The Btu Tax: Effects on Energy Markets and the Southwest

"Although the Btu tax is a small part of President Clinton's overall budget package, it has important implications for the energy industry and some regions of the Southwest."

From the perspective of the energy industry and some regions of the Southwest, the Btu tax is an important part of President Clinton's budget proposals. The proposed Btu tax would be applied to the heat content of natural gas, coal, hydroelectric power and nuclear power at the rate of $0.257 per million Btu (British thermal unit), and to petroleum products at the rate of $0.599 per million Btu.[1] If levied, the Btu tax could have significant effects on the energy markets and on the relative performances of the Southwestern and the national economies.

To evaluate the long-run effects of the proposed Btu tax on prices and quantities in U.S. energy markets, the author built a simulation model of U.S. energy markets that takes into account domestic energy demands and supplies, fuel switching and world oil market conditions. (See the box, "Simulating U.S. Energy Markets," page 11.) After using the model to obtain estimates of the long-run effects of the Btu tax on energy prices and quantities, the author calculated long-run effects of the Btu tax on employment in key energy-related industries and five Southwestern states.

Energy Prices: Who Pays the Btu Tax?

As originally proposed, the Btu tax would have been assessed on the production and importation of energy. As of this writing, it looks as though the Btu tax will be applied to energy consumption. How the Btu tax is assessed will have little effect on who actually pays the tax. (See the box, "Does It Matter How the Btu Tax Is Assessed?" page 10.)

Economics is more important than legislation in determining who pays a particular tax. When a tax is assessed on a commodity, the economic forces of supply and demand alter its market price and quantity. In altering the market price and quantity of a commodity, these economic forces alter who pays the tax, sharing it between producers and consumers in a manner that depends on the elasticities of supply and demand rather than on how the tax is assessed.

Crude Oil Prices. Under the proposed Btu tax, crude oil would be taxed at the rate of $3.47 per barrel. Of this amount, U.S. oil consumers will bear an estimated two-thirds, while oil producers worldwide bear the remaining one-third (*Chart 1*). That is, the effective price consumers will face for crude oil will rise by about two-thirds the amount of the tax, and the price oil producers will receive will fall by about one-third the amount of the tax. Foreign consumers will pay reduced oil prices.

The ability of some consumers to switch from more heavily taxed oil to less heavily taxed natural gas will restrain the increase in consumer oil prices and shift some of the tax back to producers. Much of the gas-to-oil competition occurs in the industrial sector, where residual fuel oil and natural gas are very close substitutes.

Because the United States consumes nearly 30 percent of the world's oil production, the world oil price is likely to be driven down by a U.S. tax on oil consumption. This price reduction will reduce world oil production and increase oil consumption outside the United States.[2]

Petroleum Product Prices. Under the Btu tax, prices for petroleum products can be expected to rise unevenly. Prices will rise the least

Chart 1
Crude Oil Prices

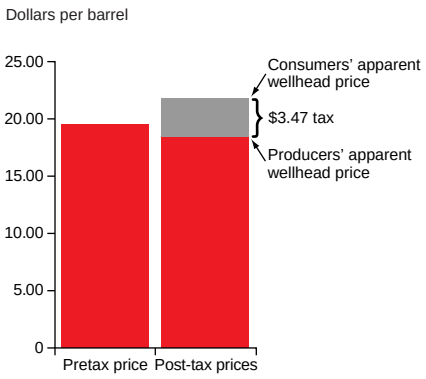
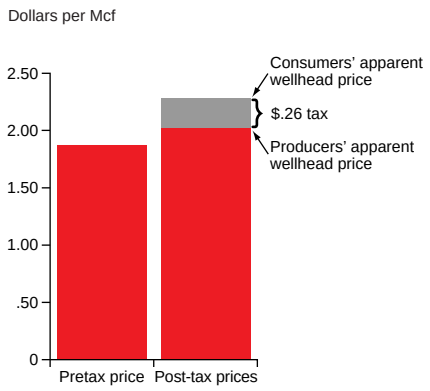


Chart 2
Natural Gas Prices



for the petroleum products for which consumer demand is the most price sensitive. Prices will rise the most for the petroleum products for which consumer demand is the least price sensitive.

