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by

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Introduction

Following the dramatic oil price increases by the Organization of Petroleum Exporting Countries (OPEC) in late 1973 and 1974, average prices remained fairly stable through 1978 in nominal dollar terms (see table 1). However the purchasing power of OPEC oil as measured by the U.S. implicit GNP deflator or the price deflator for consumption fell substantially between the first quarter of 1974 and the end of 1978, and the value of the dollar fell significantly versus a weighted average index during the same period. This contrasts strongly to the experience since the end of 1979 in which OPEC price increases have greatly outpaced the rate of inflation and exchange rate fluctuations, causing a more than doubling of the real oil price during the subsequent eighteen months.

As a consequence of the recent price shock (commonly referred to as OPEC II) and the resulting acceleration of inflation and macroeconomic adjustments, many observers have bemoaned the fact that real oil prices were allowed to fall after the 1973-74 price shock (OPEC I), and that the painful adjustments required as a result of OPEC II would have been substantially mitigated if real prices had increased gradually between 1974 and 1978. However, while much economic work has focused on the negative effects of large sudden oil price increases, little or no work has examined the effects of smaller but continuous price changes over

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time, on which basis one might consider the desirability of indexation versus historical experience. The purpose of this study is to shed some light on the issue by examining simulation results using the Federal Reserve Board MPS model and comparing the 1974-1981 period with actual (and projected) oil prices versus several alternative oil price indexing formulations.

The indexing formulations were influenced by the long run pricing strategy which has been the subject of discussion within OPEC during the last two years, as well as by the theoretical literature on optimal extraction of depletable resources. We have experimented with several pricing schemes based on the premise that the price of oil would have increased in real terms following OPEC I, after adjusting for inflation and fluctuations of the dollar in terms of other currencies. All of the indexing formulations yield a large gap between the indexed and historical price by the end of 1978, but none of the indexing schemes yield as high an oil price as has already been experienced as a result of OPEC II. Therefore, we also introduced a modified shock scenario, in which oil price increases with indexing accelerate starting in 1979 and are equal to OPEC II levels in mid 1980. The simulation results suggest that a series of small oil price increases have smaller negative effects on overall prices and income than discrete jolts of equal cumulative magnitude.

The Energy Sector in the MPS Simulations

The energy sector has been expanded from that used in earlier MPS oil price shock simulations (See Thurman and Berner (1980)). Pre-

viously, domestic petroleum demand was modeled as a function of real income and the exogenous wholesale price index for energy (PWIFE) relative to the implicit GNP deflator. The equation used in these simulations projects total primary energy demand in BTUs (BQET) as a function of real GNP (XGNP) and a thirty two quarter price lag specification. Cooling and heating degree day data (DEGC and DEGH) were used to capture seasonal variation and a dummy variable was used to capture the effect of the 1973-74 oil embargo (EMB). PFW is the gross domestic sales fixed weight deflator. μ is the observed error term, and the positive coefficient reflects partial correction for autocorrelation. The estimation technique used was Cochrane-Orcutt with a second degree Almon polynomical distributed lag constrained to zero at t-n. The sample period was 1966 through the last quarter of 1979 (quarterly data).[1]

$$\ln BQET = \underset{(-14.8)}{-4.939} \underset{(-2.7)}{-.0657\ EMB} \underset{(16.7)}{+.0001\ DEGC}$$

$$\underset{(4.1)}{+.00008\ DEGH} \underset{(22.6)}{+1.08\ \ln XGNP}$$

$$\underset{(7.3)}{-.301\ (L_{32})}\ \ln\left(\frac{PWIFE}{PFW}\right) + .238\ \mu_{-1} + \varepsilon$$

$$DW = 1.910 \qquad R^2 = .971 \qquad SE = .0246$$

where cumulative four quarter lag sums from the lag distribution L_{32} are:

$\sum_{i=1}^{Q} B_i$	Q	Cumulative Sum
	4	-.0073
	8	-.1415
	12	-.1934
	16	-.2340
	20	-.2642
	24	-.2849
	28	-.2969
	32	-.3013

The energy demand sector in the MPS model can be used to determine relative shares of petroleum, natural gas and coal at the primary level as a function of prices of the different energy components relative to the aggregate energy price index (PWIFE) with a ten quarter lag specification. However, at the time of the simulations undertaken for this study, the complete system had not been finalized, and a constant share assumption was utilized;

$$DQFL = U_{dqfl} * BQET * k_{dqfl}$$

where DQFL is domestic petroleum consumption (mb/d), U_{dqfl} is the historical ratio of petroleum consumption to total energy consumption in each time period in quadrillion BTUs, and k_{dqfl} is a unit conversion factor from quadrillion BTUs at an annual rate to millions of barrels per day (mb/d).

