

The Impact of Petroleum Product Prices on State Economic Conditions: An Analysis of the Economic Base

by

Christopher S. Decker

Mark E. Wohar

Department of Economics
College of Business Administration
University of Nebraska at Omaha
Omaha, NE 68182-0048

Abstract

In June of 2000, Indiana Governor Frank O'Bannon suspended that state's gasoline sales tax for a period of sixty days and later that summer extended the suspension an additional fifteen days, a move that was estimated to cost the state between \$22 and \$30 million in lost revenue collections. Other states during that time also proposed similar measures. While it is generally accepted that different US state economies, having different industrial compositions, will respond differently to changes in energy prices, relatively few studies have attempted to quantify these differences. Building on the few existing studies, the question addressed in this paper is where would such a policy foster economic growth (or hinder an economic downturn) and to what degree.

1. Introduction

Recent sustained increases in world oil prices as well as the current political environment have revitalized interest among economists and policy analysts in understanding the economic impact of energy on the US economy. Combined with recent terrorist activities, these price increases have renewed concerns over this country's dependence on foreign oil, resulting in heated debates over how best to overcome this dependence.

While much of the debate has taken place at the national level (i.e. whether to promote alternative fuel technologies, open up the Alaskan Wildlife Refuge for oil exploration and development, and so forth), there have been some state and local policy responses to increased energy prices. Most of these policies are designed to be transitory in nature in an effort to "weather the storm" of high prices until international oil markets return to equilibrium levels. For instance, declaring an "energy emergency" in June of 2000, Indiana Governor Frank O'Bannon suspended that state's gasoline sales tax for a period of sixty days and later that summer extended the suspension an additional fifteen days. While the mid-western states did indeed witness some of the largest increases in gasoline prices that summer and Indiana residents surely realized some relief at the gas pump as a result of this policy, the move was estimated to have cost the state between \$22 and \$30 million in lost revenue collections. Moreover, that same year, Pennsylvania State Senator Jeffrey Piccola lobbied (unsuccessfully) to temporarily suspend that state's liquid fuels tax in an effort to lower gasoline prices.

The efficacy of such temporary tax policies is itself subject to question. Opponents of such measure point to canceled or delayed road development or improvement projects resulting from lost state revenues. Such cancellations and delays can jeopardize road safety and construction jobs. Moreover, it is argued that lower gas prices resulting from the tax suspension

will likely increase gasoline consumption, running counter to efforts to alleviate foreign oil dependence.

Proponents of such policy can point to a large number of studies that have linked surges in oil prices to economic disruptions (see Stern, 1993 for a review of this literature). For instance, Hamilton (1983) found that every recession in the US, save one, was preceded by a substantial increase in oil prices. Stern (1993) too found a “Granger causal” relationship between final energy use and GDP growth in the US. Moreover, using a Vector Autoregressive (VAR) to model the US economy, Deravi and Hegji (1992) found that while increases in oil prices had a negligible effect on inflation, impulse response functions generated from a positive shock to world oil prices produced sizable, though transitory, reductions in real GDP growth. Therefore, it would seem that a policy aimed at reducing energy prices should have real effects on the economy.

Of course, the difficulty with relating the results of these studies to policies such as the one adopted by the state of Indiana is that the impacts of energy prices on an economy will vary from region to region. For instance, energy producing states such as Texas and Wyoming might very well welcome higher energy prices since it stimulates oil and gas exploration and production. Moreover, energy prices themselves vary by region. According to The US Department of Energy’s Energy Information Administration (EIA), in May of 2001 gasoline prices ranged from an average \$1.47 in Louisiana to nearly \$2.00 in California.

This being the case, two questions are addressed in this paper. First, which states will likely be the most adversely affected by higher energy prices? Second, which states will benefit the most from higher energy prices? Finally, building on answers to these questions, from a

policy perspective, which states are likely to be the greatest beneficiaries of temporary energy tax suspensions?

This paper is arranged as follows. In Section 2 we discuss the relevant regional economics literature on energy's role in determining state economic growth. In section 3 we discuss the state-level data employed in this study highlighting for each state the energy-intensive industries' contributions to the state's economic base growth. In section 4 we present our regression results, and in section 5 we rank states in terms of their respective sensitivities to a suspension of a state gas tax. In section 6 we address some of the political and economic considerations of such a policy from the perspective of our estimates and in section 5 we conclude.

2. Energy, growth, and economic base theory

While empirical studies focusing on energy price impacts on the national economy abound, our review of the literature suggests surprisingly little attention has been paid to its impact on regional (state-level) economies. Moreover, there seems to be little consensus as to the significance of energy's impact on regional economies. For instance, investigating the economies of three energy-producing states, Hunt (1988) finds lower world oil prices reduce employment growth in Wyoming and Oklahoma by between 2 and 3 percent while employment is only slightly increased in Colorado (presumably because Colorado has a more diverse industry mix in its economy). Hoag and Wheeler (1996) find that national oil price movements account for nearly 25 percent of the variance in mining employment in the state of Ohio. Finally, Bohi, and Powers (1993) finds that increases in national oil prices reduce employment and Gross State Product (GSP) growth in non-energy producing states, although the effect is very small. Contrary to these results, Munnell (1990), in a cross-sectional investigation of state employment

growth over the periods 1970 to 1988, 1970 to 1980, and 1980 to 1988 for all states and industries, finds the cost of energy (dollars per million BTU) is not consistently statistically significant. When it is, the estimated coefficient tends to be positive, running counter to the presumption that in the short and medium run energy and labor inputs are complements.

The study closest in spirit to ours is Brown and Hill (1988) who attempt to estimate the employment effects of world oil price reductions experienced between 1985 and 1988. As expected, they find that energy-producing states (Wyoming, Oklahoma, and so forth) are adversely affected by energy price declines. Conversely, those states whose principle industries consume energy inputs benefit, though statistical results obtained are not directly reported in the study.

