

July 2016

The Consumer Response to a Year of Low Gas Prices

Evidence from 1 Million People



JPMORGAN CHASE & Co.

INSTITUTE

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The JPMorgan Chase Institute is a global think tank dedicated to delivering data-rich analyses and expert insights for the public good.

Acknowledgments

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Executive Summary

In 2015, gas prices in the United States were 25 percent lower than they had been the prior year. The US Energy Information Administration projected that this drop in prices would put roughly \$700 back into the pockets of US households. Understanding in detail how big this boost really was, who experienced it, and how people responded has important implications for the economy and policymakers.

This report relies on an anonymized sample of one million Chase customers across 23 states to quantify the impact of an entire year of lower gas prices in 2015. We show that middle-income households spent about \$480 less on gas in 2015 than in 2014, the equivalent of more than a one percent increase in annual income for 60 percent of households. Seventy-two percent of households spent less on gas in 2015 than in 2014. The drop in gas spending between 2014 and 2015 varied across the country, with lower impacts felt in the West and urban areas of the Northeast.

Households had the potential to save \$630 at the pump, of which they spent the majority—58 percent. This spending provided more than a \$200 boost to spending on non-gas goods and services, primarily restaurants and retailers. The lower gas prices also caused significant changes in household transportation choices, leading people to spend \$150 more at gas stations and spend less on transit. These findings can help policymakers and other decision-makers at all levels better understand the effects of gas price declines across regions, income levels, and sectors of the economy.

Data

Gas prices were 25 percent lower in 2015 than in the prior year. From a universe of 57 million debit or credit card account holders we created samples of 1 million core Chase customers and 12 million regular card users. We ascertain the magnitude of savings households experienced from lower gas prices, and whether and on what they spent these windfall gains.

57 Million

DEBIT OR CREDIT CARD ACCOUNT HOLDERS



1 Million core sample

Debit card holders who are considered Core Chase customers

5+

5+ monthly transactions from checking account

NO

Do not hold a gas station specific card



Live in a zip code with 140+ households in our sample and in a metro area with 750+ households in our sample.

568 Million Credit and Debit Transactions



GAS SPENDING

Spending at gas stations

NON-GAS SPENDING

Spending that does not occur at gas stations

12 Million map sample

Regular users of a Chase credit or debit card



5+



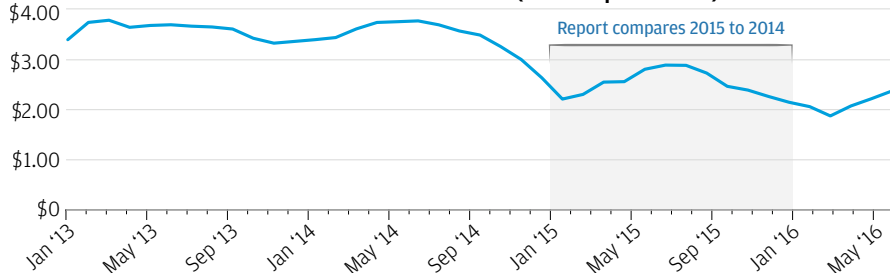
5+ monthly card transactions

Used for Geographic Analysis



We examine spending behavior in 2015 when gas prices were 25 percent lower than in the prior year.

National Retail Gas Prices (Dollars per Gallon)



Source: US Energy Information Administration

Finding One

Middle-income households spent about \$480 less on gas in 2015 than in 2014. Reductions in gas spending were equivalent to a one percent or greater increase in income for 60 percent of households.



Middle-income households experienced a \$477 drop in gas spending from 2014 to 2015. This is a significant amount for middle-income households, equal to roughly one percent of income or more than half of one month's rent or mortgage payment.

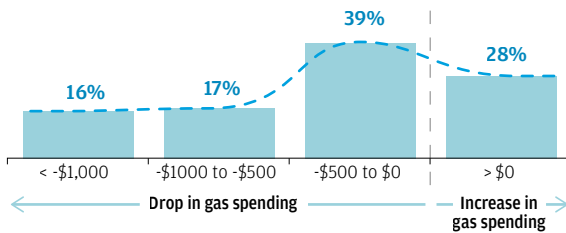
60 percent of households—those in the bottom three income quintiles—experienced savings at the pump that were equivalent to at least one percent of annual income.

Finding Two

Seventy-two percent of households spent less on gas in 2015 than in 2014, but households in the West and Northeast were impacted the least.

Most impacted: Seventy-two percent of households spent less on gas in 2015 than in 2014, including one in three households that saved more than \$500.

Distribution of change in gas spending (percent of households)*



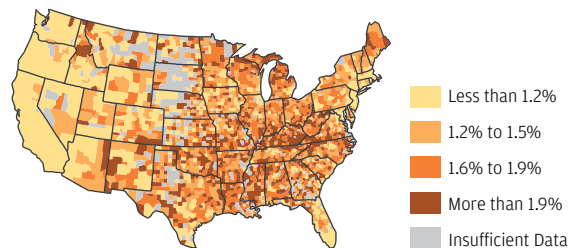
* Spending intervals on this histogram reflect card spending only and are not adjusted to reflect total spending.

Metro areas with large drops in gas spending

Metro Area	Drop as a percent of income
Indianapolis, IN	1.3%
Tucson, AZ	1.3%
Dallas-Fort Worth, TX	1.3%
Baton Rouge, LA	1.2%
Louisville, KY	1.2%

Least impacted: Households in the West and Northeast were impacted the least.

Drop in gas spending (percent of income)



Metro areas with small drops in gas spending

Metro Area	Drop as a percent of income
Washington, DC	0.5%
Las Vegas, NV	0.4%
San Francisco, CA	0.4%
New York, NY	0.4%
Los Angeles, CA	0.3%

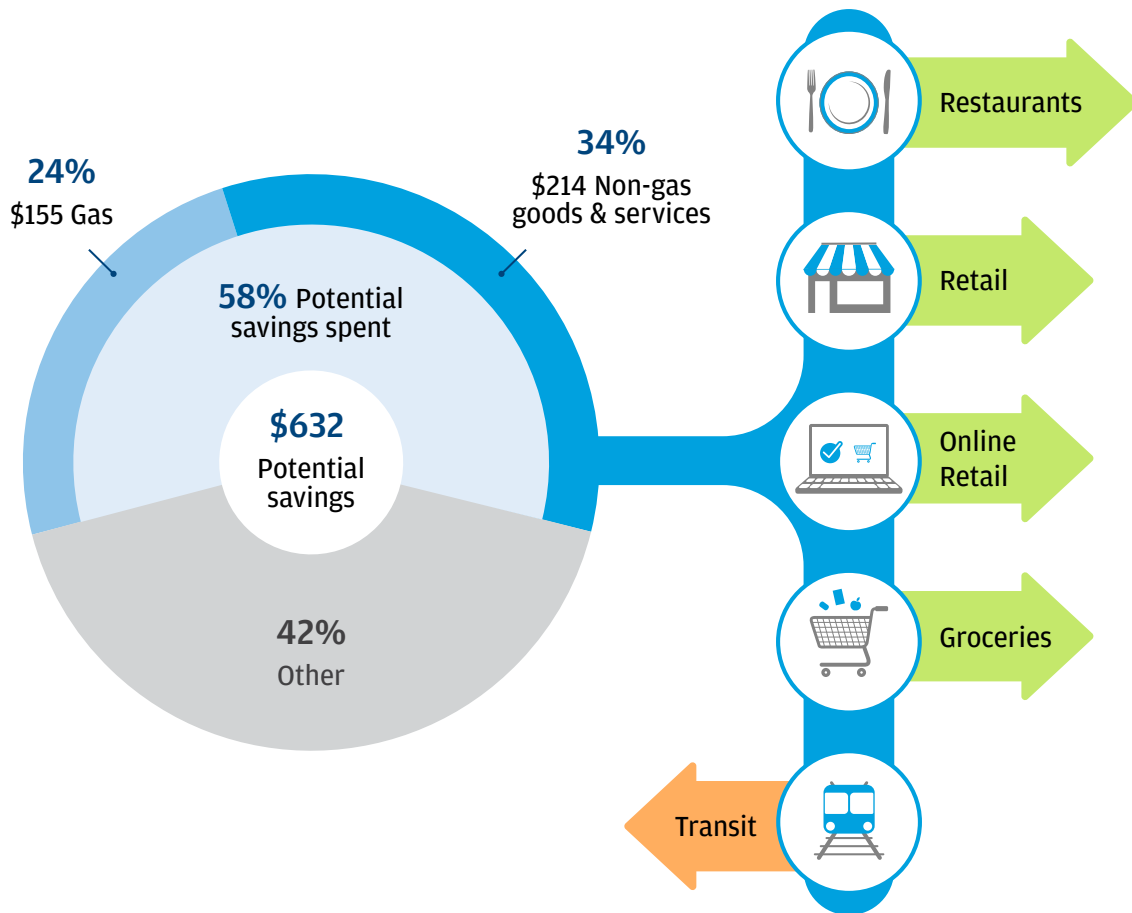
Finding Three

Households spent over \$200—45 percent of their drop in gas spending—on things other than gas, primarily on restaurants and retail.

Finding Four

Households spent over \$150 of their potential savings from lower gas prices declines at gas stations. Including this additional spending at gas stations, households spent 58 percent of their potential savings.

The 25 percent drop in gas prices generated a potential savings of \$632 for middle-income households. Households spent 58 percent of their potential savings—34 percent on non-gas goods and services and 24 percent on gas.



Households spent over \$200 on non-gas goods and services, primarily on restaurants, retail, and groceries. Gains in these categories were offset by declines in Transit spending.

Introduction

In 2015, gas prices in the US fell to levels not seen since 2008. The US Energy Information Administration (EIA) projected that this drop in prices would put about \$700 back into the pockets of US households (US Energy Information Administration, 2015). Critical questions remain open. Who specifically experienced this level of savings? Did people pocket or spend their savings from lower gas prices? What did they spend it on?

