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Allocating Petroleum Products During Oil Supply Disruptions

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For the foreseeable future, the United States will be heavily dependent on imported oil. Political instability in several oil-exporting regions makes future disruptions possible and contingency plans must be made for such events (*1*). One consequence that must be planned for is that the demand for petroleum products at predisruption prices will exceed the available supply. Whether the market or the government allocates oil products, the United States will suffer severe costs from a significant curtailment of oil imports. In the event of a severe shortfall of long duration, government intervention of some sort may be required, and allocaton plans to moderate the effects of this shortfall must be evaluated. In this article we analyze four specific petroleum allocation options: (i) oil price and allocation controls, (ii) coupon gasoline rationing, (iii) a variable gasoline tax and rebate, and (iv) no oil price controls with partial rebates (*2, 3*).

Impacts of Oil Supply Disruptions

As in previous oil shortfalls, unless the government reimposes price controls on domestic crude oil, prices will rise with the world price, and this increase will be passed on to consumers in the form of higher prices for petroleum products. For large disruptions—an unprecedented 20 percent reduction in the U.S. supply of petroleum, for example—the size of such a price increase cannot be estimated precisely. However, based on reason-

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able assumptions, such a reduction in supply could lead to price increases of 100 to 300 percent (*4*).

Sharply higher oil prices would have important effects on the economy (*5*). In the short run, there would be a transfer of income from U.S. consumers to oil exporting nations and to domestic producers, which could reach $100 billion to $400 billion annually. Because foreign and domestic producers would not immediately spend their additional revenues on U.S. goods and services, total demand would drop sharply, causing a significant decline in real output. This "oil price drag" is much like an excise tax and could, in principle, be reduced with appropriate fiscal and monetary policies. However, the appropriate mix of macroeconomic policies is controversial, their implementation would be difficult and imprecise, and they would be unable to totally eliminate the demand-side macroeconomic effects.

Summary. Four options for allocating a long-term, severe shortfall of petroleum imports are analyzed: oil price and allocation controls, coupon gasoline rationing, variable gasoline tax and rebate, and no oil price controls with partial rebates. Each of these options is evaluated in terms of four criteria: microeconomic effects, macroeconomic effects, equity, and practical problems. The implications of this analysis for energy contingency planning are discussed.

The loss of oil would also reduce the production of goods and services directly. Producers would be forced to reduce their use of petroleum, resulting in lower output and higher prices. This supply-side effect is analogous to the effects on the economy due to a major crop failure. Any plan that simply allocates a shortfall of petroleum without increasing its availability could not offset the supply-side costs of an interruption, although efficient allocation could minimize them. Further, as workers seek to protect their real incomes, higher prices for petroleum products would be reflected in higher wage demands, setting off a wage-price spiral that would compound the initial inflationary effect of higher product prices. Outlays for programs indexed to the price level would rise automatically (*6*).

The first three options analyzed here attempt to limit the demand-side macroeconomic effects and income transfers due to the supply disruption by controlling domestic crude oil and petroleum product prices. But even if price controls operate perfectly, there would be a substantial amount of oil price drag because of higher payments for imported oil. This could only be offset by more stimulative federal fiscal and monetary policies, which would be inflationary. Price controls could help mitigate the demand-side problems caused by the supply disruption, but they would cause other problems. Since the price system would no longer allocate petroleum products, the government would have to do so. Because consumers would not face the full price increase under this option, gasoline lines would result. In effect, the cost of waiting in line added to the controlled price of gasoline would raise the real price of gasoline to the market-clearing level (the price at which demand equals supply). This would impose an enormous nonmonetary cost on society.

The fourth proposal analyzed relies on uncontrolled prices to allocate petroleum products. Some of the profits of domestic oil producers would be captured by the corporate income tax and the windfall profits tax; these revenues would be rebated to consumers. The remainder would be retained—and ultimately spent—by the oil companies and their stockholders.

Criteria for Comparison

There are many possible criteria for comparing petroleum allocation plans; we have chosen the following four.

1) Microeconomic effects. Each plan will affect relative prices, economic efficiency, domestic supply incentives, inventory behavior, and interindustry and interregional relationships.

2) Macroeconomic effects. Each plan will affect economic growth, inflation, and other important macroeconomic variables.

3) Equity. Which groups benefit and which lose? Are people in similar situations treated alike? Will the plan be perceived as fair across different income groups and regions of the country?

