

Thoenes, Stefan; Gores, Timo

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AUTHORS

Stefan Thoenes (Cologne Graduate School, University of Cologne, and EWI)

Timo Gores (Cologne Graduate School, University of Cologne)

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**Institute of Energy Economics
at the University of Cologne (EWI)**

Alte Wagenfabrik
Vogelsanger Straße 321
50827 Köln
Germany

Tel.: +49 (0)221 277 29-100
Fax: +49 (0)221 277 29-400
www.ewi.uni-koeln.de

CORRESPONDING AUTHOR

Stefan Thoenes
Institute of Energy Economics at the University of Cologne (EWI)
Tel: +49 (0)221 277 29-208
Fax: +49 (0)221 277 29-400
Thoenes@wiso.uni-koeln.de

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Attention, Media and Fuel Efficiency[☆]

Stefan Thoenes^{a,*}, Timo Gores^b

^a*Cologne Graduate School and Institute of Energy Economics, University of Cologne,
Vogelsanger Straße 321, 50827 Cologne, Germany.*

^b*Cologne Graduate School, University of Cologne, Germany.*

Abstract

This study examines attention effects in the market for hybrid vehicles. We show that local media coverage, gasoline price changes and unprecedented record gasoline prices have a significant causal impact on the consumers' attention. As attention is not directly observable, we analyze online search behavior as a proxy for the revealed consumer attention. Our study is based on weekly panel data of local newspaper coverage, gasoline prices and Google search trends for 19 metropolitan areas in the US. Additionally, we use monthly state-level panel data to show that the adoption rate of the hybrid vehicle technology is robustly related to our measure of attention.

Keywords: consumer behavior, attention, media, gasoline price, energy efficiency, hybrid vehicle

JEL classification: D12, D83, L62, Q41

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*Corresponding author

Email address: Thoenes@wiso.uni-koeln.de, +49 22127729208 (Stefan Thoenes)

1. Introduction

The emissions of motor vehicles are one of the major sources of greenhouse gas emissions leading to climate change. For example, in the United States, the transportation sector accounts for 34% of the carbon dioxide emissions.¹ These emissions could be decreased with improved technologies that offer a better fuel efficiency.² For this reason, it is crucial to understand which factors are relevant for the diffusion of fuel efficient technologies.

We argue that the consumer purchasing decision process and the question when consumers are willing to invest in fuel efficiency play an important role in this context. As Allcott (2011) indicates, 40% of US consumers do not consider a vehicle's gasoline consumption when purchasing a car. Therefore, the amount of attention devoted to energy efficient vehicles and fuel costs should be a major determinant for the diffusion of new technologies. Following this rationale, we attempt to capture the dynamics of the consumers' attention to hybrid electric vehicles.³ However, attention is not directly observable and thus, finding an adequate measure for attention is challenging. We make use of Google's search query data as a direct and observable proxy for the revealed attention. By analyzing online search behavior, we effectively examine the consumers' process of gathering information about the topic to which they pay attention. Data on aggregate regional online search behavior is obtained from the service "Google Insights for Search", enabling us to track the development of the search volume of a specific query.

It is expected that there are two main channels that alter the attention devoted to

¹Source: United States Department of Energy, "Emissions of Greenhouse Gases in the United States 2009", DOE/EIA-0573(2009), Figure 3, U.S. energy-related carbon dioxide emissions by sector, 2009.

²The fuel economy of a vehicle is defined as the output (miles) per input (gallons of gasoline). In contrast, fuel efficiency, as a form of thermal efficiency, is the ratio of energy used for propulsion compared to the total amount of energy consumed. Thus, a small vehicle with a high fuel economy could still be less fuel efficient than a larger vehicle with a lower fuel economy, e.g. because a vehicle with a heavier weight also requires more physical work to drive the same distance.

³We focus on hybrid electric vehicles as they are considered to be a promising technology for increasing fuel efficiency. Furthermore, Enkvist et al. (2007) indicate that increasing the fuel efficiency of vehicles is one of the least costly ways to reduce the overall global greenhouse gas emissions.

environmentally friendly vehicles. First, as the reduced gasoline consumption is the main advantage of energy efficient vehicles, the gasoline price should be an important determinant of the consumers' attention devoted to hybrid vehicles. Tversky and Kahneman (1991) indicate that consumers also evaluate prices based on reference points. If the gasoline price is higher than such a reference point, consumers would consider a price increase as a loss and may show a stronger reaction due to loss aversion. Thus, unprecedented record gasoline prices could have an additional effect on the consumers' attention if the highest previous gasoline price is such a reference point. Second, consumers may react to media coverage of topics such as hybrid vehicles and gasoline costs.⁴ We draw upon the agenda-setting theory by McCombs and Shaw (1972), arguing that mass media influences the public agenda by determining which topics are seen as important.

However, the causality of whether media covers topics of general interest or whether media determines the general interest is not always clear. For our case, it is difficult to identify the causal influence of media because the consumers' attention and media coverage are both directly affected by gasoline prices and other possibly unobserved factors. Similar to Engelberg and Parsons (2011), we circumvent this problem by observing the behavior of different geographical groups. These groups react to the same underlying event, but are exposed to different information sources, i.e. their local newspaper. Our analysis is based on a novel weekly panel dataset consisting of 19 metropolitan areas in the United States covering the years 2004 to 2011. We control for local gasoline prices, national television reports and national newspaper coverage. In order to estimate the causal effect of local newspaper coverage on our attention measure, we allow each local newspaper to have an effect on all

⁴This hypothesis is supported by several studies indicating that economic actions are affected by media coverage. For example, Eisensee and Strömberg (2007) analyze the impact of mass media coverage on the US relief for natural disasters. To identify the effect of media coverage, they use an instrument variable, which measures the availability of other newsworthy events that crowd out media coverage of marginally newsworthy natural disasters. Tetlock (2007) analyzes the relationship between the content of newspaper articles and stock market outcomes. He shows that the sentiment of media has a distinct impact on stock prices.

other metropolitan areas. Thus, we estimate the supplemental effect that a newspaper has in its own region compared to the effect on all other regions. This identification strategy allows us to disentangle the underlying event and the causal media effect.

Our results indicate that the consumers' attention devoted to hybrid vehicles is affected by both channels. We find that local media coverage causally affects the consumers' attention and that consumers react to both gasoline price changes and unprecedented levels of the gasoline price. Building on these findings, we validate that our proxy for the attention to hybrid vehicles is relevant to the purchasing behavior. We use a panel dataset of monthly state-level hybrid vehicle registrations and market shares for the period covering the years 2006 to 2011 to show that our attention measure is robustly related to actual consumer purchasing decisions. Overall, our findings suggest that attention effects have a distinct impact on the market for hybrid vehicles.

The presented article contributes to the existing literature in two regards. First, the study adds to the growing field of attention effects by analyzing the determinants of the attention to a long-lived consumer good. Until now, the most advanced analysis of the impact of attention effects on economic choices is primarily in the finance literature. Barber and Odean (2008) show that the stock purchasing decision of individual investors is influenced by the attention to a certain choice. Given the scarcity of the resource attention and the large set of possible investments, attention-based decision making implies that investors are more likely to buy investments that grab their attention. Da et al. (2011) indicate that Google search queries are a valid direct measure of retail investor attention, which is found to affect the retail investors' behavior in financial markets.⁵ In the context of consumer behavior, Chetty et al. (2009) show that the consumers' reaction to taxation depends on the salience of the

⁵There are several other studies about attention effects in financial markets. For example, DellaVigna and Pollet (2009) indicate the existence of weekday effects due to investors' limited attention. Gilbert et al. (2012) argue that inattention leads to a temporary market reaction to stale information. Engelberg et al. (2012) examine the market impact of television stock recommendations, which are interpreted as shocks to the retail investors' attention.

tax. Masatlioglu et al. (2012) provide a theoretical framework for limited attention effects. Their model describes a decision process under the constraint of a limited consideration set and examines the implications for revealed preferences and revealed attention.

Second, our study extends the literature on the consumer search behavior in reaction to gasoline price changes. There is a range of literature (see for example Chandra and Tappata (2011)) that focuses on the relationship between the consumer search behavior and the price dispersion between different gas stations, or more broadly the competition in gasoline markets. Lewis and Marvel (2011) find that the consumers' reaction to price changes is not symmetric. Consumers increase their search effort when faced with rising gasoline prices, but do not react strongly to falling prices. In contrast to these studies, we do not focus on the search behavior related to the gasoline purchasing decision, but rather on the long-term reaction, i.e. the search behavior accompanying the vehicle purchase. Our findings are similar regarding the asymmetric consumer search behavior. Additionally, we identify a distinguished attention effect for record gasoline prices. This evidence is consistent with the results in the finance literature. For example, Yuan (2011) measures the impact of attention-grabbing events like record levels of the Dow Jones index and front page articles about the stock market. It is shown that attention influences trading behavior of individual investors. Similarly, Li and Yu (2012) show that psychological reference points of past record levels can also have an impact on aggregate stock market outcomes.

The remainder of the article is organized as follows: Section 2 describes the market for hybrid vehicles and discusses the consumers' purchasing motives. Section 3 gives detailed information about the construction of our unique dataset. In Section 4, we analyze how media coverage and gasoline prices affect the attention devoted to hybrid vehicles. In Section 5, we show that online search queries are a relevant measure and have a robust correlation with actual sales volumes. Finally, we give a short conclusion of our findings in Section 6.

