21. Irrigation energy: Values are derived from the acres irrigated from *Statistical Abstracts* for various years; converted to energy use at 10^6 kcal per acre irrigated. This is an intermediate value of two cited by Pimentel *et al.* (*3*).
22. Food processing industry: Source, *Census of Manufacturers*; direct fuel inputs only. No account taken for raw materials other than agricultural products, except for those items (packaging and processing machinery) accounted for in separate categories.
23. Food processing machinery: Source, *Census of Manufactures* for various years. Items included are the same as for farm machinery [see (*13*)].
24. Paper packaging: Source, *Census of Manufactures* for various years. In addition to direct energy use by the industry, energy values were calculated for purchased paper, plastics, and petroleum wax, according to (*14*). Proportions of paper products having direct food usage were obtained from *Containers and Packaging* (U.S. Department of Commerce, Washington, D.C., various recent editions). [The values given include only proportional values from Standard Industrial Classifications 2651 (half), 2653 (half), 2654 (all).]
25. Glass containers: Source, *Census of Manufactures* for various years. Direct energy use and sodium carbonate [converted according to (*14*)] were the only inputs considered. Proportions of containers assignable to food are from *Containers and Packaging*. Understatement of totals may be more than 20 percent in this category.
26. Steel and aluminum cans: Source, *Census of Manufactures* for various years. Direct energy use and energy used in the manufacture of steel and aluminum inputs were included. The proportion of cans used for food has been nearly constant at 82 percent of total production (*Containers and Packaging*).
27. Transportation fuel usage: Trucks only are included in the totals given. After subtracting trucks used solely for personal transport (all of which are small trucks), 45 percent of all remaining trucks and 38 percent of trucks larger than pickup and panel trucks were engaged in hauling food or agricultural products, or both, in 1967. These proportions were assumed to hold for earlier years as well. Comparison with ICC analyses of class I motor carrier cargos suggests that this is a reasonable assumption. The total fuel usage for trucks was apportioned according to these values. Direct calculations from average mileage per truck and average number of miles per gallon of gasoline produces agreement to within ± 10 percent for 1967, 1963, and 1955. There is some possible duplication with the direct fuel use on farms, but it cannot be more than 20 percent considering on-farm truck inventories. On the other hand, inclusion of transport by rail, water, air, and energy involved in the transport of fertilizer, machinery, packaging, and other inputs of transportation energy could raise these figures by 30 to 40 percent if ICC commodity proportions apply to all transportation. Sources: *Census of Transportation* (Government Printing Office, Washington, D.C., 1963, 1967); *Statistical Abstracts* (*1*); *Freight Commodity Statistics of Class I Motor Carriers* (Interstate Commerce Commission, Government Printing Office, Washington, D.C., various annual editions).
28. Trucks and trailers: Using truck sales numbers and the proportions of trucks engaged in food and agriculture obtained in (*27*) above, we calculated the energy values at 75×10^6 kcal per trucks for manufacturing and delivery energy [A. B. Makhijani and A. J. Lichtenberg, *Univ. Calif. Berkeley Mem. No. ERL-M310* (revised) (1971)]. The results were checked against the *Census of Manufactures* data for 1967, 1963, 1958, and 1939 by proportioning motor vehicles categories between automobiles and trucks. These checks suggest that our estimates are too small by a small amount. Trailer manufacture was estimated by the proportional dollar value to truck sales (7 percent). Since a larger fraction of aluminum is used in trailers than in trucks, these energy amounts are also probably a little conservative. Automobiles and trucks used for personal transport in the food system are omitted. Totals here are probably significant, but we know of no way to estimate them at present. Sources: *Statistical Abstracts, Census of Manufactures*, and *Census of Transportation* for various years.
29. Commercial and home refrigeration and cooking: Data from 1960 through 1968 (1970 extrapolated) from *Patterns of Energy Consumption in the United States* (*6*). For earlier years sales and inventory in-use data for stoves and refrigerators were compiled by fuel and converted to energy from average annual use figures from the Edison Electric Institute [*Statistical Year Book* (Edison Electric Institute, New York, various annual editions] and American Gas Association values [*Gas Facts and Yearbook* (American Gas Association, Inc., Arlington, Virginia, various annual editions] for various years.
30. Refrigeration machinery: Source, *Census of Manufactures*. Direct energy use was included and also energy involved in the manufacture of steel, aluminum, copper, and brass. A few items produced under this SIC category for some years perhaps should be excluded for years prior to 1958, but other inputs, notably electric motors, compressors, and other purchased materials should be included.
31. There are many studies of energy budgets in primitive societies. See, for example, H. T. Odum [*Environment, Power, and Society* (Wiley, Interscience, New York, 1970)] and R. A. Rappaport [*Sci. Am.* **224** (No. 3), 104 (1971)]. The remaining values of energy subsidies in Fig. 5 were calculated from data presented by Slesser (*9*), Table 1.
32. This article is modified from C. E. Steinhart and J. S. Steinhart, *Energy: Sources, Use, and Role in Human Affairs* (Duxbury Press, North Scituate, Mass., in press) (used with permission). Some of this research was supported by the U.S. Geological Survey, Department of the Interior, under grant No. 14-08-0001-G-63. Contribution 18 of the Marine Studies Center, University of Wisconsin–Madison. Since this article was completed, the analysis of energy use in the food system of E. Hirst has come to our attention ["Energy Use for Food in the United States," *ONRL-NSF-EP-57* (Oct. 1973)]. Using different methods, he assigns 12 percent of total energy use to the food system for 1963. This compares with our result of about 13 percent in 1964.

