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THE MANDATORY OIL IMPORT QUOTA PROGRAM: A CONSIDERATION OF ECONOMIC EFFICIENCY AND EQUITY*

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and
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Oil import quota schemes have been a subject of controversy among policy makers and economists alike for at least two decades. A landmark in the controversy is the Report of the Cabinet Task Force on Oil Import Control, issued in February 1970. At the time the Report was issued, however, the controversy was somewhat muted by events abroad which increased the cost of imported oil and thus reduced the price differential between imported and domestic oil. The closing of the Suez Canal, the disruption of oil flowing through a pipeline in Syria, oil embargoes in North Africa and a united negotiating front by the Oil Petroleum Exporting Countries (OPEC) all contributed to increased transportation and other costs for imported oil. As a result, domestic oil supplies became more attractive and the impact of the import quota system diminished.

These influences, however, were basically short-lived and more recently have been countered by other factors which are reducing uncertainty and tending to restore equilibrium in the international petroleum industry. World tanker tariffs are stabilizing. Contracts

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As this paper goes to press the President has announced a sweeping change in the quantitative restrictions on crude oil and replaced these with a free system while holding open the possibility of reinstating quantitative controls. This paper should serve as a guide of the cost to those who seek to reinstate such a program for national security or any other purposes.

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have been signed between the petroleum industry and Oil Petroleum Exporting Countries (OPEC) which establish prices that will prevail until 1975.[1] While Alaskan oil fields (which are at the center of their own controversy) seem closer to development, reasonable projections of demand for petroleum products exceed even this considerable increase in domestic supply. Our attention is again drawn to foreign sources of supply; the effect of an import quota becomes more apparent, more acute, and more deserving of renewed examination.

This paper will first review the historical development of the Mandatory Oil Import Quota Program and describe the manner in which it presently functions. Second, it will review several analyses made during and shortly after the Cabinet Task Force Report, and update these to reflect changing market conditions. Finally, the paper will analyze the equity and efficiency aspects of the present program in the context of its objectives, and consider alternative means of achieving those objectives.

HISTORICAL PERSPECTIVE[2]

The first U.S. experience with oil import quotas was in the 1930's under the National Industrial Recovery Act. Although the Act was declared unconstitutional in 1935, the competitive position of the United States was such that the U.S. was a net exporter of oil until 1948. By 1955 that position had eroded—due largely to major oil finds in Venezuela and the Middle East—and a Cabinent Advisory Committee recommended the use of voluntary oil import restraints to maintain the 1954 ratio of imports to domestic production.[3] The Office of Defense Mobilization thereupon established the "First Voluntary Program" and requested oil companies to reduce imports from outside the Western Hemisphere by 7%. This program failed to prevent an increase in net imports as a number of companies began to import for the first time.[4]

In 1957, the informal program was repaced by the "The Voluntary Program." This program set import quotas for four petroleum districts (I to IV). District V was exempted from control (see figure 1). Three classes of importers were designated:

1. Actually posted prices, whose meaning we will define below were established. The actual prices paid for foreign oil are treated secretly by the exporting country and the petroleum industry. Therefore, for the purposes of determining royalty payments and taxes, a posted price is negotiated and used by the parties involved.

2. For a comprehensive discussion of the historical, legal and political aspects of the Mandatory Oil Import Quota Program, *see,* Dam, *Implementation of Import Quotas: The Case of Oil,* 14 J. Law & Econ. 1 (1971). Section I is based in large part on Dam's important study.

3. Report of the Cabinet Task Force on Oil Import Control 3 (Feb. 1970). [hereinafter cited as Report].

4. *See* Dam, *supra* note 2, at 6.

PETROLEUM ADMINISTRATION FOR DEFENSE (PAD) DISTRICTS

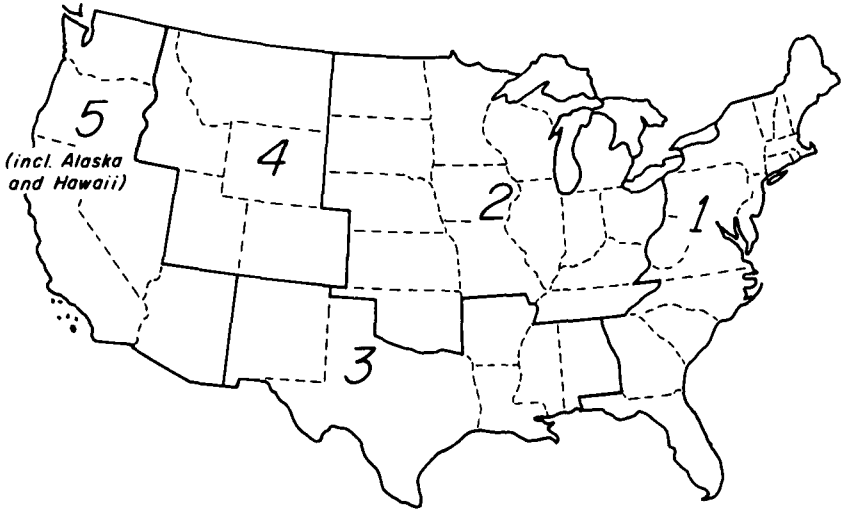

Figure 1, Source: Bureau of Mines, Mineral Industry Survey, Final Summary, 1969.

1) importers (established, larger volume importers)
2) small importers (lower volume importers with no existing record of imports prior to 1954)
3) newcomers (firms with no existing record of imports)

The allocation of quotas among classes was basically historical. This aspect of the program was significant in two respects. First, it was carried over (with modification) to the Mandatory Oil Import Program. Second, it contributed to the collapse of The Voluntary Program.

Whether any voluntary quota program could succeed, no matter what its form and structure, is a matter of speculation; but an essential element is that the participants in the program, i.e., the importers and potential importers, should regard the allocation of quotas as generally equitable.[5] Is an historical allocation equitable? Quota allocations are highly profitable to those who possess them. Quota allocations to historical importers are, in fact, rewards to persons for having imported oil when there was no restriction on its importation. For that situation to be regarded as fair or just one would

5. It is also desirable that they respect the objectives of the program, and believe the program reasonably capable of achieving those ends. This is a question of program efficiency, which we defer for consideration under the Mandatory Program.

want a statement, sanctioned in law, that it was public policy to show preference to that select group. Of course, no such preference is supposed to exist. Moreover it is not the case that alternative allocation procedures are impossible—or even difficult—to conceive. For example, quotas might be allocated according to refinery capacity, or willingness to pay for the privelege of importing, with revenues going to the general tax base rather than oil company profits. One can only conclude that allocation of quotas according to historical levels of imports by specific firms is arbitrary, inequitable, and constitutes an inherent weakness of both the voluntary program and its immediate successor the Mandatory Program.

The Voluntary Program survived until 1959. Dam, previously cited, notes four reasons for the breakdown of the Voluntary Program:

1) Noncompliance. The Voluntary Program had no enforcement mechanism[6] and simple noncompliance was widespread.

2) Newcomers. Any quota system sets up a two-price system, i.e., domestic and foreign. The more effective the quota, the greater the attraction of the foreign-priced commodity. Firms without import allocation duly responded: Requests from "newcomers" for quota allocations, plus requests for increased allocations for existing importers would have more than doubled their current imports.

3) Products. The Voluntary Import Program applied only to crude oil. Products refined from crude oil were not controlled. One would expect importers to avoid the quota by shifting the refined products instead of crude oil; as indeed they did. Residual fuel oil imports quadrupled between 1956 and 1958. Imports of unfinished oils increased 6700% from 1957 to 1958.

4) Antitrust. The Voluntary Program was said to be in disfavor within the Justice Department Antitrust Division. One company even offered fear of violating the antitrust laws as a basis for noncompliance.

