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THE GEM DIAMOND MARKET RESPONSE TO INCREASED PRODUCTION

by

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ABSTRACT

Diamonds are produced from 20 countries around the world with Australia, Zaire, Botswana, South Africa, and the USSR accounting for 95% of world natural diamond production. Between 1981 and 1986 Australia grew from a nonproducer to the world's largest diamond producer. In 1984, the Argyle diamond mine in Western Australia began operations and has since increased its market share to over 40% of world gem diamond production. Similar mine development in Botswana and increased production from other countries has more than doubled diamond production and nearly tripled gem production since 1982.

Diamonds pass through four stages to reach consumers: mining, distribution and selling of rough diamonds, manufacture, and public sale. The distribution and sale of 80% of the world's rough diamonds to the competitive wholesale and retail market is through the Central Selling Organization, a De Beers-controlled producer cartel.

Historically, De Beers has possessed sufficient control of production and sales to maintain a long-run 8% to 10% annual increase in the nominal price of diamonds. To achieve its goal of maintaining the value of diamonds and therefore long-term profits, De Beers controls supply by withholding

stocks during conditions of weak demand or oversupply and by selling from its buffer stockpile when demand is high.

At present, the gem diamond market is faced with increased production and a shift in production control away from De Beers. The implications of this situation suggest that demand for gem diamonds must increase, De Beers must stockpile a tremendous volume of diamonds, independent producers must cooperate in maintaining the cartel, or producers may seek market share through competitive behavior resulting in prices falling. Using the historical record, a simple econometric model of U.S. apparent consumption, per capita consumption trends, and intensity of use analyses, it is concluded that a decline in prices and independent competitive behavior are the least likely outcomes. Rather, demand is expected to increase by expanding both customer and product markets. Until demand has expanded sufficiently to absorb new levels of production, De Beers will continue to enlarge its growing stockpile. The financial ability of De Beers and its many related companies appears to be sufficient to maintain a growing stockpile for many years.

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Chapter 1

INTRODUCTION

Purpose and Statement of Problem

Between 1982 and 1987 world annual diamond output more than doubled from approximately 40 million carats to over 100 million carats as a result of increased production in Botswana and Australia (Figure 1.1). Of total diamond production, the percentage which is classified as gem has also increased from 25% to 44% over the same period. As a result of increased production along with an increased percentage which is gem quality, world gem production has been raised four-fold from approximately 10 million carats in 1982 to over 44 million carats in 1987 (Figure 1.2).

In addition to increased production, there has been a shift in dominance at the mining stage from De Beers controlled production, which in 1982 was approximately 44% of diamond output, to 23% in 1987. In its place, Australia has grown from a non-producer in 1981 to claim 37% and 41% of the total diamond and gem production respectively in 1987.

It is the purpose of this study to evaluate how increased world diamond production and a shift in production dominance from De Beers-controlled mines to independent mines of Australia will effect economic factors of price, demand,