Economic Strategy for Import-Export Controls on Energy Materials

Helmut J. Frank

Lifting the embargo against the United States by the oil-producing Arab countries may alter the nature of the energy question from a temporary crisis to a long-run problem. With this shift, attention is likely to focus once again on fundamental issues such as the role of imported energy sources in total U.S. supplies, the feasibility and cost of pursuing domestic self-sufficiency, the use of agricultural and industrial exports for bargaining or retaliatory purposes, and the policy instruments most suitable for attaining desirable policy objectives. The choice of appropriate foreign trade policies affecting energy can go far toward assuring the country adequate supplies at reasonable costs; the failure to do so could be disastrous for the country's security, its economic strength, or both.

Determining the role of imported energy sources in the total supply stream would not be a problem if normal economic forces could be allowed to govern trade in energy: Trade would follow the law of comparative advantage. The United States would import those goods in which foreign countries have relatively the lowest costs (say, oil) and pay for them by exporting goods in which the U.S. cost advantage is greatest (say, foodstuffs). This trade need not, indeed it should not, be limited to direct bilateral exchange. To obtain maximum benefit from the uneven distribution of natural and human resources, goods and capital should be permitted to move freely across national frontiers in response to normal economic incentives.

The recent oil embargo has brought home to every American the fact that the conditions under which free exchange can function effectively have not been allowed to govern trade in energy materials. During the past few years, the Organization of Petroleum-Exporting Countries (OPEC) has become powerful enough to control production and raise short-run prices to

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levels that are clearly excessive in light of longer term alternatives. In addition, a few Arab countries control a sufficiently large share of total production to permit them to use the "oil weapon" to exert pressure on selected importing countries for political ends. Even though foreign reserves of crude oil and natural gas are very large and real costs of production are extremely low, the United States cannot base its energy policy on the premise that the volumes which U.S. consumers would like to use will be available either cheaply or certainly under all circumstances.

