

DYNAMIC ADJUSTMENTS AND CHANGE IN THE WORLD OIL MARKET

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Introduction

The world oil market is undergoing substantial changes, in terms of overall structure, number of key participants, and market adjustment mechanisms. These changes will influence both price determination as well as critical decisions pertaining to production capacity and capacity utilization.

Problem Statement

The following type of problem is examined: If producer countries decide unilaterally to cut production or production capacity, what will the effects be on the market, and what policies can be adopted to reduce instabilities or imbalances. If consumer countries continue to adjust their demand for oil imports, what impacts will there be on prices and/or on producer production decisions.

This paper presents a model of the world oil market, disaggregated by individual components -- buyers, sellers, and international oil companies -- whose purpose is to determine the effects of the policies on one actor on the behavior and actions of others. Buyers and sellers are disaggregated according to individual countries and regions, and their distinctive characteristics specified.

The Model

The model, entitled the International Petroleum Exchange Model (IPE), is a system dynamics model of demand and supply adjustments to price and price adjustments to market changes. While the model is initialized for 1970 to enable a comparison of model results with historical observations for a ten year period, we propose to initialize the model for this paper to 1980 and simulate the effects of alternative price and production policies to 2000. Results are presented on an annual basis, although it is possible to generate quarterly or monthly observations.

Among critical issues to be examined are the potential effects on producer countries of substantial changes in consumer demand, or of expansion of consumer countries' own petroleum production, or expansion of uses of alternatives to petroleum. The conditions under which non-OPEC producers, as new entrants in the market, become important are delineated, the overall adjustments to new market conditions are determined accordingly.

This paper presents a system dynamics model of detailed market adjustment. It is a first effort to depict the world oil market in its constituent analytical as well as behavioral components.

The model may be used in three different modes:

- (1) Analytically for determining the supply and demand relationships and price formation under different conditions.
- (2) Structurally for observing relative positions of buyers, sellers and companies under different market and price conditions.

- (3) Financially for obtaining the economic consequences of alternative market conditions and price paths with regard to import payments, balance of payments, investments in the oil industry, revenue from oil sales, and so forth.

Model Uses:

Different users may emphasize or use different features of the IPE model.

Among the questions to be analyzed with use of the IPE model are the following:

- If producer countries change their price per barrel, what are the effects:

for consumers in terms of

- demand for imports
- demand
- future prices
- balance of payments
- strategic vulnerability
- investments in domestic sources of supply

for international oil companies in terms of

- corporate profits from oil sales
- investments in the oil industry

for producer countries in terms of

- oil revenue
- investments domestically
- imports of goods and services

- investments in the economies of industrial countries
- production capacity
- actual production
- If consumer countries cut their oil imports what would be the effects for:
  - strategic vulnerability
  - price
  - production rates
  - production capacity
- If non-Gulf suppliers expand production, what are the effects for:
  - Gulf production
  - price
  - consumer strategic vulnerability

These types of questions illustrate the versatility of the IPE model in allowing an integrated analysis of the world oil market under different economic and political conditions.

#### Interaction Among Actors

The model can be disaggregated (sectoralized) to represent behavior and adjustment of individual countries (or groups of countries). For example, we can examine the effects on the United States of Saudi Arabian policies, or effects on the market of U.S. import policies or demand behavior. The national adjustments to market changes can thus be identified.

#### Results

This paper presents select results of national adjustments to market changes, as well as impacts of individual national policies on the oil market.