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ANALYZING IMPACTS OF POTENTIAL TAX POLICY CHANGES ON U.S. OIL SECURITY

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INTRODUCTION

Most tax reform proposals now being discussed in the United States include provisions which could reduce petroleum production. For example, both the original Treasury Department proposal and the Bradley-Gephardt "FAIR" proposal would repeal percentage depletion and expensing of intangible drilling costs, as well as eliminate the investment tax credit and slow depreciation for equipment. The Kemp-Kasten "FAST" proposal and President Reagan's proposal retain expensing of intangible drilling costs, but the former retains, and the latter modifies, percentage depletion. Through examination of one specific proposal, the original proposal of the U.S. Treasury Department[2], this paper illustrates the general oil security and economic consequences of such changes in taxation and shows how one might analyze particular proposals.

Impacts are estimated first ignoring the possibility of oil supply interruptions. Impacts on world oil price, oil imports, and oil import costs are examined both qualitatively and quantitatively. In addition, impacts of oil supply interruptions are examined both with and without the taxation changes. The analysis allows evaluation of the degree to which the proposed tax changes would exacerbate adverse impacts on GNP, inflation, unemployment, and other key variables. Quantitative impacts are focused on the U.S. but many of the issues are just as relevant for other oil importing countries.

U.S. PETROLEUM PRODUCTION IMPACTS OF THE TREASURY PLAN

We have examined several provisions of the Treasury proposal which could have major impacts on business investment in general:

1. Reduction in the statutory corporate tax rate from 46 to 33 percent;
2. Repeal of the investment tax credit; and
3. Replacement of the accelerated cost recovery system with a different, inflation-indexed, but generally slower, depreciation schedule called RCRS.

In addition, we have examined several major Treasury Department tax proposals directly affecting oil and gas production:

1. Repeal of percentage depletion;

2. Repeal of expensing of intangible drilling costs, dry hole costs, and qualified tertiary injectants.

In addition to the above elements, the Treasury proposal includes a number of provisions which we do not examine here, such as exclusion of 50 percent of dividends paid from corporate tax liability, indexing of both interest deductibility and taxation of interest, more rapid phase-out of the crude oil windfall profits tax, and changes in foreign tax credits. Although we ignore several elements, we refer to the effects as impacts of the "Treasury proposal". This terminology is justified because we believe we have examined those elements having the greatest impacts on oil security.

We proceed by estimating, conditional on assumptions about the Treasury proposal, its impacts on the user cost of capital in oil exploration and production. User cost can be envisioned as the implicit rent a firm must charge itself for using plant and equipment. Thus the user cost of capital is the annualized cost of using the stock of capital. The cost covers funds tied up in investment (including interest costs), true depreciation, and net cost of taxes paid. Tax law changes may change the user cost of capital, and therefore, the demand for capital goods.

The user cost per dollar of investment can be written as follows:

$$c = (r + d)\,(1 - k - T\,z\,a) \,/\, (1 - T) \qquad (1)$$

where c is the user cost of capital, r, the after-tax corporate discount rate, d, the assumed geometric rate of economic depreciation, T, the statutory corporate federal tax rate, z, the present value of a dollar of tax depreciation deductions, k, the rate of the investment tax credit, and a, the basis writedown for assets using the investment tax credit[3].

In order to define the current user cost of capital, we have used two data sources for current tax treatment: first, Energy Information Administration, Department of Energy, data[4] on capital and other costs for twenty-five major producers for oil exploration and development in 1983. In summary, 50 percent of these costs were depreciated under ACRS, 26 percent were expensed, 5 percent were cost depleted, and 19 percent were carried without cost depletion or expensed if abandoned. We use these ratios in calculating user costs; such user cost estimates are labelled DOE in Table 1.

Second, we have used the assumptions of Gravelle (1983) on current tax treatment, together with her capital stock weights to calculate user costs (labelled Gravelle in Table 1). She estimates 91 percent of structures are expensed, and more importantly, that over 90 percent of the oil production capital stock is structures and less than 10 percent equipment[5].

Table 1 presents the estimated effect of the Treasury proposal on the user cost of capital. Using DOE data, it currently costs 13.2 cents per dollar of capital to use a weighted average of equipment and structures and other costs in additional investment in oil and gas exploration and production. Using Gravelle assumptions this figure is 13.5 cents. These figures compare to an overall average of 14.6 cents for all industries. The Treasury proposal raises the user cost of capital by 9.9% to 14.2 cents per dollar of capital used, or 5.2% to 14.2 cents per dollar with the respective assumptions.[6]

TABLE 1
ESTIMATES OF USER COST OF CAPITAL:
CURRENT LAW VS TREASURY PROPOSAL

	User Cost per Dollar of Capital in Oil Exploration and Production[7]		Percent Increase over Current Laws	
	DOE	Gravelle	DOE	Gravelle
Current Law	0.132	0.135	----	-----
Treasury Proposal	0.142	0.142	9.9%	5.2%

What does an increase in the cost of capital by 5 to 10 percent imply about oil production? Under a frequent assumption made by economists, the desired capital stock has a constant unitary elasticity with respect to this user cost.[8] Hence the estimated cost increase would imply a 5%-10% decline in the desired capital invested in the industry and a substantial slowing of the rate of investment. We could expect increased user cost to curtail investment in oil exploration and production substantially.

Rather than utilizing the user cost estimates directly to estimate impacts on oil production -- a difficult task in itself -- this paper accepts existing estimates of petroleum production impacts of the Treasury proposal as <u>assumptions.</u> Two sources of production impact estimates -- the American Petroleum Institute (API) and the U.S. Department of Energy -- are roughly consistent with one another and are consistent with our user cost estimates.

The American Petroleum Institute (API), based upon surveys of forecasts by several oil companies, estimated that the Treasury proposals would result in an average estimated reduction of about 500 thousand barrels per day of oil equivalent production in 1986, 1.1 million barrels in 1990, and 1.5 million barrels per day by 1995. (API, 1985). The U.S. Department of Energy (DOE) estimated that these proposals would lead to a drop in U.S. oil production of about 500 thousand barrels per day of oil and one trillion cubic feet per day of natural gas by 1987 (<u>Oil and Gas Journal</u>, 1985).

We adopt the API numbers as estimates of U.S. oil import demand increases resulting from the tax proposal. This procedure assumes that reductions in oil and gas production both lead, on a btu-for-btu basis, to increases ~~reductions~~ in import demand for oil. To the extent that natural gas production declines do not lead to fuel substitution, estimates of oil import demand should be scaled down.

Clearly there remains substantial uncertainty about the magnitude of oil import demand impacts. Increases or decreases in oil import demand impacts would imply roughly proportionate changes in oil security and economic impacts.

IMPACTS ON WORLD OIL PRICE

Increases in the U.S. import demand for oil would reduce the rate of world oil price decline in early years. In later years, when prices can be expected to rise in any event, the additional imports would increase the rate of price rise. The net result is that the U.S. would face higher oil prices under the Treasury proposal than under current tax law. In this section we quantify these price impacts.

A Projection of the World Oil System

We first develop a baseline projection of oil price and of supply and demand balances for the non-Communist countries (referred to here as WOCA, World outside of Communist areas) under current tax law. These, and all projections quoted in the remainder of the paper, are based upon the simple model of the WOCA oil market discussed in the Appendix. However, no such projections should be interpreted too precisely. Actual future prices (or quantities) could well be significantly larger or smaller than those projected.

