

Featured Articles on California's Economy

The opinions in these articles are presented in the spirit of spurring discussion and reflect those of the authors and not necessarily the Controller or his office. This month's report includes an article by C.-Y. Cynthia Lin, Assistant Professor, University of California at Davis, and Member, Controller's Council of Economic Advisors.

Gasoline Price Volatility

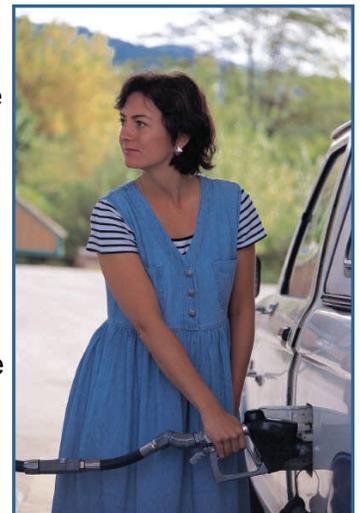
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Gasoline-powered passenger vehicles create numerous negative externalities including local air pollution, global climate change, accidents, congestion, and dependence on foreign oil. These externalities can be addressed by policymakers through a variety of actions aimed at reducing demand for gasoline or reducing pollution from automobiles. The latter could be addressed with state vehicle smog standards, industry standards, and efforts to reduce vehicle speeds and congestion. The former is typically addressed with gasoline or carbon taxes or automobile industry production standards for fuel efficiency.

A key parameter in the estimation of gasoline demand is the price elasticity of demand, which measures the percent change in gasoline demand for a percent change in gasoline price. It is a measure of how responsive consumers are to changes in the price of gasoline. The higher the elasticity in magnitude, the more consumers will decrease gasoline consumption in response to an increase in gasoline price.

A big concern among policymakers in terms of reduction of demand for gasoline is that consumers are not very responsive to changes in the price of gasoline. As the gasoline price increases, consumers do not cut back very much on gasoline. In other words, gasoline demand is inelastic. The literature shows increasingly inelastic demand for gasoline with respect to price in both the short and

long runs and recent studies using data up to 2006 have shown that price elasticity of demand has decreased by up to an order of magnitude in recent years, meaning that consumers have become significantly less responsive to changes in gasoline price. The change in price elasticity of demand may stem from structural and behavioral changes in the U.S. since the 1970s, which might include the implementation of Corporate Average Fuel Economy program (CAFÉ), changing land-use patterns, growth in per capita and household income and an increase in public transportation. The mechanisms driving the inelasticity in gasoline demand and the change in the magnitude of the elasticity over time, however, are not well understood. Moreover, anecdotal evidence suggests that despite the supposed inelasticity of demand, people did change their driving behavior and cut back on gasoline consumption when the gasoline prices were high in 2008. In ongoing research, I am examining the possible role the volatility in gasoline price may have played in explaining gasoline demand. It is possible that consumers were cutting back on



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Figure 1: Real Gas Price, Demand for Gasoline and Per Capita Disposable Income (1980-2009)