Our analysis departs significantly from the afore-mentioned in a number of key respects. First, all of the existing work has investigated regional employment or income impacts of movements in national or world energy prices, primarily the world dollar price of crude oil per barrel. However, as illustrated by the EIA data discussed above, this obscures the fact that energy prices can vary substantially from state to state. Hence, we focus attention on state-level petroleum prices as our energy price variable. Second, while like many of the previous studies mentioned measure state economic performance as employment growth, we focus attention on employment growth for those industries within a given state that are considered “basic” industries.

Economic Base Theory. There are many different modeling structures that have been employed to measure regional economies. Among these are input-output models and computable general equilibrium models. Other regional models adopt a type of Keynesian

structure as well.¹ Finally, there is the so-called economic base theory. While all of these various methodologies have various benefits and costs, we focus on an investigation of the latter.

While challenged many times in its rather lengthy existence, Economic Base Theory remains one of the principle theories of regional economic growth for at least two reasons. First, empirical support for the model remains reasonably strong and second, it is the central structure employed in almost every regional forecasting model today (Polzin, 2001). The essence of the theory asserts that a regional economy consists of sectors that are exogenous (or basic) to the local economy and sectors that are endogenous (or derivative) to the local economy. These exogenous sectors represent the specialized production of goods and services for a given region whose primary market lies outside regional boundaries. Therefore, much of the output from these sectors is for export outside the region and thereby injects income into the local economy. The automobile industry in southeast Michigan and the movie entertainment industry in southern California might be examples of industries “basic” to the local economy. The derivative industries are those that depend on the basic industries and whose purpose is to support the local economy. Examples might include retail establishments, restaurants, construction activity, and the like.

Classification of industries as basic and derivative. In determining which industries are basic and which are not in a given state, we adopt a procedure developed by the US Bureau of Economic Analysis (BEA) (1995). Their method takes into consideration both qualitative industry characteristics as well as statistical thresholds when classifying an industry as basic or not. Durable goods manufacturing, most non-durable goods manufacturing, agriculture, and some transportation sectors are generally viewed as servicing national (or even international) markets and are therefore classified as basic. For other sectors, determining if it’s basic to a local

¹ See Armstrong and Taylor or a good discussion of the various methodologies used in regional economic policy.

economy depends on whether or not the calculated location quotient, LQ_{si} exceeds a certain pre-determined threshold level.² A location quotient is simply the ratio of a state's share of economic activity, S_{si} , (in our case employment) in a given industry to the same ratio for the country as a whole, S_{USi} :

$$LQ_{s,i} = \frac{S_{s,i}}{S_{US,i}} \quad (1)$$

For instance, if the location quotient for food products exceeded 1.15 in a given state, then that industry was classified as basic.

Non-basic industries, by contrast are simply those industries that primarily support a local economies basic industries. Examples might include restaurants and shopping center services, local schools, and local government.

Energy and the base economy. As stated above, there is empirical support underscoring the importance of basic industry growth to the overall well-being of a state's economy. Polzin (2001) for instance shows empirically that over the periods 1969 to 1977, 1977 to 1985, and 1985 to 1994 a state's non-basic or derivative employment growth is strongly positively correlated with employment growth in a state's basic industries. Indeed, he finds little evidence to suggest that determinants other than basic industry growth, such as poverty rates, educational attainment and environmental conditions, consistently determine derivative employment growth.

With the economic base critical to the well-being of a state, the natural question to ask is what determines growth in the economic base. Since the focus of base industries is largely national in nature, then the economic growth for the US economy as a whole should in theory be

² For most industries, the threshold value is one. However, for some industries, the threshold values exceed one. These thresholds are constructed by BEA and are largely the result of investigating historical trends in these series. We adopt the BEA thresholds in this study.

the primary determinant of a state's economic base growth. However, many of the industries that comprise a state's economic base are "high energy content" industries, i.e. those industries that are either large consumers of energy inputs or large generators of energy inputs (such as oil and natural gas extraction, petroleum refining, etc.).

In classifying "high energy content industries", we utilized two sources. First, for manufacturing industries, we utilized The US Department of Energy's Energy Information Association's (EIA's) 1998 report on fuel consumption ratios by industry for the US as a whole. This ratio, calculated by EIA, measures a given industry's energy usage, measured in thousands of BTU's (British Thermal Units), per dollar of total value added generated in that given industry. The fuel consumption ratio for total US manufacturing was 9.4 BTUs per dollar of industrial value added. We classified those industries with ratios in excess of this average as "energy intensive." Those industries are textiles, wood products, paper, petroleum and coal products, chemicals, nonmetallic mineral products (stone, clay, and glass) and primary metals (primary iron and steel manufacturing). Since the EIA report only included manufacturing industries, we consulted the BEA's 1998 "USE" table from their input-output matrix for the US economy. This provided us with information on the inputs to each industry's total output. If an industry realizing a significant amount of its total value from oil and gas production and/or petroleum refining, we considered it an energy intensive industry. This analysis revealed that coal mining, nonmetallic mineral mining, pipelines, air, water, railroad, trucking and other service transportation sectors including local and interurban transportation (buses, taxis, etc.) should be added. Finally, we added oil and gas extraction itself to our list of energy intensive industries.

Column's 2 and 3 of Table 1 present each states' share of base employment that can be classified as energy intensive and the percentage contribution to base employment growth attributable to growth in energy intensive sectors.³ For example, energy employment's share of total base employment in Texas is 35 percent and over the period 1970 to 1999, energy employment growth accounted for 37 percent of total employment base growth in Texas. The data suggests that the energy sector's impact on base growth is higher energy producing states such as Wyoming, Louisiana, Texas and Oklahoma. Moreover, we would expect energy base employment growth to be positively correlated with higher energy prices in such states. Likewise, we should expect a negative correlation between energy prices and energy employment growth in energy consuming states. Reviewing these correlations in column 4 of Table 1, this tends to be the case. West Virginia, North Carolina, South Carolina, Tennessee, Ohio, and Indiana, for instance, derive a fair percentage of their respective economic base growth from energy intensive industries. These states tend to have a sizable amount of energy consuming industries such as chemical manufacturing and iron and steel manufacturing.