Under this assumption the percentage change in petroleum consumption is equal to the change in total energy consumption, although this would be true in the complete system only in the restrictive case of no change in relative prices of petroleum, natural gas and coal. In multiplier simulations, petroleum consumption falls somewhat more than with the constant share assumption in response to a petroleum price shock, if there is no change in coal or natural gas prices. A complete description of the new energy demand equations is available in Jacobson, Loftin and Thurman (1980).

Imports of petroleum products (EMP) in billions of dollars at an annual rate are then determined by the identity

$$EMP = (DQFL - SQFL) * PUVFL * k$$

where SQFL is exogenous domestic production (mb/d), PUVFL is the average dollar import price of oil per barrel and k is a unit conversion factor from mb/d to $billion/year.

In the reference case, the projections beyond the second quarter of 1980 for the domestic wholesale energy price are calculated as described in Thurman and Berner (1980). The simulations were run prior to the immediate decontrol of domestic crude oil prices which occurred in early 1981, and assumed the then existing phased decontrol plan in which domestic wellhead prices reached the equivalent import price in the fourth quarter of 1981. For the purpose of these simulations, the reference case assumes continued nominal oil import price increases of about 4 percent per quarter after the second quarter of 1980.

In all of our indexing schemes, we make the assumption that the percentage differential in domestic petroleum prices equals the percentage difference in import prices when comparing the reference and index cases. The nonpetroleum components of the domestic wholesale price index for energy are not assumed to increase at the same rate as the domestic petroleum price component of that index.[2] This contrasts the two possible extreme cases; no passthrough to domestic producer petroleum prices (due to effective controls), and absolute increases in domestic petroleum prices equal to the increase in the import price of petroleum. Our assumption is equivalent to asserting that the domestic/foreign petroleum price ratio is unchanged by the price path of petroleum imports in the alternate regimes.

Alternative Oil Price Scenarios

Results from five oil price indexing schemes are presented in this paper. The spirit behind the alternative mechanisms is to allow the price of oil to rise gradually in real terms measured in dollars subsequent to the 1973-74 oil price shock. While the pattern of increase and total cumulative increase differs in the various cases, all but one show considerably higher prices through 1978 after which the differential between the index cases and the reference case closes rapidly and becomes negative by mid-1980. The one exception is an exogenously determined price path which contains a price acceleration during 1979 and 1980 so that oil prices in the reference case reaches, but does not exceed, prices in the alternate regime.

Of the five oil price indexing scenarios, two are exogenously determined (including the modified shock scenario described above), and three are endogenously determined within the model simulation. All indexing schemes are calculated in terms of the U.S. import unit value for petroleum, rather than the OPEC average crude price. As can be seen in Table 1, the U.S. import price historically is slightly higher than the OPEC price (due to higher average quality composition), except in periods of rapid price increase (due to a two month transportation lag). While the choice of starting point is somewhat arbitrary, the first quarter of 1974 seems reasonable for OPEC prices, although the large oil price increases of 1973-74 were not fully reflected in the U.S. trade data until the second quarter of 1974. To reconcile this problem, the second quarter U.S. import unit value in the indexed cases was calculated as if OPEC prices had been indexed since the first quarter.

In the exogenous cases, this resulted in an increase in the second quarter 1974 U.S. import price (6.7%). We then used this contrived second quarter 1974 U.S. import unit value as the starting point in the three remaining endogenous simulations.

Our choice of oil indexing schemes was heavily influenced by the 'Summary of Recommendations' that was presented to the conference of OPEC Oil Ministers in Taif, Saudi Arabia in May, 1980 by the Committee on Long-Term Strategy.[3] This document suggests that a pricing floor should be established to maintain rising real prices combining three elements:

a) An inflation adjustment, in accordance with which prices would be adjusted by an index reflecting the impact of inflation on international trade.

b) An exchange rate adjustment on the basis of 11 currencies plus the U.S. dollar.

c) Oil prices should rise in real terms proportionately to the growth in real GNP of OECD countries.

Significantly, however, the OPEC price calculated by such a formula was proposed to be a 'minimum floor price' with the explicit qualification that 'as markets swing from surplus to shortage ... the pricing strategy must be flexible enough to go beyond the minimum floor price level'. After any possible shortage is over, it was proposed that prices be frozen in real terms until the calculated floor price catches up with the new market price, or else that the floor price be immediately raised to a higher level. Thus, an OPEC indexing scheme as formulated could not insulate the Western economics completely from an oil price shock caused, for instance, by an oil supply disruption. Therefore,

we decided to examine a modified shock, or a rapid acceleration of oil prices between the fourth quarter of 1978 and the second quarter of 1980 which would yield the same ultimate effect on the world oil price level as in the reference case.

In some formulations we used only U.S. variables rather than weighted average industrial country variables in calculating indexed oil prices. In the MPS sector, the determination of U.S. income and prices is much more developed than foreign GNP and prices (some of the foreign sector is still in experimental stage). In all cases in which the oil price is determined endogenously, the weighted average foreign exchange rate is exogenously set at historical values (with the assumption of no change between 1980-Q2 and 1981-Q4); that is, unchanged from the reference case.