On the other hand, the bargaining position of the major oil-importing countries vis-à-vis the OPEC is currently very weak. Efforts to form a common front between the United States, Europe, and Japan on energy questions have borne little fruit to date. In addition, the continuing Arab-Israeli friction and the involvement of the Soviet Union in the Middle East severely limit U.S. freedom of action. The United States is now only moderately dependent on Arab oil imports and has within its borders enough potential energy sources to eventually support a policy of essential self-sufficiency. If measures to foster development of these sources are not taken, our dependence on imports will grow very rapidly in coming years; if full-scale domestic development is pushed rapidly, the cost could be very high indeed.

The critical policy objective is, therefore, to determine how the United States can obtain an optimal combination of assured energy supplies and reasonable costs. Such a goal implies the establishment of a balance between domestic and foreign sources and the design of effective policy instruments.

Background

During the 1950's world oil production rose rapidly and so did imports into the United States. Foreign costs, including payments to the governments of the producing countries, were very low compared to costs in the United States, and U.S. oil prices were set at levels to cover the costs of low-yield stripper wells. As surpluses developed, output of the more productive wells was cut back under "prorating policies," which permit the maintenance of predetermined crude oil prices. By the mid-1950's, imports had reached such a high rate that serious national security concerns arose and President Eisenhower imposed informal quota restrictions on them. These became official in 1959 and were in force all during the 1960's. A series of changes, accommodations, and exemptions substantially modified the program, and, in 1969, President Nixon ordered a full-scale review of oil import policy by a cabinet-level task force.

In its report, the majority of the task force recommended that import quotas be abandoned and replaced by a system of tariffs. The tariffs were to establish a link between domestic and world crude oil prices and would, in effect, have imposed a ceiling on the prices domestic producers could charge for their oil. The majority was aware of the risks of heavy dependence on insecure Eastern Hemisphere sources and suggested limiting imports from these sources to 10 percent of our total supply. It was thought that availability of domestic and other oil in the Western Hemisphere made the need to invoke such a quota remote. A minority of task force members preferred to retain the prevailing quantitative controls, primarily because they believed such controls would be better for national security. The President failed to accept either recommendation, and for 3 years the country drifted along without any real policy direction. Meanwhile, domestic reserves and productive capacity of crude oil fell, while demand accelerated. By 1972, surplus capacity had nearly vanished, and import quotas had to be lifted to prevent policy-induced shortages. A set of import fees was substituted in 1973, providing a very mild degree of protection for domestic crude oil production and greater protection for finished products. The system was designed to encourage expansion of refining capacity, which had been lagging badly primarily because of policy uncertainty.

Meanwhile, however, the producing countries took advantage of strong worldwide demand and a notable absence of counterpressure from buyers; they raised government payments on oil production substantially, thereby forcing up world oil prices. This trend accelerated greatly following the outbreak of the Arab-Israeli war in October 1973, when the Arab members of OPEC enacted an embargo on exports to the United States (and the Netherlands) and reduced total production to back up the higher prices. By January 1974, government payments in the Persian Gulf reached $7 per barrel, a fourfold increase from a year earlier and a sevenfold increase from 1970. Early in 1974, the cost to the United States of imported crude oil was about $9 per barrel, compared to a $5.25 ceiling on controlled domestic production. Prices of uncontrolled domestic crude oil were comparable to world prices.

Policy Options

Suspension of the boycott, coupled with restoration of production to the preembargo level, is expected to result in some reduction in prices. As long as the cartel power of OPEC remains unchecked, however, there will be a threat of unreasonable prices, reduced production, and renewed interference with shipments. The range of options available to the United States under these circumstances is limited. Essentially, there are four:

1) The hands-off approach of attempting to foster friendly relations with oil-producing countries and permitting increased imports to satisfy the demands of the domestic market. If such a policy could be relied upon to keep energy supplies flowing at reasonable costs, it would be very attractive. It may be argued that the wiser counsels among the oil-producing countries realize that there are limits to the power of even the strongest cartel. Exorbitant prices, like those that prevailed briefly last winter, would stimulate an energy glut [which has been predicted for 1980 (*1*)] and accelerate development of alternative energy sources. Saudi Arabia thus far is the only producing country influenced by this prospect to the point of favoring a reduction from current prices. All others appear to be focusing on short-run profit maximization through high prices and restricted production. The fact that the Saudis may be the only ones whose resources could support greatly enlarged production is obviously a critical factor in this behavior. In any event, leaving vital U.S. interests hostage to the sheiks is not a viable policy option.