The foregoing analysis provides some indication of the relative importance of energy to a state's economy, however it provides little insight into the effect fluctuations in energy prices should have on the economy. This should depend on whether or not the state's base is primarily energy producing or primarily an energy utilizing. We would expect energy prices to correlate positively with the energy employment base in energy producing states since higher prices

³ Employment shares measure the ratio of the average employment in energy intensive sectors to the average of base employment over the period 1970 to 1999. The energy sector's share of base employment growth, *BASE*, was found by regressing over the period 1970 to 1999 for each state *s*

$\ln(BASE_{s,t} / BASE_{s,t-1}) = \beta_E * \ln(EBASE_{s,t} / EBASE_{s,t-1}) + \beta_{NE} * \ln(NEBASE_{s,t} / NEBASE_{s,t-1})$ where *E**BASE*_{*s,t*} is energy intensive sector employment and *NE**BASE*_{*s,t*} is non-energy intensive sector employment. The estimated β_E is reported as energy's share of total base employment.

induce increased oil and gas exploration, mining, and development.⁴ Likewise, to the extent that at least in the short run energy and labor inputs are complements in production, states whose energy base is composed of energy consuming should see reductions in energy base employment growth result from increase energy prices.

Column 4 of Table 1 presents correlation coefficients illustrating energy price movements with energy base employment growth over the period 1970 to 1999. Not surprisingly, strong negative correlations exist in heavy manufacturing states such as Alabama, Tennessee, Michigan, Iowa and Indiana and strong positive correlations appear in oil and gas producing states such as Texas, Oklahoma, and Alaska.

4. Econometric Analysis.

To measure regional price impacts on state employment growth, we have grouped states into six different categories based on the correlations reported in Table 1. Hence, we have created six different panel data sets that we use to conduct our econometric analysis. Ideally, it would have been advantageous to estimate for each state an equation relating energy-intensive economic base growth to energy prices thus providing us with state-unique energy price effects on economic growth. However, consistent state-level data on energy prices and employment are somewhat limited in the time dimension. Indeed, state-level energy price data is only available from the US Energy Information Administration as far back as 1970. Once all the necessary lags are introduced into the specification, degrees of freedom are severely limited making statistical inference unreliable. Therefore proceeded by creating these different panels.⁵

⁴ We might expect a positive correlation between energy prices and petroleum refining activities as well, however the effect may be mitigated. While higher crude oil prices might represent increased cost of inputs to refinery activity, the final products sold will fetch a higher price in the market. Given relatively inelastic demand (in the short run) for gasoline and home heating oils, etc. the net effect of higher energy prices for states whose energy base is largely petroleum refining might be positive.

⁵ We did, however, estimate fifty different regression equations, one for each state. Again, we feel that given the small sample size, the results are not reliable enough to present here (though these results are available upon

Category 1 states have correlations less than -0.40, category 2 between -0.40 and -0.20, category 3 between -0.10 and -0.20, category 4 between 0.00 and -0.10, category 5 between 0.00 and 0.10, and finally category 6 between 0.10 and higher. Table 1 reports each state's categorical designation.

The following six equations were estimated using both standard fixed-effects and random-effects OLS over the period 1970 to 1999:

$$\begin{aligned} \log(EBASE_{s,t} / EBASE_{s,t-1}) * 100 = & \alpha_s + \beta_P * \log(PP_{s,t} / PGDP_t) + \\ & \beta_G * \log(GDP96_{t-1} / GDP96_{t-2}) * 100 + \\ & \beta_E * \log(EBASE_{s,t-1} / EBASE_{s,t-2}) * 100 + e_{s,t}, \end{aligned} \quad (2)$$

where $EBASE_{s,t}$ represents for each state employment in energy intensive industries within a state's economic base, $PP_{s,t}$ is each state's average composite price for petroleum products, $GDP96_t$ is national growth domestic product, and $PGDP_t$ is the national implicit price deflator. The results of each panel regression are presented in Table 2.⁶

Focusing attention on the price effect, the resulting elasticities are negative for categories 1, 2 and 3 for both the fixed and random effects models and the price effect is strongly significant in categories 1 and 2. Moreover, the magnitudes are roughly similar across models as well. For the category 1 states, a 1 percent increase in the real price of petroleum products leads to an 8 percent decline in employment growth in energy intensive industries. For category 2 states, the resulting elasticity is about -4.7 percent. The price elasticity for category 3 states is about -1.0 percent but the effect is statistically insignificant.

request). However, it is important to note that the resulting coefficients (elasticities) on the petroleum price variable for each state are within the confidence interval of the petroleum price coefficient for each category where a given state resides. For instance, for the category 1 states, each estimated price elasticities resulting from the separate state regressions fell within the -5.7 and -10 percent range (see Table 2).

⁶To economize on space, the state intercept coefficients have been omitted from this table. However, complete results of all panel regression are available from the authors upon request.

For categories 4,5, and 6, the petroleum price effect is positive. However, real petroleum prices are only statistically meaningful for category 6 states. Within this category, comprised principally of energy producing states, a one percent increase in the real price of petroleum products increases employment growth in energy intensive industries by 4-to-5 percent. For category 4 and 5 states, the price elasticities are positive but small (0.2 and 0.92 percent respectively) and statistically insignificant.