The general indexing formula used in the simulations is as follows:

$$PUVFL_t = PUVFL_{t-1} * \left(\frac{PGNP_t}{PGNP_{t-1}} \right)^{W_1} \left(\frac{FPCI_t}{FPCI_{t-1}} \right)^{W_2} \left(\frac{XGNP_t}{XGNP_{t-1}} \right)^{W_1} \left(\frac{FGNP_t}{FGNP_{t-1}} \right)^{W_2} \left(\frac{WFER_t}{WFER_{t-1}} \right)$$

where

PUVFL = unit value price per barrel of oil
PGNP = Implicit U.S. GNP deflator
XGNP = U.S. GNP in 1972$
FGNP = Foreign real GNP
FPCI = Foreign consumer prices, multilateral weights
WFER = Weighted foreign exchange value of the dollar

and $W_1 + W_2 = 1$.

Thus the oil price is indexed multiplicatively by changes in prices, GNP and the exchange rate. In the first exogenous oil price scenario (Scenario 1), $W_2 = 0$ (no foreign variables) and the GNP adjustment is replaced by a constant 3 percent annual rate of growth. U.S. prices

are derived from historical values (Table 1). The second exogenous case (Scenario 2), is identical to the first case through 1978. Starting in the first quarter of 1979, a 6 percent per quarter increase is applied through 1980-Q2, after which oil prices are set equal to those in the reference case.

In the first endogenous case (Scenario 3), $W_2 = 0$ (no foreign variables) and an exchange rate adjustment is not included. In effect, the oil price is indexed to changes in nominal U.S. GNP. Since U.S. prices and incomes are derived within the simulation, feedback effects of oil prices to macroeconomic variables and back to oil prices again occur throughout the scenario. The next simulation (Scenario 4) includes the exchange rate adjustment; an appreciation of the dollar (increase in WFER) reduces the oil price, and conversely for a depreciation. The last simulation (Scenario 5) uses foreign as well as U.S. variables in determining oil prices, with $W_1 = .213$ and $W_2 = .787$ (the actual multilateral trade weight shares in 1976).

Comparative Simulation Results

A summary table showing simulation results for oil prices, GNP and the consumer price index in the five different scenarios, is shown in table 2. More detailed results for individual scenarios are shown in tables 3 through 7. Charts 1 through 3 display the paths of oil prices, real GNP and consumer prices. Note that the reference case consists of historical data through the second quarter of 1980^4, and a model forecast during the second half of 1980 and 1981.

Common to all of the endogenous indexing schemes is a steadily widening gap between the indexed oil price and the historical price, which reaches 20 to 30 percent by the end of 1977 and increases dramatically in 1978. By the end of 1979 the indexed prices are lower than in the reference case (due to the almost doubling of oil prices during 1979) and become increasingly negative during 1980, reaching over -30 percent in the endogenous cases. The exogenous oil price scenarios (Scenarios 1 and 2) show a greater peak price differential by the end of 1978 due to the constant 3 percent real price growth assumption. Since the U.S. growth rate averages less than 2.5 percent during the simulation period, this accounts for most of the discrepancy. By assumption, Scenario 2 shows no difference in oil price from the control case during the last six quarters of the simulation.

Scenario 3 shows a much smaller peak oil price differential than the other cases, due to the ommission of an exchange rate adjustment (as seen in Table 1, the dollar depreciated almost 10 percent between 1977 and 1978). However, the relative stability of the dollar (and actual appreciation during 1975 and 1976) results in lower prices before 1978 in Scenario 4 (with exchange rate adjustment) compared to Scenario 3. Scenario 5, which indexes oil prices to a weighted average of foreign and U.S. price variables, shows generally higher prices than the other endogenous scenarios due to the relatively rapid growth of foreign to U.S. prices in the model.

The various indexing schemes yielded a reduction in domestic energy demand of 6 to 9 percent (about 1 to 1.5 mb/d) by the end of

1978 when the price differentials between the index and reference cases are at their peak. By the end of 1981, the index schemes yield slightly higher petroleum consumption levels than the reference case (0 to 6 percent) due to the substantially lower prices. In the modified shock case (in which the price differential equals zero during the last six quarters but does not become negative), petroleum consumption remains 3.4 percent lower at the end of 1981. This differential is affected by the lag structure of the energy demand equation, and would be partially eliminated with a longer simulation period. In all cases expenditures on energy product imports are sharply higher by the end of 1978 (17 to 33 percent), and substantially lower by the end of 1981 (10 to 25 percent).

