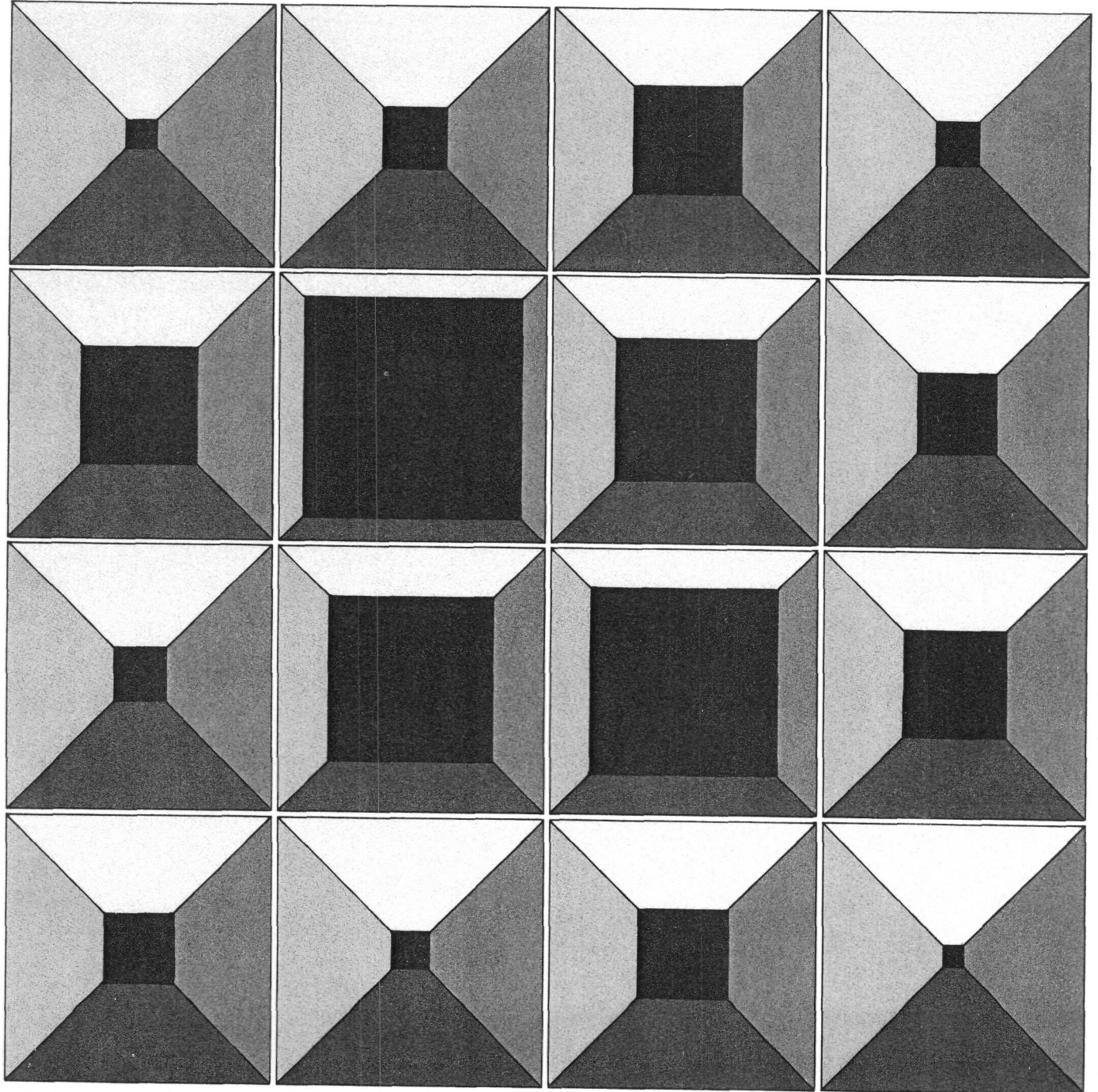
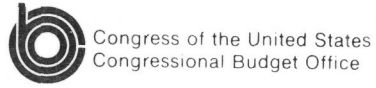


Managing Oil Disruptions: Issues and Policy Options

A CBO Study
September 1981



**MANAGING OIL DISRUPTIONS:
ISSUES AND POLICY OPTIONS**

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PREFACE

On September 30, 1981, the Emergency Petroleum Allocation Act of 1973, with its authority for coupon rationing of gasoline, expires. The Congress will, therefore, have to decide whether to extend the President's authority to institute coupon rationing in the event of an oil shortfall, to expand the list of alternative policies, or to allow the authority to lapse.

The Congressional Budget Office (CBO) has prepared this analysis of options to mitigate the negative effects of an oil disruption in response to a 1980 request by Senator Henry Jackson, then Chairman of the Senate Committee on Energy and Natural Resources. In keeping with CBO's mandate to provide objective analysis, this report makes no recommendations.

Philip Webre of CBO's Natural Resources and Commerce Division wrote the report, under the supervision of Everett M. Ehrlich and David L. Bodde. William M. Pegram of the same division wrote Appendix B. The author would like to thank Dr. Michael McKee of the Council of Economic Advisers, Dr. George Horwich of Purdue University, and Mr. Robert Dennis of CBO's Fiscal Analysis Division, who provided valuable comments on earlier drafts. Robert Dennis, assisted by Harold Smith, performed the computations. Patricia H. Johnston edited the manuscript, which was typed diligently in its several drafts by Deborah L. Dove, assisted by Angela Z. McCollough. Paula Mills typed Appendix B.

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September 1981

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SUMMARY

The vulnerability of U.S. oil imports to supply disruptions was demonstrated twice in the last decade, once by the 1973-1974 Arab oil embargo and again by the 1979 Iranian revolution. In response to the first, the Congress passed the Emergency Petroleum Allocation Act of 1973 (EPAA) and the Energy Policy and Conservation Act of 1975 (EPCA). Both acts mandated the establishment of a standby rationing plan to allocate gasoline during a shortfall, but no detailed plan is yet in place. Authority for this rationing plan will expire on September 30, 1981, and its renewal or replacement by other policies is an open issue before the Congress.

This report describes the policy alternatives that the Congress may wish to consider in reviewing standby authorities to deal with oil import disruptions. Its central theme is that large disruptions of imported oil can deal the economy a severe blow: reduced output, increased unemployment, and higher inflation. Alternative policies might allow this blow to be offset in different ways, but they cannot eliminate it. Some policies better contain the inflationary effects of a disruption but are less effective in mitigating losses in aggregate production and higher unemployment. For others, the converse is true. Further, the appropriateness of each policy varies with the size and anticipated duration of the import disruption. Thus the Congress may wish to consider a portfolio of standby policies as well as the selection of just one.

OIL DISRUPTIONS AND THEIR ECONOMIC CONSEQUENCES

The economic losses that would follow a disruption in the flow of imported oil have two sources: reduction in aggregate supply, and reduction in aggregate demand. With regard to the first, manufacturers and other oil users are forced to curtail their activities if less oil is physically available. Unless this energy source can be replaced, perhaps by oil from a Strategic Petroleum Reserve, no government policy can mitigate the loss. This reduction is exacerbated by its uneven nature. Some sectors will lose more than others, causing bottlenecks and inefficiencies that hamper efficient use of the energy that is available.

The reduction in aggregate demand is the result of the sudden redistribution of income that follows the large price increases inevitably

accompanying an oil shortfall. Large amounts of income flow from oil users to oil producers in the United States and overseas. As real income falls, consumers reduce their purchases of other goods and services. At the receiving end of the income flow, oil producers (both domestic and foreign) may not spend or invest their increased income fast enough, or in ways most constructive to the economy. Thus, aggregate demand will decrease as a consequence of the income redistribution. This is usually termed "oil price drag."

There are two principal tools that the United States could develop in advance to mitigate the effects of an oil import disruption. The first is a Strategic Petroleum Reserve and the contingency plans necessary for its use. This is widely recognized as the most practical way to reduce the physical shortfall resulting from the import disruption. Little more need be said about it here. 1/

The second is the set of demand-related policies, of which the standby authorities under EPAA are one example. The questions raised by the expiration of EPAA are whether the nation should adopt any special policies to deal with the demand-related consequences of an oil import disruption, and, if so, what they should be.

POLICY OPTIONS

There are three strategic approaches to the demand-related economic losses that would follow an import disruption. The first is for the government to do nothing beyond intelligent execution of the policies and programs now in place. This "neutral" policy would allocate the scarce supplies of oil by permitting prices to rise. The windfall profits taxes now in effect would be collected and, with new legislative authority, quickly disbursed to consumers in some equitable way. Beyond this there would be no attempt to capture and recycle the windfall revenues flowing to foreign and domestic oil producers.

The second approach would also use rising prices to allocate oil supplies. But in addition, it would employ taxes as a deliberate instrument of policy to retain in the economy some of the windfall revenues that would otherwise flow to foreign and domestic oil producers. To the extent that

1/ A detailed discussion appears in: Congressional Budget Office, An Evaluation of the Strategic Petroleum Reserve, a report prepared for the House Subcommittee on Energy and Power (June 1980).

these tax revenues could be efficiently and fairly redistributed to consumers, much of the demand-related problem, the oil price drag, could be mitigated. Prototypical tax policies would include:

- o Import tariffs, imposed either unilaterally or in consonance with other oil-importing nations, which would retain for redistribution a portion of the windfall revenue that would otherwise flow to foreign oil producers;
- o Oil refining fees, which would seek to retain the windfall revenue accruing to domestic as well as foreign oil producers;
- o End-use taxes, such as a gasoline tax, which would concentrate the effect of the disruption on final demand, thereby mitigating the inflationary effects of a disruption.

The third general strategy, coupon rationing, is derived from the approach taken by the expiring Emergency Petroleum Allocation Act. Under this option, domestic prices would be controlled and certain petroleum products (gasoline, for example) would be allocated through the distribution of ration coupons. Allocation of crude oil among refiners, a special topic treated in depth in Appendix B, would also have to be considered if this approach was adopted.

REVIEW OF POLICY OPTIONS

Each of these policy options was reviewed with three considerations in mind:

- o How the policy would change the economic consequences of an oil disruption in terms of GNP loss, unemployment, and inflation;
- o How the policy would offset the sudden redistribution of income that would accompany an import disruption; and
- o How difficult the policy would be to administer competently.

Neutral Policy

Policy Overview. The first option is based largely on the emergency authorities that would remain after the expiration of EPAA. It follows a neutral course, allowing the market to price and allocate petroleum products. The windfall profits, corporate income, and state and local taxes

now in place would collect much of the extraordinary revenue transferred by the shortage, thus ameliorating the sizable income transfers within U.S. borders. The government would quickly disburse its additional revenues in a manner that would stabilize the economy. While there would necessarily be some time lag between collection and disbursement, reducing this lag would be a key administrative goal. In addition, government expenditures for such automatic stabilizers as unemployment insurance or food stamps would increase.

Major Advantages. The major advantages of a neutral policy would be the efficient allocation of petroleum products and its administrative simplicity. Price increases would allocate products and eliminate gasoline lines by reducing demand. Income transfer programs would go into effect automatically. With the exception of an emergency mechanism to rebate quickly the increase in federal revenues from the existing windfall profits tax, the means to carry out this policy are already in place.

Major Disadvantages. Although there is a windfall profits tax on domestic producers, a neutral policy would have no provision for collecting any of the revenues that would flow to foreign oil producers. In addition, there is no existing authority to rebate quickly windfall profits tax revenues, which would be very sizable if a large shortfall developed.

Appropriate Situations. The neutral policy would be a quick and efficient response to smaller disruptions, perhaps a million barrels per day or less. But as the size of the disruption increased, the oil price drag would become more significant and the existing transfer programs might be less able to counteract the negative effects of the income redistribution.

Oil Tax or Tariff

Policy Overview. The purpose of a tax policy is to capture for recycling within the economy more of the windfall revenues flowing to producers than would be the case in the neutral policy. Although each tax has particular advantages and weaknesses, in general they all work in the same way. Each tax would be applied during, or even slightly before, the disruption to raise the price of oil products above the levels that they would otherwise reach. If all major importing nations took this action in concert, the consequent reduction in oil demand could mitigate the rise in market prices while the tax would retain a portion of the windfall revenue for the consuming nations. The funds collected by the tax would be rebated quickly, possibly through the income tax system, to mitigate the oil price drag. If the United States was to take such action alone, the tax policies would be

reduced in effectiveness, because this country would bear the entire burden but all consuming nations would benefit.

There are many variations of oil taxes that could be developed, but most can be subsumed into import tariffs, crude oil refining fees, and gasoline taxes. Each has special advantages and disadvantages.

Major Advantages. The principal advantage of an import tariff is that it would reduce the outflow of income to foreign oil producers. Although this advantage would be blunted to the extent that other oil-consuming nations did not participate, even a unilateral tariff might have some benefit. If the revenues captured by the government were recycled quickly into the economy, some of the income loss would be eliminated. The tax or tariff would still allow the market to allocate petroleum products. It could be imposed easily, without a major new administrative system.

A crude oil refining fee would have the advantages of other taxes, but, in addition, it would collect more of the extraordinary revenues accruing to domestic producers than the windfall profits tax alone. While the difference might not be significant at lower levels of disruption, as the shortfall increased and the windfall grew, the portion missed by the windfall profits tax might become quite sizable.

By contrast, a gasoline tax would concentrate the major impact of the disruption in a sector of final demand in which some consumption is viewed as discretionary. This concentration might also slow the spread of the inflationary effects of the tax through the economy, whereas a tax levied on intermediate oil uses would be incorporated immediately into the price of all goods and services that use oil in their production. This would be quite important if the disruption was likely to be temporary, since it would help prevent domestic prices from remaining at high levels after the disruption ended. In addition, a gasoline tax might have fewer recessionary effects than a tax on oil used in production, and might be perceived as more equitable than a tax on other products, such as home heating oil.

Major Disadvantages. If imposed unilaterally, any oil tax would make oil in the United States more expensive, while making world oil less expensive and more plentiful. This would happen because the tax would increase the price of oil in the United States beyond what the market would have imposed in order to reduce demand. To the extent that the United States used less oil than it otherwise would have, more would be available for foreign consumers, thus reducing their costs. In effect, the United States would subsidize foreign oil purchases. Multilateral action would alleviate this problem since consumer nations would be setting similar prices and further reducing demand.

Because oil has few close substitutes and is so crucial to consumers, any tax would have to be sizable in order to reduce demand significantly. The size of an effective tax would create significant administrative difficulties. If the shortfall were over a million barrels per day, the amount of revenue collected could conceivably exceed \$100 billion per year. Rebating this enormous amount through the tax system could be difficult. Even in relatively small disruptions, the rebate would equal federal income taxes in many households. Thus, the government, in effect, would substitute an excise tax for much of the income tax. Since the income tax system was built over a number of years with a great deal of attention to economic and equity effects, replacing it suddenly with another system might not be desirable.

Setting the tax correctly would require detailed information about prices, oil stocks, and consumer demand response. Since it is impossible to obtain precise information of this sort, the tax policy must either include a mechanism for correction or accept the diminished effectiveness resulting from collecting too much or too little.

In addition to these general disadvantages, the individual tax proposals have unique problems. For instance, because the crude oil refining fee would apply to domestic crude, the marginal incentive to produce more oil would be lost. Although the additional production might not be significant in the short run, for longer disruptions, perhaps lasting a year, these incentives could be important.

A gasoline tax, unlike crude oil taxes or tariffs, would distort the allocation of petroleum among products. It would not provide as many incentives for conservation by users of other petroleum products as would a more encompassing tax. Thus some of the demand reduction in the response to higher prices would be lost. Finally, the usefulness of a gasoline tax would diminish as the size of the disruption passed 2 million barrels per day because of inherent limitations on refinery flexibility and the extraordinary impact on one end-use market.