Figure 1 presents historical and projected world oil prices, in 1985 dollars (adjusted using the U.S. GNP implicit price deflator). Data prior to 1985 are observations of the average of official prices of OPEC crude oils traded on the world oil market (CIA data). In our baseline projection, prices decline until well into the 1990s, then rapidly increase, roughly matching their historical peak by the end of the century[9].

Figure 2 presents supply and demand history and projections for crude oil (excluding natural gas liquids) consistent with the Figure 1 price projection. (History through 1984, using BP and CIA data, except for net exports from centrally planned economies (CPE), where historical data goes through 1983.) In the baseline projection, total oil demand begins gradually rising in the late 1980s and OPEC production begins rising at a slightly later date, since non-OPEC supply continues to increase gradually during the entire century.

Figure 3 depicts history (through 1984; CIA data) and projections of OPEC available oil production capacity and OPEC oil production. The estimates of available OPEC production capacity reflects production ceilings as announced by individual countries and capacity limitations due to the Iraq-Iran war and the closure of the Iraq-Syria pipeline. Productive capacity could change from the current level, but we assume that capacity will remain constant over time.

Figure 4 plots OPEC excess available capacity, the difference between OPEC available capacity and OPEC production. There is currently an excess of available productive capacity above demand in OPEC of about 9 MMB/D. Figure 4 suggests that this excess capacity can be expected to remain for many years but to be dissipated halfway into the decade of the 1990s.

World oil prices have been projected to decline during the period of excess capacity, under continuing pressure among OPEC member nations to undercut the official selling price in order to increase or maintain their share of the depressed market. Non-OPEC nations, such as U.K. or Mexico, can also be expected to provide further downward pressure.

Prices have been projected to rise rapidly once excess capacity is dissipated, under the pressure of growing demand and only small short-run responsiveness of oil supply and demand to prices.

How rapidly oil prices will change is very uncertain, since changes depend crucially upon actions by individual producing countries balancing their own interests of sales against collective interests of high prices. Our projection uses an OPEC price reaction function as indicated in Figure 5, which postulates a functional relationship between the degree of OPEC excess capacity and the (quarterly) rate of oil price increase or decrease (See Appendix).

Although our baseline projection includes apparently precise statements of future conditions, these conditions by necessity are highly uncertain. The baseline projection should be viewed as just that -- a baseline for analysis -- not as a precise or accurate prediction of future conditions.

Price Impacts

While there persists excess crude oil production capacity, the greater the excess capacity, the more intense the downward pressure on prices. During this period, the tax induced increase in U.S. import demand would reduce the excess production capacity and would reduce the rate of price decline. In addition, the increases in U.S. import demand, by reducing excess production capacity, would hasten the time when excess capacity were dissipated and when rapid price increase would occur, as shown also in Figure 1. After the price jumps, the greater the demand for OPEC oil, the greater the market clearing price. Thus tax-induced increase in the import demand for oil will increase the expected price both before and after the next price jumps.

The difference in prices (from Figure 1) under the Treasury proposal and under current law is plotted in Figure 6. The price increase due to the Treasury proposal would gradually escalate to about $1.00 per barrel in 1993. But because prices jump earlier under the Treasury proposal, the price difference reaches $4.50 per barrel at its maximum. The difference remains above $2.00 per barrel from then on.

Comparison with Results from the Energy Modeling Forum Study

Our results can be related to the Energy Modeling Forum (EMF) results reported in World Oil. World Oil used ten prominent models of the world oil system, among other tasks, to examine the impact of an oil demand reduction program on the world price of oil. The postulated program would decrease U.S. import demand for oil and would thereby influence the world oil price in the opposite direction but the same manner as would an oil production decrease.

Table 3 shows EMF results, translated into total price impacts, in 1985 dollars. These estimates were obtained by scaling EMF price changes upward using the GNP implicit price deflator (17.8%) and multiplying by the changes in import demand associated with the Treasury proposal.

TABLE 3
PRICE INCREASES (1985 DOLLARS) ESTIMATED USING EMF STUDY

Year: Model	1990	1995
Gately	$2.70	$4.20
IEES-OMS	$2.10	$1.90
IPE	$0.10	$2.30
Salant-ICF	$1.40	$1.60
ETA-MACRO	$0.90	$3.50
WOIL	$1.30	$4.20
Kennedy-Nehring	$1.70	$1.80
OILTANK	$2.30	$1.80
Opeconomics	$0.40	$1.40
OILMAR	$0.60	$5.70
MEDIAN MODEL	$1.35	$2.10

Median EMF results differ somewhat from ours, although for both 1990 and 1995 our results fall within the range projected using the various models. The differences between EMF estimates and ours probably reflect two issues: most EMF modelers were projecting the excess capacity to last for a shorter time than is currently expected; and the EMF results as reflected in Table 3 do not fully reflect the time path of the production decreases assumed here.

ECONOMIC IMPACTS IN THE ABSENCE OF AN OIL SUPPLY DISRUPTION

Crude oil price increases which would occur under the Treasury proposal entail a number of adverse economic consequences. Most obviously, prices for refined products would increase initially by up to 2.5 cents per gallon and then later by an amount ranging over time between 5 and 10 cents per gallon. Prices of other energy carriers would be increased as well.

An increase in world oil price would imply that oil importing countries must exchange more goods and services for each barrel of oil imported. Although this terms-of-trade loss would not be reflected in measured GNP, it would represent a real loss in welfare to oil importing nations.

The increase in price and in quantity of imported oil together increase the monetary cost of oil imports. For the United States, these impacts are estimated in Figure 7 which shows the historical data on annual cost of oil imports (1985 dollars) from 1980 to the present, and projections of these import costs both with and without the Treasury proposal[10].

Figure 7 suggests that the total costs of importing oil will rise even under current law. Under the Treasury-proposed tax changes, the costs would increase additionally by up to $10 billion annually for the first years, reaching peaks of $30 to $35 billion before the turn of the century.

IMPACTS ON VULNERABILITY TO OIL DISRUPTIONS

The analysis has focused on the world oil market under smooth changes in supply and demand. Yet the history of the oil market is replete with sudden changes in oil supply availability. Revolution, war, or physical accidents could precipitously reduce oil supply. This section examines the consequences of the tax proposal for vulnerability to disruptions.

The currently depressed market could quickly be replaced by soaring prices in the event of a large enough oil supply interruption. And since the excess production capacity can be expected to decline over time, smaller and smaller disruptions will progressively become sufficient to initiate a new oil crisis.

Increases in U.S. oil imports would reduce excess oil production capacity. Since normally excess capacity can cushion impacts of oil disruptions, the Treasury proposal would increase the probability that a given physical disruption would translate into price jumps. More generally, should a disruption occur, the lower U.S. oil production rate implies less cushion and therefore a greater world oil price jump. This occurs because smaller initial excess production capacity implies a greater fraction of the disrupted quantity must be met by price-induced decreases in oil consumed. The greater the necessary consumption decline, the greater the required price jump. Thus, the Treasury proposal would increase the severity of oil shocks. In this section we estimate the magnitude of the increases.

The impact of the Treasury proposal on OPEC available capacity and demand for OPEC oil have been illustrated in Figure 3 and on OPEC excess available capacity in Figure 4. Each year before the excess were dissipated, the Treasury proposal would lead to reductions in excess available production capacity almost as large as the increases in oil import demand.