2. Hybrid Vehicle Market and Consumer Attitudes

Hybrid electric vehicles have both an internal combustion engine and an electric motor. This combination allows improved fuel efficiency compared to similar non-hybrid vehicles because the combustion engine is mostly used to support the electric motor. The battery of the electric motor is recharged while driving with gasoline and also while recovering the braking energy. Thus, as for most fuel-efficient technologies, hybrid electric vehicles have a higher purchasing price due to the increased complexity of including advanced technological parts such as an electric motor, a lithium-ion battery and a braking energy recovery system. The upfront investment expenses result in lower gasoline consumption and lower costs during the lifetime of the vehicle. Therefore, the profitability of the investment in fuel efficiency depends on future gasoline prices.

In 1999, the Honda Insight was the first hybrid vehicle to be introduced in the United States. The Toyota Prius, still the best selling hybrid vehicle in the US, was introduced in 2000. However, in the first six years, only a total of 197,483 hybrid vehicles were sold. In the following two years, during 2005 and 2006, there were 462,347 hybrid vehicles sold in the US.⁶ Even at the start of our sample period in December 2006, the market share of all hybrid vehicles was still at a rather low level of 1.65%. Thus, the hybrid car market can be considered a new market, which means that the initial awareness related to this market is relatively low.

Several studies show that the hybrid vehicle market is mainly driven by three factors: Gasoline prices, government subsidies and non-monetary factors like symbolic values or environmental concern. There are a range of studies focusing on the impact and effectiveness of government programs that foster the sales of hybrid vehicles. For example, Beresteanu and Li (2011) find that both high gasoline prices and tax incentives have a significantly positive effect on hybrid sales. Gallagher and Muehlegger (2011) present similar results and

⁶Source: US Department of Energy, <http://www.afdc.energy.gov/afdc/data/vehicles.html>

show that sales tax waivers have a much higher impact than income tax waivers, which are less salient and transparent. Chandra et al. (2010) find that government incentives have a positive effect on hybrid sales but are not very cost effective. Diamond (2009) indicates that gasoline prices may have a higher impact than government incentives.

The literature also identifies several distinct, non-monetary factors that influence the hybrid vehicle market. Kahn (2007) shows that environmental concern is one aspect that influences purchase decisions, as green party voters are more likely to buy hybrid vehicles. Heffner et al. (2007) argue that in addition to economic factors, hybrid car owners incorporate different symbolic values in their decision. These range from obvious stereotypes, like overall environmental concern, to other factors such as wanting to be seen as a moral and intelligent person, opposing war, opposing oil producers or possessing the latest technology. In this context, Griskevicius et al. (2010) find that social motives and concern for status are important factors for purchasing decisions in general. From a psychological perspective, seemingly altruistic behavior, like publicly demonstrating ownership of green products, can be seen as a costly signal to improve social status. Following this rationale, Sexton and Sexton (2011) show that the Toyota Prius benefits from its distinct recognizability as a hybrid car, which makes the Prius more attractive for status-concerned car buyers.

However, these non-monetary factors are subject to changes in the public agenda. Thus, the hybrid vehicle market should be affected by agenda-setting, in terms of media coverage increasing the general public awareness about the existence and the environmental benefits of hybrid cars.

Several considerations about the hybrid car market can also be extended to the more general topic of fuel efficiency. Despite the fact that the gasoline price is found to have an impact on consumer decisions, there is evidence that consumers are not able to fully assess the value of fuel efficiency. For example, Turrentine and Kurani (2007) use a survey approach to show that many consumers are not able to calculate the lifetime cost of their vehicle or

to make informed decisions about the fuel efficiency of a car they would like to purchase. The authors point out that drivers know the price paid at the gas station a few weeks ago, but do not use a decision-making process that is consistent with economic assumptions and theories. Furthermore, consumers also assign a symbolic value to fuel efficiency. The consumers' decision process described by Turrentine and Kurani (2007) suggests that the attention devoted to the gasoline price and fuel efficiency should have an even stronger effect than the gasoline price itself. If vehicle buyers cannot assess the present value of the investment, non-monetary effects will have a stronger impact.⁷

The question of how consumers value fuel efficiency is a topic of ongoing discussion and research. Greene (2010) reviews 28 econometric studies from the years 1995 to 2010, which do not draw a conclusive picture whether consumers undervalue or overvalue fuel efficiency. The attention and media effects found in the present article are factors that need to be considered in such studies.

3. Data

In this study, two unique panel datasets for the United States are considered. Our empirical setup focuses on four types of data: Attention measures, media coverage, gasoline prices and vehicle registrations. In the main analysis, we use local news coverage and weekly online searches in 19 metropolitan areas in the US. The dataset is an unbalanced panel from January 4th, 2004 to October 23rd, 2011 and is used to determine the causal impact of local media coverage on attention. Additionally, we test whether there is a robust relationship between our measure of attention and actual sales volumes. For this purpose, we use monthly US state-level car registration data, which was kindly provided by R. L. Polk & Co. The

⁷This view is also supported by Baker and Wurgler (2007), who show that investor sentiment has a stronger effect on stocks that are more speculative and difficult to arbitrage or value. This argument also holds for our setting, as vehicles are relatively illiquid assets and consumers have difficulties assessing the life-time fuel costs.

panel for vehicle registration data ranges from December 2006 to February 2011. We analyze the number of hybrid vehicle registrations and the hybrid technology’s market share.

As a proxy for attention, we use Google search query data as a direct measure of the public interest. Time series of regional search trends are available at “Google Insights for Search” and range back to January 2004.⁸ We collect weekly search trends for the terms “hybrid” and “mileage” in the category “Autos and Vehicles”.⁹ These queries represent the interest in the technology of hybrid vehicles and in fuel economy in general. We obtain weekly search trends for the 19 metropolitan areas and additionally aggregate weekly state-level search trends in order to derive a monthly search measure for the analysis in Section 5. Google constructs the trend index by calculating the amount of search queries that are associated with the term of interest. That number is then divided by the total number of search queries within this period and region, which yields a time series of the relative interest for the search term. The final index scales this time series to have a maximum value of 100. Table 1 shows that search terms related to automotive fuel efficiency and hybrid vehicles have several million search queries per month.

One benefit of this dataset is that the Google search query data reflects real search behavior and does not suffer from biases that may be introduced by survey methodology. Self-reporting about subjective questions, such as the current level of attention devoted to hybrid vehicles, can lead to substantial biases and inconsistencies. Bertrand and Mullainathan (2001) point out that subjective data should not be used as a dependent variable because the inherent measurement errors usually correlate with other relevant characteristics.

For the local news coverage, we construct a daily measure of the number of articles in large regional newspapers. We focus on the newspapers in the 19 metropolitan areas

⁸Available at <http://www.google.com/insights/search>.

⁹Google Insights for Search does not report a search index if the amount of searches is below a certain threshold. This happens frequently during the earlier years and for smaller states or metropolitan areas. Thus, we focus on the search trends for the terms “hybrid” and “mileage” as they represent the highest search volumes for each topic. Search volumes for other relevant terms are presented in Table 1.

listed in Table 2 and additionally use *USA Today* and *The New York Times* as a proxy for national newspaper coverage. The newspaper articles are obtained from the LexisNexis database. Our measure of the amount of news coverage is derived by summing the number of relevant articles for each newspaper and time period. We also distinguish between articles regarding the topics of “gasoline prices” and those of “efficient vehicle technologies”. The detailed search queries for both topics are described in Table 3 and are structured to be a reasonable compromise between relevancy and completeness. We generate the newspaper coverage variable by counting the number of relevant articles for each newspaper and time period (i.e. weekly or monthly). Therefore, the purpose is not to analyze the content but rather to focus on the mere presence of media coverage. The methodology has the drawback that the sentiment of media coverage may be positive or negative, which may influence both the attention and sales impact. Regarding this point, Berger et al. (2010) show that new and less-known products benefit from both positive and negative publicity. Thus, we assume that all media coverage can be treated equally in our setup because hybrid vehicles are still a relatively new and less-known product.

Additionally, we use data on television news coverage from the Vanderbilt Television News Archive. The Vanderbilt database provides access to the evening news of the four major US national broadcast networks: ABC, CBS, NBC, and CNN. We construct two daily time series of television news coverage, one for the topic of “gasoline prices and fuel economy” and one for “hybrid vehicles and efficiency technologies”. For the first topic, we use the following keywords: Gasoline, gas price, mileage, gallon and mpg. For the second topic, we use the keywords: Hybrid and fuel efficiency. Then, we eliminate all duplicates within each topic and hand-check for the relevancy of each news segment. We generate our variables by counting the total number of news segments across all networks for each topic and for a given time period (i.e. weekly or monthly).

Two different datasets of gasoline prices are obtained from the US Energy Information

Administration (EIA). In Section 4, for the analysis of the determinants of consumers' attention, we use weekly retail gasoline prices for all grades and formulations. Depending on data availability, we match our 19 metropolitan areas with gasoline prices on a regional or state level. For the analysis of the actual purchasing behavior in Section 5, we use the monthly state-level retail price of motor gasoline.

