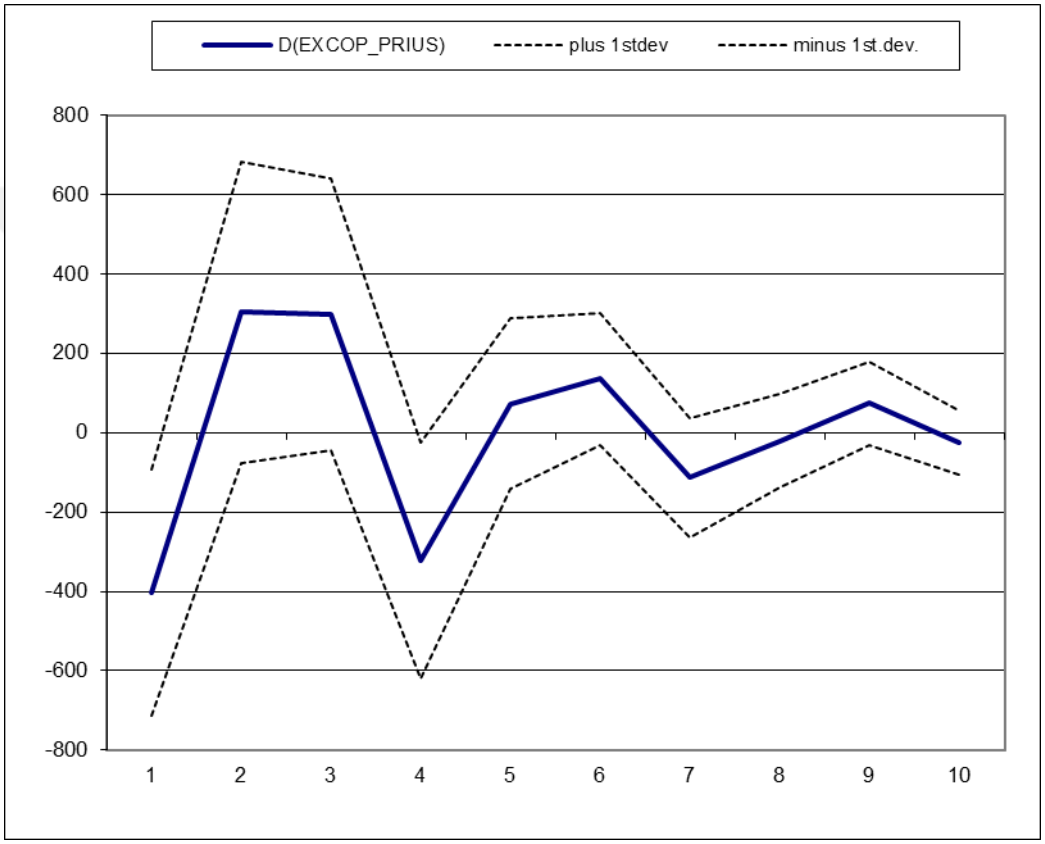


Figure-A3 GIRF of Sales Corolla Responses to Excellent Opinion Prius Growth

Response of Corolla Sales to
Generalized One S.D Excellent Opinion Prius Growth Innovation

