Gasoline Prices versus Crude Oil Prices Trends and Analysis

A Dissertation report submitted in partial fulfillment of the requirements for MS-Oil Trading (2005-07)

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BONAFIDE CERTIFICATE

Certified that this dissertation report **"GAOLINE PRICES VERSUS CRUDE OIL PRICES"** is the bonafide work of **"ANSHUMAN SHRIVASTAVA"** who carried out the project work under my supervision.

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ABSTRACT

This paper examines recent evidence on the role that gasoline margins and volatility play in the asymmetric response of gasoline prices to changes in oil prices at different stages of distribution process. In a regression model with margins, we find that margins are statistically significant in explaining asymmetry between crude oil and spot gasoline prices, spot gasoline prices and wholesale gasoline prices, and wholesale gasoline prices and retail prices. In a regression model with input volatility, we find evidence that volatility is responsible for asymmetry between wholesale gasoline prices and retail gasoline prices. When both, gasoline margins and gasoline volatility are included in the regression, we find evidence supporting margins, the search theory, volatility, the oligopolistic coordination theory and an explanation of asymmetry.

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CHAPTER 1

1.1 INTRODUCTION

Crude oil prices are determined by worldwide supply and demand, with significant influence by the Organization of Petroleum Exporting Countries (OPEC). Since it was organized in 1960, OPEC has tried to keep world oil prices at its target level by setting an upper production limit on its members. OPEC has the potential to influence oil prices worldwide because its members possess such a great portion of the world's oil supply, accounting for about 40 percent of the world's production of crude oil and holding more than two-thirds of the world's estimated crude oil reserves. Additionally, increased demand for gasoline and other refined products in the United States and the rest of the world is also exerting upward pressure on crude oil prices.

Rapid gasoline price increases have occurred in response to crude oil shortages caused by, for example, the Arab oil embargo in 1973, the Iranian revolution in 1978, the Iran/Iraq war in 1980, and the Persian Gulf conflict in 1990. Gasoline price increases in recent years have been due in part to OPEC crude oil production cuts, turmoil in key oil producing countries, and problems with petroleum infrastructure (e.g., refineries and pipelines) within the United States. Additionally, increased demand for gasoline and other petroleum products in the United States and the rest of the world is also exerting upward pressure on prices.

1.2 SCOPE

With a number of studies showing that gasoline prices respond more quickly when crude oil prices rise than when they fall, economists have offered numerous explanations for the phenomenon. Explanations include market power, search costs, consumer response to changing prices, inventory management, accounting practices, refinery adjustment costs, and the behavior of markups over the business cycle. For the gasoline markets, however, no one has posited a formal econometric test that would allow the testing of the various explanations--including market power--for price asymmetry against the available data. In the absence of such tests, judgment and economic theory must be used to sort through the explanations and determine whether the asymmetric response of gasoline prices to movements in crude oil prices is the result of market power or more benign forces.

1.3 OBJECTIVE OF THE STUDY

1. To study the relationship between gasoline prices and crude oil prices.

2. To analyze the trends and behavior of gasoline price in response to change/ fluctuation in crude oil prices.

3. To predict the future gasoline price if there exists any symmetry between the two commodities.

4. How the change in polices of developed and developing countries effects the prices of the two commodities?

1.4 RESEARCH METHODOLOGY

The proposed study consists of the following attributes:

Type of research: Exploratory (Quantitative) Research

Source of Data: Secondary data

As this study is an exploratory type of research. In order to attain the objective secondary data procured from journals and past reports, is colleted and compiled to analyze the trends which were prevailing in the global market. The methodology will also dig up the political facts effecting the prices of market of gasoline and crude oil through a proper channel of study of the prices existed in past and political reasons (if any) for such a behavior.

CHAPTER 2

LITERATURE REVIEW

A PRIMER ON GASOLINE PRICES

Website - www.eia.doe.gov

"Gasoline, one of the main products refined from crude oil, accounts for just about 16 percent of the energy consumed in the United States. The primary use for gasoline is in automobiles and light trucks. Gasoline also fuels boats, recreational vehicles, and various farms and other equipment. While gasoline is produced year-round, extra volumes are made in time for the summer driving season. Gasoline is delivered from oil refineries mainly through pipelines to a massive distribution chain serving 168,000 retail gasoline stations throughout the United States. There are three main grades of gasoline: regular, mid-grade, and premium. Each grade has a different octane level. Price levels vary by grade, but the price differential between grades is generally constant."

DO GASOLINE PRICES RESPOND ASSYMIETRICALLY TO CRUDE OIL PRICE CHANGES?

Author - Severin Borestin, A. Colin Cameron and Robert Gilbert

Source - National Bureau of Economics Research, Cambridge, August 1992

"Gasoline prices clearly respond with a lag to crude oil prices changes. This lagged response can be estimated precisely enough that it is possible to identify asymmetric response to crude oil prices increase and decreases. The evidence we have gathered supports the common belief that retail gasoline prices respond more quickly to increases in crude oil price than to decreases. Establishing the points in the distribution chain at which the asymmetries occur is a powerful tool in distinguishing between the possible explorations for the phenomenon. The response of short gasoline markets to changes in crude oil prices is responsible for some of this asymmetry, but is short-lived, lasting only about 2 weeks.

The largest source of the asymmetry appears to response of retail gasoline to wholesale price changes at terminal level. At any point in time, wholesale gasoline prices must be found elsewhere. This result is consistent with the theoretical work of Benabor and Gertner (1991), which demonstrates that consumers may search less when the common input prices of all retailers become more variable, causing short run decreases in the elasticity of demand that each retailer faces. It is also, however, consistent with a model of sticky downward price adjustment in an oligopoly with imperfect monitoring. In further work, we hope to be able to distinguish between, these and other possible explanations."

CHAPTER - 3

3.1 Introduction to Commodity Market

Most people have the impression that commodity markets are very complex and difficult to understand. Actually, they are not. There are several basic facts that one must know, and once these are understood one should have little difficulty understanding the nature of futures markets and how they function.

First, a commodity futures market (or exchange) is, in simple terms, nothing more or less than a public marketplace where commodities are contracted for purchase or sale at an agreed price for delivery at a specified date. These purchases and sales, which must be made through a broker who is a member of an organized exchange, are made under the terms and conditions of a standardized futures contract.

The primary distinction between a futures market and a market in which actual commodities are bought and sold, either for immediate or later delivery, is that in the futures market one deals in standardized contractual agreements only. These agreements (more formally called futures contracts) provide for delivery of a specified amount of a particular commodity during a specified future month, but involve no immediate transfer of ownership of the commodity involved.

In other words, one can buy and sell commodities in a futures market regardless of whether or not one has, or owns, the particular commodity involved. When one deals in futures one need not be concerned about having to receive delivery (for the buyer) or having to make delivery (for the seller) of the actual commodity, providing of course that one does not buy or sell a future during its delivery month. One may at any time cancel out a previous sale by an equal offsetting purchase, or a previous purchase by an equal offsetting sale. If done prior to the delivery month the trades cancel out and thus there is no receipt or delivery of the commodity.

Actually, only a very small percentage, usually less than two percent, of the total futures contracts that are entered into are ever settled through deliveries. For the most part they are cancelled out prior to the delivery month in the manner just described.

3.2 How Prices are Determined?

A common misconception is that commodity exchanges determine, or establish, the prices at which commodity futures are bought and sold. This is totally incorrect. Prices are determined solely by supply and demand conditions. If there are more buyers than there are sellers, prices will be forced up. If there are more sellers than buyers, prices will be forced down. Buy and sell orders, which originate from all sources and are channeled to the exchange trading floor for execution, are actually what determine prices.

These orders to buy and sell are translated into actual purchases and sales on the exchange trading floor, and according to regulation this must be done by public outcry across the trading ring or pit and not by private negotiation. The prices at which transactions are made are recorded and immediately released for distribution over a vast telecommunications network.

Probably the best way to visualize how purchases and sales are made on the floor of a commodity exchange is to think in terms of what happens at a public auction. The principle is the same, except in the futures market a two-way auction is continuously going on during trading hours. This two-way auction is made possible because of the standardized futures contract, which requires no description of what is being offered at the time of sale.

Also, the two-way auction is made practicable because the inflow of both buying and selling orders to the exchange floor is normally in sufficient volume to make buying and selling of equal importance. In a public auction the accent is on selling.

The purpose of a commodity exchange is to provide an organized marketplace in which members can freely buy and sell various commodities in which they have an interest. The exchange itself does not operate for profit. It merely provides the facilities and ground rules for its members to trade in commodity futures, and for non-members also to trade by dealing through a member broker and paying a brokerage commission.

3.3 The Clearing House

A brief explanation of the clearing house (or clearing association) and its function in futures trading is important to understanding the operation of the futures markets.

Each futures exchange has its own clearing house. All members of an exchange are required to clear their trades through the clearing house at the end of each trading session, and to deposit with the clearing house a sum of money (based on clearinghouse margin requirements) sufficient to cover the member's debit balance.

For example, if a member broker reports to the clearing house at the end of the day total purchases of 100,000 bushels of May wheat and total sales of 50,000 bushels of May wheat (which may be for himself, his customers, or both), he would be net long 50,000 bushels of May wheat. Assuming that this is the broker's only position in futures and that the clearing house margin is six cents per bushel, this would mean that the broker would be required to have $3,000 on deposit with the clearing house.

Because all members are required to clear their trades through the clearing house and must maintain sufficient funds with it to cover their debit balances, the clearing house is placed in a position of being responsible to all members for the fulfillment of contracts.

Therefore, instead of broker A who, for example, bought 50,000 bushels of May wheat from broker B being responsible to broker B for fulfillment of his end of the contract, the

clearing house assumes the responsibility. In like manner, the responsibility of broker B to broker A in connection with this transaction is passed on to the clearing house, with neither A or B having any further obligation to one another.

The clearinghouse becomes the "other party" for all futures trades between exchange members. This mechanism greatly simplifies futures trading. Considering the huge volume of individual transactions that are made, it would be virtually impossible to do business if each party to a trade were obligated to settle directly with each other in completing their transactions.

3.4 Hedging in Futures

The justification for futures trading is that it provides the means for those who produce or deal in cash commodities to hedge, or insure, against unpredictable price changes. There are many kinds of hedges, and a few examples can adequately explain the principles of hedging.

Take the case of a firm that is in the business of storing and merchandising wheat. By early June, just ahead of the new crop harvest, the firm's storage bins will be relatively empty. As the new crop becomes available in June, July and August, these bins will again be filled and the wheat will remain in storage throughout the season until it is sold, lot-by-lot, to those needing wheat.

During the crop movement when the firm's inventory of cash wheat is being replenished, these cash wheat purchases (to the extent that they are in excess of merchandising sales) will be hedged by selling an equivalent amount of futures short. Then as the cash wheat is sold the hedges will be removed by covering (with an offsetting purchase) the futures that were previously sold short. In this manner the storage firm's inventory of cash wheat will be constantly hedged, avoiding the risk of a possible price decline – one that could more than wipe out the storage and merchandising profits necessary for the firm to remain in business.

In the example just given, if the storage firm buys cash wheat at $4 a bushel, and hedges this purchase with an equivalent sale of December wheat at $4.05, a 10-cent break in prices between the time the hedge is placed and the time it is taken off would result in a 10-cent loss on the cash wheat and a 10-cent profit on the futures trade. In the event of a 10-cent advance there would be a 10-cent profit on the cash and a 10- cent loss on the futures trade.

In any case, the firm would be protected against losses resulting from price fluctuations, due to offsetting profits and losses, unless of course cash and futures prices should fail to advance or decline by the same amount. Usually, however, this price relationship is sufficiently close to make hedging a relatively safe and practical undertaking. In fact, if the future is selling at a normal carrying charge premium at the time the future is sold as a hedge, the future should slowly but steadily decline in relation to the cash as it

approaches the delivery month, thus giving to the storage interest his normal carrying charge profit in his hedging transaction.

Another example of hedging might be that of a flour mill which has just made heavy forward sales of flour, sales that will require substantially more uncommitted wheat than the mill owns. To hedge these flour sales, the mill will at the time the flour is sold buy wheat futures equivalent to the amount of wheat needed to fill its forward flour commitments, and then as the wheat is acquired to fill these commitments remove the hedges. This will protect the mill against an advance in the price of wheat between the time it sold the flour and the time it is able to procure the cash wheat necessary to make the flour.

In connection with hedging, it must be remembered that there are unavoidable risks when large stocks of any commodity subject to price fluctuation must be owned and stored for extended periods. Someone must assume these risks. Usually those in the business of storing, merchandising and processing cash commodities in large volume are not in a position to assume them. They are in a competitive business dependent upon relatively narrow profit margins, profit margins that can be wiped out by unpredictable price changes. These risks of price fluctuation cannot be eliminated, but they can be transferred to others by means of a futures market hedge.

3.5 Speculation and Its Function

The primary function of the commodity trader, or speculator, is to assume the risks that are hedged in the futures market. To a certain extent these hedges offset one another, but for the most part speculative traders carry the hedging load.

Although speculation in commodity futures is sometimes referred to as gambling, this is an inaccurate reference. The generally accepted difference between gambling and speculation is that in gambling new risks are created which in no way contribute to the general economic good, whereas in speculation there is an assumption of risks that exist and that are a necessary part of the economy. Commodity trading falls into the latter category.

Everyone who trades in commodities becomes a party to an enforceable, legal contract providing for delivery of a cash commodity. Whether the commodity is finally delivered, or whether the futures contract is subsequently cancelled by an offsetting purchase or sale, is of no real consequence. The futures contract is a legitimate contract tied to an actual commodity, and those who trade in these contracts perform the economic function of establishing a market price for the commodity.

While speculative traders assume the risks that are passed on in the form of hedges, this does not mean that traders have no choice as to the risks they assume – or that all of the risks passed on are bad risks. The commodity trader has complete freedom of choice and at no time is there any reason to assume a risk that he doesn't think is a good one. One's

skill in selecting good risks and avoiding poor risks is what determine one's success or failure as a commodity trader.

3.6 How Short Sales Are Made?

To sell a commodity future short one sells first and then closes out (or covers) this sale with an offsetting purchase at a later date. One need not have, or own, the particular commodity involved. The practice of selling short is a common one in futures markets. Those who sell short (with the exception of those placing hedges to protect a cash commodity position) do so in the expectation that prices will decline and that they will be able to buy later at a profit. A short position in the market is of course just the opposite of a long position, which involves buying first and closing out (or liquidating) later with an offsetting sale.

Some find it difficult to understand how short sales are possible, due to the preconceived idea that one cannot sell something that he doesn't own. To understand how one can sell something short one must first understand that it is possible, and perfectly legal, to sell something that he does not own – providing the sale has certain attached conditions.

One of the conditions is that one agrees to deliver what he sells at a later date. Another condition is that, if one does not deliver, he will stand any loss that the buyer may suffer as a result of an advance in price between the time one makes the sale and the time he cancels out his delivery obligation by means of an offsetting purchase.

When one sells a commodity future short, one always does so under these conditions. Of course if prices decline during the period one is short one realizes a profit on the transaction. If, for example, one sells 5,000 bushels of Chicago May wheat short at $4.10 per bushel and then later covers this short sale with an offsetting purchase at $4 per bushel, the profit is 10 cents per bushel, or $500, on the 5,000 bushel contract, less the broker's commission. In the event wheat prices advance and one is forced to cover his short sale at $4.20, one would have a loss of $500, plus commission.