5. Potential impact of state gasoline tax suspension.

These results highlight the potential benefits and costs of lower petroleum product prices in some states as well as providing some information on when changes in such prices are not likely to have a meaningful impact on a given state's employment base. Given the above estimated elasticities, it is in principle possible to more precisely estimate the potential benefit, in the form of saved jobs in a given states energy intensive employment base, of suspending a state's gasoline tax. Columns 1 and 2 in Table 3 report data on each state's imposed gas tax as well as the average price (including state and federal gas taxes) for regular unleaded gasoline in the year 2000 respectively. The final column reports the percent of the full gas price attributable to the state gas tax. Applying (the negative of) this percentage to the estimated price elasticities reported in Table 2, we can get a rough measure of the impact a gas tax suspension on a state energy intensive employment growth.⁷

Suppose, then, that each state had suspended their respective gasoline taxes in 2000. What would have been the impact on base employment in each state? In Table 4 we report the 1999 and 2000 energy intensive basic employment levels for each state as well as the growth rate

⁷ Implicit in this estimate is the assumption that there is a strong correlation between the price of petroleum products used to estimate the elasticities presented in Table 2 and regular unleaded gasoline prices. Given that, according to the US Department of Energy, transportation fuels accounts for about 67 percent of total petroleum consumption, this assumption seems reasonable (www.eia.doe.gov)

over that period. Utilizing the elasticities from Table 2 and the percent gas price reductions implied by the data presented in Table 3, we can estimate what 2000 energy base employment would have been in 2000 had a gas tax suspension been enacted by all states. Column 8 of Table 4 presents this imputed 2000 employment level and column 9 reports the difference between this and the actual 2000 employment level, ranked according to state that stand to gain the most from a gas tax suspension.⁸ In terms of jobs saved, the top five gaining states are Pennsylvania (gaining 5934 jobs with a confidence interval of 4233 and 7642 jobs), Ohio (gaining 5046 jobs with a confidence interval of 3600 and 6496 jobs), Tennessee (gaining 3344 jobs with a confidence interval of 3286 and 4305 jobs), North Carolina (gaining 3018 jobs with a confidence interval of 1769 and 4270), and Alabama (gaining 2416 jobs with a confidence interval of 1724 and 3109 jobs). Other states that gain from a state gas tax suspension include Indiana, Illinois, Wisconsin, and Michigan, all of whom are largely industrial, net energy consuming states. The top five losing states are Texas (expected to lose 5076 jobs but could lose over 10,000 jobs), Louisiana (expected to lose 1392 jobs), Oklahoma (expected to lose 1061 jobs), Kansas (expected to lose 630 jobs), and Colorado (expected to lose 626 jobs).

While these jobs losses (gains) can seem dramatic, working with levels can be misleading, particularly for highly populated states like Texas and Ohio.⁹ Viewing these job losses (gains) as a percent of 1999 energy intensive base employment, the top five gaining states are Pennsylvania (gaining 1.50 percent), West Virginia (gaining 1.36 percent), Oregon (gaining 1.21 percent), Ohio (gaining 1.20 percent), and Tennessee (gaining 1.19 percent). Other gaining

⁸ The table also provides an employment range based on the construction of a 95 percent confidence interval around each category's estimated $\ln(\text{PP}_{s,t}/\text{PGDP}_t)$ coefficient. Not surprisingly, the interval for some states is very broad, reflecting the insignificance of petroleum prices in those states. However, for those states (particularly category 1 states) where petroleum prices are significant, the interval is rather narrow, further suggesting that the estimated $\ln(\text{PP}_t/\text{PGDP}_t)$ coefficient is reliable.

⁹ It should be noted that working with percentages can be somewhat misleading as well particularly if one is considering a state that has a relatively small employment base to begin with.

states include, not surprisingly, Michigan, Iowa, and Indiana. The top five losing states are Colorado (losing 0.80 percent), Texas (losing 0.77 percent), Louisiana (losing 0.76 percent), Vermont (losing 0.73 percent) and North Dakota (losing 0.71 percent). Other states that lose the most as a result of a gas tax suspension include Kansas, Oklahoma, Wyoming and Alaska, all of whom are energy producing states. The percent losses in Vermont and North Dakota are striking since neither state is a net energy producer. However, both states have a relatively small energy intensive employment base and therefore the percent losses calculated will likely be larger and therefore can be misleading. Indeed, energy intensive employment's share of total economic base employment in Vermont and North Dakota is 11 and 18 percent, respectively. Relaxing the gas tax in these states is ultimately going to have a negligible effect on these states' economies.

6. The economics and politics of policy.

Certainly for states that overall benefit from higher petroleum product prices, a state gas tax suspension generates job losses. Therefore, states such as Texas, Louisiana, and Oklahoma are likely never to consider such policy. For those, primarily energy consuming, states where employment gains are likely to be had as a result of a tax suspension, the debate remains open.

It does seem reasonable to conclude from the above analysis that suspension of a gas tax is likely to have a negligible effect on a state's overall economy. Even a state such as Ohio where energy intensive (in this case, primarily energy consuming) jobs account for 32 percent of its employment base, the number of jobs saved on a percentage basis is rather small. Since the benefits of a tax suspension seem small and its potential costs, in the form of reduced revenues necessary to fund road and other state infrastructure products, can be rather high, we might conclude such a policy to be flawed.

Indeed, consider Indiana. As stated earlier, suspension of the gas tax is reported to have cost the state some \$22 million in lost revenue collections over a 60-day period. According to our analysis, the total number of jobs saved is on the order of 2,240. If the average worker in the energy intensive industries in question earns, say, \$60,000 per year and, as reported by Federation of Tax Administrators, Indiana's (flat) income tax rates is 3.4 percent, then saving these jobs could retain some \$4.6 million in income tax revenue.¹⁰ Further, if each worker were to spend 75 percent of his remaining income on state taxable goods and services, assuming a sales tax of 6 percent, tax revenues increase to about \$9 million. To be sure, this \$9 million figure does not reflect the savings in the form of unemployment compensation support that the state would otherwise have had to provide nor any feedback effects these saved jobs would have had on the rest of the state's economy. None-the-less, reaching total benefits of suspended tax relief necessary to cover the estimate \$22 million cost may be difficult to attain. Thus, while it is unreasonable to suggest that our analysis here is an indictment of a state gas tax suspension, it does highlight the need for precise measurement to determine if such a policy is economically justified.

