Searching for Hidden Costs: A Technology-Based Approach to the Energy Efficiency Gap in Light-Duty Vehicles

Draft

EPA United States Environmental Protection Agency

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Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

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Searching for Hidden Costs: A Technology-Based Approach to the Energy Efficiency Gap in Light-Duty Vehicles

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Abstract

The benefit-cost analysis of standards to reduce vehicle greenhouse gas emissions and improve fuel economy by the U.S. Environmental Protection Agency (EPA) and the Department of Transportation (DOT) displayed large net benefits from fuel savings for new vehicle buyers. This finding pointed to an energy efficiency gap: the amount of energy-saving technology provided in private markets appeared not to include all the technologies that produce net private benefits. The finding of a gap involves three pathways. First, the energy-saving technologies must be effective in achieving fuel reductions. Second, the cost estimates for those technologies must be lower than the present value of fuel reductions. Third, possible "hidden costs" -- undesirable aspects of the new technologies – must not exceed the net financial benefits. This study examines the existence of hidden costs in energy-saving technologies through a content analysis of auto reviews of model-year 2014 vehicles.

Content analysis involves systematic identification in texts or other media of key concepts and coding of those concepts; qualitative assessments can be quantified for statistical analysis. Auto reviewers, as professional evaluators, are likely to be sensitive to the existence of positive and negative characteristics of vehicles. Although they may identify hidden costs that some vehicle owners may not notice, it is relatively unlikely that they would miss important problems.

Results suggest that it is possible to use fuel-saving technologies on vehicles without imposing hidden costs. For each of the technologies examined, the number of reviews that evaluated them positively exceeded the number that spoke negatively. There is scant evidence in this analysis of a robust relationship between the technologies and vehicles' operational characteristics, such as handling or acceleration. It seems possible to implement these technologies without adverse effects on vehicle quality; hidden costs do not appear to explain the efficiency gap for vehicle fuel-saving technologies.

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Searching for Hidden Costs: A Technology-Based Approach to the Energy Efficiency Gap in Light-Duty Vehicles

When the U.S. Environmental Protection Agency (EPA) and the Department of Transportation (DOT) developed standards to reduce vehicle greenhouse gas emissions and improve fuel economy, they estimated significant net benefits to the standards, with the largest benefits coming from fuel savings to new vehicle buyers; indeed, the fuel savings greatly exceeded the costs of technologies that would provide those savings (EPA and DOT 2010, 2012). This finding pointed to an energy efficiency gap, also known as the energy paradox: the amount of energy-saving technology provided in private markets appears not to include all the technologies that produce net private benefits. For instance, although six-speed automatic transmissions have existed for a number of years, and appear to have a payback period of approximately one year relative to four-speed transmissions (Helfand and Dorsey-Palmateer 2015), they were uncommon in new vehicles until very recently (Hula et al. 2014). Various authors are skeptical of these estimated savings, on the basis that, if they provided the benefits claimed, private markets should have led to their adoption (e.g., Allcott and Greenstone 2012). On the other hand, if the gap exists, then it is possible for energy efficiency regulations not only to address externalities, but to save consumers money (Fischer et al. 2007). The existence of the gap, then, has significant implications for the net benefits associated with energy efficiency requirements.

A number of studies explore consumer or producer behavior at the point of deciding when to invest in energy-saving technologies (see, e.g., Helfand and Wolverton 2011; Allcott and Greenstone 2012; Gillingham and Palmer 2014). This study focuses instead on post-decision welfare – experienced utility, instead of decision utility (e.g., Kahneman and Sugden 2005) – to examine the existence of the efficiency gap. With the standards in place, the existence of the gap is, in principle, an empirical matter.

The finding of a gap involves three pathways. First, the technologies to improve fuel economy must be effective in achieving their fuel reductions. Second, the cost estimates for those fuel-saving technologies must be lower than the present value of the fuel reductions. These first two elements define the engineering analysis that is commonly the source of identified efficiency gaps.

The third element of the gap is the possible existence of "hidden costs" of the technologies: undesirable aspects of the new technologies. For instance, if six-speed automatic transmissions were especially noisy, clunky, or otherwise worse to drive than four-speed automatic transmissions, those quality impacts would reflect losses to consumer welfare that the engineering analysis would not capture (Gillingham and Palmer 2014), and might potentially close the gap. An evaluation of the new technologies should consider these costs.

This study examines the existence of hidden costs in fuel-saving technologies through a content analysis of auto reviews of model-year 2014 vehicles. Content analysis is a method to analyze text for patterns and meaning (Krippendorff 2013). It involves systematic identification of key concepts and coding of those concepts; in other words, qualitative assessments can be quantified for statistical analysis.

The study findings suggest that it is possible to use fuel-saving technologies on vehicles without imposing hidden costs. For each of the technologies, the number of reviews that spoke

positively about the technology exceeded the number that spoke negatively of them. We also find few signs that any of the technologies contribute to negative ratings of vehicle operating characteristics, such as handling or acceleration. That there is variation in success suggests that there may be room for improvement: for example, some technologies may have been implemented more effectively in some vehicles than in others. Nevertheless, this analysis does not find evidence, beyond perhaps short-run implementation concerns, that hidden costs of these fuel-saving technologies explain the existence of the energy efficiency gap in vehicles.

The next section of this paper provides the policy background for this work. Next, we describe content analysis, the method used for this study, and the details of the data collection. The results and conclusions follow.

Policy Background

In 2010 and 2012, EPA and DOT issued joint standards to reduce the greenhouse gas (GHG) emissions and increase the fuel economy (FE) from new vehicles for model-years (MY) 2012 through 2025 (EPA and DOT 2010, 2012). By 2025, the standards are projected to achieve a fleetwide average emissions level of 163 grams/mile of carbon dioxide, approximately half the emissions of an average MY 2010 vehicle. If all the improvements in GHG emissions come from improvements in fuel economy, the standards are projected to lead to fleet average fuel economy of 54.5 miles per gallon (mpg).

The standards themselves are not these values. Instead, each vehicle has a target value for GHG and FE based on its footprint, the area between its wheels. Larger vehicles have less stringent targets than smaller vehicles. Each automaker has its own individual fleetwide average standard based on the sales-weighted footprints of the vehicles that it makes in a given model year. If a manufacturer produces more small vehicles, for instance, it will have a more stringent target than a manufacturer that produces more large vehicles. This approach is intended to protect the range of vehicles available to the auto-buying public, to avoid the risk of unfairly benefiting one manufacturer over another, to allow for flexibility in sales mix in the face of shifts in market conditions, and to provide incentives to improve GHG emissions and FE across the entire fleet.[1] Within an automaker's fleet, if some vehicles outperform their targets, they generate credits that may be applied to vehicles that do not meet the targets in its own fleet, banked for use in future years, retired, or sold to another automaker whose fleet does not achieve its target.

EPA's and DOT's assessments of the standards found enormous net benefits, most of which came from the projected fuel savings. For instance, in EPA and DOT (2010), EPA projected that the average cost increase for a MY 2016 vehicle would be about $950, compared to reduced fuel expenditures of about $4000 over the lifetime of that vehicle; the payback period on the initial $950 was estimated at under 3 years. Because these net benefits to vehicle buyers appear so substantial, the question arose why market forces did not bring them into place without regulation. This phenomenon – the finding of cost-effective technologies to save energy that are not in widespread use – has been observed in various settings, such as building insulation and household appliances. Indeed, it is common enough to have a name – the energy paradox, or

[1] A flat standard, which was in force for the first four decades of fuel economy requirements, may encourage compliance by producing small but fuel-efficient vehicles that cross-subsidize large, inefficient vehicles. The footprint-based standard reduces incentives for downsizing. Whether, as Whitefoot and Skerlos (2012) suggest, it provides an incentive for increasing vehicle size depends on the slope of the footprint curve.

energy efficiency gap (Helfand and Wolverton 2011; Allcott and Greenstone 2012; Gillingham and Palmer 2014).

If the gap is real – that is, the present-value savings in energy costs outweigh all the costs of the energy-saving technology – then private markets appear not to be behaving in standard ways. A number of hypotheses have been raised to explain this behavior (Helfand and Wolverton 2011; Allcott and Greenstone 2012; Gillingham and Palmer 2014), such as imperfect information, excessive consumer discounting, or lack of salience of energy consumption as a product characteristic. Behavioral economists have found evidence of behavioral anomalies in market transactions (e.g., DellaVigna 2009). Specifically in the auto market, evidence is mixed: Busse et al. (2013) and Sallee, West, and Fann (2015) found that vehicle buyers' revealed willingness to pay for fuel economy approximately matches their future fuel expenditures, while Allcott and Wozny (2014) estimated that vehicle buyers are willing to pay about 76 percent of the value of future fuel savings, and Greene (2010) finds a wide variation in estimates of consumer willingness to pay for fuel economy.

On the other hand, it is possible that the gap does not actually exist, despite the engineering estimates. The engineering estimates may be wrong in three dimensions: they may underestimate the monetary costs; they may overstate the monetary benefits; or they may ignore "hidden costs," undesirable changes in other attributes of the product. Allcott and Greenstone (2012) cite some examples of underestimated costs and overestimated benefits, as well as the difficulties in doing good studies of these effects.

This study focuses on the question of the existence of the energy efficiency gap. In particular, it examines the question of hidden costs as a potential explanation of the energy efficiency gap in light-duty vehicles. If compliance with the standards adversely affect a vehicle's power, handling, comfort, or other attributes, then potential vehicle buyers are likely to be less interested in purchasing them, and fuel-saving technologies will face obstacles in penetrating into the market. The existence and magnitude of hidden costs would, as noted, also contribute to skepticism about the existence of the energy efficiency gap. On the other hand, if fuel-saving technologies can be implemented without imposing hidden costs, then this explanation of the efficiency gap is not supported.

Content Analysis

Many vehicle attributes of great importance to vehicle buyers are qualitative. For instance, while it is possible to measure the turning radius of a vehicle, how it feels while going around a curve – the handling – is more difficult to quantify. Whether a fuel-saving technology makes the vehicle uncomfortable to drive in some way may thus be an unquantifiable attribute. For this reason, we looked to a method, content analysis, that can summarize a large quantity of text and contexts into meaningful analysis units, to understand the effects of fuel-saving technologies on vehicle quality.

Content analysis is a method to analyze text in a systematic way. It is widely used in the humanities and social sciences to classify, measure, and evaluate themes and symbols in various communications media (Krippendorff 2013). At the simplest level, content analysis can involve counting mentions of words (as in word clouds), to highlight major topics or phrasings. In more complex situations, content analysis can involve coding to identify subtle messages; for instance, Ganahl et al. (2003) analyzed prime time television commercials in 1998 to examine the prevalence of genders and ages, and found women (especially older women) underrepresented relative to men.

Most of the studies of content analyses involving automobiles focus on the issue of safety in vehicle advertisements. Burns and Lynch (2003) found, in response to new safety requirements in 1979, that vehicle advertisements increased their mentions of safety features, but not safety itself. Ferguson et al. (2003) found that performance was the dominant advertising theme in U.S. television commercials for cars and passenger vans; safety was mentioned infrequently. Sheehan et al. (2006) examined television advertisements in Australia to examine the effect of new requirements on auto advertising on the ads themselves; they found a reduction in the occurrence of themes (Performance, Exciting/Fun to Drive) which could be considered to promote unsafe driving, though safety themes were in a very small proportion of ads.

A few content analyses have considered the environmental effects of vehicles. Pollack and Zint (2006) found that newspaper coverage of hybrid electric vehicles focused on the vehicles' environmental attributes, rather than other attributes that consumers might consider important when buying new vehicles. Wilson et al. (2008) analyze the content of New Zealand vehicle advertisements for greenhouse gas (GHG) and air pollution-related information. In their study, very few ads mentioned the vehicle's fuel efficiency or reduced emissions. Nygren et al. consider the Finnish reform of the tax on purchase of new vehicles that increased the charge for higher-GHG-emitting vehicles and reduced the charge for lower-emissions vehicles. They found that newspaper coverage was generally positive and "treated [the reform] as an apolitical, technocratic issue," though the authors express concern that the low level of coverage may have led to an over-optimistic assessment of its impacts. These studies do not, however, look specifically at the relationship between the environmental characteristics of vehicles and consumer response to them, as this study does.

We chose content analysis as a tool to look for the adverse consequences of fuel-saving technologies, because these adverse effects are likely to show up in qualitative descriptions. A high-speed automatic transmission may shift roughly, for instance, or low rolling resistance tires may not grip the road well. Professional auto reviews are expected to be a fairly sensitive and relatively objective source of these qualitative descriptions. Auto reviewers are professional evaluators, trained to identify positive and negative characteristics of vehicles. Although they may identify hidden costs that some vehicle owners may not notice, it is relatively unlikely that they would miss important problems.

Methods

The first part of the study involved selection of auto reviews to be analyzed. We followed a conceptual hierarchy to choose relevant websites in multiple stages, consistent with the practice of relevance sampling described in Krippendorff (2013). We sought websites on the first page of search returns for keywords "new cars," "buying a new car" and "auto reviews," and excluded websites that did not have national and professional auto reviews. We then used monthly unique views from Quantcast.com and Compete.com to gauge Website popularity, excluded websites that had less than one million unique views, and added a few websites that Compete.com considered similar (to reduce any bias from using websites on the first page of search results). Finally, we screened websites to ensure that reviews had an independent assessment of vehicle quality (rather than a list of specification), and evidence of test driving of the reviewed vehicles.[2] This process resulted in our using the six websites in Table 1. Though these reviews are not

[2] Test driving was considered important so that reviewers would be able to evaluate operational characteristics, such as performance, handling, and noise.

necessarily representative of all auto reviews, they represent the reviews that vehicle buyers may be most likely to see, and may therefore influence more buyers than other sites.

Table 1. Auto Reviews by Website*

Website	Initial Review Counts	Final Review Counts	Matched with Tech Data**
automobilemag.com	145	144	98
autotrader.com	233	225	163
caranddriver.com	221	218	153
consumerreports.org	88	88	39
edmunds.com	113	112	109
motortrend.com	223	221	157
Total	**1,023**	**1,008**	**719**

*After the coding was completed, we identified 15 reviews of medium-duty trucks that we considered out-of-sample.

**Vehicles with enough trim-specific information to link to a database that identifies which technologies are on which vehicles

The study examined all reviews of new model-year 2014 vehicles available for sale in the U.S. and subject to the light-duty GHG and FE standards that included evaluation after a test drive. After dropping reviews that did not meet these criteria, and splitting reviews that included discussion of more than one vehicle trim, the study coded 1,023 reviews. During the data cleaning process, we identified 15 reviews of medium-duty vehicles that are not subject to the light-duty GHG or FE standards; these were removed from the database. In addition, due to notice of violations from EPA regarding certain Volkswagen and Audi diesel engines and their emissions, we dropped 5 reviews of vehicles with those engines from our analysis (EPA 2015).

Analyzing the relationship between operational characteristics and efficiency technologies might lead to biased results if reviewers do not discuss all the fuel-saving technologies on the list when the vehicles have them. To address this concern, we linked the vehicles in the content analysis with technology characteristics from publicly available EPA data, which is used by EPA and the Department of Energy to generate the annual Fuel Economy Guides. This information was supplemented with data from other publicly available sources, such as Edmunds and Wards, for several technology characteristics that were not available in the EPA data. These data are not available for all of the coded efficiency technologies in our review database. In particular, excluded technologies are active air dam, active grille shutters, active ride height, lighting-LED, mass reduction, and passive aerodynamics in addition to the general categories: general engine, general transmission, and general powertrain. Linking the technology data with the review data requires knowing the specific trim of each vehicle. In the review database, we did not have detailed enough information on 289 vehicles (29%) to match them with the technology database. After data cleaning, analyses involving the technology data (Tech Data in the tables that follow) use 718 reviews.

Reviews are themselves not conducted randomly or to reflect sales. For instance, as seen in Table 2, the dataset contains more reviews of Mercedes (74) than Toyota (63) vehicles. The review sites also sample differently: Consumer Reports reviewed 3 Mercedes (3.4 percent out of 88 reviews), while Car and Driver reviewed 26 Mercedes, 11.9 percent out of 218 reviews. It is possible that auto reviewers focus on models with significant redesign; if so, the population of reviews is likely to have a higher proportion of new technologies than the auto population as a whole. The effect of this bias on the results of the analysis are unclear. To the extent that the new technologies are actually new to the vehicle fleet, rather than new to a particular model, this study may include more technologies where any kinks are not yet fully resolved, and thus may overstate negative impacts experienced over time.

Table 2 also compares the total reviews to the number of distinct vehicles on the market for each make using data available from fueleconomy.gov. That is, it compares the proportion of models offered by each make to the proportion of reviews. The percentages differ by 1% or less for most manufacturers, suggesting that sampling bias across makes is small relative to the fleet of available vehicles. It is important to note that a particular make-model-trim combination may be reviewed several times across websites and therefore counted more than once in the "Total Reviews" column, while it will only be listed once in the fueleconomy.gov column; and some make-model-trim combinations may not be represented in the reviews. Still, this suggests that reviews may be roughly representative of vehicles offered, even if they are not representative of vehicles sold.

Similar evidence is presented in Table 3, which lists counts by vehicle class and again compares with the vehicle listing from fueleconomy.gov. The most reviewed class is midsize cars with 23%, followed by compact cars (17%), and small SUVs (14%). Again, the majority of classes are within 1% of the national fleet-wide percentages. The most notable exception is midsize cars, which represents 17% of the fleet of available vehicles. There is no reason to expect the distribution of reviews to exactly match the distribution of available cars, since reviews will be determined by other factors, such as the redesign cycles of vehicles. However, we are encouraged by the similarity in our sample as it suggests we have a reasonable view of available vehicles and the corresponding technology.