Reductions in real GNP are present in all cases through 1978, with end 1978 values lower by 1.3 percent to 1.8 percent. The amounts vary directly with the cumulative oil price shock, with the change in level of GNP per 10 percent cumulative price increase ranging fron .24 to .33 percent. However, between 1978 and 1981, the negative impact of the oil price shock in the reference case yields a level of GNP 1.7% to 2.9% higher than the reference case. Clearly, the MPS model yields stronger real effects from large price shocks than from a series of small shocks spread over a longer period of time. This is most clearly evident in the case of the modified shock scenario, in which real GNP is 1.7 percent higher at the end of 1981, even though prices are identical to the reference case during the last six quarters.

In the case of domestic prices, the effects of the difference of small versus large oil price shocks is even more dramatic. By the end

of 1978, multiplier values per 10 percent increase in oil prices range from .10 to .16 percent for the GNP deflator and .15 to .20 percent for the consumption deflator. Change in price levels at the end of 1978 average about 1 percent in the various scenarios. However, the price levels at the end of 1981 are 4 percent or more lower in Scenarios 1, 3, 4 and 5. In the modified shock case (Scenario 2) all price indexes are 3 to 4 percent lower by the end of 1981 even though oil prices are always greater than or equal to those in the reference case.

It should be noted, however, that the price multiplier effects from a constant oil price shock are larger over the first few years of the simulation and then become smaller in subsequent years. The decline in the price multiplier is a consequence of the energy price induced reduction in aggregate demand having a strong negative effect on prices.[5] This results in relatively flat, or in some cases declining, price level multiplier between 1975 and 1978. This relationship also exaggerates the ultimate effect on prices in the reference case relative to the indexed cases at the end of 1981.

The unemployment rate gradually increases in all scenarios to a level .85 to 1.25 percentage points higher than the reference case. The peak differential occurs about one year after the peak oil price differential, due to the strong lagged effects of unemployment to reductions in GNP in the MPS model. By the end of 1981 the unemployment rate is .3 to .8 percentage points lower in the index cases, and .15 points lower in the modified shock case.

Interest rates are not strongly affected in any of the scenarios (all simulations assume unborrowed reserves identical to the reference

case). Interest rates are generally slightly higher in the first two or three years and drift lower in later years, but show no changes greater than one percentage point.

Foreign GNP effects are generally similar to U.S. GNP effects, showing somewhat stronger negative effects in the earlier years and lower percentage increases at the end of 1981 (although always higher than the reference case). Foreign price effects are much stronger than U.S. price effects, but this is largely due to the structure of the foreign price equation (discussed above), which is extremely sensitive to oil price increases.

The current account balance shows a pattern similar to expenditure on energy imports, with deterioration in the earlier years, and improvement after 1978. The end of 1981 current account improvement in the index cases is within $5 billion of the reduced expenditure on energy imports. In the modified shock case the gap is higher ($9 billion) due largely to different effects on U.S. and foreign GNP levels.

Summary

In the comparison of the multipliers from these alternative oil indexing schemes, the nonlinearities within the econometric model (and in the economy it replicates) play an important role. By smoothing the rate of increase in world oil prices, the simulated economy is spared the discrete jolts which occurred in this commodity price since 1978. Many behavioral relationships in the model and within the economy -- the trade-off between employment and prices chief among them -- will react more strongly to a sudden impulse than to an

impulse of equal magnitude occurring over time. The differences in reaction of the model to smoothly indexed oil price increases explain much of the improved economic performance even in the case of Scenario 2 where world oil price levels are made equal by the end of the simulation.

It could well be that the relative improvement in the economic indicators stemming from the various indexing schemes is understated. Investment expenditure planning, for example, would be facilitated through the increased degree of certainty which result from the oil price indexing formulas. This, and other expectational relationships within the economy, are inadequately captured in this and most econometric models.

Footnotes

1. The model was reestimated in January, 1981, following a revision in historical GNP data by the Department of Commerce, and including actual data through the first quarter of 1980. The latest estimates show a slightly lower income elasticity (1.065), and a larger cumulative price elasticity (-.33).

2. Coal and natural gas prices generally are determined through long term contracting procedures and thus the competing energy price effect on these nonoil energy prices occurs with a considerable lag and will not increase as much as petroleum prices. See Thurman and Berner (1980).

3. Text presented in Petroleum Intelligence Weekly, May 12, 1980.

4. The historical data for GNP and prices prior to the Department of Commerce revision (see footnote 1).

5. This effect is stronger than results derived in earlier oil price shock simulations using previous versions of the MPS model.

References

Thurman, S. and Berner, D. Analysis of Oil Price Shocks in the MPS Model. Paper prepared for the CEPR Conference on Energy Prices, Inflation and Economic Activity. Cambridge, November 7, 1979.