Short sales in commodities are much simpler than in stocks. When one sells a stock short he must borrow the stock for immediate delivery against his short sale. This involves a substantial loan deposit and costs that are not involved when one goes long on a stock. Also, stock exchange rules prohibit a stock from being sold short in a declining market unless the short sale is made at a price above the last sale price of the stock, or in other words on an "uptick." The short seller in commodities is faced with none of these restrictions.

3.7 Margin Requirements

When one establishes a position in a commodity future, either long or short, it is necessary to deposit with the broker a sufficient amount of money to protect the position – actually to protect the broker against loss in the event the trade entered into is

unprofitable. This deposit is referred to as the margin. It should not be confused with the clearinghouse margin required of an exchange member. The margin required of a customer by a broker is a different margin than that required of the broker by the clearinghouse. Both margins serve the same purpose, however – they insure that obligations arising from commitments in commodity futures are fulfilled.

There is no interest charged on the difference between the market value of a futures contract and the margin deposited to trade in it.

Margins in commodity trading are, in effect, the same as "earnest money" in a real estate transaction. In a real estate transaction the "earnest money," or down deposit, is to bind a contract on real estate contracted for today but to be delivered at a later date. In the case of a commodity futures contract, just as in the case of a real estate contract calling for delivery of the real estate at a later date, full payment is made upon delivery. But prior to actual delivery all that is needed is a deposit sufficient to bind the contract.

The amount of margin that one is required to deposit with the broker in order to trade in commodities is usually 10 percent or less of the market price of the commodity. Exchange regulations prescribe the minimum margins that brokers require of customers. These minimums are changed from time to time, depending on market conditions.

Also, it should be noted that at any given time one broker might require larger margins than another. The broker is limited only with respect to minimum requirements. If he feels that adequate protection requires a larger margin than the minimum required by the exchange regulations, he is free to ask for a larger margin. In this connection, however, for competitive reasons a broker is somewhat limited in the amount of margin required from his customers. Consequently, the tendency is for margin requirements among various brokers to stay pretty close in line.

After making an original margin deposit with a broker, one is obligated to add this deposit only if (1) he increases the size of his market commitment, or (2) there is a loss in his existing position due to prices moving in a direction contrary to that which he had expected. The usual procedure is for the broker to call for additional margin when the original margin has been reduced (by an adverse price move, usually calculated as of the close of the market session) to roughly 70 to 75 percent of the margin originally deposited. The margin call is normally for the amount needed to bring one's margin back up to the original requirement.

Assume that a trader has sold 5,000 bushels of May wheat short at $4 a bushel, and that the broker has required a $500 margin deposit on the transaction. One sells short, naturally, because he expects prices to decline. But suppose prices go up instead. Each one cent move in the price of wheat is equal to $50 on a 5,000 bushel contract.

This means that in the event of a three-cent advance one would have a loss of $150 in his short position. The margin balance would be reduced to $350 and the broker would

probably at this point call for an additional $150 to bring the margin back up to the original requirement.

A point that should be made clear in connection with this example is that unless one closes out his short position on this three-cent advance, the $150 loss is a paper loss only – one that will be increased or reduced depending on subsequent market action.

If one maintains his short position and if May wheat, after going up three cents, drops back to the selling price of $4 one will at this point be exactly where he was when he originally went short. There will be a credit with the broker of $500, the amount of the original margin deposit, plus the $150 that was deposited later.

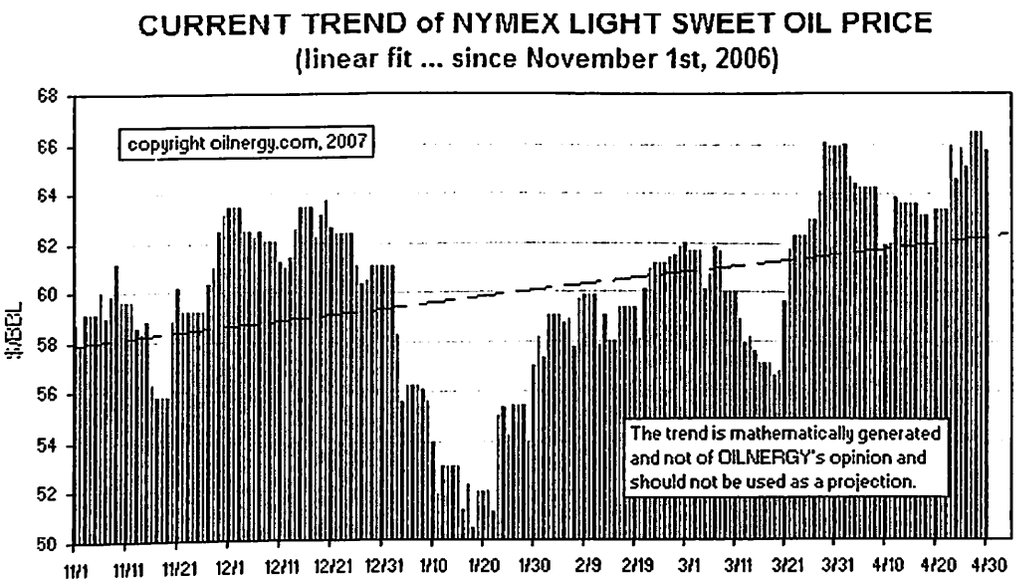
Let us suppose that after selling May wheat short at $4, prices decline to $1.90 where the trader covers his short wheat position with an offsetting purchase. In such an event one would have a $500 profit on the short sale. The broker would automatically credit this profit to the account, and with the $500 initially deposited one would have a total credit of $1,000. All or any of this credit balance is of course subject to withdrawal upon request.

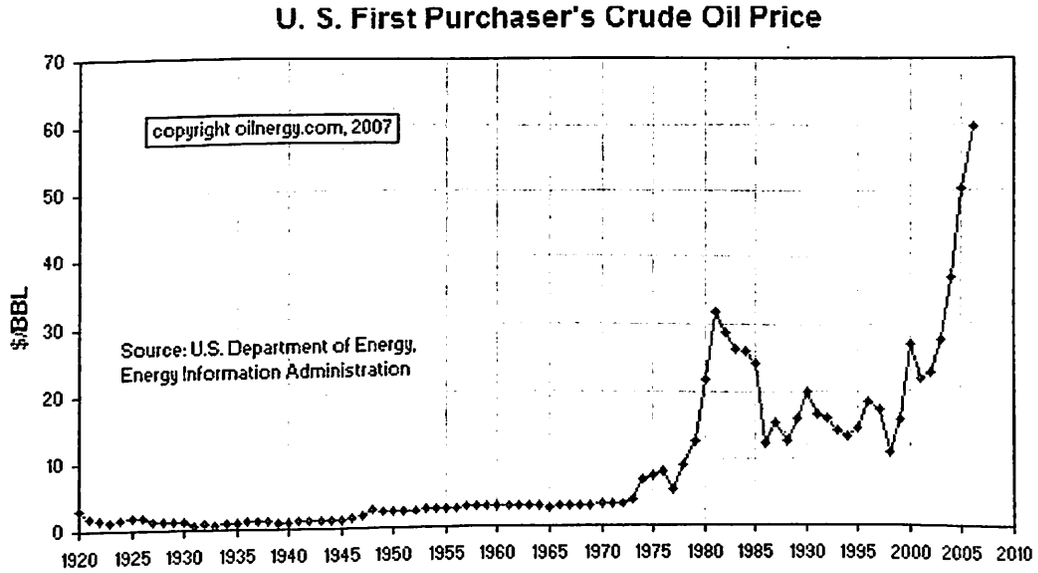
3.8 Conclusion

Commodity markets are not as commonly believed. In many ways, they operate just as public market places or auctions. For instance, prices of commodities on an exchange are determined solely by supply and demand conditions, which is no different from the way in which prices are determined in more familiar markets. In addition, commodity margins are analogous to the down payment one generally makes in connection with a real estate transaction. Once certain facts are understood, one can see that commodity markets are an integral part of a well-run economy.

CHAPTER – 4

Trends in prices of Crude Oil





4.1 What Crude Oil Prices Measures?

Crude oil prices measure the spot price of various barrels of oil, most commonly either the West Texas Intermediate or the Brent Blend. The OPEC basket price and the NMEX Futures price are also sometimes quoted.

West Texas Intermediate (WTI) crude oil is of very high quality, because it is light weight and has low sulphur content. For these reasons, it is often referred to as "light, sweet" crude oil. These properties make it excellent for making gasoline, which is why it is the major benchmark of crude oil in the Americas. WTI is generally priced at about a $5-6 per barrel premium to the OPEC Basket price and about $1-2 per-barrel premium to Brent.

Brent Blend is a combination of crude oil from 15 different oil fields in the North Sea. It is less "light" and "sweet" than WTI, but still excellent for making gasoline. It is primarily refined in Northwest Europe, and is the major benchmark for other crude oils in Europe or Africa. For example, prices for other crude oils in these two continents are often priced as a differential to Brent, i.e., Brent minus $0.50. Brent blend is generally priced at about a $4 per barrel premium to the OPEC Basket price or about a $1-2 per barrel discount to WTI.

The OPEC Basket Price is an average of the prices of oil from Algeria, Indonesia, Nigeria, Saudi Arabia, Dubai, Venezuela, and Mexico. OPEC uses the price of this basket to monitor world oil market conditions. OPEC prices are lower because the oil from some of the countries have higher sulphur content, making them more "sour", and therefore less useful for making gasoline. The NYMEX futures price for crude oil is reported in almost every major U.S. newspaper.

It is the value of a 1,000 barrels of oil, usually WTI at some agreed upon time in the future. In this way, the NYMEX gives a forecast of what oil traders think the WTI spot price will be in the future. However, the futures price usually follows the spot price pretty closely, since the oil traders can't know about sudden disruptions to the oil supply, etc.

4.2 How Crude Oil Prices Affect the U.S. Economy:

Higher crude oil prices directly affect the cost of gasoline, home heating oil, manufacturing and electric power generation. How much? According to the EIA, 96% of transportation relies on oil, 43% of industrial product, 21% of residential and commercial, and (only) 3% of electric power. However, if oil prices rise, then so does the price of natural gas, which is used to fuel 14% of electric power generation, 73% of residential and commercial, and 39% of industrial production. (Source: EIA, U.S. Primary Energy Consumption by Source and Sector, 2004)

For this reason, higher oil prices increase inflation, thereby increasing the cost of everything you buy. Concerns about inflation will depress the stock market, as happened in the summer of 2006.

4.3 How Crude Oil Prices Affects People:

Crude oil prices most directly affect you in higher gasoline prices and higher home heating oil prices (primarily for those of you who live in the Northeast U.S.) Crude oil accounts for 55% of the price of gasoline, while distribution and taxes influence the remaining 45%.

4.4 Recent Crude Oil Price Trends:

In 2006, the price of WTI crude oil hit an all-time high of $76 per barrel in July, dropping to below $60 per barrel in the fall, nearly falling below $50 per barrel in January 2007. The U.S. average retail price for regular gasoline remained at or above $3 per gallon for four consecutive weeks during the summer, before declining to an average of $2.26 per gallon over the last quarter of the year.

Many analysts explain the price shifts by citing high demand for gasoline in the summer months, and lower than expected demand for home heating oil, due to warmer winter weather. However, some analysts also blame the unknown effect of sudden shifts by hedge fund and futures traders.

As a result of the Q4 oil price decline, OPEC cut its production targets for the first time since April 2004. OPEC, particularly Saudi Arabia, wants to keep oil prices high enough to generate a comfortable standard of living for their residents, but low enough to discourage further oil exploration and development of alternative fuels.

4.5 The Crude Oil Price Outlook:

It is predicted that the price of a barrel of WTI crude to be at around $65 a barrel through 2008. This is partly because of their forecasts of supply vs. demand, and partly because of OPEC's stated intention to keep oil prices between $60-70 per barrel.

• **Prices rose further from mid-March on a strong US gasoline market and rising geopolitical tension** over Iran and Nigeria. Ongoing refinery maintenance and unplanned outages kept mogas supply tight, particularly on the US West Coast. Crude futures spiked in late March when (unfounded) rumours spread that Iranian and US naval forces had clashed in the Middle East Gulf in the midst of a standoff over Iran briefly seizing 15 UK naval personnel.

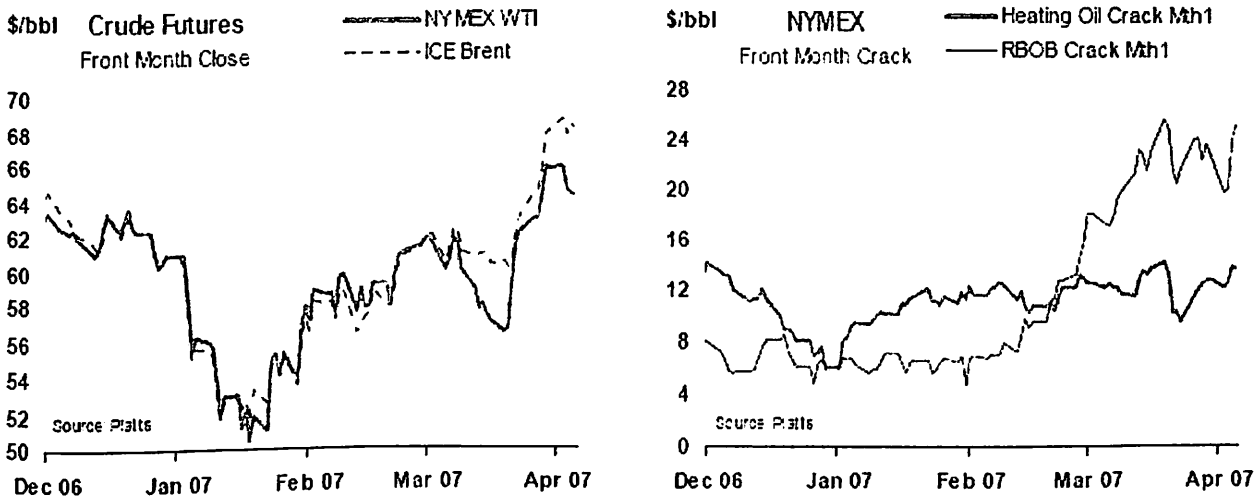
• **Crude prices were supported by OPEC production cutbacks, strong product stock draws and a thirst for gasoline-rich grades**, despite global refinery maintenance peaking in March. WTI has widened its unusual discount to Dated Brent, though this was

more a reflection of temporarily weak inland US crude demand than of the wider crude market, which remains strong.

• **Refining margins mostly rose in March** on strong gasoline prices, particularly in the US, where they remain highest. In Europe strong gasoline resulted in a higher return for more complex refineries, with hydroskimmers also pressured by weak fuel oil cracks and stronger regional crude prices. Asia suffered from similar, but more exaggerated pressures from crude and fuel oil, leaving margins more or less flat.

• **Gasoline led product prices higher**, supported by tight supply and the changeover to summer specification material. Distillate prices also rose on spring agricultural demand, while fuel oil was mainly flat as lower output due to maintenance was balanced by a seasonal downturn in demand.

• **Crude freight rates in the Mediterranean hit 15-month peaks** at the end of March as the Fos strike in southern France left almost 40 tankers stranded offshore. Meanwhile, US refiners seeking crude post-maintenance boosted VLCC rates from the Mideast Gulf to six-month highs.