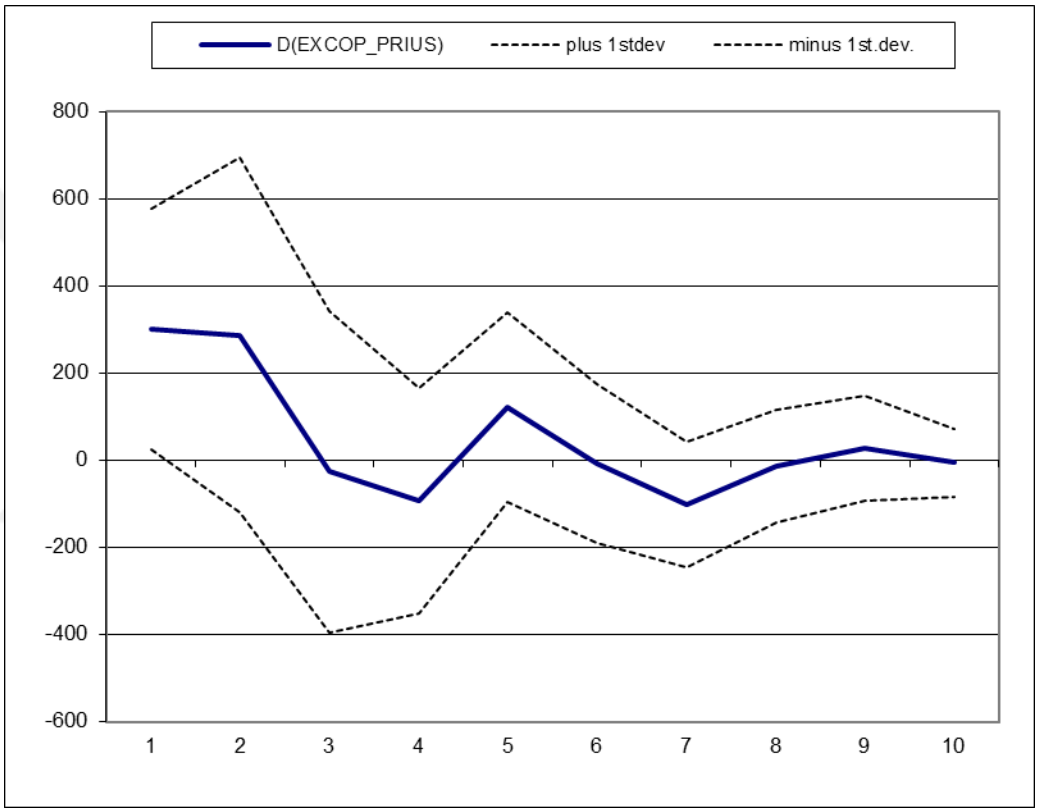


Figure-A4 GIRF of Sales Highlander Responses to Excellent Opinion Prius Growth

Response of Highlander Sales to
Generalized One S.D Excellent Opinion Prius Growth Innovation