2) Efforts to break the power of the oil cartel and restore competition. Many economists argue that no cartel has ever been effective for long and that, therefore, the power of OPEC is bound to be weakened in time. Some suggest that the process could be

speeded up by appropriate U.S. government policies, particularly those forcing the oil companies out of the business of selling crude oil for producing countries. (The oil companies are now serving as tax collectors and price props for those nations.) Whether such an approach could have succeeded 4 years ago, when OPEC first began to test its strength (*2*), is a moot question. The heavy concentration of crude reserves in the Persian Gulf certainly militates against it. Saudi Arabia is perhaps the only country that has the potential for expanding production to the point of forcing prices to break. Small populations and oil earnings far beyond immediate budget needs give Persian Gulf nations little incentive to move in that direction.

3) Rigid limits on imports without an accompanying program for developing domestic sources. Realistic assessments indicate that for a number of years the country will be hard put to maintain domestic energy supplies at present levels. Without increased imports, severe shortages would occur and economic growth would be slowed, if not stopped. One sometimes gets the impression that some less responsible ecology advocates would use the energy shortage to achieve this very objective, but the sharp increases in unemployment which a sudden slowdown in growth would cause make this course clearly unacceptable.

4) Strenuous efforts to achieve domestic self-sufficiency by 1980 or as soon thereafter as feasible. Supporters of this approach cite our vast hydrocarbons resource base, which could support greatly increased output; the availability of advanced technology for accelerated expansion of nuclear power generation and creation of a synthetic gas and petroleum liquids industry; cost projections that compare favorably with current oil cartel prices; and the desirable restraints on growth of demand that higher energy prices would impose. Objections to and reservations about the policy are serious: the lack of reliable figures on the cost of reversing the decline in oil and gas reserves and of expanding coal and nuclear power at accelerated rates; huge requirements of capital, manpower, and equipment, which would tend to increase inflationary pressures; acceptance of high energy prices or of large government subsidies, or both; significant environmental damages and risks for several key components (Western coal, shale, nuclear reactors); a timetable, at least as set by the President for Project Independence, that appears to be wholly unrealistic in the absence of forced draft allocations of critical materials and labor.

It is clear that each of the above options has such obvious drawbacks that none offers a viable course out of the energy dilemma. The only realistic approach is a judicious combination of standing ready to become self-sufficient, while satisfying increased demands by imports. Hopefully, the terms will be acceptable on economic and national security grounds. How can such a program be designed, what would its foreign trade elements be, and what are the chances of its becoming workable?

A set of acceptable terms, with which others may at least partly disagree, would include: (i) expanded total energy supplies, but with increases at a less rapid rate than in the past; (ii) an assured flow of energy supplies, or adequate provisions to overcome interruptions in major supply components; (iii) reasonable economic costs, defined as costs of incremental energy supplies from domestic sources on a large scale, given sufficient time for their development; (iv) tolerable environmental costs, defined as avoiding damages that can be minimized at reasonable costs and postponing development of sources with excessive environmental risks; and (v) policy instruments that are socially and politically acceptable to the American public.

A set of policies designed to achieve these objectives must include five elements:

1) Fostering the evolution of the world oil industry's structure toward a stable accommodation between the various interest groups.

2) Developing technology to the point where alternative domestic energy sources can be made available on reasonable terms in a comparatively short time and pursuing long-term research on more esoteric energy sources.

3) Establishing an adequate stockpile and reserve producing capacity to handle emergencies.