The time structure of the weekly gasoline prices and Google searches is as follows: The EIA measures the gasoline price on Mondays, for which reason the provided weekly data only reflects the gasoline price on this particular day. In contrast, the data provided by Google Insights for Search reflects the search behavior of the entire week (Sunday to Saturday). As the search behavior is supposed to follow the gasoline price development, the weekly queries are matched with the gasoline price of the following Monday. The gasoline price changes from the current week are reflected in the subsequent – and not the contemporaneous – gasoline price. All media variables are built from daily data and match the time structure of the Google searches. Table 4 reports summary statistics for both panel datasets used for the analyses presented in Sections 4 and 5.

4. What Drives the Attention Devoted to Hybrid Vehicles?

In this section, we investigate which factors influence the attention devoted to hybrid vehicles. As outlined in the introduction, we focus on two main channels: The observable gasoline price and the media coverage concerning hybrid vehicles. The causal influence of both unprecedented record gasoline prices and local media coverage is of particular interest. In a supplementary analysis, the study is extended to a related topic as it is unlikely that media coverage affects the attention to all topics in a similar way. If consumers are well informed about a topic or if the issue is easily observable, there should be a less distinct effect of media coverage on the consumers' attention. This hypothesis is tested using the local

newspaper coverage concerning gasoline prices and the online search queries for “mileage” as a proxy for the attention to fuel economy.

We begin with the analysis of the determinants of the consumer’s attention devoted to hybrid vehicles. Before proceeding with the regression analysis, the relationship between the relevant variables is discussed. Figure 1 shows the weekly US gasoline price in US Dollars per gallon, the number of television news segments covering hybrid vehicles, the sum of newspaper articles about hybrid vehicles or fuel efficiency in all sample newspapers and the search trend for “hybrid” for the time period from January 2004 to September 2011. The shaded areas indicate weeks with a high relative interest in hybrid vehicles.

Graphical inspection suggests that the variation of searches is closely connected to the gasoline price and news coverage. Figure 1 also shows that in 2005 and 2008, there were new record price levels that lead to the highest interest during the sample period. The actual search behavior far exceeds the amount of searches that can be explained as a proportional reaction to the gasoline price increase only. When the price drops after a period of very high prices, there is a strong sign of relief, which is mirrored by a plunge in consumers’ interest in hybrid vehicles. The graphical analysis also suggests that consumers and media react to price increases rather than to high price levels. Once the gasoline price stops rising, but remains at a high level, both consumers and media quickly lose their interest.

The periods of high attention levels always coincide with periods having steep gasoline price increases, record gasoline prices or a high media coverage on hybrid vehicles. However, there is one peak of news coverage in the first week of December 2008, which is not reflected in the Google searches. This peak of news coverage is due to the US Big Three car manufacturers’ bailout discussion and their CEOs using hybrid vehicles for the journey to the Senate hearing. Another event leading to increased news coverage on hybrid vehicles is the North American International Auto Show in Detroit, which takes place every year in January.

In the following part, we examine the impact of local media coverage and record gasoline prices on the attention devoted to hybrid vehicles. We thereby proceed in three steps. First, we describe the variables used in our setup, second we discuss our regression model specifications and third we present the results from estimating our regression models.

For our identification strategy, we rely on *local* newspaper coverage. Despite the omnipresence of the internet, local newspapers are usually read only within one city and its surroundings. Compared to media coverage on a national level, focusing on local media therefore allows to have varying media exposure for the same event and to subsequently observe the reactions of metropolitan areas which have been exposed to a different degree of media coverage. Thus, all regression models are estimated using panel data for 19 US metropolitan areas, which enables us to examine more precisely whether local newspaper coverage affects the attention to hybrid vehicles when controlling for other news coverage or time-fixed effects.¹⁰ We make use of several control variables for national media coverage. For the specifications without time-fixed effects, we use national television news coverage on gasoline prices and on hybrid vehicles as controls. Additionally, we include the news coverage in two national newspapers, *USA Today* and *The New York Times*.

Gasoline price changes are expected to have a major influence on the attention devoted to hybrid vehicles. We include asymmetric specifications of gasoline price changes as rising and falling prices may have a different influence on attention.¹¹ There are three different time frames included: The change (i.e. log difference) during the current week, the short-term price movement (week t-2 to t-6) and the mid-term perspective (week t-7 to t-18). The results of Yuan (2011) indicate that record gasoline prices may have a distinct effect on attention. Thus, we include the variable “Record Price Length” to count the consecutive number of

¹⁰Note that our setup directly controls for the possibility that a local newspaper is also read by non-local readers and vice versa. A higher share of non-local readers makes it less likely to find a causal effect of local media coverage.

¹¹This specification is consistent with the findings of Lewis and Marvel (2011).

weeks with an unprecedented price level during a price surge.¹² The variable reflects the fact that the attention rises directly with the duration of an intense price increase.

Government incentives such as tax credits are not taken into account explicitly. However, our fixed effects specification controls for all state-specific incentives that do not vary over time. Furthermore, the time-fixed effects account for all federal incentives. As the hybrid vehicle market matures, government incentives become less substantial compared to the early phase before our sample period. Marketing expenditures could be another source of an omitted variable bias that may influence both the attention and the purchasing decision modeled in Section 5. There is no data available on regional marketing focusing on hybrid vehicles or fuel efficiency; however it is likely that large and influential marketing campaigns are targeted at a national audience and are thus captured by our time-fixed effects.

We estimate our regression models using five different specifications. In the first specification, we control for the gasoline price, national television coverage, national newspaper coverage and time-invariant characteristics of metropolitan areas by fixed effects. However, we do not control for spillover effects of local news coverage in other metropolitan areas or time-fixed effects. Therefore, we estimate the average effect of local newspaper coverage, which can be interpreted as the correlation between newspaper coverage and online searches.

The second specification additionally includes *all* local newspapers as control variables. Thus, each local newspaper is also allowed to have an effect on the non-local metropolitan areas. Following Engelberg and Parsons (2011), the impact of local newspapers is now identified by the difference in the reaction between a newspaper's local and non-local readership. If there is a significant positive marginal effect of the local newspaper coverage, it can be concluded that local newspaper treatment has a causal effect on the readers' attention. For

¹²For instance, if there are five record prices in a row then the variable equals 5 in the last week. In order to account for minor gaps within such periods, the variable stagnates in case of a single week without an unprecedented price level if another record price follows afterwards. If - in our example - there has been a break in the fourth week, the variable would twice indicate that three weeks of record prices occurred and would end with a count of 4 in the last week.

example, a newspaper may feature an article about the benefits of hybrid vehicle technology. The article could have an influence on the readership by increasing the awareness about hybrid vehicles and by encouraging the readership to search for more information online. In this case, there is an increased search volume in the metropolitan area with the newspaper coverage of the hybrid vehicle technology, whereas the metropolitan areas without a local news treatment do not exhibit an increased level of attention.

The third specification includes time-fixed effects, for which reason only variables with local variation will be included. The fourth and fifth specification explicitly account for the underlying panel data structure, which is characterized by many time periods and relatively few units of observation (large T and small N). Using a panel consisting of regional groups, such as metropolitan areas, makes it important to control for cross-sectional correlation, as it is very unlikely that the patterns in different geographical areas are mutually independent. Besides accounting for this kind of spatial correlation, it is also necessary to adequately model the serial correlation of the error term as the number of time periods increases. The fourth specification therefore estimates the same model as the second specification, but uses a Prais-Winston type feasible GLS panel estimator with a panel-specific AR(1) structure and panel-corrected standard errors. Alternatively, the fifth specification uses robust Driscoll-Kraay standard errors, which account for general forms of cross-sectional correlations, autocorrelation and heteroskedasticity.

Table 5 shows the panel regression results for our model with Google searches for “hybrid” as the dependent variable. The dependent variable measures the search volume in each of the 19 metropolitan areas. Our results show that local newspaper coverage of topics related to hybrid vehicles (“Local Newspaper Hybrid”) has a significant impact on the consumers’ attention, regardless of the specification. For specifications (2) - (5), the local newspaper variable measures the supplemental effect that each local newspaper has in its own region, which we interpret as a causal effect following Engelberg and Parsons (2011). Our results

suggest that local newspapers influence the local attention devoted to hybrid vehicles, despite other information sources available. Television news coverage about gasoline prices has a significant correlation with the search volumes for hybrid. This finding is intuitive as the gasoline price affects the profitability of an investment in a hybrid vehicle. The effect of television news coverage regarding hybrid vehicles has a positive, but not conclusive, effect on the searches for hybrid.

The impact of record gasoline prices is significant in most specifications. This finding supports the hypothesis that consumers react to reference points. Following Tversky and Kahneman (1991), consumers perceive a price increase as a loss if it is above the reference point of the most recent record price. In this case, loss aversion leads to a stronger reaction in the amount of search volumes reflecting a higher level of attention.

An alternative explanation for the record price effect could be that the consumers' expectations of future gasoline prices are not consistent with the random walk hypothesis.¹³ The profitability of an investment in automotive fuel efficiency depends on future gasoline prices. If consumers expect that trends of rising gasoline prices will continue in the future, the consumers' attention would rise disproportionately during periods of extended price increases. However, Anderson et al. (2011) show that it is generally a reasonable approach to assume a no-change forecast for consumers' fuel price expectations, which is consistent with the random walk hypothesis. Nevertheless, our alternative explanation cannot be ruled out completely because Anderson et al. (2011) still observe a large dispersion of individual forecasts during periods of extreme price fluctuations as seen in the year 2008.