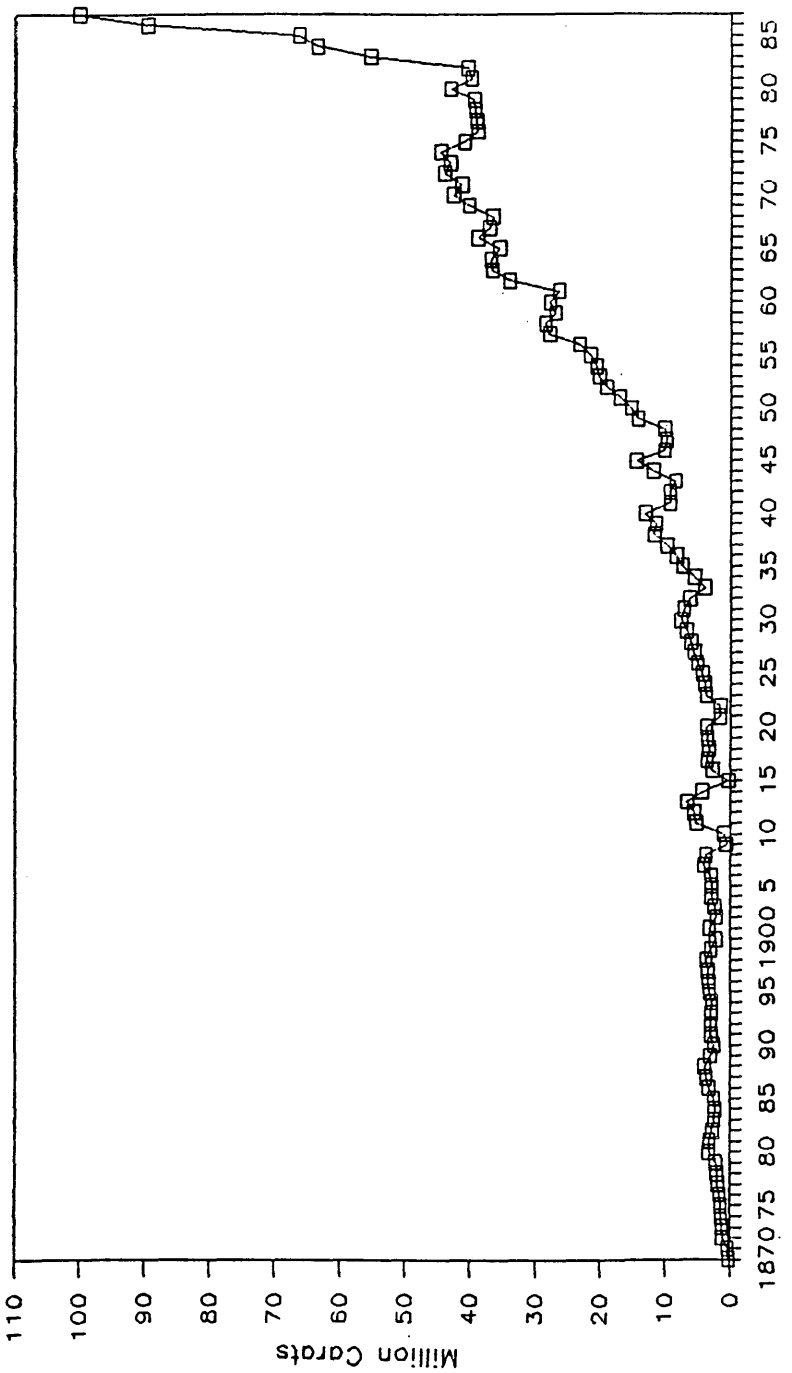

Figure 1.1

World Annual Diamond Production, 1870-1987

Source: USBM Yearbook

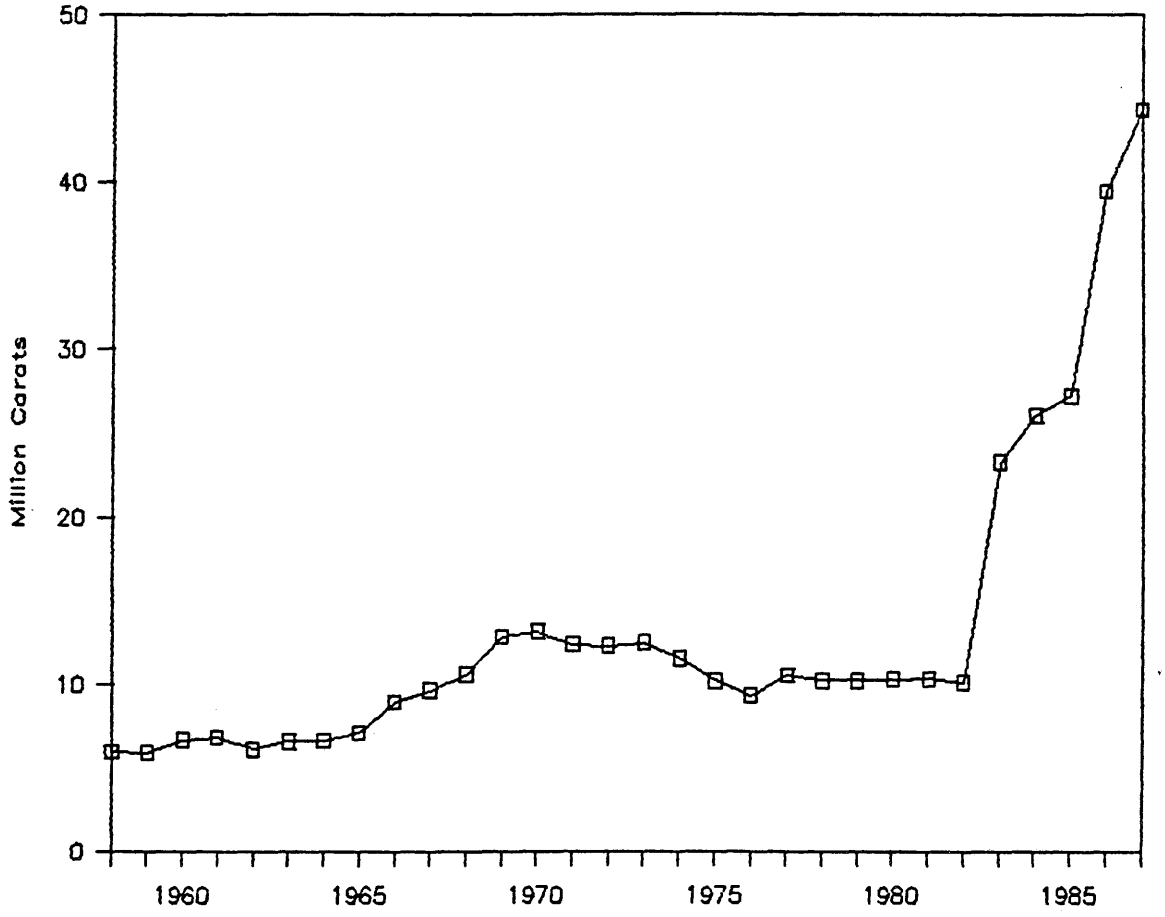

Figure 1.2

World Annual Gem Production

Source: USBM Yearbook, 1959 to 1986
Mining Annual Review, 1988

and supply. Within this framework, the behavior of producers and consumers is examined.

Scope

To evaluate the problem posed, it is necessary to understand the gem diamond production and distribution process along with consumption habits of gem diamond consumers. To this end, the De Beers group of companies, independent diamond producers, and the history of the diamond industry are investigated to understand the supply side. Consumption habits and the role of gem diamonds as a store of value, in jewelry and as an investment, are examined to understand diamond demand.

This investigation is not intended to be an exhaustive study of the numerous issues or problems within the gem diamond industry but rather a comprehensive overview of how the industry operates and how increased gem diamond production will affect the gem diamond market.

Evaluation of price, demand, supply, and De Beers's control over these factors is attempted empirically using data available from the United States Bureau of Mines, corporate annual reports, and trade journals. Limited econometric modeling is used as a guide to understanding factors which influence consumption.

Although data are available, much information on the diamond industry lies within the confidentiality of the De Beers inner circle. Information released by De Beers tends to be nonspecific (e.g., "substantial increases," "performed well," "took appropriate action,") leaving observers who have published on the diamond industry to fill in their own interpretations. This practice has led to inconsistent industry descriptions, speculation, and discussions which differ in account from writer to writer. This study attempts to present the most commonly held view and, where appropriate, present alternative views.