THE MANDATORY OIL IMPORT QUOTA PROGRAM

In 1959, by presidential proclamation, the Voluntary Program was replaced by the Mandatory Oil Import Quota Program.[7] The Mandatory Program was established on the grounds "that crude oil and the principal crude oil derivatives and products are being imported in such quantities and under such circumstances as to threaten to impair the national security."[8] The threat sought to be eliminated was—and continues to be—a dependence of the United

6. The Buy America Act was invoked with respect to suppliers to the U.S. Government, but was not an unqualified success.

7. Presidential Proclamation 3279, reprinted in Report, *supra* note 3, at 197.

8. *Id.*

States on foreign oil supplies such that the United States might be left without adequate domestic supplies should those foreign supplies for any reason cease to be available. Given restricted imports the domestic oil industry would thus be encouraged to locate and develop domestic supplies. A corollary purpose was "to prevent imports from causing a decline in the petroleum sector of the U.S. industry that would so weaken the national economy as to impair the national security."[9]

The Mandatory Program applies to both crude oil and refined products.[10] As under the previous program there are actually two separately administered schemes, Districts I-IV (east of the Rockies), and District V (west coast). Initially, the quota set the maximum level of crude oil and products at approximately 9% of total demand as estimated by the Bureau of Mines. Product imports were not to exceed 1957 levels. In 1962 the quota changed from a demand basis to a production basis by which the maximum level of imports was set at 12.2% of domestic production. This rule restricting imports to a percent of domestic production continues with two exceptions. First, in 1972 the President has permitted on a temporary basis additional imports to Districts I to IV, and second, in District V the quota is variable, being equal to the shortfall of combined District V plus Canadian production relative to total demand in District V.

Among refineries, quotas ("tickets") are allocated as a percentage of refinery inputs, subject to (a) two modifications, (b) a swap arrangement, and (c) a "finangle" factor. These are discussed in order:

(a) (1) The sliding scale. Refineries are allocated quotas according to the volume of domestic inputs. The greater the volume of inputs the greater the *total* quota allocation, but the smaller the allocation as a *percentage of total* refinery inputs. Table 1 is the scale applicable in 1969. The percentages and classes (by volume) vary year to year

Table 1

Average b/d of inputs	Percentage allocation Districts I-IV	Percentage allocation District V
first 10,000	19.5	40.0
next 20,000	11.0	9.3
next 70,000	7.0	4.1
all additional	3.0	1.9

Source: Adapted from *Report, supra*, 12.

9. Report, *supra* note 3, at 115.

10. The program distinguishes 1) crude oil, 2) unfinished oils, 3) finished products and 4) residual fuel oil to be used as fuel. Except for residual fuel oil, all unfinished oil and finished products are, in effect, carved out of the crude oil quota.For details, *see* Report, *supra* note 3, at 9; Dam, *supra* note 2, at 15.

depending on 1) total imports available for allocation, and 2) changing policy objectives and preferences.

(2) Historical minimums. Tickets allotted to any refinery under the sliding scale are subject to a minimum allotment according to the firm's last allocation under the Voluntary Program. These historical minimums are gradually being reduced and eliminated.

(b) Exchanges. Quotas may not be sold, but may be exchanged for domestic crudes or unfinished oils.[11] This permits inland refiners and others not in a position to refine imported crudes to realize most of the value of their allotment. The dollar value of quotas to firms is easily determined from the ratio at which firms exchange domestic oil for foreign. Petrochemical firms, which receive quotas although they do not use crude oil as input (they use, rather, crude derivatives), exchange their allocation of crude for petrochemical feedstocks.

(c) Manipulation of allocation computations. Again, the principal factor in determining allocations to specific firms is the volume of a given refinery's inputs, such that quota allocations are a positive function of input volume. Thus, the larger the input "base," the larger the quota allocation. It is this "base" that is manipulated. The reasoning underlying this procedure is this: certain imports are exempted from the quota either as the result of implied or expressed policy preferences or because there is no justification for restricting them given the program's "national security" basis.[12] On the other hand, it is desired to mitigate the price attractiveness of these non-domestic sources. Consequently, certain imports which are not subject to the quota may not be counted as refinery inputs for purposes of determining quota allocations. To the extent that a refinery uses low cost exempt inputs in place of domestic inputs, its quota allocation is reduced.

EXEMPTIONS AND PREFERENCES

If the Mandatory Program is complicated by the procedure described above, it becomes positively *intricate* with a web of "exemptions" and "preferences" that may delight lawyers and confound the public.

a) Overland shipments. Quota exemptions were initially granted to imported oil shipped overland to the U.S., i.e., from Mexico and Canada.[13] Overland transport, however, is not an attractive mode for shipping the relatively modest authorized quantities (30,000 barrels

11. Exchanges between District V and Districts I-IV are prohibited.

12. For example, quite secure Canadian sources of supply. This and other exceptions to the program are discussed in detail below.

13. Subject to intergovernmental agreements as to quantities.

per day) of Mexican oil. This gave rise to "El Loophole" or "The Brownsville U-Turn," which was an arrangement whereby Mexican oil was shipped by tanker to Brownsville, Texas. The oil was landed in bond and transferred to trucks. The trucks crossed the Rio Grande into Mexico, turned around and immediately recrossed the border. The oil was then released from bond and shipped by tanker to the East Coast, whereupon it was construed to have arrived overland. This bit of nonsense, which had been devised as a matter of expediency relating to short-haul Venezuelan crudes, was discontinued in January 1971 when what amounted to a country-of-origin quota was assigned to Mexico.[14]

On the other hand, the ["maritime overland"] exemption has not been extended to shipments from Canada across the Great Lakes or to rail shipments from Canada to Ketchikan in southern Alaska because of a short inland waterway crossing by rail-car ferry.[15] The potential volume of lower cost Canadian crudes threatened to become "a gaping hole in the Mandatory Program through which could eventually flow enough crude oil to cause the Program to flounder."[16] To protect the Program, and at the same time maintain the credibility of the Program's "national security" basis, Canadian crudes were initially excluded from the refinery input base for determining quota allocations. Presently, they are subtracted from the total amount of crude oil that is permitted to flow into Districts I to IV, and a ceiling of 675,000 barrels per day is maintained on Canadian exports produced in Canada. Both rules made Canadian crude considerably less attractive.

The problem of how to treat Canadian crudes is yet more complex: The so-called "Northern Tier" refiners had been built in the U.S. along the Canadian border in anticipation of using Canadian oil. To reduce the competitive disadvantage that would otherwise have been imposed on these refineries, they were granted higher historical allocation, but this higher allocation was also reduced at a more rapid rate than for other refineries. The treatment of Canadian oil generates a feeling for the awkwardness inherent in attempting to meet vaguely defined objectives via a quota system.

b) The sliding scale and the historical minimums embody an implied set of preferences. The sliding scale favors smaller refineries by a considerable margin over larger. The historical minimum is subject to the same criticisms attributed to the principle under the

14. Allocations of the Mexican quota to U.S. refineries is left to Pemex, the Mexican National petroleum company.

15. Report, *supra* note 3, at 10.

16. Dam, *supra* note 2, at 29.

Voluntary Program. Although, this appears to be a preference more tenuously held since it is being eliminated in stages.

c) Petrochemicals. The oil import quota program is an attempt to distort the allocation of resources that a free market would otherwise direct. This distortion reverberates through the economy, affecting persons, commodities, industries and prices that are outside the target area of the original decision to intervene in the market process. These secondary impacts may run counter to other, equally pressing, national objectives.

The petrochemical industry uses certain products of the petroleum industry as feedstocks. The Mandatory Oil Import Quota Program, by maintaining domestic prices higher than the world price, detrimentally affects the international competitive position of the petrochemical industry.[17] The petrochemical industry is a major contributor to the U.S. balance of payments (net exports in excess of one billion dollars in 1971).[18] To ameliorate deleterious balance of trade effects, quota tickets were assigned directly to certain petrochemical firms, albeit in a rather unsystematic manner, i.e., "through what is in effect negotiation between the industry and government officials."[19] Several problems arise in determining how the petrochemical industry should share in the quota program.

What portion of the total quota should be allocated to the petrochemical industry? This involves, among other problems, identification of the industry. Petrochemicals, of which there are several hundred, are manufactured both by oil companies and chemical companies. The administrative solution was to designate as "petrochemical plants" those which converted by chemical reaction more than 50% by weight of total plant inputs to petrochemicals. According to this formula a plant which converted 49% of its inputs to petrochemicals was not a petrochemical plant; whereas a plant which converted 99% of inputs was no more of a petrochemical plant than its 51% cousin. Once over the 50% qualification marker the ratio of inputs to petrochemical output did not matter, and allocations were based on *total* inputs, i.e., petrochemical feedstocks and everthing else that constituted plant inputs.