The JPMorgan Chase Institute's October 2015 study *How Falling Gas Prices Fuel the Consumer* quantified the impact of the decline in gas prices on consumer spending as gas prices fell precipitously to a trough in January 2015 (Farrell and Greig, 2015). At that time, the drop in gas spending represented the equivalent of a 1.6 percent increase in income for households in the lowest income quintile. At the national level, we estimated that for every dollar less spent on gas in the three month period around January 2015 relative to a year prior (when prices were 30 percent higher), consumers spent roughly 80 cents on non-gas goods and services.

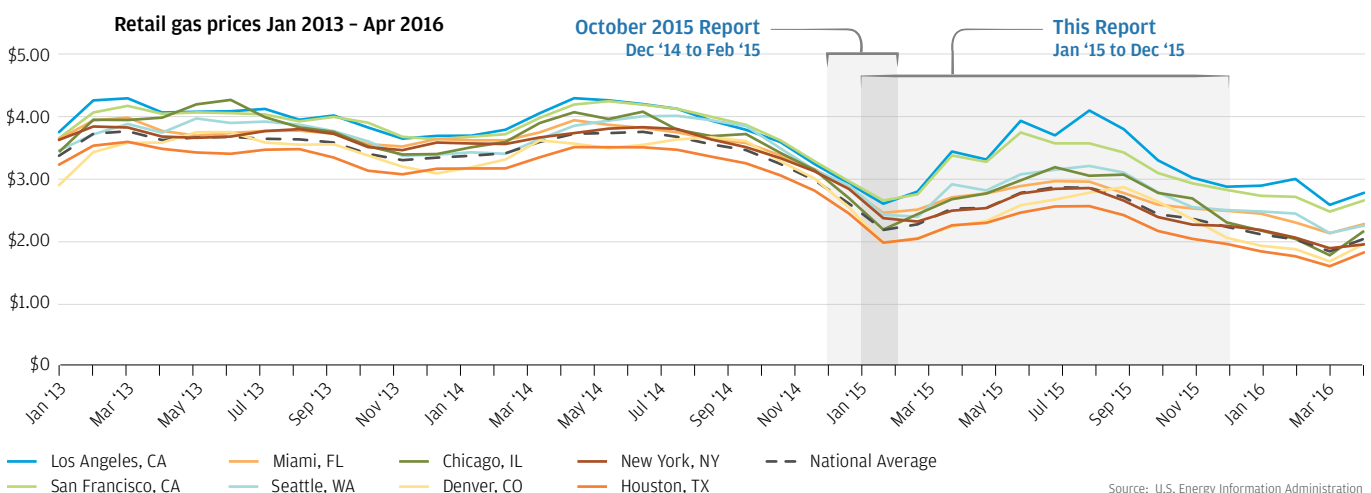
In this report we take a fresh look at these questions to quantify the impact of an entire year of lower gas prices in 2015. We examine the everyday spending behavior of a random, anonymized sample of one million core Chase customers across 23 states.¹ We find that middle-income households spent roughly \$480 less on gas in 2015 than in 2014, the equivalent of more than a one percent increase in annual income for 60 percent of households. Seventy-two percent of households spent less on gas in 2015 than in 2014. The drop in gas spending varied across the country, with lower impacts felt in the West and urban areas of the Northeast.

We estimate that households spent 58 percent of their potential savings from lower gas prices. Middle-income households spent over \$200—or 45 percent—of their \$480 drop in gas spending on non-gas goods and services, primarily on restaurants and retail. They also increased their spending at gas stations by more than \$150 relative to their trajectory of gas spending from the prior five years. Including this additional gas spending, households had a “potential savings” of \$630, of which they spent 58 percent, including 34 percent on non-gas goods and services and 24 percent on gas. Concurrently, households decreased their spending on transit, suggesting that consumers altered their transportation choices in a low gas price environment. With the remaining 42 percent of their potential savings from lower gas prices, aggregate national statistics suggest that households might have bought more vehicles and other durable goods and also possibly saved more.

Trends in gas prices and gas spending in 2015

Gas prices fell sharply in the fourth quarter of 2014 and remained low for most of 2015 despite some fluctuations. Starting at a peak monthly price of \$3.77 in June 2014, prices fell precipitously and continuously to a trough of \$2.21 in January 2015 (Figure 1). Using a year-over-year comparison to account for seasonality, November 2014 was the first month in which gas prices were lower than in the prior year. National average gas prices subsequently rose in the first half of 2015 to \$2.89 in June, and prices reached a high of \$4.00 in California. National prices then fell to a low of \$2.14 in December 2015. Across the full year, gas prices in our sample were 25 percent lower in 2015 than in 2014 (\$2.60 compared to \$3.47).²

Figure 1: Retail gas prices were 25 percent lower in 2015 than 2014



Source: U.S. Energy Information Administration

Findings

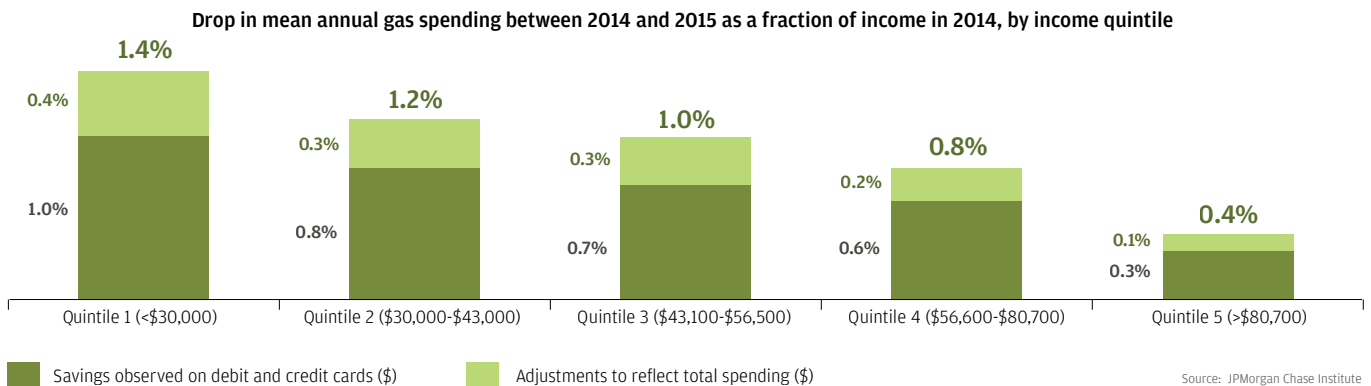
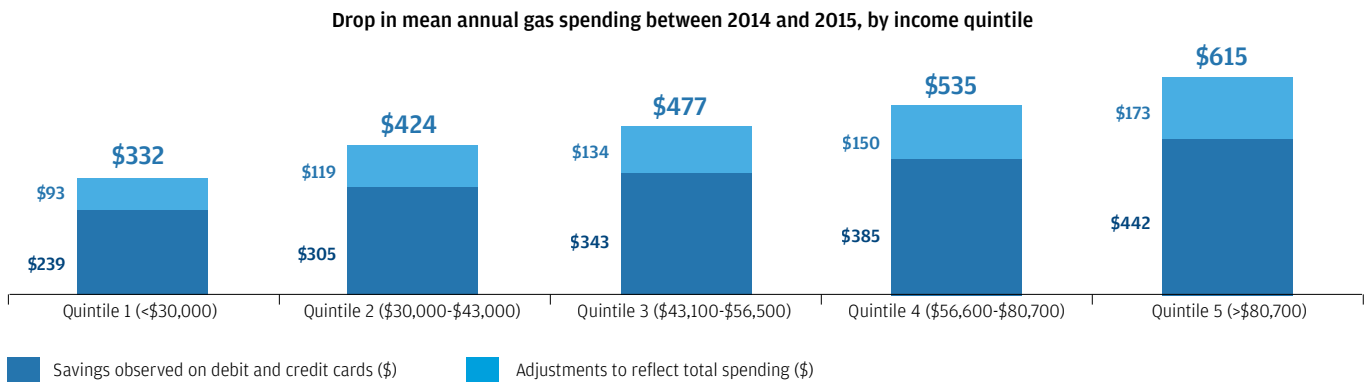
Finding One

Middle-income households spent about \$480 less on gas in 2015 than in 2014. Reductions in gas spending were equivalent to a 1 percent or greater increase in income for 60 percent of households.

Gas spending followed a similar course to gas prices. The average drop in gas spending between 2014 and 2015 was \$477 for middle-income households, representing a 19 percent drop in gas spending (Figure 2).³ Cumulatively from November 2014 through December 2015, middle-income households saved \$521. These savings are substantial for a middle income household—equivalent to more than half of one month’s rent or mortgage payment.⁴

The gas price declines resulted in a decline in gas spending that was equivalent to more than a one percent increase in annual income for 60 percent of households. Households earning less than \$30,000 benefited the most—their saving from lower gas prices of \$332 was the equivalent of a 1.4 percent boost to discretionary income.

Figure 2: Middle-income households experienced about a \$480 drop in gas spending between 2014 and 2015, equivalent to a one percent increase in annual income.