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TABLE 1

ACTUAL HISTORICAL VALUES

Year	(1) Average OPEC Price ($/barrel)	(2) U.S Oil Import Unit Value ($/barrel)	(3) Implicit GNP Price Deflator	(4) Relative Petroleum Price ((2)/(3)*100)	(5) Wtd. Average Foreign Exchange Rate ($/For. Cur.)
1973	4.74	3.33	105.9	3.14	1.081
1974	11.28	10.98	117.2	9.37	1.063
1975	10.78	11.45	128.6	8.90	1.074
1976	11.77	12.14	135.1	8.99	1.023
1977	12.88	13.29	142.5	9.33	1.031
1978	12.93	13.31	151.6	8.78	1.123
1979	18.67	18.67	163.9	11.39	1.158
1980	30.87	30.46	177.4	17.17	1.155

TABLE 2

OIL PRICE INDEXING SCENARIOS
Summary of Multiplier Results
(percent difference fron control)

Scenario #1: (1974-1981), 3% real P_{oil} increase, exchange rate adjusted.

Scenario #2: (1974-1978), 3% real P_{oil} increase, exchange rate adjusted. (1979-1981), 6% P_{oil} increase per quarter through 1980-Q2, equal to reference scenario thereafter.

Scenario #3: P_{oil} increases with endogenous U.S. $\dot{P}_y$, $\dot{Y}$.

Scenario #4: P_{oil} increases with endogenous U.S. $\dot{P}_y$, $\dot{Y}$, and adjusted for exchange rates.

Scenario #5: P_{oil} increases with endogenous U.S. and foreign $\dot{P}_y$, $\dot{Y}$, and adjusted for exchange rates.

Scenario #1

	P_{oil}	Y	P_c
1974	15.7	-0.2	0.5
1975	23.7	-0.7	1.1
1976	21.1	-1.1	0.9
1977	28.2	-1.3	0.7
1978	64.5	-1.8	1.0
1979	4.3	-1.5	-1.2
1980	-16.6	-0.1	-3.8
1981	-19.3	2.9	-4.9

Scenario #2

	P_{oil}	Y	P_c
1974	15.7	-0.2	0.5
1975	23.7	-0.7	1.1
1976	21.1	-1.1	0.9
1977	28.2	-1.3	0.7
1978	64.5	-1.8	1.0
1979	16.8	-1.7	-0.8
1980	0.0	-0.7	-3.0
1981	0.0	1.7	-4.0

Scenario #3

	P_{oil}	Y	P_c
1974	12.4	-0.2	0.4
1975	22.1	-0.5	0.8
1976	24.1	-0.9	1.0
1977	27.1	-1.1	0.9
1978	43.5	-1.4	0.8
1979	-11.9	-1.0	-1.4
1980	-35.8	0.1	-4.1
1981	-37.3	2.8	-5.4

Scenario #4

	P_{oil}	Y	P_c
1974	11.5	-0.2	0.3
1975	17.0	-0.5	0.7
1976	17.2	-0.8	0.7
1977	22.6	-0.9	0.7
1978	54.2	-1.3	1.1
1979	-4.9	-1.1	0.8
1980	-31.0	-0.3	-3.5
1981	-32.9	2.1	-4.9

Scenario #5

	P_{oil}	Y	P_c
1974	12.7	-0.2	0.4
1975	20.4	-0.5	0.8
1976	25.7	-0.9	1.0
1977	29.5	-1.1	0.9
1978	57.4	-1.6	1.1
1979	-0.9	-1.4	-0.9
1980	-25.6	-0.5	-3.5
1981	-30.3	2.1	-5.2

P_{oil} = Price of imported oil (PUVFL)

P_c = Consumer Price Index (PCON)

P_y = GNP deflator (PGNP)

Y = Real GNP (XGNP)

TABLE 3

Effect of Indexed World Oil Price
Scenario 1: Exogenous price simulation (3% real increase) with exchange rate adjustment)
(Percent difference from control; end of year rates)

	1974	1975	1976	1977	1978	1979	1980	1981
GNP (current $)	-.01	.15	-.38	-.69	-1.17	-1.98	-2.72	-1.50
GNP(1972$)	-.22	-.69	-1.12	-1.27	-1.78	-1.52	-.06	2.93
GNP deflator	.20	.85	.75	.58	.62	-.46	-2.66	-4.30
Consumption deflator	.45	1.11	.90	.72	.99	-1.21	-3.81	-4.90
Unemployment rate*	.07	.34	.59	.78	1.06	1.16	.68	-.77
Treasury bill rate*	.02	.08	-.01	-.11	-.21	-.47	-.67	-.56
Import price of Petroleum	15.73	23.69	21.10	28.19	64.54	4.27	-16.60	-19.30
Domestic petroleum consumption	-.79	-2.88	-4.22	-5.38	-8.07	-8.34	-4.65	.73
Value of petroleum imports	14.14	14.53	11.21	11.92	33.43	-15.80	-27.72	-17.56
Merchandise Trade Balance*	-4.40	-3.62	-2.26	-1.33	-10.11	26.17	36.50	16.30
Foreign GNP	-.13	-1.09	-1.11	-.94	-2.04	-2.06	.90	1.34
Foreign Consumption Prices	.98	3.27	3.61	4.48	7.43	6.25	1.26	-1.62

* For the unemployment and treasury bill rates, changes are given in percentage points. For the trade balance, the change shown is the absolute difference in $ billion (current).