Another potential source for error is the data itself. Price and production data are inconsistent in several instances. The data which appear to be most consistent are used. Interpretation and conclusions of this study are based on the assumption that the data reasonably approximate reality, although it is acknowledged that diamonds are smuggled in abundance, not declared to customs officials, and otherwise misrepresented in quantity and value to data collection authorities. In the subject area of recycled diamonds, very little data and information is available.

The volume of literature on the diamond industry is fairly limited and in general, not scholarly in content. Two exceptions are The History of Diamond Production and the

Diamond Trade by G. Lenzen and Ernest Oppenheimer and the Economic Development of Southern Africa by T. Gregory. Lenzen's thorough investigation covers the history of man's involvement with diamonds from antiquity to present. By far, the emphasis is on pre-1930 history. Although exhaustive, the book is poorly organized and difficult to read due to its translation from German. Gregory's biography of Ernest Oppenheimer is a thorough and well written biography but, for the most part, does not contain information relevant to this study.

Several books published in the early 1980s describe the industry and its operating methods from a general information perspective. Of these, two books are particularly informative. They are The Diamond World by D. Koskoff and the World of Diamonds by T. Green. Both books present comprehensive overviews of the diamond industry and its actors along with entertaining anecdotes for the general reader. Other books dating from various periods cover an assortment of peripheral issues related to the diamond industry such as its impact on development of African countries. One book in particular, West African Diamonds 1919-1983, an Economic History by P. Greenhalgh describes, in detail, the role diamonds have played in the political and economic development of west African nations. Attention is

paid to the roles of colonial multinational companies, local diggers, and state enterprises.

Data available from the U.S. Bureau of Mines Yearbook and Mineral Commodity Summaries consist of world production statistics by country from 1913 to 1986, import and export statistics (carats and value) by country of source and country of destination from 1970 to 1986. Prior to 1970, export data was not disaggregated, so a consistent data series is not available. Production is reported according to gem and industrial categories after 1958. Prior to 1958, industrial and gem production was aggregated into one production statistic. The Bureau of Mines has also reported median (particular months or annual ranges) prices for particular categories of diamonds since 1970.

Detailed and specific price data are reported on a monthly basis by Jewelers Circular Keystone, a jeweler's trade journal, for the period 1976 to 1983. The Jewelers Circular Keystone is also a rich source industry news and marketing information.

Annual reports from De Beers, Anglo American, CRA, Ashton Mining, and Freeport of Australia contain abundant specific information concerning diamond operations, revenues and business practices.

Journals and periodicals contain general information.

In particular, Mining Journal and its Mining Annual Review contain news clips and data similar to that reported by the U.S. Bureau of Mines but in some cases offers detailed information not presented by the Bureau of Mines.

The material in this study is organized so that background information and facts are presented first followed by analysis and discussion of the effects of increased production. In Chapter two, a brief history of the diamond industry is presented to provide insight into the events which have given rise to the present market structure. Chapter three provides information on diamonds, why people buy them, and a discussion of diamond demand and supply. In Chapter four, the present status of the diamond industry is reviewed. This information covers the location and quantity of production, market structure, marketing techniques, and pricing of diamonds. In Chapter five, a simple econometric model of U.S. apparent consumption is developed in an effort to explain how economic factors influence diamond demand. Chapter six uses information from chapters two through four to analyse the effects of increased production on diamond prices, demand, and supply. The final chapter summarizes findings and presents conclusions concerning the present and anticipated effects of increased production.

Chapter 2

HISTORY OF THE GEM DIAMOND INDUSTRY

In evaluating the gem diamond market and how it may respond to present production activity, it is important to understand the diamond industry's historical development. This history sheds light on methods of operation and on market reaction to particular events. Part of the story involves the manner in which diamonds have been held as objects of value from the earliest times and how producers and traders, as far as is known, have always sought some form of monopoly control over production and distribution.

Historical Review

It is not known how and when man first used diamonds, but it was probably in the first millennium B.C. in India (Koskoff, 1981). It wasn't until the fourth century B.C. that there is documented evidence of the use of diamonds for trade and as taxable items. Even at this early period, the secrets of diamond mining and production were closely guarded among a small group of producers and traders to help maintain the diamond's value and mystique. The rulers of India kept the best stones for themselves, yet some of the rest found their way through trade to late Greek and Roman civilizations

(Lenzen, 1966).

It is thought that because the diamond's optical properties were not known or appreciated at this time, a diamond's value was based in its magical abilities to heal, protect, and strengthen the owner, a value derived from the gem's rarity and hardness. Later, the Romans especially prized diamonds for their magical power that would render their bearer invincible (Lenzen, 1966).

With the spread of Christianity and resistance to beliefs in magic, diamonds declined in esteem. Also, after the fourth century A.D., with the decay of the Roman empire, the West found itself progressively unable to purchase diamonds from India for lack of gold, the only barter commodity accepted for diamonds. Thus, knowledge and interest in diamonds continued to decline into the medieval period, at which time, diamonds were relegated by lapidaries to the lowly status of seventeenth in importance in the list of gem stones used. Even in the mid-1500s, 100 years after grinding and polishing techniques were known, diamonds rated poorly as gems against the more desirable and beautiful rubies and emeralds. At this time diamonds were traditionally worn only by men.

As cutting techniques developed and spread during the seventeenth century, the diamond increased in significance

as a gem. Also, in the seventeenth century, with the onset of colonial expansion, particularly of the Dutch and Portuguese, diamond centers shifted from Venice to Lisbon, Amsterdam, Antwerp, and London in conjunction with shifts in maritime and trade power. Moves by cutters also influenced this shift (Lenzen, 1966).

It is interesting to note that until the eighteenth century and the discovery of diamonds in Brazil, there appears to have been no relationship between cost of production and price. In India since antiquity, prices had far exceeded the cost of production. For example, in the seventeenth century, the price of the smallest and therefore least rare diamond (about .5 ct) was sufficient to pay a day's wages for 30,000 laborers (Lenzen, 1966).