Appropriate Situations. The ability of the tariff to capture the flow of revenue to foreign producers might be viewed as a threat by producer nations. If producer nations should retaliate, the tariff could be counterproductive. Independent of the response of oil producers, a multilaterally imposed tariff would offer the best prospect for capturing the shortfall premium. The problems involved in redistributing these revenues, however, would limit the usefulness of taxes at disruption levels much above 2 million barrels per day.

Coupon Rationing

Policy Overview. If the price of domestic oil was to be controlled during an import disruption, a rationing system would be needed to allocate the scarce supplies. Typically, gasoline is the product rationed in most such plans. Consumption would be allocated by the distribution of coupons. These coupons would be freely negotiable, and persons with extra coupons could probably sell them at a profit. Because of price controls, U.S. consumers would pay the weighted average of the world oil price and the controlled domestic price. The price of gasoline would remain stable, while the market price of coupons would rise. In this way, some of the revenue that would otherwise be transferred to producers would remain in the hands of consumers as a group.

Major Advantages. Rationing might reduce the GNP loss from a very large shortfall by allowing consumers to keep some of the income that otherwise would be transferred to producers. Also, the existence of a white market for coupons would allow the transfer of income and gasoline among consumers, thereby helping the economy to adjust. Moreover, rationing might promote public perception that the burden of reduced supplies was being fairly shared, which, at very large levels of shortfall, would be important in promoting social cohesion.

Major Disadvantages. For a small disruption, the allocations and price controls inherent in rationing would create an inefficient distribution of petroleum products and thus might exacerbate the economic damage. Rationing would also require a large bureaucracy to prepare the program and carry it out, and might easily be undermined by mistakes; public faith in rationing could erode quickly if motorists with coupons approached gasoline stations only to find no gasoline available. Finally, domestic wellhead price controls would create the same disincentives to increased production as the crude oil refining fee discussed earlier.

Appropriate Situations. Rationing's advantages--preserving social cohesion and perceptions of equity--could become increasingly important with larger shortfalls. The lack of production incentives, however, would make strict price controls less appropriate as the duration of the disruption lengthened.

THE USE OF CONTINGENCY POLICIES

The comparative advantages of these various options appear to change with the magnitude of the disruption they confront. In the event of a small disruption, perhaps below 1.0 million barrels per day, the ease and efficiency

of a neutral policy would give it a natural advantage. At somewhat higher levels of disruption, around 1.0-2.0 million barrels per day, tax policies appear to be quite workable and capable of producing positive benefits. As the disruption size increased beyond 2 million barrels per day, the refunding problem would become increasingly severe. The tax-based policies, starting with gasoline taxes, would begin to be less effective. For large disruptions, coupon rationing might have distinct advantages that would outweigh its disadvantages.

Since oil disruptions affect both supply and demand, policies that address both are needed. Thus, the policies discussed above should not be regarded as a substitute for the Strategic Petroleum Reserve; nor are they temporary replacements until the reserve is filled. Rather, these contingency policies and the oil reserve are complementary. Each would be more effective in the presence of the other. For example, the combination of a tariff and the release of oil from the reserve would serve to: (1) replace, in part, the supply of oil lost; and (2) decrease the demand for oil and thus reduce the increase in oil prices. The resulting outflow of money could be less than that which would result if the policies were not applied in concert.

Finally, all of these contingency policies would be most effective when undertaken in consonance with other oil-consuming nations and when the probable reactions of the oil-producing nations were taken into account.

A QUANTITATIVE ASSESSMENT OF ALTERNATIVE POLICIES

The Data Resources, Inc. model of the U.S. economy was used to understand better the relative effects of each policy and the magnitude of the income flows. A large and a small shortfall were simulated, both lasting throughout 1982. The world markets are assumed to lose 7.5 and 3.0 million barrels per day, respectively. In response, U.S. oil imports initially decline by 2.5 and 1.0 million barrels per day, or roughly 40 percent and 15 percent of current U.S. imports, respectively. By contrast, the 1973-1974 oil embargo cost the United States an average of 1 million barrels per day for four months.

In response to the initial world loss, oil prices rise from a baseline projection of \$39 per barrel to \$86 per barrel for the large shortfall and \$57 per barrel for the small shortfall. As with the quantities, the world prices would also be affected by policy responses. In the year following the shortfall, it is assumed that supply is restored and prices fall to \$57 and \$47, respectively. These figures are net of any use of private stockpiles or the Strategic Petroleum Reserve. The price increases are consistent with short-term demand elasticities between -0.1 and -0.15. If the response of demand

to price increases was larger, the price and macroeconomic effects would be proportionately smaller.

Summary Table 1 draws together the results of the simulations. These results illustrate the nature of the policy tradeoffs. In general, reductions in GNP loss are obtained at the expense of greater inflation, although the inflationary effect diminishes considerably after the disruption has passed. While this conclusion can be stated with confidence, the results in Summary Table 1 should not be treated as forecasts of the course of the economy during the next oil shock. This is because the rapid increase in oil prices during a disruption produces income flows beyond the historical experience upon which the model draws. Nevertheless, these results are a useful illustration of the fundamental tradeoffs between GNP loss and inflation that alternative policies provide.

SUMMARY TABLE 1. ILLUSTRATIVE MACROECONOMIC EFFECTS OF POLICY OPTIONS

Options	GNP Loss (Percent of projected GNP) <u>a/</u>	Fifth Quarter Increase in the Unemployment Rate (In percent- age points)	Fourth Quarter Increase in the Price Level (In percents) <u>b/</u>	Eighth Quarter Increase in the Price Level (In percents) <u>b/</u>
Neutral Policy				
Small shortfall	1.6	0.7	3.1	1.9
Large shortfall	4.3	1.8	7.2	5.5
Unilateral Import Tariff				
Small shortfall	1.2	0.5	6.1	2.7
Large shortfall	4.3	1.9	13.0	7.6
Multilateral Import Tariff				
Small shortfall	1.0	0.4	5.0	1.7
Large shortfall	3.0	1.2	10.9	5.0
Crude Oil Refining Fee				
Small shortfall	0.8	0.4	6.4	3.0
Large shortfall	3.5	1.6	13.8	8.6
Gasoline Tax				
Small shortfall	0.6	0.2	5.7	3.0
Large shortfall	<u>c/</u>	<u>c/</u>	<u>c/</u>	<u>c/</u>

SOURCE: Data Resources, Inc. model of the U.S. economy.

NOTE: The small shortfall is assumed to be 1 million barrels per day for the United States; the large is 2.5 million barrels per day.

a/ Average constant dollar GNP loss for first five quarters.

b/ Percent change in GNP deflator relative to the baseline of no shortfall.

c/ Not simulated.

Since the Arab oil embargo of 1973, consuming nations have recognized that Middle Eastern oil supplies are unreliable. In the intervening years, major producers in the Persian Gulf region have twice ceased production--once in 1979 and again in 1980. Recent clashes between Iran and Iraq have threatened to engulf the entire region, which would create a major worldwide oil shortfall. These events have served to reinforce the central message of the 1973 embargo: the United States can no longer count on a stable supply of imported oil.

Not only is the supply of oil unreliable, but the size of a cutoff is potentially large. The United States imports about 35 to 40 percent of its crude oil and refined petroleum products. Of this, 10 percent comes from the Persian Gulf. Europe and Japan, however, are much more dependent on oil imports from the Persian Gulf (over 70 percent in Japan's case; less, but still substantial, for European nations). If Gulf exports ceased, these nations would have to acquire their petroleum from other sources. Inevitably, they would begin bidding for oil that remained on the world oil market, forcing up world prices. Remaining foreign suppliers might also divert some oil from the United States to other customers. Thus, not only are U.S. imports large, but they are vulnerable to events outside the immediate trading sphere of the United States.

An oil disruption would first reduce the output of manufacturing and other firms that require oil products for their various processes, which in turn would reduce aggregate supply. As a shortfall caused world oil prices to rise significantly, the remaining producers, both domestic and foreign, would reap a scarcity, or shortage, premium (the additional price paid for the oil still produced). The price increases would further depress the U.S. economy as large amounts of money--the shortage premium--were transferred from domestic consumers to foreign and domestic producers, leaving consumers with less money to buy goods and services. Inflation would rise as the higher oil prices rippled through the economy, first through refined petroleum products and then through all other products dependent on petroleum inputs. Once again the U.S. economy could face lower output and higher unemployment and higher inflation simultaneously.

Three varieties of policy responses are available to ameliorate the effects of a future shortfall. The first would allow the market to allocate the remaining oil--in essence a "neutral" policy. Second, the Congress could

impose a tax or tariff to capture and redistribute the shortage premium while still allowing the market to allocate the oil. Third, a standby coupon rationing plan could be put into effect, thus substituting government for market allocation.

These approaches could all be used in conjunction with drawing on the Strategic Petroleum Reserve (SPR), but would not depend on it for their effectiveness. Since the SPR is incomplete, it is unlikely to be used in the near future in any but the largest shortfalls. Consequently, this analysis assumes that it will not be a consideration in policy deliberations. As the SPR grows in size, the decisions regarding these policies may become less crucial. Even when the SPR attains its full capacity, however, policymakers may, in response to a shortfall, want alternatives to doing nothing or drawing down the SPR.

In response to the vulnerability of U.S. oil supplies, the Congress passed the Emergency Petroleum Allocation Act of 1973 (EPAA), and later the Energy Policy and Conservation Act of 1975 (EPCA). Both acts mandated the establishment of a standby coupon rationing plan to allocate gasoline during a shortfall. After many delays, the Department of Energy submitted a plan that the Congress approved and detailed preparations for standby rationing began recently. The authority for the standby rationing plan is due to expire in September 1981, however. Furthermore, the Administration has proposed abolishing the office that administers the preplanning for the rationing program, which, in effect, would eliminate rationing as an option for the foreseeable future. Thus, the decision before the Congress is whether to allow the present authority for standby rationing to lapse, thereby relying principally on market allocation in the event of an oil disruption; whether to renew the authority for standby rationing; or whether to devise alternate policies.

This report presents options for managing oil supply interruptions, the likely circumstances in which they would be used, and their effects. Chapter II describes the economic effects of curtailments. Chapter III then discusses the principal characteristics of oil shortfalls. A description of the various policy options and an analysis of the effects of the policies on the major areas of concern--the economy, income distribution, and ease of administration--are presented in Chapter IV. Chapter V explores the tradeoffs between the policies and charts possible courses of action. The report itself focuses on policies to mitigate the short-term effects of oil supply disruptions. Appendix A discusses policies to reduce dependence on imported oil in the long term. Appendix B discusses allocation of crude oil to refineries during emergencies.

CHAPTER II. ECONOMIC EFFECTS OF PETROLEUM SHORTFALLS

While most public attention may be focused on gasoline lines, interruptions in oil supplies have major consequences for the entire economy and income distribution. A petroleum shortfall affects the economy in three interrelated ways:

- o By reducing output and employment;
- o By increasing inflation; and
- o By redirecting income flows.

REDUCED OUTPUT AND EMPLOYMENT

An oil shortfall lowers economic output and employment in two reinforcing ways. First, it reduces operations in manufacturing and other industries dependent on oil, thus lowering aggregate supply. Second, it reduces consumer demand. A shortfall and consequent oil price rise combine to transfer large amounts of real income from consumers to oil producers. This, in turn, reduces consumer purchases, which further depresses output and employment.

This type of economic loss has been witnessed in the past two oil disruptions. During the Arab oil embargo (the last quarter of 1973 and the first of 1974), world production dropped by over 4 million barrels per day, resulting in an 18 percent reduction in U.S. oil imports. The shortfall and its ensuing price increase combined with other shocks (worldwide crop failures, devaluation of the dollar, phaseout of wage and price controls) to turn what would have been a mild contraction into a deep recession. By the end of 1974, real Gross National Product (GNP) had declined at a 7.5 percent annual rate, and employment had fallen by approximately half a million persons, adding 0.5 percentage points to the unemployment rate. In response to the uncertainty created by the Iranian Revolution of 1979, increased stock demands doubled the price of oil and diverted it from other uses. The higher oil price resulted in substantially larger dollar outflows and increased inflation; this situation compelled the Federal Reserve Board to contract the money supply, forcing up interest rates. In response to these events, GNP growth fell from an annual rate of 1.2 percent in the first quarter of 1980 to minus 9.6 in the second. Thus, whether through their

direct effect on the economy, or by forcing fiscal and monetary policy-makers to implement restrictive policies, the higher oil prices associated with oil disruptions inevitably result in reduced output and employment.

Supply-Related Effects

If less oil is available to run machines, manufacturers are forced to curtail operations, which reduces aggregate supply. Other oil consumers, such as the utility and transportation industries, also may have to cut back, further reducing output. Since a disruption reduces the physical amount of oil available, no government policy can lessen this decline unless the energy source is replaced. The initial reduction in supply is further aggravated by its uneven nature--some sectors of the economy lose more than others--and the resulting bottlenecks hamper the efficient use of the available energy.

Supply Effects by Sector. In each energy-intensive sector of the economy (transportation, residential and commercial, industrial, and utilities), the reaction to a shortfall and the possibilities for reducing the amount of oil used will be different. In general, however, consumers, both individual and institutional, will find it difficult to conserve energy in the short run.

Transportation is the most petroleum-dependent of all sectors, and has few options for switching to other fuels. Furthermore, alternative means of transportation are either not available or more costly in terms of time and/or money. Therefore, this sector can absorb massive price increases without significant decreases in demand. In addition, anticipation of shortages can even create higher demand, as happened in 1979. For example, motorists keeping their gas tanks filled (topping off) accounted for some of the gasoline lines in 1979. As a result, the transportation sector is likely to be a weak link in a policy that relies on higher prices to restrain demand.

In the residential and commercial sector, demand is more sensitive to both economic and moral persuasion. Space and hot water heating account for the major uses of petroleum in this sector. These activities are less petroleum-dependent than transportation and they can also be modulated more easily without major changes in the services provided. For example, thermostats can be reset with the turn of a dial without significantly affecting the lifestyle or comfort level of users.

In the industrial sector, the short-run response of demand is largely determined by the availability, rather than the price, of energy. While there is significant long-run potential for price-induced savings of oil, that fuel is

typically a small fraction of the cost of goods sold. Thus businesses tend to be much more concerned with security of supply, since those without access to oil or alternatives may have to cease operations. These businesses make every effort to ensure continued supplies and are relatively insensitive to higher prices, which are included in the price of final goods and services. Therefore, the factor that weighs most heavily in reducing industrial demand is the availability of alternative energy sources.

While some firms may be able to use alternative energy sources, such as coal or natural gas, the number is not thought to be large. In response to government efforts to reduce natural gas consumption by industrial users, many companies switched from natural gas to oil in the last decade. If factories that switched did not substantially modify their equipment and remove their gas hookup, they might be able, in the event of a shortfall, to return to natural gas and decrease the need for petroleum. Since the move from natural gas was encouraged when oil was cheaper, it is unlikely that much of the original gas-using capital equipment is still in place.^{1/} Changing to coal is much more complicated. Unless a firm has special facilities (for example, emissions control devices and furnace loaders), it cannot burn coal. Building these takes time. Realistically, therefore, only natural gas could serve as an alternative to industrial fuel oil in the very short run. Since the decision to modify equipment is made by many private individuals, precise estimates of the number of industrial boilers still capable of burning natural gas are not available.

Public utilities are in a peculiar situation; their demand for oil is determined by the demand for electricity, which is partly out of their control. While fuel adjustment clauses will immediately reflect the increased costs of oil and so reduce demand, a regulatory decision is needed to change the monthly fixed charge. Hence electricity consumers will feel the entire oil price increase only after a delay. Unlike other firms that can determine their output according to market conditions, utilities are enfranchised to serve a particular community's electrical needs, regardless of short-run market conditions. Utilities are, therefore, limited in their ability to reduce their oil use in response to a shortage. Their only short-term alternatives are fuel switching and power pools. Utilities have the same constraints on switching to alternative fuels as do industrial consumers. Boilers designed solely for oil cannot burn coal without modification, while some boilers can burn both natural gas and oil.