7. Conclusion.

In this paper we have investigated the likely impact of reduced petroleum product prices on US states' economies. By decomposing state employment into basic versus non-basic industries and further subdividing basic industries into energy intensive versus non-energy intensive industries, we find that the petroleum price elasticity on energy intensive employment growth can range from -8.09 percent for those primarily energy consuming states to 5.29 percent for those primarily energy producing states.

¹⁰ See <http://www.taxadmin.org>

Focusing attention on policy aimed at suspending state gasoline taxes as a way to bolster the economy in periods of high energy prices and lackluster employment growth, our analysis suggests that such a suspension will have a beneficial effect on those energy consuming states and even in such states, the effect will likely be small.

There are several avenues of future research that would be beneficial to explore. First, the focus in this paper has been on employment. However, employment decisions by firms may not be as quick to respond to changes in energy prices as other inputs to production. It might be beneficial to explore energy intensive base industries' responses to energy prices using real gross state product or personal income rather than employment. Secondly, while economic base theory has some reasonably strong empirical support, it does not allow us to understand the inter-linkages between industries (either within or outside the economic base) that, say, an input-output or regional computable general equilibrium model can provide.¹¹

Since 2000, gas prices have by in large managed to remain high and given today's uncertain political environment, there is no immediate reason to believe that the price we enjoyed in the 1990s will return any time soon. Irrespective of the shortcomings of the methodology employed here, it is clear perhaps now more than ever, that we develop a clear understanding the links between prices and the economy. While a great deal of interesting and reliable work has been done to understand these linkages at the national level, more work must be undertaken at the regional level if effective local policies can be adopted to combat high energy prices.

¹¹ Although it should be noted that such models, while valuable in their own right, do suffer from data limitations that the model structure employed here does not.

References (working on still....)

Armstrong, Harvey, and Taylor, Jim. Regional Economics and Policy, 3rd ed. Blackwell Publishers, Inc., 2000.

Brown, Stephen P.A., and Hill, John, K. 1988. "Lower Oil Prices and State Employment," Contemporary Policy Issues. 4(3): 60-68.

_____. 1995. "Energy Prices and State Economic Performance," Federal Reserve Bank of Dallas, Second Quarter, 13-23.

Bohi, Douglas R., and Powers, John R. 1993. "Energy Price Shocks and Regional Output and Employment," The Review of Regional Studies, 129-142.

Hamilton, James D. 1983. "Oil and the Macroeconomy Since World War II," Journal of Political Economy, 91(2): 228-48.

Hoag, John H. and Wheeler, Mark. 1996. "Oil Price Shocks and Employment: The Case of Ohio Coal Mining," Energy Economics, 18: 211-220.

Hunt, Gary L. 1988. "The Impact of Oil Price Fluctuations on the Economies of Energy Producing States," Review of Regional Studies, 60-78.

Deravi, Keivan, and Hegji, Charles. 1992. "The Inflationary Impact of Oil Price Shocks: A Vector Autoregressive Study," Review of Financial Economics. 2(1): 1-16.

Munnell, Alicia H. 1990. "How Does Public Infrastructure Affect Regional Economic Performance?" New England Economic Review. Sept/Oct. 10-32.

Goetz, Stephan J., Ready, Richard, and Stone, Brad. 1996. "US Economic Growth vs. Environmental Conditions," Growth and Change. 27(4): 97-110.

Polzin, Paul E. 2001. "Why Some States Grow Faster than Others: New Growth Models for State Economic Policy," Growth and Change. 32(2): 413-425.

Stern, David I. 1993. "Energy and Economic Growth in the USA," Energy Economics. 137-150.

Indianapolis Star. 2000. "Governor Suspends Gas Tax," taken from Indystar.com at <http://www.indystar.com>, June, 2002.

"Pennsylvania Lawmaker Calls for State Gas Tax Relief," taken from [wysiwyg://47/http://www.bankrate.com/brm...Edit/state/profiles/tax_story_033000.asp](http://www.bankrate.com/brm...Edit/state/profiles/tax_story_033000.asp), June, 2002.

U.S. Department of Commerce. Bureau of Economic Analysis. 1995. BEA Regional Projections to 2045: Vo. 1, States. Washington DC: U.S. Government Printing Office.

Table 1: Energy employments share of Base Economic Growth.

STATE	ENERGY'S SHARE OF BASE EMPLOYMENT	ENERGY'S SHARE OF BASE GROWTH	Ebase CORR. WITH PETPRICE	CATEGORY
AK	0.27	0.22	0.35	6
AL	0.35	0.35	-0.48	1
AR	0.31	0.29	-0.31	2
AZ	0.12	0.12	-0.29	2
CA	0.06	0.07	-0.09	4
CO	0.07	0.10	0.22	6
CT	0.10	0.10	-0.11	3
DE	0.27	0.31	0.08	5
FL	0.04	0.05	-0.08	4
GA	0.25	0.26	-0.29	2
HI	0.13	0.11	-0.09	4
IA	0.19	0.19	-0.44	1
ID	0.26	0.27	-0.29	2
IL	0.15	0.14	-0.30	2
IN	0.31	0.31	-0.43	1
KS	0.24	0.26	0.26	6
KY	0.33	0.31	-0.30	2
LA	0.47	0.50	0.14	6
MA	0.06	0.09	-0.11	3
MD	0.06	0.07	-0.15	3
ME	0.15	0.19	-0.06	4
MI	0.16	0.17	-0.45	1
MN	0.21	0.20	-0.29	2
MO	0.20	0.20	-0.32	2
MS	0.28	0.26	-0.19	3
MT	0.17	0.20	-0.22	2
NC	0.39	0.39	-0.28	2
ND	0.19	0.18	0.27	6
NE	0.16	0.16	-0.06	4
NH	0.08	0.10	0.03	5
NJ	0.20	0.23	-0.07	4
NM	0.24	0.24	-0.03	4
NV	0.14	0.17	0.00	5
NY	0.07	0.10	-0.13	3
OH	0.32	0.32	-0.42	1
OK	0.30	0.35	0.50	6
OR	0.27	0.34	-0.43	1
PA	0.20	0.24	-0.43	1
RI	0.11	0.11	0.02	5
SC	0.41	0.44	-0.30	2
SD	0.14	0.13	-0.31	2
TN	0.34	0.34	-0.45	1