4) Practical problems. This includes all the indirect costs of implementing a plan. For example, regulations to prevent fraud and abuse may be required with an allocation plan that distributes gasoline coupons or cash. Another type of practical problem is constituency development: What propensity would a plan have to create a politically powerful constituency to get it enacted and favor its continuation?

The Workings of Each Plan

Price and allocation controls. This plan would reimpose the domestic oil price controls, entitlements program, and regulations that were in effect from 1973, when the Emergency Petroleum Allocation Act (EPAA) was passed, through January 1981 (*7*). Price ceilings would be imposed on domestic crude oil so that prices would not rise with world oil prices during a disruption. Since some refiners would have access to price-controlled domestic oil while others would be forced to buy world-priced imported oil, the government would reimpose the entitlements system, averaging the prices of domestic oil and imported oil, so that all U.S. refiners pay approximately the same price. Hence even under price controls, the average price of crude oil will rise. Controls on the price markups of downstream operators (crude oil resellers, refiners, wholesalers, and retailers) would also be required; otherwise, they would be able to raise prices to market-clearing levels and thus negate the effect of price controls.

We assume that during a disruption the petroleum market would not clear under domestic price controls. Allocation regulations would be required under which suppliers would be obligated to sell proportionately reduced volumes to their historical purchasers. Thus if a wholesaler were able to satisfy only 80 percent of his demand for residual fuel oil because of the oil shortage, he would reduce deliveries to all historical residual fuel oil customers by 20 percent. The government would designate priority users, who would receive a higher portion. For gasoline and diesel fuel, however, the allocation system stops short of retail purchasers; that is, end-users are not allocated specific quantities. Each gasoline station would receive reduced supplies of gasoline based on historical purchases, the demand for gasoline at the controlled price would be greater than the quantity supplied, and gasoline lines would result.

Further actions might be required if refiners produced less of a given petroleum product than deemed desirable. This could occur in the case of home-heating oil. The Department of Energy (DOE) would have to direct refiners, though refinery yield orders, to change their relative yield of products—for example, to produce less gasoline and more fuel oil.

Coupon gasoline rationing. This option would implement the standby gasoline rationing plan approved by Congress in 1980 and substitute coupon rationing for gasoline allocation controls, but would retain the other controls described above (*8–11*). It would limit price increases for gasoline, as would the first option, but would use ration coupons rather than queues to allocate gasoline. Coupons would be distributed on the basis of registered vehicle ownership, to firms on the basis of historical use, and to priority and hardship users (*8–11*). Since coupons could be sold, market forces would set the price.

Price controls would ensure that the price of gasoline does not rise to clear the market. Since the gasoline price controls do not set price ceilings, but instead control profit margins, price controls on domestic crude oil would be required to keep the average refiner acquisition costs of oil from rising as quickly as world oil prices. Without domestic price controls and margin controls on downstream operations, gasoline prices would rise to clear the market, causing ration coupons to decrease in value over time and eliminating the need for rationing. Without price and allocation controls on petroleum products other than gasoline, refiners could increase revenues by increasing the prices and production of these products. Ration checks would be exchanged for coupons at designated issuance points. A system of local boards would be established to administer state ration reserves, providing additional allotments to those who would otherwise experience severe hardships. Ration coupons would be required for the purchase of gasoline and would then be transferred from retailers up the distribution chain to refiners and finally back to DOE.

Gasoline tax and rebate. This plan (proposed by Senators J. Bennett Johnston and Charles Percy) consists of a system of emergency gasoline taxes and rebates structured to have effects similar to gasoline rationing with a free market in coupons. Price and allocation controls on gasoline would be prohibited, but they would be required on crude oil and petroleum products to keep refiners' oil costs from rising to world levels and to prevent downstream margins from rising. The level of the variable tax on gasoline would be set so that refiners could pass through increases in average crude oil prices. Thus as world oil prices and gasoline demand changed, the size of the tax would change. Tax revenues would be rebated to registered motor vehicle owners, just as coupons would be distributed under rationing.

A specific example illustrates the similarities between the two plans. Under the rationing plan, DOE would control the gasoline price at, say, $2 a gallon. A ration check for a set number of ration coupons, each good for 1 gallon, would be mailed to each vehicle registrant, with a limit of three registered vehicles per household. Assume that each car owner would get ten coupons a week. Persons requiring more than 10 gallons a week could purchase coupons from those needing less than 10. As a free market for ration coupons develops, the going price might settle at $3 a coupon under a 20 percent oil shortfall. Thus a gallon of gasoline could be purchased for $2 and a coupon worth $3. The market-clearing price of gasoline would be $5 a gallon.