4.6 Overview

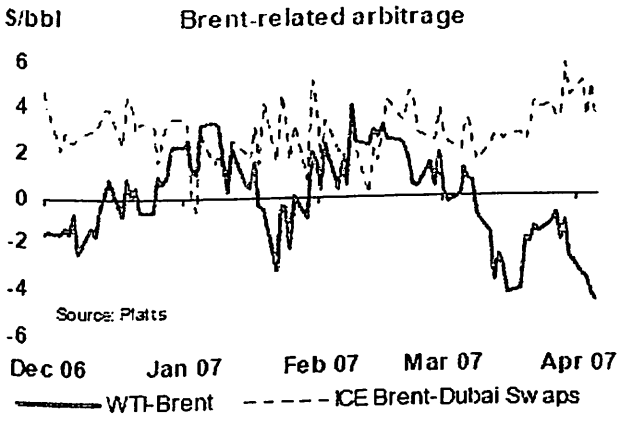
A flare-up of geopolitical tension concerning Iran contributed to rising prices between mid-March and early April. Against the background of new, tighter UN Security Council sanctions passed in late March, and both US and Iranian naval exercises in the Gulf, the Iranian detention of 15 UK navy personnel stirred worries that a confrontation of sorts was increasingly likely. Indeed on 27 March these concerns provoked a $5 spike in thin trading conditions to nearly $70/bbl on (unfounded) rumours that Iranian and US vessels had clashed in the Middle East Gulf.

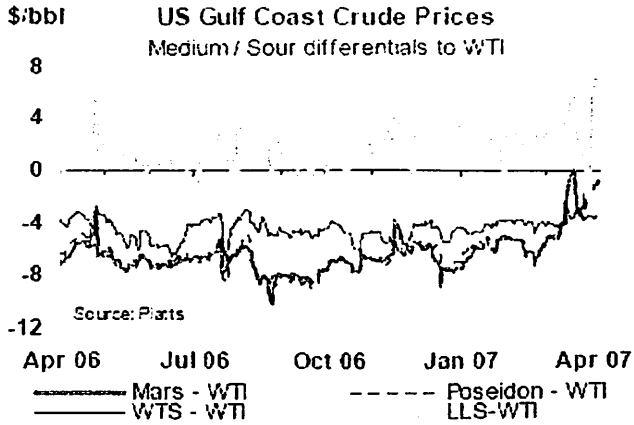
But the primary driver of higher prices was a tight US gasoline market. Although US refineries are gradually returning from seasonal maintenance, a string of unplanned outages has intensified regional tightness. This has been particularly severe on the West

Coast, driving gasoline prices to heights last seen in the aftermath of Hurricanes Katrina and Rita in 2005. Transport fuel demand has been robust which, coupled with modest gasoline and crude imports (partly related to fog in the Houston ship channel), and the switch from winter to summer-specification products, has exacerbated gasoline tightness.

In Europe, crude stocks remained at the lower end of the five-year average range in February and may have fallen even further in March. A two-week strike by dock workers in southern France's main oil hub Fos created a backlog of oil tankers that were unable to unload and OPEC production was further reduced, but with the offset that refinery throughput was lower. However, the persistent backwardation in nearby Brent futures contracts would suggest a continued tightness in European crude stocks.

European gasoline inventories, pressured by the structural reduction in regional demand were likely to have been further reduced. Before the Fos strike ended on March 31, several refineries were forced to reduce throughputs as crude stocks ran low, on average cutting throughputs by 45 kb/d in March and April (the latter due to a slow ramp-up). Meanwhile other refiners indicated they were undergoing seasonal maintenance. Elsewhere in Europe, the Rhine near Cologne was blocked for several days after a shipping accident, tightening supply upstream in southern Germany and Switzerland.





The price dip on the news that the British sailors had been released on 5 April proved fleeting, and was overwhelmed within an hour by a stronger-than-expected US weekly stock report. Moreover geopolitical issues are unlikely to go away. In particular, although Shell has indicated it hopes to restore shut in Nigerian production by the end of the year, in the short term there is concern that the run-up to the 21 April presidential election will be accompanied by more violence and kidnappings of foreign oil workers. In Ecuador, protests briefly resulted in the declaration of *force majeure* on Oriente and Napo exports, though this has since been resolved.

4.7 Spot Crude Oil Prices

Crude markets were shaped by gasoline tightness (and corresponding refinery needs) and OPEC cuts, which combined to create some unusual regional price imbalances. WTI

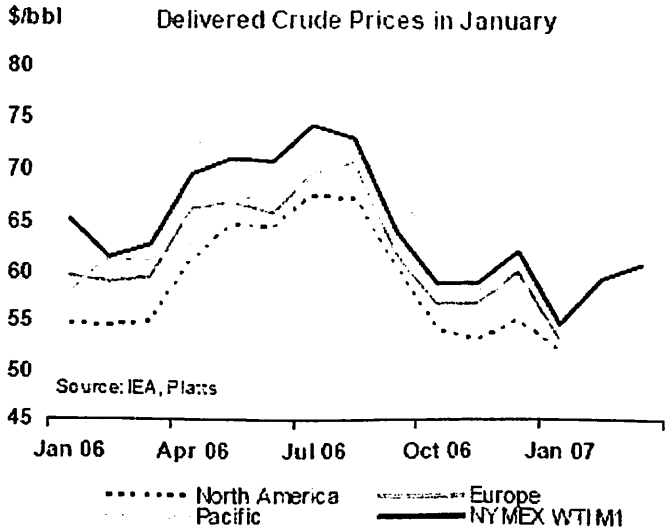
remains weak, leading to unusual spreads to domestic crudes, and is at an unusual discount to Brent for six months out on the forward curve (see text box).

Strong flows of Canadian pipeline crude, as well as refinery maintenance and problems in the US have created a glut of crude in the US Midwest. Stocks at the NYMEX WTI delivery point of Cushing, Oklahoma, are near capacity, but there are limited opportunities to ship it out, leading to heavy spot discounts. In contrast, Gulf Coast refiners' thirst for gasoline-rich crudes has kept seaborne domestic crudes strong. As a result there have been significant shifts in crude price relationships to WTI, with even sour US Gulf crude Mars briefly trading at a premium.

However, while the weak WTI/Brent spreads appear to suggest poor economics for West African and other imports, the same is not true when compared with other (currently) more representative grades such as LLS. But many Western Hemisphere crudes are priced off WTI, and this has led to some unusual trades, including reports of an Indian refiner buying Ecuadorean crude.

In Europe, Dated Brent has been exceptionally strong, also relative to other Atlantic Basin sweets. Low European crude stocks, lower OPEC output, rising freight rates in the Mediterranean (due to the Fos strike) and the worries over Iran have lent support. Urals in the Mediterranean gained vis-à-vis Urals in the Rotterdam market, partly on the Fos strike, but also due to projected lower Black Sea exports in April. Relative to Dated Brent however, both crudes remained flat at around a $3-4/bbl discount. In terms of the arbitrage outside of the region, Urals lost ground to Mars, but rose in value versus Oman.

The Asia-Pacific regional crude market was shaped by sustained demand for grades rich in gasoline and naphtha. This, coupled with shuttered offshore production due to cyclones near Austra lia, prompted regional benchmark Tapis to rise in comparison to West and North African alternatives. Supplies of Middle Eastern Oman also tightened as Omani refineries returned from maintenance. Dated Brent's premium to Dubai approximately doubled from mid-March levels to around $4/bbl, again on strong demand for light products.



However, given Brent's narrower spreads to similar light sweet grades, this did not significantly curb purchases of Atlantic Basin grades in the region.

CHAPTER - 5

Trends in prices of Gasoline

5.1 Comparing recent and historical fuel prices

Recent press releases highlight that gasoline or diesel prices have reached record prices. Expressed in nominal dollars (dollars of any particular year) this is true, but a more reasonable way to compare fuel costs in different time periods is to express the costs in constant dollars: an inflation index adjustment is applied to make dollars from a previous period equivalent to current dollars.

Adjusted for inflation, historical gasoline prices in Washington peaked in 1981, when prices were significantly higher than today. Expressed in 2005 dollars a gallon of gasoline in 1981 would cost about $3 per gallon. After the oil crisis in the late 1970's and early 1980's, average gasoline prices generally declined and by 1998 reached an all time low of about $1.25 per gallon in 2005 dollars. In 1970, a gallon of gasoline would cost about $1.50 in 2005 dollars. Unless otherwise noted, prices in the rest of this report are in nominal dollars and are for Washington State. For price comparisons over a time period of a few years, using nominal dollars is usually sufficient.

5.2 Recent price trends

Gasoline and diesel prices are not regulated and vary depending on both global and regional market conditions and supply and demand fundamentals. After declining to very low levels of less than one dollar per gallon during the winter of 1998-99, gasoline and diesel prices spiked to about $1.68 per gallon on a national basis during June of 2000 – prices were slightly higher on the west coast. This price spike occurred in the early summer when demand for motor vehicle fuel was highest – typically 7 to 9 percent higher than average demand during the winter months.

Additional factors that contributed to the price spike were the booming economy, record levels of sports utility vehicles (SUVs) and truck sales, several refinery and pipeline accidents in California and the Midwest, and the Organization of Petroleum Exporting Countries (OPEC) reestablishing limited control over its production quota goals and world crude oil price. This was the also the first sign that world demand and supply for crude oil were in approximate balance – something that hadn't occurred since 1982. Fuel prices declined sharply as the recession began in late 2000, and were relatively low and stable in 2001 and 2002.

Prices for gasoline and diesel began to rise again in 2003, with the a price spike occurring in March just before the U.S. invasion of Iraq, and the second price spike in late August, due primarily to a late surge in demand related to summer travel. Crude oil prices increased

steadily from the middle of 2003 through 2004 primarily the result of strong global demand growth[1]. Transportation fuel prices peaked again during the summer of 2004 as global crude oil demand tested the limits of global supply[2]. Prices declined during the fall of 2004 and early winter months of 2005, but began to increase fairly rapidly during the spring and summer of 2005, and have recently reached record levels (nominal dollars) of $2.65 and $2.85 per gallon for gasoline and diesel respectively.

5.3 Gasoline price volatility

Several factors appear to be driving the recent volatility in the gasoline and diesel markets:

1. High crude oil prices played a major role in most of the recent fuel price spikes. Crude oil prices have been driven by fear of war, terrorism, civil unrest and worker strikes, and by rapidly increasing world crude oil demand, particularly in Asian countries. In addition, because world crude oil trading is conducted in U.S. dollars, the weakening U.S. currency has encouraged OPEC to unofficially adjust upward its crude oil price window on which it bases oil production targets.

2. US crude oil demand and imports were at record levels during the summers of 2003, 2004 and most likely in 2005. Increasing population, more vehicles, and the continuing popularity of less fuel efficient SUVs and trucks are the factors driving growing U.S. demand for petroleum in the transportation sector.

3. U.S. refineries are producing near their limit, running at 95% capacity for much of the year, and cannot meet national demand. Consequently, increasing quantities of refined products, such as gasoline and diesel, are being imported from other countries: U.S. gasoline imports have risen nearly fourfold, from 3.4 billion gallons in 1983 to 12.9 billion gallons in 2003. With refineries running near capacity during the spring and summer, plus the advanced age of many refineries, accidents now occur frequently. The loss of production from a single large refinery, even for only a few days, can cause prices to increase regionally.

4. US inventories of crude oil, gasoline and diesel were low during 2004. Current inventory levels appear sufficient for the winter heating oil season.

5.4 Component Costs of Gasoline

There are four main components of gasoline cost:

1. Crude oil cost
2. State and Federal Taxes
3. Dealer costs and profit margin.
4. Refinery costs and profit margin

1) Crude oil cost is the price paid for a barrel of crude oil on the international market divided by 42 gallons in a barrel. This will give the price of crude oil per each gallon of gasoline. As we have seen this year, this is often the most volatile price of the fuel. Crude

oil is traded as a commodity, and as the price goes up, prices for gasoline can change very quickly. When prices for crude come down, the price for gasoline typically comes down -- but very slowly. This is typical for most commodities.

For every one dollar increase of the cost of a barrel of crude oil, there is an average increase of about 2.5-cents per gallon of gasoline. So, a $10 increase per barrel in crude prices means a 25-cent increase at the pump. This year's $26.50 increase in crude oil from January 3 to August 8 means a 66-cent a gallon increase in gasoline prices. This additional cost will not go away until crude oil prices start to come down.

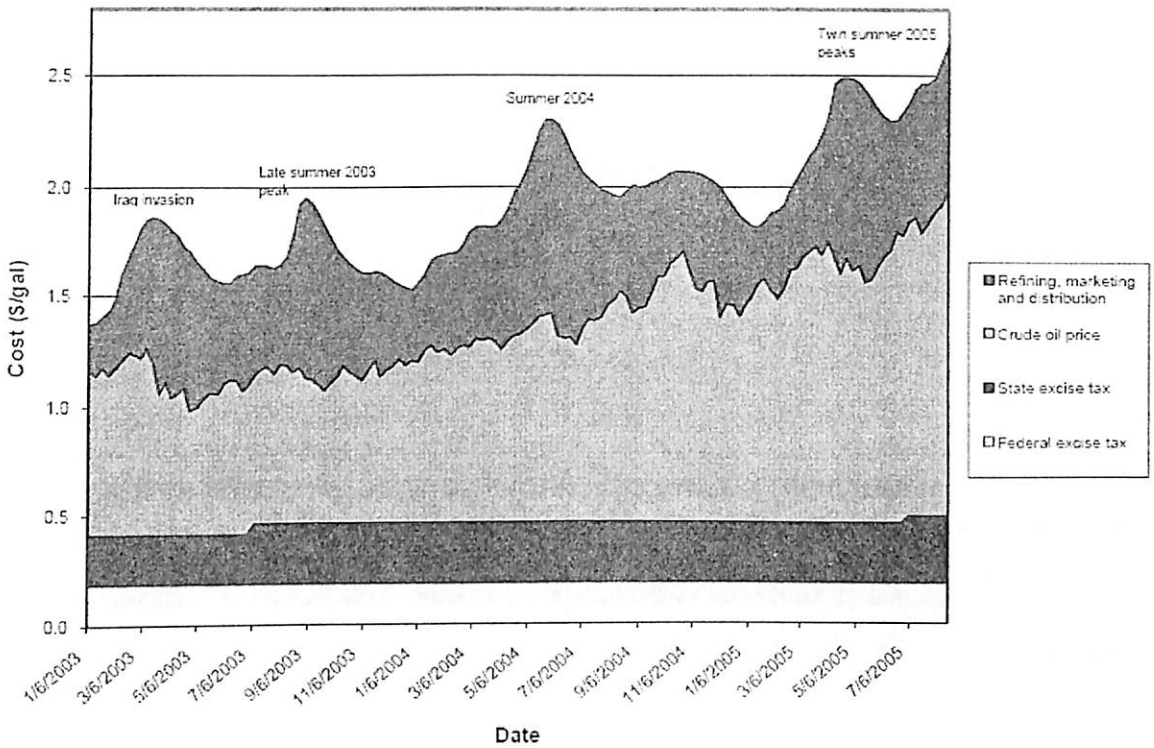
2) Taxes for gasoline in Washington are: 18.4 cents per gallon for federal excise taxes; 31 cents per gallon for state excise taxes; plus local fuel tax options. . Diesel fuel taxes are slightly higher than gasoline taxes. About the only fuel price component that doesn't change much over time are taxes.