Table 2. Auto reviews by website and make; compared with fueleconomy.gov counts*

Make	Automobile Magazine	AutoTrader	Car and Driver	Consumer Reports	Edmunds	MotorTrend	Total Reviews		Matched with Tech Data		fueleconomy.gov Counts	
Acura	4	4	5	2	4	5	24	(2%)	22	(3%)	16	(1%)
Audi	3	11	9	1	7	6	37	(4%)	32	(4%)	48	(4%)
Bentley	2		5			4	11	(1%)	11	(2%)	7	(1%)
BMW	13	11	19	3	7	16	69	(7%)	51	(7%)	98	(8%)
Buick	7	3	6	1	2	8	27	(3%)	13	(2%)	16	(1%)
Cadillac	8	8	6	1	3	10	36	(4%)	17	(2%)	35	(3%)
Chevrolet	15	16	20	10	8	16	85	(8%)	62	(9%)	77	(6%)
Chrysler	1	2			1		4	(0.4%)	4	(1%)	14	(1%)
Dodge	2	7	3	3	5	4	24	(2%)	16	(2%)	35	(3%)
Ferrari	3		1			3	7	(1%)	4	(1%)	13	(1%)
Fiat	1		3	2	1	1	8	(1%)	4	(1%)	7	(1%)
Ford	5	14	7	5	5	11	47	(5%)	34	(5%)	88	(7%)
GMC	1	7	4	1		4	17	(2%)	2	(0.3%)	36	(3%)
Honda	5	8	4	5	4	8	34	(3%)	29	(4%)	30	(2%)
Hyundai		9	2		4	4	19	(2%)	16	(2%)	38	(3%)
Infiniti	3	9	4	1	3	5	25	(2%)	22	(3%)	29	(2%)
Jaguar	4	6	8		2	8	28	(3%)	18	(3%)	20	(2%)
Jeep	6	8	10	10	4	4	42	(4%)	27	(4%)	35	(3%)
Kia	7	10	10	5	5	7	44	(4%)	38	(5%)	35	(3%)
Land Rover	3	3	3	2	1	3	15	(1%)	9	(1%)	13	(1%)
Lexus	2	3	4	3	5	6	23	(2%)	14	(2%)	25	(2%)
Lincoln		3	1			2	6	(1%)	6	(1%)	16	(1%)
Mazda	8	9	9	4	6	13	49	(5%)	33	(5%)	25	(2%)
Mercedes	6	14	26	3	6	19	74	(7%)	56	(8%)	85	(7%)
Mini Cooper	5	1	1			4	11	(1%)	9	(1%)	46	(4%)
Mitsubishi	3	4	2	3	2	3	17	(2%)	12	(2%)	19	(2%)
Nissan	4	19	6	2	5	4	40	(4%)	38	(5%)	51	(4%)
Porsche	6	3	13	1	2	9	34	(3%)	25	(3%)	52	(4%)
Ram	2	1	1		1	2	7	(1%)	1	(0.1%)	13	(1%)
Rolls Royce	3		1		2	3	9	(1%)	9	(1%)	7	(1%)
Scion	1	1		1	1		4	(0.4%)	3	(0.4%)	9	(1%)
Smart		1					1	(0.1%)	1	(0.1%)	4	(0.3%)
Subaru	4	5	2	3	3	8	25	(2%)	17	(2%)	23	(2%)
Toyota	6	17	14	5	7	14	63	(6%)	40	(6%)	58	(5%)
Volkswagen**	1	6	9	11	6	4	37	(4%)	21	(3%)	50	(4%)
Volvo		2				3	5	(0.5%)	3	(0.4%)	13	(1%)
Other***											43	(3%)
Total	**144**	**225**	**218**	**88**	**112**	**221**	**1,008**		**719**		**1,229**	

*Percentages in parentheses represent percentage of column total.

**In the analysis that follows, we exclude reviews of 5 Volkswagen/Audi diesels alleged to be in violation of emissions standards.

***Other category for fueleconomy.gov includes Aston Martin (7), Bugatti (1), BYD (1), Lamborghini (7), Lotus (4), Maserati (6), McLaren (3), Mobility Ventures LLC (2), Pagani (1), Roush (7), SRT (1), and Tesla Motors (3).

Table 3. Reviews by Vehicle Class; compared with fueleconomy.gov counts*

Vehicle Class	Final Review Count		Matched with Tech Data**		fueleconomy.gov Count	
Subcompact Cars	79	(8%)	68	(9%)	101	(8%)
Minicompact Cars	13	(1%)	12	(2%)	52	(4%)
Compact Cars	173	(17%)	126	(18%)	201	(16%)
Two Seaters	81	(8%)	52	(7%)	93	(8%)
Midsize Cars	229	(23%)	147	(20%)	215	(17%)
Large Cars	87	(9%)	71	(10%)	104	(8%)
Small Station Wagons	26	(3%)	22	(3%)	36	(3%)
Midsize Station Wagons	8	(1%)	8	(1%)	4	(0.3%)
Passenger Vans	1	(0.1%)			16	(1%)
Minivans	15	(1%)	15	(2%)	14	(1%)
Small SUVs	143	(14%)	104	(14%)	179	(15%)
Standard SUVs	89	(9%)	69	(10%)	116	(9%)
Small Pickup Trucks	1	(0.1%)			14	(1%)
Standard Pickup Trucks	41	(4%)	7	(1%)	54	(4%)
Not Recorded	22	(2%)	18	(3%)		
Other***					30	(2%)
Total	**1,008**		**719**		**1,229**	

*Percentages in parentheses represent percentage of column total.

** Vehicles with enough trim-specific information to link to a database that identifies which technologies are on which vehicles

***Other category for fueleconomy.gov contains "Special Purpose Vehicle 2WD", "Special Purpose Vehicle 4WD", and Cargo Vans.

When analyzing each review, we coded for technologies (e.g., high-speed automatic transmissions) most likely to affect the requirements for reduced GHG emissions. The list of technologies came from reviewing the technologies proposed for compliance purposes in EPA and DOT (2010 and 2012), as well as professional engineering judgment. In addition, we coded for reviews of operational characteristics such as acceleration, handling, drivability, noise, and comfort. This allows us to search for patterns in negative (or positive) operational reviews conditional on mentions of a specific technology, which could suggest the presence of hidden costs. Table 4 lists the coded efficiency technologies and operational characteristics considered in this study.

Table 4. Efficiency Technology and Operational Characteristics Coded

	Parent Hierarchy		Coding Level
Efficiency Technology	Active Air Dam		Active Air Dam
	Active Grille Shutters		Active Grille Shutters
	Active Ride Height		Active Ride Height
	Electric Assist or Low Drag Brakes		Electric Assist or Low Drag Brakes
	Electronic Power Steering		Electronic Power Steering
	Lighting – LED		Lighting-LED
	Low Rolling Resistance Tires		Low Rolling Resistance Tires
	Mass Reduction		Mass Reduction
	Passive Aerodynamics		Passive Aerodynamics
	Powertrain	Engine	Cylinder Deactivation
			Diesel
			Full Electric
			Gasoline Direct Injection (GDI)
			General Engine
			Hybrid
			Plug-in Hybrid Electric
			Stop-start
			Turbocharged
		General Powertrain	General Powertrain
		Transmission	Continuously Variable Transmission (CVT)
			Dual-clutch Transmission (DCT)
			General Transmission
			High Speed Automatic
Operational Characteristics	Charging		Charging
	Drivability	Acceleration	Acceleration Capability-power-torque
			Acceleration feel-smoothness-responsiveness
			General Acceleration
		Braking	Brake Feel-responsiveness
			General Braking
			Stopping Ability
		Handling	Cornering Ability-grip-balance-body control
			General Handling
			Steering Feel-controllability-responsiveness
		General Drivability	General Drivability
	Fuel Economy		Fuel Economy
	Noise		General Noise
			Interior Noise
			Powertrain Noise
			Tire-road Noise
			Wind Noise
	Range		Range
	Ride Comfort		Ride Comfort
	Vibration		Chassis Vibration
			General Vibration
			Powertrain Vibration

Each review was coded for all mentions of these technologies and operational characteristics. For instance, consider the following quote from a review: "We like the effortless power and the smooth transmission, but the auto start/stop system has more delay than some, the throttle can be a bit on the jumpy side and the light steering is disconcerting." (Edmunds 2014). The "smooth transmission," elsewhere identified as a 7-speed automatic, was coded as positive for high-speed automatic transmission; the stop/start system, having "more delay than some," was coded as negative. In addition, "effortless power" was coded as positive for acceleration capability, while the "disconcerting" steering was coded as negative for steering feel.

To conduct the coding, an adjudicator trained two coders to recognize the technologies and characteristics and their synonyms. As part of the training, the coders were given the same reviews to code, to check for inter-coder reliability (to ensure replicability of the results). At the end of the training, the coders reached above 90% agreement and a Cohen's Kappa coefficient of 0.6 (fair agreement), again followed by code by code review and debriefing. After the training, we continued with independent learning and assessment until the coders reached above 90% agreement and a Cohen's Kappa coefficient of 0.8 (where 0.75 is considered "excellent agreement"). The coding operation officially started after that. The coders examined reviews for mentions of the technologies and operational characteristics, and then, in context, evaluated whether the reviewers spoke positively, negatively, or neutrally about them. Checks on inter-coder reliability were conducted regularly to ensure quality.

We coded a total of 1,023 auto reviews (1,008 after data cleaning) from the six websites for model year 2014 vehicles, representing 36 manufacturers and 14 official vehicle class categories (using the classification system of the website fueleconomy.gov). Because each review had multiple individual codes (e.g., for engine and transmission), the total number of individual efficiency technology codes is 3,535, or about 3.5 codes per review. The total number of operational characteristics coded was 12,623, or 12.6 codes per review. In terms of publication dates, 43% of the auto reviews were published in 2013, while the rest were published in 2014 (26%) or no dates were recorded (31%).[3]

Results

Table 5 presents counts of individual codes for vehicle technologies, where any one review may have multiple codes covering the same or different technologies represented in the vehicle. For every technology, the number of positive codes exceeds the number of negative codes. In the aggregate, 71 percent of the codes for technologies are positive, compared to 13 percent neutral and 16 percent negative. At face value, this result suggests that the new technologies are generally being received positively. However, this representation of the results could possibly be due to positive reviews having multiple references, while negative reviews get fewer mentions.

Table 6 addresses this concern by summarizing the results when the results are aggregated to individual reviews. If an item to be coded was mentioned multiple times in a review, then its treatment depends on whether it always was coded the same way. If, for example, all the codes are positive, then, at the review level, it is listed once in the positive column. If, on the other hand, it is mentioned in both a positive and a negative way, then it gets listed twice – once for positive, and once for negative. This approach gives slightly more weight

[3] Many MY2014 vehicles were available to professional auto reviewers, and even to the general public, in 2013.

to mixed reviews, perhaps the opposite bias from the code-level analysis. It, nevertheless, shows the same pattern: the positive reviews outweigh the negative reviews for all fuel-saving technologies. In the aggregate, reviews with mentions of the technologies have positive evaluations 68 percent of the time; neutral evaluations 16 percent; and negative evaluations 16 percent of the time. This result also suggests that it is possible, for any of these technologies, to implement them in ways that auto reviewers find favorable.

Table 5: Total number of positive, negative, and neutral codes by efficiency technology

Parent Hierarchy		Coding Level	Negative		Neutral		Positive		Total
Active Air Dam		Active Air Dam	-	-	-	-	6	100%	6
Active Grille Shutters		Active Grille Shutters	-	-	-	-	1	100%	1
Active Ride Height		Active Ride Height	-	-	1	33%	2	67%	3
Electric Assist/Low Drag Brakes		Electric Assist/Low Drag Brakes	1	13%	3	38%	4	50%	8
Electronic power steering		Electronic Power Steering	51	23%	43	19%	129	58%	223
Lighting - LED		Lighting-LED	1	4%	2	9%	20	87%	23
Low Rolling Resistance Tires		Low Rolling Resistance Tires	4	24%	5	29%	8	47%	17
Mass Reduction		Mass Reduction	-	-	12	13%	80	87%	92
Passive Aerodynamics		Passive Aerodynamics	4	10%	7	17%	30	73%	41
Powertrain	Engine	Cylinder Deactivation	1	3%	4	10%	35	88%	40
		Diesel	13	9%	11	8%	122	84%	146
		Full Electric	4	11%	7	20%	24	69%	35
		GDI	7	9%	7	9%	63	82%	77
		General Engine	154	15%	112	11%	740	74%	1,006
		Hybrid	28	19%	13	9%	104	72%	145
		Plug-In Hybrid Electric	7	13%	6	11%	42	76%	55
		Stop-Start	15	27%	8	14%	33	59%	56
		Turbocharged	23	7%	25	8%	285	86%	333
	General Powertrain	General Powertrain	13	11%	19	16%	90	74%	122
	Transmission	CVT	57	31%	31	17%	97	52%	185
		DCT	27	25%	12	11%	67	63%	106
		General Transmission	47	22%	28	13%	134	64%	209
		High Speed Automatic	117	19%	101	17%	388	64%	606
Total			574	16%	457	13%	2,504	71%	3,535

*These counts exclude reviews of 5 Volkswagen/Audi diesels alleged to be in violation of emissions standards.

Table 6: Number of positive, negative, and neutral evaluations by auto review

Parent Hierarchy		Coding Level	Negative		Neutral		Positive		Total
Active Air Dam		Active Air Dam	-	-	-	-	6	100%	6
Active Grille Shutters		Active Grille Shutters	-	-	-	-	1	100%	1
Active Ride Height		Active Ride Height	-	-	1	33%	2	67%	3
Electric Assist or Low Drag Brakes		Electric Assist Or Low Drag Brakes	1	14%	3	43%	3	43%	7
Electronic power steering		Electronic Power Steering	45	22%	42	20%	121	58%	208
Lighting - LED		Lighting-LED	1	5%	2	10%	17	85%	20
Low Rolling Resistance Tires		Low Rolling Resistance Tires	4	24%	5	29%	8	47%	17
Mass Reduction		Mass Reduction	-	-	9	12%	65	88%	74
Passive Aerodynamics		Passive Aerodynamics	4	10%	7	18%	29	73%	40
Powertrain	Engine	Cylinder Deactivation	1	3%	4	11%	30	86%	35
		Diesel	7	12%	9	15%	44	73%	60
		Full Electric	2	9%	6	27%	14	64%	22
		GDI	6	9%	6	9%	54	82%	66
		General Engine	104	16%	95	15%	443	69%	642
		Hybrid	16	23%	10	14%	45	63%	71
		Plug-In Hybrid Electric	4	14%	6	21%	18	64%	28
		Stop-Start	14	27%	7	14%	30	59%	51
		Turbocharged	20	9%	23	10%	180	81%	223
	General Powertrain	General Powertrain	8	8%	19	18%	78	74%	105
	Transmission	CVT	35	31%	20	18%	57	51%	112
		DCT	16	24%	10	15%	42	62%	68
		General Transmission	30	18%	26	16%	108	66%	164
		High Speed Automatic	60	14%	81	20%	273	66%	414
Total			378	16%	391	16%	1,668	68%	2,437

*These counts exclude reviews of 5 Volkswagen/Audi diesels alleged to be in violation of emissions standards.

Because the results by codes and by reviews are similar, the following discussion focuses on the results by review.

The mentions of the technologies in the reviews are not very frequent. As noted above, there are about 3.5 codes of any of these technologies per review; excluding General Engine, General Powertrain, and General Transmission (which are not specific fuel-saving technologies), there are about 2.2 codes of fuel-saving technologies per review. The most mentioned fuel-saving technologies are high-speed automatic transmissions, turbocharging, electronic power steering (EPS), and continuously variable transmissions (CVTs); other technologies are mentioned in fewer than 10 percent of the reviews. It is important to note that absence of mention of a technology in a review does not mean that the technology is absent; it means that the reviewer did not comment on it. It seems plausible that reviewers would notice and comment on undesirable features; a lack of mention when a technology is present may then be interpreted as an absence of a hidden cost. If so, the positive and neutral codings may under-represent the true effect of the technology. To examine this question, as discussed above, we were able to match 71% of the vehicles reviewed with technology data.

The technologies mentioned most positively in percentage terms include active air dams (100 percent of 6 reviews), active grille shutters (100 percent of 1 review), mass reduction (88 percent of 74 reviews), cylinder deactivation (86 percent of 35 reviews), LED lights (85 percent

of 20 reviews), gasoline direct injection (GDI, 82 percent of 66 reviews), and turbocharging (81 percent of 223 reviews). With the exception of turbocharging, these technologies are mentioned in less than 10 percent of reviews. The proportion of the reviews that mention one of these technologies is higher for luxury brands than for standard brands:[4] 172 out of 403 reviews (43%) for a luxury brand mention one or more of these technologies, while 162 out of 600 reviews (27%) for a standard brand mention one or more. It is not possible to say whether these technologies are considered high-end, and thus more suitable for luxury vehicles, or whether they are being implemented with high quality for these uses.

The technologies with at least 20 percent of negative reviews include continuously variable transmissions (CVTs, 31 percent of 112 reviews), stop-start (27 percent of 51 reviews), low rolling resistance tires (24 percent of 17 reviews), dual-clutch transmissions (DCTs) (24 percent of 68 reviews), hybrids (23 percent of 71 reviews), and electronic power steering (EPS, 22 percent of 208 reviews). With the exceptions of CVTs and EPS, these technologies were also mentioned in less than 10 percent of reviews. These technologies were mentioned in reviews for luxury brands at close to the same rate as for standard brands: 37% (151 out of 403) of reviews for luxury brands, and 34% (204 out of 600) reviews for standard brands mentioned one or more of these technologies. As a group, the proportion of negative reviews is very similar for luxury (27%) and standard (23%) brands. Unlike the better-reviewed technologies, these technologies appear not to be over-represented in the luxury segment. Even the worst reviewed of these technologies (CVTs), though, still had 51 percent positive mentions and 18 percent neutral mentions.

Table 7 shows the percent of negative reviews for both technologies and operational characteristics by manufacturer. As it shows, there is a great deal of variation, for both categories, in the proportion of negative reviews. Bentley, Chrysler, and Rolls Royce have no negative evaluations of efficiency technologies (out of a total of 39 coded technologies), while Fiat had 53 percent of 15 coded technologies evaluated as negative. For operational characteristics, Acura, Audi, Bentley, Ram, Rolls Royce, and Smart had less than 10 percent of the characteristics evaluated negatively (Smart had only 1, positive, code); Mitsubishi had negative evaluations of 56 percent of its codes for operational characteristics. The correlation between these percentages is 0.80: companies that are well rated on operational characteristics also appear to implement efficiency technologies positively.

[4] Luxury brands are here defined as Acura, Audi, Bentley, BMW, Cadillac, Ferrari, Infiniti, Jaguar, Land Rover, Lexus, Lincoln, Mercedes, Porsche, Rolls Royce, and Volvo. These covered 403 of the 1003 reviews.