Source: JPMorgan Chase Institute

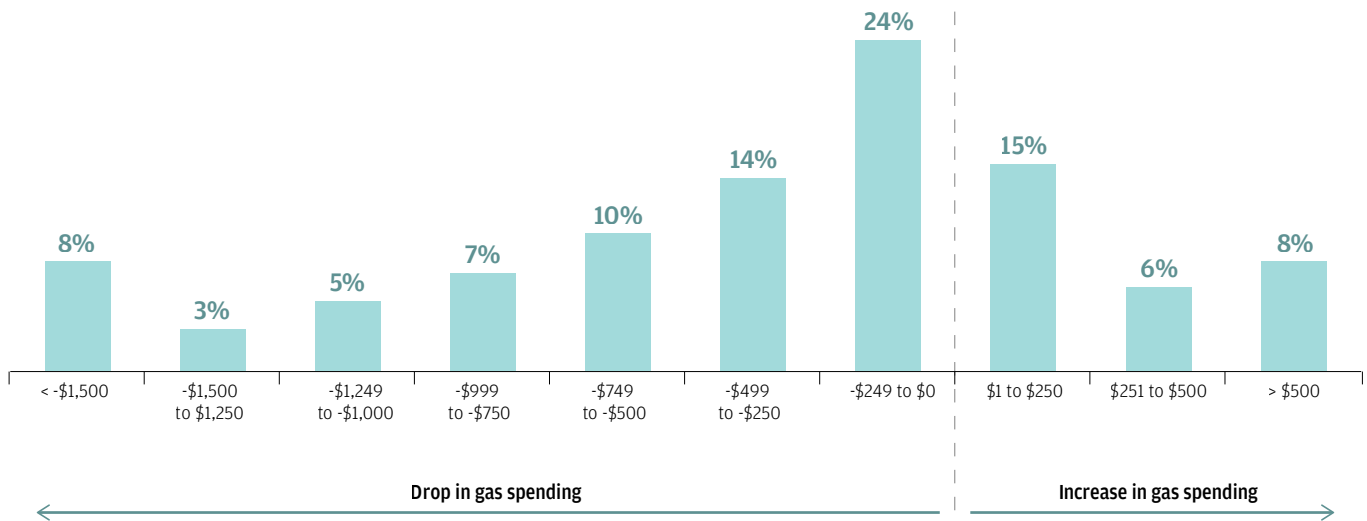
**Finding
Two**

Seventy-two percent of households spent less on gas in 2015 than in 2014, but households in the West and Northeast were impacted the least.

The drop in gas spending was not uniform across the country. Most households—72 percent—experienced a drop in gas spending (Figure 3). Based on card spending alone, 23 percent experienced a drop in gas spending of more than \$750, comparable to the EIA’s ex-ante projection of a \$700 saving for 2015 and Federal Reserve Chair Janet Yellen’s ex-post estimate of \$780 for 2015 (US Energy Information Administration, 2015; Yellen, 2016). Despite the gas price decline, 28 percent of households increased their gas spending. These households were primarily concentrated in California, where gas prices fell by only 16 percent compared to 25 percent nationally.

Figure 3: Seventy-two percent of households spent less on gas in 2015 than in 2014

Distribution of change in gas spending (percent of households)*



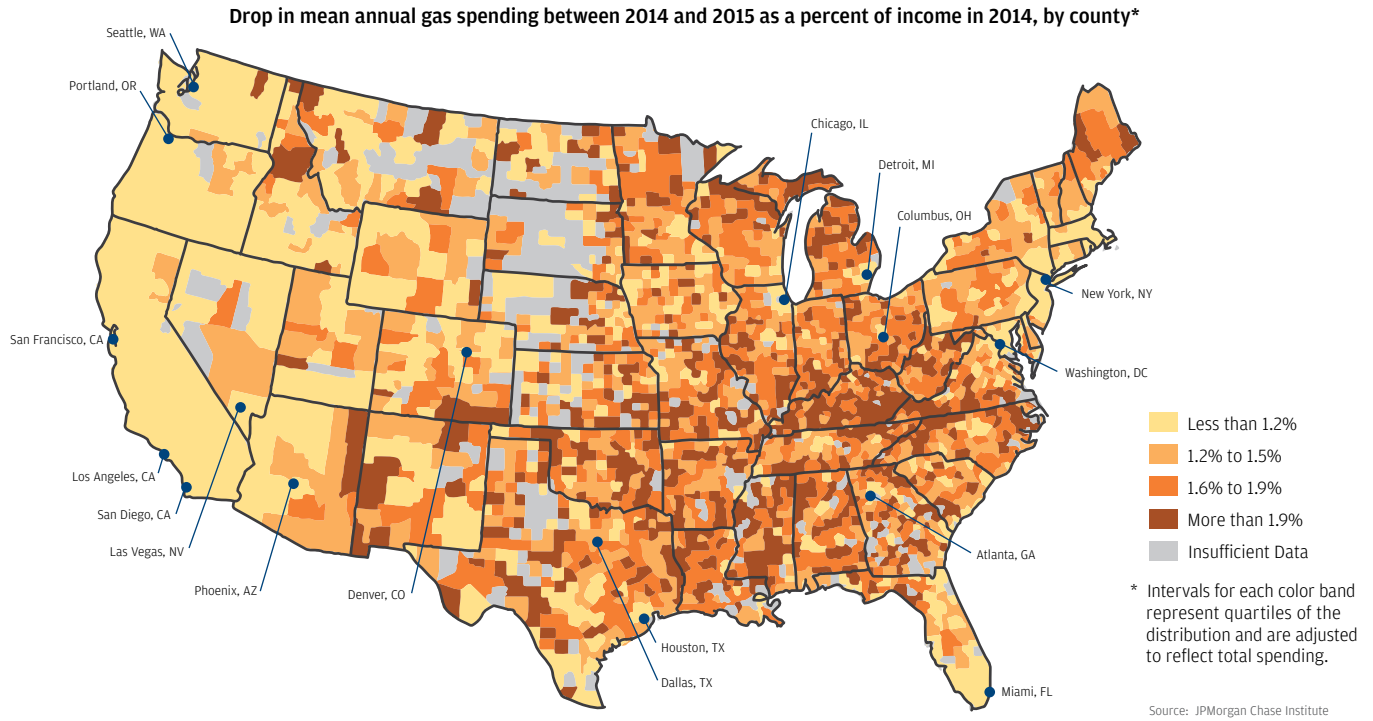
* Spending intervals on this histogram reflect card spending only and are not adjusted to reflect total spending.

Source: JPMorgan Chase Institute

Households across the country experienced different savings on gas in 2015. As a fraction of income, the drop in gas spending was lowest on the West coast and urban areas in the Northeast (Figure 4).⁵ The largest impacts were distributed throughout areas in the Midwest and South. Across the nation, the largest impacts were also felt in less urban areas.

The drop in gas spending was not uniform across the country. One in three households saved more than \$500.

Figure 4: Areas least impacted by the gas price declines were in the West and urban areas of the Northeast.



The drop in gas spending as a fraction of income varied widely across metro areas, ranging from a high of 1.4 percent in Lafayette, Louisiana, to a low of 0.3 percent in Los Angeles (Figure 5). The metro areas with the largest drops were all in the Midwest or South, and the metro areas with the smallest drops were all in California with the exception of New York City, Washington, DC, Las Vegas, and Seattle.

Figure 5: The drop in gas spending as a fraction of income was four times larger in some cities compared to others.

**Ten metro areas with the largest and smallest drop in gas spending between 2014 and 2015 as a percent of income
(Among 50 metro areas with the most Chase customers)***

Metro Areas with Largest Drop		Metro Areas with Smallest Drop	
Lafayette, LA	1.4%	Seattle, WA	0.5%
Akron, OH	1.3%	Washington, DC	0.5%
Grand Rapids, MI	1.3%	Las Vegas, NV	0.4%
Dayton, OH	1.3%	Riverside-San Bernardino, CA	0.4%
Indianapolis, IN	1.3%	San Diego, CA	0.4%
Tucson, AZ	1.3%	San Francisco, CA	0.4%
Dallas-Fort Worth, TX	1.3%	New York, NY	0.4%
Baton Rouge, LA	1.2%	San Jose, CA	0.4%
Louisville, KY	1.2%	Ventura, CA	0.4%
Oklahoma City, OK	1.2%	Los Angeles, CA	0.3%

* Spending levels are adjusted to reflect total spending.

Finding Three

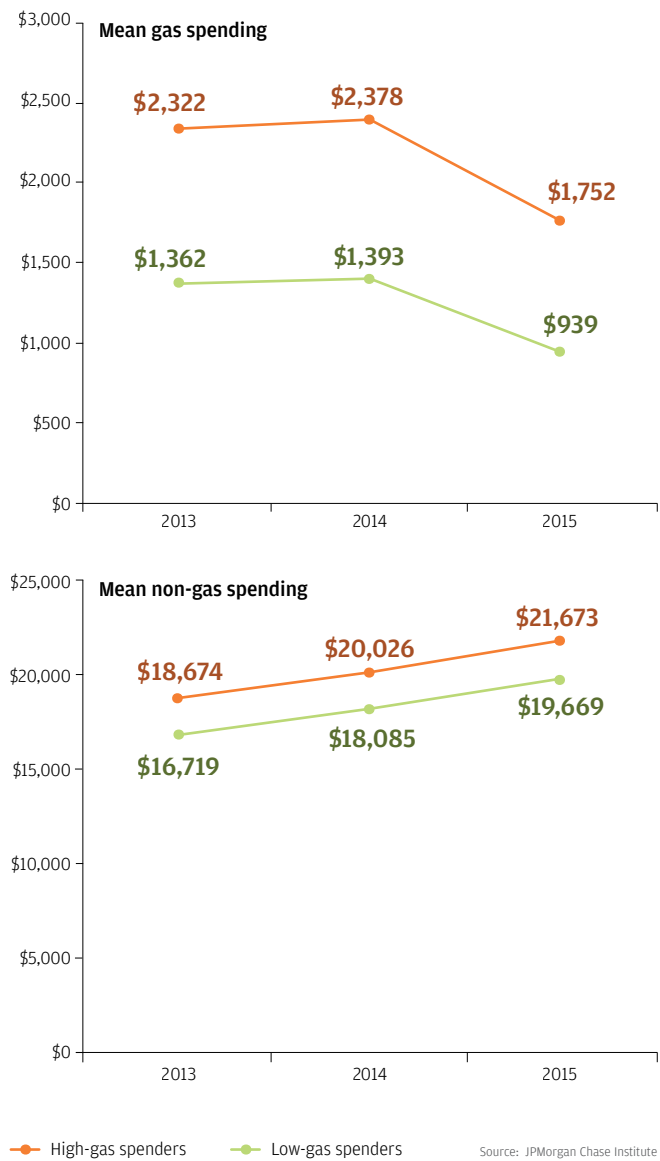
Households spent over \$200—45 percent of their drop in gas spending—on things other than gas, primarily on restaurants and retail.

We measure the impact of lower gas prices by comparing spending by households that spend a lot on gas with households that do not spend much on gas. We isolate the causal impact of the change in gas prices on consumer spending using anonymized household-level spending data. Specifically, we identify a "treatment group" of households in the top quintile in terms of gas spending and thus disproportionately impacted when gas prices are low. We refer to this group as "high-gas spenders" and compare them to a control group of "low gas spenders" comprised of households in the bottom quintile of gas spending and thus impacted to a much lesser extent when gas prices are low.