If the input basis for allocation is unsatisfactory, an output basis is no more convenient. Petrochemicals vary widely by weight and volume and are not easily, if at all, comparable. Clearly, the situation of the petrochemical industry under the Mandatory Oil Import Quota Program is ripe for revamping, but we see nothing in the present

17. And, of course, all other industries with petroleum.
18. Bureau of the Census, Dep't of Commerce, Census Reports FT 410, FT 246 (1972).
19. Report, *supra* note 3, at 13.

program or in its development that suggests that a consensus will be reached among the industries, government, and the public.

d) Puerto Rico and the Virgin Islands. Both Puerto Rico and the Virgin Islands have been brought within the import quota system to the extent that they are generally prohibited from becoming loopholes in the import quota system. However, several petroleum refineries have been given additional allocations and the right to export into the continental United States when the direct effect of such action was to create additional employment and spur economic development, and the companies additionally agreed to pay a per barrel fee into a special conservation fund.

e) Low sulfur bonus. In 1967, a presidential proclamation authorized the additional allocation of crude oil on a bonus basis to firms manufacturing low sulfur content residual fuel oil in the United States specifically to meet local pollution abatement requirements.[20] Under this authorization, District V has been granted several of these bonuses under different conditions. Bonuses in Districts I to IV have been granted, suspended and generally inactivated. However, another type of allocation has occurred in Districts II to IV in which allocations for the importation of low sulfur residual fuel were granted directly to electric utilities in 1970. Later in the year, terminal operators in District I who were in the business of selling No. 2 residual fuel oil were also granted allocations directly for the importation of residual fuel made from Western Hemispheric crude.

AN ANALYTICAL DESCRIPTION OF DOMESTIC CRUDE OIL MARKET STRUCTURES

i. *"District V"*

In order to determine the social costs of the Mandatory Oil Import Quota Program a brief description of the market structures that result from this program is important.

In PAD District V, domestic production is fully protected from foreign competition up to a specified domestic price in these states. This price depends upon the quantity of various crude oils. If the quantity of oil demanded exceeds the quantity of oil supplied by domestic plus Canadian producers, then foreign oil is permitted to enter District V to meet the *excess* quantity demanded in this district at the historical domestic price. It is important to note that Canadian producers are not completely free to export unlimited quantities of crude oil, since they are restricted by the existing capacity of the Trans-Mountain Pipeline which transports oil from Edmonton to

20. Report, *supra* note 3, at 14; Dam, *supra* note 2, at 40-41.

Puget Sound. Finally, inter-district flows of oil from states east of the Rockies into District V have been negligible. This is of course necessary if the practice of operating two distinct programs is to continue.

Figure 2 depicts diagrammatically the effect of these market restrictions on the supply function and the equilibrium price in District V. Let S_d^V be the marginal cost curve of domestic producers as well as Canadian producers. At a price of P_d per barrel the quantity of oil demanded exceeds the quantity of oil supplied by an amount equal to Q_F. This is the amount of foreign oil which is permitted to be imported into District V. The supply curve for foreign oil (S_F^V) is perfectly inelastic for amounts in excess of Q_F as imports are restricted to that quantity. This is true even if the marginal cost of foreign oil in amounts greater than Q_F is lower than domestic cost (for simplicity we

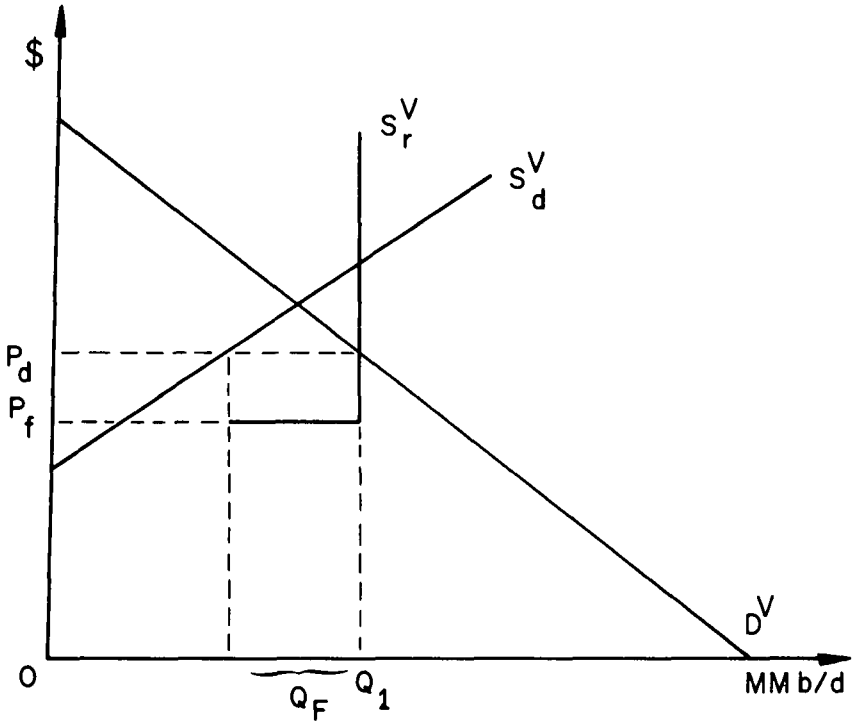

Figure 2
Domestic and Foreign Supply Schedules

have assumed that the marginal and average costs of foreign oil are equal).[21]

The resultant market supply schedule under District V's quota system is the function defined by segments A B C E F in Figure 3. If

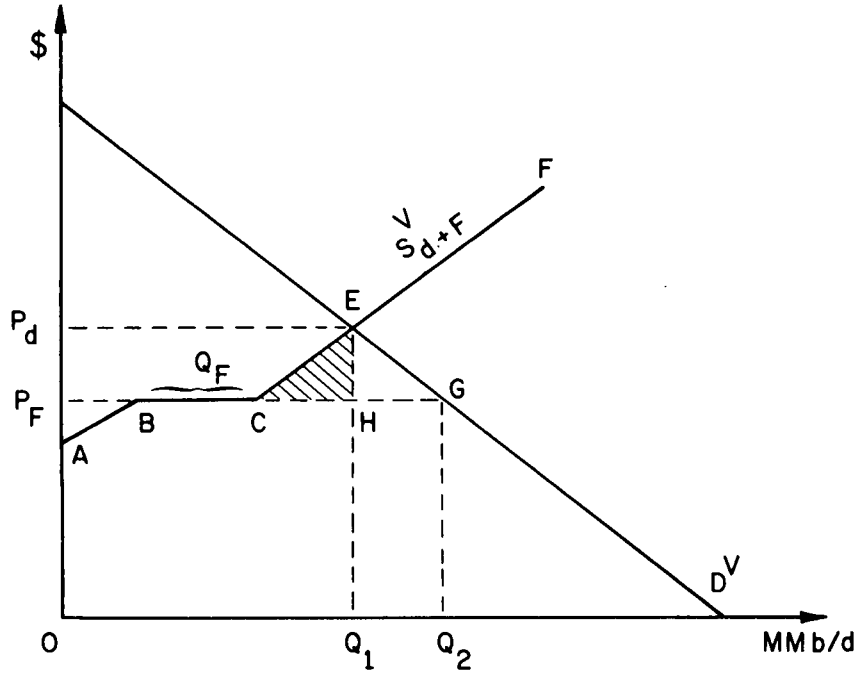

Figure 3

Demand and Supply District V

quota restrictions were removed and all foreign oil had costs represented by the completely elastic portion of the S_F^V curve in Figure 2, equivalent to segment B-C in Figure 3, the new market equilibrium point would be reached at point G. Quantity would increase from Q^1 to Q^2 and price would decline from P_d to P_f. This latter free market situation would result in a decline in domestic production at the same time total consumption increased, since some domestic oil would not be competitive at the world price which is the cost of foreign oil. The resulting economic efficiency gains would have two components: first, the costs of supplying that quantity which is

21. Since a large proportion of the cost of foreign oil is tanker costs and royalty taxes, the assumption that marginal and average costs are equal is probably close to being accurate.

consumed with the quota system in effect would be decreased by an amount represented by area CEH. Second, consumption would increase and prices fall yielding consumer benefits represented by area HEG. Looked at in another way the present quota system has social costs associated with it equal to the sum of these two components, or area CEG.

ii. *"East of the Rockies"*

The supply curve of crude oil east of the Rockies, that is PAD Districts I to IV, is derived somewhat differently, First, the amount of crude oil permitted to be imported is a percentage of estimated production in Districts I-IV. Until at least the end of 1971, that percentage was 12.2%.[22] The actual permitted volume of imports has been increased frequently since then in response to realized or anticipated shortages. While announcements since 1971 no longer refer to a fixed percentage of District I-IV production, neither has the principle been explicitly abandoned. It appears that policy makers have been making a series of *ad hoc,* temporary adjustments to cope with changing market conditions. Until such time as the policy is explicitly changed, importers and refiners may be expected to act as if these adjustments are merely temporary.