In 1725, diamonds were discovered by the Portuguese in Brazil. Until then, prices had remained relatively stable and corresponded to general price development through the sixteenth and seventeenth centuries. However, with a relatively sudden increase in supplies from Brazil, prices dropped to between 30% and 50% of what they had been. The Portuguese government soon ordered all diamond mining to be conducted according to crown control so as to restore and maintain the value of the resource. With this exertion of monopoly power, the crown took control of the market, and

prices were once again set well above cost (Lenzen, 1966; Koskoff, 1981).

Downstream, the organization between traders, cutters, and jewelers evolved as each tried to avoid carrying the risk of rough diamond price fluctuations. Jewelers initially purchased rough diamonds direct from trade merchants and then bore the burden of having the diamonds cut by contract cutters (Figure 2.1). The direct purchase linkage with trade merchants exposed jewelers to price risks. Subsequently, the cutting stage was shifted to the traders who then sold cut and polished diamonds to jewelers. In this case the trader bore the risk of price fluctuations in rough diamonds but probably passed on price fluctuations to the jewelers. Finally, traders came to sell their rough diamonds to the cutters who had bargaining power based on their knowledge of the quality of cut diamond that could be shaped from a rough stone. The cutters then sold cut diamonds to jewelers. This last structure is similar to the present day distribution network (Lenzen, 1966).

The market structure in the mid-1700s was that of a monopoly led by the Portuguese crown and aided by monopolistic maritime traders. A degree of price stability was achieved, but long-run stability could not have occurred without an increase in demand by the nobility and aristocracy

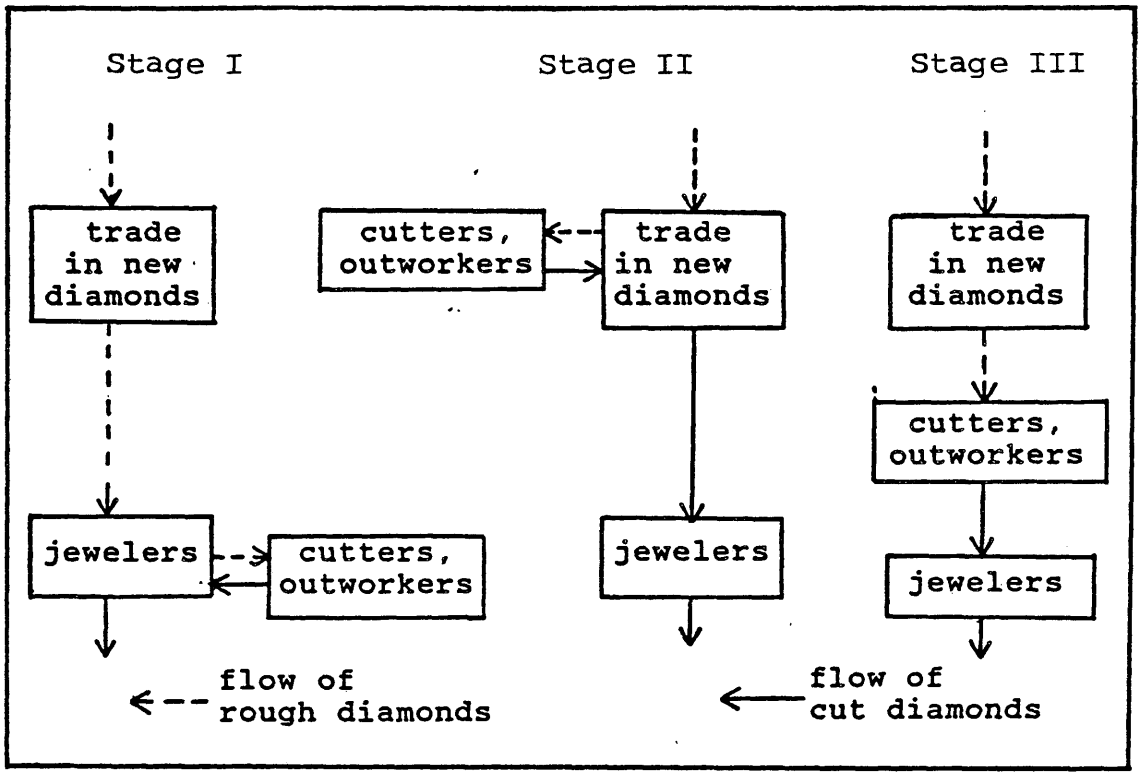

Figure 2.1.

Organizational Structure of Eighteenth Century Diamond Traders

Source: adapted from Lenzen, 1966

of Europe (Lenzen, 1966; Koskoff, 1981).

Toward the mid-1800s, Brazilian production began to decline as economically viable deposits were exhausted. As rapid industrialization in Europe and particularly in the United States, created large numbers of newly wealthy people eager to establish socioeconomic status, diamond demand increased. Thus, with demand increasing and production declining, "first carat"[1] prices more than doubled from 300 to 625 gold francs between 1858 and 1869 (Lenzen, 1966; Koskoff, 1981).

In 1866, an eight-year-old boy found the first diamond in South Africa. However, the stone was not recognized as a diamond until the following year. After changing hands it was verified as a 21.8 carat diamond. The validity of the find was slow to gain acceptance; another two years passed before the South African diamond rush began and numerous discoveries were made. In 1871, diamonds were found on the farm of the de Beer brothers (later misspelled De Beers) (Figure A1.2). At first, production did not disturb price stability in Europe. However, in 1875, economic stagnation in Europe caused a decline in demand just as South African

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[1] "First carat" refers to a one-carat price. Larger stones were priced by squaring the carat weight and multiplying by the "first carat" price.

production was increasing. In fact, between 1870 and 1880, production increased from 100,000 carats to more than three million carats (Figure 1.1). The result was a temporary price decline. However, renewed demand and economic booms of 1880-1882 and 1888-1890 helped maintain prices. As easily-recovered, near-surface diamonds were exhausted, mining costs increased, creating concern over the potential for incomplete coverage of production costs. This concern was likely to have been one of the motivating forces for consolidation of the hundreds of small claims on each deposit (Lenzen, 1966; Koskoff, 1981; De Beers, 1988; Shor, 1988).