The impact of lower gas prices is typically difficult to quantify with aggregate data because gas spending only represents about five percent of total spending, and consumer spending is influenced by many economic forces beyond the change in gas prices. We take several steps to match the levels and growth trajectories of non-gas spending between treatment and control groups so that the only difference between these groups is the extent to which they would be impacted by a change in gas prices.⁶ Figure 6 displays mean levels of spending on gas and non-gas goods and services by high-gas spenders and low-gas spenders while controlling for the household's metro area, income quintile within their metro area, and the age of the primary account holder.

The drop in gas prices generated an additional \$200 in spending on non-gas goods and services for middle-income households.

Figure 6: High-gas spenders experienced a more dramatic drop in gas spending than low-gas spenders between 2014 and 2015

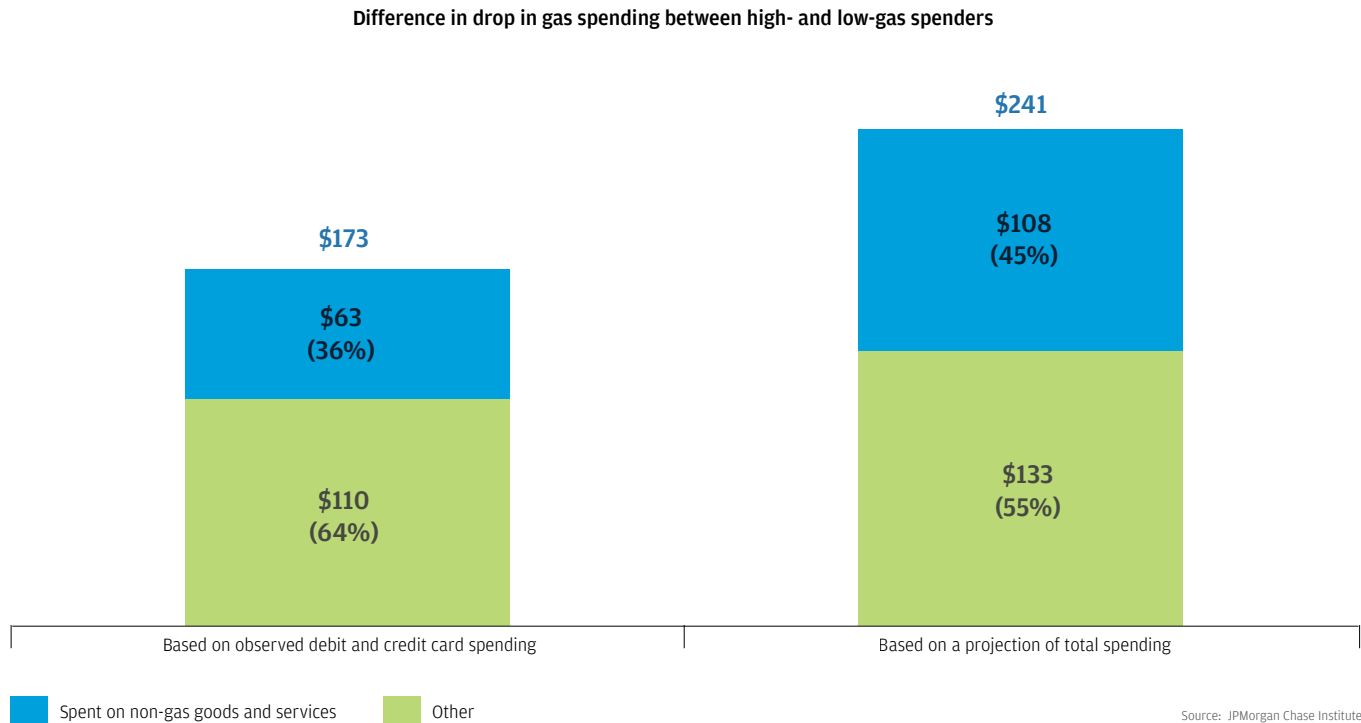


Between 2014 and 2015, gas spending dropped \$173 more for high-gas spenders than for low-gas spenders. At the same time, high-gas spenders exhibited a \$63 larger increase in non-gas spending compared to low-gas spenders (Figure 7). The ratio of these two numbers (\$63 as a fraction of \$173)—36 percent—represents the marginal propensity to consume (MPC) non-gas goods and services out of lower gas prices. This estimated MPC increases to 45 percent when we adjust for the share of total spending we believe we observe on debit and credit cards among this sample (estimated at 71 percent for gas spending and 58 percent for non-gas spending, as described in the Data and Methodology section).

It is important to acknowledge that our estimate still contains some uncertainty: the 95 percent confidence interval ranges from 10 percent to 63 percent. Our MPC estimates of 36 percent, and 45 percent after adjusting for incomplete coverage of spending, are lower than the 73 percent, and 89 percent on an adjusted basis, reported in *How Falling Gas Prices Fuel the Consumer* for January 2015 (Farrell and Greig, 2015). See the Data and Methodology section for a full discussion of additional robustness checks and a comparison of our results to the 2015 report.

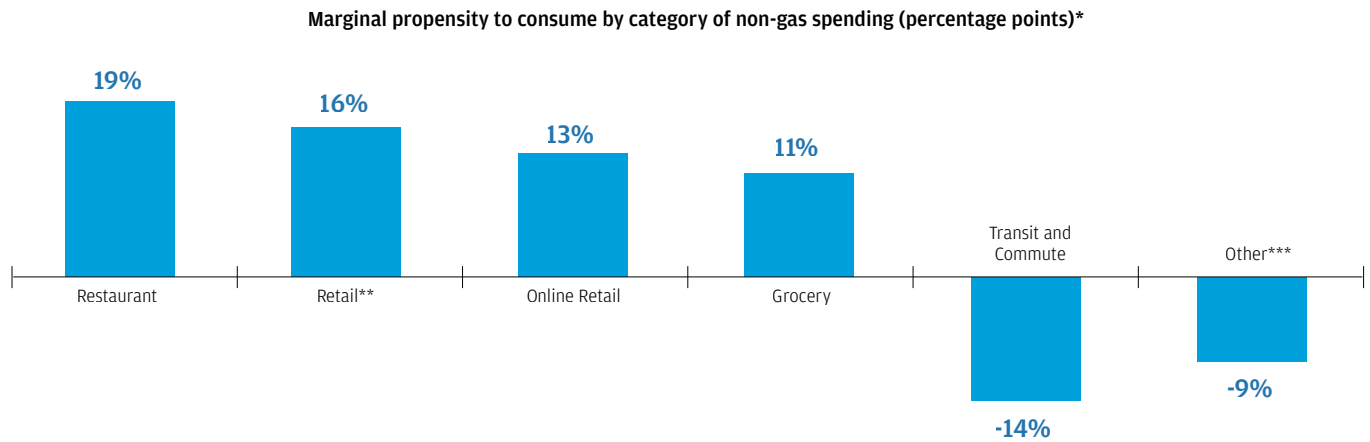
Households spent roughly 45 percent of their drop in gas spending on things other than gas.

Figure 7: Households spent 45 percent of their gas savings on non-gas goods and services



Households spent their marginal dollars saved from lower gas prices mostly on restaurants, retail, and groceries. Our baseline MPC estimate of 36 percent is an aggregation of gains in some categories offset by declines in other categories. Specifically, there were gains of 19 percentage points on Restaurants, 16 percentage points on Retail, 13 percentage points on Online Retail, and 11 percentage points on Grocery, and declines of 14 percentage points in Transit and Commute and 9 percentage points in Other categories.

Figure 8: Households spent their savings from lower gas prices primarily on restaurants and retail but also reduced spending on transit and commute



* Percentage points sum to the baseline aggregate marginal propensity to consume of 36 percent (without the scaling adjustment to account for non-card spending).

** Retail includes specialty retail stores such as drugstores, clothing, shoe, and equipment stores.

*** Other represents a combination of cash advances and payments, which declined by 13 percentage points but represent spending on unknown categories; and other categories with marginal propensities to consume less than +/-10 percentage points, including school, entertainment, auto parts, department stores, discount store, professional services, electronics and appliances, utilities, home improvement, healthcare, insurance, and travel, which increased in aggregate by four percentage points.

Source: JPMorgan Chase Institute

A negative marginal propensity to consume on Transit and Commute implies that spending in this category grew at a slower pace for high-gas spenders than low-gas spenders. There are two possible explanations for this phenomenon. First, lower gas prices may have led high-gas spending households to choose to travel by car rather than taking public transportation.⁷ The American Public Transportation Association reports that national transit ridership declined by 1.3 percent in 2015 compared to an increase of 1.0 percent in 2014 (American Public Transportation Association, 2015; American Public Transportation Association, 2016). Below we also document further evidence for this hypothesis in that lower gas prices in 2015 coincided with a significant increase in demand for gas and vehicle miles traveled.

Another possible contributing factor for the negative MPC on Transit and Commute could be a relative increase among low-gas spenders in the use of ridesharing platforms, a component of the Transit and Commute category. Elsewhere we have shown the dramatic increase in the supply of online platforms in 2015, including ridesharing platforms (Farrell and Greig, 2016). Survey evidence also indicates that ridesharing services are particularly popular among individuals who do not own a car (Smith, 2016).

Finding Four

Households spent over \$150 of the potential savings from lower gas prices at gas stations. Including this additional spending at gas stations, households spent 58 percent of their potential savings.

As we noted above, gas prices were 25 percent lower in 2015 than in 2014, but spending at gas stations only fell by 19 percent over this same period. What accounts for the difference? We estimate that households increased their spending at gas stations by over \$150 relative to what it would have been had households not altered their consumption behavior in response to lower prices. We define baseline consumption behavior to be a continuation of the growth trajectory in gas spending over the prior five years. This uptick in spending at gas stations could be attributable to an increase in the number of gallons purchased, a shift to more expensive gas options, or an increase in purchases at convenience stores located at gas stations.