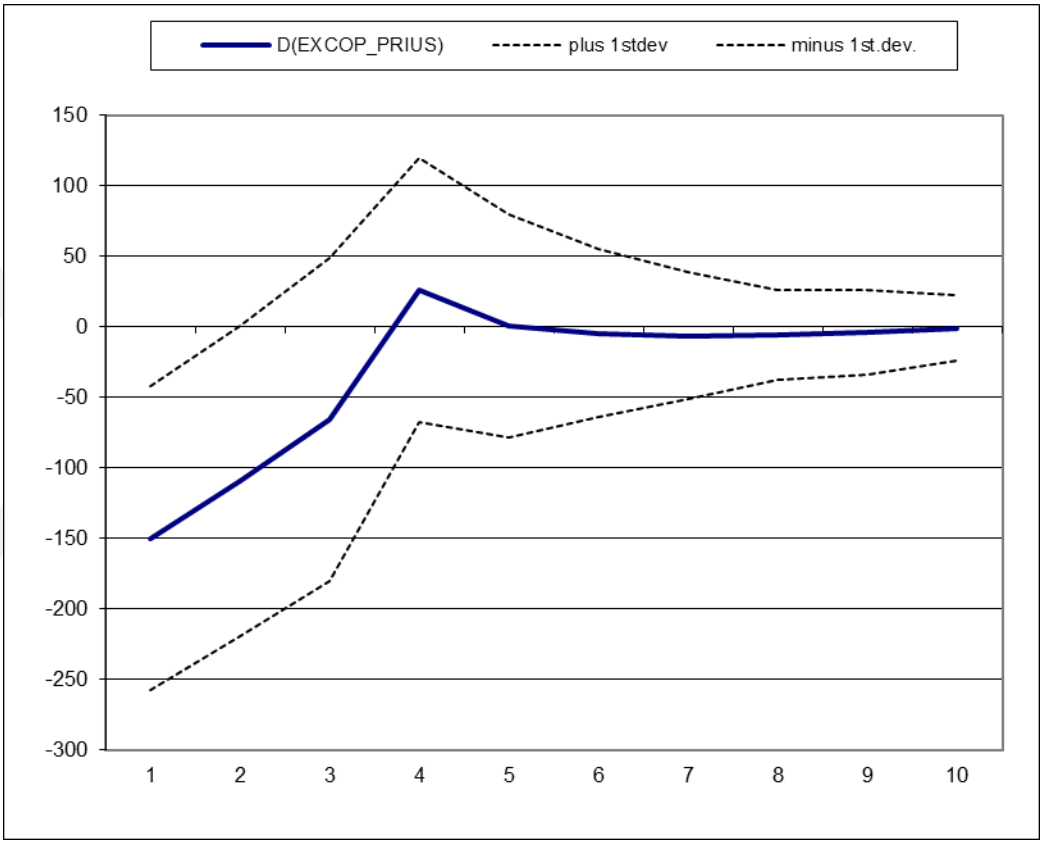


Figure-A5 GIRF of Sales RAV4 Responses to Excellent Opinion Prius Growth

Response of RAV4 to
Generalized One S.D Excellent Opinion Prius Growth Innovation

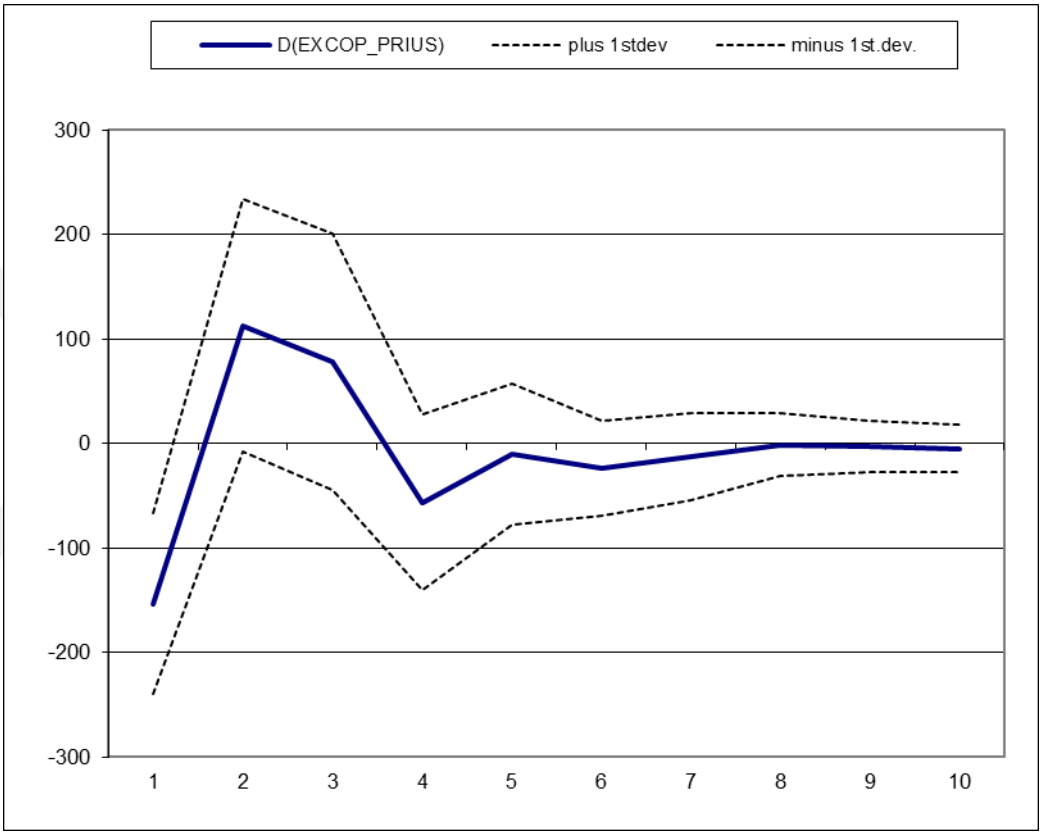
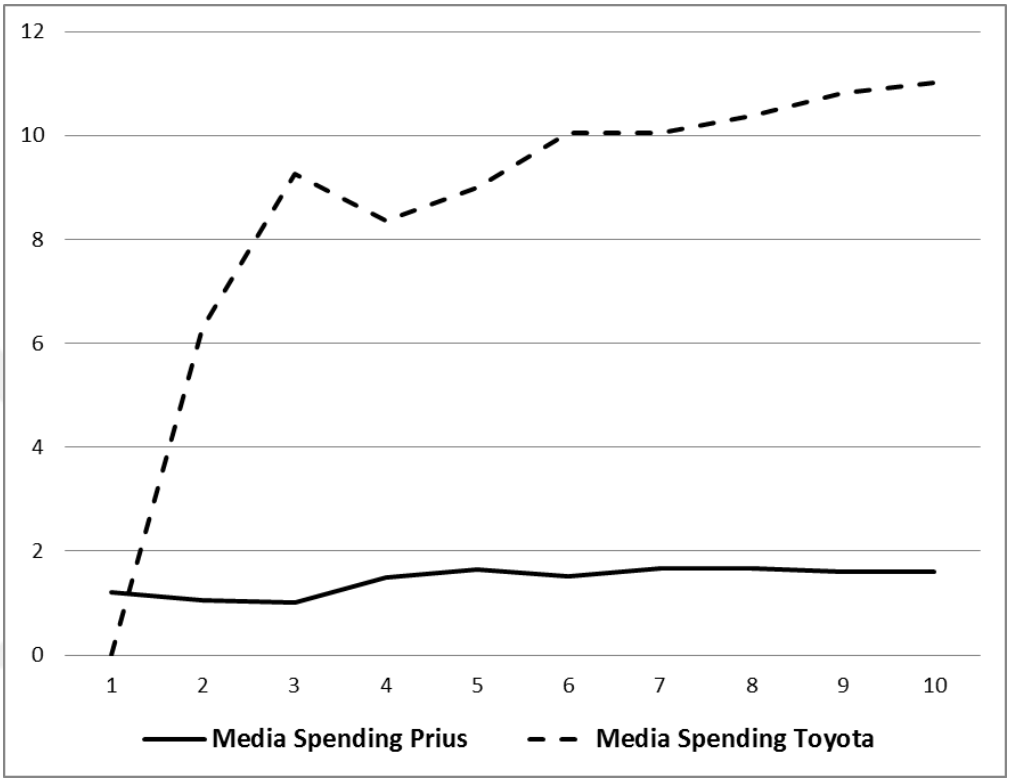


