REGULATORY REFORM
What Actually Happened

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CASE 4

Petroleum Regulation and Public Policy

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INTRODUCTION AND BACKGROUND

Focus

The petroleum industry is the largest in the world and one of the most visible. Oil companies dominate the "ten biggest" list of America's giant industrial corporations. Petroleum is highly concentrated geographically, both in the United States and worldwide. Government intervention in the industry consequently has high political and economic consequences. Winners and losers are apt to be strongly affected and easily identifiable.

Public concern over petroleum industry practices dates back to the last century. Standard Oil was the dominant company from the industry's early days until its dismemberment by the U.S. Supreme Court on antitrust violations in 1911. Domestic oil production was

Parts of this paper reflect research supported by the Energy and Environmental Policy Center at Harvard University, the National Science Foundation (SES-8408805), and the U.S. Department of Energy. We are grateful to Ronald Braeutigam, Michael Klass, and Leonard Weiss for helpful comments and suggestions.

restricted by state governments in Texas and Oklahoma from the early 1930s to the early 1970s. Federal regulations kept domestic crude oil prices below market-clearing levels from 1971 until 1981. The present era is the first in fifty years that the industry has faced market forces without strong government intervention. In this paper we will analyze recent regulation and the trend away from government control of the petroleum industry.

After reviewing conditions under which government intervention might improve economic efficiency, we will evaluate "efficiency" and "nonefficiency" motivations for price controls on domestic crude oil, the most visible form of government regulation of the industry in the 1970s. The analytical part of this discussion illustrates how simple tools of microeconomics can be used to assess the effects of price regulation on economic efficiency, oil consumption, oil prices, and income transferred abroad to pay for additional imports. We close with an examination of the current, price-decontrolled environment. Given the rationale for a public policy in the petroleum sector, what types of actions can maintain economic efficiency and at the same time protect the economy from oil supply disruptions?

Motivations for Policy Intervention

Market Failure and Economic Efficiency. Focusing first on economic efficiency, we assume that the goal of policymakers is to advance the economic welfare of the citizenry to the maximum extent possible. This has two dimensions. The first is long-run industry structure and behavior. Second, the oil market has been subject periodically to sharp fluctuations — the Suez Crisis of 1956–1957, the Arab embargo of 1973–1974, the Iranian revolution of 1978–1979, and the present Iran-Iraq war. According to the well-known "invisible hand" proposition first put forth by Adam Smith, national economic welfare is maximized when governments allow markets to operate freely. Only when some sort of *market failure* is present is there justification for public intervention. An *efficiency* case for *any* energy policy — price controls, tariffs, public stockpiles, energy conservation, or anything else — requires a demonstration of market failure.

A long-standing argument for governmental intervention is domestic monopoly. The petroleum industry has been the object of considerable government scrutiny and public mistrust over the years, in large part because of industry structure. Around the turn of the century, Standard Oil achieved notoriety for its monopolization of the industry. Three of its offspring — Exxon, Mobil, and SoCal — along with two other American (Texaco and Gulf) and two foreign giants

(British Petroleum and Royal Dutch Shell) came to be known as the "majors." These multinational companies dominated the international oil trade from the 1920s to the 1960s. The sheer size of these companies brought them into the public limelight.

Table 1 shows the concentration of United States companies in the petroleum industry. Like many mineral industries, petroleum can be divided into vertical stages. *Production* entails extraction of crude oil from existing reserves, development of newly discovered sources, and exploration. *Refining* consists of processing the crude oil by heat and chemical means into usable products. *Distribution* consists of marketing these products as well as service to consumers through gasoline stations and fuel oil deliveries.

Table 1 shows that the petroleum industry is not highly concentrated by United States standards (see Scherer, 1980, Chapter 3). Moreover, entry into the production, refining, and distribution segments of the industry is relatively easy. On the other hand, the large firms in the industry appear to face little threat from entrants. For example, only three of the largest twenty refining companies in 1980 entered the industry since World War II. All three entered by acquiring existing refineries. The largest firm to enter in the postwar period through constructing a new refinery ranked forty-fifth in 1980.

Vertical integration is prevalent in the industry. Sixteen of the twenty largest United States refiners in 1980 also appeared on the list of the twenty largest producers. An exact measure of vertical integra-

Table 1. Concentration of United States Companies in the Petroleum Industry

	Percent of Total		
	Largest Four Companies	*Largest Eight Companies*	*Largest Twenty Companies*
Production			
Crude oil extracted	25	41	60
Ownership of reserves	35	53	70
Refining			
Capacity	29	49	74
Crude oil processed	31	54	81
Distribution			
All products	28	46	65
Gasoline	28	49	65

Source: American Petroleum Institute (1981b).

tion is difficult to construct, since the majors exert influence over foreign production sources that they do not actually own. Much of the government intervention in the petroleum industry has been directed toward preserving competition between non-vertically integrated, "independent" refiners, and their larger brethren.

The majors' dominant position in the industry gradually eroded in the 1960s. Until that time, demand fluctuations had been smoothed within their vertically integrated chains, and prices had been declining slowly in real terms with discoveries of low-cost Middle Eastern oil. The entry weakened the companies' bargaining position with the Organization of Petroleum Exporting Countries (OPEC), which was founded in 1960. Crude oil prices rose in the early 1970s and then jumped substantially during the "oil embargo" of 1973–1974.

The transfer of control from the majors to OPEC in the 1970s raised a question for domestic oil regulation: What role could it have? The crude oil market is international, as low transport costs enable cargoes to travel long distances. If the price of crude oil is set in the world market, the existence of alleged monopoly power at home becomes less relevant. Domestic price controls on a freely traded international commodity have very different consequences than controls on nontraded goods; most important, excess demand is no longer allocated through rationing, queues, and the like, but through additional imports. Thus domestic regulation spills over into the international market.

Short-run fluctuations in the oil market present a different set of issues. The arguments for government intervention during a short-term supply disruption on the grounds that the interests of private agents and the nation are not identical are as follows:

1. *Macroeconomic losses.* Such losses have been substantial in the past (Fried and Schultze, 1975; Mork and Hall, 1980; Hickman and Huntington, 1984). A large, unanticipated increase in the price of oil generates economic losses for oil-importing nations through cyclical losses in aggregate demand, deteriorating terms of trade, and reduced potential output. The first effect is transitory, traceable primarily to downward inflexibility of nominal wages and non-oil prices and to demand-management problems. Related demand-side costs may stem from the redistribution of income among sectors, possibly affecting aggregate demand because of differences in propensities to spend.

The last two effects are more long term. As oil is a major input to the economy's production process, an oil price increase resulting from a supply shock will reduce potential output, that is, the output attainable with all resources fully and efficiently employed. Conserva-

tion of energy and substitution of other production factors (for example, capital and labor) in a free market will reflect adjustments to higher energy costs, but the reduction in energy consumption may lower capital and labor productivity.

2. *Monopsony power.* The United States is a large player in the world petroleum market, since its actions affect market outcomes. An example is the price control and entitlements program that subsidized oil imports in the 1970s, thereby putting upward pressure on world oil prices. Imported oil thus has an additional cost associated with it (sometimes called the "monopsony premium") inasmuch as increased United States imports result in higher prices and greater wealth transferred abroad.

3. *Vulnerability.* The level of national preparedness could affect the likelihood of a disruption (Balas, 1980; Kinberg et al., 1978). This argument clearly applies only to the case of deliberate action taken by foreign powers against the United States.

4. *National security.* The nation's security objectives may cause it to incur foreign policy and military costs, regardless of whether a disruption is deliberate. A potential example is the cost of the Rapid Deployment Force.