4) Devising a workable mechanism linking domestic and world energy markets.

5) Adopting an export strategy that would support, rather than impede, progress toward the primary goal.

World Oil Structure

The emergence of an effective producers' cartel and the acceptance of host government participation in oil-producing operations signify the transition of world oil industry from one dominated by major oil companies, supported by their home countries, to one with equally unbalanced power in the hands of a combine of producing countries. Thus the present situation is no more viable than the one in the 1970's. A reasonable equalization of power must be restored—the sooner the better. The only question is how.

One approach is to attempt the formation of a block of major oil-consuming countries, including Western Europe, Japan, and the United States, whose weight could counterbalance that of OPEC. The meagre results of the Washington conference of these countries in mid-February of this year demonstrate how difficult it is to forge a united front when each country is scrambling for short-run advantages to the detriment of the others. Even if the consuming countries were united and willing to risk a showdown with OPEC, there is no assurance that they could come out ahead in the absence of any ready alternatives to Middle East oil.

On the other hand, for several years there has been little, if any, value in efforts to slow down the institutional transition in the producing countries from private concessions to government ownership of oil production. In fact, the issue is no longer whether, or how soon, the governments will acquire a 60 percent, or even a 100 percent, share of these operations, it is how crude sales shall be handled. Until now, the U.S. government has supported, by its tax regime and otherwise, arrangements under which the bulk of these governments' share of the oil is resold to the major oil companies at predetermined prices. This arrangement does not prevent prices from going up in a tight market because the producing countries have the option of offering the oil for bids at auction. It may prevent prices from falling in a weak market. Presumably, the arrangement was in the interest of U.S. domestic producers since unduly low foreign oil prices would tend to exert pressure on domestic oil markets, even in the presence of import restrictions. Moreover, high world oil prices would be less injurious to the American economy, which in 1973

imported 36 percent of its oil, than to Europe and Japan, which must import some 90 percent or more of their needs.

With the producing cartel setting prices that exceed the probable long-term cost of alternative energy sources, however, national interest diverges sharply from the common interests of the oil producers and the oil companies. High prices in today's circumstances may still benefit the oil companies (at least temporarily), but they clearly run counter to the needs of the American economy and American consumers. It is time to reconsider the outdated policy of propping up crude oil prices in the interest of market "stability" and of allowing concessionary rights to American companies and to examine ways of speeding the evolution toward a new, more stable institutional structure for the world oil industry. Such a structure must rest on a more equal distribution of economic power among the various participants. Since this cannot be achieved at present by a countervailing organization of consuming countries, alternative methods of restoring a greater degree of competition to world oil markets must be explored.

Adelman (*2*) has suggested one possibility: withdraw the major oil companies from the selling of crude oil, and leave this to the producing countries. The private companies could still make available their technical and managerial expertise in exploration and production, for a fee, and they would of course continue to maintain for many years a strong position in refining and distribution of petroleum products—but their interest would no longer be in maximizing profits in the production and sale of crude oil. Another possibility is that a government representative of the importing country participate with officials of the private companies and the producing country in negotiating sales agreements.

Research and Development

Domestic energy self-sufficiency by 1980 is not realistic, and the cost and environmental impact are likely to be intolerable. However, a major effort toward energy independence is essential to restoring balanced bargaining power to the oil-consuming countries vis-à-vis the producing cartel. The aim and extent of the program should be twofold: (i) to develop technology to the point where a wide range of alternative domestic energy sources is practical—including coal gasification and liquefaction, methods of making direct burning of coal environmentally acceptable, syncrude production from shale, geothermal and solar power, and improved recovery techniques for oil and gas; (ii) to construct and operate a series of demonstration projects of commercial size in order to solve remaining engineering and logistical problems, develop improved second-generation plants, and provide firm cost data.