Through the 1870s two prominent mining leaders emerged, Cecil Rhodes and Barney Barnato. Cecil Rhodes bought and accumulated claims until in 1880 when, with two other holders, De Beers Mining Company Ltd. was formed. At the Kimberly mine, Barney Barnato was also consolidating claims and formed the Kimberley Central Mining Company. The Kimberley Mine with its greater production was the more powerful of the two companies. To fulfill his empire building aspirations, Rhodes secretly began buying stock in the Kimberley Company. When Barnato found out, a stock purchasing duel ensued which raised stock prices to unreasonable levels. When Barnato had spent all he could buying his own stock, but failed to gain majority control, Rhodes

pointed out to Barnato that to maintain the stock price, Barnato would have to continue purchasing. Barnato conceded defeat, Rhodes gained majority control,and the outcome was formation of De Beers Consolidated Mines Ltd in 1888, through consolidation of the De Beers Mining Company and Kimberley Central (De Beers, 1988; Shor, 1988).

Rhodes realized that for the new De Beers Consolidated Mining Company to be successful, diamond prices, which fluctuated wildly with every reported diamond strike, would have to be stabilized. Production was reduced and prices were raised 30%. Price fluctuations also indicated a need for control over distribution. In 1890 De Beers signed a contract with ten London selling houses for the sale of all of De Beers production. The largest share went to firms owned by De Beers principals, thus partial control of the marketing process was obtained. This move also marked the beginning of the producer and seller organization which came to be known as the Syndicate (De Beers, 1988; Shor, 1988).

In 1892, Europe experienced a recession which followed in the United States a year later. Diamond demand and prices fell, forcing Syndicate members to stockpile diamonds. Smaller firms which could not bear the financial strain failed, leaving the remaining Syndicate members a tighter and more closely controlled group (Shor,1988).

In 1902, the power of De Beers began to decline with the death of Cecil Rhodes and the discovery of the Premier Mine in South Africa. Production from the independent Premier Mining Company Ltd created strong competition for De Beers until 1907 when production outpaced demand, which had been reduced in part by the American financial crises of 1907-1908. Competition between De Beers and Premier caused prices to fall until Premier's management decided to sell production through the Syndicate. This decision was made so that they could keep their mine rather than allow themselves to be purchased by De Beers (Shor,1988; Koskoff, 1981; De Beers, 1988).

Again in 1908 De Beers and the Syndicate faced competitive pressure from newly discovered diamonds in German-held South West Africa. The German government created a board called "the Regie" to market their diamonds, but also soon decided to sell through the Syndicate.

In 1914, the diamond producers in southern Africa (De Beers Consolidated Mines Ltd., Premier Mining Company Ltd., New Jagersfontein Mining and Exploration Company Ltd., Kofiefontein Mines Ltd., the Imperial Colonial Office and the German Diamond Administration) and the government of the Union of South Africa met and enacted an agreement which allocated output quotas on a restricted production basis.

The agreement which was to be effective as of January 1, 1915, never came to fruition because of the outbreak of World War I.

With the start of World War I, diamond production came to a standstill and diamond prices dropped 7% to 8% but regained an overall upward trend as a result of continued U.S. demand and low production levels. In 1919, at the end of World War I, the United States imported record levels of diamonds and European demand also increased. However, in 1920, from two to three million carats (between 55% and 80% of 1920 production) were dumped on the European market by the new government of Russia. Also, the world headed into a post war recession that lasted until 1924. In response to these events the Syndicate bought outside production and supplies at the same time as it cut back its own production by 64% (Figure 1.1) (Lenzen, 1966; Koskoff, 1981; De Beers, 1988; Shor, 1988).

During the period 1902-1914, Ernest Oppenheimer worked for the Syndicate and was close to De Beers board members. However, independently he established himself financially and in 1915 with the financial backing of J.P. Morgan, formed the Anglo American Corporation of South Africa. Anglo American established itself as an important gold producer of South Africa. With the defeat of Germany, the German mining

companies of South Africa were left in a weak position. Oppenheimer, through Anglo American, consolidated the South West African companies under the banner, Consolidated Diamond Mines, (CDM). Later in 1919, a second cartel agreement was reached. The Oppenheimer-led Anglo American Corporation, by virtue of holding a controlling interest in CDM, was included in the cartel agreement and became a member of the Syndicate's marketing agency. With this move, Oppenheimer gained influence in De Beers and the Syndicate, (Gregory, 1962; De Beers, 1988; Shor, 1988).

In 1924, the Syndicate ceased to exist and was replaced in 1925 by a new Syndicate that was more tightly controlled by Oppenheimer. In 1929, Oppenheimer became chairman of De Beers, merging his own diamond interests with that of De Beers. Anglo American was retained as a separate operation specializing in gold (Gregory, 1962; De Beers, 1988; Shor, 1988).

As chairman, Oppenheimer moved quickly to consolidate production and marketing under the control of De Beers. Anglo American's shares in CDM were sold to De Beers which also bought controlling interest in the Jagersfontein Mine. During the period 1930 to 1933, De Beers dissolved the Syndicate and formed the Diamond Corporation and the Diamond Producers Association in its place. Together, these two new

corporate entities were the beginning of the Central Selling Organization (CSO). Under this new structure, the CSO established the purchase and selling system which is still in use today.