Two additional efficiency arguments for public intervention are based on imperfections in other markets. *Information* is the basis for the first. The government could gain access to confidential intelligence information regarding future supply conditions and thus be in a position to make better decisions than private agents (Marchand and Pestieau, 1979). The second is based on *insurance.* Private agents may fear to act in their own best interests because they cannot ensure there will not be a public outcry for additional government regulation or taxation (for example, windfall profits tax) during the disruption, and because of past behavior, the government cannot credibly commit itself to avoid such actions (Wright and Williams, 1982).

The importance of each of these arguments is empirical and will vary according to circumstance. Those who believe that the best energy security policy is to let the market be the determining factor, however, are obliged to reject them all.

Price Controls and Economic Efficiency. In this study we examine in detail the impacts of crude oil price controls on the behavior of domestic producers, refiners, and consumers. Price controls are direct and highly visible and thus politically attractive. The experience in the United States in the 1970s resulted in unhappiness with price controls

(Kalt, 1981). Economists' arguments against price controls (apart from innate professional distaste) in a disruption fall into three categories. First, they discourage additional supply. This argument is weak unless supply is elastic in the short run, which seems unlikely. Second, they discourage conservation when it is most needed. Like the previous argument, this depends on a short-run elasticity (in this case, of demand). There is an important additional consideration, however; the United States is not autarkic. Given imports as the marginal supply source, increased United States demand exerts upward pressure on *world prices,* which in a disruption are very sensitive. Since only domestic prices are controlled, demand pressure can raise world prices sufficiently that even the controlled domestic price eventually exceeds the price that would prevail in a free market (Hubbard and Fry, 1982). Finally, price controls redistribute substantial income, which serves to create beneficiary groups (in the past, United States refiners and consumers), making rescission difficult after the emergency has passed.

Nonefficiency Motivations for Price Controls. Price controls and subsidies dominated the regulatory pattern of the 1970s. Thus it is pertinent to consider two nonefficiency motivations for controls: "fear of inflation" and "consumer protection." The term "nonefficiency motivations" is in no way designed to minimize their importance. Indeed, one of the reasons rising energy prices have been accompanied by such political attention is the enormous size of the associated (domestic and international) transfers of income and wealth. For example, the price of crude oil imported into the United States rose from $2 in 1970 to $12 in 1974.

As general economy-wide price controls were being phased out in 1973, it became apparent that domestic oil prices would rise markedly to the level of oil prices. At the same time the fear of rekindling inflation pervaded the policymaking community. Indeed, even with price controls on domestic production, the rate of inflation accelerated sharply in 1974 and 1975. While not all of the increase in inflation was traceable to the oil supply shock of 1973–1974, one contemporary econometric study claimed that roughly 28 percent of the total increase in inflation was a result of higher energy prices (see Fried and Schultze, 1975). Further compounding the problem, as higher energy prices reduced aggregate production, the demand for labor fell, contributing to the previously unknown condition of "stagflation" — high inflation and unemployment rates.[1]

Even in the face of such an alarming connection between higher energy prices and slower economic growth, arguments for maintaining price controls in the long run are questionable. Substantial domes-

tic welfare costs are incurred because of overconsumption and underproduction of crude oil, and the controls slow down the economy's adjustment to rising oil prices during oil supply disruptions. If price controls were given preexisting distortion, there might be ample argument for phased deregulation to minimize macroeconomic side effects, but that is certainly no cause for their reimposition in the future.

Because of the importance of oil (and energy in general) in both production and consumer expenditure and because of limited possibilities for substitution in the short run, oil price increases can be expected to reduce real living standards and effect large transfers of income and wealth.[2] The particular system of price controls used throughout most of the years of petroleum price regulation in the United States transferred income from domestic producers to consumers.[3] As a point for economic analysis, however, to the extent that such transfers affect the decisions of the players involved (producers, refiners, and consumers), losses in economic efficiency result. We take up later the question of the relative efficiency of using price controls to affect consumers.

PUBLIC INTERVENTION IN THE OIL INDUSTRY: BACKGROUND[4]

Intervention Prior to 1973

Public intervention has long played an important role in the domestic petroleum industry, although the source of concern (and hence the means of intervention) has varied over time. Except for the Standard Oil case and the imposition of price controls on crude oil in the 1970s, public policy could be fairly described as "proproducer," with a wide variety of protective interventions, including (1) restrictions on domestic production, (2) favorable tax treatment for oil producers, and (3) official barriers against foreign competition.

Policies of the first type were typically embodied in state "prorationing" or "conservation" schemes, which acted to restrict domestic production by allowing each well to operate a given number of days per month. Formal federal intervention to achieve cartel-type restriction of production came with the passage of the Connally Hot Oil Act (1935), under which state prorationing schemes were coordinated.[5]

Favorable tax treatment for oil producers is as old as the income tax itself, with a "depletion allowance" of 5 percent of the value of annual production written into the Revenue Act of 1913. By 1926 the allowance had reached 27.5 percent, and it stayed there for more than forty years.

National security interests ostensibly led to the announcement of a voluntary oil import restriction program in 1957. When the voluntary program failed to reduce imports significantly, it was replaced by President Eisenhower in 1959 with an official Mandatory Oil Import Program (MOIP). With some exceptions (for example, imports to the West Coast), the program restricted imports to a set percentage of domestic producton. "Import tickets," or rights to import oil, were allocated to domestic refiners roughly according to size, though (as was typical of future intervention as well) small refiners were favored. Tickets could be bought and sold on a white market, at a price equal to the spread between domestic and imported prices.

As there was no clear efficiency rationale for the MOIP, transfers to domestic producers could be expected to be accompanied by substantial welfare costs. Such deadweight losses stemmed from the increase in the price of oil in the United States above the world price and the resulting underconsumption of oil and overproduction of domestic oil. Economic studies have indicated that such losses were quite large.[6]

The onset of the 1970s brought substantial criticisms of the MOIP both from groups concerned with its labyrinthine administration and from policymakers concerned about inflation. Though the MOIP was not eliminated until April 1973, restrictions started to be phased out in 1970.

By the early 1970s restrictions on oil imports were removed, the depletion allowance was substantially reduced (and later removed), and prorationing controls were eliminated. For the first time, however, public intervention switched to price controls. Controls were imposed on all stages of the industry as part of the economy-wide anti-inflation program announced by President Nixon in 1971.[7]

Emergency Petroleum Allocation Act

Though controls were phased out for most of the economy by the end of 1973, regulation of oil prices continued. These "Phase IV" regulations were ratified in the Emergency Petroleum Allocation Act of 1973 (EPAA). Operationally, EPAA controls separated domestic oil

into two tiers, "old oil" and "new oil." Prices for old oil were set at substantially lower levels than prices for new oil. Output levels for 1972 were established as "base period control levels." Any amount by which production from a given well fell below this control level was added to the well's "current cumulative deficiency." The first tier, "old oil," was composed of the base period control level and the current cumulative deficiency. Three other complications were introduced: (1) producers could release a barrel from the "old oil" category for each barrel of new oil produced from pre-1972 wells; (2) output from wells not brought into production until after 1972 was classified as "new oil;" and (3) output averaging less than ten barrels per day from a well was classified as "stripper oil." By the end of 1973 new, stripper, released, and import prices were not subject to controls.

Regulation soon expanded beyond price controls per se, as competition for access to controlled oil led to the imposition of allocation regulations and the virtual freezing of vertical (buyer-seller) transaction arrangements. Allocation of crude oil was controlled under the "Buy/Sell" program, which required refiners with ratios of crude oil to refining capacity in excess of the national average to sell to crude-short refiners.

