



AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search

<http://ageconsearch.umn.edu>

aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

Petroleum
C

1979

UNIVERSITY OF CALIFORNIA
DAVIS
APR 6 - 1979
Agricultural Economics Library

DEPARTMENT OF ECONOMICS
UNIVERSITY OF CALIFORNIA, DAVIS



WORKING PAPER SERIES

**STRATEGIC RESOURCES & VIABLE INTERDEPENDENCE:
THE CASE OF MIDDLE EASTERN OIL***

Elias H. Tuma

Working Paper Series
No. 119

Note: The Working Papers of the Department of Economics, University of California, Davis, are preliminary materials circulated to invite discussion and critical comment. These papers may be freely circulated but to protect their tentative character they are not to be quoted without the permission of the author.

February 1979

Department of Economics
University of California
Davis, California

**STRATEGIC RESOURCES & VIABLE INTERDEPENDENCE:
THE CASE OF MIDDLE EASTERN OIL***

Elias H. Tuma
University of California, Davis

I. Introduction

The last few years have witnessed much debate and writing about the relationship between the producers and the consumers of raw material, especially the strategic raw material. The debate has centered around concepts such as international interdependence, oil power, third world power, and "Project Independence" of the U. S.

This paper suggests the following: 1. The traditional relationship of dependence between the producers and consumers of raw material is biased in favor of the status quo. 2. Among the traded raw materials, there are strategic resources which command power and entail vulnerability, depending on the economic structure of the country in which they are traded. 3. The interdependence between producers and consumers of the strategic resources has been unstable, and politically and economically unviable. 4. A viable interdependence is feasible, depending on the ability of the producers to change the structure of their economies in the direction of more conversion and domestic utilization of the resource. 5. OPEC members, especially in the Middle East, have revived the problem of unviable interdependence, but they have not as yet replaced that with a viable interdependence with the consumers of their product.

The following section explores the relation between use of the strategic resource and power; the concepts of vulnerability and interdependence will also be explored. Next we shall briefly review the options available to the "interdependent" nations on the basis of the resources. After that we will assess the degree to which OPEC

policies have led to viable interdependence. An attempt will be made to illustrate these observations with reference to Iran. In the final section a few concluding remarks will be presented.

II. Conceptual Framework

A primary product or resource is a raw material which has been subjected to little or no processing of any sort. It usually requires relatively simple technology except in extraction and conveyance, and its production leaves a limited impact on the level of technology in the economy at large; hence, its impact on employment tends to be limited accordingly.¹

Whether a resource may be considered primary or processed is a matter of degree, depending on the use for which it is intended. Thus, for purposes of measurement, the degree to which a product is removed from its primary stage depends on the amount of value added relative to the highest value added contained in the finished product.

A strategic resource is characterized by a relatively low price elasticity of supply and a relatively low price elasticity of demand. However, the resource supply and demand may be inelastic in response to price changes because of exogenous or non-economic considerations. For example, it may be difficult to acquire jet fighters by varying the nominal price because the supply of jet fighters is dependent on political decisions and hence the supply is only apparently price-inelastic.

A product or resource may be economically strategic but has little or no political significance; opium poppy as grown in Turkey is an example. On the other hand, some resources may be politically strategic but of no direct relevance in economic terms, because of institutional restrictions. Uranium may be such a resource. An economically

strategic resource would usually command monopolistic benefits or prices; a politically strategic resource would command favorable terms in negotiations in international agreements.

Resources may become strategic or cease to be so by various means which influence the supply and the demand for the resource. The discovery of new resources or substitutes, changes in technology, changes in taste, and price or income variations may affect these elasticities, as would international agreements and planning policies also. The more structurally dependent an economy is on a given resource, the more strategic that resource would be. Therefore, a resource may be strategic in one economic situation or system of production but not in another. Hence, resources may be considered strategic according to their elasticities of supply and demand, the number of economies to which they are strategic, and the degree of structural dependence on the resources these economies represent. However, strategic resources may command economic and/or political significance only if they are demanded by an industry that is strategic and relatively indispensable to the national economy.

The role of strategic resources in international relations reflects the economic and political power they command. A resource commands power (relatively high prices) if it is strategic, control over its supply is concentrated, and its demand is diffused or little concentrated. This leads to one-sided dependence on the producer. However, the concentrated control may be offset and the economic powers diluted if the demand is also concentrated and capable of generating monopsonistic control; the countervailing monopsony power could reduce the impact of monopoly, but not abolish it. The result would be dual-dependence of the buyer and seller on each other. The price finally "agreed upon" would reflect the degree to which the monopoly and monopsony powers balance each other.

As long as we limit the analysis to consumers and producers, we may confine the analysis to economic power. However, once national boundaries are introduced, political power enters the picture. International seller cartels backed by national power will then represent one-sided dependences; when faced by international buyer cartels, dual dependences are the result.²

At this point it becomes necessary to consider not only power but also vulnerability of the producer and consumer of the strategic resource. Power has been defined as the ability to secure benefits or to have performed what would not be secured or performed in normal market situations.³ In contrast, vulnerability means the loss of potential benefits or the obligation to perform acts otherwise not performed as a result of manipulation of the strategic resource by the other party.⁴

Power and vulnerability which accrue from the control over the supply of or the demand for a resource in the international context are influenced by several considerations: country size, wealth, level of technology, determination, will to act as a monopoly or a monopsony, and the ability to back the decision to act with moral or military power.⁵

The size, wealth (endowment), and level of technology work in unison to determine the degree of power that can be mustered by controller of the resource supply or demand. The ability to maintain group control over supply or demand (united front) and the recruitment of moral support to prevent military action by the opponents would render resource-generated power a real force in negotiating the benefits. In the extreme case, a relatively large, wealthy, and highly developed country might be able to forego the resource-generated benefits altogether without suffering any serious effects; this is possible whenever exchange of the resource is mainly to enrich the quality of life, rather than to sustain it. In this case, the dependence generated by

the resource exchange may be neutral and relatively power- and vulnerability-free. On the other hand, a large wealthy economy may opt to be self-sufficient, utilize its own resources, and isolate itself as much as possible. In such a situation, only a residual dependence would prevail and the power of either party to the relationship would be minimal.

