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# IVERSITY CENTER FOR BUSINESS AND **ECONOMIC RESEARCH**

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### The Effect of Higher Fuel Prices on Nalitra Thaiprasert, PhD Research Economist Indiana's Economy

Michael J. Hicks, PhD, Center Director

#### INTRODUCTION

A significant increase in gasoline prices has the potential to slow the Indiana economy. With current gasoline prices at or above \$3.00 per gallon (in mid-January 2011), and with some projections suggesting possibly \$4.00 by late spring of 2011, a review of the impact of higher gasoline prices on the state's economy is warranted.

This report is designed to identify some of these effects and the economic sectors in which they occur. We do so in three parts. First, we explain the increase in petroleum prices and how they translate into higher gasoline and diesel prices in Indiana. Second, we review our model and estimate the effect of gas prices on specific industries in Indiana. In the third part, we summarize the results.

### **HOW DO HIGHER GASOLINE PRICES** ALTER ECONOMIC ACTIVITY?

From June 2007 to June 2008, the average gasoline price in US cities rose from \$3.05 to \$4.06. During the same period, the unemployment rate in Indiana rose from 4.5 percent to 5.6 percent. While part of this increase could be attributable to a slowing of new home construction and higher interest rates, our analysis of monthly data from 1978 through the present finds that a \$1 change in gasoline prices is associated with a 1.3 to 1.5 percent change in the unemployment rate. The smaller effect observed in the 2007-8 period may be attributable to a somewhat lessened dependence on gasoline now than in the earlier years of our study. Nevertheless, even with advances in

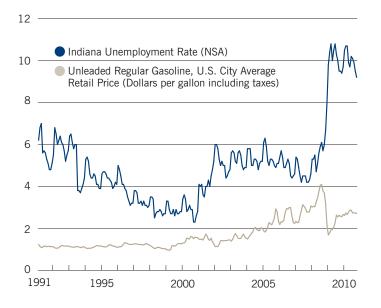
energy efficient vehicles, public transportation and alternative fuels, we remain very dependent on petroleum, and an increase in its price slows the U.S. and Indiana economies.

The 2007 price increase initiated a recession 10 months in advance of the September 2008 stock market decline. In Indiana, the effect of higher gasoline prices was especially problematic in some regions due to the concentration of manufacturing in automotive and recreational vehicle parts and assembly. Indeed, the last major layoff in Elkhart county, Indiana happened in August, 2008, a full month prior to the collapse of Lehman Brothers and the sharp national increase in unemployment.

Any increase in gasoline prices today will have very similar effect. While we are a nation in economic recovery, with a more fuel efficient vehicle stock than in 2007, the overall consequences of a similar gasoline price increase will be indistinguishable from the 2007-2008 period.

Higher fuel prices affect consumers, businesses and government alike. Higher prices at the pump increase the cost of commuting, recreational travel and reduce available income for consumers to purchase other goods and services. Businesses in virtually all sectors experience higher production costs as moving goods by rail, barge, or truck becomes more expensive. Demand for many goods also declines as consumers have less disposable income for non-transportation related spending. Government, like businesses and consumers purchases goods and services that are now more costly. This ranges from school lunches to gasoline for police patrols. Energy, especially gasoline, is

## FIGURE 1: AVERAGE GAS PRICES OVER TIME VS. INDIANA UNEMPLOYMENT RATE



# TABLE 1: FUEL EFFECTS ON AVERAGE NET HOUSEHOLD INCOMES

Household Income Category	Lost Income Equivalent (percent)
Income less than \$10,000	-0.32
\$10,000 to \$14,999	-0.68
\$15,000 to \$24,999	-1.06
\$25,000 to \$34,999	-1.20
\$35,000 to \$49,999	-1.32
\$50,000 to \$74,999	-1.67
\$75,000 to \$99,999	-1.56
\$100,000 to \$149,999	-1.66
\$150,000 or more	-1.72

the one nearly universal input to production. As Figure 1 suggests, the dance between gasoline prices and unemployment in Indiana is uncomfortably close, especially from 2000 to 2008.

## ESTIMATING THE EFFECT OF FUEL PRICE CHANGES ON THE INDIANA ECONOMY

This study employs a regional computable general equilibrium model with which to estimate the effects of gasoline, diesel, and crude oil price changes on the Indiana economy. Our computable general equilibrium (CGE) model consists of equations which describe the intersectoral linkages of over 500 of Indiana's industries, nine representative types of households, Federal, State and local government and commodities. CGE's are widely used to simulate the effects of shocks to an economy such as alternative tax policies or commodity prices.

Our CGE model was specifically developed to evaluate the effects of fuel prices and quantities on regional economic activity. The CGE provides a platform for traditional assumptions about consumer and business behavior. Our model assumes that markets generally clear (though we permit increases in unemployment rates) and that consumers and businesses make cost minimizing choices with respect to their consumption options. This permits relocation of labor through migration. The model specifically permits trade imbalances (both foreign and rest of USA). It is a short run model where capital supply is fixed (we constrain the model to the current level of plant and equipment). The model permits general price level changes (inflation) as a result of shocks.

In order to estimate the effect on Indiana's economy of the recent increase in gasoline, diesel, and crude oil prices, we begin with a baseline model from 2006. We then increase fuel prices as occurred

on average in 2010 (\$2.77 per gallon for gasoline, \$2.94 for diesel and \$76.00 per barrel for crude oil) to the level expected in 2011 (\$4.00 per gallon for gasoline and diesel and \$100 per barrel for crude oil). This allows us to estimate the more recent event using the baseline economy.