There is strong evidence that US households purchased more gas in 2015 than in 2014. Between 2014 and 2015 the Bureau of Economic Analysis reports a 3.3 percent increase in real personal consumption of gas and other energy products, and the EIA reports a 2.7 percent increase in the quantity of finished motor gasoline supplied (US Bureau of Economic Analysis, 2016b; US Energy Information Administration, 2016b). The US Department of Transportation estimates that vehicle miles travelled (VMT) increased by 3.5 percent between 2015 and 2014 (US Department of Transportation, 2015). This is a notable acceleration in the growth of VMT compared to declines in VMT between 2007 and 2011 and modest growth of 0.6 percent and 1.8 percent in 2013 and 2014, respectively. The increase in the quantity of gas consumed could also be due to a decrease in vehicle fuel efficiency.⁸

The second possible reason for increased spending at gas stations is that consumers bought more expensive gas either because they shopped around less for the least expensive gas or they upgraded from regular to premium gas. While there is historical evidence that people switched to less expensive gas when gas prices increased (Hastings and Shapiro, 2013), it is unclear whether people purchased more expensive gas in a low gas price environment.⁹

Finally, the increase in spending at gas stations might be attributable to an increase in purchasing convenience store items. Industry reports indicate an increase in the percentage of consumers that went inside the store after fueling up—41 percent in 2015 compared to 35 percent in 2014 (National Association of Convenience Stores, 2015; National Association of Convenience Stores, 2016).¹⁰

In order to quantify the full impact of lower gas prices on consumer spending, we also measure the marginal propensity to consume more gas. We do so by estimating the total potential savings from lower gas prices households might have incurred had they maintained their trajectory of gas spending from the prior five years. Real gas consumption grew by -0.5 percent between 2009 and 2014 (US Bureau of Economic Analysis, 2016b). Assuming spending at gas stations continued to grow by -0.5 percent in 2015, high-gas spenders spent 24 percentage points more of their projected savings than low-gas spenders on gas.¹¹ Thus we estimate that the marginal propensity to consume more gas was 24 percent. This implies that middle-income households would have been projected to save a total of \$632, or \$155 more than their actual savings of \$477.

Middle-income households had the potential to save \$632 from lower gas prices in 2015, had they not increased their purchases at gas stations.

Figure 9: Households spent 58 percent of their total potential savings—34 percent on non-gas goods and services and 24 percent on gas

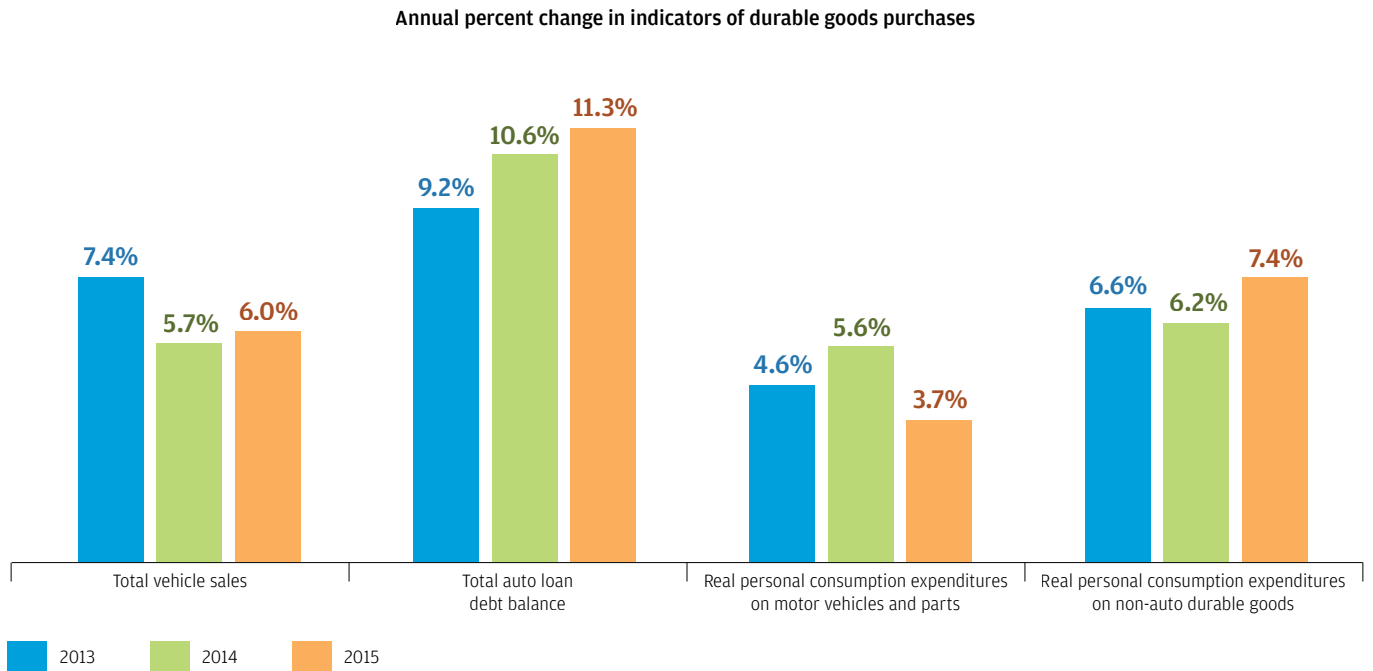


In summary, we estimate that the 25 percent drop in gas prices generated a potential savings of \$632 for middle-income households, of which households spent 58 percent—34 percent on non-gas goods and services and 24 percent at gas stations. The other 42 percent might have been saved or otherwise spent on purchases not typically paid for using a debit or credit card, notably vehicles or other durables. Below we provide some hypotheses about what households did with the remaining 42 percent of their gas savings.

How did households use the other 42 percent of their total savings from lower gas prices?

If households did not spend all of their savings from lower gas prices, what might they have done with them? National aggregate data point to a few hypotheses. First, people bought more vehicles and other durable goods in 2015. Although we would not have observed this on debit and credit card spending, it is plausible that high-gas spenders were disproportionately more likely to have increased vehicle purchases compared to low-gas spenders in response to lower gas prices. Vehicle purchases have been shown to be very sensitive to gas price fluctuations in the past (Edelstein and Kilian, 2009), and aggregate statistics suggest this might have been true in 2015 (Figure 10). The number of vehicles sold reached a 15-year high in 2015, growing by 6.0 percent compared to 5.7 percent in 2014 and 7.3 percent in 2013 (US Bureau of Economic Analysis, 2016a). Similarly, auto loan debt balances increased by 11.3 percent year-over-year in 2015, compared to 10.6 percent in 2014 and 9.2 percent in 2013.¹² In real terms, growth in spending on motor vehicles and parts slowed in 2015, while there was an acceleration in spending on other durable goods (which are also often paid for by means other than credit or debit cards).

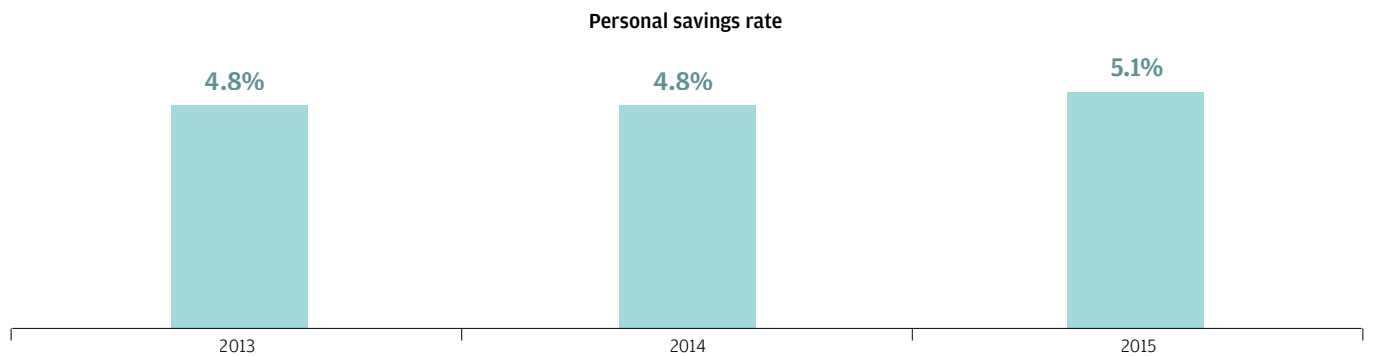
Figure 10: Vehicle sales, auto loan debt balances, and durable goods purchases increased in 2015



Source: Total vehicle sales and real personal consumption expenditures are from U.S. Bureau of Economic Analysis and were retrieved from FRED, Federal Reserve Bank of St. Louis. Total auto loan debt balance is from the Federal Reserve Bank of New York Consumer Credit Panel/Equifax.

Second, there is some evidence that people saved more. Aggregate data indicate a slight increase in the personal saving rate (Figure 11). These aggregate trends cannot be causally attributed to the gas price declines, but they would be consistent with the hypothesis that some consumers saved a portion of their windfall gains from lower gas prices.