It is, however, unlikely for the producers of a resource to adopt either extreme by exporting the total resource as a primary product, or by being autarkic for a long time. In either extreme there would be instability and conflict in international relations. Conflict would be especially likely if the terms of the transaction were to be suddenly changed or unilaterally modified. The only viable option is for both producers and consumers to become interdependent in a viable relationship. By viable is meant stable, beneficial, and self-sustaining. Interdependence, to be viable, would be built into the structure of the respective economies and, therefore, would be anticipated and taken into account in policy determination.

Viability in international politics has been defined as "the ability and the willingness of one party to destroy or eliminate another. A party that cannot be destroyed as an independent source of decisions is said to be unconditionally viable." Conditional viability prevails when destruction is refrained from, either because it does not pay to do so (secure conditional viability) or because of good will (insecure viability).⁶ Our definition introduces another dimension, namely the built-in structural interdependence that removes the need to make a decision to destroy or to refrain from destroying the other party. Under viable interdependence the economic structure would preclude the freedom of decision-making regarding the destruction of the other party. The structure itself is put in danger of "self-destruction." These various options are represented diagrammatically as follows in Figure 1.

FIGURE 1

RESOURCE EXCHANGE, POWER AND VULNERABILITY

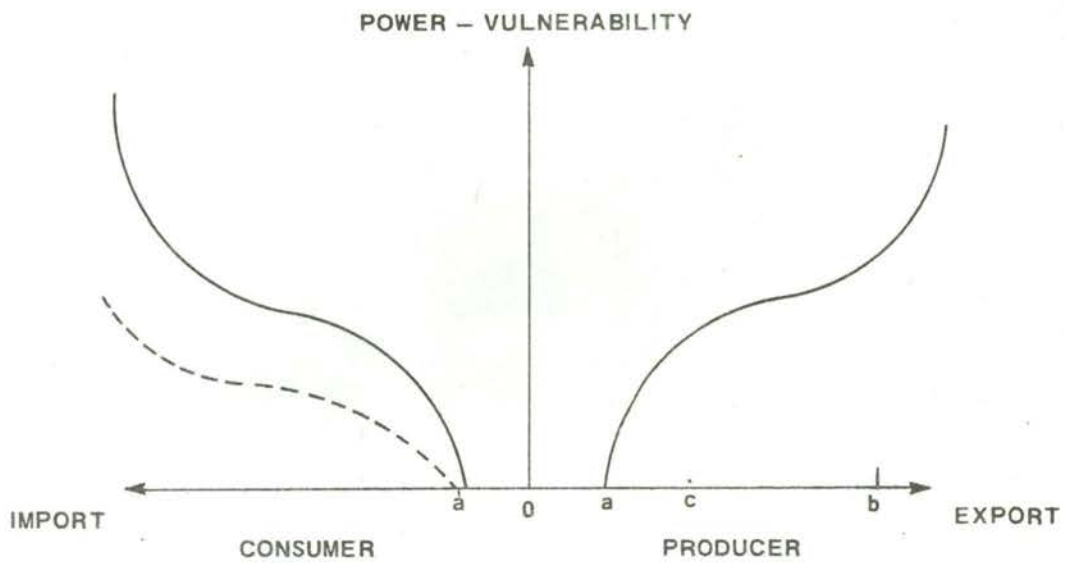


Figure 1 represents the traditional relationship in which the producer of the strategic resource exports the resource in raw form, while the consumer imports all the raw material for conversion. As exports increase, power and dependence on the resource (vulnerability) increase at a high but decreasing rate, up to b, and then at an increasing rate. Between c and b, the rate of power accumulation is slow because it is neither a forceful entry in the market, as in the prior stage, nor total domination as in the latter stage. The power of the producer is accompanied by vulnerability in this case because of the dependence on the revenue from the resource. The consumer, on the other hand, commands power and vulnerability to the degree to which dependence on the resource is unavoidable and significant, as on the left-hand side of Figure 1.

