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## ❖ California Consumers' Responses to Rising Gasoline Prices

Gasoline prices have increased dramatically in recent years, leading many to wonder how consumers are responding to these higher prices. Economic theory tells us that if gasoline prices increase – and all other factors stay the same – we would expect consumers to purchase fewer gallons. However, in the real world such responses are extremely difficult to accurately measure.

### Price Elasticity Measures Response to Price Increases

The response to prices holding all other factors the same is what economists call price elasticity of demand. In a simple example, if the price of gasoline increases 10 percent and the price elasticity of demand for gasoline is -0.2 (a typical short run elasticity for gasoline), then we would expect a 2.0 percent decline in gallons sold.

### Population Growth Increases Gasoline Consumption

In the real world however, things are seldom that simple. All other factors rarely stay the same for very long. A major factor that changes constantly is population. California's population increased about 1.3 percent in 2006, and it is reasonable to assume that the number of drivers increased at close to the same percentage. It is also reasonable to assume that new drivers average the same number of miles annually as the rest of the drivers and that their cars have similar fuel economy. With this population growth and these other assumptions, we would expect

just a 0.7 percent drop in gasoline sales instead of a 2.0 percent drop in the simple example above.

### Consumers Response to Income Increases Consumption

Another important factor in gasoline consumption is income growth. Gasoline is what economists call a "normal" good, which means that if income (or gross domestic product (GDP), which is similar to income conceptually) increases, we tend to spend some of the additional income or GDP on gasoline. This relationship between income growth and gasoline consumption is called an income elasticity. California real gross domestic product per capita increased about 3.4 percent from 2005 to 2006. If we assume an income elasticity for gasoline of about 0.4 (a typical income elasticity for gasoline) then we would expect consumers to purchase about 1.4 percent more gasoline if prices did not change.<sup>1</sup> If prices and incomes were the only two factors affecting demand over a one-year period, we would expect gasoline consumption by households to be a combination of these two effects: higher prices diminish gasoline consumption while growing incomes increase it.

### A Review of Price Elasticity Estimates

There are many other factors besides income that affect the price elasticity of demand for

<sup>1</sup>In theory and in most empirical studies income elasticities are positive numbers, while demand elasticities are negative numbers. Typically real income or real gross domestic product per capita figures are used in income elasticity calculations.

gasoline. Income and these other causal factors are difficult to statistically separate from price elasticities in making estimates. These statistical difficulties lead to a wide range of price elasticity of demand estimates for gasoline.

A review of studies for the U.S. indicates that retail price elasticities of demand for gasoline are relatively low (in absolute value) and may have decreased since the 1970s. In 2003 the Congressional Budget Office cited a 1991 study of 97 estimates of gasoline price elasticity that ranged from -0.3 to -0.9.<sup>2</sup> These included both “long run” and “short run” elasticities.<sup>3</sup> The CBO report stated that based on newer studies, the Department of Energy suggested a long run elasticity estimate of -0.38. In a 2006 study the U.S. Environmental Protection Agency assumed an “intermediate run” price elasticity of -0.2.<sup>4</sup>

<sup>2</sup>The Economic Costs of Fuel Efficiency Standards Versus a Gasoline Tax, December 2003, U.S. Congressional Budget Office, [www.cbo.gov/ftpdocs/49xx/doc4917/12-24-03\\_CAFE.pdf](http://www.cbo.gov/ftpdocs/49xx/doc4917/12-24-03_CAFE.pdf).

<sup>3</sup>Exact time periods for “long run” and “short run” are not often defined in most economic studies. This is because the definitions are based on varying lengths of time necessary for producers and consumers to respond to price changes. Responses can include purchases of more fuel efficient vehicles, which may take many years to occur in large numbers. Typically short run studies use weekly or monthly data and long run studies use annual data. The U.S. Environmental Protection agency also publishes elasticities for an “intermediate run.”

<sup>4</sup>Draft Regulatory Impact Analysis: Control of Hazardous Air Pollutants from Mobile Sources, Chapter 13, February 2006, U.S. Environmental Protection Agency, [www.epa.gov/otaq/regs/toxics/chapter13.pdf](http://www.epa.gov/otaq/regs/toxics/chapter13.pdf).

## Sharp Katrina-Related Gas Price Increase Predicted Using Elasticity

In a 2006 report, the Federal Trade Commission (FTC) used a price elasticity of demand estimate of -0.2 to predict the short run (one month) gasoline price impacts of Hurricane Katrina.<sup>5</sup> This analysis illustrates that the impacts of changes in supply greatly magnify changes in gas prices because the elasticities are so low. In this example, Hurricane Katrina reduced gasoline supplies by 3.9 percent. With a -0.2 price elasticity, the FTC estimated a price increase of 19.7 percent would occur one month later.<sup>6</sup>

## Gasoline Price Elasticities Declining Since the 1970s

A 2007 study by several University of California researchers estimated short run (monthly) U.S. gasoline price and income elasticities for both the 1970s and from 2001 to 2006 using alternative econometric (statistical) models.<sup>7</sup> The authors used a consistent set of data and models for both time periods. An interesting finding in this study

<sup>5</sup>Investigation of Gasoline Price Manipulation and Post-Katrina Gasoline Price Increases, Spring 2006, Federal Trade Commission, [www.ftc.gov/reports/060518PublicGasolinePricesInvestigationReportFinal.pdf](http://www.ftc.gov/reports/060518PublicGasolinePricesInvestigationReportFinal.pdf).

<sup>6</sup>This estimate was calculated by dividing 3.9 percent by 0.2. The result is 19.5 percent, which differs from the 19.7 percent cited in the paper because of rounding.