^{1/} For one optimistic view of the potential impact, see National Petroleum Council, Emergency Preparedness for Interruption of Petroleum Imports Into the United States (April 1981).

Utilities' other conservation alternative is to share electricity. To reduce the aggregate amount of petroleum used to produce electricity, utilities with relatively more nonpetroleum-powered capacity (for example, coal, nuclear, natural gas, and hydroelectric) could coordinate their output with utilities reliant on oil-fired plants. Much of this sharing takes place already, however, induced by the large difference in cost between oil-fired generation and its alternatives.

In addition, not all oil companies will benefit from a shortage and, indeed, some may suffer. Oil refiners who do not have access to a continuous source of crude oil will have to pay world spot oil prices for their oil, and so be at a disadvantage relative to those who have more secure access. With the expiration of price and allocation controls on September 30, 1981, this problem may become severe. Without allocation controls, some independent refiners and oil companies may have to bear a disproportionate share of the shortfall. This issue is treated in depth in Appendix B.

Limitations on Increased Domestic Oil Supply. Lags and institutional barriers may prevent significant short-run oil supply responses, even though, in theory, a shortfall and its attendant price increase should encourage the domestic production of more oil and the refining of those products for which the need is highest. A number of factors, however, could hinder increased U.S. production. Most importantly, there is little known excess capacity in operating oil production facilities and output is currently declining. Furthermore, drilling equipment in the United States is already being used and produced at or near maximum rates.

Construction of new oil production facilities is costly and time-consuming. Expansion of current production facilities is also hampered by legal constraints that were imposed to ensure that oil fields are not destroyed through improper field management, which can reduce the amount of oil ultimately recovered.

At the next stage of production, unless refiners get more oil, they cannot respond to higher prices by increasing their output. Capacity utilization would drop further if refiners gird themselves for a drawnout shortage. Stocks of crude might rise, while stocks of product would be drawn down. Thus, from the consumers point of view, the shortfall might be exacerbated.

In sum, the higher prices that accompany an oil shortfall may not have a strong effect in increasing domestic oil supplies in the short run.

Demand-Related Effects

The second source of decline in output from an oil shortfall is the sudden shift in income. Consumers, who usually cannot shift from petroleum products to other energy sources in the short run, have to pay more for the oil that they use. Since there are few close substitutes for oil, demand does not respond quickly to price pressures and prices increase dramatically. Thus, over a period of a few months, large amounts of money are transferred from consumers to oil producers at home and abroad. As their real income is reduced, consumers cut back spending in other areas.

At the other end of the income flow, oil producers--both domestic and foreign--who receive the added billions of dollars cannot spend it fast enough or in the appropriate sectors to maintain the predisruption level of aggregate demand. Since money accruing to foreign producers is increasingly recirculated through the Eurodollar market, these dollars may be slowed in their flow back to the U.S. economy. Although domestic producers are not as likely to be diverted in spending their additional income, there will be a delay in their expenditures nonetheless. Oil companies have to consolidate their income stream and make plans for major capital expenditures--and all of this takes time. Thus, the prompt responding of higher oil revenues in the U.S. economy from both domestic and foreign sources is not assured. This lag in responding is called the "oil price drag."

Such oil price drags can be significant. Following the Arab oil embargo, the cost of U.S. imports of fuels and lubricants rose from \$7.1 billion in 1973 to \$23.9 billion in 1974. Similarly, following the Iranian Revolution, net dollar outflows for oil rose from \$41.1 billion in 1978 to \$71.0 billion in 1980. The transfer from consumers to domestic producers was of a comparable magnitude. These flows were not promptly recirculated. For example, current account surpluses of oil-exporting countries grew from \$6 billion in 1973 to \$68 billion in 1974, and from \$68 billion in 1979 to \$112 billion in 1980. By contrast, capital exploration and lease expenses by the U.S. oil industry grew by only \$6 billion from 1973 to 1974, although the industry's domestic revenues rose by \$10 billion over that period. More recently, oil industry capital expenditures are only now beginning to approach the added income streams created by 1979 oil price increases.

When foreign and domestic oil producers do spend their increased revenues, they often spend them differently than would have been the case without the change in income distribution. While much of the money that flows abroad will eventually return to the United States through private banks, these funds are often used to buy real estate and other nonenergy

investments. The composition of demand, therefore, changes. Since the composition of output cannot be changed as quickly, a shift in demand will have many of the same effects as a decline in aggregate demand. Output will decline in those industries from which demand has shifted, and the sectors into which demand has moved will experience bottlenecks and inflationary pressures.

As domestic output declines, so does employment. Businesses whose products face reduced demand need fewer employees. Increased unemployment, in turn, further decreases demand.

Obviously, some sectors of the economy are more sensitive to oil price increases than others. The hardest hit areas are those that are most directly centered around petroleum use and those in which consumer purchases are most easily postponed. The automobile industry and its peripheral industries of rubber and steel are, therefore, likely to suffer greatly in a shortfall-induced economic downturn. Industries producing other consumer durables are also likely to suffer.

The temporary decline in some plants may become permanent as the higher costs of oil make some plants and products obsolete, for example, plants producing large cars. In the second quarter of 1980, demand for large cars dropped by a greater percentage than demand for all cars. Furthermore, demand for large cars may never return to previous levels. In such a case, some V-8 engine plants may become redundant. Since synthetic rubber is petroleum-based, a similar pattern may occur in the rubber industry. Thus, temporary cyclical unemployment may become permanent unemployment for some plants and workers.

INCREASED INFLATION

Several factors combine to increase the price level during an oil disruption. The price of imported oil rises. In response, domestic oil producers raise their prices. Once this has occurred, the increased costs of doing business are reflected in the price of all goods and services dependent on oil. Other businesses and employees then attempt to catch up with higher prices and so an upward spiral begins. The extent of the price spiral depends, in part, on macroeconomic policy and expectations about that policy. Once the general price level has risen, it is not likely to return to its original level, even after the original pressures dissipate. In the wake of the Organization of Petroleum Exporting Countries (OPEC) price boost of 1973, for example, all petroleum-based products continued to rise even after oil prices had ceased their climb. In the last quarter of 1974, when refined

petroleum product prices actually declined marginally, petrochemical prices, such as plastics, synthetic rubber, and pharmaceutical materials, were increasing at double-digit rates. Wages experienced their largest increase a year later, in 1975 (despite the record 8.5 percent unemployment rate). By the beginning of 1976, the general price level, as measured by the GNP deflator, was up by approximately 20 percent over the pre-embargo level. Although not all of the increase was caused by oil price increases, it is indicative of the inflationary effects of an oil shortfall.

International money markets also aggravate domestic inflation. Higher oil prices increase the number of dollars abroad, causing a glut. Soon the value of the dollar, relative to other currencies, begins to deteriorate, increasing the prices of goods imported from countries whose currencies have appreciated. Higher import prices may also allow domestic industries producing the same goods to raise their prices.

IMPACT ON INCOME DISTRIBUTION

An issue closely related to, but distinct from, the oil price drag is the income redistribution arising from a shortfall and its attendant oil price increase. Policy must concern itself with several major income flows, including from the United States to foreign producers, from domestic consumers to domestic producers, and from domestic producers and consumers to the government.

International Income Distribution

As the result of an oil shortfall, the first major change in the flow of income is from oil-consuming nations, including the United States, to oil-producing nations. As illustrated by the 1979 events in the world oil market, even a small shortfall--or the expectation of a large disruption--can raise the price of oil substantially and thus redistribute income drastically. For example, the U.S. net foreign oil payments rose from \$54.1 billion in 1979 to \$71.0 billion in 1980--a 30 percent increase. Outflows of this magnitude have a depressing effect on the economy and negative effects on the balance of payments. In addition, although the major purpose of raising interest rates in 1980 was to combat inflation, higher rates also were needed to bring this money back into the United States. Therefore, capturing the windfall created by an oil disruption before it leaves the country is one of the options that should be considered in developing a shortfall policy.

Domestic Income Distribution

Domestic oil producers also reap substantial windfalls from the price increases associated with a shortfall. These redistributions of income raise issues of equity and regional balance. While much of domestic producers' increased revenues will be retrieved through the existing windfall profits tax and increased corporate taxes, decisions about the remainder will depend on the shortfall policy chosen.

The Congress passed the windfall profits tax to ensure that the transfer of income to the oil industry resulting from decontrol would be limited. But it also would provide billions of extra dollars to the government following a shortfall. The tax receipts resulting from a disruption would represent a significant increase in government revenues. Whether the government should keep these revenues, or reimburse the money to consumers, is another of the questions that should be considered in choosing a shortfall policy.

Consumers are also affected unevenly by oil price increases. While upper-income families consume more gasoline, heating oil, and other petroleum products than do lower-income families, poorer families spend more on these products as a percentage of their income.^{2/} Currently, families in the lowest income fifth spend, as a percent of income, more than twice as much on gasoline as families in the top income fifth. Similarly, the poor spend four times as much on heating oil and twice as much for the fuel in other goods and services they consume (see Table 1).

Consumers in different parts of the country are also affected to different degrees. Consumers in the Northeast use considerably more home heating oil than do consumers elsewhere, and rural consumers spend a larger percent of their income on petroleum products than do urban and suburban consumers. Thus, if consumers continue to spend in these patterns, or even with some shifting, the income flows will hurt low-income, Northeastern, and rural families more than consumers at large.

^{2/} Congressional Budget Office, The Decontrol of Domestic Oil Prices: An Overview, Background Paper (May 1979).

TABLE 1. AVERAGE ANNUAL PETROLEUM PRODUCT EXPENDITURES AS PERCENT OF INCOME, PER FAMILY (Families ranked by money income in 1972-1973)

Families Ranked by Money Income	Gasoline Expenditures	Heating Oil and Kerosene Expenditures	Indirect Expenditures on Oil
Lowest Fifth	6.5	2.0	7.8
Second Fifth	6.2	1.2	5.4
Third Fifth	5.3	0.6	4.3
Fourth Fifth	4.4	0.7	3.4
Highest Fifth	3.2	0.5	3.1
All Families	5.1	0.8	4.6

SOURCE: Bureau of Labor Statistics, Consumer Expenditure Survey Series: Diary Data 1972.



CHAPTER III. CHARACTERISTICS OF POTENTIAL OIL SUPPLY DISRUPTIONS

The desirability of various policies for dealing with supply disruptions depends considerably on the characteristics of the event they are intended to address. This chapter discusses the following salient characteristics of potential disruptions:

- o The size and duration of the disruption; and
- o The behavior of prices during and after the curtailment.

The discussion notes how the nature of the disruption might affect the specific goals toward which each policy is directed.

SIZE AND DURATION

At least 16 nations, including Iran and Iraq when not at war, each supply 2 or more percent of the world's oil production (1.0 million barrels per day). With so many producers, instability in the world oil market can come from any one of many directions. A shortfall need not be large or lengthy in order to have significant repercussions. The 1979 Iranian shortfall was only a small percentage of the world market, yet it triggered price increases that lasted throughout the year. The initial size of the shortfall may not necessarily reflect its ultimate effect. Again in the Iranian case, Iranian production decreased permanently, while the shortfall on the world market lasted only months.

Excess Capacity

The size and duration of a shortfall will largely be determined by the extent to which market slack exists or can be solicited, through using either excess producing capacity or existing stocks. Both the 1979 Iranian and the current Iraqi-Iranian cutbacks were mitigated by increased production in other nations. To compensate for reduced Iranian production, the Organization of Arab Petroleum Exporting Countries (OAPEC) increased production from a 1978 average of 18.5 million barrels per day to 21.0 million barrels per day, a 14 percent increase. They were joined by other OPEC members and together kept the total Iranian withdrawal from being felt. Overall OPEC production actually rose 5 percent during the disruption.

In the fall of 1980, the excess capacity in the market softened the impact of the Iraq-Iran War. Before the war, there was also significant stockbuilding that helped to absorb the blow. Even so, spot market prices and some official prices increased to reflect the disruption caused by the war.

Most nations with spare capacity, however, are those most likely to be involved in hypothesized disruptions. In this decade, significant excess capacity will be limited to a few major producers, notably Saudi Arabia, Kuwait, and the United Arab Emirates. Iraq may have such capacity after rebuilding the facilities destroyed in the current hostilities; Mexico may be able to bring new capacity on-line quickly. The excess capacity of Venezuela and Nigeria, which have traditionally replaced oil lost through disruptions, may decline. Thus, long-term excess capacity will probably be centered, as it is now, in Saudi Arabia, and dependent on the special United States-Saudi relationship. The mitigating role of spare capacity is, therefore, limited. In addition, the potential costs of obtaining this extra production through diplomatic or economic concessions must be weighed against the costs of enduring shortfalls, alleviated with other policy tools.

A major consideration in relying on excess capacity is that, with each long-term disruption of the market, there are fewer sources left to replace any additional shortfalls. For example, increased production in Iraq helped replace the 1979 decreased production in Iran. With the destruction of Iraqi productive facilities, other producer nations have to replace, at least temporarily, not only the lost Iraqi production but also that share of lost Iranian production that Iraq was replacing. In short, with each shortfall the next disruption becomes potentially more destabilizing.

Stocks

Using oil stocks can mitigate the effects of a disruption in several ways. First, a cessation of stock-building purchases reduces demand in the market and so lessens the severity of any shortfall. Second, stocks can replace the physical loss of oil from a shortfall. Finally, stocks provide a psychological buffer that can moderate price pressures.

Stock levels are theoretically easy to translate into numbers of days of consumption at alternate rates. In reality, stock depletion is rarely so orderly because of the uncertain duration of the oil import curtailment. It is true, however, that larger aggregate stocks would result in more moderate price increases when supply is cut. When the Strategic Petroleum Reserve (SPR) is complete, the critical importance of choosing the proper shortfall policy will be reduced as the net amount of any shortfall is reduced. But even if current fill schedules hold, the reserve will not be

large enough to alleviate a moderate supply disruption until 1985 when it will contain more than 400 million barrels of oil, enough to provide over 1 million barrels per day for a year.

In response to being caught with very low levels of stocks in 1979, major oil-consuming nations have increased their stocks of crude oil and products to levels significantly above the average of the late 1970s. This effort has been aided by the sluggish economic growth in most industrial countries, which has depressed demand for oil products. U.S. stocks, not including the 150 million barrels in the Strategic Petroleum Reserve, currently stand at approximately 1.3 billion barrels. (Of these, only 200 to 300 million barrels are actually available for drawdown. The rest represent tank bottoms, pipeline, and the minimum needed to maintain distributive continuity.) Japan is reputed to hold over 100 days worth of stocks. Germany has launched a public corporation to increase its Industrial and Strategic Petroleum Reserves.

These strategic government stocks may be the only source of any long-term excess inventory available during a disruption. In the future, after the memory of the 1979 events has faded, consuming nations may draw down these surplus stocks, which are expensive to build and maintain (as much as \$.50 per barrel per month in interest payments alone). If this drawdown takes place and another curtailment does occur, consuming nations may again find themselves bidding against each other to ensure continuity of supply.

In an effort to increase unity among consuming nations, the International Energy Agency (IEA) has mandated oil-sharing in the event of a shortfall of 7 percent in any of the signatory nations. While the IEA has served to coordinate a massive stockpile building effort and to discourage spot market buying by member nations, the sharing agreement remains untested. (It was not used in 1979.) Complicating any effort to share supplies are increasingly stringent OPEC contracts that limit the destination of oil. Producer nations have expressed their intention to gain greater control over the market, and so IEA signatories may find themselves unable to comply with IEA agreements without risking further curtailment. Despite these problems, the existence of the IEA does provide a device through which policy options calling for a multilateral response could be implemented.