Figure 11: The personal savings rate ticked up in 2015



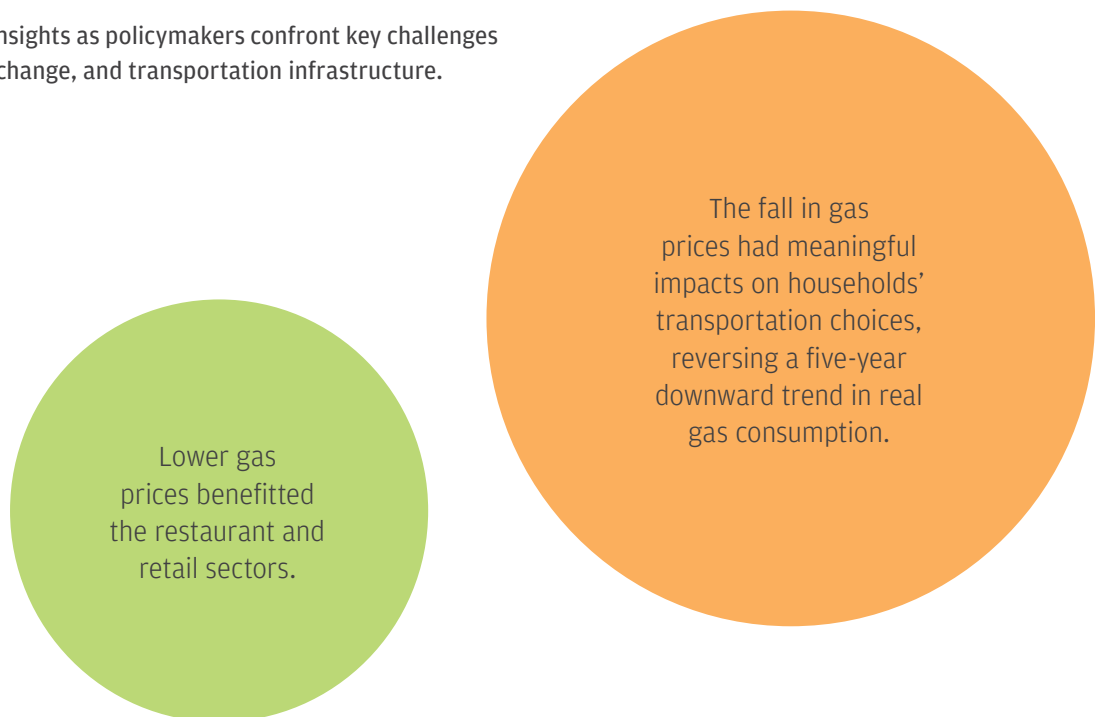
Source: U.S. Bureau of Economic Analysis

Conclusion

In this study we quantify the impact of a year of low gas prices in 2015 on consumer spending. To conclude, we summarize our key insights and their implications below.

- **Gas price fluctuations contribute to expense volatility, particularly for lower-income households.** The drop in gas spending was equivalent to more than a one percent increase in annual income for low and middle-income households. With the gradual suburbanization of the poor (Kneebone and Berube, 2013), low-income households increasingly live in areas that potentially make them dependent on motor-vehicle transportation. Gas price fluctuations add expense volatility for lower-income households with high driving needs, which both spend the highest fraction of their income on gas and also experience the most income volatility (Farrell and Greig, 2016).
- **The fall in gas prices had meaningful impacts on households' transportation choices.** Households consumed more gas when gas prices fell. In 2015, this contributed to a reversal of the five-year trend of declining real gas consumption and vehicle miles traveled. Moreover, we found that the marginal propensity to spend on transit was negative. This might imply lower ridership and revenues for public transit systems around the country and increased carbon emissions due to motor vehicles. Efforts to curb fuel consumption by increasing gas taxes should take into consideration that gas taxes are regressive given that low-income households spend a higher fraction of their income on gas. Reducing reliance on gas, through electrification of the transportation sector and increasing public transit, and taxing gas based on quantity purchased rather than price could reduce the regressivity of gas taxes, especially when gas prices are high.
- **Lower gas prices benefitted the restaurant and retail sectors.** Households spent roughly 34 percent of their potential gas savings on non-gas goods and services, primarily on restaurants and retail. These sectors which gained the most from lower gas prices in 2015 also potentially stand to lose the most if gas prices return to higher levels.

These are important insights as policymakers confront key challenges of inequality, climate change, and transportation infrastructure.



Data and Methodology

Data Privacy

The JPMorgan Chase Institute has adopted rigorous security protocols and checks and balances to ensure all customer data are kept confidential and secure. Our strict protocols are informed by statistical standards employed by government agencies, and our work with technology, data privacy, and security experts are helping us maintain industry-leading standards.

There are several key steps the Institute takes to ensure customer data are safe, secure and anonymous:

- Before the Institute receives the data, all unique identifiable information—including names, account numbers, addresses, dates of birth, and Social Security numbers—is removed.
- The Institute has put in place privacy protocols for its researchers, including requiring them to undergo rigorous background checks and enter into strict confidentiality agreements. Researchers are contractually obligated to use the data solely for approved research, and are contractually obligated not to re-identify any individual represented in the data.
- The Institute does not allow the publication of any information about an individual consumer or business. Any data point included in any publication based on the Institute's data may only reflect aggregate information.
- The data are stored on a secure server and can be accessed only under strict security procedures. The data cannot be exported outside of JPMorgan Chase's systems. The data are stored on systems that prevent them from being exported to other drives or sent to outside email addresses. These systems comply with all JPMorgan Chase Information Technology Risk Management requirements for the monitoring and security of data.

The Institute provides valuable insights to policymakers, businesses, and nonprofit leaders. But these insights cannot come at the expense of consumer privacy. We take precautions to ensure the confidence and security of our account holders' private information.

Constructing our samples

For this report we rely on JPMorgan Chase anonymized data on consumer clients who are primary account holders. To avoid double counting of financial activity, all joint accounts are captured under the primary account holder. From a universe of over 28 million anonymized checking account holders, we created a sample of approximately one million debit card holders who meet the following sample criteria:

1. They have a checking account and at least five outflow transactions from their checking account per month between October 2012 and January 2016.
2. They do not hold a gas station specific card.
3. They live in a zip code with at least 140 households in our sample.
4. They live in a metro area with at least five zip codes and at least 750 households in our sample.¹³

These criteria give us confidence that we are focusing on core Chase clients and have sufficient coverage of the geographic areas in which we assess the impact of low gas prices on spending behavior. These criteria constrain our sample to the 23 states with Chase branch locations.

For the purposes of the map of gas spending presented in Figure 4, we assembled an anonymized sample of approximately 12 million households with either a Chase debit card or Chase credit card and a minimum of five card transactions in every month in 2014 and 2015. These households are not required to also have a checking account. We use this expanded sample to produce the map of gas spending because it provides broad coverage of the nation. The map reports statistics for any county in which we have a minimum of 25 customers who meet this criterion.

The demographic characteristics of these two samples are slightly different from each other and from the nation (Figure 12). Both samples over-represent primary account holders between 25 and 54 years old, men, households in the West, and households with higher incomes compared to the US population. In addition, the map sample is even more skewed in favor of high-income households because credit card holders tend to have higher incomes.

Figure 12: Demographic characteristics of the JPMorgan Chase Institute samples versus the US population

	US Population ¹	JPMC Institute Samples	
		Core Sample ⁴ (1 million)	Map Sample ⁵ (12 million)
18-24 (%)	13%	5%	8%
25-34 (%)	18%	23%	21%
35-44 (%)	17%	22%	19%
45-54 (%)	18%	22%	20%
55-64 (%)	16%	16%	17%
65+ (%)	19%	12%	15%
Men (%)	49%	53%	55%
Women (%)	51%	47%	45%
Northeast (%)	18%	19%	17%
Midwest (%)	21%	20%	22%
South (%)	38%	28%	29%
West (%)	24%	32%	32%
Annual income (\$)	\$42,789 ²	\$62,580	\$72,555
Annual gas spending (\$)³	\$2,275	\$1,626	\$1,704
Annual non-gas spending (\$)³	\$32,446	\$18,820	\$23,989

¹ Unless otherwise noted, national estimates come from the Census Bureau's American Community Survey 2014 One Year Estimates.

² This estimate reflects mean person income in 2014 according to the 2014 Current Population Survey. Mean family income for 2014 was \$88,765.

³ National estimates come from the Consumer Expenditure Survey midyear release from July 2014 through June 2015. Non-gas spending excludes categories of spending that are unlikely to be conducted using a debit or credit card, specifically: auto purchase, auto finance, gas, shelter, and pension. Estimates for JPMC Institute samples reflect spending in the same time period (July 2014-June 2015).

⁴ The one million sample includes checking account holders with a minimum of five outflows per month, who do not have a gas station specific Chase credit card, and who live in a zip code with at least 140 other individuals in our sample.

⁵ The 12 million sample includes households who have either a credit or debit card and a minimum of five transactions per month on either one.

Measuring Spending

We measure spending behavior using debit and credit card transactions, which we refer to as card spending. We analyze information on the merchant involved in these transactions and classify all card spending at gas stations, including attached convenience stores, as “gas spending” and all other card spending (i.e. not at gas stations) as “non-gas spending.”¹⁴ Card spending offers a clean, albeit incomplete, measure of gas and non-gas spending. It provides a relatively good window into spending on goods and services but less visibility into spending categories where households more frequently use cash, checks, and electronic transfers, such as rent payments, utility bills, and vehicle purchases.¹⁵

Estimating the marginal propensity to consume non-gas goods and services

For this analysis, we describe households as either “high-gas spenders” or “low-gas spenders” based on the gas spending of other Chase customers that live in the same zip code. Specifically, we calculate the average gas spending of everybody in each household’s zip code, excluding their own, in 2014. Using this “leave-out” mean approach to estimating each household’s gas spending reduces the possibility that our results could be biased by mean reversion in household-level gas spending over time. Each household is assigned to a quintile of gas spending within the household’s metro area. Households in the top quintile of gas spending are high-gas spenders and those in the bottom quintile are low-gas spenders.

We use a “difference-in-difference” approach to isolate the impact of low gas prices on consumer behavior from other economic conditions and trends over this time frame. Specifically, we compare the difference between high- and low-gas spenders in their increase in non-gas spending between 2014 and 2015. In this research design, our low-gas spenders serve as a “control group” for how high-gas spenders (our “treatment group”) would have behaved had gas prices not dropped.

We take two steps to ensure that treatment and control groups exhibit similar levels and growth trajectories of non-gas spending so that the only difference between these groups is the extent to which they would be impacted by a change in gas prices. First, we assign households to quintiles of gas spending within their metro area. Second, we control for each household’s metro area in 2014, income quintile within their metro area in 2014, and the age of the primary account holder in 2014. This design allows us to account for differences in the distribution of gas spending and income levels within a metro area when assigning people to treatment and control groups.