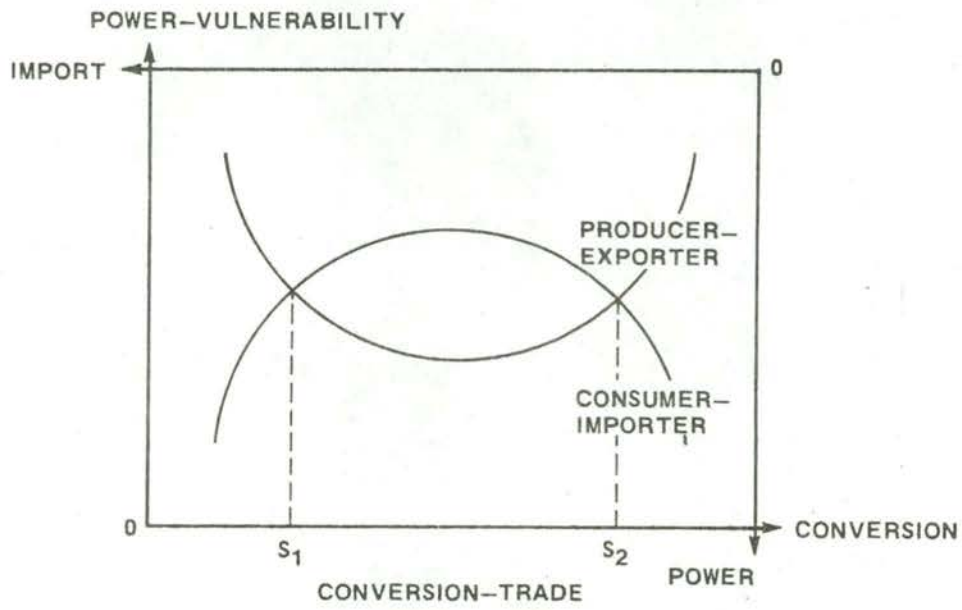
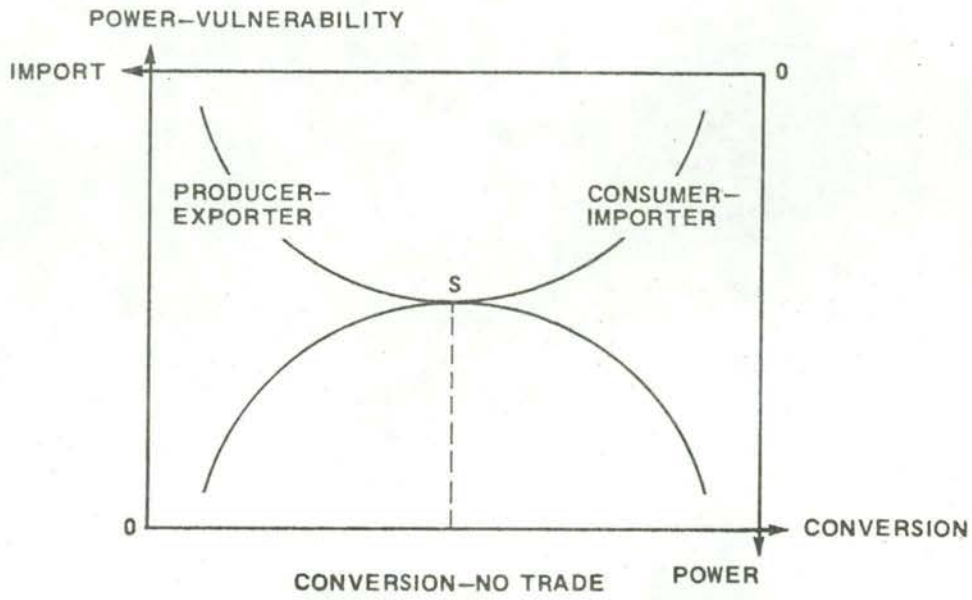
As an alternative to exporting strategic raw material, the producer may resort to conversion, either to satisfy the domestic market and cease trade, as in Figure 2, or to export processed material as in Figure 3. In each case the impact on the consumer of the resource will be a reflection of what happens in the producer country.

Figure 2 represents conversion and the tendency toward self-sufficiency by the producer, and its impact on the potential consumer, looked at from opposite corners.

The two producer and consumer curves intersect at point S, where both may be satisfied with that degree of conversion and trade since what is not converted would still be traded in raw form. Beyond S on the conversion scale, isolationism becomes serious and unhealthy, and below S dependence and power render the situation unstable. However, the point S may be difficult to maintain since there are no forces to bring either country back to that position once a change had taken place. One would therefore think of a range within which conversion and power oscillate depending on the short-run politics of the two countries; S1-S2 represents that range.

FIGURES 2, 3

INTERDEPENDENCE BETWEEN RESOURCE PRODUCER AND CONSUMER



The conversion-trade policy may be more applicable and realistic as shown in Figure 3. The producer of the strategic resource begins with conversion, high power and vulnerability, down to less power, more conversion, and less vulnerability. As conversion expands and trade in converted material becomes dominant, power again increases and with it also vulnerability. The consumer, originally of raw material and now of finished and semifinished goods, goes through the same variation of power and vulnerability but in the opposite order. Neither extreme is viable. The range S1-S2 is the range in which a stable viable interdependence may exist. In this range both countries convert and neither country would have reason to move to more dual dependence where either little or total conversion would prevail. This range allows for trade, development of the economy of both to be capable of processing, and would make it possible for both economies to benefit from the resource in raising income, advancing technology, and maintaining a relatively high level of employment. Conversion and trade, in this case, would be viable in as much as they would allow each country to specialize in the production of commodities derived from the resource and trade them with the other and thus both would have a more differentiated basket of trade commodities than under other forms of interdependence. Figure 4 represents a simplified impact model based on viable interdependence.

In Figure 4 the conversion-trade relationship is coordinated with value adding in the resource producer country, and in turn to the impact as indicated by development, employment, technology, etc. By regarding value adding a positive function of conversion, and development and employment a positive function of value adding, we can estimate the impact of conversion in the viable range S1-S2, as Va1-Va2 on the value added axis and M1 and M2 on the development axis. This impact would render

the producer economy self-sustaining, with sufficient power and little enough vulnerability to want to stay there; hence the viable interdependence.

Two major questions that need to be answered at this point are: how to determine the range S1-S2 for the producer and the consumer of the resource, and what pattern of diversification should the structural change aim at? These questions are treated elsewhere.⁷ Here we are concerned primarily with behavior and policies of oil producers and consumers during the recent past.