Under the gasoline tax and rebate plan, the results would be similar. For a disruption of the same size, the market-clearing price would still be $5 a gallon. An emergency gasoline tax of $3 a gallon would add $3 a gallon to the oil distribution chain. The tax and rebate plan would therefore permit the oil distribution network the same profits as the coupon rationing plan. Instead of mailing ten coupons worth $3 each, the government would mail a check for $30 a week to each vehicle registrant, with a limit of three vehicles per household.

General rebate. Here the prices of all petroleum products would be allowed to rise during a supply disruption. Prices would determine how much of each product would be produced and how the products would be distributed, and domestic oil prices would be allowed to rise. The windfall profits tax would capture a large portion of the higher oil revenue, which would then be rebated. Rather than trying to avoid price increases by using price controls, this option accepts the price rises and attempts to offset the negative economic consequences with rebates. Whereas gasoline consumers would be most directly affected under the preceding two plans, all consumers would be affected under the general rebate plan, which would presumably distribute the rebates more broadly. The distribution mechanism could take many forms, such as adjustment in federal income tax rates and changes in withholding liabilities, changes in existing transfer payments, and reduction in the federal debt.

The recessionary effects of a disruption will reduce tax receipts in the nonenergy sectors of the economy. Reduced revenues, combined with increased unemployment and other transfer payments, will create budgetary demands that could be financed by the increased income from the windfall profits tax. Some portion of the rebate could also be used to assist firms by reducing corporate income taxes; businesses, particularly oil-intensive ones, would have to raise the prices of their products as oil prices rise. Because consumers would receive income supplements in the form of rebates, most businesses would be able to maintain their market. Some, however, would not. For example, California fruit growers who rely on truckers to transport their produce to East Coast markets would find their goods less competitive with fruits produced closer to the market.

Microeconomic Effects

Price and allocation controls. Under this plan prices would not rise to market-levels and queuing would result. However, the true price of gasoline, including the cost of waiting in line, would rise to market-clearing levels, and the "waiting cost" would reduce consumer welfare just as would a gasoline price increase. The difference is that without price controls a higher dollar price is paid to others in the domestic economy and does not involve a loss in well-being for the nation as a whole. An increase in the effective price of gasoline to consumers produced by queuing is a net loss to society, a loss that could be equivalent to hundreds of billions of dollars (*9, 12, 13*). Further, to the extent that government-determined allocations diverged from allocation to highest value uses, significant losses in efficiency would be incurred. An allocation rule based on historical use would not be able to keep up with changing patterns of demand or determine which customers could reduce consumption most efficiently. The experience with price and allocation controls during the oil shortages of 1979 is instructive; the historically based allocation of gasoline did not take into account the variation in gasoline consumption reduction across both regions and urban and rural areas. In addition, government officials would be required to decide the priorities of oil distribution, and interest groups would likely influence these decisions.

Inventory behavior would be directly affected by the allocation plan selected. To the extent that future profits from storing oil would be limited during a disruption by price controls, rationing, or taxes, less oil might be stored by the private market prior to the disruption. During a disruption, price controls would delay oil price increases; thus it would be in the storer's interest to hold stocks while the price increases. Without controls, however, the unconstrained price would increase rapidly. After reaching the market-clearing level, prices may stabilize, reducing the incentive to maintain high oil inventory levels.

Coupon gasoline rationing. Negotiable coupon rationing would eliminate gasoline lines and allocate gasoline supplies to the highest value uses. Nonetheless, this plan would introduce inefficiencies into the petroleum market. If the bulk of the shortfall were borne by gasoline, the plan would allocate other, underpriced refined petroleum products to those who would otherwise conserve (*14*). Very expensive conservation measures might be forced on gasoline consumers, while relatively inexpensive conservation efforts for other petroleum products would be forgone. For example, commuting by automobile might be made prohibitively expensive, especially for low-income or rural households, and industries that depend on automobile traffic would be severely affected. In contrast, if the shortfall were distributed across all petroleum products, all consumers would find more efficient ways of conserving petroleum products, eliminating the need for gasoline consumers to take extreme measures. The underlying system of price and allocation controls would be reimposed, resulting in the inefficiencies described earlier. Finally, no incentives to increase domestic production would be provided.

