1987

Benefits and Costs of a Variable Oil Import Fee

Clifton T. Jones
University of Richmond

J. Patrick Raines
University of Richmond

BENEFITS AND COSTS OF A VARIABLE OIL IMPORT FEE

Clifton T. Jones
J. Patrick Raines

1987-6

Benefits and Costs of a Variable Oil Import Fee

Clifton T. Jones
Assistant Professor

and

J. Patrick Raines
Assistant Professor

Department of Economics
University of Richmond, VA 23173

February 1988

"BENEFITS AND COSTS OF A VARIABLE OIL IMPORT FEE"

Introduction

The sharp decline in real world oil prices since 1986 has had a significant impact on the U.S. economy, moderating the rate of inflation and reducing energy costs of consumers and businesses while creating widespread unemployment, bankruptcies and bank failures across the oil-producing states of the Southwest. Combined with record federal budget and trade deficits, these severe regional dislocations have rekindled the debate over an increase in the (currently very small) U.S. oil import tariff. The most frequently suggested forms such an increase would take is either that of a fixed fee of $5 or $10 per barrel (such as Representative Gephardt's proposal) or a variable fee set equal to the difference between the world oil price and a guaranteed minimum domestic price of $22 - $24 per barrel (as recently suggested by Governor Clements of Texas).

Advocates of higher oil import fees have advanced a number of rationalizations for such a policy. Interested politicians and industry spokesman point out that new oil import fees would reinvigorate the domestic petroleum industry and help to lower massive trade and federal budget deficits while reducing our dependence on insecure foreign oil.

By encouraging higher domestic production and promoting domestic conservation of oil and other fuels a higher oil import fee would help to reduce the percentage of U.S. oil demand being met by foreign suppliers. However, the enormous costs that would be associated with permanently closing our borders to all foreign energy supplies suggests that full "independence" from foreign energy sources is unlikely to ever be achieved. Imposing a new oil import fee would advance this elusive goal, but unless the higher prices stimulated domestic reserve replacement at least as much as production, doing so would amount to a so-called "drain America first" policy.[1]

Thus, the view that new oil import fees would contribute to the reduction of the U.S. trade imbalance initially appears plausible. As the cost of imported crude oil for U.S. refineries rose under the tariff, the volume of oil imports would fall, with fewer dollars flowing out of the U.S. as a result. However, there would be some negative impacts of the fee on the trade balance as well. Higher domestic energy prices would reduce U.S. firms' competitiveness in the production and sale of energy-intensive goods, both here and abroad. U.S. exports could soften at the same time that U.S. imports are being stimulated by relatively cheaper foreign goods. Additionally, oil exporting nations may decide to impose retaliatory tariffs that would further reduce U.S. exports.

From a different prospective, others (such as Broadman and Hogan (1986)) argue that a new (fixed) oil import fee is needed to internalize the social costs of foreign oil not perceived by private importers, independent of any industry assistance it might offer. A variable oil import fee (VOIF) has been advocated (see Singer (1986)) as a way to accomplish many of these ends while also insulating the U.S. economy from the costly capital adjustments associated with widely fluctuating oil prices, since it would attenuate downside risk in energy-related investments.[2] Although more difficult to administer than a fixed fee, a VOIF would disappear as world oil prices rose above the guaranteed floor. Thus, a VOIF could be more politically palatable as a protectionist measure than a fixed fee, but would become ineffective as a tool for internalizing the security premium on imported oil at higher prices.

Reasoning that a VOIF is the most likely form an increase in the U.S. oil import fee would take, this study assesses the benefits and costs of a VOIF that puts a floor of $23 per barrel (1986 dollars) under the domestic oil price.[3] Assuming such a VOIF is imposed in 1988, domestic petroleum supply and demand impacts are forecasted through 1995 and used to estimate the gross effects on federal revenues and the U.S. balance of trade over this period. Finally, we forecast the likely impacts on U.S. real GNP levels and social welfare and then draw some tentative conclusions on the net effect of a VOIF on the U.S. economy.