During this same period, De Beers suffered renewed competition after diamonds were discovered in Namaqualand and at Lichtenburg (Figure A1.2). With the assistance of state legislation, Lichtenburg production matched that of De Beers. De Beers again cut back production by closing the Koffiefontein and Bultfontein Mines, and, along with Syndicate marketing efforts, prices were maintained at a relatively stable level, fluctuating between 4% and 6%.

After the great stock market crash of 1929 U.S. sales dropped to the point of being negligible. During the depression, De Beers working operations were extensively reduced (Figure 1.1) and diamond stocks were increased as diamonds were purchased from independent producers. Diamonds were also discovered in Sierra Leone, Liberia, Ivory Coast, and the Central African Republic (De Beers, 1988; Shor, 1988).

By 1934, diamond sales began to improve and by 1937, both the Koffiefontein and Bultfontein Mines were reopened. However, in 1938, poor economic conditions in the United States depressed the market (De Beers, 1988; Shor, 1988).

In 1938, Harry Oppenheimer, son of Ernest Oppenheimer explored with N. W. Ayer of New York, the concept of advertising as a means of restoring post depression European demand and strengthening U.S. demand. An initial marketing investigation revealed that American demand resulted from the condition of the economy, changes in social attitudes, and the promotion of competing luxuries. Since De Beers could not influence the condition of the U.S. economy, it chose to develop an advertising strategy that would guide and mold social attitudes on romance, love, success, and gift giving. Advertising has since played a vital role in creating diamond demand and driving the market (Epstein, 1982).

As World War II broke out, mining virtually ceased. The Diamond Trading Company headquarters in London was destroyed by German bombs, and cutting centers in Amsterdam and Antwerp were forced to close. As the Jewish population fled Europe, diamond centers were reestablished in the United States and Palestine. Although gem sales suffered during World War II, industrial diamond sales increased to record levels (De Beers, 1988; Shor, 1988).

Through the 1940s the advertising campaign sought to present diamonds in a manner that would reinforce the link between diamonds and romance. To achieve this, numerous tactics were used. Arrangements were made with movie

producers to film scenes in which movie idols were viewed receiving and wearing diamonds. Planted news stories, lectures to school assemblies, articles on the size of diamonds exchanged by celebrities, and advertisements showing diamonds in the context of fine art describe a few of the techniques used by N.W. Ayer in its promotional campaign. In 1947, a well-publicized visit to Kimberley by the British Royal Family presented De Beers with an important opportunity to portray a royal link with diamonds. In 1949, the now famous slogan "a diamond is forever" was coined (Epstein, 1982).

In 1954 and 1955, two events strongly influenced the diamond market. Diamonds were discovered in Siberia, and General Electric announced that it had invented a process for manufacturing synthetic diamonds. Although De Beers and the Soviet Union reached a semi-secret marketing agreement to their mutual benefit, the point of significance was that De Beers was faced with a sudden increase in supply of small Soviet-produced diamonds while its advertising campaign focused on selling large diamonds. De Beers also had to dispel the sudden concern felt by consumers who thought that their highly prized diamonds would depreciate in the face of synthetic production. The synthetic scare was quickly defused as people came to realize that synthetic diamonds

were only good for industrial use (Epstein, 1982; De Beers, 1988; Shor, 1988).

The late 1950s and early 1960s saw numerous African nations gain their independence. As a result, De Beers lost a degree of control over some operations and marketing of production as nationalistic governments sought to operate independently. However, opposition to apartheid laws, willingness to deal with black governments (enlightened self interest), and the tremendous market power of De Beers helped persuade independent producers to join or return to marketing through the Central Selling Organization (Shor, 1988).

Until the early 1960s, the advertising push toward large diamonds had inadvertently reduced the market for small diamonds which were in heavy supply from Soviet production. Thus, the advertising strategy was changed to enhance the market appeal of small diamonds. Also, N. W. Ayer proposed expanding the engagement tradition to other countries. In the mid-1960s, Japan, Germany, Brazil, and Sweden were selected as targets in which to expand demand. By 1971, promotional advertising had expanded to 19 countries.

Toward the end of the 1960s and into the 1970s the small diamond campaign met with considerable success. In fact, in 1976 the average size of a diamond was 0.28 carats as opposed to 1 carat in 1939 (Epstein, 1982). This was also a period

when youthful opinion frowned on the materialism of their parents and viewed diamonds, particularly large ones, as ostentatious and to be avoided. The early 1970s also saw a decline in demand in response to the oil-shock-induced recession. By the mid-1970s, the small diamond campaign, although successful, had again, inadvertently diminished the market for large diamonds. This shift in consumer taste is likely to be in part responsible for the supply problems of the 1976-1980 period.

From 1976 to 1980, De Beers faced what probably has been the most severe test of its ability to control its producer and marketing cartel. A low supply of the sizes demanded in combination with inflationary and speculative pressures created price instability (discussed further in Chapter 6). After a run-up in diamond prices that corresponded to price increases in gold, art, real estate, and other investments, prices began to fall leading the diamond industry into a four-year recession. Curiously, De Beers opened the Jwaneng mine in Botswana in 1981 at the lowest point of the diamond recession. Shortly thereafter, the Australian CRA-Ashton Mining joint venture announced plans to commence mining of its AK1 deposit. Beginning in 1985, diamond demand again began to increase and in 1987 the CSO had record sales of $3.075 billion.

Summary

Since the earliest days of the diamond industry, sellers of rough diamonds have sought to possess monopoly power. In ancient India, rulers and producers held the monopoly: in Brazil, the Portuguese crown maintained control, and, most recently in Africa, De Beers has led the movement to centralized control. It is also noteworthy that diamond supplies have always reached the market through a controlled marketing outlet. In India, the outlet was a close-knit group of producers. In fifteenth to nineteenth century Europe, it was the traders and merchants; e.g. East India Dutch and British trade merchants and carriers. Presently the outlet is the Central Selling Organization (CSO).