TX	0.35	0.37	0.38	6
UT	0.29	0.29	-0.31	2
VA	0.18	0.20	-0.12	3
VT	0.14	0.13	0.18	6
WA	0.22	0.26	-0.15	3
WI	0.26	0.23	-0.31	2
WV	0.63	0.68	-0.43	1
WY	0.45	0.51	0.18	6

Table 2: Regression Results.

	Fixed Effects				Random Effects			
	Coefficient	t-statistic	95% confidence interval		Coefficient	t-statistic	95% confidence interval	
Category 1								
(AL TN MI IA IN OR PA WV OH)								
Log($PP_{s,t}/PGDP_t$)	-8.094	-6.873 ***	-5.786	-10.402	-8.008	-7.996 ***	-6.045	-9.970
Log($GDP96_{t-1}/GDP96_{t-2}$)	0.803	4.963 ***	1.121	0.486	0.785	6.516 ***	1.021	0.549
log($EBASE_{s,t-1}/EBASE_{s,t-2}$)	-0.296	-2.609 ***	-0.074	-0.519	-0.278	-4.268 ***	-0.150	-0.405
Adjusted R ²	0.330				0.254			
LM (3 d.f.)	33.690							
Hausman test (3 d.f.)	-0.150							
Category 2								
(MO SD WI UT AR IL KY SC AZ GA ID MN NC)								
Log($PP_{s,t}/PGDP_t$)	-4.784	-4.748 ***	-2.809	-6.758	-4.729	-5.101 ***	-2.912	-6.546
Log($GDP96_{t-1}/GDP96_{t-2}$)	0.670	4.748 ***	0.947	0.394	0.641	5.736 ***	0.861	0.422
log($EBASE_{s,t-1}/EBASE_{s,t-2}$)	-0.172	-2.085 **	-0.010	-0.333	-0.143	-2.530 **	-0.032	-0.253
Adjusted R ²	0.174				0.141			
LM (3 d.f.)	7.330 ***							
Hausman test (3 d.f.)	0.020							
Category 3								
(MT MS MD WA NY VA MA CT)								
Log($PP_{s,t}/PGDP_t$)	-1.097	-1.165	0.749	-2.943	-1.144	-1.159	0.791	-3.080
Log($GDP96_{t-1}/GDP96_{t-2}$)	0.884	6.163 ***	1.166	0.603	0.864	6.551 ***	1.122	0.605
log($EBASE_{s,t-1}/EBASE_{s,t-2}$)	-0.349	-4.089 ***	-0.182	-0.516	-0.329	-4.477 ***	-0.185	-0.473
Adjusted R ²	0.218				0.133			
LM (3 d.f.)	27.200 ***							
Hausman test (3 d.f.)	0.020							

Category 4

(CA HI FL NJ ME NE NM)

Log($PP_{s,t}/PGDP_t$)	0.225	0.140	3.378	-2.928	0.036	0.020	3.535	-3.463
Log($GDP96_{t-1}/GDP96_{t-2}$)	1.011	4.630 ***	1.439	0.583	1.003	4.692 ***	1.421	0.584
log($EBASE_{s,t-1}/EBASE_{s,t-2}$)	-0.495	-2.592 **	-0.121	-0.868	-0.486	-7.821 ***	-0.364	-0.607
Adjusted R ²	0.264				0.238			
LM (3 d.f.)	4.770 **							
Hausman test (3 d.f.)	-0.150							

Category 5

(NV RI NH DE VT)

Log($PP_{s,t}/PGDP_t$)	0.919	0.510	4.453	-2.614	0.890	0.375	5.544	-3.763
Log($GDP96_{t-1}/GDP96_{t-2}$)	0.712	2.809 ***	1.208	0.215	0.695	2.442 **	1.254	0.137
log($EBASE_{s,t-1}/EBASE_{s,t-2}$)	-0.015	-0.143	0.196	-0.226	-0.002	-0.021	0.210	-0.215
Adjusted R ²	0.125				0.063			
LM (3 d.f.)	8.350 **							
Hausman test (3 d.f.)	-0.100							

Category 6

(WY LA CO KS ND AK TX OK)

Log($PP_{s,t}/PGDP_t$)	5.293	1.950 *	10.613	-0.027	4.296	2.371 **	7.847	0.745
Log($GDP96_{t-1}/GDP96_{t-2}$)	0.523	2.783 ***	0.891	0.155	0.511	2.605 ***	0.896	0.127
log($EBASE_{s,t-1}/EBASE_{s,t-2}$)	0.268	2.854 ***	0.453	0.084	0.299	4.599 ***	0.427	0.172
Adjusted R ²	0.138				0.153			
LM (3 d.f.)	0.410							
Hausman test (3 d.f.)	-0.100							

* Significant at 10 percent

** Significant at 5 percent

*** Significant at 1 percent

Table 3: State gas tax and average price of regular gasoline.