TABLE 4

Effect of Indexed World Oil Price
Scenario 2: Exogenous price simulation (same as Scenario 1 with modified shock in 1979-80)
(Percent difference from control; end of year rates)

	1974	1975	1976	1977	1978	1979	1980	1981
GNP (current $)	-.01	.15	-.38	-.69	-1.17	-1.93	-2.66	-1.76
GNP (1972 $)	-.22	-.69	-1.12	-1.27	-1.78	-1.70	-.68	1.74
GNP deflator	.20	.85	.75	.58	.62	-.23	-1.99	-3.43
Consumption deflator	.45	1.11	.90	.72	.99	-.80	-3.00	-3.99
Unemployment rate*	.07	.34	.59	.78	1.06	1.23	.97	-.15
Treasury bill rate*	.02	.08	-.01	-.11	-.21	-.44	-.62	-.56
Import price of petroleum	15.73	23.69	21.10	28.19	64.54	16.81	0	0
Domestic petroleum consumption	-.79	-2.88	-4.22	-5.38	-8.07	-9.06	-6.88	-3.43
Value of petroleum imports	14.14	14.53	11.21	11.92	33.43	-8.51	-19.71	-10.11
Merchandise trade balance	-4.40	-3.62	-2.26	-1.33	-10.11	20.12	32.14	17.23
Foreign GNP	-.13	-1.09	-1.11	-.94	-2.04	-2.25	.21	.40
Foreign Consumption prices	.98	3.27	3.61	4.48	7.43	1.31	3.81	2.18

* For the unemployment and treasury bill rates, changes are given in percentage points. For the trade balance, the change shown is the absolute difference in $ billion (current).

TABLE 5

Effect of Indexed World Oil Price
Scenario 3: Endogenous Price Simulation (adjustment for increase in nominal U.S. GNP)
(Percent difference from control; end of year rates)

	1975	1975	1976	1977	1978	1979	1980	1981
GNP (current $)	-.04	-.09	-.13	-.32	-.71	-1.60	-2.93	-2.11
GNP (1972 $)	-.18	-.54	-.88	-1.08	-1.40	-1.01	.10	2.81
GNP deflator	.22	.63	.76	.77	.70	-.60	-.3.03	-4.78
Consumption deflator	.39	.83	.97	.88	.81	-1.37	- 4.10	-5.43
Unemployment rate *	.06	.24	.48	.67	.88	.89	.43	-.82
Treasury bill rate*	.02	.05	.02	-.04	-.12	-.41	-.67	-.55
Import price of petroleum	12.41	22.05	24.11	27.06	43.45	-11.91	-35.75	-37.32
Domestic petroleum consumption	-.71	-2.18	-3.67	-4.92	-6.77	-5.89	-.95	5.85
Value of petroleum imports	10.86	14.43	15.05	10.04	17.27	-24.48	-37.91	-23.85
Merchandise trade balance*	-2.85	-3.03	-3.08	-.04	-.10	26.05	32.51	15.37
Foreign GNP	-.13	-.75	-1.09	-1.08	-1.62	-1.32	1.65	2.34
Foreign Consumption prices	.89	2.47	3.62	4.55	6.30	3.81	-2.57	-6.30

* For the unemployment and treasury bill rates, changes are given in percentage points. For the trade balance, the change shown is the absolute difference in $ billion (current).

TABLE 6

Effect of Indexed World Oil Price
Scenario 4: Endogenous Price Simulation (adjustment for increase in nominal U.S. GNP and exchange rate adjustment)
(Percent difference from control; end of year rates)

	1974	1975	1976	1977	1978	1979	1980	1981
GNP (current $)	.02	.10	-.18	-.34	-.52	-1.26	-2.72	-2.18
GNP (1972 $)	.16	-.47	-.76	-.89	-1.30	-1.08	-.32	2.13
GNP deflator	.18	.58	.58	.56	.79	-.18	-2.41	-4.21
Consumption deflator	.33	.73	.70	.65	1.07	-.82	-3.45	-4.88
Unemployment rate*	.05	.22	.41	.55	.79	.86	.60	-.47
Treasury bill rate*	.02	.05	-.01	-.04	-.07	-.30	-.58	-.51
Import price of petroleum	11.45	16.97	17.18	22.59	54.20	-4.94	-30.99	-32.88
Domestic petroleum consumption	-.62	-1.99	-3.05	-4.01	-6.37	-6.24	-2.28	-3.70
Value of petroleum imports	10.16	10.25	9.80	9.21	27.64	-20.12	-36.56	-23.75
Merchandise trade balance*	-2.68	-1.95	-1.50	-.29	-5.50	22.60	33.04	17.43
Foreign GNP	-.11	-.75	-.83	-.78	-.92	-1.34	-.61	.45
Foreign Consumption prices	.77	2.26	2.80	3.59	6.32	4.65	-1.30	-4.88

* For the unemployment and treasury bill rates, changes are given in percentage points. For the trade balance, the change shown is the absolute difference in $ billion (current).

