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What do consumers believe about future gasoline prices?

Soren T. Anderson^a, Ryan Kellogg^b, James M. Sallee^{c,*}^a Michigan State University, NBER, United States^b University of Michigan, NBER, United States^c University of Chicago, NBER, United States

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ABSTRACT

A full understanding of how gasoline prices affect consumer behavior frequently requires information on how consumers forecast future gasoline prices. We provide the first evidence on the nature of these forecasts by analyzing two decades of data on gasoline price expectations from the Michigan Survey of Consumers. We find that average consumer beliefs are typically indistinguishable from a no-change forecast, justifying an assumption commonly made in the literature on consumer valuation of energy efficiency. We also provide evidence on circumstances in which consumer forecasts are likely to deviate from no-change and on significant cross-consumer forecast heterogeneity.

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1. Introduction

The price of gasoline is important for the economy and for economic research. Gas prices are particularly salient to consumers, and motor fuels account for 5% of all consumer expenditures. Moreover, oil price shocks are strongly correlated with recessions, even more than gasoline's expenditure share would explain (Hamilton, 2008). Consumer reactions to gasoline prices have been used to study a broad array of economic phenomena, ranging from the demand for automobiles (Busse et al., 2013; Li et al., 2009; Allcott, 2012; Gillingham, 2011; Linn and Klier, 2010) and driving choices (Small and Van Dender, 2007; Knittel and Sandler, 2012; Davis and Kilian, 2011; Li et al., 2012), to the consumption of leisure (West and Williams, 2007), search behavior (Lewis and Marvel, 2011), and mental accounting (Hastings and Shapiro, 2011).

Understanding how consumers respond to gasoline prices today requires information about what consumers believe about *future* gasoline prices. For example, if an increase in today's price causes consumers to expect an even higher price tomorrow, the effect of current price shocks on the macroeconomy could be amplified, perhaps by enough to explain the stronger-than-expected correlation between current prices and economic growth.

Unfortunately, little to no evidence exists regarding consumers' beliefs about future gasoline prices. What does the average consumer believe the future price of gasoline will be, and how does this belief vary with the current price? How varied are beliefs across individuals? Are consumers' beliefs reasonable? Do beliefs respond differently to different types of gasoline price shocks? How should researchers model consumer beliefs? In the absence of direct evidence, prior research has been left to make assumptions that are often guided by convenience. In this paper, we take first steps toward answering these questions by analyzing data from a high-quality survey that directly elicits consumer beliefs.

* Corresponding author. Fax: +1 773 702 2286.

E-mail addresses: sta@msu.edu (S.T. Anderson), kelllogg@umich.edu (R. Kellogg), sallee@uchicago.edu (J.M. Sallee).

URLS: <http://www.msu.edu/~sta> (S.T. Anderson), <http://www-personal.umich.edu/~kellogr> (R. Kellogg), <http://home.uchicago.edu/~sallee> (J.M. Sallee).

When consumers buy energy-using durable goods, they must forecast the future price of energy to determine their willingness to pay for energy efficiency. In turn, research that attempts to estimate or control statistically for consumers' valuation of energy efficiency must explicitly model consumers' beliefs about future energy prices and may draw biased inferences if these beliefs are mis-specified. This issue is most relevant for studies using identification strategies that rely on time-series variation in energy prices to identify demand—a strategy that is particularly common in automobile research (Kahn, 1986; Goldberg, 1998; Kilian and Sims, 2006; Li et al., 2009; Allcott and Wozny, 2011; Bento et al., 2012; Klier and Linn, 2010; Sallee et al., 2009; Whitefoot et al., 2011; Langer and Miller, 2011; Linn and Klier, 2010; Busse et al., 2013). These studies frequently assume that consumers adopt no-change forecasts for future gasoline prices in real terms; that is, they assume that the expected future price is the current price.¹ If consumer beliefs deviate significantly from this assumption, then researchers may under-estimate or over-estimate consumers' valuation of fuel economy (and other important attributes) depending on the direction of the deviation.²

In lieu of direct evidence, there is perhaps little reason to believe that consumer expectations will align conveniently with the no-change hypothesis favored by applied researchers. Future crude oil and gasoline prices are notoriously difficult to predict, and there is substantial controversy among academic and industry experts about what the future price of oil will be and how best to predict future prices (Hamilton, 2009; Alquist and Kilian, 2010; Alquist et al., 2013). The main goal of our paper is therefore to test directly whether consumers forecast the future price of gasoline to equal the current price.