Figure A-6 FVED comparison due to Media Spending Prius and Media Spending Toyota effect on Sales of Brown Products



REFERENCES

Aaker, A., and Kevin, K. (1990). Consumer Evaluations of Brand Extensions. *Journal of Marketing*, 54 (January), 27-41.

Al. (2008, July 2). What the Prius has taught us about innovation. Retrieved October 15, 2011, from 7P Productions: http://7pproductions.com/blog/2008/07/01/what-the-prius-has-taught-us-about-innovation/

Baker, W. E., and Sinkula, J. M. (2005). Environmental marketing strategy and firm performance: effects on new product performance and market share. *Journal of the Academy of Marketing Science*, 33(4), 461–475.

Balachander, S., and Ghose, S. (2003). Reciprocal Spillover effects: A Strategic Benefit of Brand Extensions. *Journal of Marketing,* Vol-67, 4-13.

Bansal, P., and Clelland, I. (2004). Talking trash: Legitimacy, impression management, and unsystematic risk in the context of the natural environment. *Academy of Management Journal* , Vol-47, 93-103.

Bansal, P., Roth, K. (2000). Why companies go green: A model of ecological responsiveness. *Academy of Management Journal*, 43(4), 717–736.

Borah, A., and Gerard J. T. (2015). Halo (Spillover) Effects in Social Media: Do Product Recalls of One Brand Hurt or Help Rival Brands? *Journal of Marketing Research,* Vol-53, 143-160.

Barroso, A., and Llobet, G. (2012). Advertising and Consumer awareness of New, Differentiated Products. *Journal of Marketing research,* Vol. 49, 773-792.

Bezawada, R., and Pauwels, K. (2013). What is Special about Marketing Organic Products? *Journal of Marketing*, Vol-77,31-51.

Bower, G. H. (1981). Mood and memory. *American Psychologist*, 36(2), Feb 1981, 129-148

Brown, T. J., and Dacin, P.A. (1997). The Company and the Product: Corporate Associations and Consumer Product Responses. *Journal of Marketing*, Vol-61, 68-84.