3) Dealer costs and profit margin (or the amount that the dealer charges for the fuel) includes all costs associated with the distribution and retailing of motor fuel, including but not limited to: franchise fees and/or rents, wages, utilities, supplies, equipment maintenance, environmental fees, licenses, permitting fees, credit card fees, insurance, depreciation, advertising and profit. Dealer margin normally lags changes in the wholesale price of gasoline.

4) Refinery costs and profit margin (or the prices charged by the oil companies) must cover all costs associated with production, distribution, and acquisition of gasoline. The refinery costs and profit margin covers all costs associated with refining and terminal operation: crude oil processing, oxygenate/ethanol, product shipment and storage, oil spill fees, depreciation, brand advertising, purchases of gasoline to cover refinery shortages and profits. The refinery margin generally goes up in the summer when demand for transportation fuel is highest.

Figure 1 illustrates the weekly average component prices for regular gasoline in Washington State from January 2003 through August 2005. We do not have information on refining margins (refining costs and profits) or marketing and distribution margins in Washington and so estimated the combined value of these two components by taking the difference retail price and the combined cost of crude oil and state and federal taxes.

Cost Components of Washington State Gasoline: 2003-05



As figure 1 indicates most of the recent fuel price increase is attributable to the rising cost of crude oil. Refining, marketing and distribution margins have increased, particularly if compared to margins in 2001 and 2002 (not shown). The cost of crude oil currently comprises about 56 percent of the total cost of a gallon of gasoline. The state tax on gasoline was increased by 5 cents per gallon in 2003 and 3 cents per gallon in 2005: state and federal gasoline taxes currently make up nearly 20 percent of total cost. Most notable is the large swings in refining and marketing and distribution margins during the late spring and summer months due to high demand and limited extra refining capacity on the west coast: these combined margins currently are about 24 percent of total fuel costs.

Figure 2 illustrates the weekly average component prices for regular gasoline in California from January 2003 through August 2005. California does track information on refining margins and marketing and distribution margins, and so these more detailed costs are included in Figure 2.

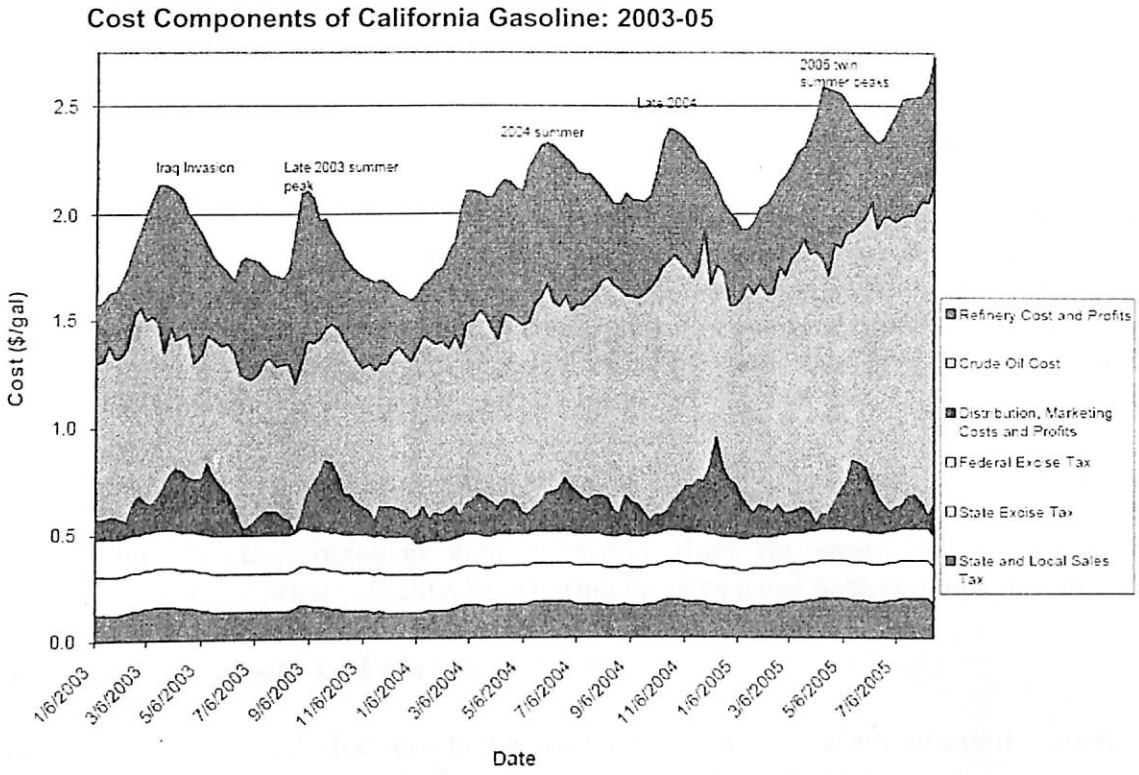


Figure 2 is similar to figure 1, but exhibits a bit more price volatility and illustrates how declines in marketing and distribution margins generally lag declines in refinery margins. This is thought to be due to an aspect of buyer psychology, where buyers don't shop as hard for low fuel prices once prices have begun to decline, thus allowing retailers to lower pump prices in a slow measured manner.

5.5 Inventories

Low petroleum inventories set the stage for our current situation, as they did last year both for heating oil and for gasoline. These low inventories originate from the tight world crude oil supply/demand balance that has evolved since early 1999. Arguably, tightness in crude markets has been the key factor driving low inventories in recent years.

Actions taken by OPEC and several other crude oil exporting countries are largely responsible for the sharp increase in oil prices from the $10 levels seen in December 1998. OPEC dramatically reduced crude oil production in 1998 and early 1999, so much so, that, even after four production increases last year, world inventories remain at extremely low levels. Furthermore, up until the last several months, scarce crude supplies encouraged high near-term prices relative to those for future delivery.

This situation, referred to as backwardation, discouraged inventory growth, and maximum refinery production. Thus, with low crude oil and product inventories, today little cushion exists to absorb changing conditions, setting the stage for volatility.

Although world demand is projected to continue growing this year, OPEC's current plans imply even less production than last year, which will keep world inventories low and maintain crude oil prices close to $30 per barrel for the remainder of the year

Within the United States, gasoline inventories have been even lower this spring than they were last year. (Figure 2) As of May 4, U.S. gasoline inventories were about 4% below their seasonal 5-year average. Midwest inventories were even lower, ending the week almost 9% lower than their 5- year average, and 4% below last year's levels at this time. (Figure 3) Both conventional as well as RFG gasoline markets are tight this year. Such low gasoline inventories are partially a consequence of refineries focusing strongly on distillate production last winter, given that the United States entered the heating season with very low inventories.

Inventories are located near demand areas and act as a buffer for mismatches between demand and production or imports. As EIA has pointed out on numerous occasions, very low gasoline stocks, combined with a market short on crude oil, generates an environment ripe for price volatility, both during the spring and peak summer periods

5.6 Growing Number of Gasoline Types

Another factor is at work that adds to the potential for volatility when inventories are low - the growth in the number of distinct types of gasoline. Today's gasoline market is comprised of many types of gasoline that serve different regional markets to meet varying environmental requirements. While producing specialized products for only those areas with air quality problems is seen as an efficient means of cleaning the air, the increase in product types adds a level of complexity in production, distribution and storage of gasoline.

The result of this targeted approach to air quality has been to create gasoline market islands. The primary examples are California and the Chicago/Milwaukee areas, in which the required gasolines are unique, and only a limited number of refineries make the products. The inventories of gasoline used in these regions can be drawn down rapidly in response to unusually high demand or a supply problem at one of the few refineries producing the specialized products, or in one of the pipelines delivering the products. Prices for gasoline in these regions then surge. If other gasoline markets are not tight, the prices surges may be limited to the specialized gasoline regions, as we have seen historically in the case of California.

5.7 Refinery Capacity Constraints

Refinery capacity limitations have also become a factor affecting the U.S. gasoline market, especially during periods of low inventories. The summer of 1997 was the first time the U.S. refinery system was pushed to its practical operating limits for gasoline production and was unable to respond adequately to unusually high gasoline demand. (Figure 3) As a result, seasonally low inventories were rapidly depleted and prices

surged. Since then, capacity has grown slightly more than demand, but the capacity situation is still tight during the summer.

With little inventory to absorb a supply/demand imbalance, and many refineries running at their practical limits, any supply problems such as refinery outages may not be resolved quickly. This factor increases the time that it takes to respond to a problem and thus increases the potential for price runups and extends the time that prices will remain high. Furthermore, even if the world petroleum market begins to see more supply at some point in the future, lack of excess refining capacity may impede the ability of the system to remedy low inventory problems quickly.

5.8 Dependence on Distant Supplies

If local inventories and local refineries cannot respond adequately to a temporary shortfall in supply, extra product may have to come from a long distance away. The cost, capacity and reliability of logistical systems, as well as travel time for movement of new supply, can all impact the total time needed for adequate supply levels to reach a market, and prices respond accordingly. For example, travel time alone can be 2 or 3 weeks for product to move from the Gulf Coast to the upper Midwest. Distance and lack of pipeline connections have always been a factor affecting California markets. Last year problems with the Explorer pipeline, which brings products from the Gulf Coast to the Midwest helped to propel prices upward.

Figure1

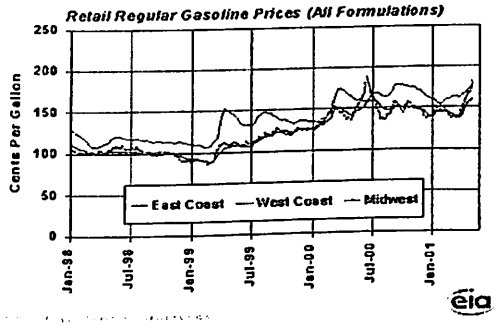


Figure2

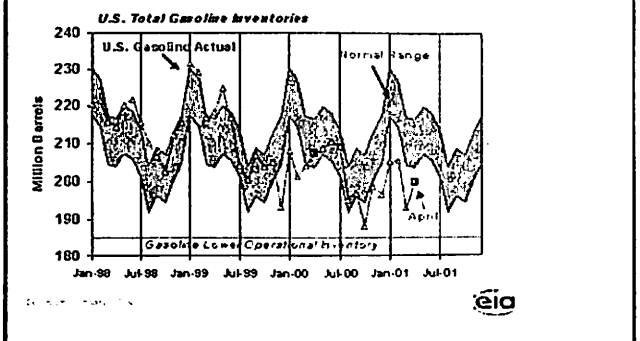


Figure3

Regional Stocks

Total Gasoline Ending Stocks (Thousand Barrels)

	PADD I	PADD II	PADD III	PADD IV	PADD V	Total US
4-May-01	52,923	47,806	63,363	5,497	30,436	200,025
Avg. '96-'00	58,495	52,397	61,775	6,399	29,456	208,521
vs. 5-year	-9.5%	-8.8%	2.6%	-14.1%	3.3%	-4.1%
vs. Last yr	-10.6%	-4.0%	4.3%	-22.7%	-1.6%	-3.7%

5.9 How does global oil supply affect the price of American gasoline?

Given the extent to which the price of crude oil affects the price of gasoline, any fluctuation in the world's crude market can have a significant impact on the gasoline market. In 1960, many of the world's largest oil suppliers formed an organization through which they could coordinate production and ensure consistent supply, thereby providing stability in an otherwise very volatile market. This group, called the Organization of Petroleum Exporting Countries (OPEC), now oversees over half of the oil supplied in the world. By coordinating production and output, OPEC wields heavy influence over the market price of crude oil.

Critics have blamed the organization for "squeezing supply" by limiting the amount of oil that is drilled and refined, thus keeping crude prices high at the expense of the world's oil importers. But others have argued that the only way to compel oil suppliers to bolster their output is to allow crude prices to rise, thereby providing the incentive for increased production capacity. Leonardo Maugeri, an executive at the Italian energy company ENI, recently wrote in *Foreign Affairs* that this is already starting to happen: "As market forces have kicked in, high prices have already started to generate more investment, which will boost both production and refining capacity in the future. In other words, high oil prices are a painful but necessary cure for the disease that has affected the oil market for about twenty years."

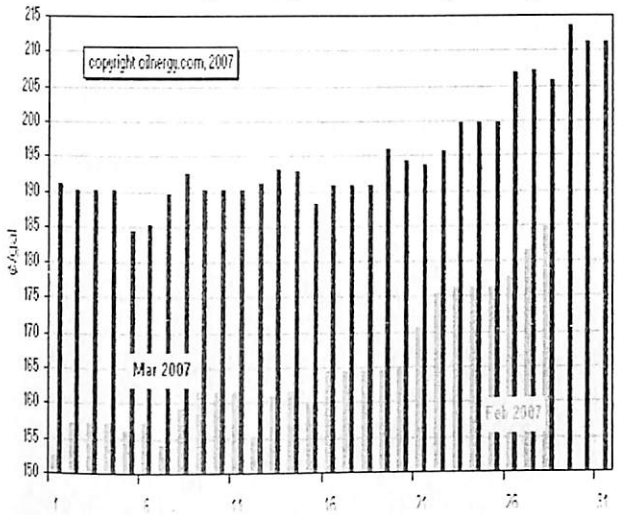
It is important to add that other factors, some out of OPEC's control, have also affected supply. These include political instability in major oil-producing nations, particularly Iraq, Iran, and Nigeria; concerns of terrorist attacks on pipelines and production facilities; and even the weather. Hurricanes Katrina and Rita, for example, caused a significant and painful price-spike in the United States. In this article, CFR's Senior Fellow in International Economics Roger Kubarych examines the market effects of oil shocks.

5.10 What about demand?

In addition to restricted supply, the world's oil market has experienced a recent spike in demand. This has raised the price of crude, and thus in turn the price of gasoline. The spike is a result of increases in demand in the United States, the world's foremost energy consumer, and of explosive growth in the oil needs of major developing nations. In 2004, China displaced Japan as the world's second largest oil importer. India and Brazil also have emerged as major oil consumers. These new markets have only exacerbated upward pressure on the price of crude. China's energy needs, and its efforts to explore new oil markets, particularly in Africa, are examined in this CFR Background Q&A.