The second distinction between District V and Districts I-IV is that since 1971 the overland exemption has ended for Canadian crude and it is treated as an import East of the Rockies.

Third, domestic oil is restricted by a system of state demand prorationing restrictions, which are also presently and apparently temporarily under revision. Whereas production of individual wells was formerly regulated administratively, individual well production is now set at "100% allowable" in most or all of the regulating states. It is important to note that a "100% allowable" is not necessarily the same as maximum efficient productive capacity. Therefore, even when allowable levels of domestic production are set at "100%" levels, domestic production may be less than that which would occur if prorationing restrictions were removed entirely. The flexibility of the prorationing restrictions to the "100%" limit appears to be another instance of temporary adjustment to market conditions.[23]

The effect of the domestic restriction is that the individual marginal cost curves of each producing well, field, or firm can not simply be added horizontally as we normally assume to be the case in

22. Proclamation 4099, 36 Fed. Reg. 246 (1971).

23. If there were no intention ever to restore effective prorationing, one would expect repeal of the so-called "Connally Hot Oil Amendments," the legislation which permits state demand prorationing. In the absence of movement in that direction, the market continues to be influenced by prorationing.

a competitive industry. Instead, each producing unit is assigned a certain allowable level of production per month. The result is that some low cost wells are sometimes idle, while higher cost wells are producing. Firms will produce from each well the allowable quantity of oil as long as the marginal costs of a barrel of oil are less than the market price. Consequently, the domestic supply function is usually above the function that would prevail in the absence of prorationing restrictions.

Furthermore, under such circumstances the cost of production will also exceed the production costs that would be expended in the absence of prorationing. As a result of prorationing there is a loss in economic efficiency, a higher price paid by consumers, and a lower quantity of oil consumed in each time period. Offsetting these deleterious economic effects, it is averred that more domestic oil is ultimately recovered than would otherwise be the case.[24]

In Figure 4, we show the supply curve for Districts I to IV that would be derived by horizontally adding the domestic supply curve (with the market demand prorationing restrictions) and the foreign supply curve (which is assumed to include Canadian crude oil and to be based upon constant marginal cost). We label this market supply curve s_{d+F}^{I+IV} and to avoid confusion, the exact labeling of the various segments that make up s_{d+F}^{I+IV} is HABCIJ. The fact that domestic supply is restricted by quota and prorationing to the equilibrium quantity, Q^1 minus the quantity of foreign oil, q_F^{ER}, results in an inelastic supply curve for both domestic and foreign oil at the equilibrium level, as indicated by the IJ segment.

Prorationing and the quota system east of the Rockies depend upon one another for effectiveness. If the quota system were to be removed, it is unlikely that the prorationing system as it is presently operated would be viable, since lower cost foreign oil suplies would displace prorationed domestic supplies. To the extent that this is true, removing the quotas east of the Rockies would reduce the cost of producing some domestic crude oil. This would be represented by area HAB in Figure 4. Additionally, a substantial portion of the domestic crude oil transported into east coast ports is presently carried in U.S. tankers, due to the restrictions of the Jones Act.[25] Since these tankers are more costly than foreign tanker displacing domestic

24. Although a discussion of the pros and cons of prorationing is stepping somewhat outside the main purpose of the present discussion, it is important to note that systems which will preserve the economic efficiency rule of least cost production and maximization of the ultimate recoverable crude oil have been discussed at great lengths elsewhere. The practice is called unit field production. *See* Davidson, *Public Policy Problems of the Domestic Crude Oil Industry*, Am. Econ. Rev., March, 1963, at 53, 85-108.

25. Jones Act, 46 U.S.C. 861 *et seq.* (1964).

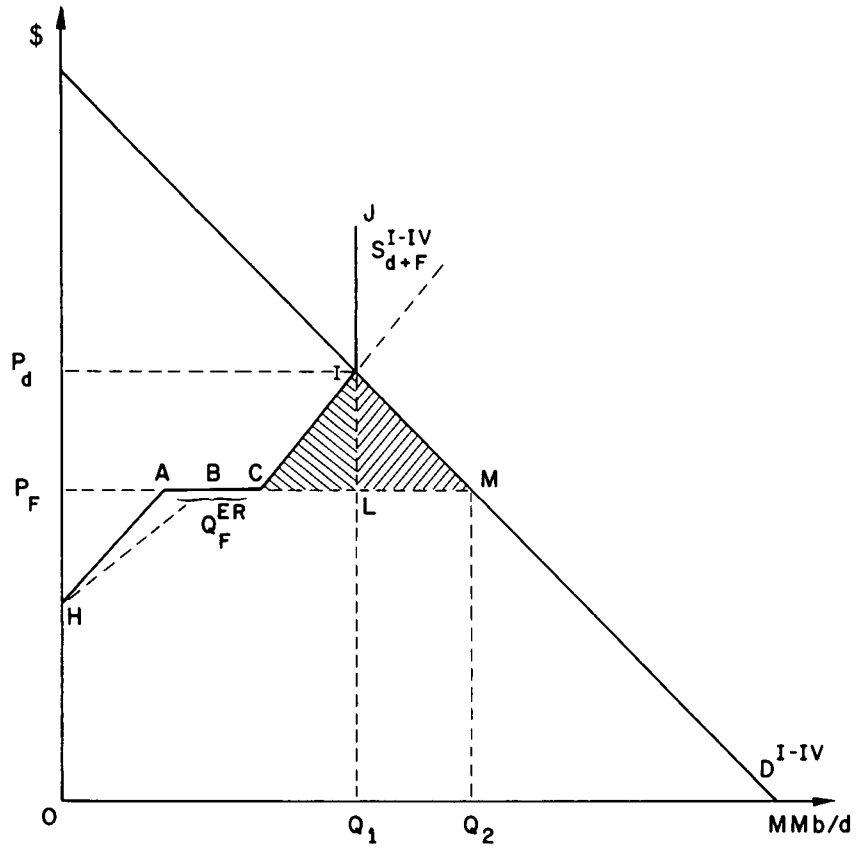

Figure 4

Demand and Supply East of the Rockies

crude in east coast ports will yield another gain to economic efficiency in the form of reduced costs.

A second component of benefits that would result from removing quotas would be the cost savings that might accrue from displacing higher cost domestic crude oil with lower cost foreign crude oil at the present level of consumption. The cost saving results from a breakdown of the state prorationing system which, as noted above, depends on the quota program for its effectiveness. This component would be represented by area CIL in Figure 4. Finally, since reduced price would be likely to result in increased consumption there would be additional consumer benefits represented by area LIM.

iii. *Market Composition*

In Tables 2 and 3, we show the actual effect of the market restrictions described above on the quantity of oil supplied to different U.S. markets in 1970 by source of supply. The somewhat surprising result is that with very different formulas for setting the level of imports, the ratio of imports to domestic production was the same in both regions of the country in 1970 at 12.2% [note that this calculation depends upon a broader definition in District V, which includes the Trans-Mountain capacity, which is considered safe for national security purposes].

Nationally the actual imports of oil were slightly more than 30% of domestic production in 1970. However, only a small percentage (4.2%) of domestic consumption in 1970 came from North Africa or the Persian Gulf. And about half of this came from the non-Arab country of Iran. Given the national security justification of the Mandatory Oil Import Quota Program, the fact that only about two per cent of the consumption in the United States comes from this relatively insecure part of the world should be noted.