Moving this far along the route to self-sufficiency will achieve two objectives vital to a foreign trade strategy. It will demonstrate concretely the limit to which the oil-producing countries can raise prices before encountering sharp supply reactions, and it will greatly shorten the lead time if world developments should again dictate that the country consider seriously the autarchy alternative. Demonstration of readiness to proceed could forestall the need to do so, while at the same time minimizing the burden on American consumers and taxpayers.

Reserve Capacity

Even under the best of circumstances, the alternative supply route can be only a limited counterweight to cartel power, because converting potential into actual supplies will require considerable time. Therefore interim measures to strengthen the bargaining power of the consuming countries are essential. These should be designed to cope with actual or threatened supply interruptions or exorbitant demands, lasting for varying time periods. For very short periods of interruption, a program of stockpiling crude oil and its products sufficient for a minimum number of days' requirements should be enacted in the United States (one already exists in Europe). Building up stocks during a period of shortages and high prices will be difficult and costly, but that is the price the nation must pay for having failed to act when it would have been easier and cheaper. A deliberate stockpiling program now will mean that the flow of products for consumers will have to be held below the total supply for a considerable period after the lifting of the Arab oil embargo.

Stockpiling oil above ground, or even in available caverns, is costly, and there are practical limits to how much time protection it can offer—at best, no more than a very few months. To fill the interval until alternative sources can be made ready, a program of standby crude oil–producing capacity should be developed. Since crude oil production has been at capacity for the past 2 years and foreign oil is more costly than domestic, even when it is available, there is no advantage in removing existing domestic fields from production for standby purposes. To do so would only increase imports or worsen shortages. Setting aside some discoveries for security purposes could be seriously considered, however. Major discoveries in suitable locations could be developed, purchased by a government agency, and held in reserve status. Some logistical facilities, such as pipelines, would have to be provided so that production could be achieved in the desired period (perhaps 120 to 180 days). Although costly, maintaining such standby capacity in crude oil would probably be less burdensome than developing equivalent productive potential in synthetic plants, which are even more capital-intensive and whose location may be less advantageous for the supply of existing refineries.

Import Control Mechanism

The selection of specific instruments for controlling the flow of oil imports is primarily a technical problem and is beyond the scope of this article. The instruments selected must, however, be supportive of basic foreign trade strategy. A primary consideration in their design must be the balancing of two opposing dangers. On the one hand, a restoration of normal oil imports without adequate protection may discourage domestic investment in petroleum and other energy sources. Without any sort of protection, the risk of prices being undermined by either competitive market forces or cartel action could be excessive. On the other hand, protection could be carried too far. Unduly high tariffs or rigid quotas would tend to encourage investment in high-cost domestic sources beyond the point of reasonable justification. Once created, these high-cost facilities would tend to be used as reasons for raising the walls of protectionism further. In the pres-

ent environment, the danger of too much protection may be greater than that of too little.

There has been a great deal of discussion, both general and specific, on the advantages and drawbacks of tariffs versus quotas for limiting imports into the United States. Fifteen years of experience with quotas have been far from happy. For one thing, by allocating specific quotas to individual companies, the system tended to set up strong pressures to cut a motley assortment of applicants into the windfall profits of the scheme. For another, any quantitative control system will become ossified and antiquated in time. If it should become necessary to resort to quotas again, the disadvantages could be minimized by an auctioning system under which resulting profits would accrue to the public treasury rather than to private quota-holders.

As long as the foreign oil-producing countries exert strict controls over production, however, a tariff, to which the United States shifted in April 1973, might be adequate to accomplish the basic foreign trade objectives. It can assure domestic investors of a market price floor, representing the cost of large-scale domestic energy supplies in the long run (including normal return on investment). Such a "guideline price" is critical to the decision of private groups to proceed with higher cost domestic oil and gas exploration, as well as with research and development of new energy sources. Without government assurance that such a price will prevail, an even more objectionable and costly system of large-scale subsidies and tax remissions would be required.