Table 7: Percent Negative Reviews of Efficiency Technologies and Operational Characteristics, by Manufacturer

Make	% Negative Tech Reviews	% Negative Operational Characteristics Reviews	Make	% Negative Tech Reviews	% Negative Operational Characteristics Reviews
Acura	6.9%	8.5%	Kia	13.3%	15.0%
Audi	5.9%	9.3%	Land Rover	4.5%	13.4%
Bentley	0.0%	6.1%	Lexus	26.4%	21.6%
BMW	9.8%	11.0%	Lincoln	38.5%	24.4%
Buick	27.3%	22.3%	Mazda	8.9%	13.6%
Cadillac	9.2%	12.2%	Mercedes	14.1%	13.9%
Chevrolet	14.0%	14.8%	Mini Cooper	22.7%	20.0%
Chrysler	0.0%	10.0%	Mitsubishi	39.1%	56.3%
Dodge	12.5%	20.6%	Nissan	34.1%	25.8%
Ferrari	9.5%	10.4%	Porsche	10.9%	12.5%
Fiat	53.3%	39.1%	Ram	11.1%	6.5%
Ford	16.4%	15.6%	Rolls Royce	0.0%	4.6%
GMC	14.3%	18.2%	Scion	16.7%	36.4%
Honda	7.7%	13.7%	Smart	--	0.0%
Hyundai	25.5%	22.1%	Subaru	32.8%	21.8%
Infiniti	28.1%	19.7%	Toyota	14.0%	22.5%
Jaguar	3.8%	11.2%	Volkswagen	13.2%	15.4%
Jeep	26.9%	25.1%	Volvo	40.0%	30.0%

For further assessment of the relationship between vehicle technologies and hidden costs, we examined the relationship between evaluations of operational characteristics – specifically, the negative evaluations -- and the technologies.

Table 8 and Table 9 provide the fraction of reviews where an efficiency technology is mentioned (Table 8) or appears in the technology data (Table 9) with negative operational characteristics. For comparison, these tables include the fraction of reviews where the efficiency technology is not mentioned (Table 8) or not included (Table 9) with negative evaluations of that characteristic, and whether those proportions are statistically different based on simple t-tests of differences in means. For instance, in Table 8, for the subset of reviews that mention CVT (83 reviews), 40% of those reviews also negatively review the acceleration capability. This differs by +26 percentage points from the subset of reviews that do not mention CVT, i.e. 14% of reviews that do not mention CVT also give a negative review of acceleration capability. This difference is statistically significant at the 1% level base on the simple t-test. This result is nearly identical to the analogous result in Table 9 using the tech data for presence of CVT. In that case, 41% of vehicles with CVT get a negative review on acceleration capability compared to 14% of vehicles without CVT, a difference which is again significant at the 1% level.

For many other technologies the differences are negative, i.e., vehicles with the technologies have fewer negative reviews. In Table 8, for example, vehicles with mentions of stop-start technology have a negative rating on acceleration capability 6% of the time, compared to 17% of cars without stop-start technology, for a difference of -11%. This difference is also significant at the 1% level based on the simple t-test. Once again, this result is very close to the result using the tech data from Table 9 where 8% of vehicles with stop-start receive a negative rating on acceleration capability, compared to 18% of vehicles without stop-start.

As noted above, we do not have tech data for all of the coded efficiency technologies in our review database. Nonetheless, the results are generally similar for technologies that are represented in both Table 8 and Table 9.

Table 8: Share of reviews with negative operational reviews conditional on efficiency technology

	Steering Feel	Cornering Ability	General Drivability	General Handling	Acceleration Feel	Acceleration Capability	General Acceleration	Brake Feel	Stopping Ability	General Braking	Tire-Road Noise
Active Air Dam (N=6)	0.00 -.15***	0.00 -.09***	0.00 -.12***	0.17 0.09	0.00 -.08***	0.00 -.16***	0.00 -.02***	0.00 -.05***	0.00 -.03***	0.00 -.02***	0.00 -.07***
Active Grille Shutters (N=1)	0.00 -0.15	0.00 -0.09	0.00 -0.12	0.00 -0.08	0.00 -0.08	0.00 -0.16	0.00 -0.02	0.00 -0.05	0.00 -0.03	0.00 -0.02	0.00 -0.07
Active Ride Height (N=3)	0.00 -.15***	0.00 -.09***	0.00 -.12***	0.00 -.08***	0.00 -.08***	0.33 0.17	0.00 -.02***	0.00 -.05***	0.00 -.03***	0.00 -.02***	0.00 -.07***
Low Resistance Tires (N=14)	0.21 0.07	0.29 0.2	0.21 0.1	0.07 -0.01	0.21 0.14	0.21 0.05	0.07 0.05	0.07 0.03	0.07 0.04	0.00 -.02***	0.07 0
Electronic Power Steering (N=193)	0.28 .17***	0.10 0.01	0.08 -.05**	0.05 -.04*	0.08 0	0.13 -0.04	0.01 -.02*	0.06 0.02	0.06 .03*	0.02 -0.01	0.09 0.03
Turbocharged (N=195)	0.14 -0.01	0.10 0.01	0.09 -0.03	0.04 -.05***	0.08 0.01	0.13 -0.04	0.01 -.02***	0.03 -0.02	0.02 -0.01	0.02 0	0.07 0
GDI (N=62)	0.13 -0.02	0.02 -.08***	0.08 -0.04	0.03 -.05**	0.08 0.01	0.21 0.05	0.00 -.03***	0.02 -.03*	0.05 0.02	0.00 -.02***	0.05 -0.02
Cylinder Deactivation (N=35)	0.17 0.03	0.00 -.1***	0.06 -0.06	0.03 -.06*	0.06 -0.02	0.20 0.04	0.00 -.02***	0.03 -0.02	0.11 0.09	0.00 -.02***	0.03 -0.04
Diesel (N=47)	0.09 -0.06	0.04 -0.05	0.04 -.08**	0.00 -.09***	0.02 -.06**	0.17 0.01	0.02 0	0.02 -0.03	0.02 -0.01	0.00 -.02***	0.02 -.05**
Hybrid (N=54)	0.15 0	0.09 0	0.22 .11*	0.07 -0.01	0.13 0.06	0.17 0	0.02 -0.01	0.15 .11**	0.06 0.03	0.06 0.04	0.00 -.08***
Plug-In Hybrid Electric (N=18)	0.06 -0.09	0.11 0.02	0.11 0	0.11 0.03	0.00 -.08***	0.17 0	0.06 0.03	0.11 0.07	0.06 0.03	0.06 0.04	0.06 -0.02
Full Electric (N=18)	0.11 -0.04	0.06 -0.04	0.17 0.05	0.06 -0.03	0.22 0.15	0.22 0.06	0.06 0.03	0.06 0.01	0.06 0.03	0.00 -.02***	0.00 -.07***
Stop-Start (N=49)	0.18 0.04	0.06 -0.03	0.10 -0.01	0.06 -0.02	0.08 0.01	0.06 -.11***	0.02 0	0.04 -0.01	0.02 -0.01	0.02 0	0.10 0.03
General Engine (N=547)	0.14 0	0.11 .04**	0.14 .05**	0.09 0.01	0.07 -0.01	0.19 .06***	0.03 0.01	0.04 -0.01	0.03 0	0.01 -.02**	0.09 .04**
High Speed Automatic (N=351)	0.15 0	0.10 0.01	0.10 -0.02	0.09 0.01	0.07 -0.02	0.15 -0.03	0.01 -.02***	0.05 0	0.03 0	0.01 -.02**	0.09 0.03
CVT (N=83)	0.24 .1**	0.14 0.06	0.31 .22***	0.18 .11**	0.17 .1**	0.40 .26***	0.02 0	0.13 .09**	0.08 .06*	0.02 0	0.11 0.04
DCT (N=54)	0.15 0	0.13 0.04	0.07 -0.04	0.11 0.03	0.07 0	0.17 0	0.02 -0.01	0.06 0.01	0.04 0.01	0.02 0	0.15 0.08
General Transmission (N=138)	0.17 0.02	0.06 -.04*	0.11 -0.01	0.06 -0.03	0.09 0.01	0.17 0.01	0.04 0.01	0.06 0.01	0.03 0	0.07 .05**	0.12 .05*
General Powertrain (N=101)	0.15 0	0.06 -0.04	0.14 0.03	0.11 0.03	0.07 -0.01	0.19 0.03	0.05 0.03	0.07 0.03	0.05 0.02	0.01 -0.01	0.10 0.03
Elec Assist Or Low Drag Brakes (N=6)	0.17 0.02	0.00 -.09***	0.00 -.12***	0.00 -.08***	0.17 0.09	0.17 0	0.00 -.02***	0.00 -.05***	0.17 0.14	0.00 -.02***	0.00 -.07***
Lighting-LED (N=17)	0.24 0.09	0.12 0.03	0.24 0.12	0.24 0.16	0.00 -.08***	0.18 0.01	0.00 -.02***	0.00 -.05***	0.00 -.03***	0.00 -.02***	0.24 0.17
Mass Reduction (N=73)	0.10 -0.05	0.07 -0.03	0.04 -.08***	0.04 -.04*	0.01 -.07***	0.10 -.07*	0.01 -0.01	0.07 0.02	0.01 -0.02	0.01 -0.01	0.08 0.01
Passive Aerodynamics (N=38)	0.11 -0.04	0.08 -0.01	0.05 -.07*	0.05 -0.03	0.03 -.05*	0.08 -.09*	0.00 -.02***	0.08 0.03	0.03 0	0.08 0.06	0.05 -0.02

The top number in each cell is the fraction of reviews with a negative coded statement about the operational characteristic (column) conditional on also having a coded statement about the efficiency technology (row). The second number measures the difference with all other reviews that do not have coded statements about the technology. Significance with 10% (*), 5% (**), and 1% (***) is estimated using t-tests for differences in means.

Table 8 Continued

	Wind Noise	Interior Noise	Powertrain Noise	General Noise	Chassis Vibration	Powertrain Vibration	General Vibration	Ride Comfort	Fuel Economy	Range	Charging
Active Air Dam (N=6)	0.00 -.03***	0.00 -.02***	0.00 -.15***	0.00 -.06***	0.00 -.01***	0.00 -.01***	0.00 -.02***	0.17 0.02	0.00 -.16***	0.00 -.01***	0.00 0*
Active Grille Shutters (N=1)	0.00 -0.03	0.00 -0.02	0.00 -0.14	0.00 -0.06	0.00 -0.01	0.00 -0.01	0.00 -0.02	0.00 -0.15	0.00 -0.16	0.00 -0.01	0.00 0
Active Ride Height (N=3)	0.00 -.03***	0.00 -.02***	0.00 -.14***	0.00 -.06***	0.00 -.01***	0.00 -.01***	0.00 -.02***	0.00 -.15***	0.00 -.16***	0.00 -.01***	0.00 0*
Low Resistance Tires (N=14)	0.00 -.03***	0.00 -.02***	0.21 0.07	0.14 0.09	0.00 -.01***	0.00 -.01***	0.07 0.05	0.21 0.07	0.00 -.16***	0.07 0.07	0.00 0*
Electronic Power Steering (N=193)	0.03 0	0.00 -.02***	0.15 0	0.04 -.03*	0.02 0.02	0.01 0	0.01 -0.01	0.13 -0.02	0.12 -.05*	0.01 0	0.00 0*
Turbocharged (N=195)	0.01 -.02**	0.01 -0.01	0.14 -0.01	0.03 -.04***	0.01 0	0.02 0.01	0.02 0	0.12 -0.03	0.13 -0.03	0.00 -.01***	0.00 0*
GDI (N=62)	0.03 0	0.02 0	0.06 -.09**	0.05 -0.01	0.00 -.01***	0.00 -.01***	0.03 0.01	0.19 0.05	0.03 -.14***	0.00 -.01***	0.00 0*
Cylinder Deactivation (N=35)	0.00 -.03***	0.00 -.02***	0.09 -0.06	0.03 -0.03	0.00 -.01***	0.03 0.02	0.03 0.01	0.23 0.08	0.06 -.11**	0.00 -.01***	0.00 0*
Diesel (N=47)	0.02 -0.01	0.00 -.02***	0.11 -0.04	0.04 -0.02	0.00 -.01***	0.02 0.01	0.00 -.02***	0.04 -.11***	0.06 -.1***	0.00 -.01***	0.00 0*
Hybrid (N=54)	0.00 -.03***	0.00 -.02***	0.20 0.06	0.09 0.04	0.00 -.01***	0.00 -.01***	0.00 -.02***	0.11 -0.04	0.17 0.01	0.00 -.01***	0.00 0*
Plug-In Hybrid Electric (N=18)	0.00 -.03***	0.00 -.02***	0.33 0.19	0.00 -.06***	0.00 -.01***	0.00 -.01***	0.00 -.02***	0.00 -.15***	0.06 -.11*	0.28 .28**	0.11 0.11
Full Electric (N=18)	0.00 -.03***	0.00 -.02***	0.11 -0.03	0.06 0	0.00 -.01***	0.00 -.01***	0.00 -.02***	0.17 0.02	0.06 -.11*	0.11 0.11	0.06 0.05
Stop-Start (N=49)	0.00 -.03***	0.00 -.02***	0.12 -0.02	0.10 0.05	0.00 -.01***	0.02 0.01	0.04 0.02	0.27 .12*	0.16 0	0.02 0.01	0.00 0*
General Engine (N=547)	0.03 0.01	0.02 .02**	0.14 0	0.06 0.01	0.01 .01***	0.02 .01**	0.02 0.01	0.19 .08***	0.20 .08***	0.00 -.01**	0.00 0
High Speed Automatic (N=351)	0.03 0.01	0.02 0.01	0.14 0	0.05 -0.02	0.01 0	0.01 0.01	0.02 0.01	0.19 .06**	0.16 0	0.00 -0.01	0.00 0*
CVT (N=83)	0.07 0.05	0.02 0.01	0.37 .25***	0.18 .13***	0.01 0.01	0.02 0.02	0.04 0.02	0.18 0.04	0.25 .1**	0.00 -.01***	0.00 0*
DCT (N=54)	0.00 -.03***	0.04 0.02	0.09 -0.05	0.06 0	0.02 0.01	0.02 0.01	0.06 0.04	0.24 0.1	0.04 -.13***	0.00 -.01***	0.00 0*
General Transmission (N=138)	0.07 .04*	0.03 0.02	0.14 0	0.10 .05*	0.02 0.02	0.00 -.01***	0.01 -0.01	0.18 0.04	0.17 0.01	0.00 -.01***	0.01 0
General Powertrain (N=101)	0.05 0.02	0.02 0	0.16 0.02	0.15 .1***	0.01 0	0.00 -.01***	0.02 0	0.15 0	0.20 0.04	0.01 0	0.00 0*
Elec Assist Or Low Drag Brakes (N=6)	0.00 -.03***	0.00 -.02***	0.17 0.02	0.00 -.06***	0.00 -.01***	0.00 -.01***	0.00 -.02***	0.00 -.15***	0.00 -.16***	0.00 -.01***	0.00 0*
Lighting-LED (N=17)	0.00 -.03***	0.18 0.16	0.06 -0.09	0.12 0.06	0.00 -.01***	0.00 -.01***	0.00 -.02***	0.24 0.09	0.12 -0.04	0.00 -.01***	0.00 0*
Mass Reduction (N=73)	0.03 0	0.00 -.02***	0.11 -0.04	0.04 -0.02	0.00 -.01***	0.01 0	0.03 0.01	0.18 0.03	0.03 -.14***	0.00 -.01***	0.01 0.01
Passive Aerodynamics (N=38)	0.03 0	0.03 0.01	0.11 -0.04	0.05 -0.01	0.00 -.01***	0.00 -.01***	0.00 -.02***	0.13 -0.02	0.13 -0.03	0.03 0.02	0.00 0*

The top number in each cell is the fraction of reviews with a negative coded statement about the operational characteristic (column) conditional on also having a coded statement about the efficiency technology (row). The second number measures the difference with all other reviews that do not have coded statements about the technology. Significance with 10% (*), 5% (**), and 1% (***) is estimated using t-tests for differences in means.

Table 9: Share of reviews with negative operational reviews conditional on efficiency technology using Tech Data

	Steering Feel	Cornering Ability	General Drivability	General Handling	Acceleration Feel	Acceleration Capability	General Acceleration	Brake Feel	Stopping Ability	General Braking	Tire-Road Noise
Low Resistance Tires (N=31)	0.23 0.09	0.13 0.04	0.16 0.06	0.13 0.05	0.06 -0.01	0.19 0.04	0.03 0	0.03 -0.02	0.10 0.06	0.03 0.01	0.03 -0.04
Diesel (N=38)	0.13 -0.01	0.00 -.09***	0.00 -.11***	0.00 -.08***	0.03 -0.05	0.13 -0.03	0.00 -.03***	0.00 -.06***	0.03 -0.01	0.00 -.02***	0.03 -.05*
Electronic Power Steering (N=532)	0.16 .05*	0.09 0.01	0.10 -0.01	0.09 .03*	0.07 -0.01	0.18 .07**	0.03 0.01	0.06 0.02	0.05 .03***	0.03 .02**	0.08 0.03
Full Electric (N=8)	0.13 -0.02	0.00 -.09***	0.00 -.1***	0.00 -.08***	0.13 0.05	0.13 -0.03	0.00 -.03***	0.00 -.05***	0.00 -.04***	0.13 0.1	0.00 -.07***
GDI (N=424)	0.13 -0.03	0.08 -0.02	0.06 -.1***	0.05 -.07***	0.06 -0.02	0.12 -.11***	0.02 -.03*	0.04 -.04**	0.03 -0.01	0.02 -0.01	0.06 -.04*
Hybrid (N=45)	0.20 0.06	0.09 0	0.22 .13*	0.07 -0.01	0.09 0.02	0.27 .12*	0.02 -0.01	0.22 .18***	0.07 0.03	0.07 0.05	0.02 -.05**
Plug-In Hybrid Electric (N=17)	0.06 -0.09	0.18 0.09	0.18 0.08	0.18 0.1	0.06 -0.01	0.18 0.02	0.00 -.03***	0.00 -.05***	0.06 0.02	0.00 -.02***	0.06 -0.01
Cylinder Deactivation (N=58)	0.14 -0.01	0.05 -0.04	0.05 -.06*	0.10 0.03	0.03 -0.04	0.07 -.1***	0.00 -.03***	0.03 -0.02	0.07 0.04	0.02 -0.01	0.09 0.01
Stop-Start (N=130)	0.14 -0.01	0.06 -0.03	0.04 -.08***	0.03 -.06***	0.08 0.02	0.08 -.1***	0.00 -.04***	0.03 -0.03	0.02 -.03*	0.01 -.02*	0.04 -.04**
Turbocharged (N=238)	0.15 0.01	0.06 -.03*	0.07 -.05**	0.05 -.04**	0.08 0.01	0.11 -.07**	0.03 -0.01	0.03 -.04**	0.02 -.02*	0.03 0	0.05 -0.03
CVT (N=54)	0.22 0.09	0.17 0.09	0.26 .17***	0.20 .13**	0.15 .08*	0.41 .27***	0.06 0.03	0.06 0	0.09 0.06	0.02 0	0.07 0
DCT (N=67)	0.13 -0.01	0.06 -0.03	0.10 0	0.06 -0.02	0.09 0.02	0.13 -0.03	0.01 -0.02	0.03 -0.03	0.03 -0.01	0.04 0.02	0.12 0.05
High Speed Automatic (N=401)	0.13 -0.02	0.09 0.02	0.08 -.06**	0.06 -0.03	0.05 -.04**	0.12 -.09***	0.02 -0.01	0.05 -0.01	0.03 -0.01	0.01 -.03**	0.07 -0.01

The top number in each cell is the fraction of reviews with a negative coded statement about the operational characteristic (column) conditional on the presence of the efficiency technology (row) as reported in the matched Tech Data. The second number measures the difference with all other reviews that Tech Data report do not have the technology. Significance with 10% (*), 5% (**), and 1% (***) is estimated using t-tests for differences in means.