Before proceeding, one convention needs explanation. When a given magnitude oil supply disruption is cited, that magnitude equals a sum of several factors: 1) the reduction in actual production from disrupted supplies, 2) the necessary loss in unused available capacity in those countries, 3) the loss of available[11] production capacity in other nations who decide not to increase production up to our estimated available capacity, plus 4) the increase in the demand motivated by the disruption itself. The actual physical loss of production from disrupted supplies will generally be much smaller than the magnitude cited for the disruption.

As an example, a complete shut-down of production in Saudi Arabia and the United Arab Emirates would reduce production in these countries by 5 MMB/D and unused available capacity by an additional 5 MMB/D, for a 10 MMB/D capacity reduction -- provided that all other available capacity were instantly utilized and no inventory build-ups were to occur.

But a much smaller physical event could also be referred to as a 10 MMB/D disruption. For example, escalation in the Iran-Iraq war could eliminate production from those countries (currently 3.2 MMB/D) and reduce production capacity in Iran and Iraq by a total of 4.3 MMB/D. If Saudi Arabia would increase production to only 6 MMB/D rather than to its estimated available capacity of 8.5 MMB/D, that action would count as a further 2.5 MMB/D capacity decline. If oil importing countries were to increase oil inventories so as to induce an increase in oil demand of 3.3 MMB/D, that too would count. The combination of actions would amount to a 10.1 MMB/D disruption.

Ideally we would begin with a physical loss, project decisions to hold production below available capacity, and project induced demand increase. We could then express the disruption magnitude as the size of the physical loss. However, because we cannot project the final two factors, the disruption size is expressed as the sum total of the three factors.

Figure 9 shows the price impact of a one-year 10 MMB/D disruption in 1988. Under current tax law, crude oil price would jump $17 per barrel. Under the Treasury proposal, however, the jump would be $24 per barrel. A tax plan such as proposed by the Treasury would increase the price shock by 40 percent.

Table 4 shows price impacts projected for several hypothetical one-year-long disruptions, occurring in either 1988 or 1992, of various magnitudes of capacity reduction -- 10 MMB/D, 7 MMB/D, 4 MMB/D, and 2 MMB/D. Table 4 shows that even while excess capacity remains large, tax changes such as in the Treasury proposal can magnify adverse price jumps stemming from large disruptions. And once the excess capacity is mostly dissipated, such tax changes could exacerbate impacts of even small disruptions.

TABLE 4
PRICE IMPACTS OF VARIOUS MAGNITUDE SHOCKS

Disruption Magnitude (MMB/D)	Excess Capacity		Price Increase Relative to no shock	
	Current law (MMB/D)	Treasury prop. (MMB/D)	Current law ($/BBL)	Treasury prop. ($/BBL)
1988 DISRUPTIONS				
10	9.3	8.5	$14.90	$20.80
7	9.3	8.5	$ 1.90	$ 4.10
4	9.3	8.5	$ 0.50	$ 0.60
1992 DISRUPTIONS				
10	3.6	2.7	$74.60	$92.10
7	3.6	2.7	$32.60	$42.30
4	3.6	2.7	$ 7.70	$12.30
2	3.6	2.7	$ 1.50	$ 3.90

While precise price impacts depend upon many factors, Table 4 illustrates that tax changes such as in the Treasury proposal generally would decrease the excess oil production capacity and would thereby significantly increase the price shock resulting from an oil supply disruption.

Comparison with Results from the Energy Modeling Forum Study

The Energy Modeling Forum study, World Oil, also applied the models of the world oil system to one disruption: a 10 MMB/D reduction in OPEC production capacity occurring in 1984. Excess capacity in 1984 was projected at the time of the study to be slightly larger than our 1992 excess capacity projection. Table 5 presents key results for various models and compares the median EMF results to results for our 10 MMB/D 1992 disruption under current tax law.

TABLE 5
SUPPLY DISRUPTION (10 MMB/D) IMPACTS ESTIMATED IN EMF STUDY

Model	Excess capacity (MMB/D)	OPEC Production Decrease (MMB/D)	Price Increase ($/BBL)	Price Increase per MMB/D Production Decrease
Gately	3.9	7.3	$50	$6.80
IEES-OMS	8.2	9.3	$60	$6.50
ETA-MACRO	5.0	5.0	$168	$33.70
WOIL	4.3	10.4	$141	$13.60
Kennedy-Nehring	0.0	10.0	$78	$7.80
OILTANK	3.5	14.7	$188	$12.80
OILMAR	4.2	8.7	$104	$12.00
MEDIAN	4.2	8.7	$104	$12.00
THIS STUDY (1992)	3.6	7.6	$ 75	$9.90

Source: World Oil. Prices have been scaled up by 17.8% (using the GNP implicit price deflator) to express all in 1985 dollars.

Our results fall well within the range of the EMF results, although the median EMF results suggest a larger price impact of disruptions than does our analysis. Comparison is hindered, however, by significant definitional differences between the studies. The EMF disruption was a 10 MMB/D reduction in the production capacity of OPEC nations. Most EMF modelers assumed that not all excess capacity would be used by OPEC member nations during the disruption. Thus what EMF called an 10 MMB/D disruption would be called a 12 MMB/D or a 15

MMB/D disruption by us. In addition, we project less excess capacity in 1992 than projected for the EMF disruption. Were excess capacity assumptions the same, EMF would have projected larger price impacts. Thus if based on standardized conditions and definitions, the EMF study would study would project significantly larger median price impacts than we project.

Comparison with the EMF study thus suggests that our analysis may underestimate price impacts of oil supply disruptions and incremental price impacts of tax changes. In what follows, our estimates will be utilized to project economic impacts of oil disruptions. But the reader is cautioned that our results should be taken as low estimates both of impacts of disruptions and of the incremental impacts of the Treasury proposal during disruptions.

MACROECONOMIC IMPACTS OF OIL PRICE SHOCKS

Sudden oil price increases can have severe consequences for the U.S. economy: GNP losses, unemployment, inflation, government deficit increases. The greater the price jump, the more severe will be its economic consequences. Thus tax changes could increase harmful GNP, unemployment, inflation, and Federal deficit impacts of oil supply disruptions.

This section quantifies economic consequences which might result from disruptions, both under current tax law and under the Treasury proposal.

Macroeconomic Impacts per Dollar of Price Change

The Energy Modeling Forum study of the economic impacts of oil shocks uses prominent models of the U.S. economy to simulate short-run economic impacts -- real GNP, inflation, unemployment rate, government expenditure, receipts, and federal deficit -- of a sudden increase in the world price of oil. The basic case assumed a $15 per barrel oil price increase, lasting for at least four years. No shifts in government fiscal policy or monetary policy were assumed in the case discussed below. Median results are summarized in Table 6.

TABLE 6
SUMMARY OF KEY MACROECONOMIC IMPACTS OF A $15 PER BARREL OIL PRICE SHOCK

	YEAR OF IMPACT 1	2	3	4	Average
Real GNP: Percentage Difference	-1.42	-2.90	-2.54	-2.07	-2.23
Inflation Rate, Implicit GNP Deflator: Percentage Points Difference	1.18	1.00	0.23	-0.07	0.59
Inflation Rate, Consumer Price Index: Percentage Points Difference	2.68	1.08	0.12	0.12	1.00
Unemployment Rate: Percentage Points Difference	0.56	1.21	1.04	0.88	0.92
Federal Receipts: Absolute Difference ($B)	$11.5	$4.5	$6.7	$9.7	$8.1
Federal Expenditures: Absolute Difference ($B)	$13.4	$19.6	$21.8	$24.2	$19.8
Rederal Deficit: Absolute Difference ($B)	$ 1.9	$15.1	$15.1	$14.5	$11.7

Source: Macroeconomic Impacts of Energy Shocks.