Gasoline tax and rebate. In two respects, this plan would be similar to gasoline rationing: (i) the losses incurred if the shortfall were borne primarily by gasoline would be the same, and (ii) the losses from reimposition of price controls would be the same. In both cases consumers do not face market-determined prices for gasoline, and incentives to increase domestic oil production are absent. However, because the tax and rebate plan would not require gasoline price controls, it could result in a more efficient allocation of gasoline supplies.

General rebate. The general rebate plan would minimize microefficiency losses. By encouraging conservation in the use of all refined products it would put the available supply of oil to its highest valued uses, and it would avoid socially divisive queues for gasoline.

Macroeconomic Effects

Price and allocation controls. Like the other options, this plan would not mitigate the supply-side macroeconomic costs of the oil shortfall. The higher effective price of oil would reduce real gross national product (GNP) and raise the general price level (*15*). The costs of queuing would be enormous, though not measured directly. For example, in the second quarter of 1979 real GNP fell 2.3 percent at an annual rate, and much of this decrease is attributed to the oil shortfall. On the demand side, however, oil price ceilings, if effective, would limit the transfer of funds to petroleum producers and the resulting oil price drag on nonpetroleum markets. Ceilings on oil product prices would also limit increases in the consumer price index (CPI).

Some of the costs of controls, such as gasoline lines, would represent a loss of general welfare, but might not reduce measured GNP. But GNP would tend to be lowered by controls because of the inability to allocate oil products to their most valued uses. The general uncertainty accompanying such nonprice allocation methods might also tend to inhibit resource movements and productivity growth (*16*).

Coupon gasoline rationing. This option would not alter the supply-side effects of an oil shortfall, but by controlling domestic oil prices it would tend to limit fiscal drag. In contrast to a gasoline tax and rebate plan, the ration coupons provide a second currency that may insulate other sectors of the economy from fiscal drag. In addition, if the coupon price were excluded from the CPI, the inflationary impact could be reduced. The microeconomic efficiency benefits over the price and allocation controls discussed above could result in less retardation of economic activity, since the rationing plan permits free-market trading of coupons and would allocate gasoline more efficiently than would direct allocations. As a result, the GNP would tend to be higher and the price level lower than would occur under price and allocation controls alone. On the other hand, if the shortfall were borne primarily by gasoline consumers, economic activity would be retarded, relative to the situation with no controls.

Gasoline tax and rebate. This plan cannot alter the supply-side effects of the oil shortfall. A tax-rebate system that includes price controls could limit oil price drag, provided the tax is rebated simultaneously. In the more likely event of uncertain and uneven rebate, the adverse impacts could be sizable. Further, the CPI would directly reflect the gasoline price increase, and this effect would be significant. For example, under the conservative assumption of a doubling of gasoline prices, the CPI would increase by more than 5 percent in the first month of the program (an 80 percent annualized rate). The increase in consumer prices would trigger increases in indexed wages and entitlement payments. More rapid wage inflation would increase production costs in the economy, and the inflationary impact would be prolonged by second- and third-round effects on wages and prices.

General rebate. This plan would not mitigate the supply-side costs of the shortfall, but, by allowing all supplies and demands to interact at market-clearing prices, decontrol would achieve a greater degree of economy-wide efficiency and a higher GNP than any of the alternative plans. Even if rebates were distributed immediately, some oil price drag would occur, and funds would flow from nonpetroleum to petroleum sectors. In addition, the rising oil prices would increase the CPI. However, the reduction in economic activity must be balanced against the efficiency gains—in terms of both resource allocation and administrative costs—of a decontrol system.

Equity

Price and allocation controls. Under price and allocation controls with queuing there is a transfer of income from those who value their time more than the average to those who value it less. This transfer of income may be monetized as the size of the queues increase, as persons with a high value of time may pay others with a low value of time to wait in line. Further, it is not clear that historical allocation is "fair," in that regions of the country that are growing more rapidly than others would probably feel they were being treated unfairly. Because of the shift in consumption patterns over time, allocation on a historical basis would become more and more unfair. For example, people may stay closer to home during a shortfall, and the pro rata allocation of gasoline to superhighway stations would oversupply them while undersupplying urban stations.

Coupon gasoline rationing. The fairness of this proposal obviously depends on the distribution of the coupons. If fairness means reestablishing an individual's predisruption purchasing power, a rationing plan should distribute the coupons according to the amount of gasoline consumed prior to the disruption. Alternatively, if it means providing equal assistance to all income groups, or more assistance to lower income groups, coupon distribution in proportion to automobile ownership may not be appropriate. In the extreme, coupon rationing could be used explicitly to distribute resources to lower income groups.