Potential Future Shortfalls

Another oil disruption is not only possible, but quite likely. Both major shortfalls and a series of small and intermediate reductions in oil production, originating from a variety of causes, are likely. Currently (in 1981),

the United States is consuming 16.6 million barrels of oil per day, of which 5.8 million barrels are imported. Several potential situations exist that might reduce this amount suddenly. If the Strait of Hormuz was closed and if the United States lost oil in proportion to its share of world oil imports, the U.S. loss would be approximately 5 million barrels per day, or over 80 percent of present imports. A change in Saudi Arabian political orientation and subsequent total withdrawal from world production would similarly reduce U.S. imports by roughly 3.3 million barrels per day, or over 50 percent of present imports, again assuming a proportional U.S. loss of world supplies. Even reduction of Saudi production to levels needed only for its present industrial development (5-6 million barrels per day) could cost the United States 1.5 million barrels per day, or 25 percent of imports. Beyond these political events are Acts of God--an accident in the North Sea wells, for example. These could, just as surely, reduce U.S. imports, at least temporarily until such damage could be repaired.

THE BEHAVIOR OF PRICES DURING AND AFTER A CURTAILMENT

The crucial questions about the behavior of prices during an oil interruption are:

- o How high will prices go?
- o Will prices return to the preshortfall level?

Price Levels

In the past, demand for oil products has been relatively insensitive to changes in price. Prices of many refined products doubled in the 1979 disruption and consumption only dropped a small percentage in the short run. Furthermore, the drop in consumption may have been caused as much by the recession as by increased prices. Significant adjustment to changes in oil prices must await changes in the capital stock of major users, a long-term process.

Since, in the short run, petroleum has few substitutes for many uses, consumers are willing to pay a great deal to ensure availability. Shortfalls are rarely orderly and, in the face of uncertainty, consumers tend to hedge. They buy more oil and pay more for it than they might ordinarily. Refiners and industrial fuel users will pay a premium for marginal oil supplies to avoid the cost of shutting down operations. All of these factors tend to cause large short-term price increases in response to shortages.

Acting to retard this tendency is the decline in real income experienced by consumers as the prices of goods increase. Demand for a good is a function of both its price and the consumer's real income. At very high prices, many persons simply will not be able to afford to buy what they used to. Moreover, as was seen in 1973-1974 and 1979, oil supply interruptions result in sizable losses in economic growth in the year and one-half following the shortfall. This suggests that lowered incomes lead to market slack that could tend to restore oil prices to preshortfall levels.

In sum, the two forces operating on demand are uncertainty and real income. The role of policy in this regard, therefore, is to reduce uncertainty, insofar as possible, and decrease demand. In the event of a shortfall, the pattern of uncertain and steplike price increases may provide an opportunity to put policies into effect to decrease demand, capture the scarcity premium, and provide for the allocation of whatever oil is left during the short-term surge of prices following a disruption.

Spot market purchases can also affect the price of oil. Although the IEA discourages consumer nations from entering the spot market in periods of shortage, this principle has often been ignored. If individual nations enter the spot market, this tends to drive up spot prices and thus increases all consumers' oil prices. In times of need or uncertainty, however, all nations use it. Although the spot market can be quite volatile, it has a significant economic impact since producer nations use it as a guide for their pricing policies. In the fourth quarter of 1979, Japan massively increased its purchases on the spot market, and the average spot market price peaked at over \$40 per barrel. In response, OPEC raised its average official price from \$20 to \$28 per barrel. In the fall of 1980, despite record stocks, Japan reentered the spot market. That reentry, combined with general market concern over the Iraq-Iran War, served to push up crude oil prices by as much as \$6 to \$6.50 per barrel in the case of premium crudes.

The Time Path of Prices

In both previous shortfalls, the official prices established during the shortfall became the official prices after the shortfall, except in those cases in which individual nations raised prices above the norm. After 1974, prices decreased in real terms, but steadily increased in nominal terms. Prices also held after 1979. Because oil prices have already been raised so much, it is possible that they may level off for several years, if present production is sustained.

In fact, it is possible that future disruptions will not result in price increases as large as those experienced in the past. In other words, the

elasticity of demand may be increasing. A consensus is emerging that oil prices might have risen substantially in the 1970s even without the catalyst of the OPEC oil embargo. This could mean that, despite the continued presence of OPEC price-setting, the oil market may function more like a competitive market in the future than it has in the past decade. Therefore, if an oil disruption is only temporary, there is a growing probability that oil prices might, in fact, fall when production is restored.

CHAPTER IV. POLICY OPTIONS AND ANALYSES OF OPTIONS

A shortfall policy should encourage efficient use of oil, restrain oil demand, and capture some of the windfall from increased prices and return it to consumers. Because the policy options discussed in this chapter would accomplish these tasks to different degrees, each would result in a different constellation of effects. Thus, either tradeoffs would have to be made or the different policies could be treated as complementary rather than as exclusive alternatives. As outlined in the chapter on shortfall characteristics, oil import curtailments can vary in many ways and, consequently, present different targets for action. Thus, policy must match the particular configuration of a given oil shortage. This chapter discusses how different disruptions would bring out different advantages and disadvantages of various policy options.

POLICY OPTIONS

In the event of an oil shortfall, the government has several options with which it could respond. The policy approaches discussed here are:

- o Pursue a neutral policy based largely on authorities that will remain after expiration of the Emergency Petroleum Allocation Act (EPAA), namely, the present tax structure and market allocation of oil;
- o Attempt, through taxes or tariffs, to collect and recycle into the economy a portion of the windfall revenues that would otherwise flow to foreign and/or domestic producers;
- o Control domestic oil prices during the disruption, and establish a coupon rationing plan to allocate the shortage in a manner similar to that in EPAA.

This section concludes with a discussion of domestic price policies in the event of a shortfall.

Neutral Policy

In the event of an oil shortfall, the simplest policy would be to allow the market to allocate it. Producers and refiners would be allowed to

charge whatever consumers would be willing to pay. Inevitably, this would promote conservation because, as prices rose, individuals should begin to reduce oil consumption. The market would accomplish its traditional "rationing through price." Marginal additions to domestic supply might occur, although the U.S. oil industry generally operates at full capacity.

Market allocation of oil would not necessarily imply that the government would remain inactive. Part of the shortage premium--approximately 70 to 80 percent--eventually would be captured by all levels of government through the windfall profits tax, increased corporate income taxes, state and local taxes, severance taxes, and other payments to government. There might be considerable delay, however, in both collection and expenditure of these funds by all levels of government, which would cause some slowing of economic growth ("fiscal drag"). To mitigate this, the government could provide a tax cut in anticipation of increases in windfall profits tax collection, but this would require either standby authority not now provided or special legislation at the outset of the disruption. In any case, automatic stabilizers, such as unemployment insurance and other transfer payments, would force government expenditures to rise in the event of such a shock. The government would, therefore, play a role in mitigating some of the macroeconomic and redistributive effects of the shortfall, while leaving the market to establish allocative efficiency.

Oil Tax or Import Tariff

If an objective of policy was to capture and recycle into the economy the windfall revenues accruing to foreign and/or domestic producers, a tax or tariff on crude oil and refined products is an instrument worthy of consideration. In theory, the tax or tariff would work as follows. In response to a world shortfall, the government, either alone or preferably in consonance with other oil-importing nations, would institute an oil tax that would raise the cost of oil products. As a result, demand for oil in the United States would decrease, and less would be imported. This, in turn, would reduce the amount demanded on the world market, and hence producer prices might not rise as much as they would have in the absence of the tax. The market would, however, establish an equilibrium at a price higher than the predisturbance price. Imposing a tax in addition to the higher price might capture some of the shortfall premium by reducing demand to a level below the original amount of the shortfall, thus "softening" world oil prices. Because it is imposed above the price that the market would reach after the disruption, however, U.S. consumers would pay more for oil used than they would have had the government done nothing.

Tax proposals would collect large amounts of funds, even at relatively low levels of shortfall. Present U.S. annual consumption of crude oil is over 5 billion barrels. If the low short-term responsiveness of demand to price continues as it has in the past, the fees necessary to lower demand significantly would be quite large. Any shortfall tax would, therefore, collect tens, possibly hundreds, of billions of dollars. For this policy to be effective, these funds would have to be distributed in a manner deemed appropriate by the Congress before they could create significant fiscal drag. While the President has the authority to impose a tariff, he does not have the authority to institute a rebate. Hence, to impose any tariff or tax rebate plan would require new legislation.

A tax or import tariff would be most effective in capturing the shortage premium if imposed by all, or most, major oil-consuming countries. If major International Energy Agreement (IEA) members imposed taxes or import tariffs to reduce internal demand, their actions would lessen increases in world prices. If the United States had to act unilaterally, however, the effectiveness of a tax or tariff would be greatly reduced. The United States is only one-third of the world market and unilateral action would serve mainly to improve availability elsewhere.

Depending upon the response of foreign oil producers, the oil price premium created by the shortfall would remain in the hands of the governments of the consuming nations for use to mitigate the negative macroeconomic effects of the shortfall.^{1/} Thus it would be essential that use of this policy be tailored to the anticipated response of the producer nations.

Several types of oil taxes are available. The principal options, discussed below, include import tariffs, crude oil refining fees, and gasoline taxes.

Import Tariff. If a tariff were imposed on imported crude oil and products, the price of all domestic oil and products would also rise to the world price plus the tariff. Thus, while foreign producers might lose some of their shortage premium, domestic producers would benefit doubly from

^{1/} If faced with a tariff, oil producers could either cut production to maintain prices, or cut prices to maintain production, or cut some of both. The exact nature of one's assumptions about their response would determine the shares of the tax burden.

the initial price rise and from the tariff. This double windfall might encourage some increased domestic oil production as the duration of the disruption increased.

Crude Oil Refining Fee. This option would place a tax on all crude oil used by U.S. refiners, both domestic and imported. Imported refined products would be taxed on an equivalent basis. Thus, its effects would be felt by domestic as well as foreign crude oil producers, unlike the import tariff. Reduction of domestic producers' windfall would lower, if not eliminate, incentives for increased production, although significantly higher production might not be possible in any case, at least for the short term. Like the tariff, a refining fee could be imposed unilaterally or in conjunction with other nations.

Gasoline Tax. Instead of using a tax to increase the prices of all oil products, the government could concentrate the effects on one product: gasoline. The benefits of concentrating the price increase on one good is based on the following argument. If the prices of all oil products rose, these increases would filter through the economy and raise the price of all goods and services. If the price of oil subsequently declined after the shortfall when the tax was removed, prices of all goods and services would not be likely to come down, since prices tend to stick at their higher levels. Thus, the general price level would have been increased. With a tax on gasoline alone, this rise in general prices could be avoided to a certain extent. Since businesses use only 20 percent of gasoline, most gasoline is in the final demand sector. Therefore, increases in gasoline prices do not ripple through the economy as much, and then only after a delay through indexed benefits and the price-wage spiral. In addition, restricting the use of gasoline might be more equitable than restricting heating fuels and less recessionary than restricting industrial fuels.

Coupon Rationing

Unlike the various tax policies discussed above, coupon rationing would not use the pump price to limit demand for gasoline. Under this policy, the government, through administrative action, would set the quantity of gasoline that could be consumed by restricting gasoline purchases to holders of ration coupons. In the event that this policy was invoked, the government would ascertain the size of the shortfall and issue coupons accordingly. Price controls would be needed, since, without them, prices would rise to their market clearing level, rendering the rationing system redundant.

Under the current standby rationing plan, coupon checks would be issued quarterly to registered vehicle owners, using the states' historical

levels of use as a basis for allocation. These checks could then be taken to specified locations and exchanged for coupons that would be used when buying gasoline. The coupons would be freely negotiable and persons with extra coupons would probably be able to sell them at some profit. Thus, because of price controls, the price of gasoline would remain stable, while the price of coupons would rise. Gasoline would still be allocated according to demand, but only a portion of demand would be expressed at the pump; the rest would be expressed in the price of the coupons. In this way, the shortage premium would remain in the hands of the consumers as a group. An additional advantage of coupon rationing is that many people view it as the most equitable method of allocating a scarce resource.

Domestic Price Policy

In the event of a shortfall, policymakers will have to decide how they wish to treat domestic oil prices. This is a problem common to most disruption policies. The question is not whether long-term price controls should be reimposed--the decision to decontrol domestic oil prices for the long run was made in 1975. Rather the issue concerns how to address transient price increases.

The main advantage of imposing temporary domestic controls on crude oil and product prices would be the resulting reduction in the transfer of income from consumers to domestic producers. Since domestic sources provide over 60 percent of U.S. oil consumption (although this percentage is expected to decline in the future), reduction of this income stream would significantly lower the income transfer that causes oil price drag and GNP loss.

On the other hand, price controls would have several disadvantages. They would lead to excess demand (the infamous gasoline lines) and less conservation since there would be no large price increases to dampen demand. This excess demand would exacerbate international income transfers and contribute to higher oil prices. It would be costly, both in terms of time lost in gasoline lines and of the social cohesion lost in the competition for remaining products. Presumably since rising world prices would increase the cost of imports, consumers still would have some incentive to conserve. In addition, even under the threat of price controls, no speculative oil inventories would be held since no profit could be realized on their sale. (Whether such inventories, other than government-sponsored, would ever be substantial is not clear, since, as discussed above, the carrying costs of oil inventories are large and, by definition, the return to a speculative stock is uncertain.)

Domestic wellhead price controls would also lower the effectiveness of a tariff. With domestic price controls, consumers would face a weighted average of uncontrolled world oil prices and controlled domestic oil prices. Since imports constitute roughly 40 percent of all oil consumption, consumers will only feel, at most, 40 percent of the tariff. Thus, if the Congress imposed both price controls and a tariff, the tariff, to be effective in reducing demand, would have to be much larger than would be the case without controls.

Finally, price controls are not the only way to reduce the flow of income to domestic producers. Windfall profits and corporate income taxes would probably capture most of the shortfall premium.

ANALYSIS OF POLICY OPTIONS

Each of these policy options was analyzed in light of the central aims of a shortfall policy:

- o To reduce the adverse economic effects;
- o To mitigate the negative effects on income distribution; and
- o To ensure administrative ease and competence, especially in allaying panic and perceptions of inequity among consumers.

Reducing the adverse economic effects of a shortfall is the principal target of ameliorative policies. Insofar as oil shortfalls lower real GNP, there will be less income for all if a shortfall is allowed to run its full course. Policies should also be designed to ensure equitable income distribution and to promote efficient use of energy, but if consumer incomes decline, the nation as a whole loses. Though the physical shortage of oil is unavoidable, many of the macroeconomic and income distribution effects of a shortfall are not.

Proposed policies must also consider the government's ability to use the tools at hand. Reliable data, such as the response of demand to increased prices, is often not available, nor are effective bureaucracies easily established, especially in the crisis atmosphere of a large oil shortage. Programs that require new federal actions--such as taxes or rationing--must be prepared in advance to be ready for immediate implementation. Effective policies must also be sensitive to the size of the disruption and the possibility of errors reverberating through the system. If a clerical error or a significantly erroneous estimate of demand elasticity can cause damage to millions, then the system cannot be considered stable. A policy,

therefore, has to be designed to minimize the results of errors, both big and small.

This section summarizes the results obtained from analyses of the performance of the various policies during oil shortfalls. All the cases analyzed in this paper assume a year-long oil supply interruption starting in 1982. The analyses describe the effects of each policy on inflation, employment, output, income distribution, and ease of administration.

In addition to the qualitative analysis, two shortfalls are simulated, using a large macroeconomic model: a large shortfall in which world markets lose 7.5 million barrels per day, and a short one in which 3.0 million barrels per day are lost. U.S. oil imports initially decrease by 2.5 and 1.0 million barrels per day, respectively. These figures represent slightly more than 40 percent and 15 percent of current U.S. imports, respectively. (By contrast, the 1973-1974 oil embargo cost the United States an average of 1.0 million barrels per day in imports, or 18 percent, for four months.) In response, oil prices rise from a baseline projection of \$39 per barrel at the beginning of 1982 to \$86 and \$57 per barrel, again respectively. In the year following the shortfall, supply is restored and prices fall to \$57 and \$47, respectively.