We then computed the change in their trade prices in and out of Indiana and its effects on other variables, such as household spendings, household and government incomes and production across Indiana's industries. We omit the government effect from sales and excise tax on fuel as it involves a secondary feedback loop in terms of tax receipts, but include the government effect from income and indirect business taxes.

Importantly, other things occurred at the same time. Indiana saw significant changes to its tax policies, the Federal Reserve lowered interest rates in order to mitigate the effects of a slowing national economy, and the government instituted a fiscal stimulus package that directly paid households from May to August of 2008. Our model intentionally omits these impacts in order to isolate the effect of gasoline prices, holding all other facets of the economy constant.

### **RESULTS**

We simulated a roughly \$1.00 increase in gasoline and diesel prices (a 50 percent increase), and a roughly \$25 increase in crude oil prices (a 30 percent increase) between 2010 and 2011.

The calculated effects are based heavily on the consumption of gasoline and diesel fuels, and crude oil by each element of the economy and the estimated responsiveness of use by each. We report household effects then aggregate sectoral effects in this section.

TABLE 2: IMPACTS OF A ROUGHLY \$1.00 PER GALLON FUEL PRICE INCREASE AND A \$25 PER BARREL CRUDE OIL INCREASE ON INDIANA'S ECONOMY

Industry	\$Millions	Percent Change	Industry	\$Millions	Percent Change
Oilseed farming	-5.02	-0.38	Oilseed processing and refining	-255.80	-13.47
Grain farming	-3.95	-0.23	Processed food	-199.46	-1.38
All other crop production	-4.77	-0.76	Manufacturing: textile, leather, wood, paper, printing, plastics and rubber	-137.49	-0.66
Animal production including cattle poultry eggs	-53.11	-2.62	Petroleum & coal product manufacturing (such as asphalt)	-142.35	-9.97
Mining and quarrying	-29.80	-3.93	Chemical manufacturing	-334.99	-1.18
Construction	24.25	0.09	Nonmetallic, mineral product manufacturing	-54.22	-1.32
Water, sewage and other systems	-19.12	-1.61	Primary and fabricated metal product manufacturing	-719.75	-1.77
Private electric	-73.70	-1.27	Machinery manufacturing	33.40	0.20
Wholesale trade	-218.14	-1.05	Computer electronic electrical equipment manufacturing	44.31	0.34
Retail trade	-311.01	-1.23	Transportation equipment manufacturing	92.24	0.15
Rail transportation	-22.50	-1.57	Miscellaneous manufacturing	0.31	0.00
Water transportation	-9.40	-1.01	Other services	-1174.16	-0.83
Truck transportation	-46.78	-0.53	Accommodation and food services	-173.84	-1.41
Transit, ground passenger and sightseeing	-65.27	-5.37	Public Administration and special sectors	-675.05	-1.443
Other basic organic chemical manufacturing	-84.16	-7.61			

Indiana's households suffered two primary effects from the fuel price increase. Most visibly, their consumption costs increased and net household income declined. To illustrate this, Indiana's average commuting time is 22.7 minutes. Assuming average speeds of 45 mph and fuel efficiency of 18 mpg this translates into an increase in fuel costs of roughly \$11.82 per week. This annualizes to roughly \$614 in fuel expenses related to commuting only. Cost for leisure, shopping and other transportation would be higher.

Households in Indiana are also affected by lost income associated with diminished economic activity. This is not simply isolated to wages and salaries, but also to income derived from investments (financial and real estate) and other income producing sources. The effect on higher income families is due to relatively larger income sources from investments (See Table 1).

The effect of gasoline prices on specific industries is contingent upon the level of consumer demand for their goods (including intermediate goods from other factories). It also affects firms as a cost of production. This translates directly into losses of economic activity. The estimated losses due to a \$1.00 price increase in gasoline (similar to the June 2007-June 2008 experience) for selected sectors appears in Table 2.

These results do not include estimates of costs to the energy sector. As users of petroleum to produce electricity, natural gas and refined gasoline, this sector also paid higher prices for inputs.

In addition to these disaggregated effects on households and industries, the aggregate economy in Indiana would be reduced by 1.95 percent as a consequence of a \$1.00 gas price and \$25 crude oil price increase. As a consequence, the unemployment rate should rise by 1.3 percent (very close to our long run estimate of 1.5 percent) and state government tax revenues would decline by 0.49 percent.

### SUMMARY AND CONCLUSIONS

This study provides a simulation for a \$1.00 gasoline price and \$25 crude oil price increase from January 2011 prices of nearly \$3.00 per gallon. This is similar to the increase in gasoline prices experienced in the U.S from summer 2007 through summer 2008, and is accompanied by similar economic changes. In particular, though the U.S. economy is modestly less sensitive to gasoline prices, its overall performance remains overall very linked to energy prices. A \$1.00 price increase would result in lower economic activity (close to 2 percent), lower employment (roughly 1.3 percent) and lower state tax revenues (roughly one half a percent) than would otherwise be the case if gasoline prices remained where they are today. Fortunately, this effect will be less painful during an economic recovery than it was at the start of the last recession. But, a gasoline price increase of this amount will slow the recovery in Indiana dramatically.

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The Center for Business and Economic Research, formerly the Bureau of Business Research, is an award-winning economic policy and forecasting research center housed within Ball State University's Miller College of Business. CBER research encompasses health care, public finance, regional economics, transportation and energy sector studies. We manage the publication of the *American Journal of Business*—a peer-reviewed scholarly journal—and the *Indiana Business Bulletin*—a weekly e-newsletter with weekly commentary and regularly updated data on housing, wages, employment, consumption, exchange rates and dozens of other economic indicators that provide evidence of the direction of change in the local, state and federal economy. In addition to research, we serve as the forecasting element in the Muncie area—holding five state and federal economic forecasting roundtables.

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