Gasoline tax and rebate. If the rebate were allocated in the same way as coupons, the distribution of income would be the same as under gasoline rationing. However, the distribution of money would make the implicit redistribution of income more evident to the public. Distributing coupons to vehicle owners may be perceived as fair, whereas the equivalent distribution of money may not.

General rebate. Uncontrolled prices would be perceived as inequitable. Money would be openly transferred from consumers to oil companies. The general rebate would only partially compensate for this transfer, although the size of the rebate could be increased by adding an emergency surcharge to the windfall profits tax. If the rebate is distributed to all citizens, some groups will argue that others are receiving too much. Thus, in terms of the distribution of income, the fairness of this program depends on the tax rate and the structure of the rebate mechanism.

Practical Problems

Price and allocation controls. A major practical problem with this plan is that the entire price control and allocation system would have to be reimposed. Each oil company would be required to submit detailed information to federal agencies and each refiner would have to report all crude oil purchases so that DOE could determine the net entitlement obligations for each refiner. Oil companies would be required to maintain records of all transactions to enable DOE to conduct audits, which would require a large federal work force. Initiating the program would take at least several months—possibly longer as actual experience under EPAA becomes more remote. Even if the program were kept intact in standby status, changing circumstances may make any control system obsolete (*17*).

Gasoline queues have proved to be socially divisive in relatively small petroleum shortfalls, but may be less divisive in a clear national emergency. Price and allocation controls without a system of end-use allocation would result in very long lines, which would, at the least, require increased security costs (*18*). Further, once in place, these controls would not be easily removed. The history of oil regulations might be a guide: the emergency controls program enacted in 1971 and 1973 did not end until 1981. In the future, as in the past, many consumers and oil companies would oppose removal of price and allocation controls (*19*).

Domestic price controls would allow oil-exporting nations to raise prices without the reduction in demand that would otherwise accompany such a price increase. Under price and allocation controls, the true price to the consumer is the sum of the controlled price and one of the following: the cost of waiting in line, the size of the tax, or the value of the coupon. Since the real price determines consumption, oil-exporting nations could increase the price, thus reducing the length of the lines, the size of the tax, or the value of the coupon, without affecting the quantity of oil consumed in the United States. Without controls, however, a price increase would raise the true cost of oil and result in a reduction in demand.

Coupon gasoline rationing. A major problem is that the oil price and allocation controls system would have to be reimposed. Moreover, the rationing system would, in effect, create a new currency and would entail the creation and operation of a massive system parallel to the monetary system to print, disperse, transfer, and, eventually, return coupons to the government (*20*). On the other hand, the price controls may significantly simplify the task of managing monetary and fiscal policies.

Much of the administrative cost and time required in the preparation and operation of rationing would stem from the employment and training of large numbers of government workers. Costs to the private sector would also be high. Another problem is that the information in the national motor vehicle registration file would be obsolete; the error rate could be as high as 20 percent. Millions of U.S. automobiles change ownership each year, and coupons might be sent to previous owners of used cars while current owners receive none.

Gasoline tax and rebate. A major practical problem would be the reimposition of the price control system. In addition, a system of gasoline taxes and rebates would have to be legislated and implemented. Because money would be used instead of coupons, many existing transfer mechanisms might be used. For example, the existing excise tax on gasoline could be raised to the desired level. Some major adjustments may have to be made to control inventory profits. However, only with considerable effort and public and private expense could existing government mechanisms such as income tax withholding, veterans' benefits, low-income energy assistance, welfare payments, or other methods be used to distribute the rebates. If rebates were distributed by check on the basis of motor vehicle ownership, information on motor vehicle registrations would have to be maintained. If they were distributed by adjusting income tax withholding rates, tax credits might be required for automobile owners whose rebates exceeded their tax liability. Procedures to deal with nontaxpaying or unemployed auto owners would be required. Because of the large income transfers, potentially hundreds of billions of dollars per year, strong incentives to cheat would exist. Additional federal employees would therefore be required to monitor compliance.

Under the Johnston and Percy tax-rebate proposals, the excise tax would be set at a level that clears the market. Setting the tax at such a level is a very difficult task, and the macroeconomic consequences of mistakes could be severe. It is not clear that the government would be able to determine the market-clearing price, for there are no precise indicators of market equilibrium. After setting the initial tax, the government would have to adjust the tax on a weekly or monthly basis as crude oil supplies and prices changed and as demand became more elastic with time. The inherent uncertainty in estimating the actual level of the tax would make accommodating fiscal and monetary policy very difficult. Further, this system would be difficult to dismantle. Rebate recipients who used less gasoline than average would not want to give up their rebates, and if history is any guide, price controls would not be easily removed.