The history of prices shows a rapid and significant downward price response to conditions of oversupply, resulting from competitive production. Also, demand decreases under poor economic conditions of recession.

In response to these factors, efforts have been made to control production and distribution. For De Beers this process has followed three premises established by Cecil Rhodes: 1) control production, 2) regulate sales, and 3) use the power derived from the first two steps to acquire or tame all possible competition (Shor, 1988). For De Beers, this has meant ownership of mines, cooperative agreements with

other mines, ownership or control of much of the distribution network, indirect control over diamond cutters, maintenance of a sizeable stockpile, and success at expanding demand for gem diamonds.

Chapter 3

CHARACTERISTICS OF DIAMONDS

As background to discussing demand and supply of gem diamonds, the following two sections offer information that is important for understanding the factors that give a diamond its value. These factors include natural characteristics and manmade ideals concerning the desirability of owning diamonds.

Nature of Diamonds

Diamonds are broadly classified into gem and industrial categories. With the beginning of Australian production, the term "cheap gem" has also come into use. Industrial diamonds are those which are too small, flawed, highly colored, or included to be used as gems. Gem diamonds are those that exhibit high clarity, are very slightly colored to "white colorless", and lack inclusions. Within the gem category, "melee" refers to small diamonds generally less than 20 points (1/5 carat). Australian "cheap gem" diamonds tend to be small colored stones traditionally considered marginal in quality. However, they are now being marketed as a new and attractive style of gem. More accurately, marketing of "cheap gem" diamonds should be viewed as a lowering or

broadening of the gem standard. They are for the most part cut and processed in India as melee.

A gem diamond's value is determined primarily by its hardness and extraordinary optical properties of transparency, brilliance, and fire. Classification of these and the artificial qualities imposed by cutting are based on the "4 c's": carats, color, clarity, and cut. In the late 1970s, a fifth "c," certification, was included.

Carats are a measure of weight. One carat is a fifth of a gram and each carat is subdivided into 100 points. The per carat price of a diamond increases geometrically. For example, a two carat stone does not cost twice as much as a one carat stone of the same quality. Rather, it may cost four times as much. Also, there are particular weights such as one carat, which are popular and carry a premium for being a specific weight. If a stone is just under one carat (say 99 points), it falls in the cheaper category. If it is 101 points, it will command a much higher price. This price difference exceeds the value a two point weight difference normally would contribute.

There are colored diamonds (blue, pink, cognac) known as fancy colors but according to the Gemological Institute of America's (GIA) standard grading system, "color" is measured as the degree of tinge away from a perfectly

colorless "white" D diamond (Table 3.1). The color scale begins with D for perfectly colorless and continues to Z with each letter designating slightly more color. Generally, stones with more color than the J category are not sold as gems. The better a diamond's color (whiter), the rarer it is, and the higher the price.

Clarity is a measure of the internal quality of the stone. Inclusions, bubbles and other imperfections of the stone reduce its clarity and value. A flawless diamond has no internal or external imperfections visible under 10X magnification. Such a stone is very rare and highly priced.

Cut describes the style and quality of how the stone has been cut. Quality of cut is determined by the accuracy with which the size and angle relationships of each facet are cut to ideal specifications. A well-cut stone is proportioned to offer the most brilliance and fire. Over the past one hundred years, there have been changes in cut style to enhance appearance. Even today, there is considerable debate between European and American cutters as to the angle and facet proportions which bring out the most desirable qualities. The quality of cut is therefore, a subjective evaluation which varies according to tastes in style and the accuracy with which the stone is cut to the specifications of the particular style.

Table 3.1

Gemological Institute of America Color and Clarity Classification System

Color Grading Scale	Description
D E F	colorless
G H I J	near colorless
K L M	faint yellow
N O P Q R	very light yellow
S . . Z	light yellow

Clarity Grading Scale	Description
fl	flawless
I.F.	internally flawless
VVS1 VVS2	very very slightly included
VS1 VS2	very slightly included
SI1 SI2	slightly included

Source: Adapted from Feder, 1985

In the late 1970s, when diamonds were promoted as the best investment opportunity available, certification of grade and quality was offered by sellers to allay the fears of untrained buyers. Unfortunately, many found at resale time that diamonds they purchased were certified at inflated qualities. Certification for investment purposes has diminished with investment interest, but a GIA certification is often available at the time of purchase. For the average engagement ring, certification is probably most important for insurance purposes (Parsons, 1969; Koskoff,1981; Wykoff,1982; Parsons, 1969).

Role of Diamonds

Diamonds are traditionally purchased for four reasons: 1) conspicuous consumption, 2) as a store of value, 3) as a keepsake, and 4) as adornment jewelry. The following sections examine the role of each of these factors in motivating diamond purchases.

Conspicuous Consumption

Early on, diamonds were held for their magical, religious, and healing abilities. Because of their esteemed value, prices were beyond the means of all except the wealthy and noble classes. Diamonds, therefore, came to be associated with socioeconomic status. With the onset of the

industrial revolution, more people were able to purchase diamonds and did so for reasons of portraying status.

Conspicuous consumption is the ownership of something for the purpose of displaying wealth to peers (Veblen, 1936; Liebenstein, 1950). An axiom to conspicuous consumption is the concept that a consumer's utility is in part derived from a diamond's higher rather than lower price. In other words, part of the price paid for a diamond goes toward the privilege of buying an expensive item.

Store of Value

As a store of value, the diamond is one of the most convenient and transportable forms of wealth. At $10,000 per carat, one ounce of one carat D flawless diamonds is worth $1,550,000 or 3444 times the value of gold (at $450 per ounce). Diamonds are ideal for smuggling and have been used extensively through the ages to transport the wealth of emigrants and national leaders.