Table 9 Continued

	Wind Noise	Interior Noise	Powertrain Noise	General Noise	Chassis Vibration	Powertrain Vibration	General Vibration	Ride Comfort	Fuel Economy	Range	Charging
Low Resistance Tires (N=31)	0.03 0	0.03 0.02	0.19 0.05	0.06 0	0.00 -.01**	0.00 -.01***	0.00 -.02***	0.03 -.13***	0.06 -.1**	0.03 0.02	0.10 .1*
Diesel (N=38)	0.03 -0.01	0.00 -.02***	0.11 -0.04	0.05 -0.01	0.00 -.01**	0.03 0.02	0.00 -.02***	0.03 -.13***	0.08 -.09*	0.00 -.01**	0.00 0*
Electronic Power Steering (N=532)	0.04 .03**	0.01 -0.01	0.16 0.04	0.07 0.02	0.01 -0.01	0.01 0	0.02 0.01	0.15 -0.01	0.14 -.08**	0.01 0	0.01 .01*
Full Electric (N=8)	0.00 -.04***	0.00 -.02***	0.00 -.15***	0.00 -.06***	0.00 -.01**	0.00 -.01***	0.00 -.02***	0.00 -.15***	0.00 -.16***	0.00 -.01**	0.13 0.12
GDI (N=424)	0.03 -0.02	0.01 -0.01	0.09 -.13***	0.04 -.05**	0.00 -0.01	0.01 -0.01	0.02 -0.01	0.14 -0.02	0.11 -.11***	0.00 -0.01	0.00 -.01*
Hybrid (N=45)	0.00 -.04***	0.00 -.02***	0.18 0.03	0.07 0	0.00 -.01**	0.00 -.01***	0.00 -.02***	0.11 -0.04	0.20 0.04	0.00 -.01**	0.00 0*
Plug-In Hybrid Electric (N=17)	0.00 -.04***	0.00 -.02***	0.29 0.15	0.00 -.07***	0.00 -.01**	0.00 -.01***	0.00 -.02***	0.06 -0.1	0.06 -0.1	0.24 .23**	0.12 0.12
Cylinder Deactivation (N=58)	0.03 0	0.02 0	0.10 -0.05	0.05 -0.01	0.00 -.01**	0.02 0.01	0.00 -.02***	0.17 0.02	0.07 -.1***	0.00 -.01**	0.00 0*
Stop-Start (N=130)	0.02 -.02*	0.00 -.02***	0.04 -.13***	0.05 -0.02	0.00 -.01**	0.01 0	0.02 -0.01	0.15 -0.01	0.10 -.07**	0.01 0	0.00 -.01*
Turbocharged (N=238)	0.01 -.03***	0.00 -.02**	0.11 -.05*	0.05 -0.03	0.00 -.01**	0.01 0	0.03 0.01	0.12 -.05*	0.11 -.08***	0.00 -0.01	0.00 -.01*
CVT (N=54)	0.07 0.04	0.02 0	0.39 .26***	0.15 .09*	0.02 0.01	0.04 0.03	0.07 0.06	0.17 0.01	0.24 0.09	0.00 -.01**	0.00 0*
DCT (N=67)	0.01 -0.02	0.01 0	0.15 0	0.06 0	0.01 0.01	0.00 -.01***	0.04 0.03	0.31 .18***	0.09 -.08**	0.00 -.01**	0.00 0*
High Speed Automatic (N=401)	0.03 -0.02	0.01 0	0.11 -.08***	0.05 -.03*	0.01 0	0.01 0	0.01 -0.01	0.14 -0.03	0.17 0.02	0.00 -0.01	0.00 -.01*

The top number in each cell is the fraction of reviews with a negative coded statement about the operational characteristic (column) conditional on the presence of the efficiency technology (row) as reported in the matched Tech Data. The second number measures the difference with all other reviews that Tech Data reports do not have the technology. Significance with 10% (*), 5% (**), and 1% (***) is estimated using t-tests for differences in means.

The descriptive statistics in Table 8 and Table 9 are essentially conditional sample means. Although it is tempting to make causal statements based on the differences, we cannot assume an absence of selection bias. For example, although the results suggest that vehicles with CVTs tend to have a higher percentage of negative reviews on acceleration capability, it could be that the same vehicles without CVTs would also generate negative acceleration reviews. In other words, we cannot rule out the possibility that CVTs have been implemented on vehicles that would have had, on average, worse acceleration scores anyway. If true, then we would not be able to attribute differences in the fraction of negative reviews by technology to the existence of the technology itself.

In order to reduce concerns about selection bias, we then estimated a series of linear probability models[5] for each operational characteristic that include fixed effects for make, vehicle class, and website, as well as vehicle attributes from the linked tech data. Although we cannot rule out the existence of selection bias using this control strategy either, our assumption is that the fixed effects and vehicle controls generate improved approximations of the effects of these technologies. At a minimum, we can use the results to discuss the correlations between efficiency technologies and vehicle performance conditional on class, make, website and vehicle attributes.

Regression results for each operational characteristic are presented in Appendix Table A1-Table A22. We estimate six specifications for each operational characteristic, all of which include fixed effects for make, vehicle class, and website. For the first two specifications, we used mentions of the technologies in the reviews as our source of the existence of the technologies on the vehicles; in the next four, we used the technology data. The regressions using the technology data are further divided between those that use only the data on the fuel-saving technologies, and those that include a set of additional vehicle attributes included in the technology data.[6] Finally, these 3 sets of regressions (Coded Tech in Review; Tech Data; Tech Data plus Vehicle Attributes) are further divided into regressions where only one technology is included, and regressions where all the technologies are included simultaneously.

This process gives six possibilities for a relationship between each operational characteristic and each technology. We provide one summary of these findings in Table 10, which shows, for each combination of an operational characteristic and a technology, whether *any* of the six regressions has a statistically significant coefficient on that relationship, and whether the sign of the effect is consistent across the significant results. A positive coefficient ("+" in Table 10) indicates that the presence of the technology is associated with an increase in the likelihood of a negative review on the characteristic – that is, a hidden cost. A negative coefficient ("-" in Table 10), in contrast, signals the possibility of a hidden benefit, a positive relationship between a technology and the characteristic.[7]

[5] As robustness checks, we ran the same sets of regressions using logit and probit specifications. We are still reviewing those results.

[6] Included vehicle attributes include horsepower, torque, number of cylinders, engine displacement, number of doors, length, width, height, wheelbase, footprint, and curb weight.

[7] For some technologies, it may be possible to use efficiency gains either to reduce GHG emissions or to enhance other vehicle characteristics, such as acceleration (e.g., Klier and Linn 2015). If so, then the hidden benefits may reflect a decision to implement technologies for purposes other than, or in addition to, GHG reduction.

Table 10: Sign and significance level of statistically significant results from linear probability model regressions that estimate the probability of negative operational characteristic reviews conditional on efficiency technology.

	Steering Feel	Cornering Ability	General Drivability	General Handling	Acceleration Feel	Acceleration Capability	General Acceleration	Brake Feel	Stopping Ability	General Braking	Tire-Road Noise
Active Air Dam						-*					
Active Grille Shutters	-***	-**			-***	-***	-*				
Active Ride Height	-**				-***		+*				
Low Resistance Tires		+**	+**								
Electronic Power Steering	+***		-***		-**	+*				+*	
Turbocharged				-**			m*	-*			
GDI		-***		-*		-**	-*			-**	-**
Cylinder Deactivation	+*	-***		+*			+*		+***		
Diesel	-*	-***	-***	-***	-**			-**			
Hybrid	-***		+**	-*			-**	+***			-***
Plug-In Hybrid Electric	-*		-*		-***						+*
Full Electric				-**	+*		-**				-*
Stop-Start					+***	-***	-*				
High Speed Automatic	-**	+*	-**		-***	-**			-**	-*	+*
CVT		+***	+**	+*	+*	+***		-*	+**		-**
DCT									+*		+**
Elec Assist / Low Drag Brakes											
Lighting-LED					-***			-***	-**		
Mass Reduction			-*		-**						
Passive Aerodynamics			-**		-*						

Non-empty table cells indicate that a statistically significant result was obtained in one of the LPM regressions that estimate the probability of a negative review for the column variable conditional on technology given by the row. The actual regression results are presented in Appendix Table A1-Table A22. A "+" indicates a consistent positive effect across regressions with significant results for the efficiency technology, i.e. the technology is associated with increased probability of a negative review. Conversely, a "-" indicates a consistent negative effect across regressions with significant results for the efficiency technology, i.e. the technology is associated with a decreased probability of a negative review. An "m" indicates mixed positive and negative results across the significant estimates. Asterisks indicate the level of the most significant result obtained across the different LPM estimates: 10% (*), 5% (**), and 1% (***) levels.

Table 10 Continued

	Wind Noise	Interior Noise	Powertrain Noise	General Noise	Chassis Vibration	Powertrain Vibration	General Vibration	Ride Comfort	Fuel Economy	Range	Charging
Active Air Dam											
Active Grille Shutters	+**		-***								
Active Ride Height			-***						-**		
Low Resistance Tires						-*		-***	-***		+*
Electronic Power Steering		-**	-*		+*			-**	-**		
Turbocharged								-**		-**	
GDI	-**		-*	-**	-*				-***		-*
Cylinder Deactivation	-**	-*							-***	+*	
Diesel							-*	-***	-***		
Hybrid		-**		-**						-*	
Plug-In Hybrid Electric			+***				+*	-**	-***	+***	
Full Electric	-**		-***	-**				-***	-***		
Stop-Start	-***	-**							-*		
High Speed Automatic				-***					-*		-*
CVT	+**	-*	+***					-*		-**	
DCT	-**					-*		+***			
Elec Assist / Low Drag Brakes				-**				-*	-**		
Lighting-LED	-***	+*	-***		+*				-*		
Mass Reduction					-*				-**	-*	
Passive Aerodynamics						-*	-***				

Non-empty table cells indicate that a statistically significant result was obtained in one of the LPM regressions that estimate the probability of a negative review for the column variable conditional on technology given by the row. The actual regression results are presented in Appendix Table A1-Table A22. A "+" indicates a consistent positive effect across regressions with significant results for the efficiency technology, i.e. the technology is associated with increased probability of a negative review. Conversely, a "-" indicates a consistent negative effect across regressions with significant results for the efficiency technology, i.e. the technology is associated with a decreased probability of a negative review. An "m" indicates mixed positive and negative results across the significant estimates. Asterisks indicate the level of the most significant result obtained across the different LPM estimates: 10% (*), 5% (**), and 1% (***) levels.

Perhaps a first observation on the table is that about two-thirds of 440 cells (20 technologies by 22 characteristics) are blank: for a majority of the technology-characteristic combinations, across all specifications, there is no correlation between the technology and the characteristic. In some cases, technologies are not expected to affect some of the characteristics: for instance, LED lights are not expected to affect noise, acceleration, or brake feel. In other cases, as previously discussed, this observation may be due to selection bias. Manufacturers choose both how to design vehicles for operational characteristics and what technologies to use in the vehicles, and other factors not included in the regressions may be correlated with both the characteristics and the technologies. As a result, the regression may not fully control for omitted factors. Hence, we describe all these results in terms of correlation rather than causality.

For most cases where a correlation is identified, the technology is associated with a *lower* probability of a negative review on the operational characteristic. Thirty-seven table cells (8.4 percent) have a significant positive (bad) result, while 108 cells (24.5 percent) have a significant negative (good) result, and only 1 (0.2 percent) is mixed. In addition, the presence of a technology may be correlated with negative effects on some characteristics but positive effects on others: looking across the rows, all but 3 technologies (CVT, DCT, and cylinder deactivation) have at least as many negative (good) significant effects as positive (bad) effects; 7 technologies (active air dam, turbocharged, GDI, diesel, electronic assist/low drag brakes, mass reduction, and passive aerodynamics) show only negative (good) significant effects.

We consider Table 10 to provide a highly sensitive measure of the possibility of hidden costs: it does not consider consistency across specifications, but rather shows any indication of a relationship between an operational characteristic and a technology. Table 11 provides the number of significant coefficients in the regressions based on consistent significance across specifications. As it shows, statistical significance is not very robust in these regressions: the number of significant coefficients drops rapidly as consistency across more regressions is sought. In fact, only 2 cells have significant results across all 6 specifications: diesel has a negative association with a negative rating for general drivability, and CVT has a positive association with a negative rating for acceleration capability. As discussed above, these sensitivities may reflect correlations of observed variables with unobserved variables.

Table 11: Number of Significant Coefficients Conditional on the Number of Specifications with Significance (out of 440 possible coefficients)

Number of Significant Estimates	1	2	3	4	5	6
Positive Correlations	37	21	12	7	2	1
Negative Correlations	108	71	24	17	4	1
Mixed Correlations	1	1	0	0	0	0
Total	146	93	36	24	6	2

The analyses above have focused on negative evaluations of operational characteristics – hidden costs – as the key variables of interest. It is possible that some of these negative evaluations of characteristics are due, not to the existence of the technology, but rather to the way that the technology is implemented. Perhaps, for instance, a badly implemented CVT is associated with negative acceleration capability, but a well implemented CVT may not have this effect. Table 12 explores this question by considering the relationship between the rating of a technology with the

ratings of the operational characteristics.[8] Each cell summarizes 22 regressions of each operational characteristic on a technology, where the dependent variable is again a dummy variable for a negative review of each operational characteristic. The regressions use the coded review data to control for "any mention" of all other technologies as well as make, website, and class fixed effects. The table reports estimates for 4 separate groups of regressions with the only differences being the rating represented by the dummy variable for the row technology. For instance, the presence of CVTs (All Mentions) is associated with a negative rating on four operational characteristics. The next column, Negative Tech, shows that negative evaluations of CVTs are associated with negative ratings for seven operational characteristics. In other words, there are more negative evaluations of operational characteristics when CVTs are rated negatively than when they are merely present. This pattern generalizes: technologies that are evaluated negatively are more likely to be associated with negative evaluations of operational characteristics than when the technologies are evaluated neutrally or positively, or are just present. It is possible that poor implementation may be contributing to negative evaluations of operational characteristics; positive or neutral evaluations of the technologies do not have the same adverse effects on operational characteristics.

[8] This analysis uses only the content analysis data, because it contains evaluations of the technologies. The technology database does not include evaluations of the technologies. This analysis uses the regressions with all technologies included.

Table 12: Relationship of Rating of Technologies with Rating of Operational Characteristics

	All Mentions	Negative Tech	Neutral Tech	Positive Tech
Active Air Dam				
Active Grille Shutters				
Active Ride Height				
Low Resistance Tires	1	2		
Electronic Power Steering	1	1		
Turbocharged		2		
GDI		1		
Cylinder Deactivation		2	1	
Diesel		2		
Hybrid		3		
Plug-In Hybrid Electric	1			1
Full Electric		1		
Stop-Start				
High Speed Automatic Transmission		7		
CVT	4	7		
DCT		1		
Elec Assist Or Low Drag Brakes		3		
Lighting-LED		2		
Mass Reduction			1	
Passive Aerodynamics		1		

Each row summarizes 4 groups of regressions, where each operational characteristic is regressed on a dummy variable for the presence of a negative, neutral, positive, or any mention (specified by the column) of the row technology. The dependent variables are again dummy variables for negative reviews of each operational characteristic. The regressions use the coded review data to control for "any mention" of all other technologies as well as make, website, and class fixed effects.

In sum, our analyses find scant consistent evidence of hidden costs of emissions-reducing technologies. Each technology is reviewed positively more often than it is reviewed negatively; this finding suggests that implementation of the technologies, and not just the technologies themselves, affects the existence of hidden costs. Correlations between the existence of the technologies and operational characteristics often suggest that the technologies *reduce* the probability of negative reviews of the characteristics, and are not robust to alternative specifications. Negative evaluations of operational characteristics appear to be more common when the technologies are evaluated negatively than when they are merely present, another suggestion that poor implementation may be the primary source of hidden costs.

Potential Qualifications of this Analysis

Content analysis as a method involves some degree of subjectivity; two readers of the same review may come to different conclusions about the reviewer's responses. We believe this concern is unlikely to be significant. First, as noted above, we conducted significant training of the coders, including testing for (and achieving) inter-coder reliability throughout the coding process. Secondly, auto reviewers have opinions, and are not expected to be shy or misleading about their views; although their language may be colorful, the sentiment is generally clear. We believe the data to be of high quality.

A notable characteristic of this work is that the analysis captures the technologies mentioned in auto reviews. One result is that biases in the data may arise because the counts of reviews for models are not proportional to vehicle sales. On the other hand, the proportions of reviews by make are similar to the proportions of vehicles offered for sale by make; this observation suggests that the reviews may be more representative of offerings. The data suggest that luxury vehicles are reviewed more than their representation in vehicle sales. In addition, it seems plausible that auto reviewers are more likely to test-drive vehicles that have undergone a significant redesign. Because redesigned vehicles are more likely to incorporate new technologies than vehicles that have not been redesigned, the data may over-represent the presence of these new technologies in the MY 2014 market. They may also emphasize the status of the new technologies; given the positive nature of the response, it suggests that automakers are generally doing well with these technologies, and it is reasonable to think that they will only do better in the future with them.

This study relies on the opinions of professional auto reviewers. People who buy new vehicles may differ in their responses to these new technologies; if the public tends to be harsher critics than the reviewers, then these results may understate negative consumer response. As mentioned above, though, we expect professional auto reviewers, as experts, to be aware of vehicle characteristics and technologies more than the general public. If so, then this study may underestimate neutral or positive responses from the general public.