An Engineering-Based Econometric Model of Petroleum Production

A dynamic, engineering-based econometric model of petroleum production in the State of Texas (see Jones and Bremmer (1987)) is used here to project the full domestic oil supply response. In brief, the model is based upon an econometric form of the exponential decline curve widely used in the petroleum engineering literature to model crude oil production by both primary and secondary methods and nonassociated natural gas production.

For both crude oil and nonassociated gas, production tends to decline exponentially over time as the reserve base is depleted, but the observed rate of decline is modelled as a function of the opposing forces of reserve and well abandonment. The rate of reserve replacement is in turn modelled by a system of econometric drilling equations that are ultimately driven by the expected profitability of new drilling prospects. The rate of well abandonment depends upon the profitability of the marginal well and the size distribution of production across the well population. Both measures of profitability depend upon the net prices received by producers after paying all applicable taxes, drilling costs, and operating expenses.

To complete the model, crude oil production resulting from the application of tertiary, or enhanced oil recovery (EOR) methods is modelled separately from conventional crude production in Texas. EOR methods have contributed little to aggregate U.S. oil production thus far, but are expected to be increasingly important in coming years as primary and secondary production declines. Not included in the retrospective analysis of Jones and Bremmer, this EOR oil supply equation is based upon projections of U.S. EOR activity made by the National Petroleum Council (1984):

(1) $$\text{EOR oil}_t = \alpha_o(t) + \alpha_1(t)NPO_t + \sum_{i=1}^{t-1} \alpha_1(t-i)(NPO_{i+1} - NPO_i) + \eta_t$$

where NPO_t represents the real net price per barrel of EOR oil after paying all production taxes, including the federal windfall profit tax (WPT), and η_t is a random error term. The coefficients α_o and α_1 are in turn specified to be quadratic functions in time, reflecting the NPC's projections of rising and then falling EOR oil production under alternative constant real price paths.

Estimation of (1) was accomplished using OLS on the NPC data, yielding the following results:

$$\hat{\alpha}_o(t) = \underset{(2.71)}{120.963} - \underset{(2.63)}{16.242t} + \underset{(1.56)}{0.289t^2}$$

$$\hat{\alpha}_1(t) = \underset{(0.75)}{1.326} + \underset{(6.26)}{1.457t} - \underset{(5.42)}{0.037t^2}$$

$$n = 114 \qquad \bar{R}^2 = 0.921$$

where the t-statistics for the null hypothesis that the parameter's true value is equal to zero are given in parentheses.

Finally, implied year-end Texas oil and gas reserve levels are calculated as: last year's reserves plus new reserve additions minus current production.

Domestic Petroleum Supply Impacts

The Texas petroleum supply model described above was used to project the annual changes in Texas oil production through 1995 that would result from the imposition of a variable oil import fee in 1988, calculated as the difference between the assumed world oil price and a domestic price floor of $23 per barrel (in constant 1986 dollars).

The assumed paths of real world oil prices and real domestic gas prices used in these simulations were taken from the DOE's Base Case scenario in its Annual Energy Outlook 1986 (AEO86). When simulating with the import fee, real world oil prices were assumed to remain unchanged, while real domestic gas prices were assumed to rise to 70 percent of the BTU equivalent price of oil.[4] Table 1 lists the prices used in the Base Case and fee simulations for 1988-1995. Once the Base Case prices rose above the floor ($23 per barrel for oil, $2.90 per MCF for gas), they were assumed to prevail in the fee simulation.

As Table 2 shows, the projected increases in Texas oil production from a VOIF would be modest, peaking at 4.5 percent in 1990 and averaging 3.7 percent over the eight-year period covered by the simulations. In terms of average daily production rates, Texas would supply around 80,000 extra barrels per day (bpd) over the first four years under the fee, falling to less than 50,000 additional bpd by 1995. Although the fee becomes dormant after 1993, the lagged nature of the price response embodied in the model projects higher oil production levels in subsequent years.

Further evidence of this lagged price response shows up in the higher projected level of Texas oil reserves as of year end 1995, which would rise by over 2 percent, or 133.7 million barrels, as a result of the fee. Thus, our analysis suggests that, at least in the case of Texas, worries that an oil import fee increase would help to "drain America first" may be misplaced. Higher domestic oil prices could stimulate reserve additions more than extraction, causing U.S. petroleum reserve levels to rise rather than fall.