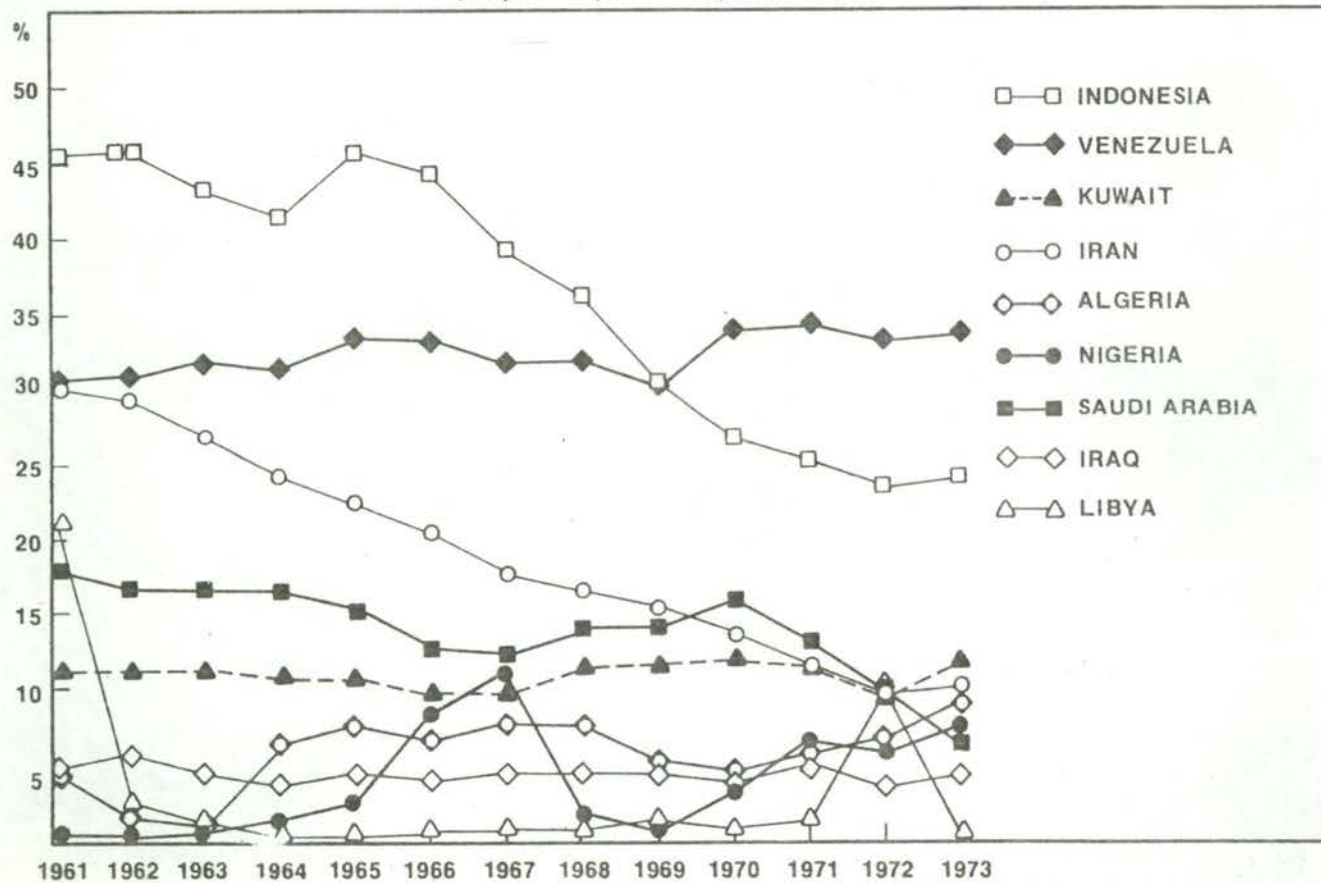
III. Historical Dependence of the Oil Producers

The developing countries which are endowed have tended to produce the raw material and export it in raw form, leaving the conversion process to others. The obvious reason for their behavior is that they have neither the capital nor the skill for conversion; and their own markets are relatively small. Thus, underdevelopment sustains and feeds on the concentrated effort to produce and export raw material, including the strategic resources. Examples abound among producers of chromium, tin, rubber, bauxite, aluminum, iron ore, lead and zinc.⁸

The trend is most conspicuous with respect to oil consumption relative to production, shown in Figure 5. Only Venezuela approaches 25% domestic use of its oil supply; the rate of domestic use has declined as output per capita of the resource has gone up thus remaining highly consistent with the traditional pattern in virtually all oil producing countries.

The trend has not changed and it can be illustrated in other natural strategic endowments: the endowed countries produce and export in raw form if underdeveloped; they produce, process, and then export or consume in finished form if developed. These

FIGURE 5
 DOMESTIC UTILIZATION OF OIL BY PRODUCERS
 (Output + Imports - Exports)/Output x 100



Based on U.N. Stat. Office, Stat. Papers, Series J, WORLD ENERGY SUPPLIES, 1976.

observations are evident, in addition to oil, in the case of copper, tin, bauxite and aluminum, iron ore, lead, and zinc.⁹

The impact of this division of labor has been of concern to the developing countries for a long time because of the potential changes in the terms of trade and their high dependence on those products for revenue. The developed countries, however, have only recently become concerned, especially after the formation of OPEC and its eventful success in controlling the supply of oil. Since then interdependence has become a common topic of discussion and policy study. The developed countries, especially the U. S., have tried to reduce their dependence on foreign oil and other energy supplies. Elaborate policy statements have been formulated to identify the options available. Table 1 summarizes these options as they relate to various classes of countries from the standpoint of the U. S. The options that are most relevant in this context are those relating to the less developed countries, LDCs, and the Resource Producers.

These options seem rational from the point of view of the U. S., a large, rich, highly developed and powerful country. In general they would apply to other rich and developed countries, especially if they are relatively large. But they are not rational for the LDC resource producers, who aim to become developed. The LDC resource producers would need to take a different perspective in analyzing these relations, and that suggests other options for them, as summarized in Table 2.

The LDC oil producers have had experience with options 1, 2, and 3a. For many years they depended on the market mechanism and buyers and sellers transacted unencumbered by regulation or restriction. The result was perceived as "economic imperialism"; the oil producers as one class of countries have remained underdeveloped, and have depended on the oil revenue for foreign exchange to finance the import of

TABLE 1

U. S. Relations With Optional U.S. Strategies	<u>U. S. Allies</u>	<u>Communists</u>	<u>LDCs</u>	<u>Resource Producers</u>
1. Reduce Risks	A L W A Y S U S E F U L			
a. Improve political relations				
b. Coercion	Not applicable	Counterproductive	Decreasingly applicable	Not efficacious
c. Internationalize	COULD LESSEN STRAINS ARISING FROM ASYMMETRIC DEPENDENCY			
2. Lessen Dependency	Reducing level of mutual dependency, if high, should reduce strains	Not applicable now (excessive future dependency would be undesirable)	Would avoid unwanted intervention consequences and reduce current tensions	Desirable, through: product substitution, alternative energy sources, lessened consumption, diversification of supply.
3. Increase Mutual	Danger of producing overload in current atmosphere	Current U.S.-Soviet strategy, based on persuasive logic	Undesirable in terms of lessening U.S. involvement	Very desirable to balance relations better, increase stake in stability of flows
4. Autarky	H I S T O R I C A L L Y C O U N T E R P R O D U C T I V E			
5. Manipulate Asymmetry Through Linkage Strategies	Theoretically possible to gain economic advantages by threatening insecurity or withholding exports, but chancy	Unproductive	Possibly counter-productive politically	Possible Western countermeasures available in future (but becomes increasingly Option 3)