NYMEX UNLEADED GASOLINE - DAILY PRICE

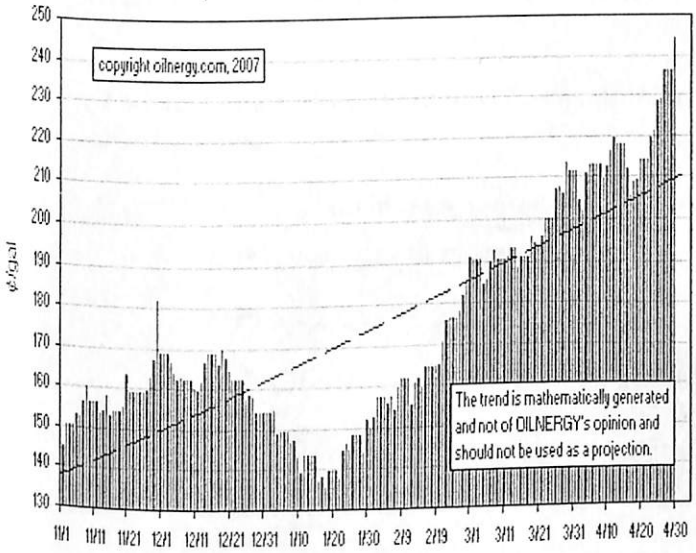
Mar 2007 avg 195.35 c/gal vs. Feb 2007 avg 164.83 c/gal



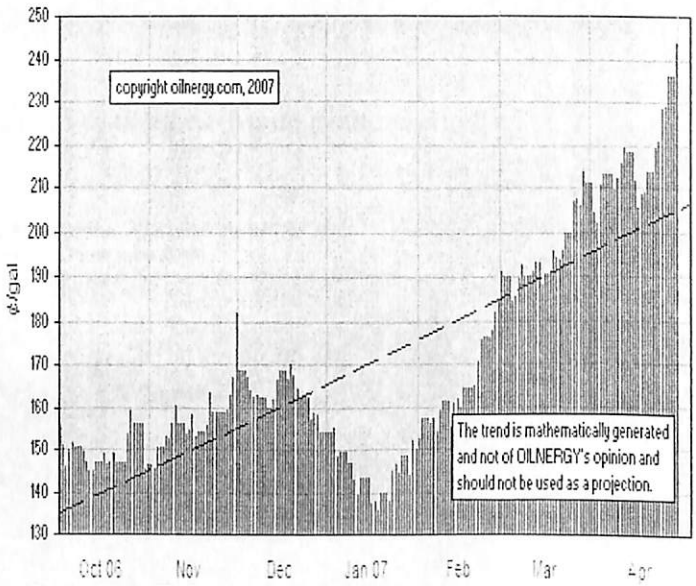
NYMEX Unleaded Gasoline - Daily Price 12 previous months

CURRENT TREND of NYMEX UNLEADED GASOLINE PRICE

(linear fit ... since November 1st, 2006)

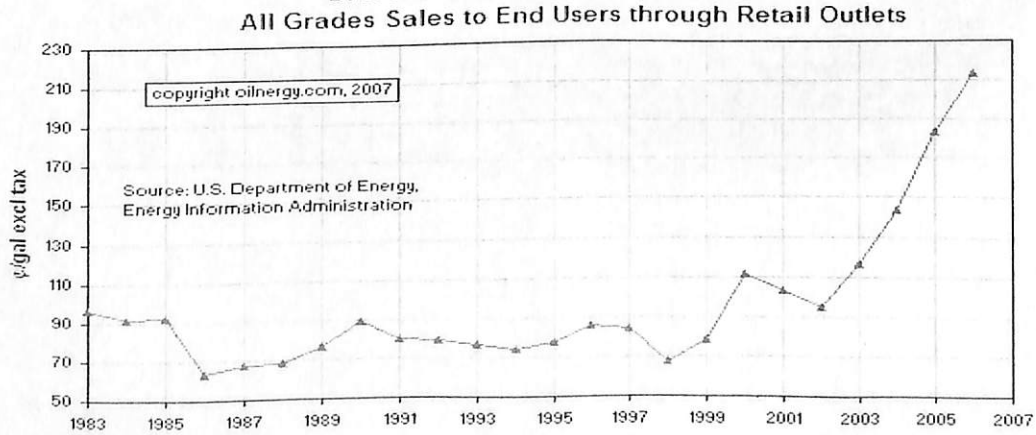


6-MONTH TREND of NYMEX UNLEAD GASOLINE PRICES



U.S. Refiner Motor Gasoline Prices

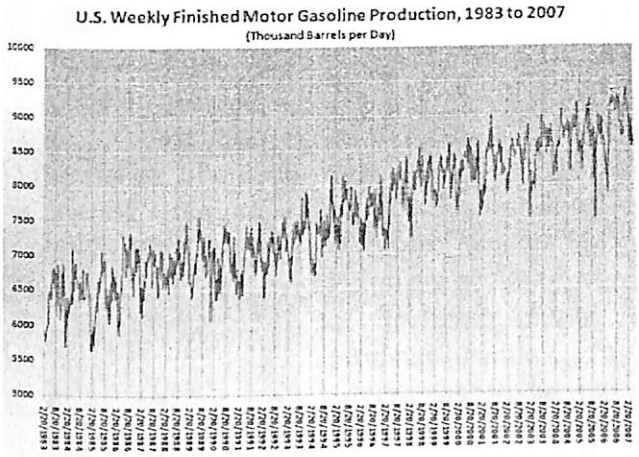
All Grades Sales to End Users through Retail Outlets

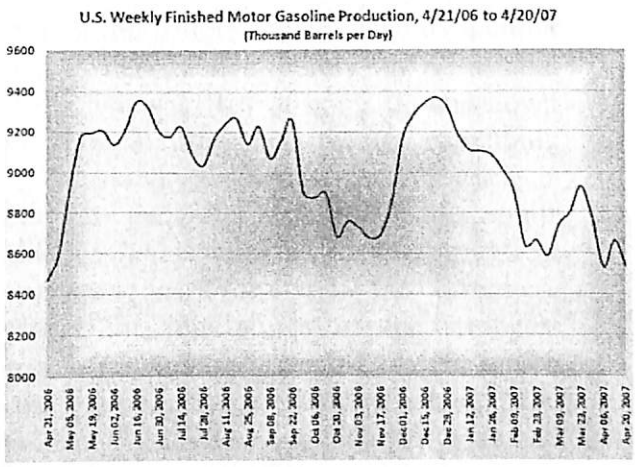


5.11Trends in Gasoline Production and Price

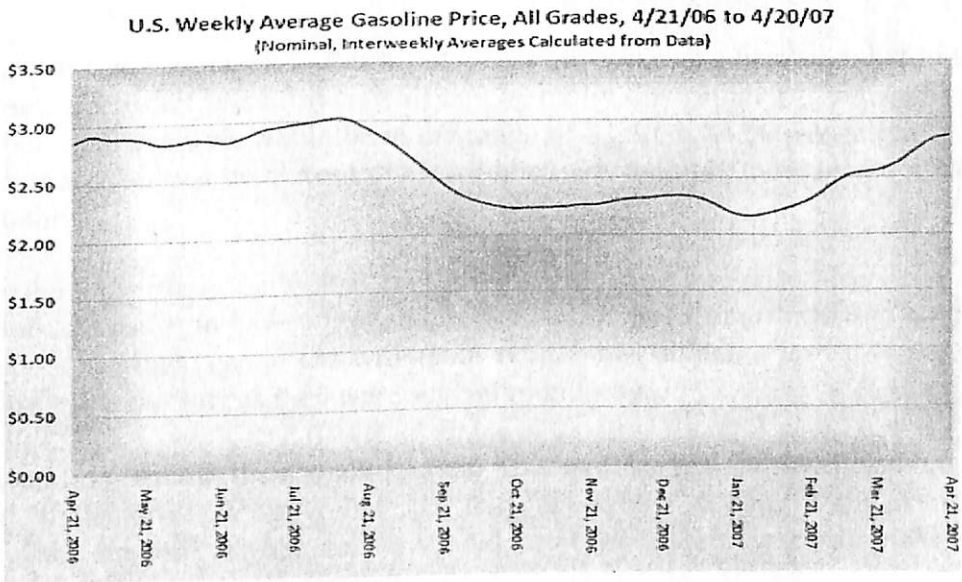
Those who were stunned by last year's run-up in gasoline prices may find themselves by this summer looking back with fond memories on $3.25 per gallon gasoline. Just like last year, refinery production is plummeting at the same time holidays and favorable weather invite drivers onto the roads for longer trips.

The first chart below, shows the weekly history of domestic production of gasoline in the U.S. from 1983 through last week. The second chart is a blow-up for the period from April of 2006 until April 20, 2007.

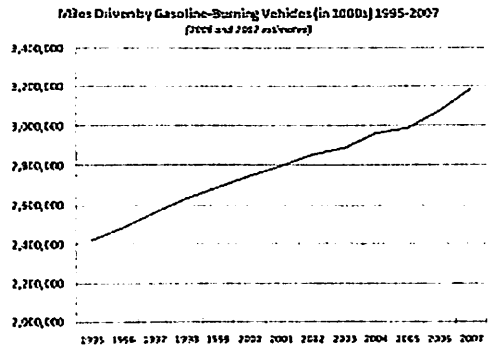




The next chart plots average U.S. gasoline prices, over the time frame of the second chart, above.



The very first chart presented the one that shows U.S. gasoline production over the past nearly 25 years, is informative. Probably its most obvious (and maybe even reassuring) feature is its upward trend, principally the result of steadily increasing demand for gas, as can be seen in the graphic at right, which shows year-by-year vehicle-miles driven from 1995 through 2007 (with 2006 and 2007 being projected from existing data).



However, that gasoline production graph at the top of this article is dominated by another feature: high volatility in the production levels is clearly not merely an occasional phenomenon, but a persistent characteristic. But, whereas that striking up-and-down pattern has always been there, a more careful look at the graph reveals something troubling about the roller-coaster of the cycles: the downward stroke in each cycle is getting stronger. In fact, the deepest down spikes were generally hitting their low points at higher and higher production levels until the output trough in February of 2000, which appears to mark the start of the current era of declining output levels at the low points of the strongest production plunges, as seen in the zoom-in graphic at left, which covers gas production during the period from 2000 to present. The 2005 cycle had a lower low than the 2003 cycle, the 2003 cycle had a lower low than the 2001 cycle, and the 2001 cycle had a lower low than the 2000 cycle. Worse, the 2005 cycle could be considered a *double* low spanning the last half of that year and the first half of 2006, a proposition that seems (and the operative word here is *seems*) to be supported by the emergence of the 2007 downturn now beginning to cause rising gas prices at the pump.

It does not take an economist to figure out where gas prices are headed either in the short or long run. The exact price drivers will be paying by this summer is somewhat hard to predict, but a fair estimate would be in the range of $3.50 to $4.00 per gallon for regular unleaded. If another war breaks out in the Middle East, multiply those prices in that range by two to three.

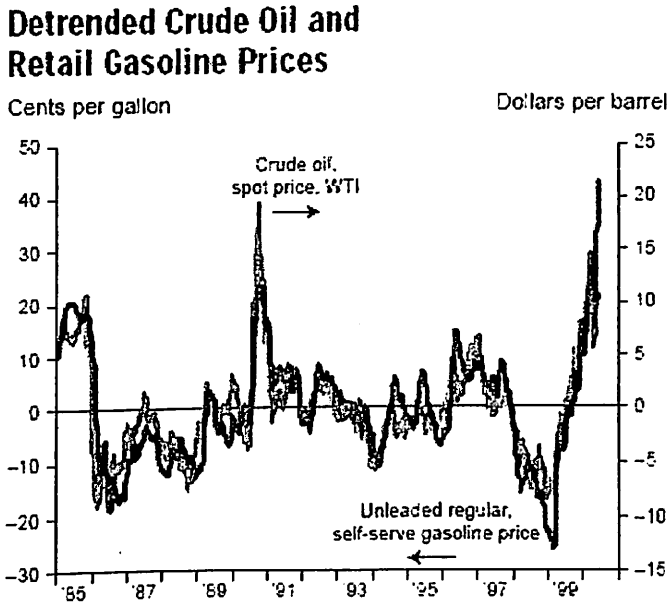
As far as the longer term outlook is concerned, after going into nose-bleed territory long enough for consumers to have wholly unproductive fits and Congressmen to hold equally unproductive hearings, gas prices will again settle back, although probably not down to where they will be as low as they were several months ago.

In the much longer term, the economist John Maynard Keynes succinctly summed up the situation: "In the long run, we're all dead." The only issue in that inevitable event, then, is the cost of the disposal of your carcass should you choose cremation using fossil fuels as the accelerant.

CHAPTER - 6

6.1 Combined movement in gasoline and crude oil prices

The United States consumes 8.5 million barrels of gasoline daily—nearly half its daily consumption of all petroleum products. The average automobile tank is filled weekly, and gasoline prices are posted at every street corner where there is a gasoline station. Consequently, most U.S. consumers are very aware of movements in gasoline prices and closely observe the asymmetry when crude oil and gasoline prices fluctuate. Many consumers complain that gasoline prices rise more quickly when crude oil prices are rising than they fall when crude oil prices are falling, exhibiting an asymmetric relationship.1 To the naked eye, movements in spot crude oil and retail gasoline prices may lend some credence to consumers' complaints



SOURCES: Department of Energy; Haver Analytics.

Furthermore, in some instances when gasoline prices have risen sharply and swiftly following a rise in crude oil prices—such as occurred in 1999 and 2000 and during the Gulf War in 1990—consumers and politicians have called for policies to put a stop to what is seen as unfair pricing practices for petroleum products.2 Such reactions seem to stem from a popular suspicion that large, integrated companies have monopolized the oil industry. The public seems to take the asymmetric relationship between gasoline and crude oil prices as evidence that the petroleum industry is monopolistic. Most of the previous research on the subject confirms at least part of what consumers suspect: it provides econometric evidence of an asymmetric relationship between gasoline and crude oil prices. This article extends inquiry into the issue by considering competing explanations for the asymmetry. The available evidence suggests that asymmetry is unlikely to be the result of monopoly power exercised by large, integrated oil companies.

An examination of the possible explanations for the asymmetry also suggests that government intervention to prevent the asymmetry between gasoline and crude oil prices is likely to reduce economic efficiency.

CHAPTER - 7

Factors which relate the price trends of gasoline and crude oil

7.1 Crude Oil's Impact on Gasoline Prices

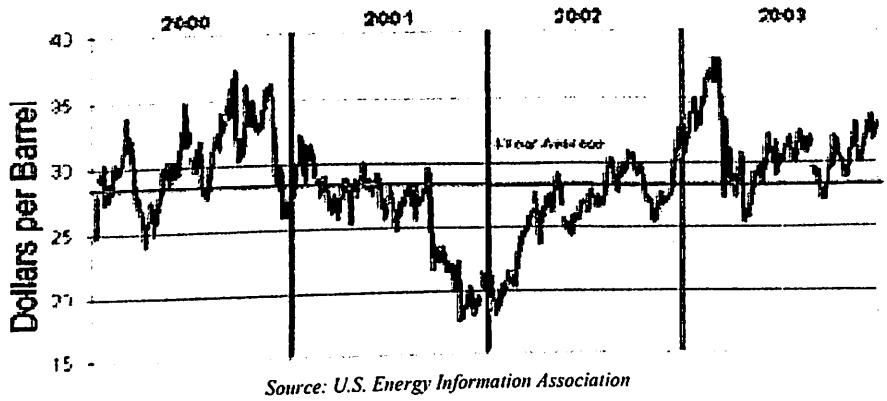
Very little can frustrate consumers more quickly than the frequently changing retail price of gasoline, particularly when they don't see a reason for sudden price increases at the pump. While there are a variety of factors that influence the posted price of gasoline, price increases most often reflect increases in the price of crude oil.

7.2 Crude Oil Markets Influence Gasoline Prices

The price of crude oil historically represents between 40 and 50 percent of the total cost of a gallon of gasoline (42.6 percent of the retail price of gasoline, averaging 2000-2003 data from the U.S. Energy Information Administration — EIA).

It is clear that volatility in the crude oil market translates into volatility in the retail gasoline market. Over the past four years the price of crude oil has fluctuated from a low of $18.28 per barrel following the September 11 terrorist attacks to $36.98 in early 2003. During these periods, gasoline prices essentially mirrored the price of crude.