Based upon Texas' historical shares of U.S. oil production levels, the Texas oil supply impacts from a VOIF were converted to national impacts, assuming an equiproportionate response.[5] A guaranteed minimum domestic price floor of $23 per barrel would stimulate as much as 426,300 additional barrels of U.S. oil production per day by 1990 under our assumptions. By 1995, the U.S. oil supply response would be down to just under 290,000 bpd, averaging about 350,000 bpd over the entire eight-year period. As Table 2 also shows, our results compare favorably with the DOE's projections of an additional 440,000 barrels of U.S. oil production per day over the same period under a roughly equivalent price floor of $22 in 1985 dollars but assuming a lower world oil price scenario. Interestingly, although these annual estimates were derived in entirely different manners, they follow very similar patterns--peaking in 1990 and declining thereafter.

Domestic Petroleum Demand Impacts

In addition to stimulating domestic petroleum production, the higher real domestic oil prices caused by a VOIF would reduce domestic consumption of crude oil. This effect would be felt in two ways: first, through the usual impact of a higher price on quantity demanded, and second through any negative impact that higher oil prices might have on real U.S. GNP, which would shift the U.S. oil demand curve to the left.

The annual impacts of the VOIF on U.S. oil demand were projected using a partial adjustment or "habits persistence" oil demand equation of the form suggested by Daly, Griffin & Steele (1982) which imposes a geometric lag on the price response and an instantaneous response to changes in real GNP. Using the lag operator L, the oil demand equation can be written as

(2) $\ln \text{Oil demand}_t = \beta o + (\beta_1/(1-\lambda L)) \ln \text{Oil price}_t + \beta_2 \ln \text{GNP}_t$

where both the oil price and GNP levels are measured in 1982 dollars. Eliminating the lag operator yields a nonlinear estimating equation of the form:

(3) $\ln \text{Oil demand}_t = \beta o^* + \beta_1 \ln \text{Oil price}_t + \beta_2 \ln \text{GNP}_t - \beta_2 \lambda \ln \text{GNP}_{t-1}$

$$+ \lambda \ln \text{oil demand}_{t-1} + \varepsilon_t$$

where the error term ε_t is assumed to be serially independent (an assumption that is substantiated in the estimation which follows). In this form, β_1 represents the short-run or instantaneous response in oil demand to changes in the real oil price, while $\beta_1/(1-\lambda)$ captures the long-run oil price elasticity. The instantaneous GNP elasticity is given by β_2. The value of λ indicates the speed of adjustment in oil demand to price changes, which should be rather slow to allow sufficient time for the stock of energy-using capital to turn over. The higher the value of λ, the slower the adjustment to price changes. For example, if $\lambda = 0.9$, approximately two-thirds of the full price response will occur within 10 years after the price change.

Estimation of (3) was accomplished via nonlinear least squares on annual observations from 1969-1986. The values of the estimated coefficients and their standard errors are given in Table 3. The short-run oil price elasticity of demand is estimated to be only -0.06 while the GNP elasticity is estimated to be very near unity (0.97); both estimates are strongly statistically significant. The fairly large and statistically significant estimate of the speed of adjustment parameter λ (0.96), implies a rather slow adjustment to price changes. The long-run price elasticity of demand, calculated as -0.06/(1-.96), is well above unity at -1.40, reflecting this long lag in response.

The assumption of serial independence of the error terms in equation (3) appears to be justified in this case. The value of Durbin's h test statistic of 1.343 is too small to reject the null hypothesis of no serial correlation. Finally, the high value for $\bar{R}^2$ of 0.942 obtained by this specification suggests that it would be well suited for forecasting future U.S. oil demand.

Using the estimated form of (3), we first projected annual U.S. oil demand assuming base case values of real oil prices and real U.S. GNP levels (in 1982 dollars, both taken from AEO86), and then again under the fee case assumptions. The impacts of higher real oil prices on annual real GNP levels in the fee case simulation were calculated using a constant elasticity of real GNP to real oil prices of -0.021 as estimated by Darby (1982).[6] These GNP impacts are discussed in more detail below in connection with the welfare costs of a VOIF.