As discussed above, our data are not sufficient to identify causality for the effects of the technologies on vehicles' operational characteristics. It is possible that some technologies show adverse (or beneficial) effects on operational characteristics that are generated in part from selection bias. The ideal experiment would be to compare reviews from vehicles with a given technology to reviews from otherwise identical vehicles without the technology. This is generally not possible. Although our strategy controls for important fixed effects and vehicle attributes, our results may still be vulnerable to selection bias. However, even at the level of correlation, we find fewer signs of adverse effects from the technologies than neutral or beneficial effects.

The reviewers' comments are based on test drives of the vehicles. As a result, they are not designed to look for problems that might arise over longer time horizons, such as with reliability or maintenance. This study covered new MY 2014 vehicles; it will take several years before these problems, if any, come to light.

Conclusion

The energy paradox exists if there are technologies whose present net value is positive for consumers, even taking into account potential hidden costs of the technologies. Engineering analyses of light-duty vehicles suggest that a number of fuel-saving technologies have positive present net values for consumers. This study investigates whether these technologies have

hidden costs, by examining professional auto reviewers' responses to these technologies in MY 2014 vehicles. For the technologies included in the study – the primary technologies expected to be used to reduce vehicle GHG and fuel consumption to meet EPA and DOT standards – we find scant evidence of hidden costs. For all the technologies, positive mentions outweigh negative mentions; indeed, negative mentions constitute less than 20 percent of the total. Though we are unable to demonstrate causality or robustness, we find that the technologies are more likely to be associated with reducing negative reviews of operational characteristics than with increasing them. Some evidence suggests that, rather than hidden costs being inherent in the technologies, the quality of the implementation of the technologies may affect vehicle quality. If so, it is likely that implementation problems are temporary: automakers appear capable of good implementation of any of the technologies, and they are likely to address concerns as they arise. We do not find evidence, then, that hidden costs provide an explanation for the energy paradox in MY 2014 light-duty vehicles.

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Appendix Tables

Table A1: "Steering feel" negative review linear probability model regressions on efficiency technology

	Any coded mention of tech in review		Tech Data		Tech Data plus vehicle attributes	
	Single	All tech	Single	All tech	Single	All tech
Active Air Dam	-0.07	-0.02				
	(0.07)	(0.07)				
Active Grille Shutters	-0.34***	-0.22**				
	(0.10)	(0.09)				
Active Ride Height	-0.18**	-0.15*				
	(0.08)	(0.08)				
Low Resistance Tires	0.09	0.04	0.11	0.11	0.16	0.18
	(0.11)	(0.11)	(0.09)	(0.09)	(0.11)	(0.11)
Electronic Power Steering	0.17***	0.17***	-0.00	0.00	-0.07	-0.06
	(0.03)	(0.04)	(0.04)	(0.05)	(0.05)	(0.05)
Turbocharged	-0.00	0.00	0.06	0.09	0.06	-0.00
	(0.03)	(0.03)	(0.04)	(0.05)	(0.07)	(0.08)
GDI	-0.03	-0.06	-0.01	-0.05	-0.04	-0.06
	(0.05)	(0.05)	(0.04)	(0.05)	(0.05)	(0.06)
Cylinder Deactivation	0.04	0.06	0.06	0.08	0.12*	0.11
	(0.09)	(0.10)	(0.07)	(0.07)	(0.07)	(0.07)
Diesel	-0.07	-0.02	-0.02	-0.04	-0.19*	-0.22*
	(0.05)	(0.05)	(0.07)	(0.08)	(0.11)	(0.12)
Hybrid	0.01	-0.06	0.03	0.02	-0.15***	-0.21***
	(0.05)	(0.05)	(0.06)	(0.07)	(0.05)	(0.08)
Plug-In Hybrid Electric	-0.04	-0.06	-0.12	-0.14*	-0.05	-0.20
	(0.07)	(0.07)	(0.07)	(0.08)	(0.11)	(0.17)
Full Electric	0.03	0.03	0.08	0.02	0.00	0.00
	(0.08)	(0.09)	(0.12)	(0.12)	(.)	(.)
Stop-Start	0.03	0.03	0.02	0.03	0.00	-0.01
	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
High Speed Automatic	-0.06**	-0.07**	-0.05	-0.04	-0.04	-0.02
	(0.03)	(0.03)	(0.04)	(0.05)	(0.05)	(0.05)
CVT	0.07	0.06	0.08	0.06	0.08	0.00
	(0.06)	(0.06)	(0.07)	(0.08)	(0.07)	(0.08)
DCT	0.05	0.03	0.03	0.01	0.08	0.05
	(0.06)	(0.06)	(0.05)	(0.06)	(0.06)	(0.07)
Elec Assist / Low Drag Brakes	0.08	0.05				
	(0.17)	(0.15)				
Lighting-LED	-0.01	-0.02				
	(0.11)	(0.11)				
Mass Reduction	-0.03	-0.05				
	(0.04)	(0.04)				
Passive Aerodynamics	-0.05	-0.03				
	(0.06)	(0.05)				
Observations		1003		718		660
Adj-R^2		0.09		0.06		0.05

Results in the "Single" columns represent coefficient estimates for individual linear probability model (OLS) regressions of a negative review of "Steering Feel" on the single technology given by the row plus fixed effects. The "All tech" columns represent single regressions on all technology variables. All regressions include make, class, and review website fixed effects. Eicker–Huber–White standard errors are reported in parentheses. Asterisks designate statistical significance at the 10% (*), 5% (**), and 1% (***) levels.

Table A2: "Cornering ability" negative review linear probability model regressions on efficiency technology

	Any coded mention of tech in review		Tech Data		Tech Data plus vehicle attributes	
	Single	All tech	Single	All tech	Single	All tech
Active Air Dam	-0.08	-0.09				
	(0.10)	(0.10)				
Active Grille Shutters	-0.19**	-0.18**				
	(0.08)	(0.09)				
Active Ride Height	-0.03	-0.02				
	(0.04)	(0.05)				
Low Resistance Tires	0.25**	0.28**	-0.01	-0.06	0.05	-0.02
	(0.12)	(0.13)	(0.07)	(0.08)	(0.10)	(0.10)
Electronic Power Steering	0.02	0.02	-0.05	-0.06	-0.06	-0.06
	(0.03)	(0.03)	(0.03)	(0.04)	(0.04)	(0.05)
Turbocharged	-0.02	-0.01	-0.03	-0.00	0.00	-0.01
	(0.03)	(0.03)	(0.04)	(0.05)	(0.06)	(0.07)
GDI	-0.07***	-0.06**	-0.01	0.00	-0.03	-0.03
	(0.02)	(0.03)	(0.04)	(0.05)	(0.04)	(0.05)
Cylinder Deactivation	-0.12***	-0.09**	-0.00	-0.03	-0.00	-0.01
	(0.04)	(0.04)	(0.04)	(0.04)	(0.05)	(0.05)
Diesel	-0.03	-0.01	-0.10***	-0.13***	-0.10	-0.12
	(0.04)	(0.04)	(0.03)	(0.05)	(0.06)	(0.09)
Hybrid	-0.03	-0.05	-0.03	0.05	-0.01	0.07
	(0.04)	(0.05)	(0.05)	(0.05)	(0.07)	(0.08)
Plug-In Hybrid Electric	0.05	0.05	0.09	0.15	0.02	0.01
	(0.08)	(0.08)	(0.12)	(0.12)	(0.11)	(0.15)
Full Electric	0.00	-0.10	-0.05	0.02	0.00	0.00
	(0.06)	(0.07)	(0.04)	(0.06)	(.)	(.)
Stop-Start	-0.05	-0.04	0.01	0.03	0.07	0.07
	(0.04)	(0.04)	(0.05)	(0.05)	(0.05)	(0.05)
High Speed Automatic	-0.03	-0.01	0.02	0.06*	0.01	0.06
	(0.02)	(0.02)	(0.03)	(0.03)	(0.04)	(0.04)
CVT	0.05	0.06	0.12**	0.18***	0.16**	0.19***
	(0.04)	(0.04)	(0.06)	(0.06)	(0.06)	(0.06)
DCT	0.02	0.03	-0.01	0.01	0.01	0.04
	(0.04)	(0.05)	(0.04)	(0.05)	(0.05)	(0.05)
Elec Assist / Low Drag Brakes	-0.02	-0.04				
	(0.03)	(0.05)				
Lighting-LED	-0.09	-0.09				
	(0.10)	(0.10)				
Mass Reduction	-0.00	-0.01				
	(0.03)	(0.03)				
Passive Aerodynamics	-0.04	-0.05				
	(0.05)	(0.05)				
Observations		1003		718		660
Adj-R^2		0.08		0.03		0.05

Results in the "Single" columns represent coefficient estimates for individual linear probability model (OLS) regressions of a negative review of "Cornering Ability" on the single technology given by the row plus fixed effects. The "All tech" columns represent single regressions on all technology variables. All regressions include make, class, and review website fixed effects. Eicker–Huber–White standard errors are reported in parentheses. Asterisks designate statistical significance at the 10% (*), 5% (**), and 1% (***) levels.

Table A3: "General drivability" negative review linear probability model regressions on efficiency technology

	Any coded mention of tech in review		Tech Data		Tech Data plus vehicle attributes	
	Single	All tech	Single	All tech	Single	All tech
Active Air Dam	-0.03	-0.03				
	(0.08)	(0.08)				
Active Grille Shutters	-0.06	-0.04				
	(0.06)	(0.06)				
Active Ride Height	-0.03	0.00				
	(0.05)	(0.05)				
Low Resistance Tires	0.12	0.12	0.14*	0.10	0.22**	0.18
	(0.12)	(0.12)	(0.08)	(0.10)	(0.11)	(0.12)
Electronic Power Steering	-0.04	-0.04*	-0.04	-0.06	-0.11**	-0.14***
	(0.02)	(0.02)	(0.04)	(0.05)	(0.05)	(0.05)
Turbocharged	-0.01	0.01	-0.03	0.02	-0.03	-0.06
	(0.03)	(0.03)	(0.04)	(0.05)	(0.07)	(0.08)
GDI	0.01	0.04	-0.06	-0.02	-0.03	0.01
	(0.04)	(0.05)	(0.04)	(0.04)	(0.05)	(0.05)
Cylinder Deactivation	-0.06	-0.08	-0.01	-0.01	-0.02	-0.05
	(0.06)	(0.07)	(0.04)	(0.04)	(0.04)	(0.04)
Diesel	-0.06*	-0.06*	-0.10***	-0.10**	-0.17**	-0.25***
	(0.03)	(0.03)	(0.03)	(0.04)	(0.09)	(0.10)
Hybrid	0.09	0.07	0.12*	0.15**	0.08	0.01
	(0.06)	(0.06)	(0.06)	(0.07)	(0.10)	(0.12)
Plug-In Hybrid Electric	0.02	0.01	0.15	0.15	-0.11	-0.31*
	(0.08)	(0.09)	(0.11)	(0.13)	(0.12)	(0.16)
Full Electric	0.10	0.04	-0.06	-0.09	0.00	0.00
	(0.10)	(0.09)	(0.05)	(0.08)	(.)	(.)
Stop-Start	-0.04	-0.03	-0.05	-0.03	-0.00	-0.02
	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
High Speed Automatic	-0.05**	-0.03	-0.04	0.02	-0.02	0.01
	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)	(0.04)
CVT	0.14**	0.13**	0.07	0.12	0.06	0.03
	(0.06)	(0.06)	(0.07)	(0.08)	(0.08)	(0.08)
DCT	-0.05	-0.05	-0.00	-0.01	-0.03	-0.04
	(0.04)	(0.04)	(0.05)	(0.05)	(0.05)	(0.06)
Elec Assist / Low Drag Brakes	-0.04	-0.05				
	(0.03)	(0.05)				
Lighting-LED	-0.03	-0.05				
	(0.10)	(0.11)				
Mass Reduction	-0.05*	-0.04				
	(0.03)	(0.03)				
Passive Aerodynamics	-0.09**	-0.06				
	(0.04)	(0.04)				
Observations		1003		718		660
Adj-R^2		0.09		0.10		0.12

Results in the "Single" columns represent coefficient estimates for individual linear probability model (OLS) regressions of a negative review of "General Drivability" on the single technology given by the row plus fixed effects. The "All tech" columns represent single regressions on all technology variables. All regressions include make, class, and review website fixed effects. Eicker–Huber–White standard errors are reported in parentheses. Asterisks designate statistical significance at the 10% (*), 5% (**), and 1% (***) levels.

Table A4: "General handling" negative review linear probability model regressions on efficiency technology

	Any coded mention of tech in review		Tech Data		Tech Data plus vehicle attributes	
	Single	All tech	Single	All tech	Single	All tech
Active Air Dam	0.27	0.25				
	(0.18)	(0.18)				
Active Grille Shutters	-0.00	-0.03				
	(0.04)	(0.04)				
Active Ride Height	-0.03	0.02				
	(0.05)	(0.04)				
Low Resistance Tires	0.03	0.05	0.01	-0.03	0.08	0.05
	(0.08)	(0.08)	(0.07)	(0.08)	(0.10)	(0.10)
Electronic Power Steering	-0.02	-0.01	-0.03	-0.03	-0.06	-0.05
	(0.02)	(0.02)	(0.03)	(0.04)	(0.04)	(0.05)
Turbocharged	-0.06**	-0.05**	-0.03	0.00	0.03	0.01
	(0.02)	(0.02)	(0.03)	(0.04)	(0.07)	(0.08)
GDI	-0.02	-0.01	-0.06*	-0.07	-0.05	-0.07
	(0.03)	(0.03)	(0.03)	(0.04)	(0.04)	(0.05)
Cylinder Deactivation	-0.04	-0.04	0.10*	0.11*	0.10	0.12*
	(0.05)	(0.06)	(0.06)	(0.06)	(0.06)	(0.07)
Diesel	-0.09***	-0.07***	-0.07**	-0.03	-0.06	-0.03
	(0.03)	(0.03)	(0.03)	(0.04)	(0.06)	(0.07)
Hybrid	-0.02	-0.03	-0.07	-0.05	-0.07*	-0.08
	(0.04)	(0.04)	(0.05)	(0.06)	(0.04)	(0.05)
Plug-In Hybrid Electric	0.06	0.07	0.11	0.06	0.09	-0.00
	(0.07)	(0.09)	(0.11)	(0.12)	(0.07)	(0.11)
Full Electric	-0.01	-0.06	-0.10**	-0.12*	0.00	0.00
	(0.06)	(0.06)	(0.05)	(0.07)	(.)	(.)
Stop-Start	-0.05	-0.05	-0.05	-0.04	-0.01	-0.00
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
High Speed Automatic	-0.01	0.00	-0.03	-0.03	-0.04	-0.03
	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)	(0.04)
CVT	0.03	0.03	0.11*	0.10	0.10	0.07
	(0.05)	(0.05)	(0.07)	(0.07)	(0.07)	(0.08)
DCT	0.06	0.05	-0.01	-0.04	0.02	-0.02
	(0.05)	(0.05)	(0.04)	(0.04)	(0.05)	(0.05)
Elec Assist / Low Drag Brakes	0.01	0.01				
	(0.04)	(0.04)				
Lighting-LED	-0.00	-0.00				
	(0.09)	(0.10)				
Mass Reduction	-0.01	-0.01				
	(0.03)	(0.03)				
Passive Aerodynamics	-0.04	-0.05				
	(0.04)	(0.04)				
Observations		1003		718		660
Adj-R^2		0.09		0.04		0.04

Results in the "Single" columns represent coefficient estimates for individual linear probability model (OLS) regressions of a negative review of "General Handling" on the single technology given by the row plus fixed effects. The "All tech" columns represent single regressions on all technology variables. All regressions include make, class, and review website fixed effects. Eicker–Huber–White standard errors are reported in parentheses. Asterisks designate statistical significance at the 10% (*), 5% (**), and 1% (***) levels.

Table A5: "Acceleration feel" negative review linear probability model regressions on efficiency technology

	Any coded mention of tech in review		Tech Data		Tech Data plus vehicle attributes	
	Single	All tech	Single	All tech	Single	All tech
Active Air Dam	0.02	0.03				
	(0.02)	(0.03)				
Active Grille Shutters	-0.23***	-0.20**				
	(0.09)	(0.09)				
Active Ride Height	-0.17***	-0.13**				
	(0.06)	(0.06)				
Low Resistance Tires	0.15	0.09	-0.02	-0.05	-0.05	-0.12
	(0.12)	(0.10)	(0.06)	(0.06)	(0.08)	(0.09)
Electronic Power Steering	0.01	0.00	-0.07**	-0.07*	-0.04	-0.03
	(0.02)	(0.02)	(0.03)	(0.04)	(0.03)	(0.04)
Turbocharged	-0.01	0.01	0.00	0.02	-0.03	-0.06
	(0.03)	(0.03)	(0.04)	(0.04)	(0.05)	(0.05)
GDI	-0.00	0.01	-0.02	-0.00	-0.06	-0.07
	(0.03)	(0.04)	(0.03)	(0.04)	(0.04)	(0.04)
Cylinder Deactivation	-0.01	-0.01	-0.01	-0.02	-0.01	0.01
	(0.03)	(0.04)	(0.03)	(0.03)	(0.03)	(0.04)
Diesel	-0.08**	-0.06*	-0.08**	-0.10*	-0.10	-0.11
	(0.03)	(0.04)	(0.04)	(0.05)	(0.08)	(0.09)
Hybrid	0.07	0.04	0.02	0.02	0.07	0.05
	(0.05)	(0.05)	(0.05)	(0.05)	(0.10)	(0.10)
Plug-In Hybrid Electric	-0.07***	-0.12***	-0.01	0.00	-0.26*	-0.38**
	(0.02)	(0.04)	(0.08)	(0.09)	(0.15)	(0.16)
Full Electric	0.16	0.15*	0.03	0.06	0.00	0.00
	(0.10)	(0.09)	(0.12)	(0.13)	(.)	(.)
Stop-Start	-0.02	-0.01	0.05	0.09	0.14***	0.14***
	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
High Speed Automatic	-0.05***	-0.03*	-0.05*	-0.04	-0.06*	-0.06
	(0.02)	(0.02)	(0.03)	(0.03)	(0.04)	(0.04)
CVT	0.08*	0.07	0.02	0.04	0.04	0.05
	(0.05)	(0.05)	(0.06)	(0.07)	(0.06)	(0.07)
DCT	0.01	-0.01	0.05	0.01	0.01	-0.01
	(0.04)	(0.04)	(0.05)	(0.06)	(0.06)	(0.06)
Elec Assist / Low Drag Brakes	0.13	0.09				
	(0.15)	(0.13)				
Lighting-LED	-0.16***	-0.17***				
	(0.04)	(0.04)				
Mass Reduction	-0.04**	-0.04**				
	(0.02)	(0.02)				
Passive Aerodynamics	-0.06*	-0.03				
	(0.03)	(0.03)				
Observations		1003		718		660
Adj-R^2		0.08		0.01		0.03

Results in the "Single" columns represent coefficient estimates for individual linear probability model (OLS) regressions of a negative review of "Acceleration Feel" on the single technology given by the row plus fixed effects. The "All tech" columns represent single regressions on all technology variables. All regressions include make, class, and review website fixed effects. Eicker–Huber–White standard errors are reported in parentheses. Asterisks designate statistical significance at the 10% (*), 5% (**), and 1% (***) levels.