Chart 1: U.S. Crude Oil Spot Price

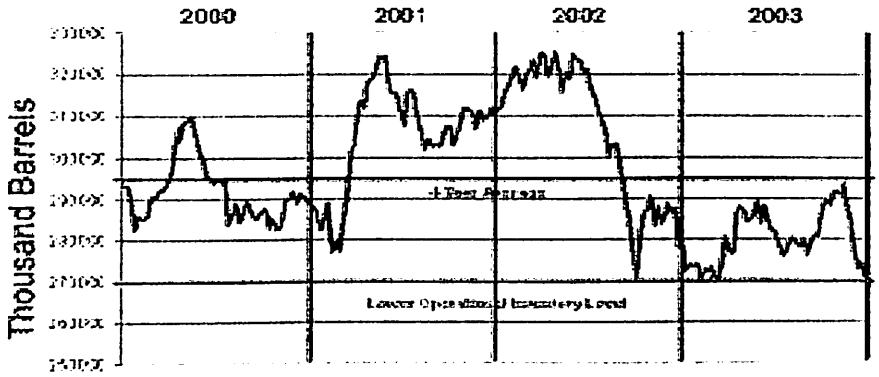


Source: U.S. Energy Information Association

7.3 Crude Oil Supplies Drive Crude Oil Prices

Crude oil price variations are mostly affected by changes in supply — or demand -- but also are influenced by speculation on the part of New York market traders who bid the price up or down depending upon expected future supplies.

Chart 2: U.S. Crude Oil Stocks



Source: U.S. Energy Information Association

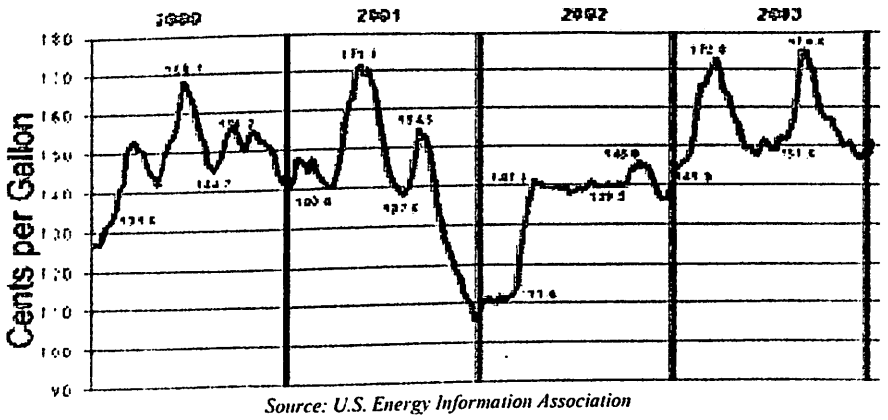
The fluctuations in the price of crude oil present a clear example of the principles of supply and demand. Comparing Charts 1 and 2, it is apparent that prices increase when stocks decrease, and vice verse.

Domestic supplies of crude oil are dangerously low and have been low for more than a year. Not since September 2002 have supplies been as high as the four-year average inventory level. The red line at the 270 million barrel mark of Chart 2 represents the Lower Operational Inventory level established by the National Petroleum Council as the lowest level of supplies at which the U.S. refining industry can efficiently operate. For the first time in more than 25 years, domestic crude oil inventories fell below that benchmark last year and closed the year just below that critical level, setting the stage for another year of tight supplies in 2004.

7.4 Gasoline Supplies Drive Retail Prices

Gasoline inventories influence the retail price of gasoline just as crude oil supplies impact crude oil prices.

Chart 3: Retail Prices (2002-2003)



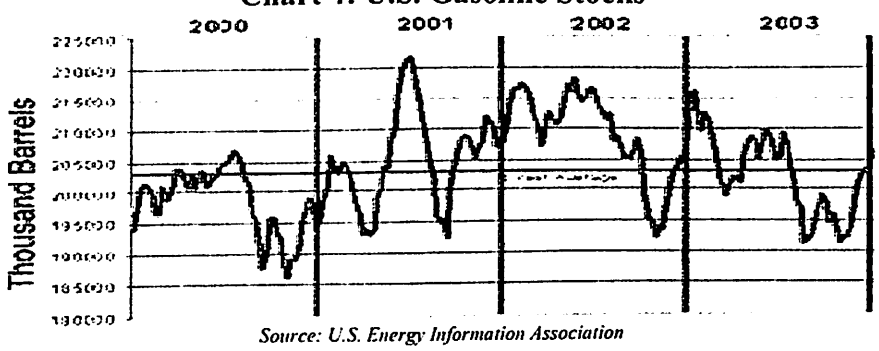
Source: U.S. Energy Information Association

Looking at the roller coaster of retail gasoline prices over the past four years reveals several trends in the marketplace. Each spring, the retail price of gasoline increases as

refiners prepare for the more environmentally stringent summer-time gasoline specifications, which are more difficult and expensive to produce. Once again, prices rise near the end of the summer when refiners begin to transfer some of their gasoline production in preparation for the winter heating oil market. During both of these transition periods, refinery gasoline production capacity is compromised in order to comply with regulatory and marketplace demands. This leads to a decrease in inventories.

Typically, when gasoline stocks become depleted, retail gasoline prices increase shortly thereafter, as seen by comparing Charts 3 and 4. And as stocks build, prices decline. However, there is a delay in this relationship, which EIA identifies as the "pass-through" effect.

Chart 4: U.S. Gasoline Stocks



Source: U.S. Energy Information Association

According to EIA, it typically takes seven weeks, but sometimes as long as 12, for retail prices to reflect changes in the wholesale price of gasoline. Wholesale prices change often, sometimes several times in one day, depending upon available supplies and changes on the crude oil market. Retailers usually do not immediately pass through such frequent adjustments to their customers; rather they spread the changes over time, easing the impact on consumers. This accounts for the offset peaks and valleys seen in the two charts.

In 2003, the average retail price for gasoline throughout the nation remained above the four-year average price of $1.452 was reported. These higher prices were largely because crude oil supplies were below their four-year average and, for most of the year, crude oil prices were above their average. Clearly, there is a relationship between crude oil and gasoline supplies, gasoline supplies and retail prices, and crude oil and retail gasoline prices. At the close of 2003, gasoline supplies were about even with their four-year average and retail prices, at $1.51, were beginning to climb above their average but remained below the 2003 average of $1.56. The climb coincided with a decrease in the supply and an increase the price of crude oil.

With a number of studies showing that gasoline prices respond more quickly when crude oil prices rise than when they fall, economists have offered numerous explanations for the phenomenon.4 Explanations include market power, search costs, consumer response to changing prices, inventory management, accounting practices, refinery adjustment costs, and the behavior of markups over the business cycle. For the gasoline markets, however,

no one has posited a formal econometric test that would allow the testing of the various explanations— including market power—for price asymmetry against the available data. In the absence of such tests, judgment and economic theory must be used to sort through the explanations and determine whether the asymmetric response of gasoline prices to movements in crude oil prices is the result of market power or more benign forces.

7.5 Market Power

Market power is probably the greatest concern to those who observe that gasoline prices respond more quickly when crude oil prices rise than when they fall. For the banking industry, Neumark and Sharpe (1992) show that market concentration is an explanatory variable for the asymmetry found in interest rate movements.

In a comprehensive study of U.S. industry, however, Peltzman (2000) finds no evidence that market power is related to price asymmetry. In addition, neither we nor Peltzman could find a theoretical model that relates market power to an asymmetric response of downstream prices to changes in upstream prices.5 Were such a model to exist, it might involve consumer search costs or firms concerned with maintaining a tacit collusion or both.

Consider an industry with a few dominant firms that are engaged in an unspoken collusion to maintain higher profit margins. Reputation can be important to maintaining such a tacit agreement (Tirole 1990). If the firms value the agreement and have imperfect knowledge of the upstream prices their competitors are paying, each firm would face an asymmetric loss function where it would be more reluctant to lower its selling price than to raise it. When upstream prices rise, each firm is quick to raise its selling price because it wants to signal its competitors that it is adhering to the tacit agreement by not cutting its margin. When the upstream price falls, each firm is slow to lower its selling price because doing so runs the risk of sending a signal to its competitors that it is cutting its margin and no longer adhering to the tacit agreement.

In the gasoline markets, such an explanation could be applied to each upstream price and its adjacent downstream price. Despite popular wisdom and an explanation linking concentration to the asymmetry between movements in crude oil and gasoline prices, there does not appear to be much evidence of monopolization in any segment of the gasoline market. The United States consumed 123 billion gallons of gasoline in 1996.

The market share claimed by the four largest gasoline refiner/marketers (37.7 percent), as well as a relatively low Herfindahl Hirschman Index of 650, suggests that U.S. gasoline production is competitive when viewed at the national level.6 Because refined products are harder and more expensive to ship than crude oil, however, gasoline markets tend to be regionalized. In addition, regional variation in the environmental regulation of gasoline formulation may be increasing the regionalization of gasoline markets.
Furthermore, changes in technology and environmental regulation have caused some smaller refiners to go out of business and increased the market share of the remaining refiners—most notably in California, where the clean air rules are more stringent than the

national average and the number of refiners has decreased (from 31 in 1990 to 23 in 1996).

If gasoline markets were strictly regional, the number of refiners serving a region would be limited by the size of the regional market and economies of scale. In those regions with a few refiners, market power would be a possibility. Nonetheless, gasoline shipments between regions seem sufficient to establish workable competition in most areas and in most regions of the country one can find a number of competing brands of gasoline. The case for market power also seems difficult to make for the retail sector. In rural areas and small towns, regional monopolies could exist, and gasoline stations have often been cited as examples of monopolistic competition.

But, the sheer number of retail gasoline stations makes complete monopolization unlikely. The United States had 190,246 retail gasoline outlets in 1996. Of these, 114,452 were branded outlets (that is, they sold brand-name gasoline) belonging to 21 companies with at least 1,000 outlets each. Citgo, a subsidiary of the Venezuelan PDVSA, had the most retail outlets, with 14,529 in 48 states; Texaco came in second with 13,785 outlets in 25 states. The top six companies had 55 percent of the branded market and 33 percent of the total retail market, none of which provides strong evidence of market concentration or market power. Nonetheless, Borenstein and Shepard (1993) find some evidence of coordinated pricing in a study using data from 1986–91 for 59 U.S. cities.

7.6 Limited Market Power and Search Costs

In the retail gasoline market, consumer search costs could lead to temporary market power for gasoline stations and an asymmetric response to changes in the wholesale price of gasoline. (See BCG, Norman and Shin 1991, Borenstein 1991, Deltas 1997, and Peltzman 2000.) Each gasoline station has a locational monopoly that is limited by consumer search.

After consumers have searched, the profit margins at each gasoline station are pushed down to a roughly competitive level. When wholesale prices rise, the owner of each station acts to maintain profit margins and quickly passes the increase on to customers. When wholesale prices fall, however, each station temporarily boosts its profit margins by slowly passing the decrease on to customers. Only after the customers engage in a costly and time-consuming search to find the lowest prices are the stations forced to lower prices to a competitive level.

A factor slowing the search process is that the costs of an intensive search are likely to be much higher for most consumers than the corresponding gains from finding a cheaper price for gasoline. The money saved is a very small part of the consumer's budget, so that consumers will not search unless the price differential is very high. How large is this differential for the average consumer? The average passenger car consumes 504 gallons of gasoline per year.

For a person filling up the tank every week, that comes to 9.7 gallons per week. The price differential between gasoline stations is usually not more than a couple of cents. If the difference were 10 cents (which is much higher than average), it would amount to 97 cents per week, about the price of a cup of coffee, which is likely to be less than the value of the time used in an aggressive search for lower-priced gasoline.

7.7 More Benign Explanations

Beyond market power and search costs, economists have offered a number of explanations for the asymmetric response of gasoline prices to movements in crude oil prices. Alternative explanations include markups that vary over the business cycle, consumer response to changing prices, inventory management, accounting practices, and refinery adjustment costs. Other than the variation in markups over the business cycle, none of the explanations can be ruled out on either theoretical or empirical grounds.

If markups vary over the business cycle, the difference between the crude oil and retail gasoline price could increase as overall prices rise. Reagan (1982) and Reagan and Weitzman (1982) offer a theoretical explanation for such a relationship based upon the variation in demand over the business cycle. Haltiwanger and Harrington (1991) further suggest that the fluctuations in margins may result from variations in the degree of collusive behavior. However, BBY find that the shocks to crude oil and gasoline prices originate with supply rather than demand, which renders the explanation inapplicable.

The consumer response to changing gasoline prices may contribute to the asymmetry between movements in crude oil and gasoline prices at the retail level. If consumers accelerate their gasoline purchases to beat further increases when its price is rising, they will increase inventories held in automobiles and quicken the pace at which the price rises. If drivers fear running out of gasoline and do not slow their purchases when its price is falling by as much as they accelerated their purchases when prices rose, the price of gasoline will fall more slowly than it rose.

Similarly, firms in the oil industry may view the short-run costs of unexpected changes in their inventories as asymmetric (see BCG). If operation costs rise sharply when inventories are reduced below normal operating levels, a reduction of upstream supply could lead a firm to raise its output prices aggressively to prevent a loss of inventories. If an increase in inventories above normal operating levels has a relatively small effect on costs, the firm could be less aggressive in reducing its selling prices when it experiences an increase in upstream supply.

Hence, inventories would buffer downstream price movements less when prices are rising than when they are falling. If oil supply shocks cause asymmetric movements in inventories—with higher inventories when oil supply is plentiful and lower inventories when oil supply is reduced—the asymmetry of price movements could be enhanced by FIFO (first in, first out) accounting.

If inventories are lower when upstream supply is reduced, the firm will sell the products incorporating the higher upstream price sooner. If inventories are higher when upstream supply is increased, the firm will sell the products incorporating the lower upstream price later. These actions help foster asymmetric pricing. Refiners also face adjustment costs to changing their output or their product mix and, consequently, adjust their output slowly when possible. When crude oil supplies are reduced, refiners as a group have little choice but to reduce output quickly, which would lead to fairly quick increases in gasoline prices. When crude oil supplies are increased, however, refiners don't necessarily have to increase output quickly. They can increase output slowly and delay the decreases in gasoline prices.

7.8 The Policy Response

If we adhere to the traditional view that economic policy should be directed only at market failures or imperfections, policy probably should not be directed at eliminating the asymmetry between crude oil and retail gasoline prices. The evidence of monopolization in refining and wholesale markets for gasoline is weak at best. Peltzman (2000) finds that asymmetry itself is not indicative of a monopolized market. Any market power that might exist at the retail level appears to be related to the costs of product differentiation—most likely in the form of locational differences. Furthermore, Peltzman finds that an asymmetric relationship between an upstream and a downstream price is as likely in competitive markets as in markets thought to be monopolized.

If competitive market forces and asymmetry coexist, steps to suppress or eliminate the asymmetry are likely to prove costly because government interference in natural market processes typically reduces economic efficiency.

If the monopolization of gasoline markets is a concern, policies will be more effective directed at monopolization than at market phenomena that can be the result of either competitive or monopolized markets.

7.8.1 Refining and Wholesale Markets

Because there is little evidence of monopolization in the refinery and wholesale markets for gasoline, the observed asymmetry between wholesale gasoline and crude prices is most likely the result of competitive market forces. Calculations based on the BBY estimates also suggest the degree of asymmetry of response in wholesale gasoline prices to changes in crude oil prices is quite small and of short duration.

Given a 1 percent increase and a 1 percent decrease in the crude oil price, the difference in response of wholesale gasoline to these changes is only 0.35 percent and persists only for two weeks. The asymmetry of response in wholesale gasoline prices starts around the third week and becomes insignificant around the fifth week. If competitive market forces account for the asymmetry between wholesale gasoline and crude oil prices, any policies to eliminate it are quite likely to involve higher costs than living with the asymmetry.