Data from Table 6 have been combined with the projected price impacts of disruptions in order to estimate economic impacts of various disruptions both under current law and under the Treasury proposal. The four-year-average economic impacts of two such hypothetical, but plausible, future disruptions are summarized in Table 7. Table 7 shows that the already severe economic consequences of significant supply disruptions can be greatly exacerbated by tax changes such as in the Treasury proposal. For example, the Treasury proposal would increase real GNP losses by 0.9% or 1.4% for the disruptions shown here, increase unemployment by 0.4 or 0.6 percentage points, and increase the federal deficit during a disruption by $4 Billion or $7 Billion.

IN CONCLUSION

This study uses the Treasury tax reform proposal as an extensive example of how one might quantitatively analyze oil market impacts of changing U.S. taxation policy and in so doing provides rough estimates of the oil security

TABLE 7
PROJECTED ECONOMIC IMPACTS OF OIL DISRUPTIONS

10 MMB/D DISRUPTION IN 1988:	Current Law		Treasury Proposal		Difference	
Crude Oil Price	Up	$15	Up	$21	Up	$6
Real GNP	Down	2.2%	Down	3.1%	Down	0.9%
Unemployment	Up	0.9%	Up	1.3%	Up	0.4%
Federal Deficit	Up	$12 B	Up	$16 B	Up	$4 B

7 MMB/D DISRUPTION IN 1992:	Current Law		Treasury Proposal		Difference	
Crude Oil Price	Up	$33	Up	$42	Up	$9
Real GNP	Down	4.9%	Down	6.3%	Down	1.4%
Unemployment	Up	2.0%	Up	2.6%	Up	0.6%
Federal Deficit	Up	$26 B	Up	$33 B	Up	$7 B

and economic impacts of tax proposals similar to the Treasury Department's. Tax changes such as proposed by the Treasury Department can be expected to increase costs of developing indigenous crude oil reserves. Lower domestic reserves would lead to lower domestic production and increased oil imports. Increasing import demand for oil would mitigate downward pressure on world crude oil prices in the short to intermediate term and would increase the rate of price increases in the intermediate to longer term when the existing OPEC excess crude oil production capacity will be greatly diminished. These crude oil price changes would increase energy prices and would increase the total cost of oil imports.

Under these circumstances, any disruption in international flows of petroleum would result in higher oil prices and more severe economic consequences if tax changes such as proposed by the Treasury Department were to be adopted. We find such economic consequences to be important and worthy of careful analysis in the context of any tax reform debates.

APPENDIX A
THE FORMAL MODEL UNDERLYING THE ANALYIS

A simple world (or more precisely WOCA area) crude oil market model underlies the analysis presented here. Data refer to crude oil, excluding natural gas liquids. For this analysis, non-OPEC oil production is assumed to grow slowly -- 0.5 MMB/D annually until 1990 and 0.2 MMB/D annually thereafter -- in the absence of price changes. But growth is influenced by prices: a 0.1 supply elasticity is assumed in both the short and long-run. OPEC available production capacity remains constant at 26.2 MMB/D. In the absence of price responses, oil demand would grow at 3.65% per year through 1990 and 3.0% per year thereafter. However demand is also responsive to price: the long-run price elasticity of demand is -0.6. Demand adjusts 15% toward the long-run price response annually; the one-year demand elasticity is -0.09. Calculations are conducted for each of the four quarters of every projection year.

Price adjustments are governed by a price reaction function, which represents the rate of oil price change as depending upon the amount of excess OPEC oil production capacity in the preceeding year. Real (inflation adjusted) oil prices remain constant if excess capacity is 3 MMB/D (89% of available capacity, 2/3 of maximum sustainable capacity), decrease slowly if excess capacity exceeds that figure, and increase for excess capacity below 3 MMB/D.

Figure 5 in the text shows the price reaction function used for this analysis. In this plot, the vertical scale is the quarterly percentage price change while the horizontal scale shows the OPEC excess available capacity. The curve broadly corresponds to historical experience[12] and is similar to those used in the Energy Modeling Forum study World Oil.

VARIABLES AND EQUATIONS

V1 :		=	Year	
V3 :	Price	=	{ 2*LV3	IF(LV16<-1.95)
			{ LV3*(1-.02*LN(LV16/3))	IF(LV16>3)
			{ LV3*(1-.3*LN((LV16+2)/5))	Otherwise
V4 :	Baseline demand	=	LV4*1.009	Before 1990
			LV4*1.0075	After 1990
V5 :	Non-OPEC Demand	=	((LV5/LV4)¯(1-B75))*((V3/$5.35)¯(B75*B74))*V4	
V6 :	OPEC demand	=	LV6*1.0175	
V7 :	WOCA Demand	=	V5+V6	
V8 :	CPE exports	=	2.23	
V9 :	Non-OPEC supply	=	(V3/27)¯0.1*(21.8+(V1-1985)/2)-V17	Before 1990
			(V3/27)¯0.1*(21.8+(V1-1990)/4)-V17	After 1990
V10:	OPEC Production	=	V7-V8-V9	
V11:	OPEC export demand	=	V5-V8-V9	
V12:	Net OPEC demand	=	V11+V6	
V13:	OPEC sustainable capacity	:	An exogenously specified input	
V14:	OPEC avail. cap.	:	An exogenously specified input	
V15:	Unused sustainable cap.	=	V13-V12	
V16:	Unused available cap.	=	V14-V12	
V17:	Tax supply reduction	:	An exogenously specified input	
V18:	Reference price	:	An exogenously specified input	
V19:	Reference U.S. production	:	An exogenously specified input	
V20:	Reference U.S. Consumptn.	:	An exogenously specified input	
V21:	Equivalent U.S. productn.	=	V19*(V3/(V18))¯0.1-V17	
V22:	U.S. Consumption	=	((LV22/LV20)¯(1-B75))* ((V3/V18)¯(B75*B74))*V20	
V23:	U.S. Oil Imports (MBl/d)	=	V22-V21	
V24:	Annual oil import cost	=	0.365*V23*V3	

PARAMETERS

B74:	L.R. demand elast.	-0.60
B75:	Adjustment speed	0.04

KEY:

Symbols V1, V2, ..., V24 represent the varibles of the model. Symbols LV1, LV2, ..., LV24 represent values of variables V1, V2, ..., V24, lagged by one quarter. Symbols B74 and B75 represent paremeters of the model. The symbol ¯ denotes exponentiation, * indicates multiplication.