Table A6: "Acceleration capability" negative review linear probability model regressions on efficiency technology

	Any coded mention of tech in review		Tech Data		Tech Data plus vehicle attributes	
	Single	All tech	Single	All tech	Single	All tech
Active Air Dam	-0.15*	-0.15				
	(0.09)	(0.10)				
Active Grille Shutters	-0.22***	-0.20**				
	(0.08)	(0.09)				
Active Ride Height	0.23	0.20				
	(0.29)	(0.31)				
Low Resistance Tires	0.02	0.02	0.01	-0.12	-0.03	-0.15
	(0.12)	(0.12)	(0.09)	(0.10)	(0.11)	(0.12)
Electronic Power Steering	-0.02	-0.01	0.07*	0.08	0.02	0.04
	(0.03)	(0.03)	(0.04)	(0.05)	(0.05)	(0.06)
Turbocharged	-0.01	-0.01	-0.05	-0.01	-0.02	-0.05
	(0.03)	(0.03)	(0.04)	(0.05)	(0.09)	(0.10)
GDI	0.03	0.05	-0.11**	-0.13**	-0.11*	-0.13**
	(0.05)	(0.05)	(0.04)	(0.06)	(0.05)	(0.06)
Cylinder Deactivation	0.01	-0.00	-0.03	0.01	-0.03	0.01
	(0.07)	(0.07)	(0.06)	(0.07)	(0.07)	(0.07)
Diesel	0.04	0.05	0.02	0.10	-0.07	-0.05
	(0.07)	(0.07)	(0.07)	(0.08)	(0.11)	(0.13)
Hybrid	-0.02	-0.05	0.07	0.08	0.04	0.05
	(0.05)	(0.06)	(0.07)	(0.08)	(0.11)	(0.13)
Plug-In Hybrid Electric	0.03	0.02	0.00	-0.05	0.03	-0.18
	(0.09)	(0.10)	(0.10)	(0.12)	(0.11)	(0.18)
Full Electric	0.08	0.05	-0.07	-0.12	0.00	0.00
	(0.11)	(0.11)	(0.13)	(0.15)	(.)	(.)
Stop-Start	-0.11***	-0.10**	-0.09*	-0.08	-0.15**	-0.13**
	(0.04)	(0.04)	(0.05)	(0.05)	(0.06)	(0.06)
High Speed Automatic	-0.05*	-0.03	-0.10**	-0.06	-0.11**	-0.08
	(0.03)	(0.03)	(0.04)	(0.05)	(0.05)	(0.05)
CVT	0.21***	0.21***	0.23***	0.26***	0.18**	0.20**
	(0.06)	(0.07)	(0.09)	(0.09)	(0.09)	(0.10)
DCT	0.05	0.06	-0.02	-0.01	0.04	0.02
	(0.06)	(0.06)	(0.06)	(0.07)	(0.07)	(0.08)
Elec Assist / Low Drag Brakes	-0.01	0.01				
	(0.17)	(0.16)				
Lighting-LED	-0.09	-0.13				
	(0.09)	(0.10)				
Mass Reduction	-0.02	-0.01				
	(0.04)	(0.04)				
Passive Aerodynamics	-0.08	-0.07				
	(0.05)	(0.05)				
Observations		1003		718		660
Adj-R^2		0.09		0.10		0.10

Results in the “Single” columns represent coefficient estimates for individual linear probability model (OLS) regressions of a negative review of “Acceleration Capability” on the single technology given by the row plus fixed effects. The “All tech” columns represent single regressions on all technology variables. All regressions include make, class, and review website fixed effects. Eicker–Huber–White standard errors are reported in parentheses. Asterisks designate statistical significance at the 10% (*), 5% (**), and 1% (***) levels.

Table A7: "General acceleration" negative review linear probability model regressions on efficiency technology

	Any coded mention of tech in review		Tech Data		Tech Data plus vehicle attributes	
	Single	All tech	Single	All tech	Single	All tech
Active Air Dam	-0.07	-0.07				
	(0.06)	(0.06)				
Active Grille Shutters	-0.08	-0.09*				
	(0.05)	(0.05)				
Active Ride Height	0.02*	0.02				
	(0.01)	(0.02)				
Low Resistance Tires	0.06	0.05	-0.04	0.01	-0.03	0.01
	(0.06)	(0.07)	(0.04)	(0.05)	(0.07)	(0.07)
Electronic Power Steering	-0.00	-0.00	0.02	0.02	0.03	0.04
	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)
Turbocharged	-0.02*	-0.02	0.04*	0.04	0.04	0.05
	(0.01)	(0.01)	(0.02)	(0.03)	(0.04)	(0.04)
GDI	-0.01	-0.02*	0.01	-0.02	-0.03	-0.04
	(0.01)	(0.01)	(0.02)	(0.03)	(0.03)	(0.03)
Cylinder Deactivation	0.01	0.02*	-0.02	-0.02	-0.02	-0.01
	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)
Diesel	0.03	0.03	0.02	0.01	0.06	0.06
	(0.02)	(0.02)	(0.01)	(0.02)	(0.04)	(0.05)
Hybrid	-0.00	-0.01	-0.03	-0.05	-0.06**	-0.07
	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)	(0.05)
Plug-In Hybrid Electric	0.04	0.03	-0.03	-0.05	-0.03	0.03
	(0.06)	(0.04)	(0.02)	(0.04)	(0.05)	(0.06)
Full Electric	0.03	0.01	-0.08**	-0.10	0.00	0.00
	(0.07)	(0.07)	(0.04)	(0.06)	(.)	(.)
Stop-Start	0.02	0.02	-0.04	-0.06*	-0.05	-0.04
	(0.02)	(0.02)	(0.03)	(0.03)	(0.04)	(0.04)
High Speed Automatic	-0.01	-0.01	0.03	0.01	0.04	0.02
	(0.01)	(0.01)	(0.03)	(0.03)	(0.03)	(0.04)
CVT	-0.04	-0.04	-0.05	-0.06	-0.04	-0.04
	(0.03)	(0.03)	(0.04)	(0.04)	(0.04)	(0.04)
DCT	0.01	0.01	-0.01	-0.02	-0.01	-0.01
	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)	(0.03)
Elec Assist / Low Drag Brakes	-0.01	-0.02				
	(0.01)	(0.02)				
Lighting-LED	-0.02	-0.01				
	(0.02)	(0.02)				
Mass Reduction	0.00	0.00				
	(0.02)	(0.02)				
Passive Aerodynamics	-0.01	-0.01				
	(0.01)	(0.01)				
Observations		1003		718		660
Adj-R^2		0.03		0.04		0.06

Results in the "Single" columns represent coefficient estimates for individual linear probability model (OLS) regressions of a negative review of "General Acceleration" on the single technology given by the row plus fixed effects. The "All tech" columns represent single regressions on all technology variables. All regressions include make, class, and review website fixed effects. Eicker–Huber–White standard errors are reported in parentheses. Asterisks designate statistical significance at the 10% (*), 5% (**), and 1% (***) levels.

Table A8: "Brake feel" negative review linear probability model regressions on efficiency technology

	Any coded mention of tech in review		Tech Data		Tech Data plus vehicle attributes	
	Single	All tech	Single	All tech	Single	All tech
Active Air Dam	0.01	0.03				
	(0.01)	(0.02)				
Active Grille Shutters	-0.03	-0.03				
	(0.04)	(0.05)				
Active Ride Height	-0.02	-0.01				
	(0.03)	(0.04)				
Low Resistance Tires	0.02	-0.00	-0.01	-0.01	0.01	-0.01
	(0.07)	(0.07)	(0.06)	(0.06)	(0.04)	(0.04)
Electronic Power Steering	0.02	0.02	0.01	0.00	-0.00	-0.03
	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)	(0.03)
Turbocharged	-0.02	-0.01	-0.04*	-0.03	-0.06	-0.07
	(0.02)	(0.02)	(0.02)	(0.03)	(0.05)	(0.06)
GDI	-0.00	-0.01	-0.02	0.00	0.00	0.02
	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)
Cylinder Deactivation	0.01	0.01	-0.03	-0.02	0.01	-0.01
	(0.05)	(0.05)	(0.04)	(0.05)	(0.03)	(0.04)
Diesel	-0.02	-0.01	-0.04**	-0.04	-0.09	-0.11*
	(0.03)	(0.03)	(0.02)	(0.03)	(0.06)	(0.07)
Hybrid	0.10**	0.10*	0.18***	0.18***	0.10	0.07
	(0.05)	(0.05)	(0.06)	(0.07)	(0.08)	(0.10)
Plug-In Hybrid Electric	0.09	0.09	-0.05	-0.03	0.05	-0.03
	(0.08)	(0.09)	(0.04)	(0.05)	(0.07)	(0.12)
Full Electric	0.02	-0.00	-0.02	-0.01	0.00	0.00
	(0.06)	(0.06)	(0.03)	(0.05)	(.)	(.)
Stop-Start	-0.02	-0.02	0.01	0.02	0.02	0.01
	(0.03)	(0.03)	(0.03)	(0.04)	(0.03)	(0.04)
High Speed Automatic	-0.00	0.01	-0.01	0.02	0.02	0.02
	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)	(0.02)
CVT	0.07	0.06	-0.09*	-0.04	-0.07	-0.05
	(0.04)	(0.04)	(0.05)	(0.05)	(0.05)	(0.06)
DCT	0.00	0.00	-0.01	0.00	-0.03	-0.02
	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)	(0.04)
Elec Assist / Low Drag Brakes	-0.01	-0.03				
	(0.02)	(0.05)				
Lighting-LED	-0.10***	-0.11***				
	(0.03)	(0.04)				
Mass Reduction	0.03	0.02				
	(0.03)	(0.03)				
Passive Aerodynamics	0.04	0.03				
	(0.04)	(0.04)				
Observations		1003		718		660
Adj-R^2		0.04		0.05		0.04

Results in the "Single" columns represent coefficient estimates for individual linear probability model (OLS) regressions of a negative review of "Brake Feel" on the single technology given by the row plus fixed effects. The "All tech" columns represent single regressions on all technology variables. All regressions include make, class, and review website fixed effects. Eicker–Huber–White standard errors are reported in parentheses. Asterisks designate statistical significance at the 10% (*), 5% (**), and 1% (***) levels.

Table A9: "Stopping ability" negative review linear probability model regressions on efficiency technology

	Any coded mention of tech in review		Tech Data		Tech Data plus vehicle attributes	
	Single	All tech	Single	All tech	Single	All tech
Active Air Dam	-0.01	-0.01				
	(0.01)	(0.02)				
Active Grille Shutters	-0.07	-0.05				
	(0.04)	(0.04)				
Active Ride Height	0.01	0.01				
	(0.02)	(0.02)				
Low Resistance Tires	0.03	0.01	0.08	0.07	0.09	0.05
	(0.07)	(0.07)	(0.06)	(0.06)	(0.08)	(0.08)
Electronic Power Steering	0.02	0.02	0.00	0.01	-0.02	-0.01
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)
Turbocharged	-0.01	-0.00	-0.00	0.00	0.01	0.00
	(0.01)	(0.02)	(0.02)	(0.03)	(0.04)	(0.04)
GDI	-0.01	-0.01	-0.01	-0.01	-0.02	-0.03
	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)	(0.04)
Cylinder Deactivation	0.04	0.05	0.05**	0.07***	0.08***	0.09***
	(0.05)	(0.05)	(0.02)	(0.03)	(0.03)	(0.03)
Diesel	0.01	0.02	0.00	0.03	-0.00	0.02
	(0.03)	(0.03)	(0.03)	(0.04)	(0.05)	(0.06)
Hybrid	0.02	0.00	0.02	0.05	-0.00	0.03
	(0.03)	(0.03)	(0.04)	(0.04)	(0.02)	(0.04)
Plug-In Hybrid Electric	0.02	0.01	-0.02	-0.02	-0.05	-0.04
	(0.05)	(0.05)	(0.06)	(0.05)	(0.05)	(0.06)
Full Electric	0.05	0.03	-0.01	-0.03	0.00	0.00
	(0.05)	(0.06)	(0.02)	(0.04)	(.)	(.)
Stop-Start	-0.00	-0.00	-0.03	-0.02	-0.04	-0.04
	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)
High Speed Automatic	-0.03**	-0.02	-0.02	0.01	-0.02	0.01
	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)
CVT	0.06*	0.06*	0.07	0.08**	0.08*	0.09**
	(0.03)	(0.03)	(0.05)	(0.04)	(0.04)	(0.04)
DCT	0.04	0.03	0.05	0.07*	0.07*	0.07*
	(0.03)	(0.03)	(0.03)	(0.04)	(0.04)	(0.04)
Elec Assist / Low Drag Brakes	0.10	0.08				
	(0.16)	(0.16)				
Lighting-LED	-0.07**	-0.08**				
	(0.03)	(0.03)				
Mass Reduction	-0.03	-0.03				
	(0.02)	(0.02)				
Passive Aerodynamics	-0.01	0.00				
	(0.03)	(0.03)				
Observations		1003		718		660
Adj-R^2		0.02		0.03		0.04

Results in the “Single” columns represent coefficient estimates for individual linear probability model (OLS) regressions of a negative review of “Stopping Ability” on the single technology given by the row plus fixed effects. The “All tech” columns represent single regressions on all technology variables. All regressions include make, class, and review website fixed effects. Eicker–Huber–White standard errors are reported in parentheses. Asterisks designate statistical significance at the 10% (*), 5% (**), and 1% (***) levels.

Table A10: "General braking" negative review linear probability model regressions on efficiency technology

	Any coded mention of tech in review		Tech Data		Tech Data plus vehicle attributes	
	Single	All tech	Single	All tech	Single	All tech
Active Air Dam	0.01	0.02				
	(0.01)	(0.02)				
Active Grille Shutters	-0.01	-0.01				
	(0.04)	(0.04)				
Active Ride Height	0.01	0.03				
	(0.02)	(0.02)				
Low Resistance Tires	0.00	-0.01	0.03	-0.01	0.06	0.04
	(0.01)	(0.02)	(0.04)	(0.05)	(0.07)	(0.07)
Electronic Power Steering	-0.01	-0.01	0.03*	0.03	0.01	0.02
	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)
Turbocharged	-0.01	-0.00	-0.01	0.01	0.02	0.05
	(0.01)	(0.01)	(0.01)	(0.02)	(0.03)	(0.04)
GDI	-0.02**	-0.01*	-0.03	-0.03	-0.02	-0.01
	(0.01)	(0.01)	(0.02)	(0.03)	(0.03)	(0.03)
Cylinder Deactivation	-0.02	-0.02	-0.01	0.01	-0.02	-0.01
	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)
Diesel	-0.01	-0.02	-0.00	0.00	-0.00	0.03
	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.03)
Hybrid	0.05	0.05	0.05	0.04	0.12	0.12
	(0.03)	(0.04)	(0.04)	(0.05)	(0.08)	(0.09)
Plug-In Hybrid Electric	0.05	0.05	-0.01	-0.01	0.00	0.07
	(0.06)	(0.07)	(0.01)	(0.03)	(0.07)	(0.09)
Full Electric	-0.00	-0.02	0.14	0.13	0.00	0.00
	(0.01)	(0.03)	(0.13)	(0.14)	(.)	(.)
Stop-Start	-0.02	-0.02	-0.01	0.00	-0.02	-0.01
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
High Speed Automatic	-0.02*	-0.02*	-0.03	-0.02	-0.02	-0.01
	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.03)
CVT	0.00	-0.00	-0.01	-0.00	-0.01	0.01
	(0.02)	(0.02)	(0.04)	(0.03)	(0.03)	(0.03)
DCT	-0.04	-0.05	-0.01	0.00	0.01	0.01
	(0.03)	(0.03)	(0.02)	(0.03)	(0.03)	(0.03)
Elec Assist / Low Drag Brakes	-0.00	0.00				
	(0.02)	(0.02)				
Lighting-LED	-0.02	-0.01				
	(0.02)	(0.02)				
Mass Reduction	-0.00	-0.01				
	(0.02)	(0.02)				
Passive Aerodynamics	0.06	0.07				
	(0.04)	(0.05)				
Observations		1003		718		660
Adj-R^2		0.02		0.01		0.01

Results in the "Single" columns represent coefficient estimates for individual linear probability model (OLS) regressions of a negative review of "General Braking" on the single technology given by the row plus fixed effects. The "All tech" columns represent single regressions on all technology variables. All regressions include make, class, and review website fixed effects. Eicker–Huber–White standard errors are reported in parentheses. Asterisks designate statistical significance at the 10% (*), 5% (**), and 1% (***) levels.