The Data Resources, Incorporated (DRI) model of the U.S. economy was used to simulate the macroeconomic effects of an oil disruption under each policy. The results should be treated as illustrative of the type of impact that might occur, and not as forecasts of the course of the economy during the next oil shock. The rapid increase in oil prices during a disruption would produce income flows beyond the historical experience upon which the model draws. While these models can simulate mechanically the transfer of hundreds of billions of dollars between sectors, CBO cannot view the results as more than illustrative of the macroeconomic effects. At larger levels of disruption, minor model specifications and assumptions become quite important and may significantly influence the results. Nevertheless, these results are useful in conveying a sense of the magnitude of the income flows and the relative effects of alternative policies.

To test the effectiveness of the policy alternatives, rather than using the Strategic Petroleum Reserve, private stocks, or the spare capacity in OPEC, it is assumed that these price increases elicit no supply response, and that they do not open stocks held by governments or private individuals.

These price levels assume short-run elasticities of demand for crude oil in the -0.1 to -0.15 range. While many analysts feel that past demand has been that inelastic, future demand may be more responsive (certainly so

in the long run). If future demand is more elastic, then the world crude oil prices would rise less in response to a shortfall and the negative economic effects forecast here would overstate the actual consequences of an oil interruption. For example, with an elasticity twice as high, prices would rise only to \$45 in the 1 million barrel per day case, and the economic impact would be proportionately reduced.

Since the results of the simulations are sensitive to monetary and fiscal policy assumptions, these are kept the same across policies and should not affect the relative effectiveness of the policies. All simulations assume constant nonborrowed bank reserves. To ensure that model results occurred because of the policy options and not from other changes in fiscal policy, it was assumed for all simulations that the incremental proceeds of the windfall profits tax were rebated one quarter later through income tax cuts, and that the proceeds of taxes, tariffs, and fees were rebated as collected through income tax reductions. The assumptions about receipts from the windfall profits tax are based on law in effect in July 1981.

Neutral Policy Option

Economic Effects. Under this option, the combination of oil shortage and price increase would have a recessionary impact on the economy, while simultaneously increasing inflation. The large shortfall would transfer an additional \$232 billion from consumers to foreign and domestic oil producers and the federal government in the first year alone (see Table 2). This massive transfer of funds would result in significant oil price drag. When simulated with the DRI model, this income transfer resulted in an average constant dollar GNP loss of 4.3 percent for the first five quarters below the baseline projection in which economic conditions were identical, but in which no shortfall occurred (see Table 3).

Unemployment would also rise significantly. The large shortfall simulation resulted in a fifth quarter rise in the unemployment rate of 1.8 percentage points above the baseline of no shortfall. In this simulation, unemployment peaked one quarter after the shortfall had ended, even though oil prices were falling by that time.

In the small shortfall, the negative GNP effects would be countered by automatic stabilizers (unemployment compensation, food stamps, and so forth), which would tend to increase the federal deficit in the event of a recession. As the size of the shortfall increased, the windfall profits tax receipts would increase more rapidly than automatic expenditures, thus aggravating the decline in real output and employment. A program of

TABLE 2. ILLUSTRATIVE INCOME FLOWS OF ALTERNATIVE POLICIES (In billions of current dollars) a/

Options	Incremental Revenues			Total Incremental Consumer Expenditures <u>b/</u>	Tax Cut <u>c/</u>	Net Consumer Income Loss <u>d/</u>
	Foreign Oil Producers	Domestic Oil Producers	Federal Government			
Neutral Policy						
Small shortfall	28.6	21.5	53.8	103.9	33.3	70.6
Large shortfall	43.5	53.9	134.5	231.9	83.3	148.6
Unilateral Import Tariff						
Small shortfall	13.0	38.4	135.4	186.8	99.0	87.8
Large shortfall	-9.1	87.4	280.8	359.0	197.7	161.3
Multilateral Import Tariff						
Small shortfall	-9.9	28.0	121.6	139.7	95.0	44.7
Large shortfall	-34.0	66.2	261.8	294.0	198.8	95.2
Crude Oil Refining Fee						
Small shortfall	17.0	20.5	162.6	200.1	142.6	57.5
Large shortfall	-5.2	42.7	347.3	384.8	305.3	79.5
Gasoline Tax						
Small shortfall	20.7	20.6	150.0	191.3	129.9	61.4
Large shortfall	<u>e/</u>	<u>e/</u>	<u>e/</u>	<u>e/</u>	<u>e/</u>	<u>e/</u>

NOTE: The small shortfall is assumed to be 1 million barrels per day for the United States; the large is 2.5 million barrels per day.

a/ Fourth quarter 1982 extrapolated to an annual basis.

b/ Sum of incremental revenues of foreign and domestic oil producers and the federal government; numbers may not add to totals because of rounding.

c/ A tax cut was used in all simulations as the vehicle for refunding government receipts to consumers.

d/ Incremental consumer expenditures, minus tax cut.

e/ Not simulated.

TABLE 3. ILLUSTRATIVE MACROECONOMIC EFFECTS OF POLICY OPTIONS

Options	GNP Loss (Percent of projected GNP) <u>a/</u>	Fifth Quarter Increase in the Unemployment Rate (In percent- age points)	Fourth Quarter Increase in the Price Level (In percents) <u>b/</u>	Eighth Quarter Increase in the Price Level (In percents) <u>b/</u>
Neutral Policy				
Small shortfall	1.6	0.7	3.1	1.9
Large shortfall	4.3	1.8	7.2	5.5
Unilateral Import Tariff				
Small shortfall	1.2	0.5	6.1	2.7
Large shortfall	4.3	1.9	13.0	7.6
Multilateral Import Tariff				
Small shortfall	1.0	0.4	5.0	1.7
Large shortfall	3.0	1.2	10.9	5.0
Crude Oil Refining Fee				
Small shortfall	0.8	0.4	6.4	3.0
Large shortfall	3.5	1.6	13.8	8.6
Gasoline Tax				
Small shortfall	0.6	0.2	5.7	3.0
Large shortfall	<u>c/</u>	<u>c/</u>	<u>c/</u>	<u>c/</u>

SOURCE: Data Resources, Inc. model of the U.S. economy.

NOTE: The small shortfall is assumed to be 1 million barrels per day for the United States; the large is 2.5 million barrels per day.

a/ Average constant dollar GNP loss for first five quarters.

b/ Percent change in GNP deflator relative to the baseline of no shortfall.

c/ Not simulated.

accelerated recycling into the economy of windfall profits receipts would be needed, therefore, just to counter the fiscal drag. Such a program was assumed, with a one quarter lag. Without this, the macroeconomic losses would be larger.

Inflation would also be aggravated by a curtailment. In the larger shortfall, the refinery acquisition price of oil would rise by roughly 120 percent with the result that oil product prices and other domestic energy prices would rise significantly. When simulated, the large shortfall resulted in an increase in the price level of 7.2 percent above the baseline in the fourth quarter and 5.5 percent in the eighth quarter, based on the GNP deflator.

Income Distribution Effects. As mentioned above, the shortfall would result in a large transfer of income to oil producers at home and abroad. The windfall profits tax and corporate income tax would ensure, however, that most of the domestic windfall would be captured by the government for redistribution. Of the total windfall produced, foreign producers would capture almost 20 percent and domestic producers, after all taxes, almost 25 percent. In the larger shortfall, net consumer income loss would be \$148.6 billion; for the small one, \$70.6 billion.

Administrative Ease. The federal bureaucracy can be presumed ready to handle present programs in the event of massive oil-induced dislocations. In the event of major downturns in the economy, many federal programs, like unemployment compensation and other transfer payments and entitlements, would be used much more intensively than is usual. In the 1974-1975 recession, these programs were able to increase their caseloads dramatically without significant deterioration in service. Since the windfall profits tax would increase federal revenues significantly, there would be ample funds available for these programs.

The central administrative problem with a neutral policy involves the rebate of the extra windfall profits tax revenues. In the large shortfall simulation, these totalled over \$80 billion in the first year. The experience with tax cuts of this magnitude is quite limited. Furthermore, it might be difficult to achieve the political consensus needed to design a specific tax cut when sums of this size are involved.

Tax Options

Because of the very different nature of the various tax proposals, four different sets of simulations were performed: a unilateral import tariff, a multilateral import tariff, a crude oil refining fee, and a gasoline tax. They are analyzed together in this section.

This section first outlines the major assumptions used to simulate the effects of each tax policy:

- o **Unilateral Tariff.** In this scenario, the United States alone imposes a tariff above the shortfall price increase, causing the world price to fall, but only by roughly one-third of the tariff. Thus, U.S. consumers have to bear the brunt of the tariff. If U.S. consumers bear an even larger share of the tariff, the benefits of a unilateral tariff would be further reduced. The net result of the unilateral tariff is that oil in the United States is more expensive, while oil in the rest of the world is less expensive and more available than under the neutral policy. On the other hand, the federal government is able to capture a portion of the shortage premium that would have otherwise been lost to foreign producers. In all tariff simulations, domestic producers are assumed to raise their prices to match the world level plus the tariff. The tariffs are all imposed for the duration of the shortfall after a one quarter delay. In the unilateral case, the tariff levels are \$20 per barrel in the event of a small shortfall, and \$49 per barrel for a large shortfall. The tariff revenues are used to reduce income taxes.
- o **Multilateral Import Tariff.** In this scenario, IEA members impose tariffs high enough to conserve enough oil to eliminate a shortfall. For modeling purposes, the policy is assumed to be successful and world oil prices remain at preshortfall levels. To the extent that this policy is not successful, the benefits of the tariff would be reduced. The required level of tariff is \$24 per barrel in the event of a small shortfall, and \$60 per barrel for a large shortfall. The funds collected are used to reduce income taxes in all participating countries.
- o **Crude Oil Refining Fee.** In this option, the U.S. government taxes all oil, both domestic and foreign, used by U.S. refiners. Imported refined products are taxed on an equivalent basis. World prices are assumed to rise, though not by as much as without any tax. In its effects on world prices and quantities, the crude oil refining fee appears to be very similar to the unilateral tariff. The main difference is the direct collection of more of the shortage premium from domestic producers with the fee rather than partial collection of less of the premium through the windfall profits tax under the tariff. The fee ends with the shortfall. The fee would range from \$20 per barrel in the event of the small shortfall to \$49 per barrel in the event of the large shortfall.

- o Gasoline Tax. In order to place the entire burden of a large shortfall on gasoline, consumption would have to drop almost 40 percent. Because of this, a gasoline tax would not be an effective option in the event of a large shortfall. It is difficult to conceive of a tax program that could decrease gasoline consumption by 40 percent, nor, given present knowledge, could the estimates of the effects of such a program be viewed with much confidence. Therefore, gasoline taxes have been simulated only for the small shortfall. Because of the smaller base upon which to place the burden of the tax, the gasoline tax is set at \$1.14 per gallon (or \$48.3 per barrel), approximately twice the level of taxes on crude oil for the small shortfall. Like the import tariffs and the crude oil refining fee, the gasoline tax funds are used to reduce income taxes. No special assumptions have been made about the relative price sensitivity of the demand for gasoline versus other oil products. Gasoline demand, however, is assumed to be more elastic than crude oil demand. If gasoline demand is only as responsive as crude oil, the macroeconomic benefits of the gasoline tax are overstated. If gasoline demand is much more price sensitive, the economic benefits are understated.

In the various tax and tariff simulations, imposition of the tax is delayed by a quarter, because it is assumed that the government will not be able to implement a rebate mechanism immediately. If, however, the tax is imposed immediately (a preemptive tax) but the refunds delayed, the resulting fiscal drag will be much more severe than it would be under the neutral policy option. On the other hand, if prices are allowed to rise before the tax is imposed, many of the benefits of the tax (that is, the capture of the windfall) will be lost if prices stick at their higher level. Thus, policymakers face a tradeoff between exacerbating the macroeconomic effects of a disruption by imposing a preemptory tax before the rebate is ready, or risking the loss of the effects of a tax if prices do not drop.

Economic Effects. When simulated, the policies produce strikingly different effects on output and employment. Under a large shortfall, the unilateral tariff would result in an average real GNP loss of 4.3 percent for the first five quarters, identical to that of neutral policy, while a multilateral tariff would reduce this to a 3.0 percent loss. The unemployment rates exhibit a similar disparity. The unilateral tariff would result in a fifth quarter unemployment rate 1.9 percentage points greater than the baseline while the multilateral tariff would result in a fifth quarter increase of 1.2 percentage points. The inflationary effects of the import tariffs would be larger than those of a neutral policy. The larger shortfall would produce a fourth quarter price level increase of 13.0 percent with the unilateral tariff

and 10.9 percent if the United States was joined by other IEA members. Eighth quarter figures were 7.6 and 5.0 percent, respectively (see Table 3).

When the refining fee option was simulated, the model responded to the change in income flows. The average five-quarter real GNP loss was 3.5 percent under the large shortfall. The unemployment rate showed a peak increase of 1.6 percentage points. The refining fee would produce a price level increase of 13.8 percent over the base case in the fourth quarter and 8.6 percent in the eighth quarter.

When the gasoline tax was simulated for the small shortfall, the average real output loss was 0.6 percent, compared to 1.6 percent under a neutral policy. Unemployment was correspondingly reduced to 0.2 percentage points above the baseline, compared to 0.7 percentage points under a neutral policy.

Inflation, under the gasoline tax option, is much more complicated to measure than under the other options. The Consumer Price Index (CPI) is more gasoline intensive than is the economy as a whole, since private consumer purchases constitute the bulk of gasoline expenditures. Thus, individual consumers would feel the inflationary impact of the gasoline tax more than would the economy as a whole. Since a gasoline tax, unlike other policy options, enters the CPI directly, such a tax would increase benefits, such as Social Security, that are tied to the CPI. These second-round changes would increase the inflationary effects of the gasoline tax. A decision regarding the definition of the CPI in this circumstance might be necessary. Despite this, to make the gasoline tax simulation comparable to the other tax options, the measure of inflation used is the percent change in the GNP deflator. When the gasoline tax was simulated, the price level was increased by 5.7 percent after four quarters and 3.0 percent after eight (see Table 3).

Income Distribution Effects. With a successful multilateral tariff, the shortage premium would be retained by consumer nations to a greater extent than under neutral policy. Income flows to foreign oil producers would actually decrease under a successful tariff, more so with a multilateral tariff than with a unilateral one. However, under a unilateral tariff, most of the money retained would be transferred to domestic oil companies.

The primary impact of the refining fee would be to concentrate the bulk of the shortage premium in the hands of the government for use in stimulating the economy. Of the total increase of revenues raised from consumers, over 90 percent would end up in the hands of the government, as compared to less than 60 percent under neutral policy, which explains the decreased GNP loss. Domestic oil producers would also find their share of

the windfall was reduced from almost 25 percent to roughly 10 percent. This might reduce the marginal incentive to produce more oil.

The gasoline tax, like the unilateral tariff and refining fee, would reduce only U.S. demand. As a result, like the tariff or fee, it would have limited impact on world prices. (Like the unilateral tariff, the simulation assumes U.S. consumers bear the bulk of the gasoline tax.) If properly set, however, a gasoline tax might mitigate price increases and windfalls to domestic oil producers. Like the refining fee, the primary distributive impact of the gasoline tax seems to be that the gasoline tax would concentrate the windfall in the hands of the government. The government's refunding program would ensure that the windfall premium was relatively equitably distributed among consumers. The exact distribution of the windfall would depend on the details of the refunding program.

Administrative Ease. The two central administrative difficulties confronting a tax or tariff proposal are:

- o Determining the correct tax level; and
- o Recirculating the funds quickly enough so as not to create fiscal drag.