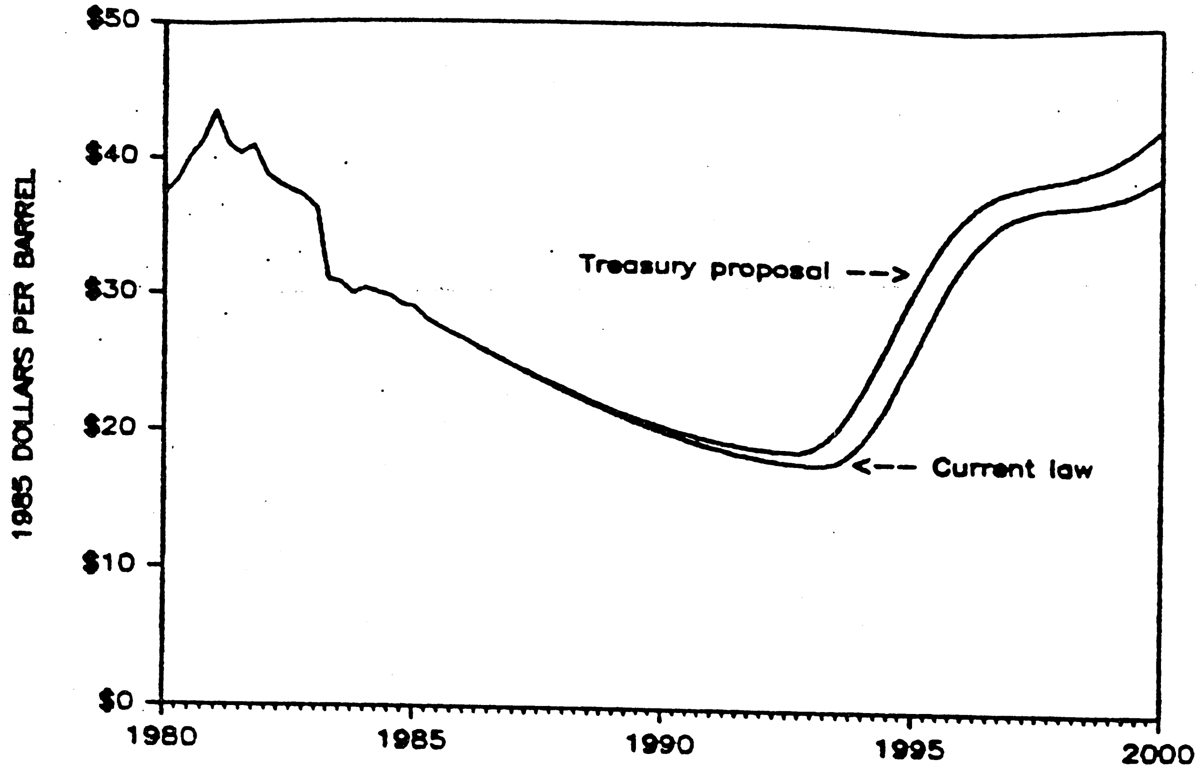

FIGURE 1
PROJECTIONS OF WORLD CRUDE OIL PRICE UNDER THE TREASURY PROPOSAL AND UNDER CURRENT LAW

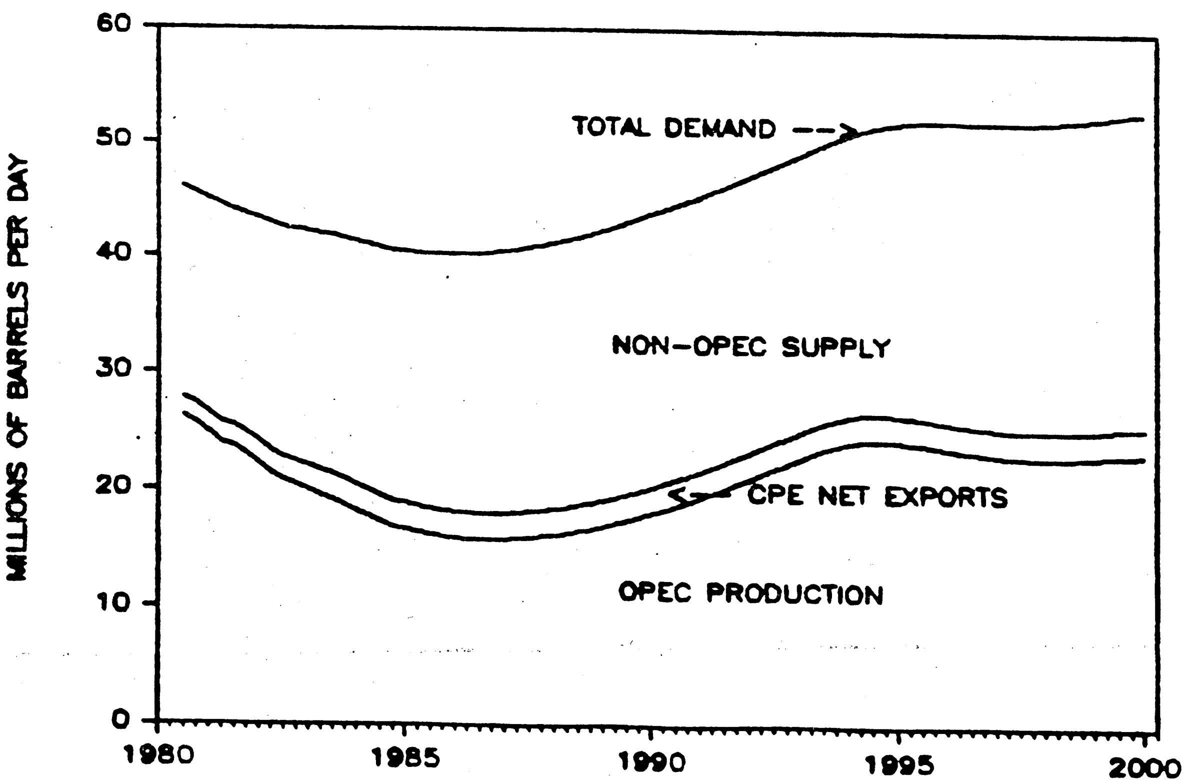

FIGURE 2
SUPPLY AND DEMAND BALANCE FOR CRUDE OIL

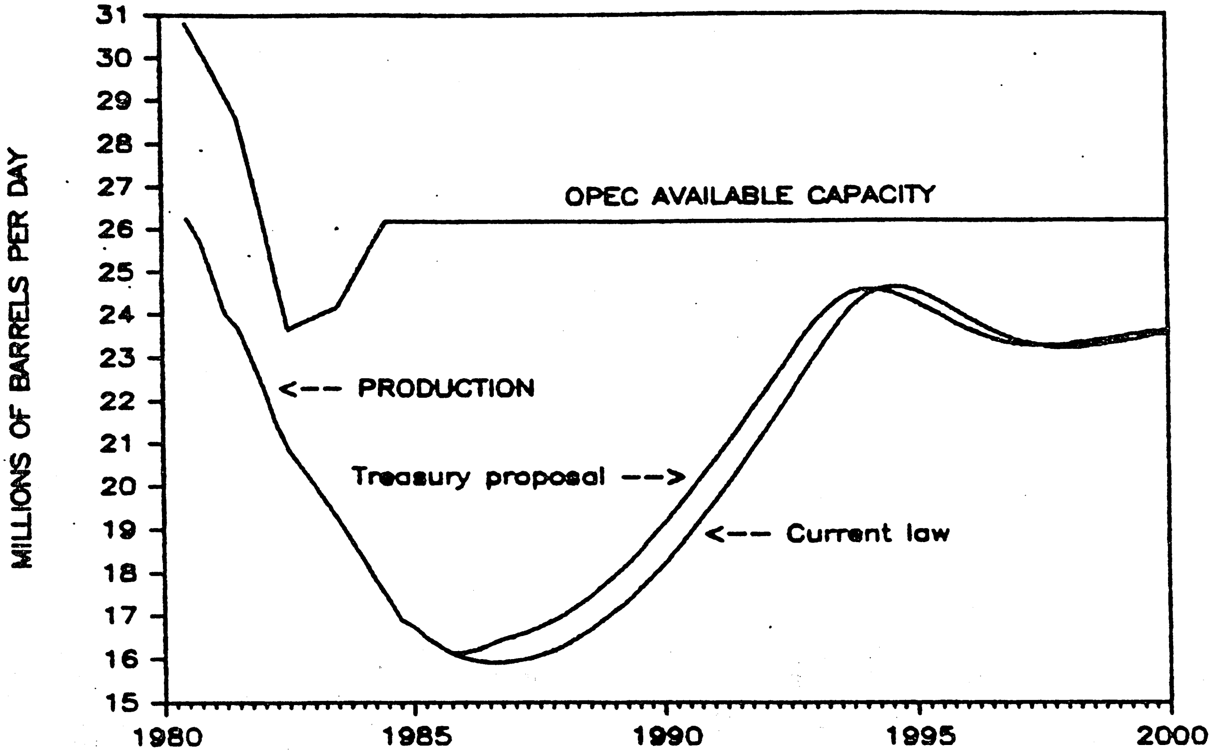

FIGURE 3
PROJECTED OPEC AVAILABLE OIL CAPACITY AND OIL PRODUCTION

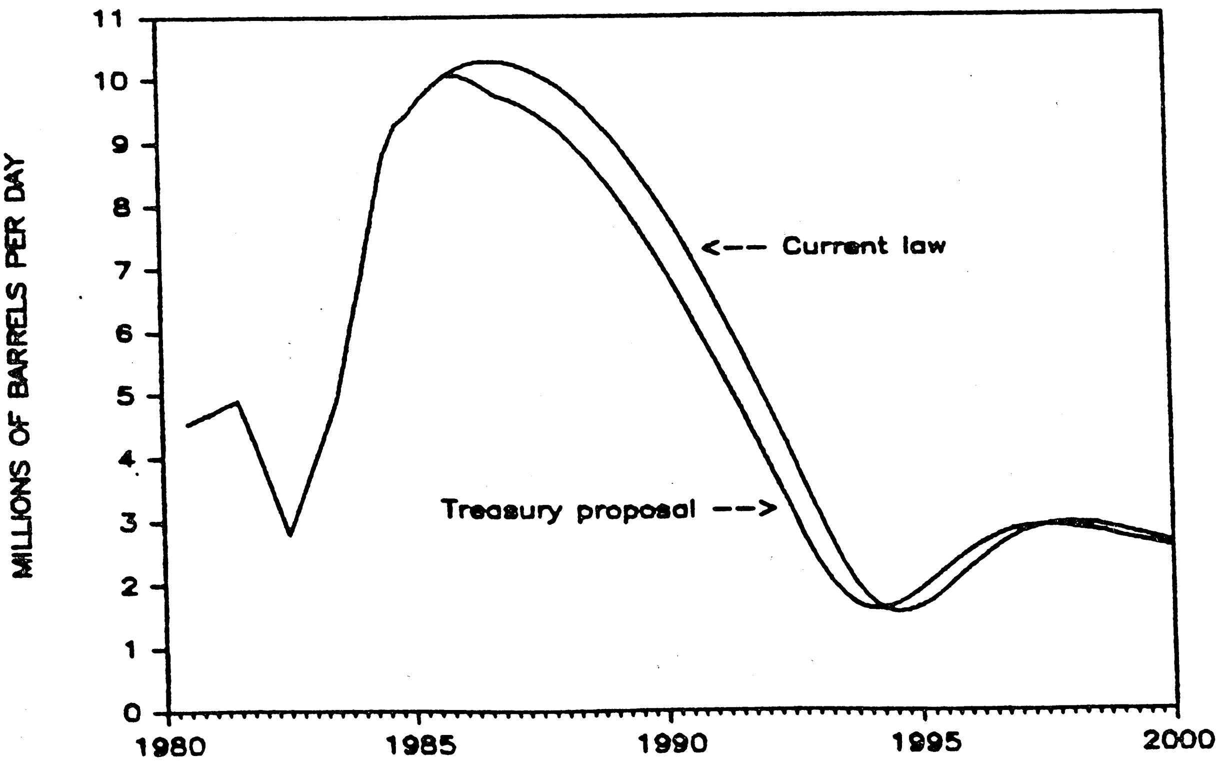

FIGURE 4
PROJECTIONS OF OPEC EXCESS AVAILABLE OIL PRODUCTION CAPACITY

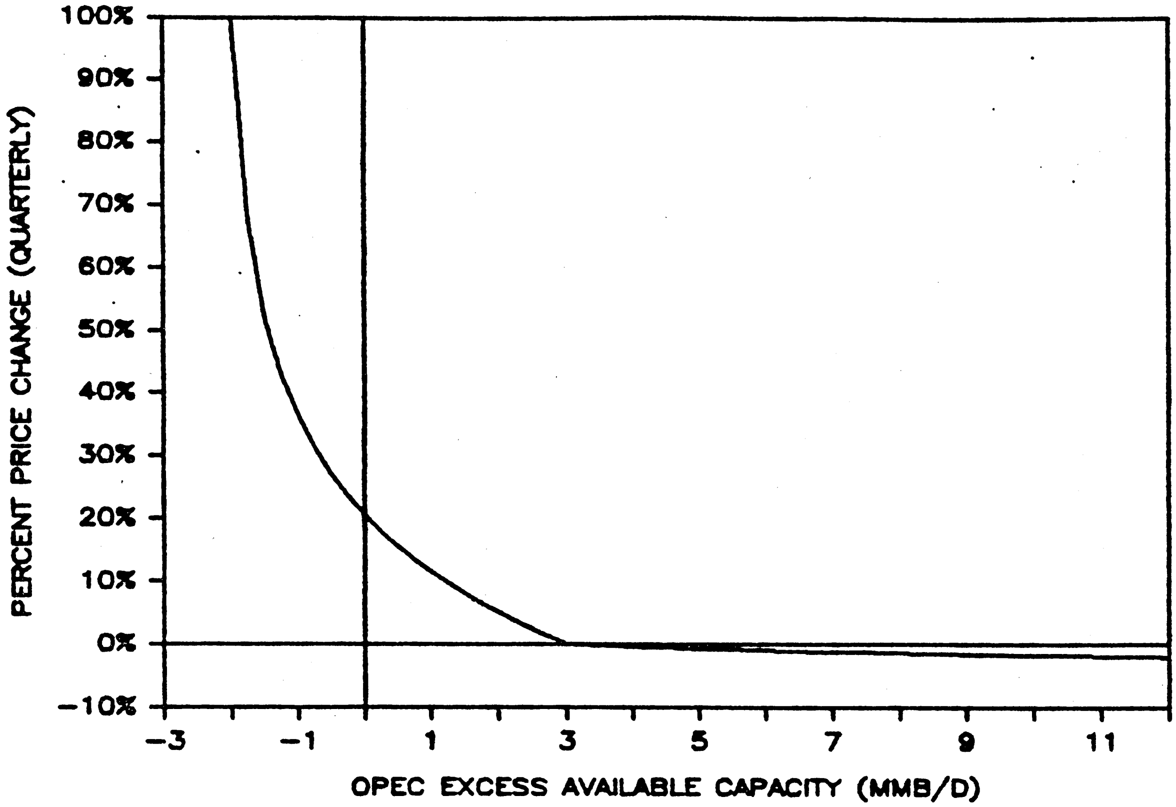

FIGURE 5
PRICE REACTION FUNCTION USED FOR THE ANALYSIS

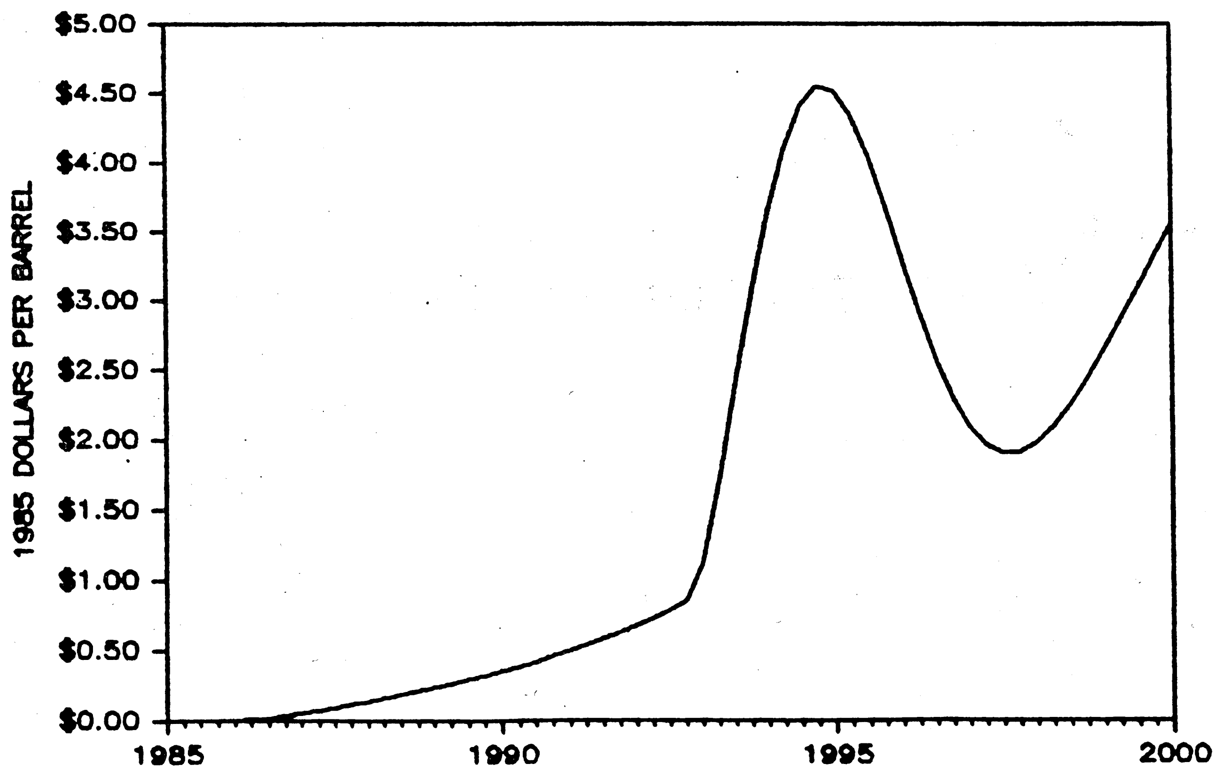

FIGURE 6
PROJECTED CRUDE OIL PRICE DIFFERENCE STEMMING FROM TAX PROPOSAL

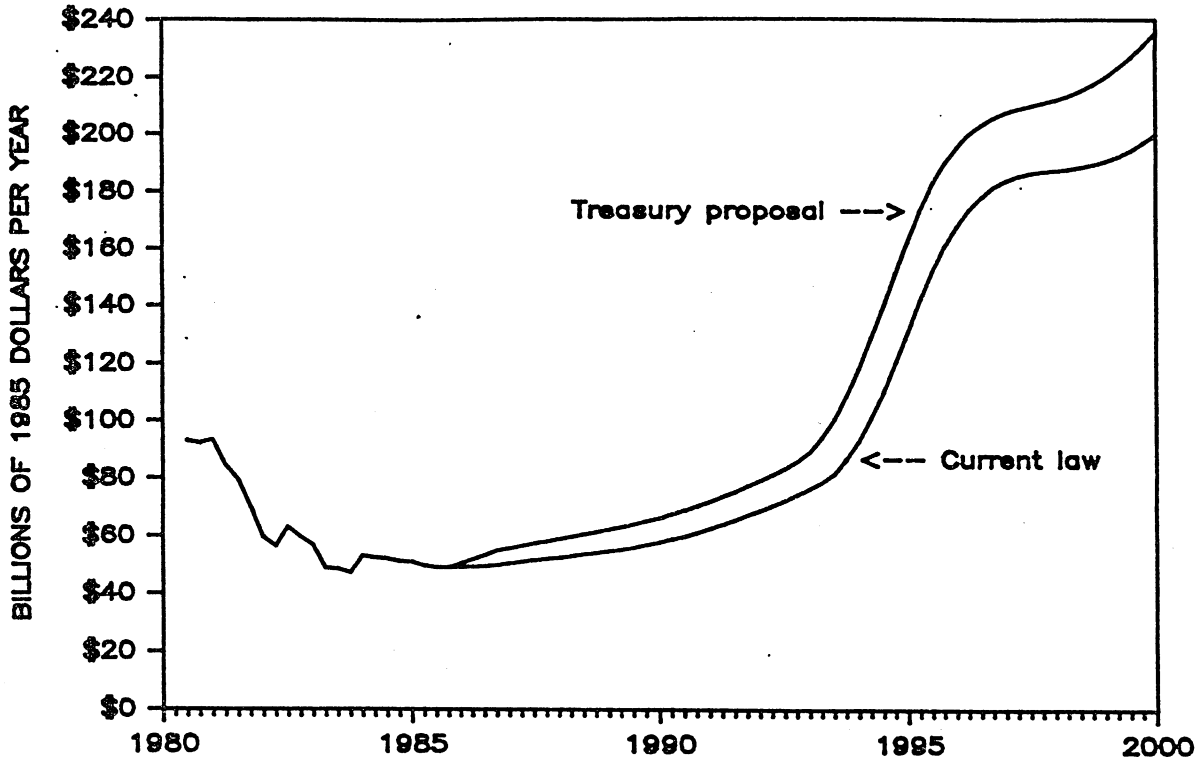

FIGURE 7
PROJECTIONS OF ANNUAL COST OF OIL IMPORTS

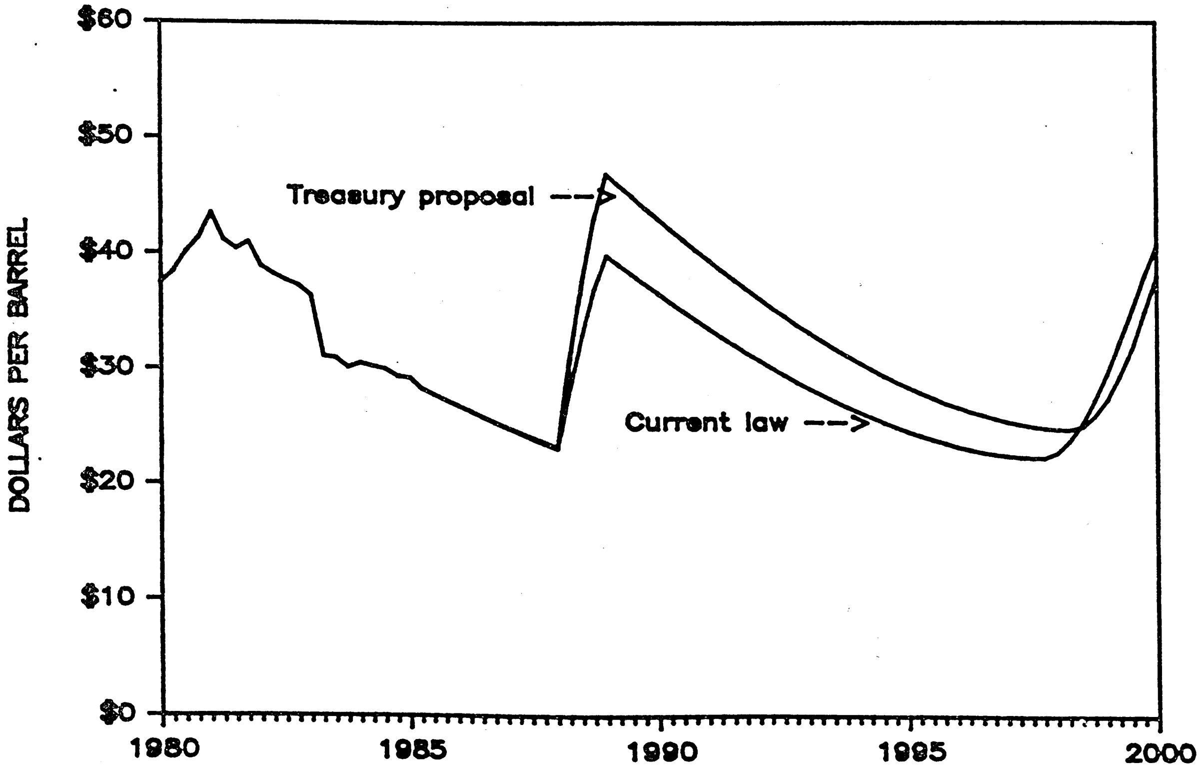

FIGURE 8
OIL PRICES IN RESPONSE TO 10 MMB/D DISRUPTION OCCURRING IN 1988

NOTES

1. Both authors are Stanford University faculty members. James L. Sweeney is a Professor of Engineering-Economic Systems and Director of the Center for Economic Policy Research. Michael J. Boskin is a Professor of Economics and Chairman of the Steering Committee of the Center for Economic Policy Research. Professor Boskin was primarily responsible for analyzing the specific tax changes and their impacts on the user cost of capital; Professor Sweeney was primarily responsible for analysis of the impacts of decreased production on oil markets and the U.S. economy.

2. See "Tax Reform for Fairness, Simplicity, and Economic Growth" in the references.

3. The cost of acquiring mineral rights must be capitalized and deducted in subsequent years. They are deducted over time through cost or percentage depletion, except that abandoned properties are deducted at abandonment. Cost depletion is a method for recovering capitalized costs