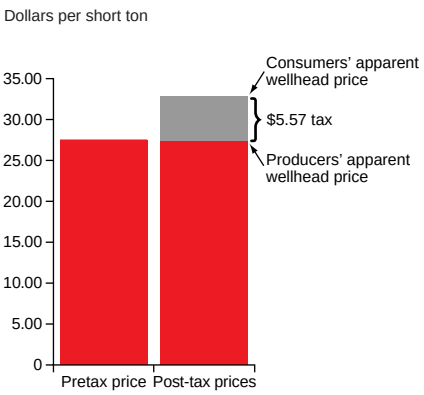
Economic research indicates that consumers of the heaviest products, such as residual fuel oil, are the most price sensitive. Consumers of lighter products, such as distillate fuel, are somewhat less price sensitive. Consumers of the lightest products, such as gasoline and jet fuel, are the least price sensitive. Therefore, prices for lighter products can generally be expected to rise by more than those for heavy products.

The overall price of petroleum products is also likely to rise by more than the price of crude oil. With natural gas substituting for residual fuel oil and, to some extent, distillate fuel oil, the mix of petroleum products will be shifted toward lighter products. Because the shift will require a greater percentage of the barrel to be cracked, the cost of refinery operations will rise, and the overall price of petroleum products will rise by more than the price of crude oil.

Natural Gas Prices. Under the proposed Btu tax, natural gas would be taxed at the rate of $0.26 per thousand cubic feet (Mcf). The price that consumers will pay for natural gas is likely to rise by more than the amount of tax (*Chart 2*). Switching from more heavily taxed oil to natural gas will bid up the price of natural gas by more than the amount of its Btu tax. Producers will see increased prices at the wellhead.[3]

Coal Prices. Under the proposed Btu tax, coal would be taxed at the rate of $5.57 per short ton. The price that consumers pay for coal will rise by an estimated 95 percent of the tax, while the price received by coal producers will fall by 5 percent of the tax (*Chart 3*). Most of the tax on coal is shifted forward because higher prices for oil and natural gas will discourage consumers from shifting away from coal, even when its price rises.

Chart 3
Coal Prices



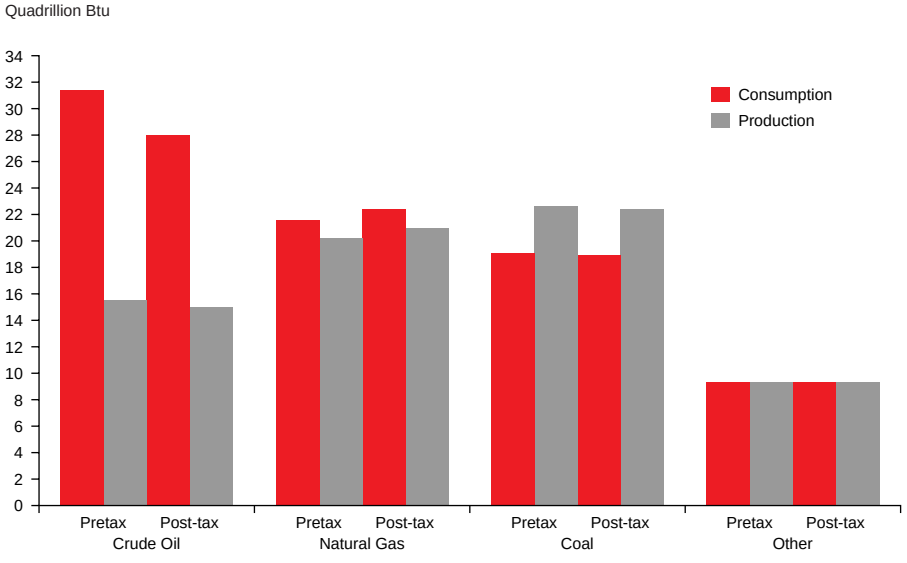
U.S. Energy Consumption

Under the Btu tax, U.S. oil consumption will fall an estimated 10 percent or more, while U.S. oil production will fall by about 3 percent (*Chart 4*). Higher consumer prices for oil and the substitution of natural gas for oil will reduce U.S. oil consumption. Lower supply prices will reduce U.S. oil production. The net effects of reduced oil consumption and production will be to reduce U.S. oil imports by nearly 20 percent.[4]

In addition, U.S. natural gas consumption will rise by an estimated 4 percent, despite the fuel's higher price. Fuel switching from oil to natural gas accounts for both the higher price for natural gas and its increased consumption. Higher natural gas prices will stimulate an increase in domestic production of about the same magnitude as consumption. Natural gas imports will remain essentially unchanged.