First, the elasticity of demand for oil and gasoline is not known with enough accuracy to set the tax or fee with confidence. Estimates of the short-term elasticity of demand for crude oil and gasoline vary from roughly -0.05 to -0.5. The appropriate tax level would be extremely different for each end of the range. For example, even in the relatively tight range of -0.1 to -0.15, the tax or fee required to decrease gasoline demand by 20 percent would vary considerably. If gasoline supply were to be constrained to 80 billion gallons per year (a figure roughly equivalent to a 20 percent shortage or about 1.3 million barrels per day), the difference in federal revenues between these two elasticity assumptions, which are equally defensible, would approach \$90 billion. In addition, since the elasticity of demand also changes over time, the problem of setting the tax or fee level would be complicated because planners would be aiming at a moving target. This margin of error in elasticity estimates obviously could limit the potential effectiveness of a chosen policy.

While it is impossible to obtain precise information of this sort, absolute accuracy might not be needed. If the tax or tariff were set too low to achieve the desired decrease in demand, the world price could rise to compensate. The United States, alone or in conjunction with other IEA members, could then either raise the tax again to attempt to capture the additional windfall, or could allow foreign producers to keep the extra funds,

perhaps in exchange for political or economic concessions. If it did the latter, the output benefits of the tariff could be somewhat reduced, as income would be flowing to producers, but the inflationary impact would decrease as well. If the tax was set too high, either producer oil prices would drop below predisruption levels (although this would seem unlikely) or demand would be over-restrained, and again the GNP loss might be increased as might the inflationary impact. In such an event, the tax could be lowered, but this move would have uncertain effects as final product prices might remain at their higher levels. Although policymakers could change an incorrectly set tax, tariff, or fee, such a change could have major costs. A rise in the tax might very well stimulate short-term oil demand as consumers increased buying in anticipation of further price rises. It also might exacerbate perceptions of government incompetence.

No less a problem would be to recycle tax receipts fast enough so as not to induce further macroeconomic contractions. Without prompt reimbursement, the increased level of outlays could force families to cut back on all spending. If not reimbursed, the gasoline tax, for example, would represent an increase in federal taxes of 50 percent for the median family of four, under the small shortfall scenario.

The most commonly discussed plan to reimburse the tax, often called the "prebate" plan, would refund the money by decreasing the level of income tax withheld from paychecks. The amount withheld would be recomputed, using both tax and refund criteria. Since the tax, tariff, or fee would reduce the income tax on a dollar-for-dollar basis, the problem of fiscal drag resulting from delays in the rebates would be minimized, that is, the federal government would never receive additional revenues from the taxes.

Even though the prebate plan would avoid many of the macroeconomic problems associated with the tax options, it is not without its own drawbacks. The Internal Revenue Service (IRS) could serve as a rebate mechanism, but only with difficulty. The complexity of the tax schedules would be increased greatly. The IRS would have to inform and educate all the employers in the country about the changes in the tax system. Serving as the rebate mechanism would also increase the IRS' burden in keeping track of multiple jobholders, persons with changes in marital or job status, and so forth. The IRS auditing effort would also have to be increased substantially and might not be able to accomplish its mission effectively.

In the event of a substantial shortfall, the prebate system would largely replace the income tax system with a tax on crude oil and/or products. A tax designed to reduce gasoline consumption by a quarter, for

example, would produce revenues sufficient to compensate entirely for the income taxes of a family of four with a gross adjusted income of \$20,000. In the event of a shortfall, this plan would call for adjustment of all the tax schedules, based on the first signs of trouble in the world oil market. The changes in the tax rates could not be set in advance, since they would have to vary with the situation.

Because the income tax system is quite complex and was built up over a period of years, substituting a new system imposed for emergency purposes might not be the optimal strategy. One possible alternative might be to set the tax/rebate system ahead of time. Thus, while the tax would not be designed for the specific shortage, and some of the shortage premium would be inevitably lost or overtaxed, the proposal would substantially reduce the administrative burden of the tax. In this way, the tax schedules could be publicized in advance and ad hoc adjustments could be avoided.

Any plan to rebate through the income tax system, however, would have to cope with the millions of persons who do not pay taxes, but rather live on various income maintenance programs. Since these persons would be paying, directly and indirectly, the higher oil product prices, induced in part by federal taxes or tariffs, they also should receive some rebate. This rebate might be distributed through temporary increases in recipients' benefit levels. Some mechanism would also have to be designed for persons missed by both the tax and benefit programs. It should be recognized that each addition to the rebate mechanism to make it more comprehensive and sophisticated would make it administratively more cumbersome. At some point, further attempts to achieve a perfectly just rebate program would not be worth the increased cost.

In addition to the generic tax and rebate problems outlined above, the gasoline tax would be vulnerable to some unique administrative problems. As mentioned above, the gasoline tax would feed directly into the CPI. Whether and how to adjust the CPI to reflect the fact that this tax is temporary and refunded is a matter of concern.

In point of fact, refineries are not sufficiently flexible to permit the entire shortfall loss to be taken out of gasoline production. In the event of a substantial disruption, however, up to 80 percent of the loss could be absorbed from gasoline production, depending on the actual amount and mixture of the crude oil lost. Providing refiners with the incentives to meet this goal could be difficult, since each refinery has a unique set of profit margins on different products and a different mix of crude oil types and so would respond differently to an identical set of circumstances. Thus while placing a tax of sufficient size on gasoline might reduce demand by the desired amount, refiners might choose to supply a different level of product.

This could create further problems, causing a longer adjustment period than other tax options.

Coupon Rationing

Since the administration of a rationing program would be difficult, it would probably not be imposed unless the shortfall was quite large. Coupon rationing is most useful for those extreme situations in which it would equitably distribute the oil shortage and price burdens and thus promote social cohesion.

Economic Effects. Since coupon rationing would involve government control of significant portions of the economy, the relationships underlying the conventional macroeconomic models would change, rendering the models useless for some purposes. Therefore, the coupon rationing policy was not simulated. In theory, a coupon rationing scheme would be equivalent to a refundable gasoline tax. Ideally, coupons and tax rebates could be distributed so that consumption and income distribution were similar. Therefore, the effects of a gasoline rationing system should be similar to those of a gasoline tax. In reality, however, there would be major differences. Of these, the most significant would be the potential for economic damage as the increased administrative burden caused administrative errors to multiply. Aggregate supply inevitably would be curtailed, thus decreasing the positive economic benefits of an equivalent tax scheme.

Income Distribution Effects. A coupon rationing program would keep the domestic part of the shortage premium in the hands of consumers. If domestic wellhead prices were held constant through controls, domestic producers should experience no windfall. The government would give the ration coupons away free, but would limit their quantity. The government could collect a small tax to pay for the administration of rationing, but this should not be significant.

Unless instituted with a tariff, however, a coupon rationing plan would not decrease the international income flows and might actually increase them. To prevent foreign producers from capturing more of the shortfall premium from consumers, the government might have to set a minimum price on coupons, perhaps through open market operations. If this were not done, foreign producers might raise their prices beyond that immediately suggested by the market. Since domestic prices would be controlled, consumers would face a weighted average of controlled and uncontrolled prices. Foreign producers could raise their prices until this weighted average equalled the price all oil would have commanded without controls. Because

of oil markets in other nations, it is unlikely that foreign producers could actually raise their prices to capture all the premium; still, part of the premium clearly would be vulnerable. Under such circumstances, without some floor price for coupons, the economic premium, rather than passing from domestic producers to consumers, would pass from domestic producers through consumers to foreign producers.

The entitlement conferred by coupons would be central to a rationing plan. Everyone who received a coupon would receive equal access to gasoline, highlighting the appearance of equity which might be absent from plans using higher prices and taxes to ameliorate shortfalls.

The current standby plan, which would allocate ration rights according to vehicle ownership, might be tilted slightly toward lower-income families. This would occur because lower-income families drive less while all vehicle owners would receive the same amount of coupons. (This would be offset to the extent that lower-income families have less fuel-efficient vehicles.) Assuming lower-income persons sold their extra coupons and all driving was decreased evenly from present consumption patterns, the plan would result in a slight net increase in the annual income of lower-income households, while upper-income households would have to spend more. Since the coupons would be, in effect, a second currency, the distributional impacts of the plan would be very sensitive to the allocation of ration rights.

Administrative Ease. The central administrative problem with coupon rationing is that, in effect, a second currency (ration coupons) would be introduced in a short period during a crisis. Currency now in circulation totals about \$110 billion. Gasoline consumed in the United States has averaged about 100 billion gallons per year. Thus, in the event of a 20 percent shortfall, the government would have to put into circulation a second currency almost three-quarters the size of the currency now in place, assuming each coupon would be good for one gallon. Given the level of effort now required for maintaining order in U.S. currency, the size of this task should not be underestimated. In addition, the second currency would be distributed according to criteria different from the first. Major tasks confronting a coupon rationing program would include ensuring: (1) efficient distribution of coupons to consumers, (2) proper allocation of fuel among states, and (3) continued supplies of fuel.

Hoarding in anticipation of coupon rationing might also be a problem. This phenomenon should be transitory, but could result in a shaky beginning for the program. A greater problem would result from the uneven quality of different state motor vehicle registration files. If these files were used as they now stand, a significant fraction of the potential recipients could be missed. If even 1.0 percent were omitted, approximately 1.5 million vehicle

owners would be without coupons. Thus rationing might begin with several million individuals not having received their coupon checks.

Depending on the number of persons missed, the white market for coupons might be able to handle some of the initial disequilibrium. Persons who did not receive their coupon checks could purchase them from persons with extra coupons. When they did receive their coupons, they could sell them to recoup their expenses. If the number of persons missed were large, however, the market might not be able to provide coupons at a moderate price for all who desired them. Since the coupon market would not be fully established, market modalities would be unfamiliar to large numbers of people. The general atmosphere would be one of extreme uncertainty. Thus the initiation of the coupon market would likely be unstable. An influx of several million purchasers might precipitate panic buying of coupons, which would defeat the purpose of rationing.

An often-cited problem with the plan to distribute coupons to owners of registered vehicles is that it would encourage people to buy and register junk cars for their coupon value. Simply disallowing new registries would be counterproductive as it would further restrict whatever demand remained for the automobile manufacturing industry. Permitting case-by-case settlements on the basis of historical usage, as DOE has proposed, would be an administrative nightmare of countless hearings and appeals.

An additional issue is the imposition of wellhead price controls. The Administration plan, as announced last year, did not actually include, but only assumed, price controls. In the absence of wellhead and product price controls, coupon rationing would not keep oil companies from raising gasoline and other product prices sufficiently to capture any windfall. Coupon prices would then drop as product prices rose. Without price controls, therefore, rationing would lead to a situation similar to the neutral policy of allowing the market to allocate and price oil.

Similarly, without refinery mix and allocation controls, the amount of fuel in each state would not necessarily match the needs. A rationing plan would be premised on faith in its coupons. If supplies and demand in any given state did not match, lines would begin to grow, and this could defeat one of the purposes of the rationing plan: ensuring an orderly petroleum market. The government might, therefore, need to adjust the level of product stocks and mix to ensure that such shortages do not occur.

The President's budget proposals for fiscal year 1982 include elimination of the office responsible for the preplanning necessary for the institution of coupon rationing. Abolition of this office would, in effect, mean

that coupon rationing would be eliminated as a policy option. The pre-planning is intended to reduce to one quarter the leadtime needed to institute coupon rationing. Without such advanced preparation, a much longer period would be needed. Indeed, a major crisis could come and go without a rationing plan being available. If the planning office was eliminated and a major crisis did occur, the Administration might find itself subject to myriad demands for action and relief without any tools at its disposal. Any actions it took in response to this political pressure would, of necessity, be ad hoc. Given past experience with ad hoc efforts, it is unlikely these would work smoothly.

CHAPTER V. POLICY TRADEOFFS AND IMPLEMENTATION

The macroeconomic tradeoffs among the options discussed in Chapter IV are fairly clear: some policies are less inflationary but sustain higher output loss, while other policies reduce output loss but are more inflationary. Tradeoffs also exist between macroeconomic considerations and the other goals of disruption policies: some policies are more equitable but less flexible, while other flexible policies are less equitable. Given these tradeoffs, there is no single best policy. The policy of choice will depend on the nature (for instance, size, expected duration, cause, and resolution) of the disruption. This chapter makes explicit the tradeoffs between the different policies and the situations in which they could be implemented with greatest advantage.

POLICY TRADEOFFS

Macroeconomic Tradeoffs

A tradeoff between inflation and GNP loss is possible. Since GNP loss causes unemployment, the tradeoff will also be between unemployment and inflation. In essence, the policies must accommodate a real loss to the economy. The tradeoff is among ways to take it. At lower levels of disruption, if real income is valued more highly than low inflation, then the multilateral tariff or a crude oil refining fee would be the preferred alternative. If other International Energy Agency (IEA) members did not cooperate, the options available would be a unilateral tariff, a refining fee, or a gasoline tax. If lower inflation is more valued, even at the cost of lower income, then a neutral policy would be the appropriate policy.

At 2.5 million barrels per day shortfall, if income losses are more important than inflation, the multilateral tariff would rate best, followed by a refining fee. If combating inflation is the central policy goal, then a neutral policy would be the appropriate course of action. (Since coupon rationing has not been simulated, including it in a discussion of macroeconomic tradeoffs is impossible.)

Tradeoffs Among Other Criteria

Macroeconomic considerations are not the only criteria to use in evaluating policy. Promotion of social cohesion and administrative ease

were previously singled out as being important, independent of their effects on macroeconomic variables.

At lower levels of disruption, both the crude oil refining fee and gasoline tax would produce similar GNP losses. Since the crude oil fee would not distort market allocation, it would be the policy of choice if only economic criteria were considered. A gasoline tax might serve to ease uncertainty in the transportation sector, however. Thus, policymakers might consider balancing some loss of economic efficiency against alleviating consumer fears of shortages. Similarly, there are tradeoffs between the flexibility of unilateral actions and the additional capture of the shortage premium that multilateral tariffs might bring.

In cases of larger disruptions, the social cohesion and perception of equitable distribution of the burden, which is the main benefit of coupon rationing, would be a tradeoff against the administrative difficulty such a plan would present. The rationing plan would have to be well-executed, however, in order to maintain intact its perceptions of equity.

POSSIBLE SCENARIOS FOR POLICY IMPLEMENTATION

The policy analyses of the previous chapter suggest that different policies might have a comparative advantage, depending on the characteristics of the shortfall. The most important of these characteristics are whether the curtailment and subsequent price rise are permanent or transitory and whether consuming nations coordinate activities or not. This section analyzes the implications of various policies when these characteristics are considered.

Temporary Interruptions

In the event of a small disruption (less than 1.0 million barrels per day), the ease and efficiency of a neutral policy would give it a natural advantage. As the size of the shortfall increases, however, and oil price drag might become more severe, some federal action might be required. In small to intermediate sized, but temporary, shortfalls, a gasoline tax might have a comparative advantage. At low levels of shortfall, the refunds would be manageable and need not involve complex tax changes that would be required at higher levels. Even if the shortfall was large enough to require a coupon rationing program, a gasoline tax might serve as a buffer during the period after the shortfall, but before the rationing program could take effect.

Of course, if U.S. policy for reduction of demand was coordinated with IEA efforts, the benefits of these programs would increase as some of the additional income flow to producer nations was reduced. The coordination with IEA members would not have to be accomplished only through a tariff. The gasoline tax or crude oil refining fee might also be imposed multilaterally to increase the benefits of both.

Somewhere above a shortfall of 2 million barrels per day, a shift to gasoline coupon rationing might be considered. Taxes would no longer remove much demand and the amount of money collected by the tax would become a significant fraction of total tax revenues, making rebates cumbersome. Although coupon rationing would also be cumbersome, it would have the advantage, at these larger levels of disruption, of limiting demand to the quantities available while minimizing GNP loss. Like the gasoline tax at lower levels, the coupon rationing plan would be most effective if implemented in conjunction with other nations' efforts to reduce demand. It should be noted, however, that in the event of a very large shortfall, the gasoline market might not be able to absorb the entire shortfall.