General rebate. Very large interruptions may strain the ability of market mechanisms to function effectively. On the other hand, a major advantage of this plan is that price and allocation regulations would not have to be reimposed. No new tax mechanism would be required, but new rebate mechanisms would be needed, especially to handle the enormous revenues generated by large disruptions. With considerable effort the rebates could be handled as an increment to existing programs—for example, through increased transfer payments and refundable income tax credits. However, if the rebates were made strictly per capita, the rebate mechanism would be even more difficult. Assembling a master list of all citizens for the purpose of distributing rebates might be construed as an unprecedented invasion of privacy, especially since the plan should be brought to a state of readiness in advance of an emergency. If the income tax system were used, many people who do not now file income tax returns would need to do so to receive

Table 1. Summary evaluation of petroleum shortfall allocation plans.

Criterion	(1) Price and allocation controls	(2) Coupon gasoline rationing	(3) Gasoline tax and rebate	(4) General rebate
Microeconomic effects	Gasoline prices artificially low Gasoline queues Pronounced microeconomic inefficiencies Interregional and intertemporal inefficiencies	No gasoline queues Inefficiencies among petroleum products Price and allocation controls No incentives for domestic production	Effects similar to plan 2 More efficient than gasoline rationing	Minimizes microefficiency losses No gasoline queues Allocates oil to highest value uses Encourages conservation Encourages domestic production
Macroeconomic effects	Reduces GNP Increases prices Queuing costs Limits income transfers Inhibits resource movements and productivity growth	Limits fiscal drag No impact on supply side Creates second currency May reduce GNP No impact on CPI	No effects on supply side Limits oil price drag Increases CPI	Mitigates supply-side effects Higher GNP Higher economic efficiency Increases CPI
Equity	Income transfers on basis of time value Regional inequities	Depends on criteria for coupon distribution	Depends on criteria for rebates Money rebates more explicit than coupons	Uncontrolled prices perceived unfair Huge income transfers from consumers to producers Depends on structure of rebate mechanism Bad signal to oil-producing countries
Practical problems	Price control and allocation system reimposed Administrative costs Social divisiveness System difficult to dismantle Reduced impact on conservation	Price control and allocation system reimposed Administrative costs High error rate Constituency development	Legislation of tax and rebate system Administrative problem with rebates Constituency development	Strain on market mechanism New rebate methods required Administrative problems Time to implement

the rebate. If the interruption were large enough to drive prices up to the level at which the rebate would be greater than many families' withholding liability, refundable credits or a combination of withholding reductions and sales or payroll tax reductions may be required.

Procedures may have to be established to deal with hardship cases, exceptional needs of medical patients, low-income users of fuel oil, and related cases. However, the rebate program should be designed carefully to avoid measures that encourage oil use; for example, it should not reward homeowners who continue to consume home-heating oil at predisruption levels. All oil should be priced at its replacement value; the rebate should assist those in jeopardy of suffering and should generally restore purchasing power to the economy. The time required to implement an emergency allocation plan is also important. If world oil prices rise rapidly at the outset of an interruption, plans that are difficult and time-consuming to implement may be less useful; demand reductions under the general rebate plan would be immediate.

Overall Evaluation

The differences between the plans are summarized in Table 1. On grounds of microeconomic efficiency, the differences are apparent. The general rebate plan allows individual firms and consumers the most flexibility in adapting to the oil interruption and provides the greatest incentive for increased domestic oil production and storage. The coupon rationing and tax-rebate plans allow efficient allocation of gasoline, but do not provide for the optimal mix of petroleum products. If the burden of the crude oil shortfall is placed primarily on gasoline, these two plans are less efficient in microeconomic terms than the general rebate plan. The price and allocation plan is the most inefficient in that allocations are based on historical usage or queuing, both of which impose enormous social costs.