-86-

TABLE 2

Interdependence Policy Options

LDC Resource Producer Strategy Relations with Resource Consumers

<u>OPTIONS</u>	<u>LDC</u>	<u>DC</u>	<u>LDC Resource Producer</u>
A. <u>Continued Interdependence</u>			
1. Free Market Exchange	Share underdevelopment	Face monopsony	Exhaust resources without development
2. Internationalization	Commodity Agreements		Tenuous
3. Cartel (monopoly) with			
a. Uniform prices	Antagonism and economic burdens	Conflict — face monopsony	Unstable relationship
b. Discriminatory prices favoring LDCs	Envy and new layer of interdependence	Antagonism and rise of new alliances	Unstable
b. <u>Reduce Interdependence</u>			
4. Reduce supply and control prices	Antagonism and poverty	Antagonism and threat of retaliation	Unstable
5. Change structure			
a. Reduce supply and become self-sufficient	Antagonism with possible development		Isolationism
b. Reduce supply of raw material and increase supply of processed derivatives; no price control	Join forces	Restructure; more equal bargaining and less conflict	New power and trade distribution; development Viable and stable

intermediate and consumer goods. The sellers' dependence on the buyers has seemed to worsen in recent years, especially in the case of other and more perishable raw material and agricultural products. Hence, commodity agreements have been introduced as a means of guaranteeing an acceptable price for the parties concerned.

Commodity agreements may have helped to reduce serious price fluctuations but they have not had much impact otherwise. Worse still, commodity agreements have often entailed waste of capacity and products. For example, often acreage limitations have resulted in keeping the land idle; at other times the "surplus" output has been dumped in the sea or destroyed to avoid dumping on the market; yet food has been in short supply in various parts of the world. The impact on the developing producer countries has been superficial in that such agreements have not affected the production process or the structure of the economy; dependence and underdevelopment have continued. Nevertheless, commodity agreements are still being explored as means of stabilizing prices and incomes accruing from strategic raw materials and resources.¹⁰

The first major departure from these trends has come with the oil cartel, beginning in 1960 but more seriously and effectively since 1973 when OPEC fully controlled the price of oil to be sold on the international market. Though previous attempts had been made to monopolize the marketing of resources, success came when the producers became politically independent, the third/fourth worlds became conspicuous and outspoken, and when oil became strategic enough to command power. For a while option 3a seemed to be most effective in restoring to the LDC resource producers the power they had lost and the means to become rich and modern. Now, a few years later, it is apparent that such has not been the case. Option 3a has created antagonism between the LDC producers and the LDC consumers of the resource because the sudden increase in prices put a severe burden on their budgets and

development plans. It has also antagonized the DC consumers enough for them to threaten, though unsuccessfully, to combat with a consumer monopsony. On more than one occasion, the DC consumers have threatened to use economic weapons, such as withholding the sale of strategic commodities, or even to apply military strength.¹¹ It is apparent also that the LDC producers cannot continue to depend on this option much longer because the consumers are now aware of the strategy and are prepared for it, much better than they were previously; the two-price system concluded in the last OPEC meeting suggests the inadequacy of this option.

Option 3b was an attempt to relieve the LDC consumers of the unexpected price rise burden, but it was replaced by direct aid or loans to offset the price increase, rather than apply discriminatory pricing. Antagonism has not been possible to avoid.

So far these various "traditional" options have failed in still another way. The impact of the new oil wealth on development has been limited. The oil producers have not used their oil revenues effectively to promote development. According to available estimates, the oil exporting countries of the Middle East spent about \$25 billion of their \$80 billion oil revenue in 1974 on various domestic programs and about \$45 billion in 1975. The deployment of the rest is shown in Table 3 for all OPEC members.

According to this breakdown about 60% of the Middle East oil revenues were recycled into the Western economies directly in 1974 and about 40% in 1975, in addition to what was recycled through trade. The trend has continued through 1976 and 1977. As a result, it is hard to observe a major impact of this newly created wealth on economic structure or development of the LDC oil producers. In fact, it is possible to build a case against most of OPEC investments in the industrialized countries as economically unjustified, politically compromising, and in the long run contrary to the

TABLE 3

OPEC Surplus Disposition

Held as Foreign Reserves \$ billion as of Dec. 31, 1975			Estimated Deployment of Investible Surpluses \$ Billion for all OPEC Members		
	1975	1976**	In U.S.	1974	1975
<u>Middle East Countries</u>					
Algeria	1,353	1,987	Govt. & Agency Secur.	6	3.4
Iran	8,697	8,833	Bank Deposits	4	.5
Iraq	2,727	4,601	Other-inclu. equities & property	1	2.6
Kawait	14,000	1,929	Sub total	11	6.5
Libya	2,195	3,206			
Qatar	2,000	—			
Saudi Arabia	23,319	27,025	<u>In U.K.</u>		
U.A.E.	2,000	—	British Govt. Stocks	.9	.4
Sub total	56,291	47,581	Treasury Bills	2.7	.9
			Sterling Deposits	1.7	.6
<u>Other Members</u>			Other Sterling Invest.	.7	.3
Ecuador	286	515	Other Foreign Currency borrowing	1.2	.2
Gabon	146		Sub total	7.2	2.0
Indonesia	586	1,499			
Nigeria	5,795	5,203	<u>In Euro-currency Markets</u>		
Venezuela	8,861	8,578	In the U.K. (London)	13.8	4.1
Sub total	15,654	15,795	In other countries	9.0	5.0
TOTAL	71,945	63,376	International Organizations	3.5	4.0
			Special bilateral facilities and other investments inclu. loans to other countries	11.9	12.3
			Sub total	38.2	25.5
			TOTAL	56.4	34.0
			TOTAL OIL REVENUE	100.7	99.6*

Source: OAPEC Bulletin, January 1977, pp. 28-29

*From NYT, International Economic Survey, January 25, 1975, p. 28.