In addition to the fear of shortages, an obvious byproduct of EPAA-styled price regulation were differences in average crude costs paid by refiners. That is, refiners with access to price-controlled oil would have lower average costs than those purchasing only decontrolled oil. To equalize these interrefiner differences, Congress adopted an "old oil entitlements" program in late 1974. Under this program the number of entitlements given to a particular refiner was equal to the number of barrels of controlled oil it would have used in the previous month assuming national-average proportions of controlled and uncontrolled oil. If a refiner used more price-controlled oil than the national average, it was required to purchase entitlements to refine the excess. The "entitlement price" reflected the spread between the acquisition costs of uncontrolled and old oil across refiners. We discuss the impact of the entitlements program on marginal incentives in a later section. The introduction of the entitlements program effectively eliminated the need for the Buy/Sell program.

Many exceptions to the entitlements program were made under the EPAA tenure, primarily to give extra entitlements to favored groups. Principal categories included (1) the Small Refiner Bias program, (2) the Exceptions and Appeals Relief system, and (3) the United States Strategic Petroleum Reserve. Under the Small Refiner Bias program, extra entitlements were given on a sliding scale with fewer entitlements given as refinery throughput increased up to

175,000 barrels per day.[8] The Exceptions and Appeals Relief system conferred additional entitlements on refiners with "hardships." In practice, the program was an administrative nightmare.[9]

Energy Policy and Conservation Act

The Ford administration favored deregulation upon expiration of the EPAA in early 1975. Congress, however, passed the Energy Policy and Conservation Act (EPCA), which took effect in February 1976, and maintained domestic petroleum price regulation. The introduction of a three-tier pricing program extended controls to almost all domestic production exempted from controls under the EPAA.

Under the original EPCA legislation, authority for price controls (except for emergency standby status) was to expire on September 30, 1981. The EPCA defined all output from a property less than its base period control level plus current cumulative deficiency as "lower tier oil." Any output from wells brought into production after 1975 and output from pre-1976 wells greater than assigned lower tier output became "upper tier oil." Finally, stripper oil and imported oil prices were not subject to controls. Upper tier oil sold for its price on September 30, 1975, less $1.32, plus adjustments for inflation (and for incentives). Lower tier oil sold for its price on May 15, 1973, plus $1.35, with additional inflation and incentive adjustments. EPCA amendments in 1976 eased these controls by allowing average domestic prices to rise by at least 10 percent per annum (irrespective of inflation). Average prices in 1976 were roughly $5 for lower tier oil, $11.50 for upper tier oil, and $12 for stripper oil.

Deregulation

On June 1, 1979, President Carter began (under legislative authority from EPCA) a gradual decontrol of domestic crude oil prices. Ostensibly to capture most of the income transfers from domestic consumers to domestic producers, the Crude Oil Windfall Profit Tax Act of 1980 was also enacted under the Carter administration. The tax is not at all a profits tax. Rather, it is an excise tax on the difference between the market price of a barrel of crude oil and a predetermined base price. We discuss the implications of such a tax for producer behavior in the next section.

Three tiers of oil are categorized under the Act for tax purposes. Tier One consists of recently decontrolled upper tier oil and all lower tier and upper tier oil under the EPCA. Its base price is equal to the

ceiling price in May 1979, adjusted for inflation. Stripper and Naval Petroleum Reserve crude oil constitutes Tier Two, the base price for which is about a dollar higher than the Tier One base price. The tax rates on the first two tiers are 70 and 60 percent, respectively. Tier Three oil includes oil from post-1978 wells, heavy crude oil, and incremental oil from tertiary recovery. Its base price is $2 above the May 1979 upper tier ceiling price, and its tax rate is 30 percent. A small amount of oil is exempt from "windfall profit" taxation on the grounds of exceptionally high cost of production or ownership by nonprofit organizations.

The windfall profit tax will be phased out beginning January 1988 or the first month (but no later than January 1991) after the federal govenment has collected $227 billion from the tax. To evaluate the impact of the tax on producer revenues, note that in conjunction with existing corporate income taxes, the windfall profit tax will collect more than 70 percent of crude oil price increases during its tenure. While the elimination of price controls and entitlements subsidies got rid of the regulation-induced distortion of consumption decisions, the excise tax system enacted under the Crude Oil Windfall Profit Tax Act will continue to distort producer behavior. The revenues from the tax (about $66 billion as of 1984) have been assigned to a variety of energy assistance, research, and subsidy programs.

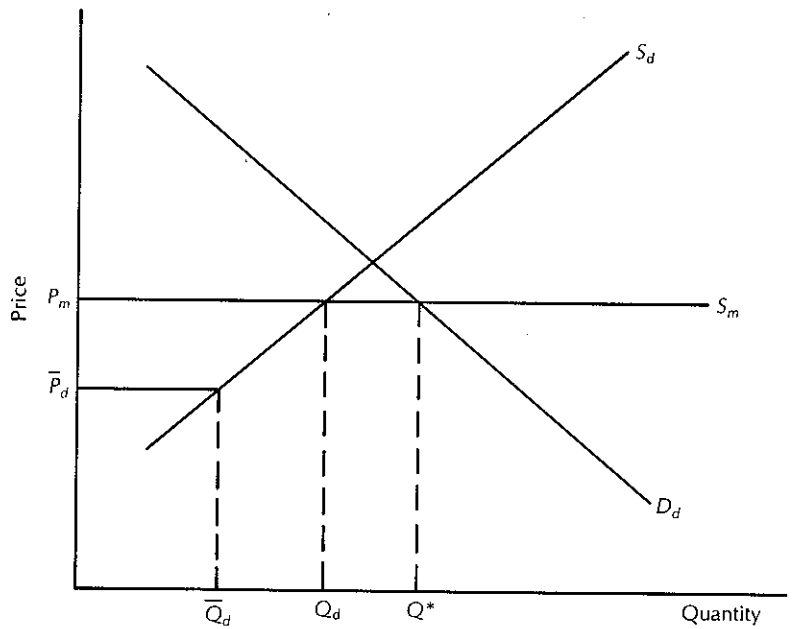
ECONOMIC ANALYSIS OF GOVERNMENT INTERVENTION

Price Controls and Economic Efficiency

The level of demand for oil would be *efficient* if oil were used in such a way that its economic value was no less than the price of imports. Depending on their implementation, price controls can create distortions in both the domestic demand for and supply of oil. These distortions in turn can lead to substantial deadweight losses for the economy as a whole — losses above transfers among consumers, producers, and refiners. Departures from efficiency are measured in terms of these deadweight losses — reductions in the size of the national economic pie. In addition, to the extent that the United States is not a price taker in the world oil market, distortions in domestic demand and supply can influence the world price. As a first step we follow Kalt (1981) in making two assumptions about market structure: (1) domestic refining and production of oil is assumed to be

undertaken competitively (Table 1) and (2) the United States is assumed to have no monopsony power in the world oil market. We relax the second assumption later.

Contemporary popular claims notwithstanding, the original EPAA-type price controls did not distort refiner marginal costs (and hence, given our "competitive refiners" assumption, consumer prices and demand). To see this, note the description of the domestic refining market in Figure 1. D_d and S_d represent the domestic demand for and supply of crude oil, respectively. Given the price-taking assumption (that is, changes in United States oil imports do not affect world oil prices), the supply of imports is represented by the horizontal line S_m at world price P_m. $\bar{P}_d$ represents the controlled domestic price. In the absence of price controls, producers within the United States



NOTE: Figure 1 is simplified by assuming that all domestic oil is price controlled at the same level, as under EPAA.