U.S. coal production and consumption will fall only slightly (by an estimated 1 percent). Higher prices for natural gas and oil will prevent consumers from making a significant switch away from coal, even though its price will rise by 95 percent of the tax. Slightly lower

Chart 4
Primary Energy Consumption and Production



prices for producers will reduce their production of coal. With U.S. coal producers receiving only slightly lower prices, coal exports should remain essentially unchanged.

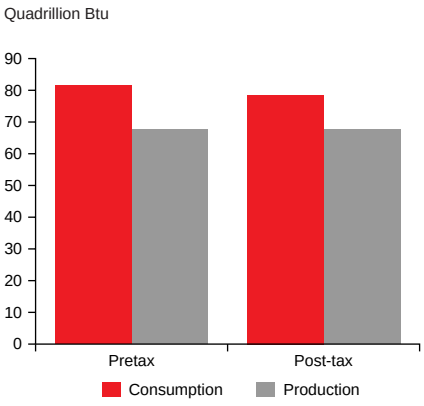
The use of nuclear, hydro and other energy sources is likely to remain essentially unchanged.

Overall, the Btu tax can be expected to reduce U.S. energy consumption by a little less than 5 percent (*Chart 5*). The Btu tax will stimulate U.S. energy production slightly, with natural gas production rising more than oil and coal production fall. Net energy imports will be reduced by more than 20 percent.

Industrial and Regional Effects of the Btu Tax

The Btu tax is likely to have significant effects on energy-related industries and the Southwest. Accordingly, the author analyzed the effects of the Btu tax on employment in five key energy-related industries (oil and gas extraction, coal mining, oil-field machinery, refining and petrochemicals) and five Southwestern states (Arizona, Louisiana, New Mexico, Oklahoma and Texas). Estimates for the energy-related industries rely on historical, econometric relationships between energy prices and the performance of each industry. Estimates for the states rely on specialized input–output techniques.[5]

Chart 5
Total U.S. Energy Consumption and Production



Does It Matter How the Btu Tax Is Assessed?

The economic incidence of a tax can be quite independent of its legal incidence. If a tax is applied to a commodity's production, supply and demand will shift some of it forward to consumers. If a tax is applied to a commodity's consumption, supply and demand will shift some of it backward to producers. In a freely operating market, the final consumer and producer shares of a tax are not affected by the legal assignment of the tax.

Chart A
Tax Incidence

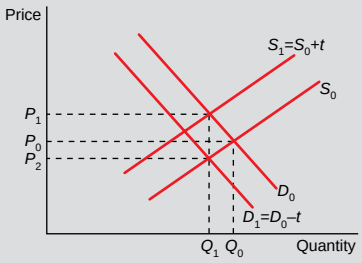


Chart A illustrates how supply and demand redistribute a tax. In the figure, the pretax supply and demand curves are shown as S_0 and D_0, respectively. The pretax market-clearing price and quantity are shown as P_0 and Q_0, respectively.

If the tax is applied to producers, the supply curve will shift upward by the amount of the tax because suppliers will have to cover the tax, as well as their production costs. The new supply curve is shown as S_1. With the new supply curve, the market-clearing quantity is reduced to Q_1.

The price consumers pay rises to P_1. The per unit tax is shown as P_1 minus P_2. After paying the tax, producers would receive a price of P_2. Of the total tax, consumers will pay P_1 minus P_0 because that is how much the consumer price would rise. Producers will pay P_0 minus P_2 of the tax because that is how much the producer price would fall.

If instead the tax is applied to consumers, the demand curve will shift downward by the amount of the tax because consumers will deduct the tax from the amount they are willing to pay producers for each quantity of output. The new demand curve is shown as D_1. Because the tax levied on consumers is the same as would have been levied on producers, the shift in demand (from D_0 to D_1) is the same as the shift in the supply curve (from S_0 to S_1). Given this shift in the demand curve, the market-clearing quantity is Q_1, which is the same quantity as when the tax was applied to producers.

Including taxes, consumers pay the price P_1 for the product. Producers receive a price of P_2. The per unit tax would remain P_1 minus P_2. Consumers would still pay P_1 minus P_0, and producers would still pay P_0 minus P_2.