** World Bank, World Development Report 1978, Table II.

national interests of the countries they originated from, because they sustain the asymmetrical pattern of interdependence with the DC consumers.

OPEC members, especially the Middle East countries, have embarked on large programs of education, health, and welfare for their citizens, though there have been obstacles in the way of implementation. Schools have been built in large numbers though teaching and equipment are lacking; clinics and hospitals have been established, sometimes even in places where there are neither doctors nor patients. Roads have been built though there may be neither people nor goods to transport over them. Four-lane highways have been built even in places where there are neither cars nor trade to cater to. However, much of the local expenditure allocated to development projects has been concentrated in industries such as petrochemicals, cement factories, steel mills, food processing and agricultural development. In addition, large sums of money have been spent on the installation of telecommunication systems, the establishment and expansion of shipping lines, and the building of plastics factories. Construction has in all cases been an important factor in absorbing capital, both in housing and business projects.

In addition we find a bulging expenditure program devoted to defense, even though there is no apparent or potential enemy. Kuwait, Saudi Arabia and Iran have spent more than 25% of their annual state budgets on defense up to 1974. However, Saudi Arabia has reduced its relative defense expenditure in 1975 to 10% while Iran has increased it to about 28% of their much larger state budgets. It is true that the Iranian Armed forces have often performed the functions of a rural development and literacy corps, but this large defense expenditure can hardly be justified on development grounds.¹² The reaction to this "waste" has no doubt been reflected in the breakdown

of the system in Iran, the departure of the Shah and the near total breakdown of the economy.

The limited impact of expenditure in Iran and the Arab oil producers on economic development is best reflected in the following:

The paucity of contracts for plants producing machinery, electrical goods, scientific equipment and transportation equipment underlies the non-industrialized nature of most of the region. Such industries require skilled workers and large, sophisticated, affluent markets. It may well be decades, for instance, before plants are established to produce the machinery and equipment for the region's growing petrochemical industry. Although autos are assembled in a number of countries and buses are assembled in Iran, Algeria and Lebanon, there are no supportive industries to supply parts to the assembly plants. On the other hand, a beginning is being made in Morocco, Egypt, Lebanon, Iraq and Iran, where contracts have been let for the construction of plants to produce tires, batteries, valves and miscellaneous auto parts.¹³

It should be noted that the authors are quite sympathetic to what is happening in the Arab world. At the same time, only two of the countries that are showing a beginning are oil producers; the rest import the machinery and none make it.

These observations lead to the following conclusions: The LDC resource producers, including OPEC members, have used a small percentage of the resource domestically; they have continued and sometimes succeeded in adjusting prices to their benefit; they have utilized the newly acquired wealth in ways that will not reduce their dependence on the developed countries, nor will it create viable interdependence.

New initiatives have been proposed for the oil producers, as represented by Saudi Arabia, presumably by the oil producers themselves: "The Downstream Operations Initiative" would give Saudi Arabia certain economic privileges in the U. S. in return for secure oil supplies; presumably the same initiative could be applied to other parties. "The 'Oil for Industry' initiative would promote exchange of oil for industrial machinery and technological expertise to permit fair conditions for development and competition.

"The Inter-Regional Development Initiative" would channel surplus capital into capital-starved countries in the region to promote inter-regional development.¹⁴

These initiatives, however, are not much different from what has been done in recent years and cannot be expected to reduce the asymmetry of dependence or the vulnerability of the LDC resource producers. The option that seems most appropriate, though probably the most difficult, is option 5b of Table 2, which is the subject of the following section.