Table A11: "Tire road noise" negative review linear probability model regressions on efficiency technology

	Any coded mention of tech in review		Tech Data		Tech Data plus vehicle attributes	
	Single	All tech	Single	All tech	Single	All tech
Active Air Dam	0.05	0.03				
	(0.04)	(0.05)				
Active Grille Shutters	0.01	0.04				
	(0.02)	(0.03)				
Active Ride Height	0.02	0.01				
	(0.03)	(0.03)				
Low Resistance Tires	0.01	0.03	-0.02	0.02	-0.01	0.04
	(0.08)	(0.10)	(0.04)	(0.05)	(0.05)	(0.06)
Electronic Power Steering	0.04	0.04	-0.03	0.01	-0.05	-0.03
	(0.02)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Turbocharged	0.03	0.03	0.01	0.05	0.07	0.07
	(0.02)	(0.02)	(0.03)	(0.03)	(0.05)	(0.05)
GDI	-0.01	-0.01	-0.06*	-0.10**	-0.08*	-0.08
	(0.03)	(0.03)	(0.03)	(0.04)	(0.05)	(0.05)
Cylinder Deactivation	-0.02	-0.02	0.02	0.02	0.00	0.01
	(0.04)	(0.04)	(0.04)	(0.04)	(0.05)	(0.05)
Diesel	-0.02	-0.01	-0.03	-0.03	-0.02	-0.06
	(0.03)	(0.03)	(0.03)	(0.04)	(0.07)	(0.07)
Hybrid	-0.08***	-0.08***	-0.07**	-0.08**	-0.05	-0.06
	(0.02)	(0.02)	(0.03)	(0.04)	(0.04)	(0.05)
Plug-In Hybrid Electric	0.03	0.05	0.05	0.03	0.06	0.18*
	(0.06)	(0.07)	(0.08)	(0.10)	(0.08)	(0.10)
Full Electric	-0.05*	-0.06	-0.09*	-0.10	0.00	0.00
	(0.03)	(0.05)	(0.05)	(0.07)	(.)	(.)
Stop-Start	-0.00	0.00	-0.01	0.01	0.03	0.03
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
High Speed Automatic	0.01	-0.00	0.03	0.04	0.05	0.07*
	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)	(0.04)
CVT	-0.03	-0.02	-0.08*	-0.08*	-0.11**	-0.09
	(0.04)	(0.04)	(0.04)	(0.05)	(0.04)	(0.06)
DCT	0.08	0.08	0.08*	0.07	0.10**	0.11*
	(0.05)	(0.05)	(0.04)	(0.05)	(0.05)	(0.06)
Elec Assist / Low Drag Brakes	-0.02	-0.01				
	(0.03)	(0.04)				
Lighting-LED	0.08	0.08				
	(0.10)	(0.10)				
Mass Reduction	0.02	0.02				
	(0.04)	(0.04)				
Passive Aerodynamics	0.01	-0.01				
	(0.04)	(0.04)				
Observations		1003		718		660
Adj-R^2		0.11		0.14		0.15

Results in the "Single" columns represent coefficient estimates for individual linear probability model (OLS) regressions of a negative review of "Tire Road Noise" on the single technology given by the row plus fixed effects. The "All tech" columns represent single regressions on all technology variables. All regressions include make, class, and review website fixed effects. Eicker–Huber–White standard errors are reported in parentheses. Asterisks designate statistical significance at the 10% (*), 5% (**), and 1% (***) levels.

Table A12: "Wind noise" negative review linear probability model regressions on efficiency technology

	Any coded mention of tech in review		Tech Data		Tech Data plus vehicle attributes	
	Single	All tech	Single	All tech	Single	All tech
Active Air Dam	-0.04	-0.02				
	(0.08)	(0.07)				
Active Grille Shutters	0.02**	0.03				
	(0.01)	(0.02)				
Active Ride Height	0.02	0.02				
	(0.02)	(0.03)				
Low Resistance Tires	-0.02	-0.02	0.00	-0.01	0.02	-0.01
	(0.02)	(0.03)	(0.03)	(0.04)	(0.05)	(0.05)
Electronic Power Steering	0.00	0.01	0.02	0.02	0.02	0.03
	(0.02)	(0.02)	(0.02)	(0.01)	(0.03)	(0.02)
Turbocharged	-0.01	-0.01	-0.02	0.00	-0.00	-0.00
	(0.01)	(0.01)	(0.02)	(0.02)	(0.03)	(0.03)
GDI	-0.00	0.01	-0.05**	-0.06**	-0.06**	-0.09**
	(0.02)	(0.03)	(0.02)	(0.03)	(0.03)	(0.04)
Cylinder Deactivation	-0.05**	-0.06**	-0.00	0.01	0.01	0.04
	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)	(0.04)
Diesel	0.01	0.01	0.00	0.02	-0.01	0.02
	(0.03)	(0.03)	(0.03)	(0.04)	(0.05)	(0.06)
Hybrid	-0.01	-0.02	-0.00	-0.02	-0.01	-0.05
	(0.01)	(0.01)	(0.01)	(0.03)	(0.02)	(0.04)
Plug-In Hybrid Electric	0.01	0.01	0.00	-0.05	0.02	-0.07
	(0.01)	(0.02)	(0.02)	(0.04)	(0.06)	(0.09)
Full Electric	-0.02	-0.03	-0.06*	-0.11**	0.00	0.00
	(0.02)	(0.02)	(0.04)	(0.05)	(.)	(.)
Stop-Start	-0.07***	-0.07***	-0.01	-0.02	-0.03	-0.02
	(0.02)	(0.02)	(0.01)	(0.02)	(0.02)	(0.02)
High Speed Automatic	-0.01	-0.01	-0.01	-0.02	-0.03	-0.05
	(0.01)	(0.01)	(0.02)	(0.03)	(0.02)	(0.03)
CVT	0.05*	0.06**	0.04	0.02	0.05*	0.03
	(0.03)	(0.03)	(0.02)	(0.03)	(0.03)	(0.04)
DCT	-0.05**	-0.05**	-0.04	-0.05	-0.03	-0.06
	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)	(0.04)
Elec Assist / Low Drag Brakes	-0.02	0.01				
	(0.03)	(0.03)				
Lighting-LED	-0.10***	-0.11***				
	(0.03)	(0.03)				
Mass Reduction	0.01	0.01				
	(0.02)	(0.02)				
Passive Aerodynamics	0.00	0.01				
	(0.03)	(0.03)				
Observations		1003		718		660
Adj-R^2		0.09		0.13		0.15

Results in the “Single” columns represent coefficient estimates for individual linear probability model (OLS) regressions of a negative review of “Wind Noise” on the single technology given by the row plus fixed effects. The “All tech” columns represent single regressions on all technology variables. All regressions include make, class, and review website fixed effects. Eicker–Huber–White standard errors are reported in parentheses. Asterisks designate statistical significance at the 10% (*), 5% (**), and 1% (***) levels.

Table A 13: "Interior noise" negative review linear probability model regressions on efficiency technology

	Any coded mention of tech in review		Tech Data		Tech Data plus vehicle attributes	
	Single	All tech	Single	All tech	Single	All tech
Active Air Dam	0.01	-0.01				
	(0.01)	(0.02)				
Active Grille Shutters	0.00	-0.00				
	(0.01)	(0.01)				
Active Ride Height	0.01	0.00				
	(0.02)	(0.02)				
Low Resistance Tires	0.00	0.01	0.02	0.05	0.04	0.06
	(0.01)	(0.01)	(0.04)	(0.05)	(0.06)	(0.06)
Electronic Power Steering	-0.01**	-0.01**	-0.03*	-0.03*	-0.03	-0.04
	(0.01)	(0.01)	(0.02)	(0.02)	(0.03)	(0.03)
Turbocharged	0.01	0.00	-0.00	-0.01	-0.01	-0.02
	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)
GDI	0.00	0.01	0.01	0.02	0.01	0.02
	(0.02)	(0.02)	(0.01)	(0.02)	(0.02)	(0.02)
Cylinder Deactivation	-0.02*	-0.03*	0.01	0.00	0.01	0.00
	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Diesel	-0.00	0.00	-0.01	-0.01	-0.01	-0.04
	(0.01)	(0.01)	(0.01)	(0.01)	(0.03)	(0.03)
Hybrid	-0.02**	-0.01	-0.00	-0.02	-0.01	-0.05
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.03)
Plug-In Hybrid Electric	-0.00	0.00	-0.02	-0.03	-0.01	-0.05
	(0.01)	(0.01)	(0.01)	(0.03)	(0.04)	(0.05)
Full Electric	-0.02	-0.02	-0.04	-0.06	0.00	0.00
	(0.02)	(0.02)	(0.03)	(0.06)	(.)	(.)
Stop-Start	-0.02**	-0.02**	-0.00	-0.00	0.01	-0.00
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
High Speed Automatic	0.00	-0.00	0.00	-0.01	-0.00	-0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)
CVT	-0.02	-0.02	-0.03	-0.04	-0.04	-0.06*
	(0.03)	(0.03)	(0.02)	(0.03)	(0.03)	(0.03)
DCT	0.03	0.04	0.01	-0.00	0.01	-0.01
	(0.03)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)
Elec Assist / Low Drag Brakes	-0.01	-0.01				
	(0.02)	(0.02)				
Lighting-LED	0.14*	0.15*				
	(0.08)	(0.08)				
Mass Reduction	-0.01	-0.01				
	(0.01)	(0.01)				
Passive Aerodynamics	0.02	0.01				
	(0.03)	(0.03)				
Observations		1003		718		660
Adj-R^2		0.05		0.03		0.02

Results in the “Single” columns represent coefficient estimates for individual linear probability model (OLS) regressions of a negative review of “Interior Noise” on the single technology given by the row plus fixed effects. The “All tech” columns represent single regressions on all technology variables. All regressions include make, class, and review website fixed effects. Eicker–Huber–White standard errors are reported in parentheses. Asterisks designate statistical significance at the 10% (*), 5% (**), and 1% (***) levels.

Table A14: "Powertrain noise" negative review linear probability model regressions on efficiency technology

	Any coded mention of tech in review		Tech Data		Tech Data plus vehicle attributes	
	Single	All tech	Single	All tech	Single	All tech
Active Air Dam	-0.02	-0.00				
	(0.06)	(0.06)				
Active Grille Shutters	-0.34***	-0.31***				
	(0.10)	(0.10)				
Active Ride Height	-0.22***	-0.22***				
	(0.08)	(0.08)				
Low Resistance Tires	0.01	0.04	-0.02	-0.05	0.04	-0.01
	(0.11)	(0.12)	(0.08)	(0.10)	(0.12)	(0.13)
Electronic Power Steering	0.01	0.01	-0.02	-0.01	-0.07*	-0.04
	(0.03)	(0.03)	(0.04)	(0.04)	(0.04)	(0.04)
Turbocharged	0.00	0.02	0.02	0.04	-0.05	-0.02
	(0.03)	(0.03)	(0.05)	(0.04)	(0.08)	(0.07)
GDI	-0.03	-0.04	-0.02	-0.03	-0.10*	-0.09*
	(0.04)	(0.04)	(0.04)	(0.05)	(0.05)	(0.05)
Cylinder Deactivation	0.04	0.05	0.02	0.03	0.03	0.05
	(0.06)	(0.07)	(0.06)	(0.06)	(0.06)	(0.07)
Diesel	-0.04	-0.03	-0.04	-0.03	-0.09	-0.07
	(0.05)	(0.05)	(0.06)	(0.07)	(0.11)	(0.11)
Hybrid	0.07	0.04	0.02	0.06	0.00	0.02
	(0.06)	(0.06)	(0.06)	(0.07)	(0.11)	(0.12)
Plug-In Hybrid Electric	0.19	0.24*	0.19	0.21	1.10***	1.06***
	(0.12)	(0.12)	(0.15)	(0.16)	(0.10)	(0.14)
Full Electric	-0.05	-0.15	-0.22***	-0.17**	0.00	0.00
	(0.09)	(0.09)	(0.06)	(0.08)	(.)	(.)
Stop-Start	-0.01	-0.01	-0.05	-0.03	-0.01	0.01
	(0.05)	(0.05)	(0.06)	(0.06)	(0.06)	(0.06)
High Speed Automatic	-0.03	-0.01	-0.04	-0.00	-0.03	0.01
	(0.03)	(0.03)	(0.04)	(0.05)	(0.05)	(0.05)
CVT	0.16***	0.16***	0.06	0.11	0.05	0.07
	(0.06)	(0.06)	(0.07)	(0.08)	(0.08)	(0.08)
DCT	-0.04	-0.04	0.06	0.05	0.07	0.08
	(0.05)	(0.05)	(0.05)	(0.06)	(0.05)	(0.06)
Elec Assist / Low Drag Brakes	0.09	0.10				
	(0.15)	(0.15)				
Lighting-LED	-0.19**	-0.22***				
	(0.07)	(0.08)				
Mass Reduction	-0.01	0.00				
	(0.04)	(0.04)				
Passive Aerodynamics	-0.06	-0.07				
	(0.06)	(0.05)				
Observations		1003		718		660
Adj-R^2		0.14		0.16		0.19

Results in the "Single" columns represent coefficient estimates for individual linear probability model (OLS) regressions of a negative review of "Powertrain Noise" on the single technology given by the row plus fixed effects. The "All tech" columns represent single regressions on all technology variables. All regressions include make, class, and review website fixed effects. Eicker–Huber–White standard errors are reported in parentheses. Asterisks designate statistical significance at the 10% (*), 5% (**), and 1% (***) levels.

Table A15: "General noise" negative review linear probability model regressions on efficiency technology

	Any coded mention of tech in review		Tech Data		Tech Data plus vehicle attributes	
	Single	All tech	Single	All tech	Single	All tech
Active Air Dam	-0.09	-0.09				
	(0.09)	(0.09)				
Active Grille Shutters	0.01	0.02				
	(0.02)	(0.02)				
Active Ride Height	0.01	0.02				
	(0.03)	(0.03)				
Low Resistance Tires	0.04	0.04	0.03	0.05	0.04	0.05
	(0.09)	(0.08)	(0.05)	(0.06)	(0.07)	(0.08)
Electronic Power Steering	-0.02	-0.02	-0.02	-0.02	-0.04	-0.02
	(0.02)	(0.02)	(0.03)	(0.03)	(0.04)	(0.04)
Turbocharged	-0.02	-0.01	0.01	0.03	-0.03	-0.05
	(0.02)	(0.02)	(0.02)	(0.03)	(0.04)	(0.04)
GDI	0.00	0.02	-0.05*	-0.06**	-0.07**	-0.07**
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Cylinder Deactivation	-0.04	-0.04	-0.01	0.00	-0.01	0.01
	(0.04)	(0.04)	(0.02)	(0.02)	(0.03)	(0.03)
Diesel	0.00	0.00	-0.02	-0.02	0.00	-0.04
	(0.03)	(0.03)	(0.04)	(0.04)	(0.05)	(0.06)
Hybrid	0.03	0.01	0.01	-0.03	-0.05*	-0.10**
	(0.04)	(0.03)	(0.04)	(0.05)	(0.03)	(0.05)
Plug-In Hybrid Electric	-0.02	-0.03	-0.02	-0.07	-0.01	-0.11
	(0.02)	(0.03)	(0.02)	(0.04)	(0.07)	(0.09)
Full Electric	0.03	0.02	-0.05	-0.11**	0.00	0.00
	(0.06)	(0.06)	(0.03)	(0.06)	(.)	(.)
Stop-Start	0.02	0.02	0.00	0.01	0.01	0.01
	(0.04)	(0.04)	(0.05)	(0.05)	(0.04)	(0.05)
High Speed Automatic	-0.04***	-0.04**	-0.02	-0.02	-0.00	-0.01
	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)	(0.04)
CVT	0.05	0.04	-0.03	-0.05	-0.02	-0.04
	(0.05)	(0.05)	(0.06)	(0.06)	(0.06)	(0.06)
DCT	0.01	0.01	0.01	-0.02	0.03	0.00
	(0.04)	(0.04)	(0.04)	(0.04)	(0.03)	(0.04)
Elec Assist / Low Drag Brakes	-0.06**	-0.06				
	(0.02)	(0.04)				
Lighting-LED	-0.09	-0.09				
	(0.08)	(0.08)				
Mass Reduction	-0.01	-0.01				
	(0.02)	(0.03)				
Passive Aerodynamics	-0.02	-0.01				
	(0.04)	(0.04)				
Observations		1003		718		660
Adj-R^2		0.14		0.17		0.20

Results in the “Single” columns represent coefficient estimates for individual linear probability model (OLS) regressions of a negative review of “General Noise” on the single technology given by the row plus fixed effects. The “All tech” columns represent single regressions on all technology variables. All regressions include make, class, and review website fixed effects. Eicker–Huber–White standard errors are reported in parentheses. Asterisks designate statistical significance at the 10% (*), 5% (**), and 1% (***) levels.

Table A16: "Chassis vibration" negative review linear probability model regressions on efficiency technology

	Any coded mention of tech in review		Tech Data		Tech Data plus vehicle attributes	
	Single	All tech	Single	All tech	Single	All tech
Active Air Dam	-0.00	-0.00				
	(0.01)	(0.01)				
Active Grille Shutters	-0.00	0.00				
	(0.01)	(0.01)				
Active Ride Height	0.01	-0.00				
	(0.00)	(0.00)				
Low Resistance Tires	-0.00	-0.00	-0.00	-0.00	-0.01	-0.02
	(0.01)	(0.01)	(0.00)	(0.01)	(0.01)	(0.02)
Electronic Power Steering	0.02	0.02*	0.01	0.01	0.01	0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Turbocharged	0.01	0.00	-0.00	-0.01	-0.01	-0.01
	(0.01)	(0.01)	(0.00)	(0.00)	(0.01)	(0.01)
GDI	-0.02*	-0.01	0.00	0.00	-0.00	-0.00
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Cylinder Deactivation	-0.04	-0.03	-0.01	-0.01	-0.00	-0.00
	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)
Diesel	0.00	0.00	0.00	0.01	0.02	0.01
	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Hybrid	-0.01	-0.01	-0.01	-0.00	-0.00	0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Plug-In Hybrid Electric	-0.01	-0.01	-0.00	0.00	-0.04	-0.02
	(0.01)	(0.01)	(0.01)	(0.01)	(0.04)	(0.04)
Full Electric	0.01	0.02	0.01	0.01	0.00	0.00
	(0.01)	(0.01)	(0.01)	(0.01)	(.)	(.)
Stop-Start	-0.00	-0.01	-0.00	-0.00	-0.01	-0.00
	(0.01)	(0.01)	(0.00)	(0.00)	(0.01)	(0.01)
High Speed Automatic	0.00	0.00	0.00	0.01	0.00	0.01
	(0.01)	(0.01)	(0.00)	(0.01)	(0.00)	(0.01)
CVT	0.01	0.01	0.01	0.01	0.01	0.02
	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.02)
DCT	0.01	0.01	0.01	0.02	0.02	0.02
	(0.01)	(0.02)	(0.01)	(0.02)	(0.02)	(0.02)
Elec Assist / Low Drag Brakes	-0.01	-0.02				
	(0.02)	(0.02)				
Lighting-LED	0.01*	0.01				
	(0.01)	(0.01)				
Mass Reduction	-0.01*	-0.01*				
	(0.01)	(0.01)				
Passive Aerodynamics	-0.01	-0.01				
	(0.01)	(0.01)				
Observations		1003		718		660
Adj-R^2		0.02		-0.01		-0.02

Results in the “Single” columns represent coefficient estimates for individual linear probability model (OLS) regressions of a negative review of “Chassis Vibration” on the single technology given by the row plus fixed effects. The “All tech” columns represent single regressions on all technology variables. All regressions include make, class, and review website fixed effects. Eicker–Huber–White standard errors are reported in parentheses. Asterisks designate statistical significance at the 10% (*), 5% (**), and 1% (***) levels.