We conduct our analysis using high-frequency data on consumer beliefs about future gasoline prices from the Michigan Survey of Consumers (MSC). Every month, the MSC asks a nationally representative sample of about 500 respondents to report their beliefs about the current state of the economy and to forecast several economic variables. Since 1993, the MSC has regularly asked respondents to report whether they think gasoline prices will be higher or lower (or the same) in five year's time and then to forecast the exact price change. To the best of our knowledge, we (along with Richard Curtin, our collaborator on a related paper (Anderson et al., 2011)) are the first researchers to use this unique cache of information on gasoline price expectations, and very little existing work directly measures consumer beliefs about future energy prices in any context.³

Our analysis indicates that in normal economic climates the average consumer expects the future real price of gasoline to equal the current price. That is, we generally cannot reject the hypothesis, commonly assumed in the automobile demand literature, that the average consumer's forecast of future gasoline prices moves one-for-one with changes in the current price. While a no-change gasoline price forecast is obviously not perfect, we believe it is a good benchmark for determining whether consumer forecasts are reasonable.⁴

We do identify some specific settings in which the average consumer's forecast deviates from no-change. The first such case is the 2008 financial crisis, during which consumers predicted that gasoline prices would rebound following their sharp decline. In a companion paper, Anderson et al. (2011), we show that this prediction turned out to be prescient. The second case deals with state-specific price shocks, such as those that might arise from local refinery outages, which tend to be short lived and for which a no-change forecast is therefore clearly inaccurate. We find that consumer forecasts do change less than one-for-one with state-specific gasoline price movements, but they nevertheless predict more persistence in state-specific shocks than is actually present in the historical data.

Two recent papers, Davis and Kilian (2011) and Li et al. (2012), find that gasoline consumption is much more responsive to changes in gasoline taxes than to changes in pre-tax gasoline prices. One explanation for this result, emphasized by both papers, is that consumers might perceive changes in gasoline tax policy to be more persistent than price fluctuations caused by shifts in supply and demand. We use our data to directly test this hypothesis, but we find no evidence that consumer forecasts respond more strongly to tax changes than to pre-tax price changes.

We also find substantial heterogeneity in forecasts across consumers. In our sample, the standard deviation in the price forecast across respondents each month averages 62 cents (in 2010 dollars). Using a simple simulation, we find that this heterogeneity may generate as much variation in consumers' willingness to pay for fuel economy as is generated by heterogeneity across consumers in vehicle miles traveled or discount rates. We also find that the degree of heterogeneity in consumers' forecasts co-varies with gasoline prices and that, when we study consumers who are surveyed twice (six months apart), this heterogeneity is mostly accounted for by individual fixed effects. We believe these results will be valuable for a

¹ Equivalently, consumers are assumed to believe that gasoline prices follow a martingale process. Throughout the paper, we use the “no-change” terminology as it accords with the literature on oil price forecasting (see for example Alquist et al., 2013). We do not use the term “random walk” because a random walk process further implies that the price innovations are iid.

² This issue is a specific instance of the broader empirical problem, discussed by Manski (2004), that preferences and expectations are generally not both identified from choice data alone.

³ One recent exception is Allcott (2012), which estimates automobile demand using a specially designed survey instrument that asks consumers to report (among other things) their beliefs about future gasoline prices in real terms. We compare our results to Allcott's below.

⁴ A no-change forecast for crude oil is theoretically sensible because rapidly rising or falling prices would induce storage and extraction arbitrage (Hamilton, 2009). In addition, no-change forecasts predict future crude oil prices as well as or better than forecasts based on futures markets and surveys of experts (Alquist and Kilian, 2010; Alquist et al., 2013). This argument is based on the crude oil literature. Retail gasoline prices may behave differently on short time horizons, but they will be tethered to crude prices over a five-year horizon. Likewise, retail prices may spike in specific locations due to refinery outages or supply disruptions, at which time it is reasonable to expect mean reversion in prices in those specific locations, but we believe such occurrences will be too rare to influence our aggregate statistics.

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