Table 4 gives the projected annual U.S. oil demand impacts from 1988 through 1995, both in thousand barrels per day and as percentages of base case consumption. The reductions in average daily U.S. oil consumption levels start out substantial--over half a million bpd in 1988--and grow even larger very quickly. By 1991, the conservation gains have more than doubled to over 1.1 million bpd, or 6.3 percent of base case consumption. Over the eight-year simulation period the annual average reduction in oil consumption due to the VOIF is estimated at 979,800 bpd, an annual drop of 5.6 percent.[7]

Balance of Trade Impacts

In the past six years the United States has experienced an unprecedented deterioration in its international trade position. The U.S. balance on current account has turned from a $6 billion dollar surplus in 1981 to a deficit of nearly $150 billion in 1987. The deficit of U.S. real net exports of goods and services was equivalent to more than 4 percent of real GNP in 1986 - the largest deficit in post-war history. The deterioration between 1981 and 1986 was the result of a worsening of the U.S. trade balance in 9 of the 10 major product groups used to classify international trade.[8] Thus, one potentially favorable effect of a VOIF is the contribution it could make toward reducing such large U.S. trade deficits.

As mentioned earlier, a VOIF would affect the trade balance in several competing ways. Clearly, as Table 4 showed, as the fee increased the cost of imported crude the U.S. consumption of foreign oil would decline. A reduction in the volume of oil imported by this U.S. would directly (although temporarily) improve the U.S. trade account. However, the deleterious effects must also be considered. A smaller quantity of U.S. dollars circulating abroad as a result of the decline in the U.S. demand for foreign oil will bring about exchange rate adjustments, making the dollar increase in value vis a vis foreign currencies so that American made goods will become more expensive. Additionally, higher oil import fees will raise domestic manufacturers' costs of production to the extent that their products or production processes are energy intensive. As U.S. goods and services become more expensive, the positive effect of a VOIF on the trade balance would be dampened. Finally, if oil producing nations retaliated by imposing tariffs on U.S. goods, U.S. exports would be further depressed and any beneficial trade effects reduced a correspondingly greater extent.

The projected impacts of a VOIF on the U.S. trade balance from 1988-1995 are shown in Table 5. Estimates for changes in the net oil import bill are based upon the assumed path of world oil prices through 1995 shown in Table 1 and the sum of reductions of U.S. demand for imported oil (from Table 4) and increases in domestic production of oil (from Table 2).

Our projections indicate that a VOIF which sets the domestic price of oil at $23 per barrel (1986 dollars) would lower U.S. oil imports by an annual average of 1,330,500 bpd, or 15.4 percent through 1995. The cumulative reduction in the U.S. net import bill would be $81 billion over this period, with a present value of $63.8 billion in 1987 when discounting at a real rate of 5 percent. However, the annual reductions in the U.S. net oil import bill range from only $5 billion in 1988 to $12.8 billion in 1995. Even if there is no further deterioration in the other internationally traded product groups, this improvement in the trade deficit would be rather small relative to the size of recent current account deficits.

Federal Revenue Impacts

Another of the popular rationales behind a significant increase in the U.S. oil import fee is that it would provide a new source of federal revenues to help reduce our annual budgetary shortfalls. As Table 6 shows, a VOIF of the type considered above would, under our assumptions, generate additional gross federal revenues of almost $62 billion (1986 dollars) over the next eight years, for a present value in 1987 of $54.7 billion (again discounted at a 5 percent real rate). Projected annual gross revenues from a VOIF would be $17.2 billion in 1988, falling slowly to $9.7 billion by 1991 before dropping off sharply as the fee becomes dormant in 1994.

Several caveats apply when looking at these gross revenues estimates. First, the projected amount of the variable fee per barrel depends crucially upon the path of world oil prices, which, for simplicity's sake, we assumed would remain unchanged from the DOE Base Case values. Clearly, under higher (lower) world oil prices the actual gross fee receipts would be lower (higher) than those presented here. Secondly, should there be special exemptions from the fee for selected foreign oil producers (e.g., Mexico) or domestic exporters of refined petroleum products, our projections of gross revenues would have to be revised downwards. Finally, the net impact of a VOIF on federal income revenue levels would probably be lower than the gross impacts of Table 6 since fee-included increases in domestic energy costs could negatively impact U.S. GNP levels and hence, reduce aggregate taxable income. The Joint Committee on Taxation recently estimated (1987, p.62) the net revenue effect of a similar VOIF (establishing a $24 nominal price floor, with no exemptions) to be an increase of $15.7 billion (current dollars) in 1988, $9.7 billion in 1989 and $8.7 billion in 1990, or roughly three-quarters of our projections over the same period.