Broniarczyk, S. M., Alba, J. (1994a). The Importance of the Brand in Brand Extension. *Journal of Marketing Research*, Vol. 31, No. 2, 214-228.

Broniarczyk, S. M., Alba, J. (1994b). The Role of Consumers' Intuitions in Inference Making. *Journal of Consumer Research.* Vol-21 (3), 393-407.

Cole, J. (2014). "Nissan CEO: Leaf is now profitable, 80% of its sales comes from 4 US cities", Inside EVs, October 5th, accessed March 21st 2017 at: http://insideevs.com/nissan-ceo-ghosn-leaf-sales-success-profits/

Coskuner-Balli, G. (2013). Market practices of legitimization: Insights from Consumer Culture Theory. *Marketing Theory*, Vol. 13 Issue 2, 193-211.

Cronin, J. J., Smith, J. S., Gleim, M. R., Ramirez, E., & Martinez, J.D. (2011). Green marketing strategies: An examination of stakeholders and the opportunities they present. *Journal of the Academy of Marketing Science*, 39(1), 158–174.

Dekimpe, M. G., &. Hanssens, D.M. (1999). Sustained Spending and Persistent Response: A New Look at Long-Term Marketing Profitability. *Journal of Marketing Research*, Vol-36, 397-412.

Enders W., Siklos, P. (2001). Cointegration and Threshold Adjustment. *Journal of Business & Economic Statistics*, Vol-19, 166-176.

Erdem, T. (1998). An empirical Analysis of Umbrella Branding. *Journal of Marketing Research*, Vol-25, 339-351.

Erdem. T., and Swait. J. (1998). Brand Equity as a Signaling Phenomenon. *Journal of Consumer Psychology*, Vol-7,131-157.

Erdem, T., and Sun, B. (2002). Empirical Investigation of the Spillover Effects of Advertising and Sales Promotions. *Journal of Marketing Research,*Vol-39,408-420.

EPA. (2003). EPA Agency Report December 2003, https://archive.epa.gov/airquality/eac/web/pdf/pr031231_eac_sc_appalachian.pdf

Fishbein, M., & Ajzen, I. (1975). Belief, attitude, intention, and behavior: An introduction to theory and research. *Reading, MA*: Addison-Wesley.

Greene, L. (2104). Forget the Porsche, drive a Prius if you want to impress the ladies. Modal Trigger, April 22nd.

Han, M. (1989). Country Image: Halo or Summary Construct? *Journal of Marketing Research,* Vol-26, 222-229.

Hanssens, D., Pauwels, K., Srinivasan, S., Vanhaule, M., Yildirim, G. (2014). Consumer Attitude Metrics for Guiding marketing Mix Decisions. *Marketing Science* Vol.33, No.5,534-550.

Hardie, B., and Fader, P. (1993). Modeling Loss Aversion and Preference Dependence effects on Brand Choice. *Marketing Science,* Vol-12, 378-394.

Huang, M., and Rust, R. (2011). Sustainability and consumption. *Journal of the Academy of Marketing Science,* Vol.39.1, 40-54.

Hult, G., and Tomas, M. (2011). Market-focused sustainability: market orientation plus! *Journal of the Academy of Marketing Science,* Vol-39, 1-6.

Janakiraman, R., Sismeiro, C., Dutta, S. (2008). Perception Spillovers across Competing Brands: A Disaggregate Model of How and When. *Journal of Marketing Research,* Vol. 46, Issue 4, 467-481.

Johson, R.L. (2009). Organizational motivations for going green or profitability versus sustainability. *The business review* 13.1, 22-28.

Kahneman, D., Slovic, P., and Tversky, A. (1982). *Judgment Under Uncertainty: Heuristics and Biases.* Cambridge, UK: Cambridge University Press.

——— and Snell, J. (1992). Predicting a Changing Taste: Do People Know What They Like? *Journal of Behavioral Decision Making*, 5 (3), 187–200.

Kardes, F., Gurumurthy, M., and Dornoff, R. (1993). Brand Retrieval, Consideration Set Composition, Consumer Choice, and the Pioneering Advantage. *Journal of Consumer Research,* 20 (1), 62–75.