Even if it is the result of market power, the asymmetry is so fleeting that the likely costs of the unintended consequences of a policy to prevent price asymmetries probably would outweigh the benefits. If policymakers are concerned about the monopolization of refinery or wholesale markets for gasoline, the most prudent policy is to watch for mergers that increase market concentration without providing gains in the economies of scale, rather than to take direct steps to suppress asymmetry.

7.8.2 Retail Markets

Compared with the upstream markets, price asymmetries in the retail market are longer in duration and smaller in magnitude. Locational differentiation and consumer search costs could contribute to market power, and Borenstein and Shepard (1993) find evidence of coordinated pricing in the retail gasoline market. But, asymmetric pricing can arise whether or not there is market power. Consequently, the benefits of policies to eliminate asymmetry in the retail gasoline market are likely to be small, while the costs could be high.

Calculations made with the BBY estimates suggest that a 1 percent increase and a 1 percent decrease in the price of oil lead to a peak differential of only 0.2 percent in the response of the retail gasoline price. To illustrate, suppose the current prices for oil and gasoline are $30 per barrel and $1.50 per gallon, respectively. The peak difference in the response of the retail gasoline price to a $6 increase and decrease in the per barrel price of crude oil would be only 6 cents per gallon.10 For the average driver, this differential would amount to about 60 cents in the peak week. Because the differential is so small and search costs are high, it is not surprising that the price asymmetry persists longer than 16 weeks.

Since there is no evidence or theory suggesting that asymmetry necessarily arises from market power in the retail market, policies aimed at eradicating asymmetry are likely to reduce efficiency. Even a simple policy of requiring retail margins to remain constant over time could have unintended consequences for inventories and lead to shortages when prices are rising. More complicated policies would be more difficult to administer.

Again, the best policy seems to be to watch for mergers that increase market concentration, rather than to take direct steps to suppress the asymmetry.

CHAPTER - 8

Findings and Suggestions

8.1 Some of the major factors that drive crude oil prices:

Geopolitical Uncertainties. Tensions continue between Western countries and Iran over its nuclear ambitions. The unstable relationship could jeopardize exports from Iran, the world's fourth-largest oil exporter. Other global concerns include civil unrest, political uncertainty and sabotage affecting the flow of oil from Nigeria, another significant oil supplier. Meanwhile, friction continues between the governments of the United States and Venezuela, a major exporter to the United States. Additionally, a series of production cuts by members of the Organization of Oil Exporting Countries (OPEC) have tightened world oil markets.

Approach of Driving Season. Warm weather invites people to hit the road for spring and summer vacations along with weekend trips. The increase in travel drives fuel demand, and gasoline prices typically follow. The EIA is forecasting $2.87 as the peak nationwide average price for a gallon of regular gasoline this driving season (April-September). That's down slightly from last summer's average peak of $2.98.

Refinery and Pipeline Issues. Refineries usually use the spring months for major routine maintenance and to retool for summer gasoline blends required in various parts of the country to meet air emission requirements. Refinery maintenance as well as unplanned shut-downs reduces gasoline production. Depending on inventory levels and the strength of gasoline demand, this situation may put pressure on prices until additional gasoline supplies can be imported.

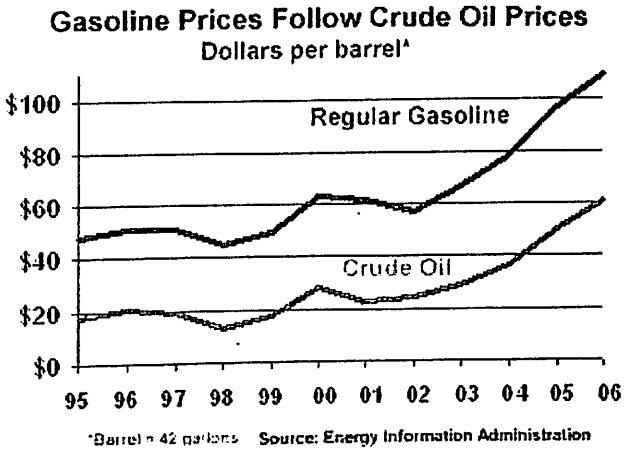
Growing Demand. Consumption of gasoline and other oil products is growing around the world, especially in rapidly developing countries such as India and China, which is now the world's second-largest energy user. Global oil demand is expected to rise by more than 1.4 million barrels per day in 2007, compared with a growth rate of 1.2 million barrels per day in 2006, according to the EIA. Gasoline demand in the United States has been growing less than in developing nations, but Americans remain the world's largest gasoline consumers, using an average of 390 million gallons a day in 2006.

Lack of Spare Production Capacity. In the past, a supply disruption in one area of the world has been softened by the ability of major oil-producing nations such as Saudi Arabia to increase output to make up the difference. Now, much of that reserve capacity has been soaked up by increased demand, with the supply cushion now estimated to be about two million barrels a day in a world that every day is using 85 million barrels (or nearly 3.6 billion gallons) of oil products.

Lower Alaskan Oil Production. Full production is resuming in Alaska's Prudhoe Bay Oil field after operations were partially shut down last August because of pipeline corrosion. The situation resulted in a temporary loss of as much as 4 percent of the nation's oil production.

Fuel Specifications. United States refiners in the spring and summer of 2006 began phasing out the fuel additive methyl tertiary butyl ether (MTBE) and replacing it with ethanol. The switch to ethanol, which is mandated by federal law, has resulted in a tightened supply and higher prices for this grain-based product. Although increased use of ethanol is expected to bring environmental benefits, ethanol adds to gasoline production costs because it currently is more expensive than the MTBE it is replacing.

Hurricane-related Supply Interruptions. Hurricanes in the late summer of 2005 had a major impact on energy-producing facilities in the Gulf of Mexico, where roughly one-third of oil production the United States occurs. Even today, repairs are continuing at some production and pipeline facilities that received severe damage more than a year ago.



8.2 Findings

Crude oil prices and gasoline prices are linked, because gasoline is derived from the refining of crude oil. As a result, crude oil prices and gasoline prices generally follow a similar, albeit not identical, pattern over time. For example, from January 2004 to the present, the price of West Texas Intermediate crude oil rose by almost $20 per barrel, an increase of almost 60 percent, while over the same period, average gasoline prices rose nationally from $1.49 to $2.20 per gallon, an increase of 48 percent.

Explanations for this large increase in crude oil and gasoline prices include rapid growth of world demand for crude oil and petroleum products, instability in the Persian Gulf region, and actions by the Organization of Petroleum Exporting Countries (OPEC) to restrict the production of crude oil and thereby increase its price on the world market. In addition to the cost of crude oil, gasoline prices are influenced by a variety of other

factors, including refining capacity constraints, low inventories, unexpected refinery or pipeline outages, environmental and other regulations, and mergers and market power in the oil industry.

Gasoline prices in California, and in other West Coast states, have consistently been among the highest in the nation and recent experience is no different. For the last week in April, the price of regular grade gasoline in California was $2.57 per gallon, about 37 cents above the national average.

Explanations for California's higher than average gasoline prices include (1) California's unique gasoline blend, which is cleaner burning and more expensive to produce than any of the other commonly used gasoline blends; (2) a tight balance between supply and demand in the West Coast, and the long distance to any viable sources of replacement gasoline in the event of local supply disruptions; and (3) California's higher level of gasoline taxes— California currently taxes a gallon of gasoline at 30 cents per gallon more than the state with the lowest taxes, Alaska. Some sources have also attributed high gasoline prices, in part, to the fact that California's refining sector is more concentrated in the hands of fewer companies than in other refining areas, such as the Gulf Coast.

Future gasoline prices will, in large part, be determined by the supply and demand for crude oil and its price on the world market. World crude oil demand is projected to rise, so new sources will have to be developed or prices will rise. Technological innovations that reduce the cost of finding or extracting crude oil could reduce prices, other things remaining constant.

Greater conservation or improvements in energy efficient technologies could also mitigate rising demand and reduce upward pressure on prices. In addition, alternative fuel sources may become more economical, thereby supplanting some of the demand for crude oil and gasoline in the future. America faces daunting challenges in meeting future energy demands, and policy makers must choose wisely to ensure that the country can meet these demands, while balancing environmental and quality of life concerns.

It is estimated that the nationwide price for regular gasoline will average $2.81 a gallon this summer compared with $2.84 a gallon last summer. Prices on the West Coast are typically higher than the national average because of taxes and higher refining costs associated with regional environmental requirements.

The cost of crude oil is the largest of many factors propelling gasoline prices. As the principal raw material for making gasoline, oil accounts for more than half of the cost of gasoline. Crude oil prices have risen considerably since 2001, and in recent weeks oil prices reached a six-month high. Crude oil is an internationally traded commodity, and events and developments in both oil-producing countries and oil-consuming nations can have effects throughout the world.

CHAPTER - 9

9.1 Limitation of Study

Since no econometric test has been conducted so far regarding this topic, hence it becomes quite difficult for us to accurately quantify the fluctuation between the two commodity prices. Further, the factors which are responsible for the fluctuation of crude oil prices may diverge from that of the factors influencing the gasoline prices. Therefore, we can measure behavior of prices of the commodities in the broader aspect only.

9.2 Conclusion

A number of studies confirm casual observations that gasoline prices respond asymmetrically to crude oil price movements by rising more quickly when crude oil prices are rising than falling when crude oil prices are falling. Although popular opinion seems to attribute the asymmetry to market power, Peltzman (2000) shows that price asymmetries arise independently of market structure. In addition, no formal theory relating market power to asymmetry has been tested (to our knowledge), nor is there much evidence of concentration in U.S. markets for gasoline. Consumer search costs and locational advantages may provide market power to some retailers, but such market power might be viewed as the costs of product differentiation under monopolistic competition.

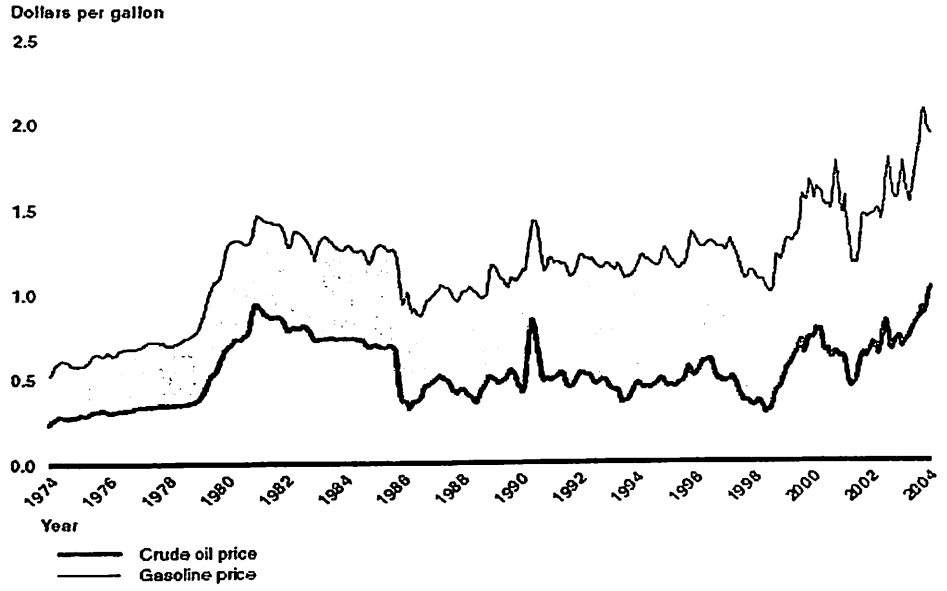
With the evidence pointing away from market power as an explanation, asymmetry is likely to be the consequence of other market factors. As such, policies to suppress asymmetric price movements are likely to lead to undesirable outcomes. If one is concerned about market power in the production, distribution, and marketing of gasoline, the best policy seems to be watching for mergers that increase market concentration without increasing economies of scale, rather than taking direct steps to suppress asymmetry.

Crude oil prices and gasoline prices are inherently linked, because crude oil is the primary raw material from which gasoline and other petroleum products are produced when crude oil prices fluctuate, gasoline prices generally follow a similar pattern. In recent months, crude oil prices have risen significantly—from January 2004 to the present, the price of West Texas Intermediate crude oil, a benchmark for international oil prices, has risen by almost $20 per barrel, an increase of almost 60 percent. Over the same period, average gasoline prices rose nationally from $1.49 to $2.20 per gallon, an increase of 48 percent.

Explanations for this large increase in crude oil and gasoline prices include rapid growth of world demand for crude oil and petroleum products, particularly in China and the rest of Asia, instability in the Persian Gulf region (the source of a large proportion of the world's oil reserves), and actions by the Organization of Petroleum Exporting Countries

(OPEC) to restrict the production of crude oil and thereby increase its price on the world market. Figure one illustrates the relationship between crude oil and gasoline prices over the past three decades. The figure shows that major upward and downward movements of crude oil prices are generally mirrored by movements in the same direction by gasoline prices.

Figure 1: Gasoline and Crude Oil Prices—1974-2004 (Not adjusted for inflation)



As we look ahead at the remainder of this year and next, it is expected that crude oil prices to remain above $50 per barrel. World demand, while likely growing less than in 2004, is expected to continue relatively strong growth. Projections for 2005 and 2006 call for worldwide growth averaging 2.2 million barrels per day, or 2.6 percent, per year, down from the 3.4 percent growth in 2004. With little excess crude oil production capacity, this growth will be met mainly by expanded capacity in Russia, the Caspian Sea region, and Saudi Arabia, but the balance between supply and demand is expected to remain tight, leaving little room for error.

The tight crude oil market also increases the likelihood of continued crude oil price volatility. For example, crude oil prices could ease somewhat over the next few months as world demand relaxes seasonally and refinery maintenance in other parts of the world eases the pull on crude oil supplies. However, as the world's high demand season gets underway in the run-up to winter, crude prices may rise again, possibly to the mid-$50's per barrel, as seen earlier this year. High refinery utilizations and non-fungible product specifications reduce supply response flexibility and thus add to the potential for volatility.

At this point, little is certain. Gasoline markets could turn in either direction. If crude oil prices do not increase further, the United States may have already seen or may lie near its high point for summer gasoline prices. Even so, a second peak towards the end of the driving season is possible if summer demand surges as it did in 2003, even without

further increases in the price of crude oil. California's tight market is even more subject to short-term swings in price through the summer months than elsewhere in the United States. In addition, crude oil markets could tighten again as we near the fourth quarter with world demand rising seasonally. If this occurs, crude prices could also contribute to a late summer or early fall increase in gasoline prices.