Industrial Effects. Estimated employment losses in energy-related industries range from zero in domestic oil and gas extraction to more than 6 percent in refining (*Chart 6*). U.S. employment will fall by just under 0.2 percent if petrochemical feedstocks are exempt from the tax and just over 0.2 percent if petrochemical feedstocks are not exempt from the tax.[6]

Losses in oil prices and production and gains in natural gas prices should combine to produce a net

Simulating U.S. Energy Markets

To analyze how the Btu tax would affect U.S. energy markets, the author constructed a simulation model that represents the operation of supply and demand in various segments of the U.S. energy market. The model relies on estimated values of the long-run price elasticities of domestic energy demands and supplies, the long-run potential for fuel switching (cross-price elasticities), and the long-run price elasticities of international oil demands and supplies. These estimates were obtained from a variety of sources.[1]

The model is calibrated to energy prices and quantities for the period 1990–92. The calibrated model provides estimates of the effects the Btu tax would have had on market prices and quantities for energy during that period had the tax been in place some time prior to 1990 and had the market made its long-run adjustments to the tax. In this way, the analysis is presented in a manner that is independent of particular forecasts for future energy prices and quantities.

[1] The model incorporates research conducted under the auspices of the Energy Modeling Forum at Stanford University, research done at the Federal Reserve Bank of Dallas and information from the wider economics literature. See Douglas R. Bohi, *Analyzing Demand Behavior: A Study of Energy Elasticities* (Baltimore: Johns Hopkins University Press for Resources for the Future, 1981); S. P. A. Brown and Keith R. Phillips, "U.S. Oil Demand and Conservation," *Contemporary Policy Issues*, January 1991, pp. 67–72; S.P.A. Brown and John K. Hill, "Lower Oil Prices and State Employment" *Contemporary Policy Issues*, July 1988, pp. 60–68; S. P. A. Brown and Hillard G. Huntington, "The Economic Cost of Conservation: A Multi-Model Approach," work in progress, 1993; S. P. A. Brown and Kelly Ann Whealan, "Oil Price Expectations and Conservation," work in progress, 1993; Stephen P. A. Brown and Mine K. Yücel, "The Pricing of Natural Gas in U.S. Markets," Federal Reserve Bank of Dallas *Economic Review*, Second Quarter, 1993; Energy Modeling Forum, *International Oil Supplies and Demands*; Hillard G. Huntington, "OECD Oil Demand: Estimated Response Surfaces for Nine World Oil Models," *Energy Economics*, January 1993, pp. 49–56; Leonard Waverman, "Econometric Modelling of Energy Demand: When Are Substitutes Good Substitutes?" in *Energy Demand: Evidence and Expectations*, David Hawdon (ed.), 1992; Mine K. Yücel and Shengyi Guo, "Single-Fuel and Multi-Fuel Energy Policy," work in progress, 1993.

wash for the domestic exploration and production industry. Nevertheless, employment losses are likely to occur in oil-field machinery manufacturing. These losses arise because exports of oil-field machinery will fall with lower world oil prices.

If petrochemical feedstocks are exempt from the Btu tax, petrochemical employment will fall by an estimated 1.4 percent because petrochemical producers will still pay higher prices for natural gas. If petrochemical feedstocks are not exempt, petrochemical employment will fall by an estimated 3.6 percent.

Effects on the Southwest. The Btu tax will have uneven effects across the Southwest (*Chart 7*). Including multiplier effects, Texas will experience estimated employment losses about twice the national average, and Louisiana will experience employment losses about three times the national average. For these states, high concentrations of oil-field machinery and energy-intensive industries—such as refining and petrochemicals—account for the strong effect.

Oklahoma will experience employment losses estimated at about one and one-half times greater than the national average. A high concentration of refining and oil-field machinery accounts for the difference between Oklahoma and the national average. A low concentration of petrochemicals moderates the employment losses in Oklahoma.

New Mexico and Arizona will see employment losses estimated below the national average. Low concentrations of refining and petrochemicals account for the difference between New Mexico and the national average. Arizona's low concentrations in oil-field machinery industry, refining and petrochemicals contribute to the mild effect on employment in the state.