Table 2

District V Sources of Supply in 1970
(thousand of barrels per day)

	Daily Total		Cumulative Daily Total
District V Production	1,304		1,304
Other Domestic Sources	193		1,497
Canadian Overland (Exempt)	220		1,717
Venezuela	100		1,817
Persian Gulf	115		1,932
Indonesia	100		2,032
Less Exports to South East Asia (Taiwan)	(78)		1,954
Ratio of Net Foreign Imports less 50 barrels of Indonesian Supply to District V plus Canadian Exempt Supply	$\frac{(100 + 115 + 50 - 78)}{(1{,}304 + 220)}$	=	12.2%
Total Actual Imports (exc. Canada) / (Domestic Production in District V + Canadian Production)	= $\frac{237}{1524}$ = 15.6%		
Total Actual Imports / Domestic Production in District V	= $\frac{457}{1304}$ = 35.0%		

Sources: Bureau of Mines, U.S. Department of Interior, "Mineral Industry Surveys," Washington, D.C. (various year-end summary issues) such as December 1968, December 1969, 1969 Final Summary and June 1971) . . . ; and Office of Oil and Gas, Map and Summary of International and Interregional Flows of Crude Oil in 1970, Washington, D.C., 1971.

Table 3

"Districts I to IV Sources of Supply in 1970"
(thousands of barrels daily)

		Daily Total	Cumulative Daily Total
Districts I to IV Production		10,007	10,007
Other Domestic Sources		24	10,031
Other Domestic Outflows		(193)	9,838
Canada (includes 35 above the 1970 annual limit set by President Nixon)		430	10,268
Mexico		45	10,313
Caribbean (includes 34.8 to Puerto Rico outside the system		1,550	11,863
Other Western Hemisphere		225	12,088
Free Europe		120	12,208
North Africa		220	12,428
West Africa		80	12,508
Middle East via pipeline		25	12,533
Middle East via the Cape of Good Hope		260	12,793
Sum of foreign imports less 1,513 in residual fuel oil, less Canadian above the limit (35), less exports (142) and less Puerto Rico (34.8) divided by domestic production in Districts I to IV	$\frac{1222}{10007}$ = 12.2%		
Total actual imports Domestic Production in Districts I to IV	= $\frac{2995}{10007}$ = 29.5%		

Sources: Bureau of Mines, U.S. Department of Interior, "Mineral Industry Surveys," Washington, D.C. (various year-end summary issues) such as December 1968, December 1969, 1969 Final Summary and June 1971) . . . ; and Office of Oil and Gas, Map and Summary of International and Interregional Flows of Crude Oil in 1970, Washington, D.C., 1971.

This statement is not made to minimize the prospects of future dependence on Persian Gulf sources of supply as U.S. demand increases. (We show some recent forecasts in Appendix B.) In fact, there are several reasons why the Persian Gulf area (especially the non-Arab country of Iran) may become a major source of U.S. oil. First, the other industrialized countries of the free world, most notably western Europe and Japan have an even faster rate of growth in demand than the U.S. These areas, too, will compete for secure, non-Arab sources of supply, which cannot be expected to meet the entire free world demand. Second, the production costs in the Persian Gulf are among the lowest. Additionally, a growing world oil tanker industry is making advances in: (1) improved speed, (2) efficiency and (3) capacity, which tend to reduce the transportation costs of these more distant sources of supply. Finally, the prospect of increasing

taxes and demands for participation and/or ownership by host countries in the petroleum operations and profits, means that foreign oil is more valuable for the U.S. and the oil industry today than at some point in the future, a principle known popularly as making hay while the sun shines.

ESTIMATING THE SOCIAL COST OF THE MANDATORY OIL IMPORT QUOTA PROGRAM

By using the analytical descriptions of the domestic markets for crude oil which were described in the previous section and the prices, costs and supply schedules presented in Table 4 and Appendices A, B and C respectively, we can estimate the social cost, amount of subsidy and equity effects of the present Mandatory Oil Import Quota

Table 4

1971 Crude Oil Prices in Various Markets

Market	Quality	Price per Barrel	Source
New York	30-30.90 API	$4.14	Louisiana South plus gathering costs of 14¢ and transportation of 45¢.
Los Angeles	30-30.90 API California sulfur range 1% to 2%.	$3.43	Signal Hill plus gathering and transportation costs of 5¢.
Chicago	26-26.90 API	$3.89	Louisiana South plus gathering costs of 9¢ and transportation of 25¢.
South Louisiana (Wellhead)	30-30.90 API (less than .5% sulfur).	$3.55	Platt's Crude Oil Summary Aug. 25, 1971.
Tokyo	Average of all Crudes Imported.	$1.83	Platt's August 19, 1971.
Canada (Eastern)	Average of all Crudes Imported Venezuela	$1.98 $2.08	Platt's for April 1, 1971 listings.
West Germany	Average of all imports.	$3.03	Platt's as of May 1971.
United Kingdom	Average of all imports.	$2.74	Platt's as of June 1971.
Australia	Average of all imports.	$1.53	Platt's as of June 1971.

All prices are based upon data published in recent editions of *Platt's Oilgram Price Service*, with U.S. prices based upon Crude Oil Supplement of August 25, 1971, Volume 49, No. 164-B. Costs are based upon the Cabinet Task Force, (1970) for Chicago and New York and the State of Alaska, (1971) and Tussing, et. al. (19710.

Program. These calculations will be made at two points in time—year end 1970 (the last year for which adequate actual data is available) and 1975 using various forecasts and different assumptions about 1975. Separate calculations will also be made for each of the two separately regulated domestic markets, District V and the east of the Rockies market or Districts I-IV.

a. The Impact of Quotas in District V

At year end 1970 the average price of crude oil was $3.43 per barrel in District V (from Table 4). The price that would be expected if quotas were dropped would be the world price or $2.42 per barrel (i.e., $2.30 from Table 1, Appendix A, plus 10.5¢ U.S. Tariff, plus 1¢ additional transportation cost to Los Angeles). Since oil consumption in 1970 was about 1.95 million barrels per day or about 713 million barrels per year in District V, the total subsidy from consumers of oil to producers of domestic oil and refiners of foreign crude oil was about $720,000,000 in 1970. ($1.01 x 713 million barrels).

To determine the amount of domestic oil that is produced at real costs in excess of the foreign crude alternatives, we can use the supply schedule derived in Appendix C, and the real cost of foreign crude. A "without quota" point of reference for the latter is the Los Angeles price of Persian Gulf crude less federal excise tax, i.e., $2.31. The domestic price of crude at Los Angeles at year end 1970 was $3.43 per barrel (from Table 4). At the 1970 level of consumption, about 550,000 barrels per day, and a difference in real costs of $1.12 per barrel, we can calculate the first component of social costs—corresponding to the triangular area CEH in Figure 3. These costs equal the amount of resources that are needlessly expended to produce the same quantity of crude oil at the current price and can be calculated by:

$$\text{social costs (component 1)} = \frac{1}{2} \cdot \frac{\$1.12}{\text{barrel}} \cdot \frac{550{,}000}{\text{day}} \cdot \frac{365 \text{ days}}{\text{year}}$$

$$\approx \$112{,}000{,}000 \text{ per year}$$

If it is assumed that the slope of the demand schedule is equal to the slope of the supply schedule (in terms of elasticity in equilibrium this implicitly assumes the two have an elasticity of about 1.1), then we can also calculate the social costs that result from foregone consumer surplus. Since a higher price and lower quantity are caused by restricting competition this is a real loss to society. Assuming the slopes of demand and supply are equal means that the social cost of this second component equals the first or $112,000,000 per year. Should the oil supply schedule be less elastic in equilibrium than

demand this is an underestimate of the second component of social cost, and vice versa.

To calculate the size of the subsidy and social costs of the Mandatory Oil Import Quota Program in 1975 we can use the same approach but several variables may be expected to change in value. In Appendix A the future cost and price of foreign crude are estimated using the presently contracted crude price increases and an assumption that new technology will reduce the transportation costs of foreign crude oil. The expected price and real cost of foreign crude are \$2.30 and \$2.19 per barrel for these assumptions in District V in 1975. If the present tanker technology is not improved, costs will not fall and for this assumption the foreign price and real costs are expected to be \$2.48 and \$2.59 per barrel in District V in 1975.

The level of consumption is estimated to grow to 2.4 MMb/d in 1975 in District V. We will calculate social costs and the size of the subsidy for two different cases. First we will assume that domestic production will not increase, since domestic prices will be assumed to be fixed at their year end 1970 level. Therefore, under this first case all new demand will be supplied by foreign crude oil. Under this case the social costs of the unnecessary expenditures to produce the same quantity of crude oil at the current price (component 1) will change only slightly from their 1970 level, increasing if new technology in transportation is implemented and decreasing if current technology is unchanged. Since demand has grown, we are certain that the second component of social costs, foregone consumer surplus benefits, will be greater in 1975 than as estimated in 1970. We can therefore be certain that the 1970 estimate of total social costs, \$224,000,000 per year in District V will be an underestimate of 1975 District V social costs.