Figure 1. Market Equilibrium with Price Controls

would produce Q_d, and refiners would purchase Q^*, with $Q^* - Q_d$ coming from imports. With domestic price controls at P_d, domestic producers reduce their quantity supplied to $\bar{Q}_d$, and imports widen to $Q^* - \bar{Q}_d$. Total refinery purchases do not change (only the split between domestic production and imports), because the marginal cost of crude oil is still the (unchanged) import price. Thus there are no demand-side distortions. There are, however, *supply-side* distortions because the difference in domestic production $Q_d - \bar{Q}_d$ could have been produced at less than the world price.

As Figure 1 indicates, rents on the inframarginal (price-controlled) barrels were captured only by refiners with access to controlled crude oil. A major reallocation of those property rights occurred in November 1974, with the introduction of the entitlements program. Again, simply put, rights to controlled crude oil (entitlements) were granted as an equal proportion of each refiner's total input. Most important for our purposes, the program not only redistributed rents but also lowered refinery *marginal costs* and production decisions. This is because the purchase of additional barrels allowed a refiner additional entitlements to lower priced oil, partially offsetting the cost.

The entitlements program under the EPAA is best understood as the system of taxes and subsidies depicted in Figure 2. The entitlements program equalized (subject to the exceptions mentioned in section II) the marginal cost of crude oil across refiners as the weighted average cost of all oil refined domestically. That is, the weighted average price P_s in Figure 2 corresponded to

$$P_s = mP_m + (1 - m)\bar{P}_d$$

where m represents the fraction of domestic consumption coming from imports. Of course, $P_s < P_m$, with the difference being the value of the per unit entitlement subsidy.

The program implicitly taxes away the rents on controlled oil $\bar{R}[(P_m - \bar{P}_d) \times \bar{Q}_d]$, redistributing them (the area $(P_m - P_s) \times Q^{**}$) to all refiners — even those without access to controlled oil. Two results can be distinguished from the previous case of price controls without entitlements: (1) a subsidy (equal to $P_m - P_s$) is generated, lowering refiner marginal cost, and (2) as a consequence, total refinery purchases increase (from Q^* to Q^{**}). Since the refining sector is assumed to be competitive, the marginal price faced by consumers of petroleum products declines.[10] The resulting increase in final demand (and refinery purchases) increases imports and the nation's oil import bill.

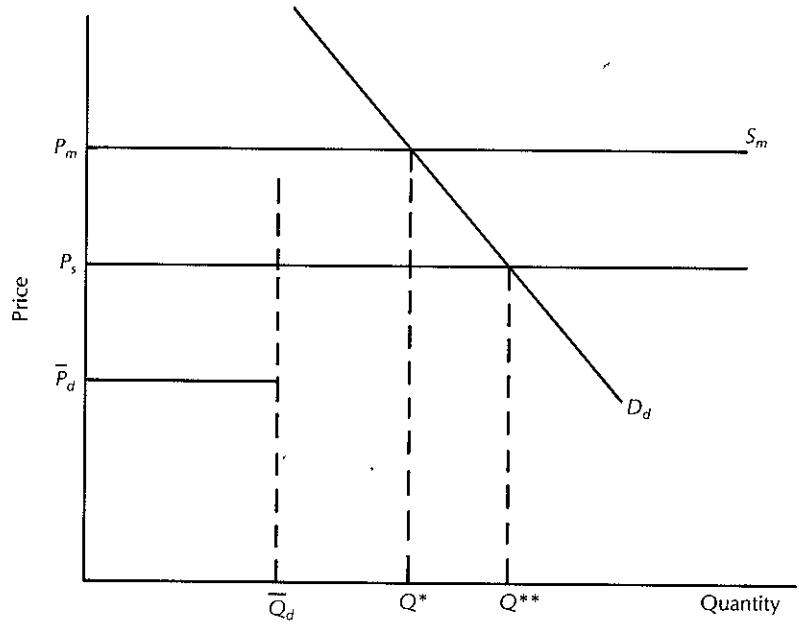


Figure 2. Crude Oil Price Controls and Entitlements

After the passage of the EPCA, the entitlements program changed to accommodate the new three-tier pricing system in February 1976. New entitlements had to be created for upper tier oil, since upper tier oil prices were reduced below market levels. The existence of multiple tiers complicates the diagram in Figure 2, but the qualitative points about the redistribution of rents on the controlled oil remain.

As part of the original provisions of the EPCA, ultimate decontrol of crude oil prices was scheduled for the fall of 1981. Designed to capture the price increases on oil already under production, President Carter's Crude Oil Windfall Profit Tax Act in reality imposed excise taxes on domestic oil production. As such, the taxes prolong the system of multi-tier price regulation, even though crude oil prices are now decontrolled.

Measuring the Welfare Costs of Crude Oil Price Controls

Our next step is to examine the impacts of petroleum price regulation on efficiency in production and consumption. Such information will help us to quantify the benefits of crude oil price decontrol. Price controls effected a massive redistribution of rents (associated with controlled oil) away from producers to refiners and consumers. Even though the windfall profit tax superseded price controls, it continues to forestall significant transfers of wealth to crude oil producers.

We first calculate the efficiency losses due to price controls under the continuing assumption that the United States is a price taker in the world oil market. The marginal social cost in the calculations is the price of an extra barrel of imported oil, since this measures foreign producers' claim on United States output. As shown in Figure 3, the operation of the price controls-cum-entitlements subsidy program increases domestic demand from Q^* to Q^{**}, creating a welfare cost on the consumption side equal to the area ABC. On the supply side, the controls reduce domestic production from Q_d to $\bar{Q}_d$. This reduction is made up with imports, which cost United States refiners P_m per barrel (Figure 3), when United States producers could produce them at a lower marginal cost (as represented by the S_d function). Hence an additional welfare cost represented by the area DEF is created. How significant these welfare costs are to society depends on assumptions about the shapes (elasticities) of the D_d and S_d curves.

Trends in world oil prices and the difference between the world price and the marginal cost of oil to domestic refiners (because of the entitlements subsidy program) are reported over the period from the first quarter of 1974 to the second quarter of 1984 in Table 2.[11] The peak in world oil prices occurred at about the same time as crude oil prices were decontrolled in the United States, as world demand decreased (because of a slowdown in output growth in most industrial countries and the lagged effects of higher oil prices) and supply conditions improved.

Kalt (1981) provides some estimates of the deadweight losses from domestic overconsumption and underproduction for the years during which the entitlements program operated. His calculations are summarized in Table 3. Constant-elasticity demand and supply relationships were assumed, with a (one year) price elasticity demand of -0.5 and a set of supply elasticities for production from existing wells and new production (see Kalt, 1981, pp. 195–205). The calculations in Table 3 make clear the size of the annual welfare costs involved —

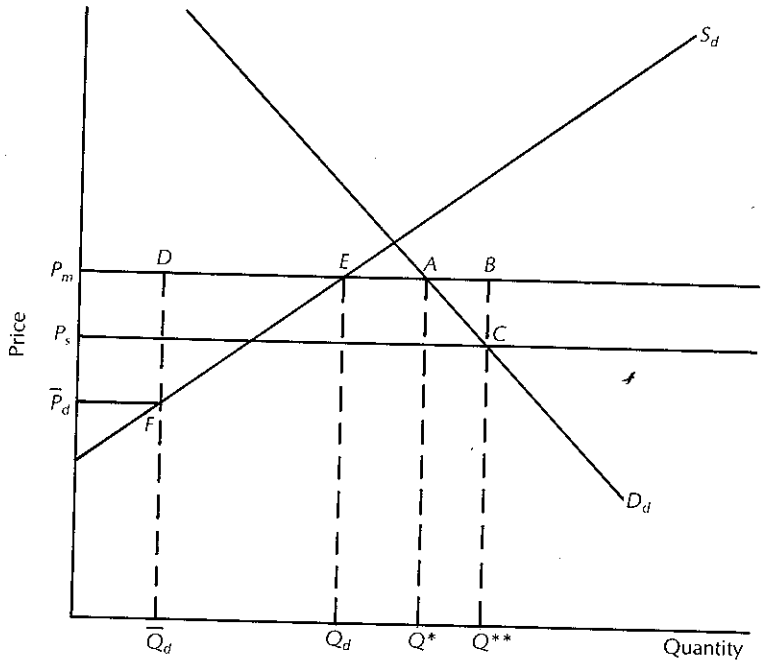


Figure 3. Measuring the Welfare Costs of Price Controls

typically in excess of $1 billion (1980 dollars). Expenditures on additional oil imports were on the order of $15 to $20 billion per year.