Keller, K., Aaker, D. (1992a). The effect of corporate Images and Brand Strategies on New Product Evaluations *Research Paper* No:1216.

Keller, K., Aaker, D. (1992b). The Effects of Sequential Introduction of Brand Extensions. *Journal of Marketing research,* Vol.29, 35-50.

Keller, K., Lehman, D. (2006). Brands and branding: Research findings and future priorities. *Marketing science,* Vol-25, 740-759.

Kıhlstrom, R.E., Riordan, M.H. (1984). Advertising as a Signal. *Journal of Economy,* 92, 427-450.

Kireyev, P., Pauwels, K., Gupta, S. (2016). Do display ads influence search? Attribution and dynamics in online advertising . *International Journal of Research in Marketing.* Vol-33, 475-490.

Knapp, A., Henning, T., Mathys, J. (2014). The Importance of Reciprocal Spillover Effects for the Valuation of Best Seller Brands. *J of Acad. Mark. Sci,* Vol-42, 205-221.

Kumar, V., Christodoulopoulou. A. (2014). Sustainability and branding: An integrated perspective. *Industrial Marketing Management* , Vol-43,6-15.

Lane, V., and Jacobson, R. (1995). Stock Market Reactions to Brand Extension Announcements: The Effects of Brand Attitude and Familiarity. *Journal of Marketing,* 50 (I), 63-77.

Luo, X., Bhattacharya, C. B. (2006). Corporate Social Responsibility, Customer Satisfaction, and Market Value. *Journal of Marketing,* Vol. 70, Issue 4, 1-18.

Makower, J. (2009). Taking care of business. Retrieved August 25, 2009 from www.greenbiz.com.

Menguc, B., & Ozanne, L. K. (2005). Challenges of the "green imperative": a natural resource-based approach to the environmental orientation—business performance relationship. *Journal of Business Research,* 58(4), 430–438.

Mervis, CB., Rosch, E. (1981). Categorization of Natural Objects. *Annual Review of Psych.* Vol-32 Pages: 89-115.

Mılgrom, P and Roberts, R. (1986). Prices and advertising Signals of Product Quality. *Journal of Political Economy.,* 94, 796-821.

Montgomery, C.A, and Wernerfelt .B. (1992). Risk Reduction and Umbrella Branding. *Journal of Business, Vol-* 65, 31-50.

Moore, W and William, J. (1978). A Study of Amount of Halo in the Perceptions of Automobiles. *Journal of Consumer Psychology,* 1978 Vol-5,481-484 .

Nelson, P. (1974). Advertising as Information. *Journal of Political Economy,* Vol. 82 Issue 4, 729.

Newport, F. (2017). Gallup Social Issues March 2017, http://www.gallup.com/poll/206159/americans-tilt-toward- protecting-environment-alternative fuels.aspx?g_source=Social+Issues&g_ medium= newsfeed&g_ campaign=tiles.

Nijs, V.R., Dekimpe, M.G., Steenkamp, J.B., & Hanssens, D.M. (2001). The Category Demand Effects of Price Promotions. *Marketing Science*, 20 (1), 1-22.

Nijs, V.R., Srinivasan, S., & Pauwels, K. (2007). Retail-price drivers and retailer Profits. *Marketing Science*, 26 (4), 473-487.

Norcia, V. D., & Tigner, J. (2000). Mixed motives and ethical decisions in business. *Journal of Business Ethics*, 25(1), 1–13.

Olson, E. (2013). The Green Innovation Value Chain. *Journal of Product Innovation Management*, Vol -4, 782-793.

Oliver, J., Rosen, D. (2010). Applying the Environmental Propensity Framework: A Segmented Approach to Hybrid Electrical Vehicle Marketing Strategies . *Journal of Marketing Theory and Practice*, Vol.18, 377-393.

Ottman, J. A., Stafford, E. R., & Hartman, C. L. (2006). Avoiding green marketing myopia. *Environment*, 48(5), 22–37.

Palda, K. S. (1966). The Hypothesis of a Hierarchy of Effects: A Partial Evaluation. *Journal of Marketing Research*, 3, 13–24.