On the other hand, we are also reasonably certain, even assuming that District V prices are fixed, that the size of the subsidy from consumers to oil companies will increase, since the total annual consumption is forecast to increase. Using new tanker technology the price of foreign crude oil was expected to fall in 1975 relative to 1970, which will also increase the size of the subsidy. However, with the old technology tankers, foreign crude prices will increase, thus tending of offset the growth in consumption. Using the same approach as outlined above, the 1975 District V subsidy, assuming domestic prices are constant, can be calculated as:

$$\text{New Tanker Technology} \quad \frac{2.4 \text{ million barrels}}{\text{day}} \quad \frac{365 \text{ days}}{\text{year}} \quad \frac{(\$3.43-\$2.30)}{\text{barrel}}$$

$$\approx \$990 \text{ million per year}$$

$$\text{Old Tanker Technology} \quad \frac{2.4 \text{ million barrels}}{\text{day}} \quad \frac{365 \text{ days}}{\text{year}} \quad \frac{(\$3.43\text{-}\$2.59)}{\text{barrel}}$$

$$\approx \$733 \text{ million per year}$$

An alternative method to meet growth in demand would be for domestic supply to expand in response to an increase in the domestic price of crude oil. Using the supply schedules derived in Appendix C, the price of domestic crude oil would have to increase by about 90¢ per barrel in order for domestic production to expand to meet the expected growth in demand. This means that the 1975 price would increase to $4.33 per barrel in District V. Under this case both the social costs and size of the subsidy will increase significantly relative to the 1970 estimates. Using the same procedures as before, social costs and subsidies can be calculated as follows:

Social Costs

Component 1

$$\text{New Tanker Technology} \quad \frac{1}{2} \quad \frac{(1.0 \text{ million barrels})}{\text{day}} \quad \frac{365 \text{ days}}{\text{year}} \quad \frac{(\$4.33\text{-}\$2.19)}{\text{barrel}}$$

$$\approx \$391 \text{ million per year}$$

Assuming equal elasticities of supply and demand, component 1 equals component 2 and total social costs equal $782 million per year.

$$\text{Old Tanker Technology} \quad \frac{1}{2} \quad \frac{(1.0 \text{ million barrels})}{\text{day}} \quad \frac{365 \text{ days}}{\text{year}} \quad \frac{(\$4.33\text{-}\$2.48)}{\text{barrel}}$$

$$\approx \$338 \text{ million per year}$$

Assuming equal slopes for demand and supply total social costs equal about $676 million per year.

Subsidy

$$\text{New Tanker Technology} \quad \frac{(\$4.33\text{-}\$2.30)}{\text{barrel}} \quad \frac{2.4 \text{ million barrels}}{\text{day}} \quad \frac{365 \text{ days}}{\text{year}}$$

$$\approx \$1.78 \text{ billion per year}$$

$$\text{Old Tanker Technology} \quad \frac{(\$4.33\text{-}\$2.59)}{\text{barrel}} \quad \frac{2.4 \text{ million barrels}}{\text{day}} \quad \frac{365 \text{ days}}{\text{year}}$$

$$\approx \$1.52 \text{ billion per year}$$

The subsidy and social costs calculations presented above for District V in 1970 and 1975 are summarized in Table 5.

Table 5

Summary of the Social Costs and Subsidy of the Mandatory Oil Import Quota Program in District V in 1970 and 1975

	(Annual Costs) Social Costs	Subsidy
1970	$224 million	$720 million
1975		
(a) No domestic price change all new demand met by foreign crude[a]		
(1) Old Tanker Technology[a]	$219 million	$733 million
(2) New Tanker Technology[a]	$234 million	$990 million
(b) No increase in foreign crude imports, domestic price increase of 90¢ per barrel		
(1) Old Tanker Technology	$676 million	$1,520 million
(2) New Tanker Technology	$782 million	$1,780 million

[a]Rough estimates based upon the change in real costs per barrel

b. The Impact of Quotas East of the Rockies

By making use of the analytical model described above, the prices, costs, levels of consumption described in the attached appendices, and a methodology similar to that used for District V can be applied to Districts I to IV. In order to apply such a procedure, average domestic and foreign prices must be calculated due to the difference noted above for the three principal markets east of the Rockies, New York, Chicago, and the Gulf Coast. Using 1970 regional consumption estimates these are derived as follows:

Region	Consumption	Price	Foreign Real Cost
New York	46%	$4.14 per barrel	$2.31 per barrel
Chicago	32%	3.89	2.56
Gulf	22%	3.55	2.31
	100%	$3.93 per barrel	$2.39 per barrel;
		Foreign price =	$2.50 per barrel

The demand in Districts I to IV in 1970 was 12.8 million barrels per day. Of this total about 3 million barrels were imported each day. Based on the supply schedule derived in Appendix C, about 4 million barrels per day of domestic crude were produced at costs below the average real cost of foreign crude, or about $2.39 per barrel. In 1975, demand in Districts I to IV is expected to grow to 15.6 million barrels per day at current prices. Consider two cases: first, the situation in which all the increase in domestic consumption comes about without a price increase due to an increase in foreign imports of one million

barrels of oil per day and an increase in domestic production in Alaska all of which is assumed to be supplied to the oil short markets east of the Rockies markets at real costs below the cost of foreign crude oil. Alaskan oil will presumably supply about 1.8 million barrels per day in 1975. An equivalent to this case is to assume that all the new demand is supplied by low cost foreign crude with no increase in domestic price.

Alternatively, consider a case in which demand prorationing restrictions are eliminated to permit an increase in domestic production to meet an increase in domestic price. Under this case foreign imports will presumably remain at their 1970 level and we calculate the size of the price increase required to expand domestic output by 2.8 million barrels per day, i.e., about $.48 per barrel; thus the 1975 price would be $4.41 per barrel. Interestingly, the *Oil and Gas Journal* of May 10, 1971, published a forecast of $4.50/bbl by 1980. The size of the subsidy and social cost table were calculated for these two cases in 1975. The calculations are summarized in Table 6. Note that the resource costs of the Jones Act and state prorationing are *not*

Table 6

Summary of the Social Costs and Subsidy of the Mandatory Oil Import Quota Program in Districts I to IV in 1970 and 1975

	(Annual Costs)	
	Social Cost	Subsidy
1970	$3.26 million	$ 6.68 billion
1975		
(a) No Domestic Price Increase expand Alaskan production and Foreign Inputs		
Imports		
(1) Old Tanker Technology[a]	$2.96 billion	$ 7.20 billion
(2) New Tanker Technology[a]	$3.56 billion	$ 8.85 billion
(b) Domestic Price Increases by 48¢ per barrel to expand domestic production outside of Alaska		
(1) Old Tanker Technology	$5.88 billion	$ 9.90 billion
(2) New Tanker Technology	$6.80 billion	$11.56 billion

[a]Approximate adjustments to reflect changes in tanker technology. Note also that part of the decline in social costs is due to supplying east of the Rocky markets with low cost Alaskan crude at the rate of 1.8 million barrels per day in 1975.

included in the social cost estimates. However, since both contribute to higher prices east of the Rockies, we must not attribute the full subsidy from consumers to oil companies to the Mandatory Oil Import Quota Program. In the case of the Jones Act, which would be a subsidy from consumers to the domestic maritime industry, we can determine the approximate percentage of the subsidy that is due to this restriction. The average price difference between domestic and foreign crudes is about $1.50 per barrel. An outside estimate of the extra cost of transporting domestic crude due to the Jones Act is 25¢ per barrel. About 50% of the crude east of the Rockies might be affected by the Jones Act, therefore something less than 1/12 $(= \frac{.25}{1.50} \times \frac{1}{2})$ of the subsidy calculated in Table 6 should be attributed to the maritime industry, the remainder goes to oil companies and is due to the joint restrictions of supply caused by the Mandatory Oil Import Quota Program, and the residual to the effects of state demand prorationing which continue to be felt.

c. National Totals and Policy Implications

Table 7 summarizes the social cost and subsidy calculations for the nation in 1970 and 1975. Both the program's social costs and its

Table 7

Summary of the Social Costs and Subsidy of the Mandatory Oil Import Quota Program for the Nation in 1970 and 1975

	(Annual Cost)	
	Social Cost	Subsidy
1970	$3.5 billion	$ 7.4 billion
1975		
(a) No Domestic Price Increase		
(1) Old Tanker Technology	$3.2 billion	$ 7.9 billion
(2) New Tanker Technology	$3.8 billion	$ 9.8 billion
(b) Domestic Price Increase		
(1) Old Tanker Technology	$6.6 billion	$11.4 billion
(2) New Tanker Technology	$7.6 billion	$13.4 billion

resultant subsidy are expected to increase quite significantly in 1975 relative to 1970. Also, if domestic price increases are used to hold the percentage of foreign crudes down to levels approximately equal to their present levels, both values can be expected to almost double in 1975 relative to 1970.