that allows for deduction of the percentage of estimated reserves produced each year multiplied by the capitalized value of costs. Thus, if 3 percent of an oil well's remaining reserves were produced in the year, 3 percent of the unrecovered costs are written off in that year. The cost of exploring for oil and gas are handled the same way as the cost of acquiring mineral rights.

The cost of development is deductible at the time of the expenditure. However, the Tax Equity and Fiscal Responsibility Act of 1982 limited this expensing for integrated oil and gas producers to 85 percent of intangible drilling costs, with the remaining 15 percent to be written off over 3 years. The Deficit Reduction Act of 1984 decreased the fraction of intangible drilling cost (IDC) which could be expensed to 80 percent -- the restriction applying only to producing wells. Dry holes are expensed in full, and non-integrated producers are allowed the full immediate deduction.

Capital machinery and equipment used in oil and gas operations is subject to the accelerated cost recovery system and eligible for the investment tax credit. Most of this is in the ACRS five-year depreciation class.

4. Private communication with John Rasmussen, U.S. Department of Energy.

5. The national income accounts count much energy equipment in the 5 year ACRS class as structures, since they are "bolted down," e.g. blast furnaces or rolling mills.

6. These estimates are close to those contained in Gravelle (1985) who uses slightly different assumptions and considers possible interest rate and personal tax effects of the Treasury proposal in more detail.

7. Figures are calculated using Equation (1) with the following assumptions:
   - r = .055
   - d = .165 for machinery, .0663 for structures
   - T = .46 for current law, .33 for Treasury proposal