There are likely to be further costs to the economy (over and above these distortions in consumption and production) from crude oil price regulation, stemming from (1) a gap between the private and social costs of imported oil and (2) feedback effects from changes in United States demand to prices in the world market.

With respect to the first point, in addition to possible "national security externalities" associated with dependence on foreign oil, the structure of the United States economy leads to the creation of a "macroeconomic" externality in the presence of a large and unanticipated increase in the price of crude oil (see the statistical evidence in Hamilton, 1983). The inability of wages and non-oil prices to adjust downward in response to an oil supply shock exacerbates the effects of the shock on inflation, real output, and unemployment.

When the United States is a price taker, the price relevant for the

Table 2. Price Regulation and the Marginal Cost of Oil to Domestic Refiners, 1974–1984[a]

Year	Quarter	World Price	Domestic[b] Marginal Cost	Year	Quarter	World Price	Domestic[b] Marginal Cost
1974	1.	11.59	—	1979	1	15.32	13.65
	2	12.93	—		2	18.41	15.90
	3	12.65	—		3	25.22	21.48
	4	12.60	11.25		4	30.39	26.03
1975	1	13.03	10.62	1980	1	34.05	28.90
	2	13.56	10.73		2	34.72	29.14
	3	14.11	11.19		3	33.45	29.01
	4	14.84	11.76		4	32.28	29.87
1976	1	13.42	10.72	1981	1	36.54	—
	2	13.56	10.83		2	35.91	—
	3	13.60	11.16		3	34.42	—
	4	13.79	11.60		4	34.27	—
1977	1	13.77	11.48	1982	1	33.05	—
	2	13.79	11.36		2	31.20	—
	3	14.27	12.02		3	31.53	—
	4	14.54	12.45		4	31.78	—
1978	1	14.44	12.47	1983	1	29.62	—
	2	14.51	12.84		2	28.61	—
	3	14.46	13.04		3	28.87	—
	4	14.54	13.18		4	28.94	—
				1984	1	28.76	—
					2	28.79	—

[a]Prices are in United States dollars per barrel. A dash means that the two prices are equal (for example, no entitlements subsidy).
[b]See note 12 for definition.

calculation of efficiency losses increases from P_m to $\hat{P}_m$ to reflect the negative externalities associated with imported oil. The analogue to Figure 3 is Figure 4. The welfare loss due to distortions in consumption increases by the area *IJAB* to area *CIJ*, and the welfare loss due to distortions in domestic production increases by area *GHDE* to area *FGH*.

When the United States is no longer assumed to be a price taker in the world oil market, the increase in United States demand caused by the price controls-cum-entitlements subsidy program will lead to an increase in the world price. We can construct a world demand

Table 3. Welfare Costs of Entitlements Subsidy, 1975–1980 (Millions of 1980 Dollars)

	Demand Side			*Supply Side*		
	Dead-weight Loss	*Additional Crude Imports (MMB)*	*Expenditure on Additional Imports*	*Dead-weight Loss*	*Additional Crude Imports (MMB)*	*Expenditure on Additional Imports*
1975	1037	491	9602	963	99	1948
1976	852	477	8764	1046	344	6288
1977	654	433	8052	1213	455	8444
1978	300	305	5285	816	348	6034
1979	627	361	9200	1852	331	8444
1980	1038	373	14,261	4616	530	20,214

Source: Kalt (1981), Tables 5.1 and 5.2.

curve for oil imports by adding the import demands of other countries to that of the United States. (The United States import demand curve is the difference between the domestic demand and supply curves.) In Figure 5 we combine the import demand relationships with the upward-sloping import supply function of oil exporters.[12]

Consider the impact of the price controls and entitlements in this case. Since domestic price controls increase the level of demand for imports at any given world price, the import demand curve shifts to the right to D'_m. In addition, to the extent that the United States is a large player in the world market, the slope becomes steeper, since United States import demand is less sensitive to changes in the world price because of the entitlements subsidy. The entitlements subsidy in effect dilutes the effects of changes in the world price on United States consumption because an increase in the world price raises the value of an entitlement.

It is this latter modification that is likely to have the most serious consequences during oil supply disruptions (in which the S_m curve shifts back and to the left), since demand response to world price changes will not be as great as in the "no controls" case. These qualifications introduced by potential monopsony power of oil-importing countries increase the social cost of additional crude oil imports, raising the domestic welfare costs of price controls.

Removing the assumption that the United States is a price taker in the world oil market and replacing it with an upward sloping import supply curve, we can recalculate the deadweight losses sketched in

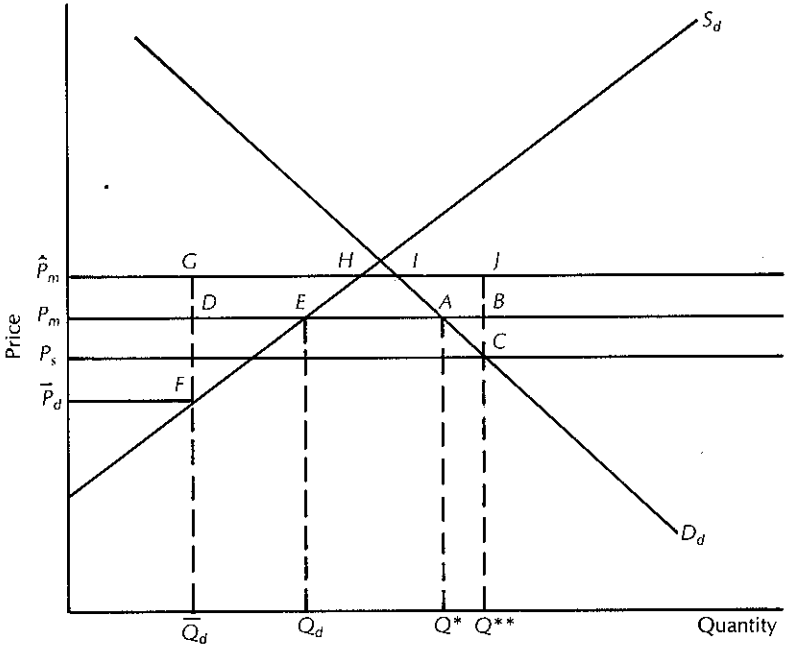


Figure 4. Welfare Costs of Price Controls When Oil Imports Have Negative Externalities

Figure 3 resulting from the operation of the domestic price controls-cum-entitlements subsidy program. To focus on distortions in consumption, we consider the simple case wherein domestic supply is perfectly inelastic at Q_d. The marginal cost of oil to domestic refiners (MC_d) is less than the world price because of the entitlements subsidy, but as imports become relatively more important, the per unit subsidy diminishes. Hence MC_d approaches S_m, the import supply curve, as quantity demanded increases. These relationships are depicted in Figure 6.