Welfare and GNP Effects

The preceding sections of this paper quantify the likely benefits of a VOIF to the U.S. economy. The primary costs resulting from a VOIF would involve changes in net social welfare and possible reductions in real U.S. GNP levels.

A straightforward static analysis of the annual changes in net social welfare was obtained by summing the annual changes in consumer surplus (Δ oil demanded * Δ oil price due to fee ÷ 2) and the annual additional production costs expended domestically for oil that could be obtained more cheaply abroad (Δ oil produced * Δ oil price due to fee ÷ 2). Following this methodology, we project a very modest cumulative projected welfare loss of less than $5.4 billion, with a present value of $4.7 billion (in 1986 dollars, using a 5 percent real discount rate).

The other significant component of the costs engendered by a VOIF is the impact on U.S. real GNP levels. These real GNP losses were estimated earlier in order to project the U.S. oil demand impacts of Table 4, using Darby's oil price elasticity of GNP of -0.021 and the percentage changes in oil prices shown in Table 1 (i.e., % Δ in GNP = (-0.021) * % Δ in oil price due to fee). These annual real GNP losses were converted from percentage changes to absolute 1986 dollar losses using the real GNP projections found in the DOE's Base Case scenario of AEO86, disappearing as expected 1994 when world oil prices rise above the floor. From 1988 to 1995, cumulative real GNP losses totaled $131.4 billion, with a present value (discounted at 5 percent) in 1987 of $116.6 billion, or about 2.5 percent of real GNP in 1986.

Summary and Policy Implications

This study began by using an econometric model of petroleum production in the State of Texas to project the Texas oil supply effects when a VOIF is implemented in 1988 that establishes a guaranteed minimum domestic price floor of $23 per barrel (1986 dollars). Assuming an equiproportionate national response, the corresponding U.S. oil supply response would average 350,000 additional bpd over the eight-year simulation period 1987-1995, or less 4 percent per year.

The annual impacts on U.S. consumption of petroleum products caused by a VOIF were projected by simulating with a partial adjustment oil demand equation estimated over the period 1969-1986. Over our eight-year simulation period the annual average reduction in oil consumption was projected to be 979,800 bpd, or 5.6 percent per year.

The balance of trade effects of a VOIF were calculated as the sum of the annual reductions in U.S. oil consumption and increases in domestic oil production, assuming world oil prices follow the Base Case path projected by the DOE. We found that U.S. oil imports would fall by an average of 1,330,500 bpd each year (about 15.4 percent), lowering the U.S. net-import bill by a total of $81 billion. Similarly, our simulation indicates the federal government could expect to collect almost $62 billion in additional gross revenues from a VOIF over the next eight years. Annual gross fee revenues would decline from more than $17 billion in 1988 to slightly below $1 billion in 1993 and disappear as the fee became dormant in 1994 and 1995.

The most direct benefits of a VOIF would probably occur within the domestic petroleum producing regions. Although integrated multinational oil companies would see an increase in the cost of bringing their own foreign crude to the U.S. for refining, the regional employment and income effects of a VOIF would undoubtedly be positive. Additionally, the stimulus to the economies of oil producing states would generate substantial tax revenues to state governments, and reduce federal income maintenance expenditures in those areas.

As recent debates among those seeking the Presidency in 1988 have pointed out, new oil import fees would have an uneven incidence on domestic industries, regions, and taxpayers. The disparate geographic distribution of oil-intensive industries and significant regional differences in home heating fuel usage would mean a disproportionate sharing of the burden of any new oil fee across the states and a corresponding re-distribution of income from consumers to producers.[9]

Clearly, a VOIF is not a painless way of reducing the budget deficit, improving the trade deficit, or revitalizing the domestic petroleum industry. The likelihood of foreign oil producing nations implementing retaliatory tariffs is difficult to predict, but to the extent they are imposed on U.S. goods, U.S. production and employment will be adversely affected. Similarly, any retaliatory increase in the world oil price reduce the level of expected tariff revenues, but would be less likely to occur since recent OPEC behavior suggests that it may not be wealth-maximizing to push oil prices higher at this point in time.