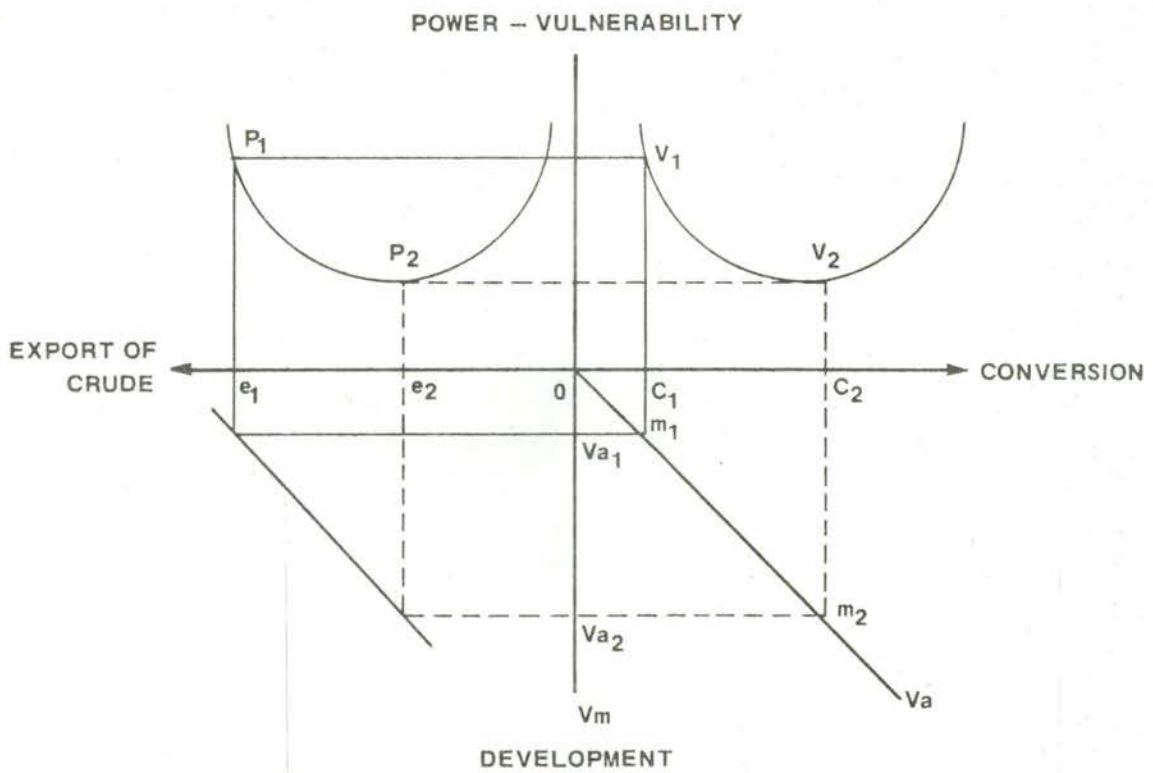
IV. Viable Options

Structural change is basic to viable interdependence. In a nutshell, structural change should: 1) increase the ability of the resource producer to utilize more of the resource domestically, such that the country's dependence on the raw material exports would be curtailed; 2) increase the country's ability to produce and trade on the market finished and semi-finished products deriving from the resource; 3) enable the country to trade and bargain on relatively equal technological and economic ground; and 4) make the country less vulnerable to the severe market fluctuations or the changes in the politics of the consumer countries than has been the case.

Let us look at Iran as an oil producing country and explore how such structural changes may be brought about. Iran, the most populous OPEC member used 9% of its oil output domestically in 1977.¹⁵ The position of Iran may be illustrated diagrammatically, as in Figure 6.

In 1977 Iran processed only about 14% of its oil output. The rest was exported in crude form; however, 34% of the refined oil was also exported. Roughly these are equivalent to Oc1 on the conversion axis and Oe1 on the crude export axis respectively. Accordingly, Iran is highly vulnerable at v1 because of the small conversion. But Iran

FIGURE 6
VIABLE INTERDEPENDENCE: IRAN



This diagram has been derived systematically, ref. footnote 7.

is also powerful because of consumer dependence on its crude oil exports, as shown in p1; this dependence is being felt now that oil production is shut down in Iran. Such a position, however, contributes little to development in the form of value adding, technological change, or employment, as shown on the value added axis, the impact being Oval, which corresponds to v1, p1, e1, d1, m1, c1. As long as these patterns of use and trade continue, instability and backwardness are bound to continue.

The converted crude is consumed primarily in the form of gasoline, kerosene and jet fuel, and fuel oils which are used in industrial production. The total quantity of all these fuels amounted to only 14.5% of the crude oil produced in 1977, one third of which was exported. Given other derivations and petrochemicals, the estimated 11% of total crude oil used domestically seems reasonable.¹⁷ Though the data on the value added and employment and development impact are vague, it is apparent that the impact has been limited, as in Va1, since the processing has been mainly in the form of refining which is highly concentrated, capital intensive, and dependent on machinery produced abroad.¹⁸

A rough estimate of the impact on industry might be the relative productivity of labor. Up to 1967, the ratio of product per worker in industry relative to the economy-wide ratio was low, amounting to 61.5%. In comparison, the product per worker in the services was 140.2% and in the oil industry it was about 4000%, relative to the economy-wide product per worker. Only agriculture was below industry, the ratio being 48.3%.¹⁹

Another proxy measure may be the ratio of manufactured exports to total exports which in Iran declined from 5.1% in 1955 to 3.2% in 1969, and to 1% in 1975 presumably because crude exports increased much more in quantity and value than did the exports

of other goods. The decline in ratio, however, may suggest the limited impact of oil on structural change in the economy.

Iran depends on the export of crude, as in e1, and earns large sums of money that should serve development well. The use of these funds, however, tends to have a limited effect on the economic structure of the country. Iran earned about \$18 billion in 1974-75 from oil, which was a great jump over the previous annual earnings of \$1.3 billion in 1970/71 and \$5 billion in 1973/74. The sudden increase in earnings had a shock effect on expenditure and development planning. Iran allocated roughly 71% of its oil revenue to Plan Organization, the agency responsible for planning development on behalf of the State. The allocation of funds, as classified by Plan Organization was concentrated toward development (80-88%) and the rest for non-development projects. Of the development expenditure, 14-19% was allocated for industry and mines.²⁰ In 1976 investment reached 30% of GDP, while the gross savings were 42%, suggesting Iran's inability to utilize its available capital. Since 1977, however, Iran has faced a deficit in its resource balance due to heavy expenditure on imports for consumption as well as on armament.

This allocation pattern suggests a great commitment to the idea of development, which was continued in the Fifth Plan 1973-77. However, a large part of the expenditure is on imports of finished and semifinished capital and consumer goods. Except for a modest beginning in the production of spare parts, such as spark plugs and pistons, all machinery is imported. For example, Iran spends 12% of its oil revenue on arms, but little is invested in the manufacturing of arms. Iran has a growing cotton agriculture and manufacturing sector, but all machinery must be imported. The same is true of machine tools, scientific equipment, and other heavy machinery, the production of which would consume large amounts of energy. As a result, the value added, the

employment, and the technological spillover from these industries are lost to Iran, to the present generation of Iranians, and even more so to the future generations, who would not have the oil earnings to purchase the products of foreign industry.