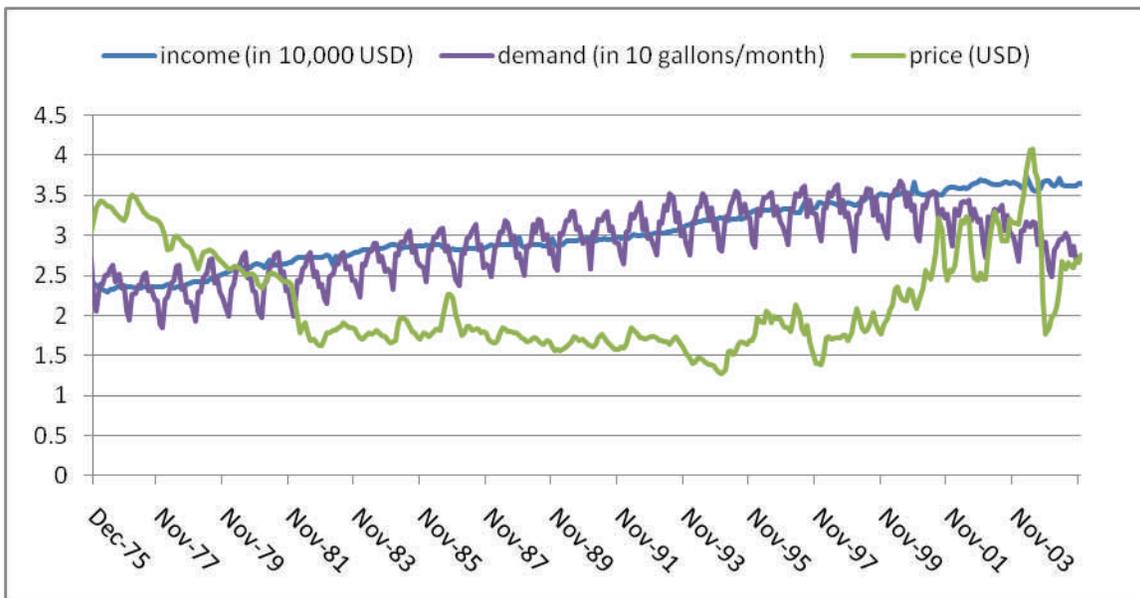
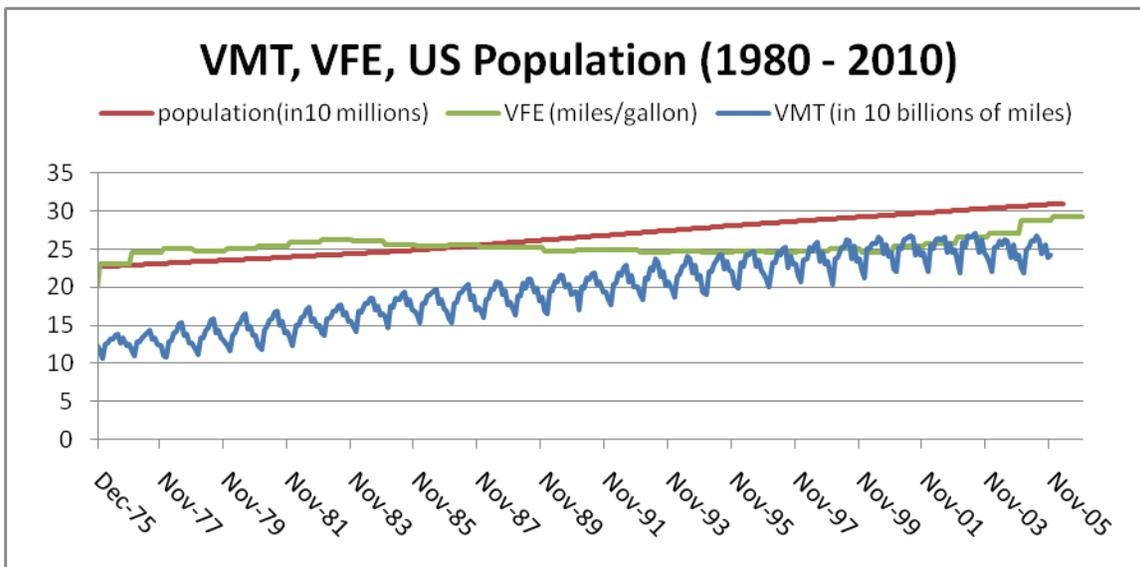


Figure 2: VMT, VFE, and US Population



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gasoline consumption in recent years not so much because the prices were high per se, but more because the prices were volatile.