On the other hand current (1972) administration policies are answering short run growth in demand by gradually increasing the amount of foreign imports.[26] Since this is a gradual addition to supply

26. *See* reports published during the summer of 1972 in the Washington Post, Wall Street Journal and other sources of the Nixon administration plans to selectively increase oil import quotas on an interim basis.

the effect of the supply restrictions in keeping the price high will be undiminished. Present policies, which will result in an increase in foreign dependence in any case, will result in greater social costs and subsidies, and could be replaced immediately by dropping foreign restrictions and thus preventing further inefficient use of resources of more than $3 billion per year and consumer subsidies to oil companies of about $9 billion per year.

An additional clarification about present and future conditions is in order: when foreign taxes are treated as real costs to the U.S.—not simply intergovernmental transfers—the average cost of U.S. oil ($1.90 per barrel as calculated in Appendix D) is actually lower than the estimate for foreign crude made above. This was also noted by Stauffer[27] since economic benefits and costs are determined from marginal rather than average costs. This finding, however, does not alter the conclusions of the preceding analysis.

The fact that the recent increase in taxes paid to foreign governments (resulting from higher posted prices) has resulted in higher average real cost does, however, represent a significant change in relative cost.

The analysis in this paper assumes that the relative costs of foreign and domestic oil would be constant through 1975, which depends on the tax and royalty payments extracted by the OPEC countries from U.S. buyers. These payments are based on posted prices, not the actual f.o.b. price of oil.

In a competitive world market one would expect purchasers of foreign oil to resist such price increases as part of the ordinary bargaining process between buyers and sellers. But because U.S. oil companies receive a credit on their U.S. corporate income tax for payments to foreign governments, the additional foreign tax bite is rather less painful and proportionately less resisted. Such changes in relative prices may be readily incorporated into this analysis, although enormous complexity is involved in the determination of a single estimate for social cost.

The policy which seems more likely given past history of government regulations in the oil industry is for some increase in domestic price to prevent a loss of markets to foreign competition. If this alternative is selected, the present social costs and subsidy will nearly double in the five years from the publication of the Cabinet Task Force Report to 1975. The program will require the expenditure of non-productive resources of about $6 billion in 1975 under this latter case. It is useful to compare such a cost with the intended benefit of

27. Estimated Economic Cost of U.S. Crude Oil Production, a paper by T. R. Stauffer presented to the Society of Petroleum Engineers, San Antonio, Texas, Oct., 1972.

the program, national security. The Cabinet Task Force calculated that as an alternative to the quota system oil equal to a one-year supply of foreign consumption could be purchased and stored in either steel tanks or salt domes. It estimated the costs of such alternatives at 40¢ to 73¢ for tanks and 19¢ to 45¢ for domes.[28] Assuming that about 30% of the total consumption would be imported in 1975, this means that even if the cost of storage was to increase to $1.00 per barrel of annual equivalent of foreign crude, storage still costs less than $2 billion per year and saves from about $1.5 to $4.5 billion per year in real resources.

Considering the second justification of the Mandatory Oil Import Quota Program, protection of domestic production, it should be noted that this could be accomplished in a more equitable manner. First, a tariff program could replace the current quota program. This would keep the domestic price high but would also transfer to the treasury some of the subsidy now going to oil companies and refineries. This would reduce the need for new taxes in 1975 by about $4 billion and still leave the industry subsidized for its domestic production since prices would be kept high.

A tariff would also make the price in Los Angeles and New York the same for foreign crude oil. At the present time prices are some 70¢ per barrel higher in New York due to the Mandatory Oil Import Quota Program in conjunction with state demand prorationing and the Jones Act. This inequity, which falls most heavily on east coast consumers, would be removed by a federal tariff applied equally to all foreign crude oil imports. The separate schemes now used under the present two part quota system could be replaced by an equally applied tariff.

In closing, it should be noted that if the costs of the present program as described above are considered too large relative to the benefits of the program, i.e., national security and protection of domestic production from competition, then a final policy alternative would be to drop the Mandatory Oil Import Quota Program entirely and allow the competitive laws of the free enterprise capital system, unfettered by bureaucratic decision-making, to determine the resultant market price and quantity of oil. Such a decision would save from about $3.25 billion to $7.5 billion per year in real resources in 1975 and result in savings to consumers of about $8 billion to $13.5 billion per year in 1975.

28. Report, *supra* note 3, at 299-309.

Appendix A
Cost of the Alternative Source of Supply

To calculate the real cost of a foreign crude oil, a specific reference crude, Iranian Light 34° API, has been selected. In Table A-1 this cost is derived. In determining the real cost of foreign crude oil to the United States, and adopting a national efficiency perspective, taxes paid to foreign governments represent real costs for the United States, while taxes paid to governments within the country are monetary transfers. [The national efficiency perspective, it should be noted, lends an upward bias to the estimate of real cost. As noted, *infra*, a world efficiency reduces the estimate of real costs, but still not to zero.] The reason for this conclusion is that payments made by oil companies to different state treasuries reduce the welfare of oil company owners, but this is offset by benefits to taxpayers. Such transactions are usually considered transfers of income within an economy rather than real resource costs. When tax payments are made to residents of another country, this is not the case. At some point in the future, such tax receipts may be used to demand real goods or services from the U.S. economy, and as such, would represent real costs to this country. Therefore unless a world efficiency perspective which took into account comparative advantages as opposed to a national efficiency perspective, were to be adopted, such a levy by oil producing countries must be considered real costs to the importing economy. It should be noted that by asymmetrically treating foreign taxes as real cost, all estimates of the social cost of the Mandatory Oil Import Quota Program made in the text above are understated.

Tariffs paid to the U.S. Treasury (approximately 10.5c per barrel) are monetary transfers. Accordingly, by subtracting U.S. taxes and including taxes paid to producing countries, the real cost of a barrel of oil, using Iranian Light (34° API, 1.4% sulfur) as a reference crude, is $2.13 in 1975. An additional adjustment is necessary to make the Iranian Light reference crude comparable to the quality of domestic oil that will be used for comparison purposes (30° API) (degree API). This means that the average cost of the lighter Iranian crude would be $2.07 per barrel.

TABLE A-1

Average Costs for Persian Gulf Oil
Delivered to U.S. Coastal Ports

	($ per barrel) Iranian Light 34° API (1.4% Sulfur)	
	1971	1975
Production[a]	10¢	11¢
Payments to Foreign Governments[b]	1.11	1.27
Other Costs[c]	30¢	30¢
FOB arms length Price	$1.51	$1.68
Transportation Costs[d]	74¢	45¢
Total Cost to U.S. (delivered)	$2.25	$2.13
U.S. Tariff	10.5¢	10.5¢
Delivered Price	$2.36	$2.24
Average Price for early 1970's	$2.30	

[a]See: M. A. Adelman, forthcoming manuscript to be published under the tentative title, *World Petroleum Markets*, no attempt to relate this figure to the specific crude shown in this table has been made. Adelman's calculation is best viewed as an overall average.

[b]See: August 25, 1971 issue of *Platt's Oilgram Price Service* and June 21, 1971 issue of the *Oil and Gas Journal* for Crude Price Postings in 1971 and 1975. Payments to Foreign Governments are based upon a 49% of posted price calculation, which has been approximately determined by Mikesell for Iran. See Mikesell, R. F., *Foreign Investment in the*

Petroleum and Mineral Industries (Baltimore: The Johns Hopkins Press, 1971) (especially p. 247).