TABLE 7

Effect of Indexed World Oil Price
Scenario 5: Endogenous Price Simulation (adjustment for increase in U.S. and foreign prices and income and exchange rates)
(Percent difference from control; end of year rates)

	1974	1975	1976	1977	1978	1979	1980	1981
GNP (current $)	.02	.11	-.17	-.33	-.67	-1.55	-2.98	-2.46
GNP (1972 $)	-.18	-.53	-.94	-1.12	-1.57	-1.36	-.54	2.07
GNP deflator	.32	.64	.77	.80	.91	-.19	-2.46	-4.44
Consumption deflator	.37	.83	.99	.93	1.13	-.89	-3.54	-5.19
Unemployment rate*	.06	.25	.50	.69	.97	1.07	.79	-.34
Treasury bill rate*	.02	.06	.01	-.03	-.10	-.37	-.64	-.60
Import price of petroleum	12.72	20.35	25.65	29.49	57.35	-.92	-25.57	-30.26
Domestic petroleum consumption	-.68	-2.23	-3.77	-5.11	-7.55	-7.53	-3.84	2.14
Value of petroleum imports	11.28	12.63	16.32	11.48	25.30	-20.53	-35.61	-24.78
Merchandise trade balance*	-2.99	-2.51	-3.39	-.51	-2.93	24.97	34.86	20.90
Foreign GNP	-.12	-.83	-1.03	-1.16	-1.86	-1.84	1.09	1.65
Foreign Consumption prices	.86	2.55	3.65	4.75	7.33	5.68	.05	-3.65

* For the unemployment and treasury bill rates, changes are given in percentage points. For the trade balance, the change shown is the absolute difference in $ billion (current).