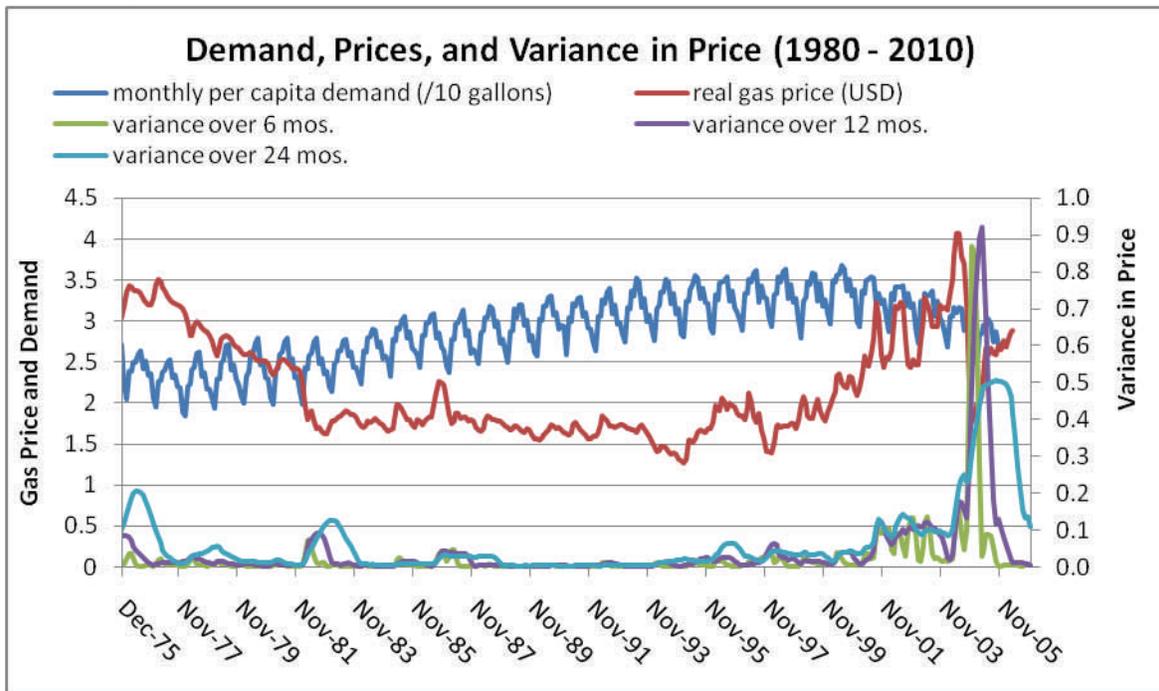
Retail gasoline prices have displayed higher than normal volatility in recent years. In 2008, gasoline hit its highest real price in the past 30 years at just over \$3.99 per gallon of unleaded regular grade gasoline in May of 2008 and dipped as low as \$1.74 per gallon just 7 months later. While there have

been extensive studies in which price elasticity of demand for gasoline has been estimated, it is unclear how volatility in gasoline prices impacts consumer demand.

Figure 1 shows per capita fuel demand, calculated as vehicle miles traveled (VMT), divided by vehicle fuel economy (VFE), plotted against real gasoline prices and per capita personal disposable income.

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Figure 3: Gasoline Demand, Price, and Variance of Price (1980 – 2010)



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In the past decade, U.S. real gas prices have hit both a 30-year low and high, and show more volatility compared to the relatively steady gasoline prices of the late 1980s and 1990s. Note the downward trend in per capita gasoline demand in the past five years – which occurs as per capita income continues to grow. This downward trend is the first since the early 1980s. In the 1980s there was a clear and sustained hike in the real price of gasoline and a slight dip in real per capita disposable income; the combination of these provide an easy explanation for the downward dip in income. The recent downward dip in demand, however, is occurring as per capita disposable income continues to grow while there is no sustained hike in real gas prices, although there is a general trend upward. This indicates that there are likely variables other than price and income that are impacting demand.

Figure 2 shows total U.S. VMT plotted against VFE and population. This illustrates the mechanisms behind the change in demand for gasoline, which are two-fold. In recent years, for example, where we see a slight down-turn in demand for gasoline, we see that vehicle miles traveled decreased beginning around 2006 and vehicle fuel efficiency

increased around the same time. Although changing VMT is largely a short-run phenomenon (even though there could be long-run components such as relocation and building of transportation infrastructure), changing VFE is likely a long-run phenomenon. Consequently, it is important to understand consumers’ responses in both the short and long runs in order to implement any policy aimed at reducing gasoline demand.

Figure 3 shows gasoline price, demand and variance in price, calculated over the previous 6, 12, and 24 months. The increase in price volatility since 2005 is apparent.

In an ongoing study, I am examining the effects of gasoline price volatility on the demand for gasoline. I find that volatility in prices has little impact on demand in the very short run. In the long-run, however, volatility in prices decreases the demand for gasoline. In an atmosphere of price volatility, consumers will tend to consume less gasoline. Thus, high volatility in gasoline prices in recent years may have caused consumers to reduce their gasoline consumption. These results have important implications for policymakers who wish to reduce gasoline consumption and the negative externalities it creates.