Assessing the net gains or losses to the U.S. economy on a cumulative, present value basis, the VOIF described herein might reduce the U.S. trade deficit and federal budget deficit over the next eight years by as much as $118.5 billion, incurring real GNP losses of $116.6 billion and social welfare losses of at least $4.7 billion. Thus, at best, a VOIF would generate a cumulative net loss of $2.8 billion. However, this modest net loss could turn out to be even larger if the actual net federal VOIF revenues are only three-quarters as large as the gross revenues projected in Table 6, as we think they might be.

In summary, a comparison of the relatively small contributions we have projected that a VOIF would make towards reducing the federal budget deficit and the U.S. trade deficit with the probable losses in social welfare and real GNP, suggest that arguments for the imposition of a new variable fee on imported oil must rely on other rationales. For example, a VOIF might realistically be sold as a relatively low-cost way to assist the hard-hit oil producing States, while providing some measure of security against oil supply disruptions and insulating the economy against the adjustments that would be caused by temporary oil price "free falls." Quantification of these less tangible benefits would also be a promising topic for further research.[10]

NOTES

1. Reasoning similarly, any policy designed to discourage domestic production could be classified as a "drain OPEC first" strategy. In either case, it should be kept in mind that recoverable reserves are economic variables, rising and falling with prices, rather than fixed physical stocks. Whether the level of recoverable reserves in the U.S. would rise or fall under a new oil import fee is an empirical issue that we address below for the case of a variable fee.

2. In a recent "Letter to the Editor" of The Wall Street Journal (Jan. 26, 1988, p.37) the Director and Associate Director of the Center for Enterprising at Southern Methodist University in Dallas argue that a variable oil import fee of $18 a barrel" would appear to be the most appropriate vehicle for mitigating price fluctuations and stabilizing the domestic exploration and production industry while imposing minimal burdens on businesses and consumers."

3. A price floor of $23 per barrel was selected as representative of the wide range of minimum domestic oil prices currently being proposed. In its recent report to the President on Energy Security, the U.S. Department of Energy (DOE 1987) analyzed a $22 price floor in 1985 dollars--essentially the same as our fee. However, their study assumed a much lower oil price path than we use in the analysis which follows, and thus offers a benchmark for comparison with our results.

4. Determining the impact of a VOIF on world oil prices and domestic gas prices is problematic. While any drop in U.S oil imports would reduce world demand for oil and tend to depress world oil prices, oil-exporting countries might choose to reduce their supply enough to forestall any price decline, possibly raising the price up to the floor. We chose to assume no change in world oil prices as a benchmark case, encouraged in part by the DOE's conclusion in its study that world oil prices would be little affected over the long run by a variable oil import fee (1987, p.D-19). The assumption that domestic gas prices would rise to 70 percent of the BTU equivalent price was based on an analysis by Milton Russell (1983, p.10).

5. Annual U.S. oil production levels (Q_t^{US}) are related to Texas oil production levels (Q_t^{TX}) according to the formula: $Q_t^{US} = Q_t^{TX}/\theta_t$, where θ_t is Texas' share of aggregate U.S. oil production during year t. Values of θ_t for 1988-1995 were projected from a simple linear trend model, estimated via OLS over the period 1978-1987:

$$\hat{\theta}_t = \underset{(0.003)}{0.328} - \underset{(0.001)}{0.009}t \qquad \bar{R}^2 = 0.969 \qquad S.E. = 0.005$$

where the standard errors are given in parentheses.

Projecting U.S. oil production impacts in this way implicitly assumes a unitary elasticity of U.S. oil production with respect to Texas oil production. A log-linear regression analysis over the same period (1978-1987) produced an estimate of this elasticity that was not statistically different from unity (estimated value = 0.745, standard error = 0.21), supporting our assumption of an equiproportionate response.