The heavy expenditure on arms and "prestige projects" was compounded by heavy dependence on foreign firms for the construction of schools, hospitals, and even houses, though local facilities should be capable of such undertakings. The expenditure on nuclear generators, so far in advance of any danger of running out of oil, seems most unwarranted. Direct exploitation of oil to produce energy would be more efficient than exporting crude oil in order to earn revenues which in turn are recycled into foreign economies in return for nuclear generators to produce energy—which could have been produced with the use of oil in the first place. This is especially peculiar since Iran has neither the uranium, nor the technology, nor the skill needed to operate these generators and maintain them. It may be noted that Iran is utilizing its natural gas in the same fashion: export in raw form, low conversion, and a limited impact on the structure of the economy. However, it is unlikely that this trend of contracting and expenditure will be resumed by the new regime that takes over now that the Shah has left the country. It is evident also that the role of foreigners will be restricted.²¹

To achieve viable interdependence a new pattern must evolve. Iran might increase its conversion of oil to O_c2 or roughly to about 60% of its crude output before shutdown or roughly 3.3 mb/d; that would reduce its vulnerability to $V2$; reduce its export of crude to $e2$, with the option of exporting finished products, and thus increase the value added to $O_{va}2$. The process of development, employment, technical know-how, and viable interdependence would then become a reality. Can this change be implemented?

Given its pattern of investment and expenditure on consumption and nonproductive commodities, Iran would fare better if it were to cut its crude oil exports by half, and redirect investment into industries that would consume energy, create employment, and raise the level of technology. For example, while producing petrochemicals, it should be possible to build factories that make the machines for the petrochemical industry. While the purchase of arms may seem necessary, the making of arms would have a multiple effect: the security effect and the economic and viability effect. Israel offers the best example in that respect. Iran is a major buyer of agricultural machinery and motorized equipment. To invest in the making of such machinery would utilize strategic resources, save on foreign exchange, reduce dependence on the outside, make it possible to build machinery that is suitable for the local environment, and radically reduce the technological gap between Iran as an LDC oil producer and the DC oil consumers. As a spillover, Iran might even attract back the skilled people that have emigrated and thus restore a strategic resource whose loss has often caused a bottleneck in the process of development and the achievement of viable interdependence. Many other areas for investment may be suggested. The main argument is that once Iran has embarked on this redirection of investment, Iran can begin to speak of a partnership and a viable interdependence with the developed world.

FOOTNOTES

- * I am grateful to Andrzej Brzeski, Peter Lindert, Amir Ahanduan for valuable comments on previous versions of this paper.
1. W. G. Tyler, "Manufactured Exports & Employment Creation in Developing Countries: Some Empirical Evidence," Economic Development and Cultural Change, 24 (2), January 1976.
 2. Interdependence, as this relationship is known in the literature, between less developed and developed countries has been attacked as a mechanism which keeps the less developed in that position "exchanging raw materials and foodstuffs for manufactured products from the capitalist nations." Klaus Knorr, The Power of Nations: The Political Economy of International Relation. Basic Books, 1975, p. 234.
 3. For other definitions and uses, see Klaus Knorr, Power and Wealth. New York: Basic Books, 1973, p. 3 ff.
 4. For various attempts to measure power see my Economic History and the Social Sciences. Problems of Methodology. Berkeley: University of California Press, 1971, pp. 271-273; for measurement of vulnerability, in a micro-economic framework, Martin Shubik, Strategy and Economic Structure, summarized in Bruce M. Russett, ed., Economic Theories of International Politics. Markham Publishing Co., 1968, pp. 148-170.
 5. For a general discussion of the determinants of power, Klaus Knorr, Power and Wealth, esp. Chapter 4, on which most of the following few paragraphs are based.
 6. Kenneth Boulding, Conflict and Defense. Harper Torch Book, 1963, p. 58.
 7. See my "International Interdependency and World Welfare" Chapter XVII in The New Economics of the Less Developed Countries, Nake M. Kamrany, ed., West View Press, 1978.
 8. Hayward Alker, Jr., Lincoln P. Bloomfield and Nazli Choucri, Analyzing Global Interdependence. Center for International Studies: MIT, 1974, V. I., pp. 117-123. This is probably one of the most up-to-date treatments of interdependence available.
 9. Details on these and other resources for the decade of the 1960s and on may be found in the Command Document, World Economic Interdependence and Trade Commodities. London: Her Majesty's Stationary Office, 1975.

10. The most recent attempt to promote agreements has been the UNCTAD meeting held in Nairobi in the spring of 1975; 18 commodities have been placed on the list for possible stabilization during 1978. In the meantime, a fund would be created to stockpile surpluses and help to stabilize prices. Wall Street Journal, July 19, 1976, p. 14.
11. The most recent effort in this regard has been a confidential memo from the former U.S. Treasury Secretary Simon to the President urging a four-measure policy of get tough with Japan as a means of combating the power of OPEC. Jack Anderson column, Sacramento Bee, September 21, 1976.
12. MEED, 7 February 1975, p. 5.
13. "Plow-Back: The Use of Arab Money" by Bertrand P. Boucher and Harbans Singh, reporting on a larger study, in Aramco World Magazine, September-October 1975, p. 23.
14. Michael Field, A Hundred Million Dollars a Day, London: Sidgwick and Jackson, 1975, pp. 66-69.
15. OPEC Bulletin, IX #38, September 1978. It should be noted that the smaller countries such as Kuwait and Qatar cannot hope to become industrial economies in the sense of this analysis unless they integrate themselves with other economies in the region.
16. Until the Shah was forced to leave the country, there were indications that Iran was on the way to applying the same approaches to other endowments. Copper and iron ore were on the list for such treatment, namely to be exported in raw form.
17. If biased, this estimate would be against our hypotheses and hence may strengthen the conclusions if confirmed. Data are taken from UN Statistical Office, Statistical Papers, Series J, World Energy Supplies, 1976.
18. W. G. Tyler, op. cit., p. 363.
19. Jahangir Amuzegar and M. Ali Fekrat, Iran: Economic Development Under Dualistic Conditions, University of Chicago Press, 1971, p. 100.
20. Fereidun Fesharaki, Development of the Iranian Oil Industry, Praeger, 1976, Chapter 6; J. Amuzegar, Iran: An Economic Profile (for 1976 figures), Washington: The Middle East Institute, p. 175-176.
21. For the most recent summary of conditions see Youssef M. Ibrahim, "Behind Iran's Revolution: Too Much Spending, Too Soon," New York Times International Economic Survey, February 4, 1979, p. 60 ff.