None of the plans mitigate the supply-side macroeconomic costs—higher prices and recession—associated with an oil supply disruption. The true price of oil, whether measured in terms of queues, coupons, or dollars, will be higher than before the disruption. Like a crop failure, the loss of oil will reduce output and will raise prices. No method of allocation can avoid these supply-side macroeconomic losses. Emergency allocation plans and monetary and fiscal policies can, however, affect the demand-side macroeconomic costs. The sudden, massive movement of funds into the oil market could sharply reduce output in nonoil sectors of the economy. This oil price drag is associated most dramatically with the gasoline tax and rebate and the general rebate plans. Further, if an allocation plan can somehow exclude oil price increases from the CPI, labor contracts and government entitlement programs that are indexed to the CPI will not escalate as rapidly as if oil price increases are included *(21)*. Price controls keep oil price increases out of the CPI by requiring payment in terms of time spent waiting in gasoline lines, while rationing keeps gasoline price increases out of the CPI by creating a second currency.

While unquestionably an important criterion, equity is to a large degree a matter of perception. None of the four plans will be perceived as fair to all groups. The general rebate plan may be perceived as the least equitable, since it allows prices to rise and enables oil companies to charge what the market will bear. Wealth will be transferred from oil consumers to oil producers, both domestic and foreign. Even if the existing windfall profits tax is augmented during the emergency to capture most of the windfall, and even if all revenues are rebated to consumers, the public's perception will likely be one of oil companies making money at the expense of consumers. To a lesser degree, the gasoline tax and rebate plan will likely be perceived as unfair because it involves an explicit tax on consumer products. Paradoxically, the gasoline rationing plan, which is as fair as the tax and rebate plan, may be perceived as the most equitable means of allocating gasoline supplies. Even though the two plans would probably lead to similar distributions of available gasoline supplies, the possession of a coupon confers a "right" to a gallon of gasoline in a way that currency does not. Even the coupon gasoline rationing plan will be perceived by some—those who do not own automobiles, for example—to be unfair. The arbitrary nature of the first-come, first-served gasoline lines resulting from this plan cannot be perceived as fair for any extended period of time.

The nature and magnitude of practical problems associated with each plan are important considerations. Three of the plans—price controls, rationing, and gasoline tax and rebate—would require DOE to reimplement oil price controls. The reimposition of these controls with the attendant entitlements program simultaneously with the imposition of gasoline rationing would strain DOE resources. Regarding time to implement, the ability of the general rebate plan to allocate oil supplies quickly appears to give it significant advantages over other options.

The four plans require different amounts of information on which to base decisions. The rationing plan requires projections of the volumes of gasoline available several months in advance. The gasoline tax and rebate plan requires estimates of the size of the tax necessary to equate demand with supply; such information is not now available and is not likely to be reliable even if collected. The general rebate plan requires relatively less data for the decisions required. Finally, the ease of dismantling an allocation system following a disruption must be considered. Plans requiring any form of price controls may prove more difficult to phase out than ones that do not.

Clearly, much more analysis is required before the least objectionable allocation plan can be identified. The impact of each plan on income groups and regions of the country is still poorly understood. The practical problems of the plans, especially the tax and rebate and the general rebate plans, are now only dimly perceived. Further study of these critical issues is required.