The domestic subsidy raises United States demand from Q^* to Q^{**}, increasing the world price by $P_m^{**} - P_m^*$, and raising imports by $Q^{**} - Q^*$. The deadweight loss due to the extra domestic consumption is represented by the region ADE. This loss per se is smaller than when the United States was assumed to be a price taker, because the attendant increases in the world price and the weighted-average re-

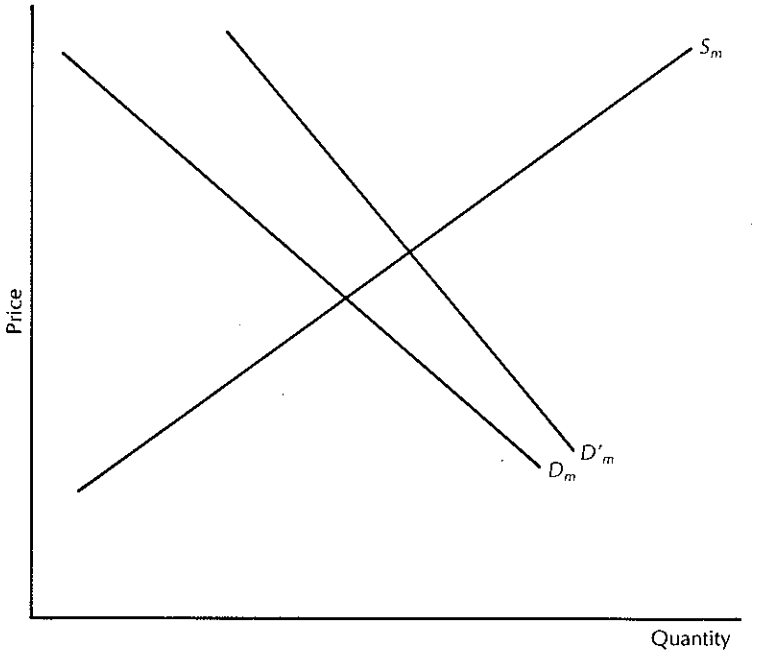


Figure 5. U.S. Policies and World Oil Prices

finer's acquisition cost reduce consumption. There is, however, an additional loss (represented by *AEC*) corresponding to the inefficient extra foreign production.

The rectangle *ABGF* represents an incremental wealth transfer from the United States to foreign oil producers, a deadweight loss from the point of view of the United States economy alone, but not from the point of view of the world economy. This wealth transfer is likely to be large, since it reflects the price increase the United States must pay on *all* imports, not just the additional imports due to the regulations. Even this transfer may involve second-order welfare costs because of the macroeconomic externalities accompanying oil price increases discussed before.

In addition to losses imposed on the United States economy, a negative externality is created for all oil-importing countries because of the higher world price. Such losses could be substantial for most major Organization for Economic Cooperation and Development

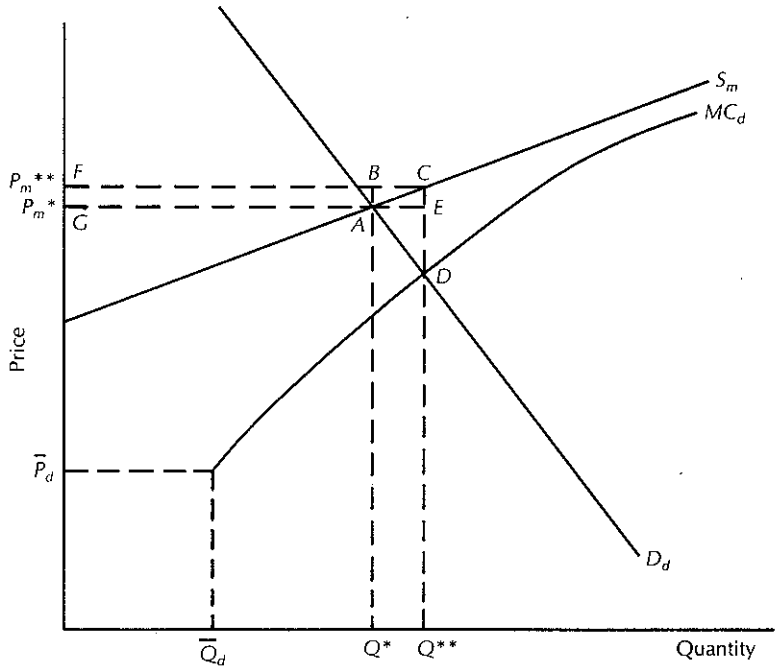


Figure 6. Welfare Costs of Domestic Controls When United States Is Not a Price Taker

(OECD) countries, whose impost demand elasticities are likely to be much lower in absolute value than in the United States.[13]

In Table 4 we modify the Kalt estimates of the deadweight loss on the demand side under the assumption that the United States faces an upward-sloping supply schedule in the world market. Four alternative values of the elasticity of that import supply curve (ϵ_m) are used: 0, 0.5, 1.0, and 5.0. Of course, the size of the deadweight loss depends on the magnitude of the supply response. In all cases, though, the deadweight loss is reduced, because additional imports due to entitlements are less a result of the upward-sloping foreign supply curve. The additional loss from excess foreign production is too small to offset this. These losses do not include possible costs from macroeconomic externalities associated with higher oil prices or the cost to other countries of higher oil prices.

Table 4. Deadweight Loss from Entitlements Subsidy, 1975–1980 (Millions of 1980 Dollars)

			Elasticity of Import Supply Curve		
	$\epsilon_m = \infty$	$\epsilon_m = 5.0$	$\epsilon_m = 1.0$	$\epsilon_m = 0.5$	$\epsilon_m = 0.0$
1975	1037	903	571	415	0
1976	852	742	469	275	0
1977	654	570	360	262	0
1978	300	261	165	120	0
1979	627	545	345	251	0
1980	1038	904	570	415	0

NOTE: First column is from Table 3. Other columns are based on calculations from data in Table 3.

Although an upward-sloping foreign supply curve results in lower deadweight losses, it causes a wealth transfer from the United States to foreign oil exporters, as shown in Table 5. This is because the demand resulting from the entitlements program raises the price artificially. The transfer is a loss to the United States economy and a corresponding gain to the economies of oil-exporting countries. The more inelastic foreign supply, the greater is the loss. Thus in a disruption, when supply is very inelastic, the entitlements program is particularly harmful — it raises price further and causes large transfers abroad.

Summary

The price controls and entitlements program imposed substantial costs on the United States economy. It increased consumption and decreased domestic production, thereby fueling import demand and world oil prices. Yet the government's desire to do something about the "energy crisis" — the swift and steep run-up in oil prices — cannot be dismissed on economic or political grounds. The goals of controlling inflation and averting a massive wealth transfer from oil consumers to producers led to price ceilings on domestic crude oil production. Unequal access to low-priced oil by refiners led to the entitlements program, which effectively used the rents generated by these ceilings to subsidize imports.

The unfortunate consequences of past regulatory programs do

Table 5. Wealth Transfers Abroad Due to Entitlements Subsidy, 1975–1980 (Millions of 1980 Dollars)

	$\epsilon_m = \infty$	$\epsilon_m = 5.0$	$\epsilon_m = 1.0$	$\epsilon_m = 0.5$
1975	0	1720	5660	8610
		(5.8%)	(19%)	(28.9%)
1976	0	1540	5070	7690
		(4.3%)	(14.3%)	(21.7%)
1977	0	1420	4670	7090
		(3.2%)	(10.4%)	(15.8%)
1978	0	930	3060	4630
		(2.3%)	(7.6%)	(11.5%)
1979	0	1630	5340	8130
		(2.7%)	(8.8%)	(13.4%)
1980	0	2510	8290	12,540
		(3.4%)	(11.3%)	(17.1%)

NOTE: Calculations are based on data in Tables 3 and 4. Figures in parentheses are percentage increases in world oil prices resulting from the United States entitlements program. Transfers from oil importing countries outside the United States are not included.

not imply that pure laissez-faire is the best solution, however. The failure of explicit price regulation to satisfy desires for both economic efficiency and consumer protection leads naturally to a consideration of policies designed to influence the *world* oil price itself rather than creating an artificial difference between domestic and world prices. The final section looks at the problems the oil market faces in the post-decontrol era and possible government policies to address them.