In conclusion, the regression models indicate that consumers react to movements of the gasoline price by adjusting their search intensity. Additionally, unprecedented record gasoline prices and local media coverage raise the attention devoted to hybrid vehicles in a

¹³The random walk hypothesis assumes that the current price is the best estimate for future prices regardless of the price history.

causal relationship.

We proceed with the supplementary analysis and examine whether local media coverage regarding gasoline prices likewise affects the attention devoted to fuel economy. As the gasoline price is directly observable, media coverage is expected to have a less distinct effect. The gasoline price is the most obvious factor that influences the attention devoted to fuel economy. When gasoline prices rise, consumers are likely to be forced to change their general consumption behavior. For example, Gicheva et al. (2010) and Ma et al. (2011) show that increases in gasoline prices lead to changes in the grocery purchasing behavior due to changes in residual disposable income. The pressure to change general consumption patterns could also lead to an increased interest in fuel economy.

The variables for the supplementary analysis are displayed in Figure 2, which shows the weekly US gasoline price, the number of television news segments covering the gasoline price or fuel economy, the sum of newspaper articles about gasoline prices in all sample newspapers and the search trend for “mileage” for the time period from January 2004 to September 2011. The shaded areas indicate weeks with a high relative interest in fuel economy.

Similar to the setup for hybrid vehicles, the variation of searches for fuel economy is closely connected to the gasoline price and media coverage. Comparing Figures 1 and 2, the newspaper coverage of “hybrid vehicles and fuel efficiency” is noisier than the coverage of “gasoline prices”. However, the topic of efficient technologies has a more general character and is not as closely tied to the gasoline price movement. Furthermore, the search trends for “mileage” and “hybrid” are very similar. This finding indicates that the increased fuel efficiency of hybrid vehicles is indeed perceived as the major advantage of hybrid vehicles.

In April 2006, there was a peak of television coverage on gasoline prices, with up to 35 relevant news segments in one week. During this time, several economic and political events occurred that constituted the increased television reporting. First, there was a strong increase of gasoline prices from \$2.41 on March 13th to \$2.96 on April 24th. Second, on April

25th, George W. Bush held a speech on energy policy, which was widely covered by the media. Lastly, discussions about oil companies' high profits and a windfall profit tax gained increased media attention.

Table 6 presents the results of regressing Google searches for “mileage” on media coverage, record gasoline prices and gasoline price changes. The basic setup of the regression model is the same as for the results shown in Table 5. However, all newspaper variables are now constructed to reflect the news coverage on gasoline prices.¹⁴

The results shown in Table 6 indicate that the relationship between the local news coverage concerning gasoline prices and the attention to fuel economy is as expected. Only in the first specification, there is a significant relationship between the two variables. As in Table 5, the first specification estimates the average effect of local newspaper coverage without controlling for other local news coverage in the remaining metropolitan areas or for time-fixed effects. Thus, we find a strong positive correlation between newspaper coverage and searches. However, when estimating effects with a causal interpretation (i.e. the additional regional effect of local newspaper coverage on the attention devoted to mileage), the results indicate that the interest in searching for mileage is unaffected by media coverage. Therefore, it can be concluded that the treatment of local newspaper coverage in regards to gasoline prices has no causal influence on the attention devoted to fuel economy. However, the length of unprecedented gasoline prices has a positive impact on the attention level. This finding indicates that gasoline expenditures become a “top of mind” topic when the prices reach new all-time highs.

Overall, the aim of the analysis is to examine which factors influence the attention devoted to hybrid vehicles. We demonstrate that both local media coverage and unprecedented record gasoline prices significantly increase the attention devoted to hybrid vehicles. The supplementary analysis examines whether local media coverage concerning gasoline prices

¹⁴See Table 3 for a precise definition of the relevant search terms.

similarly affects the attention devoted to fuel economy. We observe a strong correlation, but we do not find a causal effect. An intuitive explanation for this finding is that consumers can be assumed to be rather well informed about the current gasoline price, which can be easily observed at gas stations. Therefore, the media coverage concerning gasoline prices does not provide much additional information and has consequently no causal effect on attention. In contrast, hybrid vehicles are a relatively new fuel-efficient technology and consumers may not be fully aware of the existence and benefits of hybrid vehicles. Thus, media coverage has the ability to increase the amount of attention devoted hybrid vehicles.

The finding that media coverage alters the consumers' attention to hybrid vehicles is of interest in two regards. First, this result indicates that consumers would most likely invest more in new, efficient technologies if they had a deeper knowledge of the topic. This insight may be of importance to both policymakers and car manufacturers dealing with the distribution of environmentally friendly vehicles. Second, and more generally, our finding is interesting concerning the role of the media as a part of an individual's decision-making process. Our results seem to reject the hypothesis that the media merely replicates publically available information and does not influence the consumers' considerations. However, the impact of media coverage depends on the specific topic considered and cannot be generalized for all circumstances.

5. Attention and Hybrid Vehicle Purchases

In this section, we examine the validity of our attention measure by analyzing the relationship between monthly state-level hybrid vehicle registrations and online search queries. First, the relation between our key variables is graphically illustrated. Figure 3 shows the monthly US retail gasoline price for all grades and formulations (in US Dollars per gallon), the Google online search queries for "hybrid" as a measure of attention, the monthly number

of hybrid vehicle registrations in the US (in thousands per month) and the market share of hybrid vehicles (in %). The shaded area indicates months with a high attention.

The graphical analysis shows that the changes in the gasoline price and the search volume are closely related to both the total number and the market share of hybrid vehicle registrations. Figure 3 also reveals the effect of one-time events that have a major influence on the hybrid vehicle market. For instance, the impact of the Cash Allowance Rebate System (C.A.R.S.), commonly known as “Cash for Clunkers”, can be seen in the increase of sales and hybrid vehicle market shares during July and August 2009. The drop in sales after March 2011 is partially due to supply chain problems resulting from the disastrous earthquake and tsunami in Japan.¹⁵

In the next step, we use monthly state-level registration data to examine the actual hybrid vehicle purchasing behavior. Table 7 shows the results of the regression analysis for the hybrid vehicle registrations as the dependent variable. Similarly, the results in Table 8 represent the same model specifications, but use the market share of hybrid vehicles as the dependent variable. The Google variable measures the monthly state-level search queries for “hybrid” and is supposed to mirror the consumers’ attention related to hybrid vehicles. As both the dependent variables and the Google variables are transformed into logarithms, the regression parameters can be interpreted as elasticities. The variable “Record Price” is built as a dummy indicating months with an unprecedented high gasoline price.

In specification (1), we use state-fixed effects and control for national media coverage, gasoline price movements and record price levels. Specifications (4) and (5) include the same variables, but are estimated with a Prais-Winston type panel estimator and Driscoll-Kraay standard errors, respectively. Specifications (2) and (3) include state- and time-fixed effects, and Specification (3) uses an alternative gasoline price variable, i.e. the logarithm of the gasoline price instead of price changes.

¹⁵These one-time events do not affect our analysis as the time-fixed effects account for such occurrences.

Focusing first on Table 7, we show that Google searches for “hybrid” have a significantly positive effect on hybrid vehicle registrations for all specifications. Our estimates indicate that an increase of the search volume by 1% is associated with an increase of hybrid vehicle purchases in the range between 0.12% and 0.28%. Thus, it can be concluded that our attention measure is valid and robustly related to sales volumes.

The results of the regressions with the market share of hybrid vehicles as the dependent variable are shown in Table 8. The evidence for the relationship to our attention measure is mixed. Specification (1), which only includes state-fixed effects, suggests a counterintuitive negative parameter. Yet, this parameter is insignificant using the more appropriate Driscoll-Kraay standard errors in specification (5). Using specifications with time-fixed effects and the Prais-Winsten estimator suggests a significantly positive parameter. Given the definition of our Google variable, which reflects the number of search queries related to a topic, a less distinct relationship between searches and market shares is plausible. If the search queries for hybrid vehicles were expressed as a share of all search queries in the automotive category, we would expect a more distinct relationship with market shares rather than sales volumes.

The television news coverage on gasoline prices and fuel economy has a significantly positive effect on the number of hybrid vehicle registrations. However, the television news coverage on hybrid vehicles is not significant, which may be caused by the fact that the overall amount of news coverage is very low. In the regression with the market share of hybrid vehicles as the dependent variable, the results for television coverage are mixed and do not suggest a conclusive relationship.

The results for the gasoline price variables are in line with economic intuition. Since the profitability of hybrid cars depends on the gasoline price, a positive association between these two variables is assumed. We find that rising gasoline prices have a positive impact on hybrid registrations and market shares. In model (3), which includes the logarithm of the gasoline price as well as state- and time-fixed effects, the record price variable has a

significant coefficient while the logarithm of the gasoline price is insignificant.

Overall, the most credible specifications for both dependent variables indicate a positive relationship between our attention measure and hybrid vehicle registrations. Our results show that the variables used in the main part of our study, Section 4, are relevant for the hybrid vehicle market and thus valid proxies for the empirical analysis pursued.