   - k = .10 for eligible assets; 0 otherwise
   - a = .95 for assets eligible for the investment tax credit; 1.0 otherwise

The current law assets is estimated by the U.S. Department of Energy, Energy Information Administration, as 50% ACRS, 26% expensed, 5% cost depleted, 19% carried without cost depletion/expensed as abandoned. It is assumed that the expensed capital will be moved into RCRS Class III under the Treasury proposal. Gravelle (1983) has a much higher fraction expensed than estimated by DOE, 91%. This number is based on regulatory policy assumptions, not actual tax data. It is unclear what fraction of oil and gas "structures" investment she treats as eligible for the investment tax credit. To be conservative, we assumed zero, which is why DOE user costs are slightly lower than those using Gravelle's assumptions. With some fraction getting the ITC, the "Gravelle" user cost would be down and the precentage increase in the Treasury proposal larger. Her capital stock figures weight structures at about 90% of the total.

8. See Jorgenson (1970) and Eisner, et. al., (1982) for estimates of, and debates over, the size of this parameter. Gravelle (1985) assumes unitary elasticity.

9. Our projection includes several years in which prices are increasing rapidly. However, if such price rises could be anticipated with confidence, firms would find it profitable to build up inventories just prior to the price increases. The inventory build-ups would increase demand and would halt the price decline earlier than projected here and would reduce the rate of price increase. However, we believe that ignoring of this factor does not significantly influence our analysis of the tax impacts.