Precisely where the price should be set is a matter for detailed study, and the level, once established, will certainly require periodic adjustments for inflation and changes in real costs. A first guess is that it should currently be about $7 per barrel. The tariff would then have to be set so that foreign oil could not be laid down in the United States to undercut the domestic price. Should foreign prices plus transport costs exceed the domestic guideline price, the tariff on crude oil could remain at the present minimal levels of 10.5 to 21 cents per barrel. Should the price at which foreign oil is offered fall significantly, the tariff would need to be raised to protect domestic producers. Additional protection should continue for refined products, in order to encourage restoration of domestic self-sufficiency in most finished products. The mechanism would resemble that of the European Economic Community for protecting its agricultural production, to which the United States, ironically, has been strongly opposed.

Other Security Measures

Two other actions could reduce the risks of relying substantially on oil imports. One is close collaboration with the government oil companies of the more conservative Persian Gulf countries, such as Iran and Saudi Arabia. Collaboration should not take the form of exclusive, long-term supply contracts on a favored nation basis, as Saudi Arabia proposed in 1973 and the U.S. government rejected. In addition to discriminating against other countries, such contracts would lend U.S. endorsement to the selective protection approach favored by some European countries. Such an approach tends to direct trade into bilateral and barter channels and may turn the terms of trade even more heavily against the consuming countries.

More promising may be to encourage joint ventures in refining and domestic energy development between Middle East government companies and American oil companies and large energy consumers. Such arrangements would offer at least three advantages: they would absorb some of the excess oil receipts of the OPEC countries, which otherwise might be put to less productive uses (such as real estate investment) or kept in short-term assets, thereby contributing to financial instability; they would augment the supply of funds available to domestic energy companies, whose financial requirements will be very great and may place strains on capital markets; and they may offer increased supply assurance by giving some OPEC governments a direct financial stake in the continuous flow of oil. They may even contribute toward greater competitiveness in U.S. energy markets, since the partners of the government companies will more likely be independents and newcomers than established international majors.

A second promising approach is through renewed effort by the U.S. government to improve relations with Western Hemisphere countries having substantial energy supply potential. During the past 3 years, the prospect of some of the vast Canadian oil and gas deposits becoming available to the U.S. market has become very bleak, reflecting growing Canadian nationalism and concern over the environmental impact of large-scale development of the Canadian Arctic and mining of tar sands. Attitudes and actions of some high officials in Washington, especially during 1971 and 1972, certainly contributed to the negative attitudes of Canadians toward increased trade in energy materials with the United States. A serious effort to reverse the present negative climate and to concentrate on the mutual interests of the two countries is overdue.

There are also vast potential hydrocarbons reserves in the tar belt and heavy oil deposits in Venezuela. It has not been commercially practical to develop these in the past, but it may well be at today's higher prices. Considerable technical development remains to be done, and the U.S. government has offered to collaborate with Venezuela to investigate recovery methods. Although Venezuela is a charter member of OPEC and certainly adheres to the restrictive high-price policy of that organization, it is much less likely to join in politically based embargoes than some Eastern Hemisphere suppliers. To a considerable extent, of course, this also applies to other non-Arab producing countries such as Iran, Nigeria, and Indonesia. Greater reliance on these sources, to the extent that this can be done without discriminating against others, would thus offer additional protection.

Export Strategy

Export control measures that could be used to improve the energy position of the United States fall into two categories: direct actions, such as sharing scarce fuel supplies with other nations, and indirect actions, such as controls on U.S. exports of foodstuffs and industrial products. During periods of domestic energy shortage, there are bound to be pressures to minimize energy exports from the United States. This is already happening with petroleum products and may spread to coal, which has become tight. Moreover, there will be objections to offers, such as that made by Secretary of State

Henry Kissinger at the oil-consuming nations conference in February 1974, to share scarce energy supplies with other consuming countries, provided these countries reciprocate. From a long-range point of view, such objections are unwise, despite the unfortunate short-run impact of energy exports during periods of shortage.