6. Conclusion

The study extends the research on consumer attention effects to the area of energy efficiency. Specifically, the analysis indicates which factors alter the consumers' attention devoted to fuel efficient technologies like hybrid vehicles. We use a novel panel dataset to show that the revealed consumer attention to hybrid vehicles depends on the gasoline price, unprecedented record gasoline price levels and media coverage. In our empirical setup, attention is measured by Google online search behavior. As search queries reflect real-life actions of millions of United States citizens, this data most importantly does not suffer from possible survey biases. The accuracy of our attention measure is validated by the robust relationship to the actual purchasing behavior. Given that we analyze a market for high-cost durable goods, a setting in which consumers should exhibit a high effort in decision making, the empirical findings from this study are also of relevance to economic decisions in other markets.

The finding that attention effects influence the diffusion of innovative and energy efficient technologies leads to important policy implications. In order to limit greenhouse gas emissions and to reduce the dependency on oil imports, fuel efficient technologies must become a "top of mind" topic in any vehicle purchasing decision. Initiatives aiming at increasing awareness and education about such technologies may be an important tool to foster the adoption of hybrid vehicles.

Given that consumers' attention levels have a fluctuating nature, car manufacturers should consider the current level of the attention devoted to efficient vehicles when planning their marketing effort and campaign contents. During periods of steep gasoline price increases or record gasoline prices, consumers have a much higher interest and are more receptive to information about fuel efficient technologies.

A more general finding is that periods of rising gasoline prices are more effective at drawing temporary attention to fuel efficiency than periods of steadily high gasoline prices. In fact, volatile gasoline prices provoke strong reactions of both the media and consumers. Therefore, it can be inferred that volatile gasoline prices, as they occurred in the years 2005 to 2008, have a positive impact on the diffusion of green technologies.

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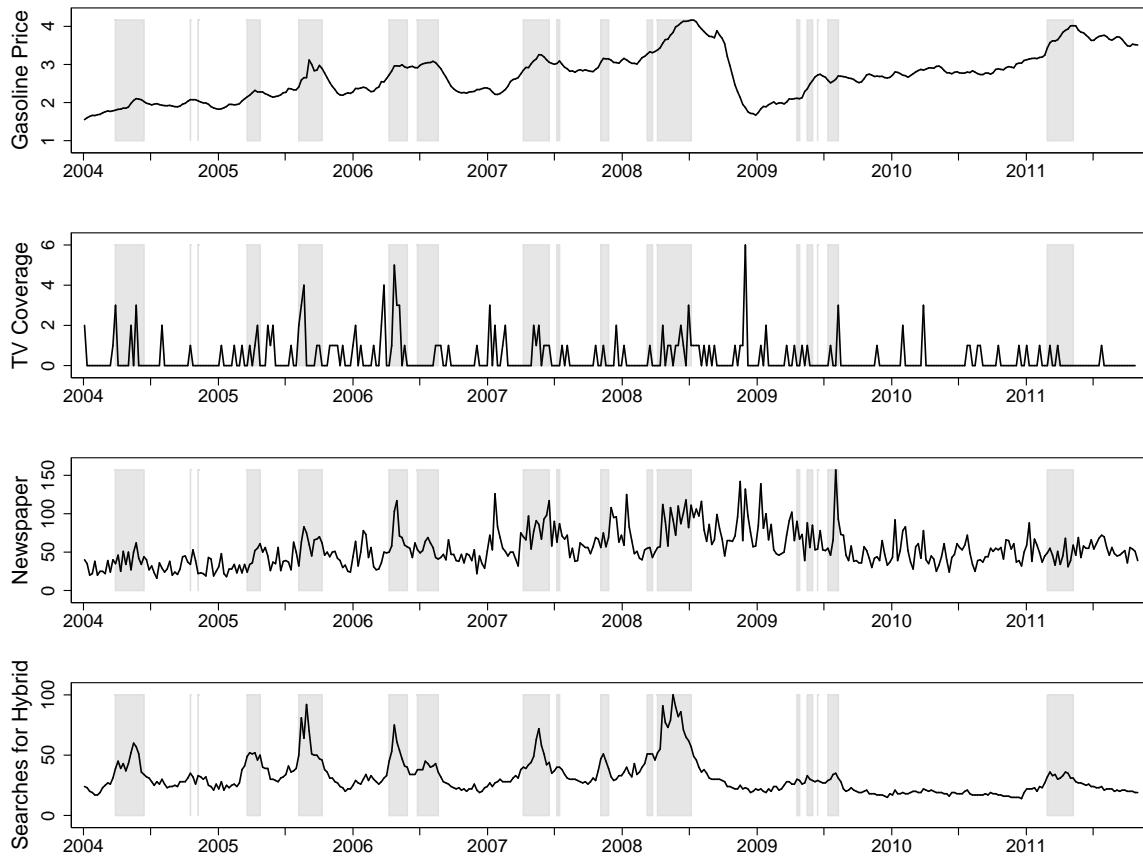


Figure 1: Gasoline Price, Media Coverage and Attention Devoted to Hybrid Vehicles

Notes: The first panel shows the weekly US retail gasoline price for all grades and formulations in US Dollars per gallon, the second panel shows the weekly sum of TV evening news segments about hybrid vehicles, the third panel shows the sum of newspaper articles about hybrid vehicles or fuel efficiency in all sample newspapers and the fourth panel shows the Google online search queries for “hybrid”. The shaded area indicates weeks with a high attention to hybrid vehicles, which is defined as a Google search index that is above the overall median and in the highest tertile per year.

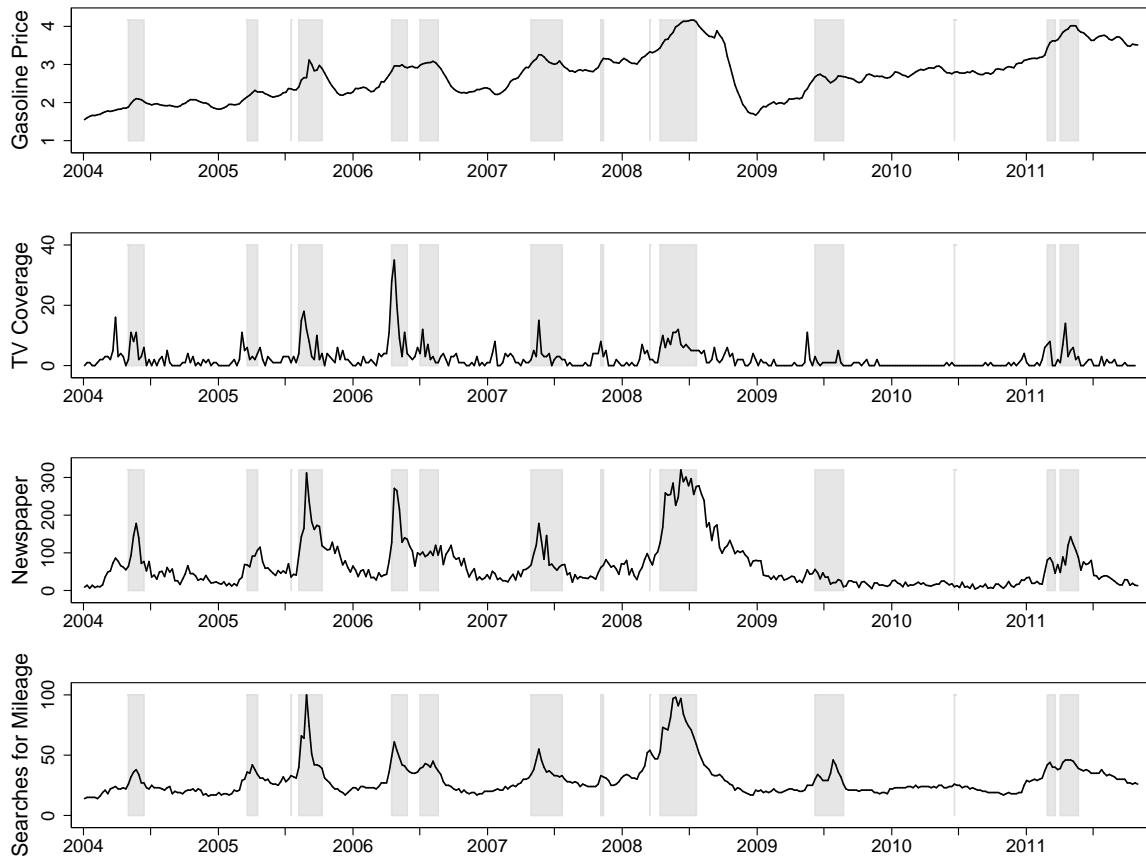


Figure 2: Gasoline Price, Media Coverage and Attention Devoted to Fuel Economy

Notes: The first panel shows the weekly US retail gasoline price for all grades and formulations in US Dollars per gallon, the second panel shows the weekly sum of TV evening news segments about gasoline prices or fuel economy, the third panel shows the sum of newspaper articles about gasoline prices in all sample newspapers and the fourth panel shows the Google online search queries for “mileage”. The shaded area indicates weeks with a high attention to fuel economy, which is defined as a Google search index that is above the overall median and in the highest tertile per year.