10. U.S. oil production, consumption, and imports have been derived from the low price case (Case D) of the Annual Energy Outlook, 1984, of the Energy Information Administration. Quantities have been adjusted from this case by application of price elasticities around the DOE low price trajectory. See Appendix.

11. Several concepts of OPEC capacity are often used. Concepts and definitions used by the CIA are as follows: "Installed capacity, also called nameplate or design capacity, includes all aspects of crude oil production, processing, transportation, and storage." Installed capacity in 1985 is estimated by the CIA to be 41.4 MMB/D. "Maximum sustainable or operational capacity is the maximum production rate that can be sustained for several months; it considers the experience of operating the total system and is generally some 90-95 percent of installed capacity. This capacity concept does not necessarily reflect the maximum production rate sustainable without damage to the fields." Maximum sustainable capacity in 1985 is estimated by the CIA to be 34.8 MMB/D. "Available or allowable capacity reflects production ceilings announced by individual members. Iraqi capacity is limited by restrictions placed on exports as a result of the Iraq-Iran war and the closure of the Iraq-Syria pipeline." Available capacity is estimated by the CIA to be 26.2 MMB/D. In all capacity estimates throughout this paper, available capacity is the concept utilized.

12. Price reaction functions fitted from the entire post-embargo period generally show more rapid declines than does the one used here for periods of large excess capacity. However recently OPEC seems to have been able to limit price decreases more effectively than in the past. The more current observations have been incorporated judgmentally into the price reaction function used here.

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