ENERGY POLICY AFTER PRICE DEREGULATION

The failure of crude oil price regulation to address the most significant economic problem in the oil market — short-run instability of world oil prices and accompanying macroeconomic fluctuations caused by oil supply disruptions — suggests a search for new channels for government intervention.[14] Considering the principal sources of market failure in the short run to be macroeconomic externalities and

monopsony power of oil-importing countries, we focus on three policy options widely discussed since oil prices were decontrolled: (1) imposition of oil import tariffs, (2) use of public strategic stockpiles, and (3) participation in coordinated policy agreements with other major oil-importing nations.[15]

Tariffs

To the extent that the marginal social cost of imported oil exceeds its market price, a policy entirely opposite from price controls and subsidies suggests itself — namely, tariffs. As a long-run proposition, tariffs force consumers to "internalize" the social cost of imported oil and may lower the world price if (1) the United States has monopsony power in the world oil market and (2) producers do not retaliate strategically (see the discussion in Bohi and Montgomery, 1982). Tariffs, however, transfer income to domestic oil producers, an action likely to be unpopular.

On the other hand, if periodic oil supply disruptions are the primary source of concern, the design of a short-term, or "disruption," tariff, tax, or quota poses a different problem. Again, by restricting imports, downward pressure is exerted on world oil prices. In an economy free of macroeconomic rigidity these are "first-best" policies for correcting market externalities and thus improving social welfare. Although such policies are well suited to the objective of easing oil market conditions, they do so at the expense of raising domestic prices still further, thereby aggravating the macroeconomic harm associated with a disruption, and ought to be viewed with extreme skepticism.[16] Nevertheless, they have been proposed (Verleger, 1982; Hogan, 1982).

Public Stockpiles: The United States Strategic Petroleum Reserve

Ten years ago the U.S. Congress authorized the creation of the Strategic Petroleum Reserve (SPR) with the intent of bolstering energy security. As of this writing, the reserve stands at over 450 million barrels of oil (about thirty days of domestic consumption) — a large and potentially powerful policy instrument.[17] Economic issues surrounding the SPR center principally around its optimal size and drawdown behavior in the event of an oil crisis.[18]

The benefits stemming from a reserve must be compared with its

costs in order to determine the optimal size. These costs comprise the purchases of oil to be stored, the possible increase in world oil prices resulting from these purchases, the interest paid on capital borrowed to make the purchases, the purchase or development of storage capacity, and the operation and maintenance costs of the storage program.

Some have suggested that releasing SPR oil would serve to replace oil imports during an embargo. This assumption — that embargoes against particular countries and "access" to oil supplies make sense — is simply unbelievable in a market as large and liquid as world oil. The 1973–1974 shock was spread about evenly across importing countries (Stobaugh, 1976). Warnings of dire consequences resulting from increasing "rigidities" since then (Neff, 1981) have a curious "Chicken Little" aspect to them. Since an analytical framework is lacking, it is even unclear what constitutes supporting evidence.

Given the diverse assumptions and methodologies used in engineering and economic studies, it is encouraging, as well as surprising, that the recommendations regarding SPR allocations fall in a relatively narrow band. A survey by the National Petroleum Council (1981) found that of twenty studies conducted in the 1970s, all but two suggested figures between 500 and 1,000 million barrels, with the more recent recommendations in the upper half of this range. Analyses conducted in the early 1980s, when the climate appeared most menacing, recommended sizes of 750 to 2,000 million barrels (Chao and Manne, 1982; Hogan, 1983; Rowen and Weyant, 1982; U.S. Department of Energy, 1982).

Issues surrounding drawdown are perhaps the most difficult part of analyzing the SPR. The effectiveness of the SPR will depend on assumptions about (1) market structure, (2) expectations (about the likelihood of future shocks or the duration of present ones), and (3) the reaction of domestically held private stocks and foreign public stockpiles to announced and unannounced SPR policy.

As a stylized description of the use of public stocks to exploit short-run monopsony power in the oil market, there are three channels through which SPR releases affect world oil prices. The *direct* effect is to ease price increases as the SPR release reduces the demand for OPEC output during a crisis. A *feedback* effect occurs, because holding down the world price serves to hold down domestic prices at home and abroad as well, thus reducing the cutbacks in United States and foreign consumption. The feedback effect clearly works against the direct effect. The *interaction* effect depends on the reaction of domestically held private stocks and foreign stocks to SPR releases.

Cooperation (on the part of private stocks or foreign stockpile authorities) serves to magnify the benefits of the SPR release, while competition serves to mitigate them.

The importance of oil inventories, which fell during the last shock but climbed sharply during the previous two, is widely acknowledged. A satisfactory explanation for inventory behavior remains elusive, yet is critical in assessing the private sector's response to public intervention. For example, expectations about changes in oil price controls may affect private stockpiling.[19] Moreover, the government's SPR will be rendered impotent if its releases are hoarded by private stockholders.

Simulation studies have found significant benefits in terms of reduced oil prices during shocks (Hubbard and Weiner, 1983b).[20] Recent theoretical work has emphasized the importance of market structure, expectations, and United States monopsony power as determinants of the success of the SPR in reducing oil price increases and their attendant macroeconomic costs (Hubbard and Weiner, 1984).

International Coordination of Energy Policies: Using Public Stockpiles

A broad consensus holds that international cooperation in meeting oil shocks is both essential and terribly difficult. Prospects for coordination are perhaps greatest for stockpile intervention. Among the OECD countries, this cooperation is under the aegis of the International Energy Agency (IEA).

It is not our task here to provide a detailed critique of past IEA actions; suffice it to say that consumer cooperation has not always been a resounding success. Indeed, it has sometimes proved difficult to detect. The relevant regulations are codified in the International Energy Program, signed by the United States in 1974. The details are too involved to present here (see U.S. Senate, 1974), but the salient points are three. First, countries are required to hold buffer stocks in proportion to their imports. Second, the agreement is dormant until a determination of emergency is made. The emergency is signaled as a quantity shock, which must be sufficiently large in absolute value to reduce supply by 7 percent compared to its pre-shock value. (In practice, the time unit is the quarter, and the pre-shock value is a moving average of the previous four quarters.) Third, the agreement calls for countries to "restrain demand" by 7 percent (through such means as taxes, tariffs, regulation, and exhortation) and substitute buffer stock

releases in making up any remaining loss in supply (for example, a 10 percent reduction in quantity supplied calls for 3 percent to be made up by stockpile releases in addition to the 7 percent demand restraint). The scheme's monopsonistic intent is clear.

One problem with the IEA agreement is that the 7 percent threshold corresponds to a severe disruption. Assuming Free World oil consumption of roughly fifty mb/d (million barrels per day) and taking the IEA share of consumption as constant, a loss of 3.5 mb/d (net of increased exports by other producers) is necessary to trigger the emergency mechanism. The Iranian crisis, during which oil prices more than doubled, was of considerably lesser magnitude. Second, demand restraint proved to be easier said than done. The March 1979 agreement to cut consumption by 5 percent was honored more in the breach than in the observance.