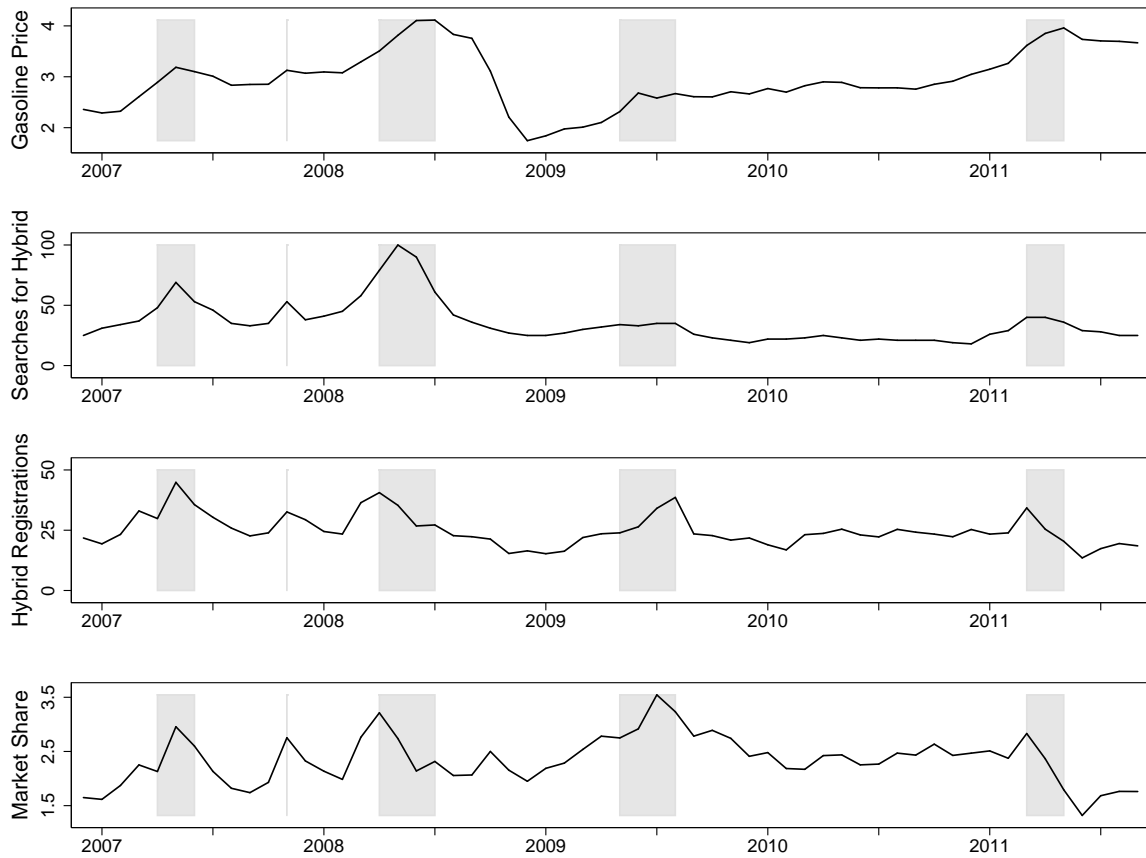


Figure 3: Gasoline Price, Attention and Registrations of Hybrid Vehicles

Notes: The first panel shows the monthly US retail gasoline price for all grades and formulations in US Dollars per gallon, the second panel shows the Google online search queries for “hybrid”, the third panel shows the monthly number of hybrid vehicle registrations in the US (in thousands per month) and the fourth panel shows the market share of hybrid vehicles (in %). The shaded area indicates months with a high attention, which is defined as a Google search index that is above the overall median and in the highest tertile per year.

Table 1: Average Monthly US Google Search Volume for Fuel Efficiency Related Terms

Keyword	Monthly search volume
mileage	3,350,000
hybrid	2,740,000
mpg	2,740,000
prius	1,000,000
fuel economy	450,000
fuel efficiency	246,000

Notes: Average monthly search volume according to Google Keyword Tool, which is available at <http://adwords.google.com/select/KeywordToolExternal>. The figures are for the category “Vehicles”, English language, for the US only and were obtained on January 31, 2012. The reported volume is an estimate of the average monthly search volume during the last 12 months and is calculated by Google.

Table 2: List of Newspapers Used in the Analysis

Metropolitan Area	State	Newspaper
Atlanta	Georgia	The Atlanta Journal Constitution
Austin	Texas	The Austin American Statesman
Boston	Massachusetts	Telegram Gazette
Chicago	Illinois	The Chicago Sun-Times
Denver	Colorado	The Denver Post
Detroit	Michigan	The Detroit News
Houston	Texas	The Houston Chronicle
Las Vegas	Nevada	Las Vegas Revue Journal
Los Angeles	California	The Orange County Register; The Daily News of Los Angeles
Madison	Wisconsin	Wisconsin State Journal
Minneapolis-Saint Paul	Minnesota	Star Tribune
New York	New York	The New York Post
Norfolk-Portsmouth	Virginia	The Virginian Pilot
Philadelphia	Pennsylvania	The Philadelphia Inquirer; Philadelphia Daily News
Salt Lake City	Utah	The Salt Lake Tribune
San Francisco	California	The San Francisco Chronicle
St. Louis	Missouri	St. Louis Post-Dispatch
Tampa	Florida	St. Petersburg Times; The Tampa Tribune
Washington	District of Columbia	The Washington Times
National	National	New York Times
National	National	USA Today

Notes: The choice of included newspapers depends on the availability of data in LexisNexis and the relevancy of each newspaper within a certain metropolitan area. Additionally, only metropolitan areas with sufficient available data from Google are considered. Given these binding restrictions, 19 metropolitan areas and their major newspapers are used in the analysis.

Table 3: LexisNexis Database Search Queries for all Newspapers

Panel A. LexisNexis search command related to hybrid vehicles and fuel efficiency

fuel efficiency
OR (fuel W/2 standard)
OR (efficient W/10 mileage)
OR (ALLCAPS (CAFE) W/10 (standard OR fuel OR efficient OR regulation))
OR (gas W/2 guzzler)
OR (electric W/2 (car OR vehicle))
OR ((plug W/2 in) W/2 (car OR vehicle))
OR (hybrid W/2 (car OR vehicle))
OR toyota prius
OR ((toyota OR Honda OR Hyundai Or Lexus OR Ford) W/2 Hybrid)

Notes: The search query should take into account both the completeness and the relevancy of the found articles. It reflects news coverage concerning fuel efficiency, electric vehicle technology, hybrid vehicles and related regulation standards. The command *W/2* indicates that two words are in the text within 2 words distance. The command *ALLCAPS* requires a word to be written in capital letters.

Panel B. LexisNexis search command related to gasoline prices

(gas! OR pump)
W/4 (cost OR price)
W/6 (record OR high OR soar! OR ris! OR surg!
OR climb! OR jump! OR spik! OR peak OR expensive
OR sink! OR low! OR drop! OR plung! OR down! OR fall!
OR fell OR declin! OR cheap! OR tumb! OR crash!)
NOT W/seg (jet OR airline OR kerosine OR kerosene OR shale OR natural)

Notes: The search query should take into account both the completeness and the relevancy of the found articles. It reflects news coverage concerning gasoline price movements and levels without focusing on either rising or sinking prices. The syntax as follows: ! is used as a wild card, e.g. *surg!* includes surging. The command *W/4* indicates that two words are in the text within 4 words distance. *NOTW/seg* does not allow the following word to be in the same segment within one article.

Table 4: Summary Statistics

Panel Dataset for Section 4					
	Mean	Std. Dev.	Min.	Max.	N
Google Hybrid	30.404	14.922	7	100	7227
Google Mileage	28.747	13.701	8	100	6984
Local Newspaper Hybrid	2.294	2.872	0	56	7771
Local Newspaper Gasoline	2.908	3.846	0	37	7760
TV Hybrid	0.373	0.797	0	6	7752
TV Gasoline	2.387	3.717	0	35	7752
Newspaper USA Today Hybrid	2.824	1.963	0	9	7771
Newspaper NYT Hybrid	8.335	4.755	0	27	7771
Newspaper USA Today Gasoline	3.308	3.468	0	20	7771
Newspaper NYT Gasoline	6.672	6.386	0	40	7771
Record Price Length	0.998	3.007	0	25	7771
$\Delta GasPrice_{t,t-1}^{Pos}$	0.01	0.017	0	0.228	7771
$\Delta GasPrice_{t,t-1}^{Neg}$	-0.009	0.016	-0.134	0	7771
$\Delta GasPrice_{t-2,t-6}^{Pos}$	0.033	0.043	0	0.315	7771
$\Delta GasPrice_{t-2,t-6}^{Neg}$	-0.025	0.055	-0.438	0	7771
$\Delta GasPrice_{t-7,t-18}^{Pos}$	0.068	0.08	0	0.403	7771
$\Delta GasPrice_{t-7,t-18}^{Neg}$	-0.046	0.116	-0.841	0	7771

Notes: The dataset consists of weekly observations for the 19 metropolitan areas listed in Table 2 and ranges from January 4th, 2004 to October 23rd, 2011.