Permanent Declines in Petroleum Production

If the curtailment appeared to be permanent, or so long lasting as to result in long-term changes in the market, the principal purpose of policy would be to help the economy adjust to lower levels of oil consumption and higher prices. At low levels of disruption, neutral policy might provide as adequate an option as any. As the disruption increased, the shock would cause more disruption and oil price drag might be a problem. While with the temporary shortfall there would be an end to the income transfers, with a permanent oil loss, debilitating income transfers and low GNP growth might continue for several years if the consuming nations could not agree on a strategy to reduce demand. Policies to manage the long-run problems caused by oil imports are beyond the scope of this report, however. One such policy--a tariff on imported oil--is discussed in Appendix A.



APPENDIXES

APPENDIX A. LONG-RUN POLICIES TO REDUCE OIL IMPORTS

In the long run, reducing oil imports and diversifying energy sources are the principal ways to reduce U.S. vulnerability to oil disruptions. Of course, a completed Strategic Petroleum Reserve would also help. Today, oil imports are clearly above the level that correctly balances the economic use of resources with economic vulnerability. Given the limitations on increased domestic oil production, long-term policies to reduce oil imports should encourage conservation and substitution of other energy sources, such as natural gas, coal, and renewable resources.

A previous CBO report spelled out the risks to the United States of dependence on imported oil. ^{1/} These are future macroeconomic losses as oil prices rise, the possibility of future disruptions in the supply of foreign oil, deterioration in the balance of payments, and constraints on relations with other nations. These risks pose costs that are borne by all U.S. citizens.

To reduce these risks, a number of analysts have suggested the imposition of a long-term oil import tariff, levied to represent the costs of the risks. Since perfect calculation of the risks requires the unobtainable knowledge of future events, setting the precise value of the tariff is impossible. Estimates range between \$10 to \$30 per barrel.

There are other ways to reduce imports. Some of them, like decontrol of domestic oil prices, have already been implemented. Others, such as utility rate reform to encourage the use of coal by utilities or natural gas deregulation, are available. This appendix, however, focuses on various tariff proposals and their relationship to these other policies.

ECONOMIC EFFECTS OF AN OIL IMPORT TARIFF

Economic Benefits

By raising the price of oil in the United States, an oil import tariff on crude oil and refined products would encourage both conservation (for example, through the purchase of more fuel-efficient cars or by driving less) and substitution of other energy sources (for instance, coal conversions of

^{1/} The Congressional Budget Office, The World Oil Market in the 1980s: Implications for the United States (May 1980).

industrial boilers). While the demand response to higher oil prices is limited in the short run, the opportunities for conservation and substitution, as the capital stock is replaced, would increase significantly over time.

By decreasing U.S. and, therefore, worldwide demand, the tariff might succeed in lessening some future increases in oil prices. In turn, the inflationary drag of higher oil prices on economic growth would be lower. In addition, some of the revenues that would normally go to foreign oil producers through higher oil prices would be recouped by the tariff and could be used to stimulate the economy. Through reducing U.S. oil imports, a tariff might also lessen somewhat the risks of deterioration in the balance of payments, U.S. vulnerability to oil supply disruptions, and constraints on U.S. foreign policy.

Economic Costs

Because it would raise the price of oil, an import tariff would impose some major costs on the U.S. economy. Aggregate output would decrease, and some economic sectors would be severely affected, notably the automobile and steel industries. Furthermore, a tariff would create shifts in income between producers and consumers and among consumers, and ultimately might not improve the U.S. balance of trade. Some of these costs could be ameliorated through additional policies, but some might have to be accepted in order to obtain the benefits of reduced imports.

Output and Aggregate Income. The higher oil prices induced by a tariff would result in increased unemployment in the short run and lower economic output in the longer term by reducing the amount of goods and services that could be produced profitably. In the shorter run, higher oil prices would also transfer income from the users of oil to oil producers or to the government (through windfall profits tax and tariff receipts), who might not quickly respond this income to purchase goods and services or reduce taxes. Consequently, demand would fall, further reducing income and employment. Furthermore, higher oil prices would increase the demand for money to pay for the oil, and, unless the Federal Reserve allowed the money supply to accommodate this demand, tighter credit and higher interest rates would ensue, restraining both consumption and investment. Oil price increases would also tend to reinforce the inflationary spiral, as people attempted, with varying success, to shift the loss of real income to others. Fiscal and monetary policies could not deal with this increased inflationary pressure without exacerbating the short-run problems described above. Thus, higher energy prices would tend to entrench stagflation in the economy.

Effects on Specific Sectors. The dampening effects of an oil import tariff on economic growth would not be distributed evenly across all sectors of the economy. Higher gasoline prices, for example, would affect automobile sales especially. Although the U.S. automobile industry is shifting to production of smaller, more fuel-efficient cars, its capacity to produce smaller engines and auto bodies will be limited in the next several years. Thus, imposing an oil import tariff in the near future would reduce domestic auto sales as consumers bought more fuel-efficient foreign vehicles. In addition, the reduced income and higher interest rates induced by a tariff would cut into auto sales. Thus, the effects of a tariff on the automobile industry would be sizable.

Other industries would be affected as well. Energy comprises 15 to 20 percent of the final costs of steel production, and the higher energy costs caused by an oil import tariff might be more than the steel industry could pass on to consumers, thus squeezing profits and, presumably, investment in that industry. Other energy-intensive industries that could be similarly affected include paper, chemicals, refining and cement.

The petrochemical industry, which relies heavily on oil as a feedstock for production of its final product, is particularly vulnerable to higher oil prices. In recent years, U.S. petrochemicals have been exported successfully, to a large extent because of the subsidy afforded this industry by domestic oil and gas price controls. By adding to the cost of petrochemical feedstocks, an oil import tariff might reduce, or even destroy, the competitiveness of U.S. petrochemicals in international trade, particularly since oil price decontrol is completed and if natural gas deregulation takes place. If an oil import tariff is implemented, policymakers would have to consider whether or not to allow some exclusion for the oil used by the petrochemical industry.

The sizable effects of an oil import tariff on specific industries suggest that such a tariff might best be phased in in accordance with these industries' abilities to accommodate its effects. By announcing its intention to raise oil prices over time in a series of steps, the government could create an expectation of higher prices that would induce these industries to begin an adjustment in their products and processes before the higher prices were implemented. This would also mitigate many of the adjustment effects across the economy.

Income Distribution. The imposition of an oil import tariff would lead to several significant income transfers. First, presuming a \$20 tariff level, the federal government would collect approximately \$45 billion per year at current import levels. These receipts could be rebated to households through adjustments in income tax withholding and transfer payments,

although it would be difficult to devise a rebate system to reach every household. Second, since the imposition of an oil import tariff would raise the price of domestically produced oil and oil substitutes, such as some natural gas and coal, domestic energy producers would receive higher revenues. Unless all domestic energy products were additionally taxed or their prices controlled, an income transfer larger than \$50 billion per year would result. It should be noted, however, that the windfall profits and corporate income taxes would collect the bulk of the extra revenues realized by domestic oil producers for potential recycling to consumers. A far smaller portion of the windfall realized by natural gas and coal producers would be recycled through current taxes.

Balance of Trade. An oil import tariff would have mixed effects on the U.S. balance of trade. Certainly, the imposition of a tariff would reduce the outflow of dollars in payment for oil, and would therefore strengthen the dollar. But an import tariff could have a negative effect on U.S. exports. By subjecting U.S. industries to higher energy costs than their foreign competitors, a tariff might reduce their competitiveness in world markets. Although a tax credit could be devised to offset increased energy costs for firms producing exports, it would be extremely difficult to administer equitably and efficiently. Given the uncertainty surrounding the effect of higher energy prices on the competitive position of U.S. exports, it is unclear whether an oil import tariff would significantly improve the U.S. balance of trade.

Factors Affecting the Relative Costs and Benefits of Oil Import Tariffs

As the above discussion has indicated, an oil import tariff would allow the United States to reduce oil imports, but only by imposing economic costs. But no long-term reduction in U.S. oil imports can be achieved without paying some price. The size of the cost, however, might be affected by several factors, among them the efficiency with which the economy responds to an oil import tariff, the reaction of producing nations, and whether or not the tariff is multilaterally imposed.

Economic Responsiveness. The same inefficiencies impede the responsiveness of the economy to higher energy prices whether they result from an oil import tariff or other causes. These inefficiencies include reduced investment because of high interest rates generated by inflation, an inappropriate level of conservation measures caused by the relatively rapid turnover in residences and commercial structures, and regulatory biases that induce uneconomic fuel use. Inasmuch as these imperfections were corrected, the responsiveness to any oil price increase would improve, and the relative advantages of an oil import tariff would be substantially increased.

Producer Response. To the extent that world oil prices would fall in response to reduced U.S. imports caused by an oil import tariff, the benefits of a tariff would increase. Should foreign producers curtail output sufficiently to maintain the world market price of oil, then the entire tariff would be borne by U.S. consumers, and prices would increase by an amount equal to the tariff. If, however, producing nations were unwilling to cut back output that much, a market glut could result, and producer prices would fall somewhat. Rather than an actual price decline, the slackened market might be reflected in a reduced rate of price increases. Reducing the world price through the tariff would redistribute income significantly from foreign producers to domestic consumers, since the dollar outflow for oil would be reduced, and government tariff receipts could be recycled into the economy. Thus, the relative benefits of an import tariff would increase to the extent that foreign producers moderated any production cutbacks.

A Multilateral Tariff. The U.S. benefits of a tariff would also be increased if it were imposed multilaterally by the major consuming nations. Joint imposition would increase the tariff's downward pressure on world oil prices by creating a larger world surplus. In addition, a multilateral tariff could eliminate the competitive disadvantage of U.S. exports created by a unilateral tax.

EFFECTIVENESS OF OIL IMPORT TARIFFS RELATIVE TO OTHER OIL IMPORT POLICIES

An import tariff might be most appropriate after implementation of all conservation and substitution policies that are economic at the current world oil price. This is a reflection of the fact that these policies carry a lower resource cost than those necessitating higher oil prices.

Although natural gas prices are being raised gradually to oil-equivalent prices under the Natural Gas Policy Act, controls still provide a subsidy to consumers. Accelerating the movement toward gas decontrol might, therefore, be preferable to higher oil prices. Similarly, eliminating the current regulatory bias against new coal-fired capacity in electric utilities could reduce oil imports by up to 500,000 barrels per day within a few years without major economic costs. This policy would be preferable to oil import tariffs in overall effectiveness, although joint implementation would result in greater import reduction than would be obtained from either option alone.

Although there are other tax options, such as taxing gasoline or all transportation fuel, these appear to be less preferable than oil import fees on both efficiency and administrative grounds. Directing the entire burden

to gasoline would preempt any other reductions in the use of oil. By decreasing the efficiency with which higher oil prices force conservation and substitution of other fuels, a gasoline tax would result in a more difficult economic adjustment to higher oil prices than is necessary.

It should also be noted that the imposition of an oil import tariff might accelerate the production of unconventional sources of energy. Synthetic liquid fuels and renewable resources are particularly promising in this regard. By raising the price that consumers pay for energy, an oil import tariff would make both of these types of energy more competitive. By allowing the higher price created by the tariff to accrue to producers of synthetic fuels, an oil import tariff could act like a price guarantee for such energy production. If a tariff raised the price of energy to the point at which synthetic liquid energy became competitive, the tariff should be viewed as an effective substitute for many of the financial subsidies now being considered for the synthetic fuels industry.

APPENDIX B. ALLOCATION OF CRUDE OIL AMONG REFINERS
DURING OIL DISRUPTIONS

The main body of this paper analyzed three alternative approaches that the Congress might consider in preparing the nation for a future disruption in supplies of imported oil:

- o A neutral policy based largely on authorities that would remain after the expiration of the Emergency Petroleum Allocation Act (EPAA) and that would rely on market allocation of crude oil and products;
- o A tax-based policy that would attempt to retain and recycle the income that would otherwise flow to foreign and domestic oil producers; and
- o A rationing policy derived from the position originally taken in EPAA.

If the third of these approaches was adopted, the Congress would need to consider standby authority for the allocation of crude oil among domestic refiners in the event of an oil disruption. This is because the wellhead price controls on domestic crude oil inherent in rationing implies that some refiners would have access to price-controlled domestic oil, while others would be forced to buy imported oil at the world price. In the absence of a program to allocate the benefits of lower-priced domestic crude among refiners, some would reap large profits, while others would experience large losses.

Even without wellhead price controls associated with the rationing option, some refiners, and perhaps their customers, might be at a disadvantage during an oil disruption. Thus, the issue of allocating crude oil among refiners is present in all three approaches.

The federal government has had the authority to allocate crude oil since 1973, under the EPAA which expires September 30, 1981. After this date, the President has the authority, under Section 251 of the Energy Policy and Conservation Act (EPCA), to allocate crude oil only to implement the obligations of the United States under agreements with the International Energy Agency (IEA). According to these agreements, a

shortfall in any member nation exceeding 7 percent of historical consumption would trigger the international allocation program.

The issue before the Congress is whether standby authority to allocate crude oil beyond that granted by EPCA ought to be provided to the President. This appendix considers the issue in view of four goals for an effective allocation program:

- o Increase U.S. preparedness prior to a disruption;
- o Produce and distribute efficiently the right mix of products;
- o Keep refiners out of the spot market to minimize panic buying during disruptions; and
- o Distribute the burden of a disruption equitably.

The next four sections of the paper compare the ability of two policy alternatives to satisfy these goals: a crude oil allocation program and market allocation of crude oil. The final section discusses a series of decisions relating to the establishment of an allocation program and the Congressional debate over the extension of the EPAA.

INCREASE PREPAREDNESS FOR A DISRUPTION

There are two key factors that influence U.S. preparedness for oil import disruptions: the level of oil stockpiles and the degree of diversification of sources of supply. Expectations regarding the way in which crude oil would be allocated during a disruption would affect both of these factors.

The Importance of Stockpiles and Diversification for Preparedness

Petroleum stockpiles are probably the most effective means to reduce the adverse effects of an oil supply disruption. Previous CBO work has indicated that each barrel of Strategic Petroleum Reserve (SPR) oil could avert about \$200 of potential GNP loss in the event of a year-long supply interruption in 1984. ^{1/} The current SPR stockpile of about 180 million

^{1/} See Congressional Budget Office, An Evaluation of the Strategic Petroleum Reserve (June 1980) and Financing Options for the Strategic Petroleum Reserve (April 1981).

barrels is only 18 percent of the 1 billion barrel reserve authorized by the Congress. While the SPR is being filled, private stockpiles play an essential role in providing some interim protection against the adverse effects of an oil supply disruption. Once the SPR is in place, they still might have use as a complement to the government reserve. Thus, any effect that a mandatory crude oil sharing program would have on incentives for private stockpiling could be very important.

Diversification of oil supply sources could also affect preparedness. The security of U.S. imported oil supplies would be enhanced to the extent that the nation began to import more from countries currently exporting little oil to the United States while importing less oil from present major suppliers. 2/

The Importance of Expectations

Government allocation of crude oil would create two categories of refiners: those who would be required to sell to other refiners, and those who would buy from other refiners. Of concern is how the imposition of crude oil allocation would affect the behavior of these two classes of refiners prior to the disruption. Since the focus is on behavior prior to the disruption, the refiner's expectation of his category--either buyer or seller--is the important consideration.

The refiner's expectation could be formed in a number of ways. If the sharing rule for allocation was not determined prior to the disruption, then past allocation rules or other evidence might influence his expectations. Alternatively, the sharing rule might specify who would be a buyer or seller. For example, a rule could define buyers and sellers using such criteria as size and storage capacities, sources of foreign and domestic oil, or whether the refinery was part of an integrated operation. For example, during some parts of the buy-sell program that existed under petroleum price controls from 1974 to 1981, buyers had to be small or independent refiners whereas sellers were limited to the 15 largest refiners.