<sup>7</sup>Jonathan Hughes, Christopher R. Knittel, and Dan Sperling, “Evidence of a Shift in the Short-Run Price Elasticity of Gasoline Demand” (February 14, 2007). Center for the Study of Energy Markets. Paper CSEMWP-159. [repositories.cdlib.org/ucei/csem/CSEMWP-159](http://repositories.cdlib.org/ucei/csem/CSEMWP-159).

is that consumers appear to be less responsive to prices today than they were in the late 1970s (1975 to 1980). The results show price elasticities ranging from -0.21 to -0.34 in the 1970s. These estimates imply that if nothing else changes, a 10 percent increase in the average price of gasoline would result in consumption declines ranging from 2.1 percent to 3.4 percent. For the 2001 to 2006 period, the estimates range from -0.034 to -0.077. These estimates imply that if nothing else changes, a 10 percent increase in the average price of gasoline would result in consumption declines of less than one percent (about 0.34 to 0.77 percent). Another interesting finding from this study is that income elasticities ranged from 0.21 to 0.75 for both the late 1970s as well as the more recent time period.

### Typical Price and Income Elasticities Imply Small Consumption Response

From 2003 to 2006 California average gasoline consumption had increased 1.0 percent, while retail gasoline prices have increased about 38 percent after adjusting for inflation. Over the same time period real per capita gross state product increased 10.4 percent, and population increased 4.0 percent. From the earlier discussion, a relatively small increase in gasoline consumption occurring with such a large price increase should not surprise us. If we assume the growth figures given from 2003 to 2006, an income elasticity of 0.4 and a price elasticity of -0.2, the result is very close to a 1.0 percent increase in gasoline consumption.

## ❖ U.S. Economic Developments

### Below Average Real GDP Growth in Recent Quarters

Turning to recent trends in overall U.S. economic growth, real gross domestic product (GDP) rose a seasonally adjusted annual rate of 2.0 percent in the first half of 2007. Growth has been below its long-term average of 3.1 percent since the first quarter of 2006. According to many economists, real GDP growth is expected to remain below its long term trend for the rest of 2007 before improving in 2008. A survey of 53 professional forecasters polled by the Federal Reserve Bank of Philadelphia in May calls for real GDP to increase 2.1 percent in 2007 and 2.9 percent in 2008.

## ❖ California Economic Developments

### California Real GDP Faster Than U.S.

In June the U.S. Bureau of Economic Analysis released its annual GDP estimates for states for 2006 and revised estimates for the previous three years. The report shows that California real GDP has grown much faster than U.S. GDP for the past three years, both in total and on a per capita basis. Real per capita GDP increased 3.4 percent in California in 2006, while U.S. per capita real GDP increased 2.4 percent.

### California Employment Growth Faster Than U.S. So Far In 2007

Available data indicate that the California economy appears to be continuing to grow faster than the U.S. as a whole so far this year. One of the most comprehensive indicators of economic well being available for

states on a timely basis is nonagricultural payroll employment. California payroll employment in the first half of 2007 increased 1.6 percent compared to the first half of 2006, which was faster than U.S. payroll employment growth of 1.5 percent. In 2006, California payroll employment rose 1.9 percent, while U.S. payrolls increased 1.8 percent.

### Construction Permits Declining In 2007

Construction Industry Research Board data indicate that from January through June 2007, home building permits were issued at a seasonally adjusted annual rate of about 126,000.<sup>8</sup> This figure is below that of the Governor's May Revision forecast of 132,800 permits for this year. Both of these figures are far lower than in 2006 when 164,000 residential home permits were issued in California.

### Declining Home Sales, But Rising Home Prices

In June the California Association of Realtors (CAR) issued its mid-year forecast of housing activity for 2007.<sup>9</sup> They forecast a 14 percent decline in existing home sales, but a 1.8 percent increase in median home prices for this year. The June forecast was an update of the original 2007 forecast released by the CAR in October 2006. Compared to its October forecast, CAR is now forecasting a greater decline in existing home sales, but higher median home prices.

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<sup>8</sup>Website: [www.cirbdata.com](http://www.cirbdata.com).

<sup>9</sup>"Mid-Year Forecast Update," *Trends in California Real Estate*, June 2007, California Association of Realtors, [www.car.org/library/media/papers/pdf/2007%20Midyear%20Forecast.pdf](http://www.car.org/library/media/papers/pdf/2007%20Midyear%20Forecast.pdf).

## Contact Us

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To contact your Board Member, see [www.boe.ca.gov/submenus/boardmembers.htm](http://www.boe.ca.gov/submenus/boardmembers.htm)

## Online Resources

For more information about topics covered in this issue, please visit any of the websites listed below.

**California Department of Finance**  
[www.dof.ca.gov](http://www.dof.ca.gov)

**California Employment Development Department (EDD), Labor Market Conditions in California**  
[www.labormarketinfo.edd.ca.gov](http://www.labormarketinfo.edd.ca.gov)

**Federal Reserve Bank of Philadelphia, Survey of Professional Forecasters**  
[www.phil.frb.org/econ/spf/index.html](http://www.phil.frb.org/econ/spf/index.html)

**National Association for Business Economists**  
[www.nabe.com](http://www.nabe.com)

**U.S. Bureau of Economic Analysis**  
[www.bea.gov](http://www.bea.gov)

**U.S. Bureau of Labor Statistics**  
[www.bls.gov](http://www.bls.gov)

**U.S. Census Bureau**  
[www.census.gov](http://www.census.gov)