Chart 1

OIL PRICE PER BARREL

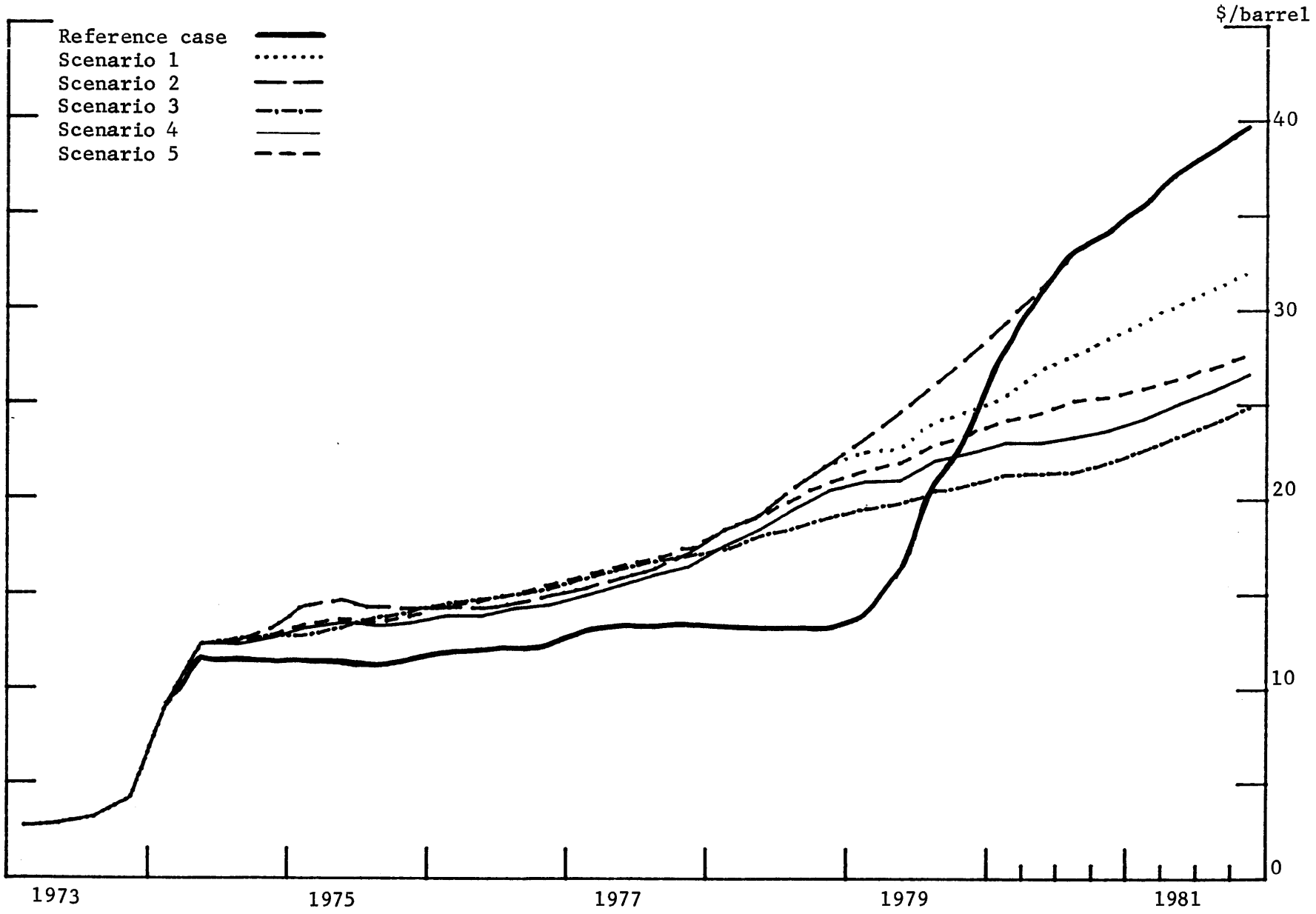

Chart 2

REAL GNP

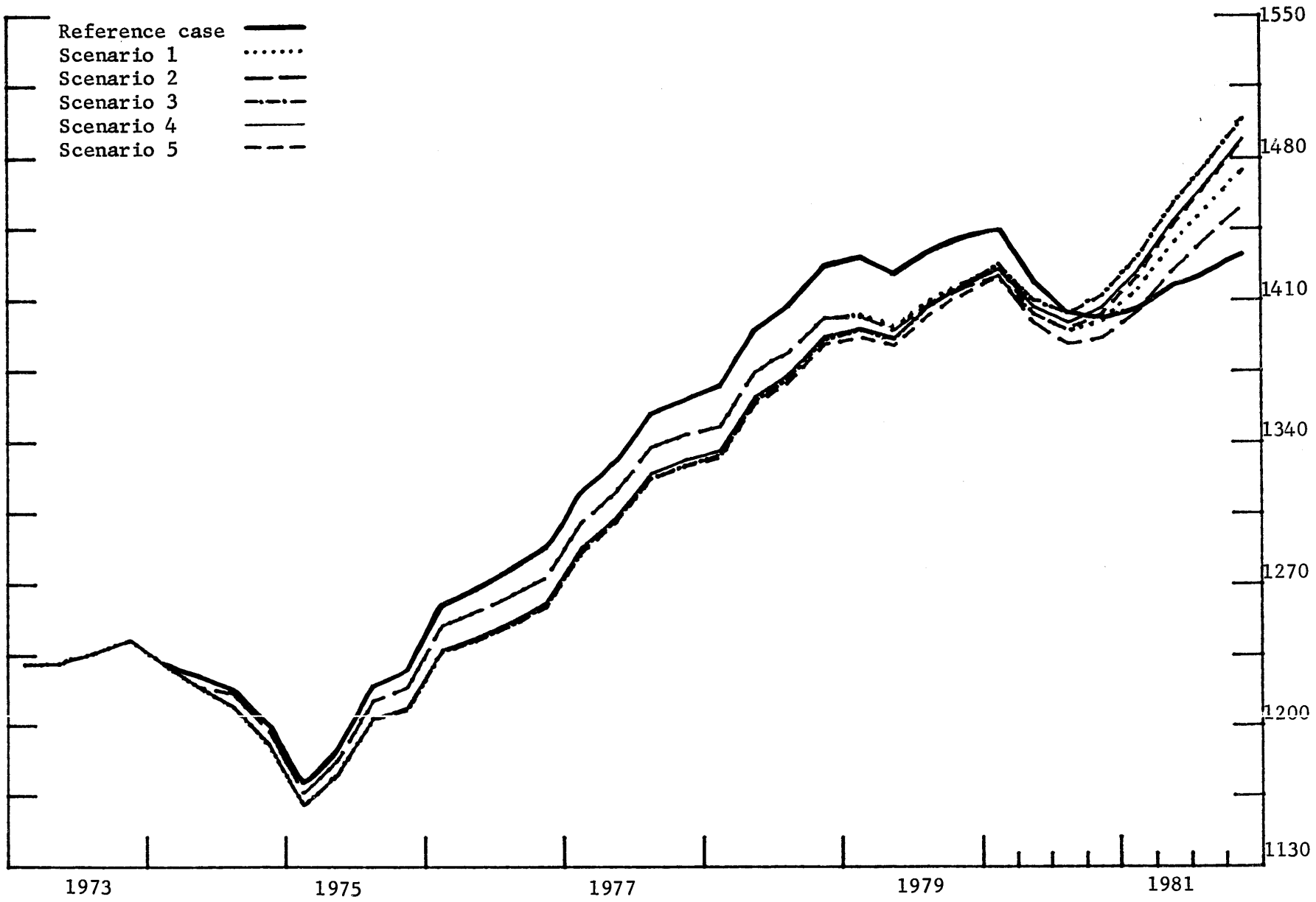

Chart 3

CONSUMPTION PRICE INDEX