Any business will, of course, attempt to avoid and insure against "stockouts," or shortages of raw materials. This is especially true in an industry like refining, which has high fixed costs that continue whether or

2/ For more detail about the prospects of developing new sources, see Congressional Budget Office, The World Oil Market in the 1980s: Implications for the United States (May 1980).

not the refinery is operating. In fact, a number of institutional features of the oil industry, such as crude stockpiles, vertical integration, multiple sources of supply, and a mix of short- and long-term oil supply contracts, can be explained as insurance activities that attempt to exercise some control over the availability of crude oil. ^{3/}

Refiners Who Expect to Receive Crude. Government allocation would constitute a substitute form of insurance for firms against the competitive disadvantage arising from a disruption-induced shortage of crude. Thus refiners who expect to receive crude oil under a government allocation program during disruptions would have less incentive to diversify their sources of supply and stockpile oil than if no allocation occurred.

Refiners Who Expect to Give Crude. The effect of government allocation on the diversification and stockpiling activities of refiners who expect to give crude would depend on the nature of the allocation program. In general, allocation rules in which the amount supplied is constant in all circumstances might increase incentives for diversification and stockpiling by firms giving oil. One example of such a procedure would be to assign each major refiner a predetermined amount of oil as a standby obligation to other refiners under an emergency allocation program. Faced with such an allocation procedure, a major refiner might secure more oil in advance. This positive incentive could occur because once major refiners have stockpiled their standby obligations, they would retain the benefits from every additional barrel of inventories.

On the other hand, diversification and stockpiling activities of firms giving up oil might be decreased by allocation rules in which the amount supplied depended on the extent of diversification and stockpiling. For example, if refiners giving oil would have to give up any oil beyond the amount they held in a base period, if refiners had to share some portion of each barrel in inventory, or if allocation would equalize the capacity utilization rates of all refiners, then incentives to stockpile or diversify after the base period would be considerably reduced, since some of the additional oil obtained might have to be sold to other refiners during a disruption.

^{3/} A vertically integrated oil company controls several, if not all, stages of oil production, refining, and selling. Such a firm contrasts with an independent refiner who has to contract for crude and arrange for sales to retailers. For a more detailed discussion of vertical integration, see David J. Teece, Vertical Integration and Vertical Divergence in the U.S. Oil Industry, Institute for Energy Studies, Stanford University (1976).

It is, therefore, theoretically possible to design allocation rules that would increase the diversification and stockpiling activities of firms giving oil, provided that recipients and donors are defined in advance. Furthermore, these rules could be designed so that the increased activities of these firms would more than outweigh any reduced diversification and stockpiling activities of firms receiving oil.

In practice, however, these rules would be very difficult to implement. What would the government do about refiners who had been designated to give up oil if their crude supplies had been reduced or cut off? As it became apparent over time that the sellers list was out-of-date, what would the government do with the predesignated selling refiners who no longer had the best access to crude oil? If refiners believed that the government would amend its allocation procedures in these or other circumstances, the incentive to diversify or add to inventories might be blunted. Faced with an uncertain allocation rule, all refiners might reduce their inventories in order to reduce their potential sharing obligations.

Finally, rules with preassigned sharing obligations based on the size of the refinery would encourage the construction of smaller refineries or would reduce competition. To avoid this bias toward constructing smaller refineries, an exemption could be established denying new small refiners the right to buy. While such a rule would not encourage the construction of new small refineries, it would tend to be anticompetitive in that benefits would be conferred on existing firms that would not be available to new entrants.

PRODUCE AND DISTRIBUTE PRODUCTS EFFICIENTLY

During an oil emergency, the most useful product mix of refineries might differ from that of normal periods. There would be uncertainty about which uses of petroleum products would be reduced more than others through the availability of substitutes (such as coal or natural gas for residual fuel oil), government regulation (for example, mandatory Sunday closing of gasoline stations), or other factors. Although the precise changes in the required product slate of refiners would be difficult to predict, the desired product mix might be substantially different from normal output, both nationally and regionally.

At the other end of the refining process, the mix of crude input would probably be altered also, since a disruption would likely be centered in a nation or region with disproportionate production of one type of crude. Thus, oil supply disruptions would change the physical characteristics, such as the weight and sulfur content, of crude oil used in refining.

Matching these different crude inputs and products slates would greatly complicate the task of an allocation program. It would not be enough merely to attempt simply to prorate available supplies based on the market allocation of some prior period. Because of the changes in input/output mix, adjustments among refiners would have to match the resulting crude supplies and the demand for products. But even such a rebalancing of crude inputs and outputs probably would not be efficient since it might be cheaper to shut down some refineries entirely rather than to operate all plants at a reduced rate of capacity utilization. This preference has been observed recently in refinery closings by major multi-plant refiners. A recent National Petroleum Council report states that in a major crude oil curtailment ". . . extended shut-down of unutilized capacity may be more practical, economical, and energy efficient than attempting to operate all units at reduced throughputs." ^{4/}

If a government allocation program is to replace a market system effectively, it must have access to a great deal of current information about crude oil supply, the processing capabilities of refineries, and demand for products. The timely acquisition of such information is likely to be a significant administrative barrier. The history of government allocation of petroleum in recent years suggests that, in the absence of these data, government allocation would probably exacerbate problems during a disruption. For example, areas with larger discretionary demand had sufficient gasoline during previous disruptions, while long lines occurred in other places. To be sure, these effects were often the result of price and allocation controls on refined products, rather than allocation of crude oil among refiners. Nevertheless, the administrative difficulties they suggest could also apply to government allocation of crude oil. This implies that government allocation might not improve circumstances for consumers and could easily create the very situation it seeks to avoid: a physical shortage of petroleum products.

KEEP REFINERS FROM BUYING ON THE SPOT MARKET

It is commonly suggested that government allocation of crude oil would keep crude-deficient refiners from buying on the spot market. With lower demand for spot oil, spot prices would fall. Since spot prices often serve as price indicators to the Organization of Petroleum Exporting

^{4/} National Petroleum Council, Emergency Preparedness for Interruption of Petroleum Imports into the United States (April 1981), p. 23.

Countries (OPEC), it is further asserted that keeping some refiners out of the spot market would not only lower spot prices, but future contract prices as well. This argument vastly oversimplifies the effect of government allocation, however.

Government crude oil allocation would have uncertain effects on spot purchases during a disruption. If the government allocation program reduced the size of the desired stockpile before the disruption, it would also reduce the size of the desired stockpile during a disruption. From these suppositions alone, however, it is difficult to infer anything about the effect of government allocation on spot purchases. Spot purchases reflect, among other things, changes in the level of stockpiles, not the size of the stockpile at any one time. A government allocation program that reduced the size of stockpiles before and during the disruption might not affect the change in the level of the stockpile resulting from the disruption and hence might not increase the level of spot purchases during a disruption.

DISTRIBUTE THE BURDEN OF THE DISRUPTION EQUITABLY

The effect of an allocation program would depend on how the initial allocation of crude oil was translated into a distribution of products to consumers. If shortages of crude oil to particular refiners translated into shortages to the ultimate consumers of these refineries' products, then particular regions of the country or particular users of petroleum products might be disproportionately affected.

One view of this process is that the initial allocation of crude oil determines the allocation of product. For example, if consumers relied on a refiner whose output would be eliminated or curtailed because of lack of crude, then those consumers would bear the brunt of the shortfall. According to this view, refiners with crude would supply only their traditional customers in order to maintain goodwill and fulfill contracts, leaving customers of crude-deficient refiners without access to petroleum products. Indeed, the Uniform Commercial Code "requires a seller to fulfill contractual commitments to existing customers before seeking new business or taking on new customers that may have been served by other sellers. In a severe supply disruption, even those refiners whose crude oil access has not been significantly affected may have only sufficient supplies to meet contractual commitments to their existing customers." 5/

5/ National Petroleum Council, Emergency Preparedness, p. 31.

The opposing view is that the market would allocate resources relatively efficiently, and that existing business relationships and the requirements of contract law would not impede this allocation process. Although the cost of some transactions might prevent a perfect allocation process, the limited supply of products would generally flow to the most highly valued users. The principal concern with this view is whether the time required to establish new, market-based patterns of distribution would be sufficient to cause undue hardship for some oil users.

These two views represent different conceptions about the effect of formal and informal rights to receive oil, as embodied in contracts and existing business relationships, on the ultimate distribution of product. The latter view might be more correct because it recognizes that these rights could be traded effectively in a number of ways. For example, refiners and their existing customers could renegotiate their existing contracts so as to reduce the delivery of product. Or, large customers might continue to receive the historical amount of product, but to resell the product to those without it. In either event, the customer could maximize his profit by reducing the volume of product consumed or stockpiled, thus freeing up product for customers historically served by crude-short refiners.

With regard to oil users, a market system would be the least costly way to reallocate crude oil during a disruption. If special assistance to certain customers was desired, then direct government subsidies or product set-asides for these purchases could be employed. Some customers or regions might suffer hardship during the time required for a workable market to become established, however. This hardship might befall these customers even with a government allocation system, if the government system was not established quickly. It would require a great deal of preplanning and continual, close monitoring of the flow of crude oil through the economy for a government program to be superior in this respect.

With regard to refiners, government allocation would benefit small and independent refiners, who generally would experience cutoffs during supply disruptions. If price controls were applied to domestic crude, those refiners without access to controlled oil would be at a further disadvantage. Mandatory allocation would mitigate these problems by spreading the burden among all refiners.

SUMMARY OF ANALYSIS

The preceding analysis suggests that government allocation of crude oil might be a relative weak tool to offset the adverse effects of an oil

disruption. A summary of the analysis with respect to the four evaluation criteria follows:

- o Preparedness for Disruption. Some allocation plans would increase preparedness while others would decrease it. Allocation plans, which could potentially increase preparedness, would do so only if they were credible and realistic.
- o Produce and Distribute Products Efficiently. Allocation tends to reduce the efficiency of both the production and distribution of crude oil products.
- o Keep Refiners Out of the Spot Market. Although allocation might affect the level of stockpiles before and during a disruption, the net effect on spot purchases is difficult to determine.
- o Distribute the Burden Fairly. There is little apparent distinction in terms of effect on oil users between government allocation and market allocation of crude oil. Market allocation would concentrate the burden on particular refiners while government allocation would spread the burden among refiners. The time required to establish a workable market or government allocation program might cause temporary hardship in some areas.

POLICY CONSIDERATIONS IN DESIGNING AN ALLOCATION PROGRAM

If there was a standby crude oil allocation program, its design would require a series of decisions about the specific features of such a program. These specific features, which would largely determine the success or failure of such programs, include:

- o Physical allocation of crude versus an entitlement to purchase oil;
- o Price of allocated oil;
- o Sharing rule;
- o Size of disruption required to trigger allocation programs; and
- o Certainty of allocation.

Physical Allocation of Oil versus Entitlements

The effect of oil allocation during disruptions would depend critically on whether crude oil was physically allocated and transported or whether only the "right" to buy oil was allocated. Under the EPCA oil price control program, the entitlements program allocated rights to buy oil, and differences between these rights and the oil actually delivered were resolved by payments among refiners. Similarly, the National Petroleum Council proposal for an allocation program involves marketable rights to buy oil as long as sellers of rights can continue to supply their customers.^{6/} Allocation of rights would appear to be superior to plans that involve the physical allocation of oil. Allocation of rights would provide equity among refiners as would all allocation plans, but it would not reduce the ability of refiners to produce and distribute products as long as transactions regarding sale of rights could be made easily. The major disadvantage of allocation of rights would be that the incentives for preparedness would be identical to physical allocation plans, and thus might be inferior in most instances to the incentives under market allocation.

Price of Allocated Oil

The price of allocated oil would affect the volumes of oil allocated and the incentives of refiners receiving and giving the oil. The effect on the volume would result simply because crude oil allocation would occur at the option of the receiving refiner. The more favorable the terms to the receiving refiner, the larger the allocation he would seek and the larger the incentive effects on the receiving refiner and the refiner giving the oil. Setting the price at marginal or replacement cost would allow the selling refiner to pass through the total cost of the oil to the buying refiner. This would tend to eliminate the incentives of the selling refiner to negotiate a low price when he purchases the oil originally.

Selling at marginal cost would also fail to assist the buying refiner, who presumably could purchase oil on the world market at the same price. Setting the price below the marginal cost of crude to the selling refiner, on the other hand, would result in a subsidy from the selling refiner to the buying refiner. Allocation at average costs, such as the average cost of all crude oil to the selling refiner, could result in a significant subsidy since the marginal cost (the cost of spot crude) would probably be much higher than the average cost during a disruption.

^{6/} National Petroleum Council, Emergency Preparedness.

Sharing Rule

Several types of sharing rules are available. In general, rules fall into two categories:

- o Those for which the name of each selling refiner and quantity obligated would be known prior to the disruption; and
- o Those for which the identity and sales obligation of sellers would not be known until the disruption, and might depend on these refiners' stockpiles, crude oil deliveries, size, or other variable and uncertain factors.

If preparedness were the major criterion, then allocation rules in which the refiner would have a fixed potential sharing obligation would be highly preferable to rules in which the allocated amount was based on crude oil stockpiles or deliveries or on capacity utilization. Similar considerations would apply to the rule specifying the amount that each eligible refiner could buy. To the extent that this amount was independent of the current deliveries and stockpiles of the buying refiner, incentives for proper diversification and stockpiling would be maintained.

Thus, it is not possible to generalize that government-mandated crude oil allocation would make the United States better or worse prepared for a supply disruption. Evaluated strictly in terms of preparation for a supply disruption, the sharing rules can be arrayed in descending level of preparedness:

- o Allocation rules with fixed standby selling obligations and purchasing opportunities (assuming they could be made credible);
- o Market allocation;
- o Sale of SPR oil to eligible refiners; and
- o Allocation rules in which obligations to sell or opportunities to buy would depend strongly on stockpiling, deliveries to refiners, or capacity utilization rates.

Other evaluation criteria, such as cost or fairness, might lead to a different ranking, however. Allocation rules that would encourage some refiners to stockpile and diversify sources of supply more than they would under other alternatives would increase the costs of those refiners. If the goal was to increase preparedness, increasing stockpiles of SPR oil might be a cheaper form of storage than would be available to refiners. Alternatively, the government could require refiners and importers to store oil as

an Industrial Petroleum Reserve (IPR). The Energy Policy and Conservation Act (EPCA) gives the Secretary of Energy the discretionary authority to require petroleum refiners and importers to store as an IPR up to 3 percent of the oil passing through their facilities. This authority expires June 30, 1985. 7/ The issue is whether the potential gain in preparedness resulting from a credible allocation procedure would be cost-effective and would result in an equitable distribution of costs, when compared to an option such as increased SPR storage or an IPR.

Size of Disruption

The size of the disruption is an important determinant of whether government should intervene in the market. Government intervention would involve administrative costs that would not vary greatly with the size of the disruption. Furthermore, market forces are often judged to be adequate to deal with minor changes but are considered less reliable for large disruptions. For both of the reasons, government intervention is often suggested for large disruptions whereas market forces are suggested for small disruptions. The discussion of tax, tariff, and rationing options in the body of the paper is one example of such an analysis.

Such an approach has also been suggested for government allocation of crude oil. For example, the National Petroleum Council recommended allocation for large disruptions and market allocation for small disruptions. The analysis in this appendix, however, does not support a distinction between the policies suitable for small and large disruptions. Market forces to allocate crude oil do not appear to "break down" as the disruption size increases.

Certainty of Allocation

If the nature of the allocation was uncertain, refiners would act according to what they expected government policy would be but would protect themselves against the uncertainty. Congressional action to lessen this uncertainty would be beneficial as long as the indicated policy did not produce worse incentives than the policy refiners would expect in the absence of Congressional action. Thus, if the Congress decided to grant the President standby authority to impose allocation of crude oil, specification of the nature of the permitted allocation program could yield significant benefits.

7/ For more detail, see Congressional Budget Office, Financing Options for the Strategic Petroleum Reserve.