STATE	STATE GAS TAX (cents per gallon)	GAS PRICE (INCL. TAXES) (cents per gallon) ²	STATE TAX % OF FULL PRICE
AK	8.00	157.80	5.07
AL	18.00	138.10	13.03
AR	18.60	137.30	13.55
AZ	18.00	147.80	12.18
CA	18.00	151.90	11.85
CO	22.00	148.70	14.79
CT	36.00	167.70	21.47
DE	23.00	149.90	15.34
FL	13.00	132.20	9.83
GA	7.50	125.00	6.00
HI	16.00	163.30	9.80
IA	20.00	144.70	13.82
ID	25.00	156.00	16.03
IL	19.00	149.70	12.69
IN	15.00	140.30	10.69
KS	18.00	138.90	12.96
KY	16.40	141.20	11.61
LA	20.00	139.10	14.38
MA	21.00	154.10	13.63
MD	23.50	146.00	16.10
ME	19.00	149.00	12.75
MI	19.00	145.80	13.03
MN	20.00	151.30	13.22
MO	17.00	139.70	12.17
MS	18.40	141.60	12.99
MT	27.00	158.70	17.01
NC	22.30	140.90	15.83
ND	20.00	152.00	13.16
NE	24.60	149.10	16.50
NH	19.50	151.50	12.87
NJ	10.50	141.70	7.41
NM	18.88	147.18	12.82
NV	24.75	164.85	15.01
NY	22.65	150.15	15.08
OH	22.00	147.80	14.88
OK	17.00	136.00	12.50
OR	24.00	160.70	14.93
PA	25.90	147.40	17.57
RI	29.00	156.50	18.53
SC	16.00	134.20	11.92
SD	20.00	152.70	13.10
TN	20.00	137.40	14.56

TX	20.00	137.50	14.55
UT	24.50	148.90	16.45
VA	17.50	140.20	12.48
VT	20.00	151.00	13.25
WA	23.00	156.70	14.68
WI	23.80	150.90	15.77
WV	25.35	149.25	16.98
WY	9.00	139.50	6.45

¹ Sources: gasoline prices were taken from the the US Energy Information Administration, Department of Energy. State gasoline tax data was taken from The Louisiana Mid-Continent Oil and Gas Association at <http://www.gaspricewatch.com/usgastaxes.asp>, June, 2002

² Federal Tax of 18.4 cents per gallon included.

Table 4: Potential impact of state tax suspension on EBASE.

STATES	EBASE, 1999	EBASE, 2000	% GROWTH 1999-2000	ELASTICITY*%PRICE REDUCTION (from Table 2 and 3)	EFFECT ON %GR of EBASE	IMPUTED 2000 EBASE LEVEL	JOBS SAVED (LOST)			% OF (1999) EBASE	
							Est.	Range	Est.	Range	
PA	395,338.00	414,300.00	4.68	142.22	6.11	420,234.34	5,934.34	(4,423.86 , 7,322.14)	1.50	(1.12 , 1.85)	
OH	418,846.00	416,316.00	-0.61	120.48	0.60	421,362.07	5,046.07	(3,762.72 , 6,224.56)	1.20	(0.90 , 1.49)	
TN	281,321.00	282,170.00	0.30	117.82	1.48	285,514.09	3,344.09	(2,493.68 , 4,124.97)	1.19	(0.89 , 1.47)	
NC	408,819.00	397,078.00	-2.91	75.72	-2.16	400,095.91	3,017.91	(1,834.25 , 4,135.30)	0.74	(0.45 , 1.01)	
AL	231,518.00	227,790.00	-1.62	105.50	-0.57	230,205.85	2,415.85	(1,801.78 , 2,979.54)	1.04	(0.78 , 1.29)	
IN	263,895.00	257,457.00	-2.47	86.54	-1.60	259,694.60	2,237.60	(1,669.24 , 2,759.09)	0.85	(0.63 , 1.05)	
IL	340,805.00	341,664.00	0.25	60.72	0.86	343,744.85	2,080.85	(1,265.09 , 2,850.50)	0.61	(0.37 , 0.84)	
WI	239,954.00	238,090.00	-0.78	75.45	-0.03	239,893.26	1,803.26	(1,096.01 , 2,470.92)	0.75	(0.46 , 1.03)	
MI	161,650.00	158,174.00	-2.17	105.48	-1.12	159,851.21	1,677.21	(1,250.89 , 2,068.55)	1.04	(0.77 , 1.28)	
OR	123,671.00	123,266.00	-0.33	120.88	0.88	124,765.10	1,499.10	(1,117.83 , 1,849.21)	1.21	(0.90 , 1.50)	
WV	102,890.00	101,432.00	-1.43	137.48	-0.05	102,836.08	1,404.08	(1,046.76 , 1,732.34)	1.36	(1.02 , 1.68)	
KY	190,877.00	189,359.00	-0.80	55.56	-0.24	190,414.10	1,055.10	(641.53 , 1,445.21)	0.55	(0.34 , 0.76)	
SC	181,564.00	176,339.00	-2.92	57.04	-2.35	177,347.66	1,008.66	(613.28 , 1,381.65)	0.56	(0.34 , 0.76)	
MO	170,448.00	169,691.00	-0.45	58.22	0.14	170,681.76	990.76	(602.38 , 1,357.15)	0.58	(0.35 , 0.80)	
IA	99,331.00	81,183.00	-20.18	111.87	-19.06	82,096.32	913.32	(681.11 , 1,126.51)	0.92	(0.69 , 1.13)	
GA	316,172.00	316,834.00	0.21	28.70	0.50	317,744.75	910.75	(554.05 , 1,246.87)	0.29	(0.18 , 0.39)	
AR	135,638.00	135,166.00	-0.35	64.81	0.30	136,044.84	878.84	(534.26 , 1,203.99)	0.65	(0.39 , 0.89)	
MN	130,295.00	130,952.00	0.50	63.24	1.14	131,782.75	830.75	(505.04 , 1,138.07)	0.64	(0.39 , 0.87)	
UT	84,776.00	86,212.00	1.68	78.72	2.47	86,893.30	681.30	(414.06 , 933.61)	0.80	(0.49 , 1.10)	
NY	334,103.00	334,647.00	0.16	16.55	0.33	335,201.24	554.24	(-399.00 , 1,558.19)	0.17	(-0.12 , 0.47)	
AZ	77,788.00	80,157.00	3.00	58.26	3.58	80,625.38	468.38	(284.77 , 641.59)	0.60	(0.37 , 0.82)	
ID	37,730.00	37,377.00	-0.94	76.67	-0.17	37,664.66	287.66	(174.83 , 394.17)	0.76	(0.46 , 1.04)	
MT	36,247.00	33,147.00	-8.94	81.39	-8.13	33,417.89	270.89	(164.62 , 371.22)	0.75	(0.45 , 1.02)	
VA	146,753.00	140,008.00	-4.71	13.69	-4.57	140,199.84	191.84	(-138.14 , 539.21)	0.13	(-0.09 , 0.37)	
WA	111,140.00	111,866.00	0.65	16.10	0.81	112,046.27	180.27	(-129.78 , 506.78)	0.16	(-0.12 , 0.46)	
MA	108,027.00	108,096.00	0.06	14.95	0.21	108,257.72	161.72	(-116.44 , 454.59)	0.15	(-0.11 , 0.42)	
MS	115,850.00	113,289.00	-2.24	14.25	-2.09	113,450.61	161.61	(-116.36 , 454.25)	0.14	(-0.10 , 0.39)	
CT	67,299.00	68,164.00	1.28	23.55	1.51	68,324.71	160.71	(-115.63 , 452.11)	0.24	(-0.17 , 0.67)	
SD	20,058.00	20,086.00	0.14	62.66	0.77	20,212.25	126.25	(76.75 , 172.95)	0.63	(0.38 , 0.86)	
MD	45,291.00	49,776.00	9.44	17.66	9.62	49,863.97	87.97	(-63.32 , 247.34)	0.19	(-0.14 , 0.55)	
HI	33,761.00	34,667.00	2.65	-2.20	2.63	34,659.36	-7.64	(-119.85 , 117.83)	-0.02	(-0.35 , 0.35)	