[c]These costs are used to include all other costs transportation and gathering and payments made to determine the FOB arms length price. In a sumission to the Cabinet Task Force, the New England Council, *et. al.*, estimated this FOB price to be $1.30. At the old posting of $1.80 and Adelman's production costs of 10¢, this would mean a difference of 30¢ ($1.30-$1.00 (=.10 + ½ ($1.80))), which we denote as other costs.

[d]We show a high and low cost for transportation to be consistent with the Cabinet Task Force calculations. It should be noted that the New England Council, *et. al.*, used a figure of 57¢. This would imply a $2.11 delivered price to the U.S. east coast, up 24¢ since their 1969 estimate.

Appendix B Production and Consumption Forecasts
Domestic Production Forecasts

TABLE B-1

	Well Head Price $3.50 per Barrel*	
1970 Production[a] (actual)	11.3 MMb/d	
1980 Production (estimated)	15.6 MMb/d (IPAA)	14.1 MMb/d (CTF)
1975 Production (Straight Line Estimate)	13.5 MMb/d (IPAA)	12.7 MMb/d (CTF)
	Well Head Price $2.50 per Barrel*	
1975	8.0 MMb/d (IPAA)	9.7 MMb/d (CTF)
1975	Well Head Price $2.00 per Barrel	
	5.25 MMb/d (IPAA)	8.2 MMb/d (CTF)

*Joint Economic Committee, *Report on Crude Oil and Gasoline Price Increases of November 1970: A Background Study*, U.S. Government Printing Office: November 3, 1971. Appendix P, prepared by the Independent Petroleum Association of America (IPAA). Note CTF refers to the Cabinet Task Force, *supra*.

[a]See tables 2 and 3 above

Table B-2

Production by Region in 1975
Under Different Price and Production Assumptions* (MMb/d)

Average Well Head Price	National	Districts I-IV	District V
	IPAA Production Schedule		
$3.50	13.5	11.9	1.6
$2.50	8.0	7.1	.9
$2.00	5.25	4.65	.6
	CTF Production Schedule		
$3.50	12.7	11.2	1.5
$2.50	9.7	8.6	1.1
$2.00	8.2	7.2	1.0

*Joint Economic Committee, *supra*, November 3, 1971. The regional estimates in this table are based on an assumption that the elasticity of supply of petroleum is the same in all regions of the country. IPAA is the Independent Petroleum Association of America. CTF is the Cabinet Task Force.

Table B-3

Crude Oil Consumption Forecasts by Region of the Country*

Year	National	District I	II	III&IV	V
		(MMb/d)			
1970[a]	14.75	5.9	4.1	2.8	1.95
1975[b]	18.0	7.2	5.0	3.4	2.4
1980[c]	22.0	8.8	6.1	4.2	2.9

*Source: 1970 National and district V and I-IV totals based on values shown in table 2 and table 3 above.

[a]The District I to IV breakdown is based upon the breakdown found in: Timenes, N., "Analysis of Transportation Alternatives," appendix C, *An Analysis of the Economic and Security Aspects of the Trans Alaska Pipeline,* Washington, D.C.: U.S. Department of Interior, December, 1971.

[b]The 1975 estimates were based upon the 1970 actual consumption data and 1980 forecasts. The same regional consumption patterns that existed in 1970 were assumed to continue.

[c]The 1980 national forecast is based upon the median case found in Gordon, R. L., "Analysis of Future Demand for Crude Oil," appendix C, part 1, *An Analysis of the Economic and Security Aspects of the Trans Alaska Pipeline.* Washington, D.C.: U.S. Department of Interior, December 1971. The middle case assumes an average annual rate of nearly 5% per year and a compound exponential rate of 3.8% per year. The latter was used to estimate the 1975 levels of consumption.

Appendix C

Derivation of Regional Supply Schedules*

National

	IPAA	CTF
$\frac{\Delta \text{ Quantity}}{\Delta \text{ Price}}$	$= \frac{(13.5\text{-}8.0)\text{MMb/d}}{(\$3.50\text{-}\$2.50)}$	$\frac{(12.7\text{-}9.7)\text{MMb/d}}{(\$3.50\text{-}\$2.50)}$
	$= \frac{550{,}000\text{b/d}}{10¢}$	$\frac{300{,}000\text{b/d}}{10¢}$

Average of IPAA and CTF

$$\frac{(550{,}000\text{b/d}}{10¢} + \frac{300{,}000\text{b/d})/2}{10¢} = \frac{425{,}000\text{b/d}}{10¢}$$

Regional

1970 Production
National = 11,335,000 b/d
District V = 1,304,000 b/d
District I-IV = 10,031,000 b/d

Percent District V = $\frac{1.304 \text{ MMb/d}}{11.335 \text{ MMb/d}} = .115$

Percent District I-IV = $\frac{10.031}{11.335} = .885$

Slope District V = .115 (425,000b/d/10¢) $\approx$ 50,000b/d/10¢
Slope District I-IV = .885 (425,000 b/d/10¢) $\approx$ 375,000 b/d/10¢

1970 Market Equilibrium
District V
Price = $3.43 per barrel
Quantity = 1.95 MMb/d
Domestic Quantity = 1.5 MMb/d
Districts I-IV

		New York Chicago Gulf
Average Price	=	46%(4.14) + 32% (3.89) + 22%(3.55) = $3.93 per barrel
Quantity	=	12.8 MMb/d
Domestic Quantity	=	9.8 MMb/d
Supply Price	=	a + b (Quantity Supplied)
SP	=	a + b (QS)
b	=	slope
a	=	1970 Equilibrium Price - b (Equilibrium Quantity)

District V

$b_V = 1/ \frac{\Delta \text{ Quantity}}{\Delta \text{ Price}} = \frac{\Delta \text{ Price}}{\Delta \text{ Quantity}} = \frac{10¢}{50{,}000 \text{ b/d}}$

$a_V = \frac{\$1.00}{500{,}000\text{b/d}} (1{,}500{,}000\text{b/d}) = \$.43$

District V Supply Schedule

Supply Price $_V = .43 - \frac{1}{500{,}000\text{b/d}}$ Quantity Supplied

Districts I-IV

$$b_{I\text{-}IV} = \frac{\text{Price}}{\text{Quantity}} = \frac{10¢}{375{,}000\text{b/d}}$$

$$a_{I\text{-}IV} = \$3.93 - \frac{\$1}{3{,}750{,}000\text{b/d}} (9{,}800{,}000) = \$1.32$$

District I-IV Supply Schedule:

$$\text{Supply Price I-IV} = 1.32 - \frac{1}{3{,}750{,}000} \text{ Quantity Supplied}$$

*Joint Economic Committee, *supra*, November 3, 1971. The regional estimates in this table are based on an assumption that the elasticity of supply of petroleum is the same in all regions of the country. IPAA is the Independent Petroleum Association of America. CTF is the Cabinet Task Force.

Appendix D

Estimating The Average Real Resource Costs of a Barrel of Crude Oil in 1970*
(Millions of dollars)

I.	Exploration	$2,287
	Development	2,631
	Production	3,236
	Overhead	825
	Total	$8,979
	Less Production Taxes	-857
		$8,122
	Add 10% Opportunity Cost of Capital	+812
	Total Costs	$8,934
II.	Annual average daily production	11.3MMb/d[a]
		x 365 days
		4.125 billion barrels

III. Allocation of total cost of oil and gas production to oil

	High oil cost case[b]	Low oil cost case[c]
Average Cost per Barrel of Oil	= .875($8934 million) / 4.125 billion barrels	.65 ($8934 million) / 4.125 billion barrels
Approximate Average Cost Per Barrel of Oil	= $1.90	$1.40

*Source of cost data is: American Petroleum Institute, et al *Joint Association Survey of the U.S. Oil and Gas Producing Industry*, Washington, D.C., November 1971.

[a]1970 domestic production data is found in tables 2 and 3 above.

[b]Splitting cost of production in the ratio of 7 to 1 for oil to gas was suggested to me as an industry rule of thumb by C. S. Overmiller, Chief Economist for Humble Oil and Refining Company, Houston, Texas.

[c]Splitting cost of oil and gas 65% oil and 35% gas is based upon an assumption made in a Joint Economic Committee Background Study, JEC, *supra*, November 3, 1971.