As illustrated in Figure 6, our treatment and control groups have, by design, different levels of gas spending (\$986 or a 71 percent difference in 2014), but they have very similar levels of non-gas spending (\$1,941 or an 11 percent difference in 2014). We believe low-gas spenders are a valid control group because high-gas spenders and low-gas spenders exhibited very similar trends between 2013 and 2014 when gas prices were high and relatively constant: gas spending increased by 2.2 percent for low-gas spenders and 2.4 percent for high-gas spenders, and non-gas spending increased by 8.2 percent and 7.2 percent for the two groups, respectively.

The marginal propensity to consume (MPC) non-gas goods and services is estimated by dividing the difference in the increase in non-gas spending between the two groups by the difference in the drop in gas spending between high- and low-gas spenders. Between 2014 and 2015, non-gas spending increased by \$63 more for high-gas spenders than low-gas spenders, and gas spending dropped \$173 more for high-gas spenders than for low-gas spenders (Figure 7). Our baseline MPC estimate is thus 36 percent (\$63 as a fraction of \$173).

We estimate the 95 percent confidence interval for the MPC with an instrumental variable regression, in which we use whether a household is a high- versus low-gas spender as an instrument for the year-over-year change in gas spending (Equation 1, first stage), controlling for the household’s metro area (as defined by their Core Based Statistical Area), income quintile within their metro area in 2014, and the age of the primary account holder in 2014. We then regress the year-over-year change in non-gas spending on the predicted year-over-year change in gas spending and our control variables (Equation 2).

$$(1) \Delta Gas Spend_i = a + \beta_1 * I(High Gas Spender)_i + CBSA_{i,2014} + IncQuintile_{i,2014} + Age_{i,2014} + \epsilon_i$$

$$(2) \Delta Non Gas Spend_i = a + \beta_2 * \widehat{\Delta Gas Spend}_i + CBSA_{i,2014} + IncQuintile_{i,2014} + Age_{i,2014} + \epsilon_i$$

Where:

$$\Delta Gas Spend_i = GasSpend_{i,2015} - GasSpend_{i,2014}$$

$$\Delta NonGas Spend_i = NonGasSpend_{i,2015} - NonGasSpend_{i,2014}$$

$CBSA_{i,2014}$: Core Based Statistical Area in which the household lived in 2014

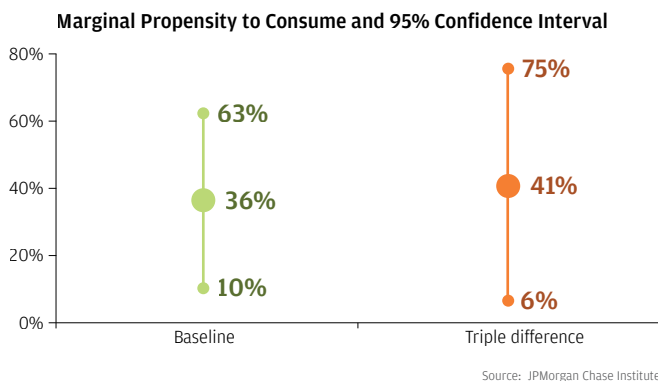
$IncQuintile_{i,2014}$: Income quintile of the household in 2014, assigned within their CBSA

$Age_{i,2014}$: Age of the primary account holder in 2014, assigned to one of the age bins displayed in Figure 12.

Coefficient β_2 in Equation 2 above, which represents the ratio of the difference in the change in non-gas spending for high-gas spenders versus low-gas spenders to the difference in the change in gas spending for the two groups, while controlling for metro area, income quintile, and age of the primary account holder, recovers our baseline MPC estimate of 36 percent. The 95 percent confidence interval of the MPC ranges from 10 percent to 63 percent. This range is calculated by multiplying the standard error of β_2 , 13 percent, by ± 1.96 and adding the result to the estimated MPC.¹⁶

As a robustness check, we also account for any underlying differences in trends between high- and low-gas spenders prior to the drop in gas prices by estimating the “triple difference” in which we subtract the dollar change in spending between 2013 and 2014 from the dollar change in spending between 2014 and 2015. This estimate removes the pre-trends in dollar terms and is valid assuming that these pre-trends would have continued similarly for both groups in the absence of a change in the price of gas. This triple-difference approach yields a similar estimate of 41 percent with a 95 percent confidence interval of 6 to 75 percent.

Figure 13: The confidence intervals on our MPC estimate range from 6 to 75 percent



In order to estimate the impact of low gas prices on the purchase of goods and services generally in the economy, we scale our MPC estimate to account for the fact that people pay for a higher share of their total gas spending using a debit or credit card (versus cash, checks, or electronic payments) relative to non-gas spending categories. We estimate the fraction of gas spending observed on card by dividing mean gas spending observed for Chase customers between July 2014 and June 2015 (\$1,626) by the mean consumer expenditure on gasoline and motor oil reported in the Midyear 2014-2015 Consumer Expenditure Survey (\$2,275) (Figure 12). Similarly we estimate the fraction of non-gas spending observed on card by dividing non-gas card spending for Chase customers (\$18,820) by the mean

consumer expenditure on total non-gas consumption (\$32,446) for 2014. In defining non-gas expenditures within the Consumer Expenditure Survey, we exclude auto purchases, auto finance, shelter, and pension related expenditures, which we believe are expenditures extremely unlikely to be made using debit and credit cards and for which card spending is not a good proxy.

Comparing observed spending on Chase cards to these national benchmarks, we estimate that roughly 71 percent of gas spending occurs on debit and credit cards and only 58 percent of non-gas spending occurs on debit and credit cards.¹⁷ This adjustment requires that we multiply our point estimate of 36 percent by 1.2 (the ratio of 71 percent and 58 percent), which increases the MPC from 36 percent to 45 percent.

In summary, we find robust estimates of a marginal propensity to consume ranging from 36 percent to 41 percent, which, after accounting for the full range of spending beyond credit and debit card transactions, scale up to a range of 45 percent to 50 percent.

Comparison of these Findings to “How Falling Gas Prices Fuel the Consumer” (Farrell and Greig, 2015)

The MPC estimates of 36 percent, and 45 percent after adjusting for incomplete coverage of spending, are lower than the 73 percent, and 89 percent on an adjusted basis, presented in our earlier report on this topic, *How Falling Gas Prices Fuel the Consumer*, for January 2015 (Farrell and Greig, 2015). Since our baseline estimate of 36 percent falls within the 95 percent confidence interval of our January 2015 estimate under certain specifications, we cannot rule out the possibility that the propensity to consume savings at the pump on non-gas goods and services is the same in both time frames.

There are a number of reasons why the MPC might differ between our previous report and the results presented here, including differences in the samples, differences in the methodologies, and other factors such as seasonality and behavioral changes. Additional analyses show that the difference in MPC estimates is not due alone to changes in sample or methodology (assignment to treatment and control groups and estimation approach described in Figure 14). When we apply the sample and methodology in this report to the January 2015 time frame, we obtain an MPC estimate of 89 percent for January 2015, compared to 73 percent reported in Farrell and Greig (2015).¹⁸

Figure 14: The methodology in this report reflects a number of differences in sample and methodology (differences reflected in bold)

	MPC estimate for Jan 2015 (Farrell and Greig, 2015)	MPC estimate for 2015 (Farrell and Greig, 2016)
MPC time frame	December 2014 - February 2015.	January 2015 - December 2015.
Sample	<p>They have a checking account and at least five outflow transactions from their checking account per month between October 2012 and June 2015.</p> <p>They do not hold a gas station specific card.</p> <p>They live in a zip code with at least 140 other households in our sample.</p>	<p>They have a checking account and at least five outflow transactions from their checking account per month between October 2012 and January 2016.</p> <p>They do not hold a gas station specific card.</p> <p>They live in a zip code with at least 140 other households in our sample.</p> <p>They live in a metro area with at least five zip codes and at least 750 other households in our sample.</p>
Assignment to treatment and control groups	<p>Household gas spending is estimated based on zip code-level leave-out mean gas spending of all other households in the zip code.</p> <p>Quintiles of gas spending are assigned nationally.</p>	<p>Household gas spending is estimated based on zip code-level leave-out mean gas spending of all other households in the zip code.</p> <p>Quintiles of gas spending are assigned within each metro area.</p>
Estimation approach	<p>Difference-in-difference comparison between high- and low-gas spenders in the year-over-year increase in non-gas spending (numerator) and drop in gas spending (denominator).</p>	<p>Difference-in-difference comparison between high- and low-gas spenders in the year-over-year increase in non-gas spending (numerator) and drop in gas spending (denominator).</p> <p>We control for each household’s metro area, income quintile within their metro area, and age when estimating mean gas and non-gas spending for our treatment and control groups.</p>
MPC on non-gas goods and services	<p>73 percent (confidence interval of 51 - 95 percent)</p> <p>89 percent when adjusted to reflect total spending</p>	<p>36 percent (confidence interval of 10 - 63 percent)</p> <p>45 percent when adjusted to reflect total spending</p>

It is also possible that the difference in the MPC estimates reflect true differences in economic behavior. First, the price environment was very different in the two time frames. The initial estimate was based on a year-over-year comparison of spending in December 2014 through February 2015 at the trough in gas prices immediately after they fell precipitously. As illustrated in Figure 1, gas prices have remained lower in 2015 than in 2014 but varied substantially over the course of the year and across geographies. It could be the case that the MPC is sensitive to thresholds in price levels or in price drops, in that consumers might respond more strongly when gas prices fall below a certain value or when the change in price exceeds a certain value. When we exclude California, where the drop in gas prices was less substantial, we estimate the MPC to be 30 percent, within the 95 percent confidence interval of our national baseline estimate of 36 percent (10 percent to 63 percent).

Second, seasonal patterns in spending could also impact the two MPC estimates given their different time frames. A household's MPC from lower gas prices might be higher for non-gas goods and services during the year-end holiday shopping season in December, whereas their MPC might tilt towards gas spending in the summer months.¹⁹ The January 2015 estimate captures holiday spending in December but not summer months. This report compares a full year of spending in 2015 versus 2014 and thus the full range of seasonal effects in consumer spending.