The United States exports substantial volumes of foodstuffs, industrial materials, and equipment to the Arab oil-producing countries. Because these countries resorted to a boycott on oil exports to the United States, there is widespread support for an embargo of U.S. exports of goods vital to these countries' economies.

There is little reason for objecting to the Congress granting the Executive Branch the power to deny American products to countries interfering with the shipment of goods to us. Implementing such a provision should be limited to the most dire of circumstances, however. An American embargo could easily be evaded or circumvented in the absence of full support from U.S. trading partners. Items could be rerouted through third countries, or alternative sources outside the United States (including the Soviet Union) could replace American exports. Quick resort to retaliatory trade measures would foster the already dangerous tendency toward economic warfare, which, if widely pursued, can only endanger world prosperity. The remedy lies in a removal of the sources of friction, not in aggravating the pitch of battle.

Conclusions

Five policy elements should be combined in assuring adequate energy supplies at acceptable costs: moving toward a more balanced distribution of power between producing and consuming countries; developing a technological readiness for national energy independence; establishing desirable stocks and reserve productive capacity; relying on a flexible tariff system for linking domestic and world energy markets; and adopting an export strategy that supports the basic objective.

Two conditions are sine qua non's to any import-export strategy regarding energy materials. Policies must be clearly laid out and pursued with a steady hand in order that investors can afford to commit the vast sums necessary and expect recovery and adequate returns, typically spread over long periods of times. The policy package must be internally consistent, avoiding the conflicts and contradictions that so often have marred U.S. energy policy in the past.

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Oil Money and World Money: Conflict or Confluence?

Thomas R. Stauffer

I attempt to analyze here the impact of escalating oil prices upon the international money markets and the balance of payments positions of the major powers. Since oil is by far the most important item moving in world trade —and since effective export prices have roughly quadrupled since October 1973 —it is germane to ask whether such convulsive price increases might touch off seismic repercussions throughout the international economy.

This question is all the more relevant because current assessments of the impact of higher oil prices differ diametrically. Some observers, like Walter Levy, foresee recession and global relapse. Others, equally astute, invoke the inherent resiliency of the marketplace—the invisible, but supple, hand—and argue that some new equilibrium condition is near at hand and not unacceptable. Somewhere between the Scylla of hysteria and the Charybdis of insouciance must lie reality.

I shall identify only the bounds of the problem and illustrate the several issues using approximate, order-of-magnitude calculations. The analysis will be broken down into the following parts: (i) parameters of the oil price increase; (ii) prior role of Middle Eastern oil in the international balance of payments; (iii) contribution of oil price increases to inflation; (iv) impact of price increases upon trade balances; (v) their implications for financial markets; and (vi) interpretations and tentative conclusions.

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Oil Prices—the Quantum Jump

Between early October 1973 and January 1974, the tax reference, or posted, prices of Middle Eastern crude oils rose from \$3.01 to \$11.65 per barrel (1 barrel $= 1.59 \times 10^2$ liters). The oil-producing states unilaterally decreed these two upward revisions. These "prices" are used to determine exporting governments' revenues, which, in turn, are by far the largest component of the effective price of crude oil on world markets, as illustrated in Table 1. Government revenues rose from \$1.76 to \$7, and consequently the tax-paid costs for crude oil in the Persian–Arabian Gulf area rose from \$1.88 to \$7.13 per barrel.

The effect upon actual prices was somewhat greater, since the average prices are the sum of costs, taxes and royalties, producing-company profits, and a margin for the governments' equity—crude oil that the companies are obligated to buy back at higher prices under recent participation agreements. Omitting all intricacies, one can estimate that the typical f.o.b. price of oil in the Gulf rose \$5.50 to \$6 per barrel in 4 months.

The widely quoted and awesome prices of \$17 to \$22 per barrel represented only a minor fraction of the total market, and were largely the re-