Pauwels, K. H., Hanssens, D.M., & Siddarth. S. (2002). The Long-term Effects of Price Promotions on Category Incidence, Brand Choice, and Purchase Quantity. *Journal of Marketing Research*, 34 (November) 421-439.

Pesaran, H. H. & Shin, Y. (1998). Generalized Impulse Response Analysis in Linear Multivariate Models. *Economic Letters*, 58 (1), 17-27.

Porter, M. E., & Van der Linde, C. (1995). Green and competitive: Ending the stalemate. *Harvard Business Review*, 87(9), 120–134.

Pujari, D., Wright, G., & Peattie, K. (2003). Green and competitive: influences on environmental new product development performance. *Journal of Business Research*, 56(8), 657–674.

Rao, A., Monroe, K. (1988). The Moderating Effect of Prior Knowledge on Cue Utilization in Product Evaluations, *Journal of Consumer Research,* Vol- 15 (2): 253-264.

Rangaswamy, A., Raymond, B., and Terence A, O. (1993). Brand Equity and the Extendibility of Brand Names. *International Journal of Research in Marketing,* 10 (March), 61-75.

Russo, M. V., & Fouts, P. A. (1997). A resource-based perspective on corporate environmental performance and profitability. *Academy of Management Journal*, 40(3), 534–559.

Roch, E., Mervis, C.B. (1975). Studies in the Internal Structures of Categorizations' *Cognitive Psychology,* Vol- 7, 573-605 .

Rose, S. (1993). The Making of Memory. London: Bantam Books.

Sirsi, A., Ward, J., and Reingen, P. (1996). Micro cultural Analysis of Variation in Sharing of Causal Reasoning about Behavior, *Journal of Consumer Research*, 22, 345-372.

Smith, S. (2008). Prius, profits and promises make an interesting story. *Orlando Sentinel*, accessed June 2, 2016 at: http://articles.orlandosentinel.com/2008-04-19/news/scscolumn19_1_toyota-prius-development-costs-profit.

Srinivasan, S., Pauwels, K.H., Hanssens, D.M., & Dekimpe, M.G. (2004). Do Promotions Benefit Manufacturers, Retailers or Both? *Management Science*, 50 (5), 617-629.

Srinivasan, S., Vanhuele, M., Pauwels, K . (2010) Mind-Set Metrics in Market Response Models: An Integrative Approach. *Journal of Marketing Research* , Vol. 47 Issue 4, 672-684

Stiglitz, J. (1987). The Causes and consequences of the dependencies of quality on Price, *Journal of Economic Literature, 25,* 1-48.

Stafford, E. R., & Hartman, C. L. (1998). Toward an understanding of the antecedents of environmentalist-business cooperative relations. *American Marketing Association Conference Proceedings,* 9, 56.

Sutherland, Max. (1993). Advertising and the Mind of the Consumer. St. Leonards, Australia: Allen and Unwin.

Tauber, E.M. (1981). Brand Franchise Extension: New Product Benefits from Existing Brand Names. *Business Horizons,* 24 (March/April), 36-41.

Tauber, E.M. (1988). Brand Leverage: Strategy for Growth in a Cost- Controlled World. *Journal of Advertising Research,* 28 (August/September), 26-30.

Tellis, Gerald. (2004). Effective Advertising: Understanding When, How, and Why Advertising Works (Marketing for a New Century), Sage Publications.

Thorndike, E. (1920). A consistent error in Psychological Rating's. *Journal of Applied Psychology,* Vol-4, 25-29.

United Nations. (1987). Report of the World Commission on Environment and Development. General Assembly 42/187, 11th December 1987. *http://www.un-documents.net/a42r187.htm*.

Vakratsas, D., and Ambler, T. (1999). How Advertising Works: What Do We Really Know? *Journal of Marketing,* Vol-63, 26–43.

Wernerfelt, B. (1988). Umbrella Branding as a Signal of New Product Quality: An Example of Signaling by Posting a Bond. *RAND Journal of Economics,* 19 (3), 458-466

Will, G. (2009). This Week with George Stephanopoulos, *ABC News*, May 5th, video available at Auto blog: http://www.autoblog.com/2009/05/05/george-will-recycles-prius-loses-money-untruth/#slide-11781