Panel Dataset for Section 5					
	Mean	Std. Dev.	Min.	Max.	N
ln(Market Share Hybrid Registrations)	0.726	0.492	-1.565	2.249	2117
ln(Hybrid Registrations)	5.825	0.995	3.401	9.218	2117
ln(Google Hybrid)	3.227	0.416	2.015	4.508	2117
TV Hybrid	1.529	1.636	0	7	2117
TV Gasoline	7.787	8.98	0	38	2117
USA Today Hybrid	13.92	5.093	5	31	2117
NYT Hybrid	37.041	10.112	19	66	2117
USA Today Gasoline	12.846	13.228	1	56	2117
NYT Gasoline	26.372	27.068	1	112	2117
Record Price	0.258	0.438	0	1	2117
$\Delta GasPrice_{t,t-1}^{Pos}$	0.039	0.048	0	0.253	2117
$\Delta GasPrice_{t,t-1}^{Neg}$	-0.03	0.079	-0.539	0	2117
$\Delta GasPrice_{t-2,t-3}^{Pos}$	0.038	0.049	0	0.253	2117
$\Delta GasPrice_{t-2,t-3}^{Neg}$	-0.033	0.081	-0.539	0	2117
$\Delta GasPrice_{t-4,t-6}^{Pos}$	0.06	0.081	0	0.382	2117
$\Delta GasPrice_{t-4,t-6}^{Neg}$	-0.063	0.151	-0.975	0	2117
ln(Gas Price)	0.829	0.23	0.036	1.375	2117

Notes: The dataset consists of monthly state-level observations from December 2006 to February 2011.

Table 5: Panel Regression Results of the Impact of Local Media Coverage on the Interest in Hybrid Vehicles

Table 5
Hybrid Vehicle Technology and Attention

	<i>Dependent Variable: Google Search Queries for Hybrid</i>				
	(1)	(2)	(3)	(4)	(5)
Local Newspaper Hybrid	0.505 *** (0.099)	0.198 ** (0.087)	0.216 ** (0.092)	0.084 *** (0.031)	0.198 *** (0.041)
TV Gasoline	1.606 *** (0.063)	1.151 *** (0.053)		0.813 *** (0.110)	1.151 *** (0.254)
TV Hybrid	1.232 *** (0.144)	0.899 *** (0.180)		0.355 (0.367)	0.899 (0.629)
Record Price Length	0.439 *** (0.100)	0.590 *** (0.093)	0.145 * (0.083)	0.623 *** (0.125)	0.590 (0.366)
$\Delta GasPrice_{t,t-1}^{Pos}$	85.903 *** (7.892)	69.722 *** (7.699)	19.985 * (9.611)	55.073 *** (14.834)	69.722 * (36.551)
$\Delta GasPrice_{t,t-1}^{Neg}$	-29.778 *** (5.748)	-1.409 (6.701)	33.838 ** (14.748)	-2.715 (21.179)	-1.409 (27.269)
$\Delta GasPrice_{t-2,t-6}^{Pos}$	65.301 *** (4.226)	59.877 *** (3.993)	23.278 ** (8.226)	48.852 *** (9.297)	59.877 *** (14.703)
$\Delta GasPrice_{t-2,t-6}^{Neg}$	14.571 *** (1.620)	13.037 *** (1.892)	11.185 ** (4.288)	17.459 ** (8.653)	13.037 (7.565)
$\Delta GasPrice_{t-7,t-18}^{Pos}$	27.910 *** (2.099)	22.313 *** (2.788)	13.518 *** (4.619)	20.866 *** (6.400)	22.313 *** (6.722)
$\Delta GasPrice_{t-7,t-18}^{Neg}$	11.089 *** (0.719)	12.132 *** (0.817)	10.359 *** (3.559)	13.201 *** (4.657)	12.132 *** (3.647)
Newspaper USA Today	-0.204 ** (0.075)	-0.279 *** (0.054)		-0.033 (0.147)	-0.279 (0.211)
Newspaper NYT	-0.173 *** (0.026)	-0.105 *** (0.032)		-0.096 (0.070)	-0.105 (0.076)
Newspaper Chicago		0.283 *** (0.033)		0.194 (0.118)	0.283 * (0.151)
Newspaper Minneapolis-Saint Paul		0.311 *** (0.042)		0.107 (0.184)	0.311 (0.268)
Newspaper St. Louis		0.476 *** (0.049)		0.430 *** (0.165)	0.476 ** (0.224)
Newspaper Atlanta		1.380 *** (0.087)		0.548 *** (0.154)	1.380 *** (0.207)
Newspaper Denver		0.127 (0.126)		-0.035 (0.202)	0.127 (0.287)
Newspaper Madison		0.688 *** (0.093)		0.269 (0.210)	0.688 ** (0.317)
Newspaper Detroit		-0.040 * (0.021)		0.015 (0.053)	-0.040 (0.064)
Newspaper Washington, D.C.		0.270 *** (0.042)		0.095 (0.171)	0.270 (0.223)

(continued)

Table 5—*continued*
Hybrid Vehicle Technology and Attention

	<i>Dependent Variable: Google Search Queries for Hybrid</i>				
	(1)	(2)	(3)	(4)	(5)
Newspaper Norfolk Portsmouth		−0.482 *** (0.095)		−0.208 (0.149)	−0.482 ** (0.219)
Newspaper San Francisco		−0.118 ** (0.045)		−0.066 (0.139)	−0.118 (0.229)
Newspaper Philadelphia		0.591 *** (0.112)		0.311 * (0.168)	0.591 * (0.302)
Newspaper New York		−0.795 *** (0.098)		−0.264 (0.208)	−0.795 ** (0.281)
Newspaper Houston		−0.016 (0.036)		0.066 (0.131)	−0.016 (0.218)
Newspaper Boston		0.566 *** (0.084)		0.306 (0.267)	0.566 (0.498)
Newspaper Tampa		0.070 (0.070)		0.071 (0.129)	0.070 (0.264)
Newspaper Los Angeles		0.780 *** (0.042)		0.360 *** (0.119)	0.780 *** (0.217)
Newspaper Salt Lake City		−0.156 (0.115)		−0.060 (0.169)	−0.156 (0.232)
Newspaper Austin		−0.168 *** (0.057)		−0.046 (0.208)	−0.168 (0.311)
Newspaper Las Vegas		−0.552 *** (0.127)		−0.189 (0.248)	−0.552 (0.363)
Intercept	22.070 *** (0.518)	17.101 *** (0.540)	30.225 *** (1.405)	20.914 *** (1.190)	17.101 *** (1.782)
R ²	0.469	0.557	0.812	0.355	0.557
N	7208	7208	7227	7208	7208
Metro-Fixed Effects	YES	YES	YES	NO	YES
Time-Fixed Effects	NO	NO	YES	NO	NO

Standard errors are clustered by metropolitan area in models (1), (2) and (3). Model (4) is estimated using a Prais-Winsten regression with a panel-specific AR(1) structure and panel-corrected standard errors. Driscoll-Kraay standard errors are used in model (5).

*, **, and *** represent significance at the 10%, 5% and 1% level, respectively.

Table 6: Panel Regression Results of the Impact of Local Media Coverage on the Interest in Fuel Economy

Table 6
Fuel Economy and Attention

	<i>Dependent Variable: Google Search Queries for Mileage</i>				
	(1)	(2)	(3)	(4)	(5)
Local Newspaper Gasoline	0.555 *** (0.100)	-0.022 (0.082)	-0.006 (0.080)	-0.044 (0.029)	-0.022 (0.040)
TV Gasoline	0.481 *** (0.058)	0.238 *** (0.066)		0.207 *** (0.076)	0.238 ** (0.099)
TV Hybrid	-0.141 (0.123)	-0.058 (0.138)		-0.059 (0.225)	-0.058 (0.402)
Record Price Length	0.672 *** (0.096)	0.585 *** (0.079)	0.105 (0.140)	0.519 *** (0.087)	0.585 *** (0.197)
$\Delta GasPrice_{t,t-1}^{Pos}$	31.155 *** (8.123)	5.320 (7.952)	10.317 (9.551)	6.613 (9.767)	5.320 (21.334)
$\Delta GasPrice_{t,t-1}^{Neg}$	28.674 *** (8.825)	70.244 *** (10.654)	12.522 (12.849)	26.333 * (14.478)	70.244 *** (23.416)
$\Delta GasPrice_{t-2,t-6}^{Pos}$	19.104 *** (2.876)	13.620 *** (3.008)	28.173 *** (7.293)	16.808 *** (6.389)	13.620 (8.454)
$\Delta GasPrice_{t-2,t-6}^{Neg}$	31.798 *** (2.124)	32.999 *** (2.186)	22.808 *** (5.735)	28.992 *** (6.022)	32.999 *** (6.828)
$\Delta GasPrice_{t-7,t-18}^{Pos}$	10.727 *** (1.516)	4.518 *** (1.354)	13.207 *** (3.136)	4.655 (4.491)	4.518 (8.475)
$\Delta GasPrice_{t-7,t-18}^{Neg}$	14.736 *** (0.989)	14.550 *** (0.926)	16.820 ** (7.679)	15.087 *** (3.210)	14.550 *** (1.927)
Newspaper USA Today	0.577 *** (0.045)	0.269 *** (0.046)		0.211 *** (0.079)	0.269 * (0.155)
Newspaper NYT	0.514 *** (0.046)	-0.147 *** (0.039)		-0.033 (0.055)	-0.147 (0.121)
Newspaper Chicago		0.284 *** (0.037)		0.114 * (0.068)	0.284 (0.175)
Newspaper Minneapolis-Saint Paul		0.312 *** (0.050)		0.194 * (0.112)	0.312 (0.189)
Newspaper St. Louis		-0.059 (0.042)		0.056 (0.080)	-0.059 (0.159)
Newspaper Atlanta		0.203 *** (0.048)		0.224 *** (0.070)	0.203 (0.147)
Newspaper Denver		0.499 *** (0.076)		0.306 ** (0.134)	0.499 (0.337)
Newspaper Madison		0.112 ** (0.043)		0.070 (0.111)	0.112 (0.175)
Newspaper Detroit		0.189 *** (0.042)		0.126 * (0.068)	0.189 (0.134)
Newspaper Washington, D.C.		-0.090 ** (0.042)		0.082 (0.091)	-0.090 (0.162)