Table A17: "Powertrain vibration" negative review linear probability model regressions on efficiency technology

	Any coded mention of tech in review		Tech Data		Tech Data plus vehicle attributes	
	Single	All tech	Single	All tech	Single	All tech
Active Air Dam	-0.01	-0.01				
	(0.01)	(0.01)				
Active Grille Shutters	-0.00	0.00				
	(0.01)	(0.01)				
Active Ride Height	-0.01	-0.02				
	(0.02)	(0.02)				
Low Resistance Tires	-0.01	-0.01	-0.01	-0.01	-0.02*	-0.03
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)
Electronic Power Steering	0.00	0.00	-0.01	-0.01	-0.01	-0.02
	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)
Turbocharged	0.01	0.01	0.01	0.01	0.01	0.00
	(0.01)	(0.01)	(0.01)	(0.01)	(0.03)	(0.03)
GDI	-0.01	-0.01	0.00	-0.00	-0.00	-0.00
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Cylinder Deactivation	0.01	0.02	0.02	0.02	0.02	0.02
	(0.02)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)
Diesel	0.01	0.01	0.01	0.01	-0.02	-0.03
	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)
Hybrid	-0.00	-0.00	-0.00	0.00	-0.00	0.01
	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)	(0.02)
Plug-In Hybrid Electric	-0.00	0.01	-0.00	-0.00	-0.00	-0.02
	(0.01)	(0.01)	(0.01)	(0.01)	(0.04)	(0.04)
Full Electric	-0.01	-0.00	-0.01	-0.00	0.00	0.00
	(0.01)	(0.01)	(0.01)	(0.01)	(.)	(.)
Stop-Start	0.01	0.01	-0.00	-0.01	-0.01	-0.01
	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)
High Speed Automatic	0.00	0.00	0.01	0.00	0.01	0.02
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
CVT	0.01	0.01	0.01	0.01	-0.00	0.01
	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)
DCT	0.01	0.01	-0.02*	-0.02	-0.01	-0.01
	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)
Elec Assist / Low Drag Brakes	-0.02	-0.02				
	(0.02)	(0.03)				
Lighting-LED	-0.01	-0.01				
	(0.01)	(0.01)				
Mass Reduction	0.00	0.01				
	(0.01)	(0.02)				
Passive Aerodynamics	-0.02*	-0.02*				
	(0.01)	(0.01)				
Observations		1003		718		660
Adj-R^2		0.01		0.02		0.02

Results in the “Single” columns represent coefficient estimates for individual linear probability model (OLS) regressions of a negative review of “Powertrain Vibration” on the single technology given by the row plus fixed effects. The “All tech” columns represent single regressions on all technology variables. All regressions include make, class, and review website fixed effects. Eicker–Huber–White standard errors are reported in parentheses. Asterisks designate statistical significance at the 10% (*), 5% (**), and 1% (***) levels.

Table A18: "General vibration" negative review linear probability model regressions on efficiency technology

	Any coded mention of tech in review		Tech Data		Tech Data plus vehicle attributes	
	Single	All tech	Single	All tech	Single	All tech
Active Air Dam	0.01	-0.01				
	(0.02)	(0.02)				
Active Grille Shutters	-0.00	-0.01				
	(0.01)	(0.02)				
Active Ride Height	-0.01	-0.01				
	(0.01)	(0.01)				
Low Resistance Tires	0.06	0.08	0.01	0.00	-0.00	-0.00
	(0.06)	(0.06)	(0.01)	(0.02)	(0.02)	(0.02)
Electronic Power Steering	-0.01	-0.02	0.01	0.01	0.01	0.02
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Turbocharged	-0.00	-0.00	0.02	0.02	0.02	0.02
	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.03)
GDI	0.02	0.02	0.01	0.01	0.00	-0.00
	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)
Cylinder Deactivation	0.02	0.01	-0.01	-0.02	-0.01	-0.02
	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.02)
Diesel	-0.01*	-0.01	-0.01	-0.02	-0.03	-0.03
	(0.01)	(0.01)	(0.01)	(0.02)	(0.03)	(0.04)
Hybrid	-0.01	-0.01	-0.01	0.00	-0.03	-0.01
	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.03)
Plug-In Hybrid Electric	0.00	0.02	0.00	0.02	0.06	0.10*
	(0.01)	(0.01)	(0.01)	(0.02)	(0.04)	(0.06)
Full Electric	-0.01	-0.03	0.00	0.01	0.00	0.00
	(0.01)	(0.02)	(0.02)	(0.02)	(.)	(.)
Stop-Start	0.03	0.03	0.01	0.01	0.01	0.02
	(0.03)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)
High Speed Automatic	-0.00	0.00	-0.00	0.00	-0.00	0.01
	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)
CVT	0.02	0.02	0.03	0.04	0.04	0.04
	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)
DCT	0.03	0.03	0.01	0.01	0.02	0.04
	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)	(0.04)
Elec Assist / Low Drag Brakes	-0.01	-0.02				
	(0.02)	(0.03)				
Lighting-LED	0.01	0.01				
	(0.01)	(0.02)				
Mass Reduction	0.00	0.01				
	(0.02)	(0.02)				
Passive Aerodynamics	-0.04**	-0.04***				
	(0.01)	(0.02)				
Observations		1003		718		660
Adj-R^2		0.06		0.10		0.11

Results in the “Single” columns represent coefficient estimates for individual linear probability model (OLS) regressions of a negative review of “General Vibration” on the single technology given by the row plus fixed effects. The “All tech” columns represent single regressions on all technology variables. All regressions include make, class, and review website fixed effects. Eicker–Huber–White standard errors are reported in parentheses. Asterisks designate statistical significance at the 10% (*), 5% (**), and 1% (***) levels.

Table A19: "Ride comfort" negative review linear probability model regressions on efficiency technology

	Any coded mention of tech in review		Tech Data		Tech Data plus vehicle attributes	
	Single	All tech	Single	All tech	Single	All tech
Active Air Dam	-0.02	-0.04				
	(0.13)	(0.14)				
Active Grille Shutters	-0.03	-0.05				
	(0.05)	(0.06)				
Active Ride Height	-0.05	0.03				
	(0.05)	(0.07)				
Low Resistance Tires	0.11	0.08	-0.18***	-0.15**	-0.13*	-0.14*
	(0.11)	(0.10)	(0.05)	(0.06)	(0.07)	(0.08)
Electronic Power Steering	-0.00	-0.02	-0.09**	-0.05	-0.07	-0.05
	(0.03)	(0.03)	(0.04)	(0.05)	(0.05)	(0.05)
Turbocharged	-0.04	-0.03	-0.08**	-0.08*	0.02	0.00
	(0.03)	(0.03)	(0.04)	(0.05)	(0.07)	(0.08)
GDI	0.07	0.05	-0.06	-0.04	-0.03	-0.02
	(0.05)	(0.05)	(0.04)	(0.05)	(0.05)	(0.06)
Cylinder Deactivation	0.06	0.04	0.08	0.07	0.05	0.08
	(0.08)	(0.08)	(0.06)	(0.07)	(0.08)	(0.08)
Diesel	-0.14***	-0.12**	-0.19***	-0.10*	0.07	0.05
	(0.05)	(0.05)	(0.05)	(0.06)	(0.10)	(0.10)
Hybrid	-0.01	-0.02	-0.01	-0.01	0.00	0.05
	(0.05)	(0.05)	(0.05)	(0.07)	(0.07)	(0.09)
Plug-In Hybrid Electric	-0.09**	-0.12**	-0.08	-0.08	0.00	0.12
	(0.04)	(0.05)	(0.10)	(0.10)	(0.11)	(0.16)
Full Electric	0.08	0.10	-0.16***	-0.12	0.00	0.00
	(0.09)	(0.08)	(0.06)	(0.07)	(.)	(.)
Stop-Start	0.00	0.02	-0.07	-0.02	0.05	0.05
	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)
High Speed Automatic	0.01	0.02	-0.02	0.00	-0.01	0.01
	(0.03)	(0.03)	(0.04)	(0.04)	(0.04)	(0.05)
CVT	-0.02	-0.01	-0.08	-0.04	-0.10*	-0.05
	(0.05)	(0.05)	(0.05)	(0.06)	(0.06)	(0.07)
DCT	0.06	0.06	0.20***	0.15**	0.18**	0.17**
	(0.06)	(0.06)	(0.06)	(0.07)	(0.07)	(0.08)
Elec Assist / Low Drag Brakes	-0.06	-0.09*				
	(0.05)	(0.05)				
Lighting-LED	-0.10	-0.11				
	(0.10)	(0.10)				
Mass Reduction	0.07	0.07				
	(0.05)	(0.05)				
Passive Aerodynamics	-0.02	-0.03				
	(0.06)	(0.07)				
Observations		1003		718		660
Adj-R^2		0.12		0.16		0.16

Results in the “Single” columns represent coefficient estimates for individual linear probability model (OLS) regressions of a negative review of “Ride Comfort” on the single technology given by the row plus fixed effects. The “All tech” columns represent single regressions on all technology variables. All regressions include make, class, and review website fixed effects. Eicker–Huber–White standard errors are reported in parentheses. Asterisks designate statistical significance at the 10% (*), 5% (**), and 1% (***) levels.

Table A20: "Fuel economy" negative review linear probability model regressions on efficiency technology

	Any coded mention of tech in review		Tech Data		Tech Data plus vehicle attributes	
	Single	All tech	Single	All tech	Single	All tech
Active Air Dam	0.05	0.06				
	(0.05)	(0.06)				
Active Grille Shutters	-0.09	-0.05				
	(0.06)	(0.07)				
Active Ride Height	-0.25**	-0.18*				
	(0.11)	(0.09)				
Low Resistance Tires	-0.17***	-0.17***	-0.18**	-0.16*	-0.15	-0.24**
	(0.04)	(0.05)	(0.07)	(0.08)	(0.11)	(0.12)
Electronic Power Steering	0.01	0.02	-0.12**	-0.11**	-0.10*	-0.13**
	(0.03)	(0.03)	(0.05)	(0.05)	(0.06)	(0.06)
Turbocharged	0.02	0.04	-0.00	0.03	0.01	-0.06
	(0.03)	(0.03)	(0.04)	(0.05)	(0.08)	(0.09)
GDI	-0.09***	-0.05	-0.09*	-0.10*	-0.11*	-0.05
	(0.03)	(0.03)	(0.05)	(0.06)	(0.06)	(0.07)
Cylinder Deactivation	-0.17***	-0.14**	-0.09	-0.10	-0.15**	-0.15**
	(0.06)	(0.06)	(0.06)	(0.06)	(0.07)	(0.08)
Diesel	-0.13***	-0.15***	-0.10*	-0.09	-0.21**	-0.33***
	(0.04)	(0.05)	(0.06)	(0.06)	(0.09)	(0.11)
Hybrid	-0.02	-0.02	0.01	-0.02	0.20	0.17
	(0.05)	(0.05)	(0.07)	(0.08)	(0.12)	(0.13)
Plug-In Hybrid Electric	-0.06	-0.06	-0.09	-0.12	-0.25*	-0.53***
	(0.07)	(0.06)	(0.09)	(0.11)	(0.14)	(0.20)
Full Electric	-0.05	0.01	-0.16***	-0.17**	0.00	0.00
	(0.07)	(0.07)	(0.06)	(0.08)	(.)	(.)
Stop-Start	-0.02	-0.01	-0.12*	-0.12*	-0.11	-0.13*
	(0.06)	(0.06)	(0.06)	(0.07)	(0.07)	(0.07)
High Speed Automatic	-0.04	-0.05*	0.00	-0.00	-0.04	-0.01
	(0.02)	(0.03)	(0.04)	(0.04)	(0.04)	(0.05)
CVT	-0.04	-0.04	-0.04	-0.01	-0.04	0.01
	(0.06)	(0.06)	(0.07)	(0.08)	(0.08)	(0.09)
DCT	-0.03	-0.06	0.01	-0.08	-0.01	-0.03
	(0.03)	(0.04)	(0.05)	(0.06)	(0.06)	(0.07)
Elec Assist / Low Drag Brakes	-0.13**	-0.11*				
	(0.07)	(0.06)				
Lighting-LED	-0.15*	-0.14				
	(0.09)	(0.10)				
Mass Reduction	-0.07**	-0.07**				
	(0.03)	(0.03)				
Passive Aerodynamics	0.01	0.06				
	(0.05)	(0.05)				
Observations		1003		718		660
Adj-R^2		0.13		0.10		0.14

Results in the "Single" columns represent coefficient estimates for individual linear probability model (OLS) regressions of a negative review of "Fuel Economy" on the single technology given by the row plus fixed effects. The "All tech" columns represent single regressions on all technology variables. All regressions include make, class, and review website fixed effects. Eicker–Huber–White standard errors are reported in parentheses. Asterisks designate statistical significance at the 10% (*), 5% (**), and 1% (***) levels.

Table A21: "Range" negative review linear probability model regressions on efficiency technology

	Any coded mention of tech in review		Tech Data		Tech Data plus vehicle attributes	
	Single	All tech	Single	All tech	Single	All tech
Active Air Dam	0.01	0.00				
	(0.01)	(0.01)				
Active Grille Shutters	0.00	0.00				
	(0.00)	(0.00)				
Active Ride Height	0.00	0.00				
	(0.01)	(0.01)				
Low Resistance Tires	0.05	0.02	0.01	-0.03	-0.01	0.00
	(0.07)	(0.07)	(0.03)	(0.03)	(0.01)	(0.01)
Electronic Power Steering	0.00	0.00	0.00	0.00	0.00	-0.00
	(0.01)	(0.01)	(0.00)	(0.01)	(0.00)	(0.00)
Turbocharged	-0.01**	-0.00	-0.01	0.01	0.02	0.02
	(0.01)	(0.00)	(0.01)	(0.01)	(0.02)	(0.02)
GDI	0.00	0.00	-0.01	0.01	0.01	0.02
	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)
Cylinder Deactivation	0.01*	0.01	0.00	0.00	0.00	-0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)	(0.01)
Diesel	-0.01	-0.01	-0.00	-0.01	-0.01	-0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)
Hybrid	-0.02*	-0.01	-0.02	-0.00	-0.00	0.00
	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)	(0.01)
Plug-In Hybrid Electric	0.28***	0.27**	0.26**	0.28**	-0.02	0.02
	(0.11)	(0.11)	(0.12)	(0.12)	(0.02)	(0.03)
Full Electric	0.10	0.02	-0.02	0.04	0.00	0.00
	(0.08)	(0.08)	(0.01)	(0.03)	(.)	(.)
Stop-Start	0.01	0.02	0.00	0.01	-0.00	-0.00
	(0.02)	(0.02)	(0.00)	(0.01)	(0.00)	(0.01)
High Speed Automatic	-0.01	-0.00	-0.01	0.01	0.01	0.01
	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)
CVT	-0.02*	-0.02**	-0.02*	-0.01	-0.01	-0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
DCT	-0.00	0.00	-0.00	0.01	0.00	0.01
	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)
Elec Assist / Low Drag Brakes	-0.00	-0.00				
	(0.01)	(0.02)				
Lighting-LED	-0.01	-0.00				
	(0.01)	(0.01)				
Mass Reduction	-0.01*	-0.01				
	(0.00)	(0.01)				
Passive Aerodynamics	0.02	0.00				
	(0.03)	(0.02)				
Observations		1003		718		660
Adj-R^2		0.17		0.14		0.01

Results in the “Single” columns represent coefficient estimates for individual linear probability model (OLS) regressions of a negative review of “Range” on the single technology given by the row plus fixed effects. The “All tech” columns represent single regressions on all technology variables. All regressions include make, class, and review website fixed effects. Eicker–Huber–White standard errors are reported in parentheses. Asterisks designate statistical significance at the 10% (*), 5% (**), and 1% (***) levels.

Table A22: "Charging" negative review linear probability model regressions on efficiency technology

	Any coded mention of tech in review		Tech Data		Tech Data plus vehicle attributes	
	Single	All tech	Single	All tech	Single	All tech
Active Air Dam	0.00	0.00				
	(0.00)	(0.00)				
Active Grille Shutters	0.00	0.00				
	(0.00)	(0.00)				
Active Ride Height	0.01	0.00				
	(0.00)	(0.01)				
Low Resistance Tires	0.00	-0.01	0.08*	0.05*		
	(0.00)	(0.02)	(0.04)	(0.03)		
Electronic Power Steering	-0.00	-0.00	0.01	0.01		
	(0.00)	(0.00)	(0.00)	(0.00)		
Turbocharged	-0.00	-0.00	-0.01	0.00		
	(0.00)	(0.00)	(0.01)	(0.00)		
GDI	-0.00	0.00	-0.02*	-0.00		
	(0.00)	(0.00)	(0.01)	(0.00)		
Cylinder Deactivation	-0.00	-0.00	-0.01	-0.00		
	(0.00)	(0.00)	(0.01)	(0.00)		
Diesel	0.01	0.01	0.01	0.00		
	(0.00)	(0.00)	(0.01)	(0.01)		
Hybrid	0.00	0.00	0.00	0.00		
	(0.00)	(0.00)	(0.00)	(0.00)		
Plug-In Hybrid Electric	0.09	0.10	0.07	0.06		
	(0.06)	(0.08)	(0.05)	(0.05)		
Full Electric	0.03	0.00	0.10	0.08		
	(0.05)	(0.07)	(0.12)	(0.11)		
Stop-Start	-0.00	0.00	0.00	0.01		
	(0.00)	(0.00)	(0.00)	(0.00)		
High Speed Automatic	-0.00	-0.00	-0.01*	0.00		
	(0.00)	(0.00)	(0.01)	(0.00)		
CVT	0.00	0.00	0.00	-0.00		
	(0.00)	(0.00)	(0.00)	(0.00)		
DCT	-0.00	-0.00	-0.01	0.00		
	(0.00)	(0.00)	(0.01)	(0.00)		
Elec Assist / Low Drag Brakes	-0.01	-0.00				
	(0.01)	(0.01)				
Lighting-LED	0.00	0.01				
	(0.00)	(0.00)				
Mass Reduction	0.01	0.02				
	(0.02)	(0.02)				
Passive Aerodynamics	0.00	-0.01				
	(0.00)	(0.01)				
Observations		1003		718		
Adj-R^2		0.07		0.10		

Results in the “Single” columns represent coefficient estimates for individual linear probability model (OLS) regressions of a negative review of “Charging” on the single technology given by the row plus fixed effects. The “All tech” columns represent single regressions on all technology variables. All regressions include make, class, and review website fixed effects. Eicker–Huber–White standard errors are reported in parentheses. Asterisks designate statistical significance at the 10% (*), 5% (**), and 1% (***) levels.