References and Notes

1. This analysis was conducted before the Iran-Iraq war, but that crisis underscores the importance of this type of analysis. See, for example, "The world oil market in the 1980s: Implications for the United States" (Congressional Budget Office, Washington, D.C., May 1980).
2. In the event of an energy emergency of the magnitude discussed here, many other types of administrative and regulatory actions may be employed to allocate oil and encourage energy conservation. Space does not permit us to analyze these other options in depth. Some of them are analyzed in J. Berman *(3)*; F. D. Boercker *et al.*, "Emergency petroleum conservation: A review and analysis of selected measures" (ORNL/TM-7059, Oak Ridge National Laboratory, Oak Ridge, Tenn., 1980); "Designing methods for distributing petroleum during a shortage and selecting standby mechanisms" (Resource Planning Associates, Inc., Cambridge, Mass. May 1979).
3. J. Berman, "A summary of contingency planning for energy emergencies" (Energy and Environmental Policy Center, John F. Kennedy School of Government, Harvard University, Cambridge, Mass., 1980).
4. The precise price increases depend on the price elasticities of products, elasticity demand functions, and other variables. Here we used a price elasticity of −0.1 in the first quarter after the disruption, increasing gradually to −0.6 by the 16th quarter.
5. Although some work on estimating the detailed economic impacts of energy emergencies has been completed, the estimates vary so widely and are so sensitive to assumptions that it is impossible to quantify the impacts with any degree of certainty. It is clear that the consequences would be severe, and the general direction of the changes is agreed on; however, numerical estimates are not reliable and standard econometric models are incapable of handling disturbances of this severity.
6. This would occur because government entitlement programs and many labor union contracts contain cost-of-living agreements, which index payments to the CPI.
7. The Emergency Petroleum Allocation Act of 1973, as amended by the Energy Policy and Conservation Act of 1975, allows the President to control the prices of domestic crude oil and the price markups or margins of downstream operations. In addition, the President is allowed to allocate crude oil and refined products. President Reagan rescinded price controls on petroleum products in January 1981, and the authority to impose price and allocation regulations will end when EPAA expires in September 1981. However, Congress may extend or modify this authority or may reimpose a price control and allocation program in the event of a severe energy emergency.
8. "Progress report to the Congress on the standby motor fuel rationing plan" (U.S. Department of Energy, Washington, D.C., June 1980).
9. "Standby gasoline rationing plan" (Department of Energy, Washington, D.C., June 1980).
10. "Report to the Congress on the standby fuel rationing plan" (Council on Wage and Price Stability, Washington, D.C., June 1980).
11. A. Jacobs, "The economic effects of implementing the standby gasoline rationing plan" (Energy and Environmental Policy Center, John F. Kennedy School of Government, Harvard University, Cambridge, Mass., November 1980).
12. J. P. Stucker and T. F. Kirkwood, "The economic impact of automobile travel cost increases on households" (R-1842-NSF/FBA, Rand Corporation, Santa Monica, Calif., July 1977).
13. P. K. Verleger, "Petroleum price and allocation regulations during the 1970's: History and economic analysis," paper presented at the Conference on the Future Role of the Federal Government in the Petroleum Sector, held at Yale University, New Haven, Conn., November 1980.
14. During the disruption the prices of all petroleum products would rise with the of imported oil. Price controls would attempt to hold product price increases to a minimum. The true price of gasoline (the controlled price plus the value of the ration coupon) would rise dramatically, however. See S. Lawrence, *Am. Econ.* **22** (No. 1), 17 (1978); W. S. Salant, "Rationing and price as methods of restricting demand for specific products" (Paper 355, Brookings Institution, Washington, D.C., 1980); J. Tobin, *Econometrica* **20** (No. 4), 521 (1952); D. A. Johnson, *Rev. Bus. Econ. Res.* **26** (No. 3), 55 (1974).
15. The oil embargo of 1973–1974 is estimated to have resulted in a long-run decrease in GNP of $300 billion to $400 billion. See P. K. Verleger *(13)*; R. H. Bezdek and N. V. Kannon, *J. Energy Nat. Resour.*, in press; R. H. Bezdek *et al.*, paper presented at the Third International Conference on Alternative Energy Resources, Bal Harbour, Fla., December 1980.
16. A. Jacobs *(11)*; P. K. Verleger *(13)*; paper presented at the Aspen Institute Program on Options for Fueling America's Transportation, Aspen, Colo., April 1980.
17. Audit and enforcement activities would require a large federal work force. Since the regulations that control prices and allocate products may not be in place before the disruption, this regulatory system would begin at a very simple level. Even though it has taken more than 7 years to develop the EPAA regulations through legislation, rule-making, and exceptions, many problems still remain. The time required to implement a congressionally approved rationing plan has been estimated as 3 to 6 months. [M. L. Telson, paper presented at the Second Annual International Conference of the International Association of Energy Economists, Churchill College, Cambridge, England, June 1980; A. Alm and W. Hogan, "Meeting an oil emergency" (editorial) (Energy and Environmental Policy Center, John F. Kennedy School of Government, Harvard University, Cambridge, Mass., 1980); J. Berman *(3)*; *(8, 9)*].
18. During the Iranian crisis in the summer of 1979, for example, there were several murders and at least one "energy riot" attributed to gasoline lines. Since it is debatable whether there was a petroleum shortage in 1979, one wonders what would happen in the event of a real 20 percent petroleum shortfall.
19. Segments of the oil industry may oppose removal of the allocation system because it would ensure purchasers equal portions of their supplier's oil, irrespective of the purchasers' economic efficiency.
20. Alternatively, the rebates could be distributed more efficiently by the electronic funds transfer system [R. H. Bezdek, "Use of the electronic funds transfer system in conjunction with energy contingency plans" (Department of Treasury, Washington, D.C., 1980)].
21. It may be advisable to enact legislation to give the government the authority to override CPI inclusion of petroleum increases in times of national energy emergencies.

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