Third, it is possible that the overall consumption response tempered over time as consumers adjusted to a "new normal" in their level of gas spending. The estimated MPC in January 2015 resulted from an abrupt change in price over just a few months. The estimated MPC in 2015, meanwhile, captures many months after the initial price drop. Households may choose to allocate their savings at the pump in different ways as more time passes between the initial price drop and when the response is measured. They could, for example, first spend this extra money on restaurants and non-durable goods and then switch to saving it or purchasing durable goods like vehicles, which would not typically be purchased with a debit or credit card.

We estimate the MPC for each quarter in 2015. The MPC was 41 percent in the first quarter, 54 percent in the second quarter, 67 percent in the third quarter, and 78 percent in the fourth quarter. These quarterly estimates do not average to our annual baseline estimate of 36 percent because we assign households to treatment and control groups based on their quarterly (rather than annual) gas spending in 2014.

Estimating the marginal propensity to consume more gas

To estimate the impact of lower gas prices on gas spending (Figure 9), we compare the difference between the projected quantity of gas consumed in 2015 with the actual quantity of gas consumed by low- and high-gas spenders. We infer the quantity of gas consumed for low- and high-gas spenders in 2014 and 2015 by dividing mean gas spending in 2014 and 2015 by the estimated prices paid among our sample in 2014 and 2015. We use monthly state-level data on gas prices from GasBuddy.com to estimate an average price for 2014 and 2015 by weighting prices by the level of spending in each state by month in our sample. This weighted price was \$3.47 for 2014 and \$2.60 for 2015. We use the mean gas spending for low- and high-gas spenders reported in Figure 6, which are estimated while controlling for the household's metro area, income quintile within their metro area, and age of the primary account holder.

We estimate projected gas spending in 2015 by making the simple assumption that the rate of growth in the quantity of gas consumed from 2014 to 2015 was equal to -0.5 percent, the average annual growth rate from 2010 to 2014 while prices were relatively stable (US Bureau of Economic Analysis, 2016b). We then estimate the projected change in gas spending in 2015 as the projected gas spending in 2015 minus the actual gas spending in 2014. The difference between the projected change in gas spending in 2015 and the actual change in gas spending is then defined as the additional spending on gas. Since high- and low-gas spenders exhibit, by design, such different levels of gas spending, we construct our difference-in-difference estimate in percentage terms.²⁰ Our estimate of the marginal propensity to consume more gas is the difference between high- and low-gas spenders in their additional spending on gas as a percent of their projected gas spending in 2015. Assuming their demand for gas continued to grow by -0.5 percent in 2015, high-gas spenders were projected to save 24 percentage points more of their projected savings than low-gas spenders.²¹ Thus we estimate that the marginal propensity to consume more gas from lower gas prices was 24 percent in 2015.

Endnotes

- 1 For the purposes of our research, the unit of analysis is the primary account holder, whom we subsequently refer to as a "household". In our core sample of one million accounts, the mean number of authorized users per account is 1.5, and 55 percent of accounts have only one authorized user. This implies a lower mean household size in our sample than the national estimate of 2.65 in the 2014 American Community Survey. It may be the case that some households in our sample have multiple accounts with different individuals listed as the primary account holder. A full description of our samples can be found in the Data and Methodology Section.
- 2 The US Energy Information Administration reported national gas prices of \$2.43 in 2015 compared to \$3.36 in 2014, a 28 percent drop (US Energy Information Administration, 2016a). Our annual estimates reflect price levels weighted by spending observed in our sample across 23 states. See the Data and Methodology section for a description of this calculation.
- 3 The actual observed drop in gas spending for middle-income households based on debit and credit card spending was \$343, which we scale up to reflect an estimate of total spending. See the Data and Methodology section for an explanation of this scaling.
- 4 The mean drop in gas spending between 2014 and 2015 for the whole population (\$481) was nearly identical to that of middle-quintile households (\$477). Estimates for spending on rent or mortgage ("shelter") are based on annual estimates reported for the middle income quintile in the Consumer Expenditure Survey midyear update for the period July 2014 through June 2015 (\$8,870 divided by twelve months for a monthly estimate of \$739).
- 5 For this map we rely on a larger sample of regular debit or credit card users. See the Data and Methodology section for a description of this sample.
- 6 See the Data and Methodology section for a complete description of our approach.
- 7 It is worth noting that the Transit and Commute category includes not only rail and bus lines, but also taxicabs, limos, tolls, parking fees, and ridesharing apps.
- 8 While the long term trend has been an increase in fuel efficiency from 15 miles per gallon (MPG) in the 1980s to roughly 21 MPG in 2007, average fuel efficiency has been relatively flat since 2007. However, in 2014, the most recent data available, there was a 1.1 percent decline in average fuel efficiency (US Department of Transportation, 2016). This could be due in part to the recent increase in purchase of larger vehicles. US total vehicle sales reached a 15-year high in 2015 growing by 5.9 percent compared to 2014, due almost entirely to 12.7 percent growth in light trucks, which offset a decline in the sale of cars (US Bureau of Economic Analysis, 2016a). In addition to buying new cars that are less fuel efficient, it could also be the case that households that have more than one car are less likely to drive their most fuel-efficient car when gas prices are low.
- 9 Industry reports indicate that the percentage of people who cite price as the most important factor when purchasing gas increased from 66 percent in 2014 to 71 percent in 2015 (National Association of Convenience Stores, 2015). Any consumers who switched from regular to premium gas between 2014 and 2015 would have encountered a larger than usual price spread between regular and premium gasoline of 17 percent compared to 10 percent in 2014 (US Energy Information Administration, 2016a).
- 10 An increase in gas station convenience store purchases could indeed have a meaningful impact on overall spending at gas stations. The National Association of Convenience Stores estimates that 71 percent of sales at convenience store gas stations—where more than 80 percent of gasoline is purchased—comes from purchases of gasoline (National Association of Convenience Stores, 2013). In other words, nearly 30 percent of spending at those gas stations is on goods and services other than gasoline.
- 11 See the Data and Methodology section for a detailed description of this calculation.
- 12 Delinquency rates on auto loans declined by -0.1 percent in the fourth quarter of 2015 versus 2014 suggesting that the growth in auto loan debt balances is due to new auto loans rather than delayed payments on existing loans (Schlagenhauf and Ricketts, 2016).

- 13 We define metro areas as Core Based Statistical Areas (CBSA). We set 750 as the threshold in order to ensure that we had a minimum of 30 households in each combination of zip code and income quintile within a metro area. Households that met the first three sample criteria but did not live in a CBSA with a total of 750 households were combined into a synthetic CBSA for each state. If the synthetic CBSA within the state did not also have a minimum of 750 households, those households were excluded.
- 14 It is worth noting that we are not able to observe itemized purchase receipts and therefore cannot distinguish between gas and convenience store purchases within gas stations. However, the National Association of Convenience Stores estimates that 71 percent of sales at convenience store gas stations, where more than 80 percent of gasoline is purchased, comes from purchases of gasoline (National Association of Convenience Stores, 2013). The percent of gas sold at large discount stores, such as Walmart, has been increasing. At these stores fuel transactions are typically separate purchases and categorized as gas stations.
- 15 Research by the Federal Reserve Bank of San Francisco estimates that roughly 60 percent of total spending on food, personal care and general merchandise are made on credit or debit cards, compared to less than 50 percent for all other categories (Bennet et al., 2014).
- 16 Figures may not sum correctly due to rounding.
- 17 Although we believe benchmarking our estimates to the CES provides us with the best calibration, we believe our resulting scaling factor of 1.2 is conservative. Industry reports indicate that 78 percent of consumers paid for their gas using a debit and credit card in 2015 (National Association of Convenience Stores, 2015). In terms of total spending, consumers used debit or credit cards for 51 percent of their overall spending in 2012 (Herbst-Murphy, 2015) and 37 percent of their payments in 2013 (Schuh and Stavins, 2015). These estimates would imply a scaling factor of between 1.5 and 2.1. Discrepancies between our estimates and the CES may reflect not just non-card spending but also differences in unit of analysis. The CES estimates reflect a consumer unit or household, whereas some households in our data may have accounts under distinct primary account holders that would not be aggregated together in our data asset. As a result, our mean household size of 1.5 is substantially lower than the mean size of a consumer unit of 2.5 in the CES.
- 18 When we apply just the methodology described here to the Farrell and Greig (2015) sample, we estimate an MPC of 60 percent for January 2015, compared to 73 percent reported in Farrell and Greig (2015). Conversely, when we apply the Farrell and Greig (2015) methodology to the sample described here, we estimate an MPC of 86 percent for January 2015.
- 19 Seasonal category-specific promotions on credit cards could also influence spending choices on Chase credit cards. These might have influenced our results only for credit card spending to which these promotions applied and only to the extent that the promotions differed between 2014 and 2015. Credit card spending represented just 24 percent of total spending in our sample in 2015. The largest promotional program in our sample applied to roughly four percent of spend. Under that program, promotions differed between 2014 and 2015 in that five percent cash back was offered at gas stations in Q1 of 2014 but not Q1 of 2015; select grocery stores in Q1 of 2015 but not in Q1 of 2014; Lowes in Q2 of 2014 but Bed Bath & Beyond, H&M, and Overstock in Q2 of 2015; and Department Stores in Q4 of 2014 but not in Q4 of 2015.
- 20 We also estimate the marginal propensity to consume more gas using a difference-in-difference in levels approach comparable to our method for calculating the marginal propensity to consume non-gas goods and services. When doing so, we find that high-gas spenders were projected to save \$250 more than low-gas spenders, but they actually saved just \$173 more than low-gas spenders (69 percent), implying an MPC on gas of 31 percent. We observed that high- and low-gas spenders exhibited different trajectories in gas spending between 2014 and 2015: high-gas spenders decreased their gas spending by a larger percentage than low-gas spenders. Given the fact that high- and low-gas spenders exhibit different levels of gas spending, this difference in trajectories could bias our estimates upward. Comparing the percentage of potential savings spent on gas between high- and low-gas spenders (the results presented in Finding 4 and Figure 9) attempts to correct for this bias.
- 21 We also estimate the marginal propensity to consume more gas assuming the 2014 growth rate of 0.7 percent (US Bureau of Economic Analysis, 2016b). This increases the estimate from 24.5 percent to 25.5 percent.

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