The corresponding impact of the VOIF on U.S. aggregate oil reserves is unlikely to be nearly as equiproportional as the impact on daily production levels, and so is not pursued here.

6. This was the same way that the DOE tackled the thorny issue of real GNP impacts in its study, so we are indebted to them for the suggestion (p. C-9). For their simulations, Broadman and Hogan assumed a considerably larger GNP price elasticity of -0.05. It should be noted that the impact of a new oil import fee on U.S. GNP may differ from that of an increase in world oil prices because a fee generates an intra-U.S. transfer from U.S. consumers to the U.S. government, rather than to foreign producers. Thus, either elasticity may be an overstatement of the true impact. A more ambitious analysis would involve the use of a large scale macroeconomic model to estimate the GNP effect, clearly beyond the scope of this paper.

7. Since the estimated oil price impacts on real GNP may be overstated, we re-ran these demand projections assuming no price-induced change in real GNP. The results were virtually the same, with an annual average reduction of 912,800 bpd or 5.2 percent. Hence, almost all of the reductions in oil demand can be attributed to higher oil prices alone.

8. Interestingly, the only product group that showed an improvement was the mineral fuels and lubricants sector, primarily due to the worldwide softening in energy prices over this period.

9. Of course, differing regional impacts and re-distributions of income have accompanied the imposition of the federal WPT and most other energy related taxation and regulations, including federal restrictions on fuel use and uniform emission standards for coal fired power plants.

10. Broadman and Hogan estimate the security-related benefits that a socially optimal fixed import fee would provide, and the recent DOE study estimates about $3 billion (1985 dollars) in security and macroeconomic adjustment benefits from a $22 price floor, but only for the year 1995, when a hypothetical oil supply disruption is assumed to occur. Either calculation depends crucially on the probability of unanticipated disruptions, which is not easily estimated.

References

Broadman, Harry G. and William W. Hogan. "Oil Tariff Policy in an Uncertain Market," Discussion Paper Series, Kennedy School of Government, Harvard University, November 1986, #E-86-11.

Daly, George, James M. Griffin and Henry B. Steele. "Recent Oil Price Escalations: Implications for OPEC Stability," Chapter 6 in OPEC Behavior and World Oil Prices, ed. by James M. Griffin and David J. Teece (George Allen and Unwin: London) 1982.

Darby, Michael R. "The Price of Oil and World Inflation and Recession," American Economic Review, 72, September 1982, 739-751.

Joint Committee on Taxation. "Description of Possible Options to Increase Revenues Prepared for the Committee on Ways and Means," Staff report #JCS-17-87, June 25, 1987 (U.S. GPO: Washington).

Jones, Clifton T. and Dale S. Bremmer. "Regional Impacts of Petroleum Price Regulations: The Case of Texas, 1973-1983," working paper, November 1987.

National Petroleum Council, Committee on Enhanced Oil Recovery, draft report, May 30, 1984.

Russell, Milton. "Overview of Policy Issues: A Preliminary Assessment," from Part One of The Deregulation of Natural Gas, ed. by Edward J. Mitchell (American Enterprise Institute for Public Policy Research: Washington, D.C.) 1983.

Singer, S. Fred. "The Case for a Variable Import Fee on Oil," testimony presented to the Senate Finance Committee, February 27, 1986.

U.S. Department of Energy, Energy Security: A Report to the President of the United States, Washington, D.C. (March 1987).

U.S. Department of Energy, Energy Information Administration, Annual Energy Outlook 1986: With Projections to 2000, Washington, D.C. (February 1987).

Table 1. Projected Domestic Oil and Gas Prices, 1988-1995

	Oil (1986$/bbl.)			Gas (1986$/MCF)[a]		
Year	Base Case[b]	With Fee	Percent Change	Base Case	With Fee	Percent Change
1988	16.18	23.00	+42.2	2.14	2.90	+35.5
1989	16.99	23.00	+35.4	2.28	2.90	+27.2
1990	17.84	23.00	+28.9	2.43	2.90	+19.3
1991	19.33	23.00	+19.0	2.68	2.90	+ 8.2
1992	20.93	23.00	+ 9.9	2.94	2.94	-
1993	22.68	23.00	+ 1.4	3.24	3.24	-
1994	24.57	24.57	-	3.57	3.57	-
1995	26.61	26.61	-	3.93	3.93	-

[a] Seventy percent of the full BTU-equivalent price of oil, calculated as (0.70)(0.18)(oil price in $/barrel), using the DOE's BTU conversion factor from oil to gas of 0.18 barrels of oil = 1 thousand cubic feet (MCF) of gas.