NM	37,625.00	36,888.00	-1.98	-2.89	-2.01	36,877.36	-10.64	(-166.84 ,	164.20)	-0.03	(-0.44 ,	0.44)
ME	36,976.00	37,397.00	1.13	-2.87	1.10	37,386.27	-10.73	(-168.17 ,	165.51)	-0.03	(-0.45 ,	0.45)
NE	46,523.00	48,809.00	4.80	-3.71	4.76	48,790.88	-18.12	(-283.81 ,	279.69)	-0.04	(-0.61 ,	0.60)
NH	23,114.00	23,278.00	0.71	-11.83	0.59	23,250.48	-27.52	(-165.52 ,	113.03)	-0.12	(-0.72 ,	0.49)
RI	13,364.00	17,756.00	28.42	-17.03	28.25	17,725.79	-30.21	(-181.48 ,	124.26)	-0.23	(-1.36 ,	0.93)
FL	181,524.00	181,825.00	0.17	-2.21	0.14	181,784.77	-40.23	(-630.88 ,	620.26)	-0.02	(-0.35 ,	0.34)
DE	30,771.00	30,214.00	-1.83	-14.10	-1.97	30,171.43	-42.57	(-255.93 ,	174.97)	-0.14	(-0.83 ,	0.57)
NJ	314,204.00	325,425.00	3.51	-1.67	3.49	325,370.75	-54.25	(-851.21 ,	836.18)	-0.02	(-0.27 ,	0.27)
NV	42,242.00	43,212.00	2.27	-13.80	2.13	43,152.42	-59.58	(-358.20 ,	244.85)	-0.14	(-0.85 ,	0.58)
VT	8,556.00	8,881.00	3.73	-70.11	3.03	8,818.96	-62.04	(-91.83 ,	-8.76)	-0.73	(-1.07 ,	-0.10)
AK	28,457.00	29,509.00	3.63	-26.83	3.36	29,429.92	-79.08	(-117.17 ,	-11.14)	-0.28	(-0.41 ,	-0.04)
WY	33,448.00	34,646.00	3.52	-34.15	3.18	34,527.89	-118.11	(-174.96 ,	-16.64)	-0.35	(-0.52 ,	-0.05)
CA	485,159.00	489,685.00	0.93	-2.67	0.90	489,554.46	-130.54	(-2,046.71 ,	2,013.69)	-0.03	(-0.42 ,	0.42)
ND	22,493.00	22,917.00	1.87	-69.64	1.17	22,757.95	-159.05	(-235.41 ,	-22.44)	-0.71	(-1.05 ,	-0.10)
CO	78,368.00	80,301.00	2.44	-78.31	1.65	79,674.62	-626.38	(-926.91 ,	-88.42)	-0.80	(-1.18 ,	-0.11)
KS	90,998.00	92,225.00	1.34	-68.59	0.65	91,594.58	-630.42	(-933.12 ,	-88.96)	-0.69	(-1.03 ,	-0.10)
OK	156,828.00	160,865.00	2.54	-66.16	1.88	159,804.19	-1,060.81	(-1,570.25 ,	-149.67)	-0.68	(-1.00 ,	-0.10)
LA	183,770.00	183,542.00	-0.12	-76.10	-0.89	182,150.48	-1,391.52	(-2,059.28 ,	-196.42)	-0.76	(-1.12 ,	-0.11)
TX	655,159.00	661,870.00	1.02	-76.99	0.25	656,793.89	-5,076.11	(-7,511.89 ,	-716.55)	-0.77	(-1.15 ,	-0.11)