Among the lessons to come out of the 1979 and 1980 supply shocks was that while high stockpile *levels* are a sine qua non for the functioning of international sharing agreements, it is the *drawdown* (or buildup) behavior that is likely to spell the difference between containment and disaster. Another is that actions taken in a so-called sub-trigger disruption (one falling beneath the threshold) may serve to avert a 1979-style catastrophic price run-up. Demand restraint having failed, the economic damage attending a sub-trigger disruption has called forth proposals for coordinated drawdown programs.

As it figures prominently in current policy discussions, we focus here on the impact of international coordination in the evaluation of SPR drawdown strategies. How effective would SPR draw be in relieving pressure in the world oil market if other IEA members do not do likewise? Or, even worse, what it some countries fill while others draw?

Since the oil market is international, the use of a buffer stock by one country has spillover effects on others, further emphasizing potential benefits from international policy coordination. The supposed merits of such coordination notwithstanding, issues of whether such an outcome would occur in the absence of an agreement and of what type of institutional mechanisms might facilitate cooperation have been largely ignored.

That cooperation can reap benefits begs the question of how it might be achieved. Regulation at the international level is difficult to enforce. Since there is no regulator with the power to require compliance, the incentive question naturally arises. While import restriction is clearly in the interest of the group as a whole, the effectiveness of the regulatory rules in attaining the cooperative outcome is not evident. It is in the interest of each individual country to be a "free rider," taking advantage of import restrictions by others.

Summary

Much of the failure of previous domestic intervention stems from its inability to address the most serious problem — the instability of world oil prices in the short run and accompanying economic fluctuations caused by oil shocks. We analyzed some policy options discussed in the wake of price deregulation to deal with these issues — namely, the use of oil import tariffs or public strategic stockpiles either by the United States alone or in an internationally coordinated agreement. Such policies, by their design to influence world (rather than just domestic) oil prices, avoid many of the distortions introduced by price regulation.

CONCLUSION

Government intervention in the domestic petroleum industry is almost as old as the industry itself. Even after the decontrol of domestic crude oil prices in 1981, public policies on "windfall profit" taxation, maintenance of an SPR, and participation in international agreements in the event of oil crises continue to affect market outcomes. The task for economists and decision-makers is to isolate sources of market failure (in the short run or the long run), and design policies accordingly.

Close to the heart of economists, the pursuit of economic efficiency in domestic energy markets carries real benefits. The programs of United States petroleum price regulation during the 1970s were accompanied by significant deadweight losses — losses not offset by gains to consumers, refiners, or domestic and foreign producers. Because of the size of the oil trade, any recurrence of "shocks" will generate distributional concerns. Those concerns are best addressed, however, through conventional macroeconomic policies and through systematic energy policies designed to influence world oil prices.

Past experience has taught policymakers that price controls, instead of mitigating the effects of foreign oil supply disruptions, acted to exacerbate them, as well as imposing substantial losses on the economy. In the mid-1980s we have available policy instruments such as the SPR that are more appropriate for addressing the problem at hand.

NOTES

[1]A recent study of econometric models of the United States economy by the Stanford University Energy Modeling Forum found substantial effects on inflation, output, and unemployment from oil price shocks; see Hickman and Huntington (1984).

[2]See, for example, the studies in Landsberg and Dukert (1981).

[3]We will discuss this system in detail in the section on government intervention.

[4]More detailed histories of various facets of United States energy policy can be found in Goodwin (1981), Kalt (1981), Weimer (1982), and Vietor (1984).

[5]Kalt (1981, p. 5) notes that the Federal Oil Conservation Board (1924–1929), the National Recovery Act's Petroleum Administration (1933–1935), and the Department of the Interior (after World War II) backed similar anticompetitive measures.

[6]For example, Bohi and Russell (1978) found that the MOIP reduced the consumer surplus of oil users by $5.4 billion during 1969, while augmenting producer rents domestically by $2.3 billion and transferring import rights worth $0.8 billion to chosen refiners. The resulting deadweight loss is $2.3 billion, or about 43 percent of the reduction in consumer surplus.

[7]For a detailed discussion of the Nixon price controls as they applied to the oil industry, see Kalt (1981).

[8]Of the 290 refineries operating in the United States in 1978, roughly 265 (over 90 percent) had refining capacities of less than 175,000 barrels per day (American Petroleum Institute, 1981a). These "small" refineries accounted for 20 to 25 percent of industry capacity (American Petroleum Institute, 1980).

[9]Kalt (1981, p. 62) notes: "In the first twelve months of the entitlements program, for example, only about $85 million (1980 dollars) were distributed through Exceptions and Appeals. By the late 1970s, several hundred million dollars per year were being distributed through Exceptions and Appeals."

[10]We assume that imports are not an important factor in the United States market for refined products. For evidence on this, see Kalt (1981). If this is not the case, imports of products are reduced to offset the additional crude imports.

[11]Various regulations have complicated the definition of the marginal cost to domestic refiners. From the first quarter of 1974 (1974:1) through 1974:3, the imported price (which exceeded the domestic price because of price controls) was the marginal cost. From 1974:4 through 1976:3, the marginal cost faced by American refineries is measured as the import price less the value of crude oil entitlements to refineries (which effectively acted to reduce the marginal cost). From 1976:4 through 1980:4, the uncontrolled price of domestically produced stripper oil was used as the marginal cost. After decontrol, the world price is again used to represent the marginal price.

[12]The diagram in Figure 5 is drawn under the assumption that oil suppliers are competitive; adding monopoly elements would complicate the analysis, but the qualitative conclusions remain.

[13]Even if total demand elasticities were identical across countries, the fact that the United States has significant domestic production gives it a substantially higher net import demand elasticity than, say, Japan or West Germany.

[14]As discussed in the previous sections, price controls were most likely imposed because of distributional concerns. Cushioning the impact of rapidly rising energy prices for particular groups (for example, the poor) can be implemented through modifications of existing transfer programs without relying on sweeping domestic energy policies.

[15]The use of conservation measures is also frequently discussed in policy circles. However, emergency mandatory conservation and fuel-switching combine the negative aspects of price regulation and demand restriction. That is, they are not only inefficient — since there is no reason to believe that those who can most economically conserve will do so — but also lead to macroeconomic costs.

[16]In principle, monetary policy could accommodate the added price increase. The goals of monetary policy are broader, however, and such a response may conflict with other objectives.

[17]The SPR need not, of course, be both owned and managed by the government. See the discussion of different options and institutions in Hubbard and Weiner (1985).

[18]For a detailed discussion of the SPR as an economic policy instrument, see Hubbard and Weiner (1985).

[19]Controls may even increase stockpiling initiatives (for the wrong reasons) — for example, the anticipation of higher price ceilings. Indeed, domestic privately held inventories rose sharply relative to trend in the months prior to President Reagan's decontrol of crude oil prices in January 1981; see Hubbard and Weiner (1983a).

[20]Releasing SPR oil on the spot market is not the only way in which stockpile intervention might occur. Devarajan and Hubbard (1984) consider the case of selling oil through futures contracts, finding that futures sales (1) achieve much of the price-reducing benefits in the early stages of a disruption and (2) lead to a lower price trajectory overall when compared with spot market sales.

[21]Given a specification of the optimizing behavior of the public stockpiles of consuming countries, we can estimate the benefits of stockpile coordination using "game-theory" methods in economics. Theoretical analyses of the benefits of public stockpile coordination (Hubbard and Weiner, 1984) have found that whether member countries to an agreement drew down more stocks at the onset of a shock than if there had been no agreement depends on (1) the expected persistence of the shocks and (2) the heightened monopsony power made possible by coordinated buyer behavior.

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