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Annexure - 1

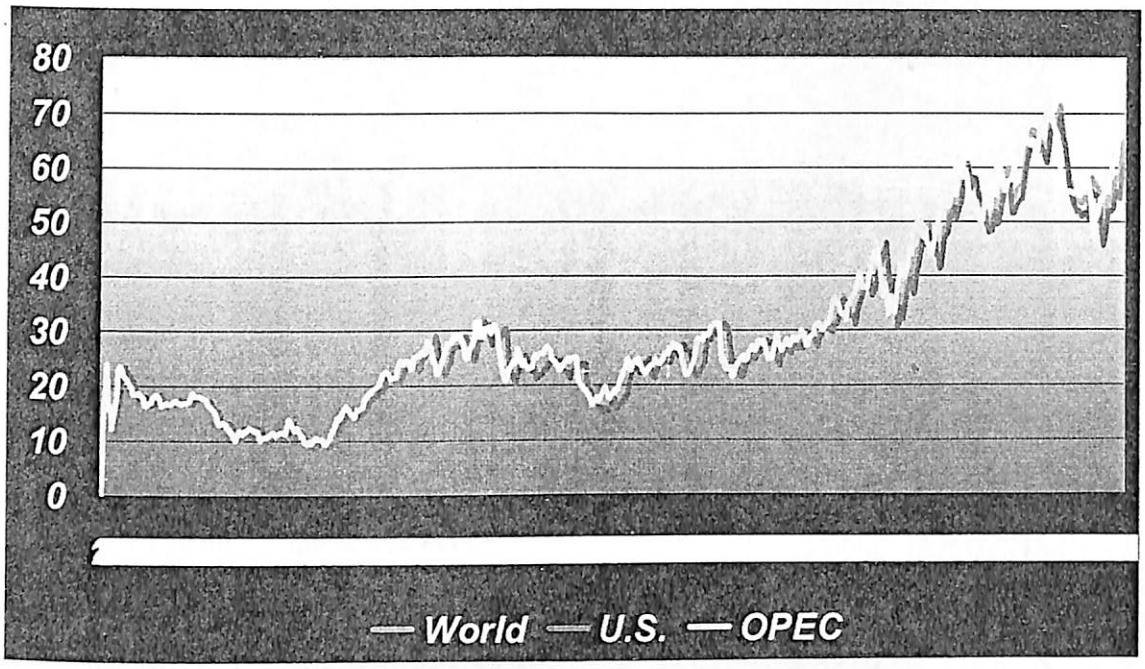

Figure1- Comparison Spot Price FOB Weighted by Estimated Export Volume (Dollars per Barrel); Source: Self developed with the data available on EIA site from Jan 78 to Mar 07.

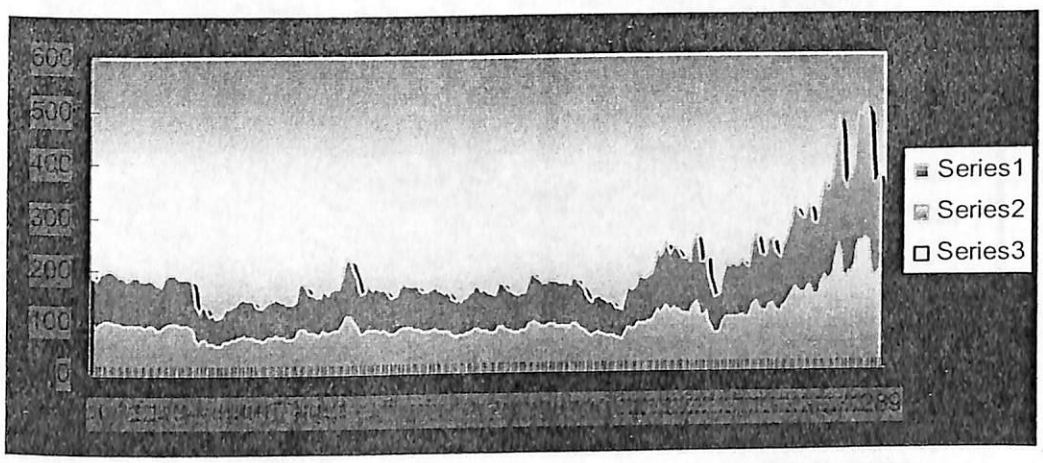

Figure 2- U.S. Refiner Gasoline Prices by Grade and Sales Type; Source: Self developed with the data available on EIA site from Jan 83 to Jan 07.

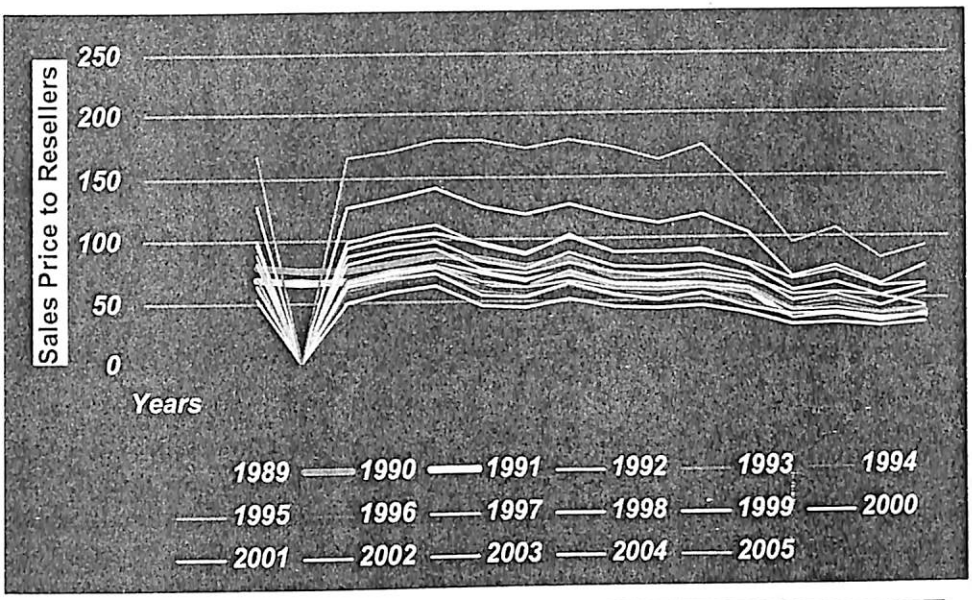

Figure 3 : Refiner Sales Prices and Refiner Margins for Selected Petroleum Products, 1989-2005.

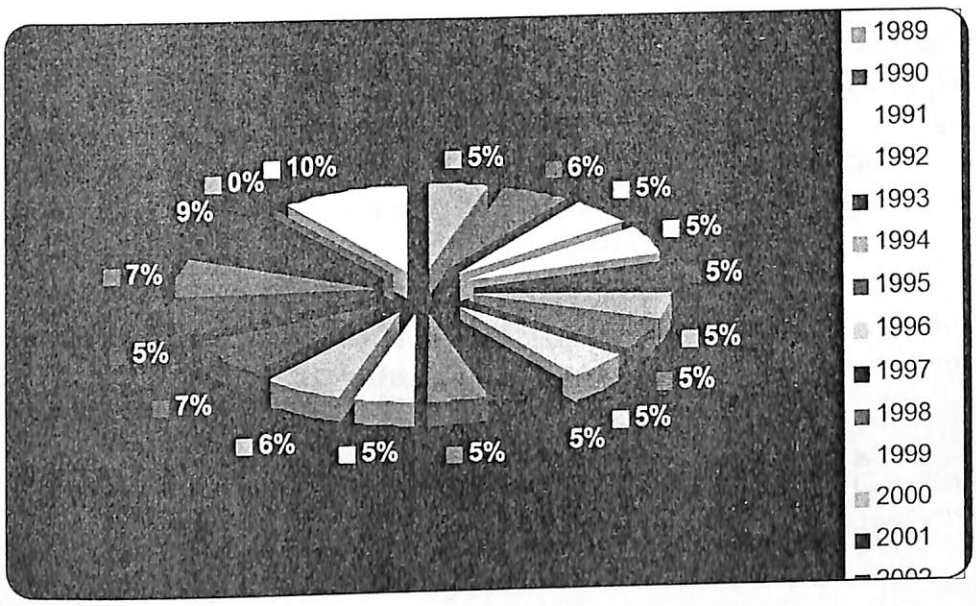

Figure 4 : Refiner's Margin (U.S.), 1989-2002.

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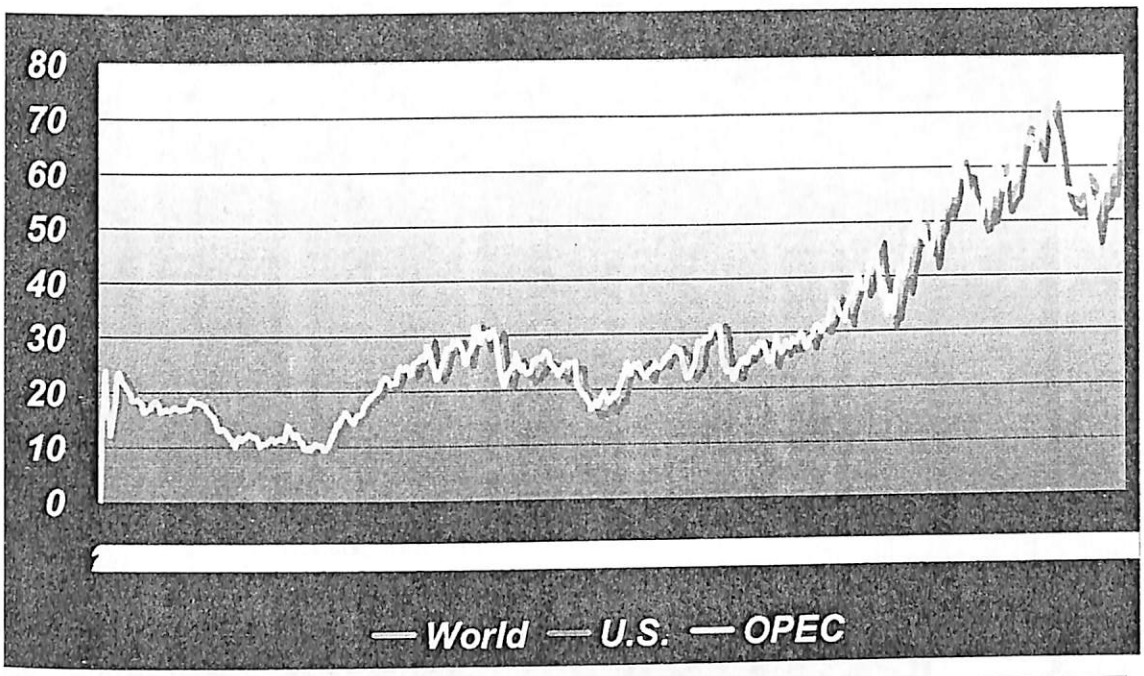

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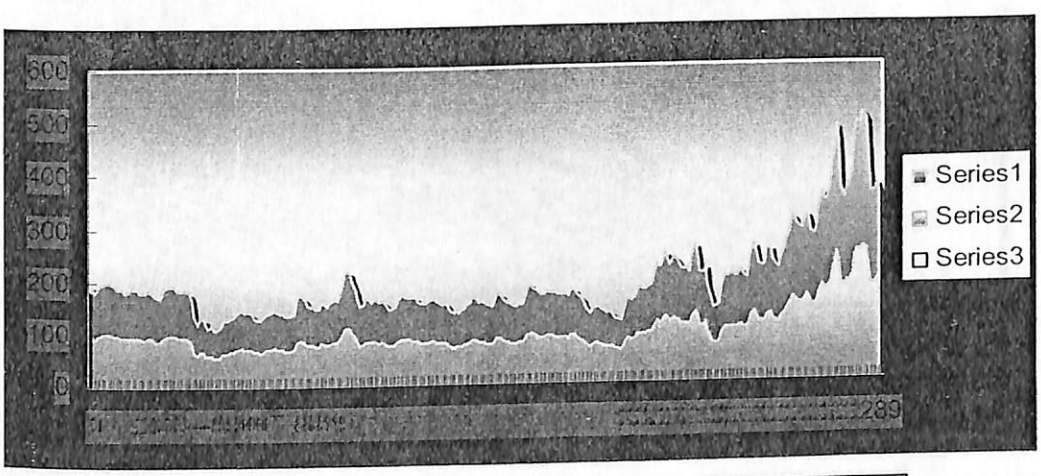

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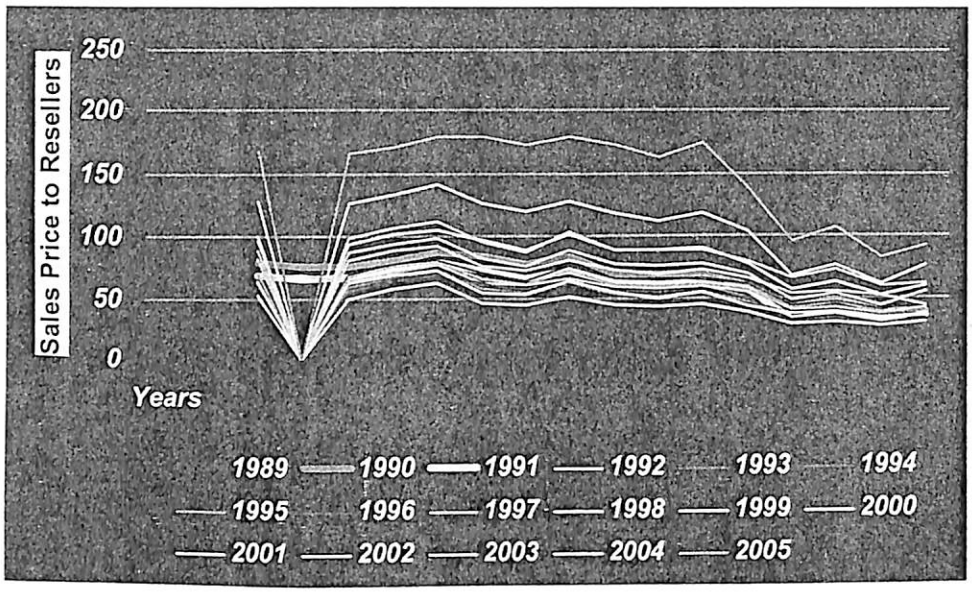

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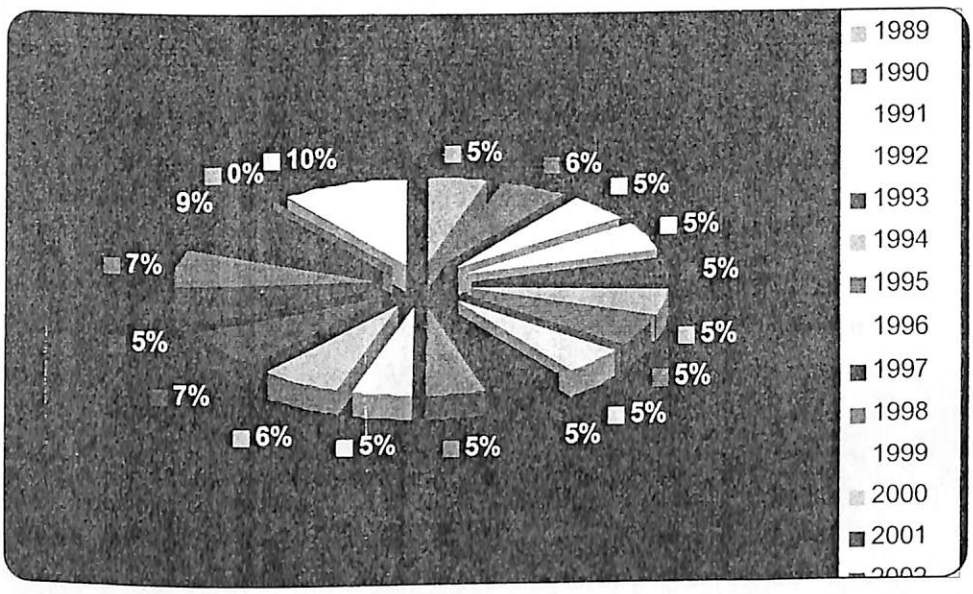

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