Conclusion

Although the Btu tax is a small part of President Clinton's overall budget package, it has important implications for the energy industry and some regions of the Southwest. The effects are uneven but generally negative across various segments of the domestic energy industry. The one exception may be oil and gas extraction, where gains in natural gas prices and production could

Chart 6
Long-Run Employment Effects of Proposed Btu Tax

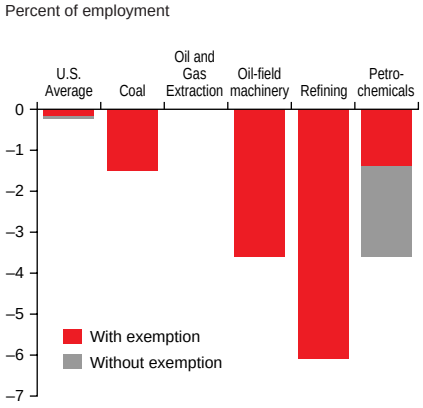
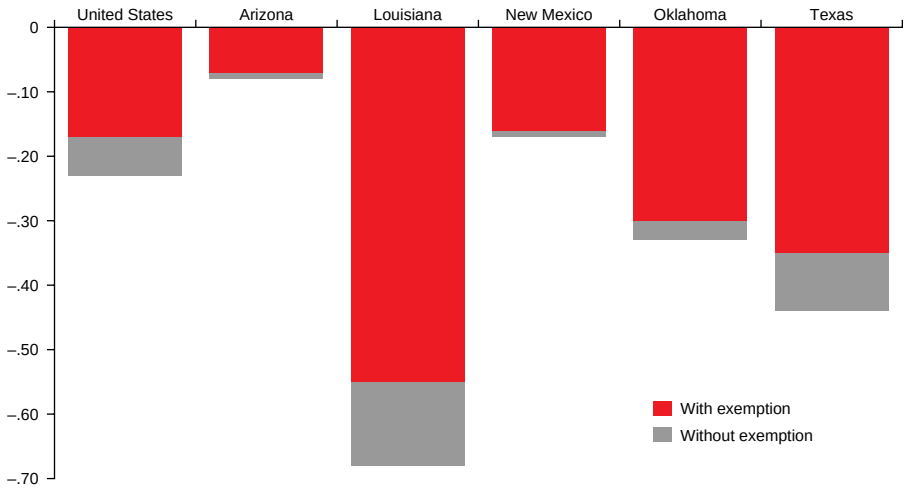


Chart 7
Long-Run Employment Effects of Proposed Btu Tax

(Percent of Total Nonfarm Employment)



offset the losses in oil prices and production.

Some regions of the Southwest—those with high concentrations of oil production, oil-field equipment manufacturing, refining and petrochemicals—will fare somewhat worse than the nation as a whole. Those regions with high concentrations of natural gas or low concentrations of oil-field equipment manufacturing, refining and petrochemicals will fare somewhat better than the nation as a whole.

—Stephen Brown

[1] A British thermal unit is the quantity of energy required to raise the temperature of one pound of water one degree Fahrenheit at or near 39.2 degrees Fahrenheit.

[2] The analysis assumes that OPEC will make the average supply response that can be inferred from the world oil market models used in the Energy Modeling Forum study, *International Oil Supplies and Demands*. The average of those models showed a positive relationship between world oil prices and OPEC supply—but not revenue targeting.

If OPEC acts to maintain its revenue in the face of the Btu tax by increasing its production, less of the Btu tax on oil will be shifted forward to consumers. In addition, consumer prices for natural gas and coal prices will rise by less, U.S. oil consumption will fall by less, and U.S. natural gas and coal consumption will be lower than estimated. Total U.S. energy consumption will fall by less than estimated.

If OPEC acts to hold world oil prices constant in the face of the Btu tax, all of the Btu tax on oil will be shifted forward to consumers. In addition, consumer prices for natural gas and coal prices will rise by more, U.S. oil consumption will fall by more than estimated, and U.S. natural gas and coal consumption will be higher than estimated. Total U.S. energy consumption will fall by more than estimated.

[3] The preferred treatment of natural gas under the Btu tax may have contributed to increases in spot and futures prices for natural gas. One of the strongest weekly gains in spot prices for natural gas occurred the week after the Clinton administration announced its budget proposals.

[4] From the perspective of world oil conservation, some of the reduction in U.S. oil consumption will be offset by increased consumption outside the United States that is brought about by lower world oil prices.

[5] See S. P. A. Brown and John K. Hill, "Lower Oil Prices and State Employment," *Contemporary Policy Issues*, July 1988, pp. 60–68, for a description of the methodology.

[6] The author estimates the rise in consumer energy prices resulting from the Btu tax would permanently reduce the level of GDP by about 0.4 to 0.5 percent below what it would be without the tax.

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