[b] According to U.S. Department of Energy's Annual Energy Outlook 1986, Table A8, p.37, for 1988-1990 and 1995. Prices for 1991-1994 obtained by interpolation.

Table 2. Projected Oil Supply Impacts from a Variable Oil Import Fee, 1988-1995 (thousand barrels per day)

Year	Texas Oil Production		U.S. Oil Production: Present Study	U.S. Oil Production: DOE (1987)[a]
1988	+76.7	(3.6)[b]	+340.8	+410.0
1989	+83.6	(4.0)	+386.8	+520.0
1990	+88.2	(4.5)	+426.3	+590.0
1991	+81.6	(4.3)	+414.5	+540.0
1992	+70.1	(3.9)	+373.2	+490.0
1993	+52.3	(3.0)	+294.0	+380.0
1994	+47.7	(2.8)	+282.2	+370.0
1995	+46.0	(2.8)	+287.7	+220.0
Annual average	+68.2	(3.7)	+350.7	+440.0

As of year end 1995:

- Texas oil reserves + 133.7 million barrels (+2.2%)[b]

[a] See Table B-3, p.D-26 in U.S. Department of Energy, Energy Security: A Report to the President.

[b] Percent change relative to base case projections.

Table 3. Nonlinear Least Squares Estimation Results for U.S. Oil Demand Equation

Coefficient	Estimated Value	Standard Error
β_o^*	0.233	0.131
β_1	-0.059[a]	0.010
β_2	0.969[a]	0.192
λ	0.958[a]	0.044
$\bar{R}^2 = 0.942$	S.E. = 0.020	n = 18
D.W. = 1.378	Durbin's h = 1.343[b]	

[a] Statistically significant at the 1 percent error level.

[b] Unable to reject the null hypothesis of no serial correlation.

Table 4. Projected U.S. Oil Demand Impacts from a Variable Oil Import Fee, 1988-1995 (thousand barrels per day)

Year	Average Daily Oil Consumption	Percent Change[a]
1988	- 517.7	- 3.0
1989	- 788.6	- 4.5
1990	-1015.5	- 5.6
1991	-1136.4	- 6.2
1992	-1169.1	- 6.3
1993	-1112.9	- 5.9
1994	-1070.1	- 5.6
1995	-1028.4	- 5.4
Annual Average	- 979.8	- 5.6

[a] Relative to base case projections.

Table 5. Projected Trade Balance Effects of a Variable Oil Import Fee, 1988-1995

Year	World Oil Price (1986 $/bbl.)	Change in Net Oil Imports [a]	Change in Net Oil Import Bill [b]
1988	16.18	- 858.5(-11.1%) [c]	- 5.1
1989	16.99	-1175.4(-14.9%)	- 7.3
1990	17.84	-1441.8(-16.8%)	- 9.4
1991	19.33	-1550.9(-17.7%)	-10.9
1992	20.93	-1542.3(-16.9%)	-11.8
1993	22.68	-1406.9(-15.5%)	-11.6
1994	24.57	-1352.3(-15.2%)	-12.1
1995	26.61	-1316.1(-15.1%)	-12.8
Annual Average		-1330.5(-15.4%)	
Total			-81.0
Present value in 1987 (5% real discount rate)			-63.8

[a] Thousand barrels per day.

[b] Billions of 1986 dollars.

[c] Percent change relative to base case projections.

Table 6. Projected Gross Federal Revenues from a Variable Oil Import Fee, 1988-1995

Year	Variable Fee (1986$/bbl.)	Gross Fee Revenues (billion 1986 $)
1988	6.82	17.2
1989	6.01	14.8
1990	5.16	13.5
1991	3.67	9.7
1992	2.07	5.7
1993	0.32	0.9
1994	0.00	0.0
1995	0.00	0.0
Total		61.8
Present value in 1987 (5% real discount rate)		54.7