(continued)

Table 6—*continued*
Fuel Economy and Attention

	<i>Dependent Variable: Google Search Queries for Mileage</i>				
	(1)	(2)	(3)	(4)	(5)
Newspaper Norfolk Portsmouth		0.147 (0.102)		0.161 * (0.092)	0.147 (0.178)
Newspaper San Francisco		-0.034 (0.048)		0.116 (0.114)	-0.034 (0.226)
Newspaper Philadelphia		0.328 *** (0.068)		0.181 ** (0.079)	0.328 ** (0.151)
Newspaper New York		0.320 *** (0.070)		0.096 (0.133)	0.320 (0.256)
Newspaper Boston		0.839 *** (0.155)		0.427 *** (0.155)	0.839 ** (0.293)
Newspaper Houston		-0.053 (0.036)		-0.025 (0.066)	-0.053 (0.109)
Newspaper Tampa		0.216 *** (0.040)		0.148 ** (0.070)	0.216 (0.146)
Newspaper Los Angeles		0.322 *** (0.067)		0.347 *** (0.090)	0.322 * (0.166)
Newspaper Las Vegas		-0.369 *** (0.067)		-0.147 (0.123)	-0.369 (0.249)
Newspaper Austin		0.361 *** (0.098)		0.271 ** (0.133)	0.361 (0.272)
Newspaper Salt Lake City		0.034 (0.068)		-0.134 (0.084)	0.034 (0.175)
Intercept	19.806 *** (0.319)	20.220 *** (0.309)	22.218 *** (2.104)	21.402 *** (0.688)	20.220 *** (0.863)
R ²	0.586	0.659	0.823	0.509	0.659
N	6956	6870	6973	6870	6870
Metro-Fixed Effects	YES	YES	YES	NO	YES
Time-Fixed Effects	NO	NO	YES	NO	NO

Standard errors are clustered by metropolitan area in models (1), (2) and (3). Model (4) is estimated using a Prais-Winsten regression with a panel-specific AR(1) structure and panel-corrected standard errors. Driscoll-Kraay standard errors are used in model (5).

*, **, and *** represent significance at the 10%, 5% and 1% level, respectively.

Table 7: Panel Regression Results of the Impact of Attention on the Registrations of Hybrid Vehicles

	<i>Dependent Variable: Log of # of Hybrid Registrations</i>				
	(1)	(2)	(3)	(4)	(5)
ln(Google Hybrid)	0.276 *** (0.033)	0.123 *** (0.036)	0.121 *** (0.038)	0.231 *** (0.063)	0.276 *** (0.050)
TV Gasoline	0.008 *** (0.001)			0.007 ** (0.003)	0.008 ** (0.004)
TV Hybrid	0.003 (0.003)			0.008 (0.011)	0.003 (0.015)
Record Price	-0.013 (0.014)	0.027 (0.017)	0.036 ** (0.018)	0.044 (0.030)	-0.013 (0.029)
$\Delta GasPrice_{t,t-1}^{Pos}$	0.799 *** (0.128)	0.663 *** (0.195)		0.604 * (0.327)	0.799 ** (0.368)
$\Delta GasPrice_{t,t-1}^{Neg}$	0.221 *** (0.075)	-0.211 (0.329)		0.300 (0.259)	0.221 (0.178)
$\Delta GasPrice_{t-2,t-3}^{Pos}$	1.493 *** (0.103)	0.415 * (0.224)		1.196 *** (0.315)	1.493 *** (0.363)
$\Delta GasPrice_{t-2,t-3}^{Neg}$	0.676 *** (0.067)	-0.228 (0.204)		0.248 (0.260)	0.676 *** (0.204)
$\Delta GasPrice_{t-4,t-6}^{Pos}$	0.319 *** (0.059)	-0.075 (0.157)		0.325 (0.244)	0.319 (0.213)
$\Delta GasPrice_{t-4,t-6}^{Neg}$	0.195 *** (0.030)	0.211 * (0.104)		-0.065 (0.162)	0.195 * (0.113)
USA Today Hybrid	-0.002 * (0.001)			-0.005 * (0.003)	-0.002 (0.003)
NYT Hybrid	-0.002 *** (0.001)			0.000 (0.002)	-0.002 (0.002)
USA Today Gas	0.004 ** (0.002)			-0.000 (0.004)	0.004 (0.005)
NYT Gas	-0.005 *** (0.001)			-0.003 (0.002)	-0.005 ** (0.002)
ln(Gas Price)			0.061 (0.172)		
Intercept	4.966 *** (0.106)	4.585 *** (0.099)	4.612 *** (0.119)	5.076 *** (0.212)	4.966 *** (0.164)
R ²	0.494	0.967	0.967	0.965	0.494
N	2117	2117	2117	2117	2117
State-Fixed Effects	YES	YES	YES	NO	YES
Time-Fixed Effects	NO	YES	YES	NO	NO

Standard errors are clustered by state in models (1), (2) and (3). Model (4) is estimated using a Prais-Winsten regression with a panel-specific AR(1) structure and panel-corrected standard errors. Driscoll-Kraay standard errors are used in model (5).

*, **, and *** represent significance at the 10%, 5% and 1% level, respectively.

Table 8: Panel Regression Results of the Impact of Attention on the Market Share of Hybrid Vehicles

Table 8
Hybrid Technology's Market Share and Attention

	<i>Dependent Variable: Log of Hybrid Technology's Market Share</i>				
	(1)	(2)	(3)	(4)	(5)
ln(Google Hybrid)	−0.076 ** (0.031)	0.076 * (0.039)	0.069 * (0.038)	0.173 *** (0.060)	−0.076 (0.071)
TV Gasoline	0.005 *** (0.001)			0.005 (0.003)	0.005 (0.005)
TV Hybrid	−0.018 *** (0.003)			0.004 (0.011)	−0.018 (0.019)
Record Price	0.077 *** (0.010)	0.029 ** (0.012)	0.039 *** (0.012)	0.030 (0.029)	0.077 * (0.043)
$\Delta GasPrice_{t,t-1}^{Pos}$	0.985 *** (0.104)	0.962 *** (0.175)		0.685 ** (0.303)	0.985 ** (0.416)
$\Delta GasPrice_{t,t-1}^{Neg}$	−0.222 ** (0.086)	−0.349 (0.373)		−0.207 (0.232)	−0.222 (0.205)
$\Delta GasPrice_{t-2,t-3}^{Pos}$	1.315 *** (0.129)	0.358 * (0.205)		0.723 ** (0.294)	1.315 ** (0.599)
$\Delta GasPrice_{t-2,t-3}^{Neg}$	0.254 *** (0.075)	−0.286 (0.285)		−0.032 (0.230)	0.254 (0.206)
$\Delta GasPrice_{t-4,t-6}^{Pos}$	0.410 *** (0.055)	0.050 (0.146)		0.275 (0.218)	0.410 (0.396)
$\Delta GasPrice_{t-4,t-6}^{Neg}$	−0.116 *** (0.031)	−0.112 (0.136)		−0.189 (0.141)	−0.116 (0.129)
USA Today Hybrid	0.001 * (0.001)			−0.001 (0.003)	0.001 (0.004)
NYT Hybrid	0.001 * (0.001)			−0.001 (0.002)	0.001 (0.002)
USA Today Gas	0.009 *** (0.001)			0.004 (0.004)	0.009 * (0.005)
NYT Gas	−0.006 *** (0.000)			−0.005 *** (0.002)	−0.006 *** (0.002)
ln(Gas Price)			0.180 (0.168)		
Intercept	0.811 *** (0.100)	−0.460 *** (0.118)	−0.466 *** (0.120)	0.173 (0.204)	0.811 *** (0.237)
R ²	0.208	0.882	0.880	0.464	0.208
N	2117	2117	2117	2117	2117
State-Fixed Effects	YES	YES	YES	NO	YES
Time-Fixed Effects	NO	YES	YES	NO	NO

Standard errors are clustered by state in models (1), (2) and (3). Model (4) is estimated using a Prais-Winsten regression with a panel-specific AR(1) structure and panel-corrected standard errors. Driscoll-Kraay standard errors are used in model (5).

*, **, and *** represent significance at the 10%, 5% and 1% level, respectively.