As a commodity investment, diamonds offer the investor an opportunity for capital gains. During the mid to late 1970s, when prices for large high quality stones increased rapidly, diamonds became a popular investment. Some believed diamonds offered a hedge against inflation; others sought to make short-term gains as prices increased ten-fold in five

years. From 1976 to 1979, diamonds were promoted as the ultimate investment with returns far beyond that of gold, stocks, or real estate. Numerous diamond investment brokerage firms blossomed, not all of which were reputable. A high level of speculative buying and unsustainable price rises continued until March 1980 when prices began to decline.

Besides price risk, diamond investments pose other risks. Although diamonds are sold in a geographically wide market, liquidity is poor except at a heavy discount. The typical resale price is 25% to 50% less than purchase price (Koskoff, 1981; Epstein, 1982). Valuation is also a problem in that it requires the subjective judgment of a trained appraiser and cannot be determined readily by the average investor. As mentioned, to reduce valuation risk, certificates verifying a diamond's grade, weight, and quality have accompanied investment sales. However, in many cases, stones were certified at inflated values resulting in heavy losses for many investors.

De Beers does not look kindly on speculative investment because it tends to destabilize prices and detracts from the stable market image De Beers seeks to portray. Since 1980, commodity investment in diamonds has lost its popularity.

Keepsake

The tradition of giving a diamond as a betrothal gift is said to have begun in 1477, when Maximillian of Austria gave his betrothed, Mary of Burgundy, a ring set of diamonds (Koskoff, 1981). Since then, this tradition has grown to involve the majority of European, American and Japanese couples.

As a keepsake, a diamond's attraction is based in the popular sentiment that a diamond embraces all the ideals that love brings to a relationship. As a result, sentiments are attached to diamonds, which are not attached to most other luxury goods. This is particularly true of wedding-related jewelry. Implicit in the concept of any keepsake is the property of durability and to a large extent, value. The store-of-value property of diamonds is suggested as an important underlying component of a diamond's popularity as a keepsake. For some, conspicuous consumption plays an important role in the keepsake concept in either impressing the receiver or those who observe diamond ownership.

Jewelry

Jewelry as adornment is possibly the largest portion of the diamond sales market. In this category, sentimental value may be attached to articles of jewelry, but not to the

same extent as wedding-related keepsake jewelry. For example a tennis bracelet or a cocktail ring may not carry the same degree of sentimental attachment as that of a wedding ring. Making a distinction between keepsake jewelry and adornment jewelry is important because it separates diamond purchases into two motivational categories. Purchases within each category are likely to respond differently under varying economic conditions.

Conspicuous consumption is likely to play a more significant role in the purchase of adornment jewelry than in keepsake jewelry. Also, adornment jewelry is probably more likely to be subject to changing fashions, tastes, and whim, and therefore circulated in the diamond cumulative supply pool more readily than keepsake jewelry.

Demand

The motives that drive people to purchase diamonds as described in the previous section lead to five distinct sources of consumer demand: 1) wedding related jewelry, 2) other occasion jewelry, 3) luxury jewelry, 4) investment, and 5) capital flight.

In 1981, 77% of American couples and 60% of Japanese couples bought diamond engagement rings (Koskoff,1981). Because the proportion of the population that marries does

not fluctuate greatly over time, gem diamond demand for engagement rings is relatively stable. Table 3.2 shows the number of U.S. marriages each year for the period 1970 to 1987 and indicates slight fluctuations in marriage rates but no clear trends that might suggest an impending impact on demand.

Couples usually budget a certain amount for a ring and buy the stone that is within that budget. If prices rise, smaller or lesser quality stones will be purchased. Because of the ease of substitution between stones of lesser and better quality, the applicability of the "too expensive" concept is limited. Therefore, this portion of diamond revenues should be close to unit elasticity.

Purchase of luxury jewelry is dependent upon disposable income, particularly for persons in higher income brackets. In turn, disposable income is dependent upon income and tax rates. A low to medium income bracket bachelor or couple with average disposable income is probably not as likely to buy luxury jewelry as higher income persons. In addition, the propensity of a person to spend disposable income on luxury jewelry is likely to be dependent upon the availability and desire for competing luxury items such as fur coats and fashionable clothes.

The percentage of gem diamond trade which is for

Table 3.2

U.S. Marriages 1970 to 1987

YEAR	NUMBER OF MARRIAGES	% CHANGE FROM PREVIOUS YEAR
1970	2,179,000	
1971	2,196,000	+0.8
1972	2,269,000	+3.3
1973	2,277,000	+0.4
1974	2,223,000	-2.4
1975	2,126,000	-4.3
1976	2,133,000	+0.3
1977	2,176,000	+2.0
1978	2,240,000	+2.9
1979	2,317,000	+3.4
1980	2,413,000	+4.1
1981	2,438,000	+1.0
1982	2,495,000	+2.3
1983	2,444,000	-2.0
1984	2,487,000	+1.8
1985	2,425,000	-2.5
1986	2,400,000	-1.0
1987	2,421,000	+0.9

Source: U.S. Department of Health and Human Services, 1988

investment or store-of-value purposes is difficult to determine. However, since investments are usually made in top quality large stones which comprise only a very small portion of gems in existence (several thousand to several tens of thousands), the diamond investment market represents only a small percentage, by volume, of the total market.

As an investment, gem diamonds must compete with other investment opportunities. Diamonds, like gold, produce no dividends. Investment value is derived from capital gains. In the ten years between 1971 and 1980, diamonds reportedly produced a nominal annual rate of return of 15.1 percent compared with gold which produced 31.6 percent; stocks, 7.5 percent; bonds, 6.4 percent; U.S. farmland, 12.6 percent; and houses, 10.2 percent (Green, 1981). At least a portion of gold's high rate of return can be attributed to price normalization following the pre-1971 period of fixed gold prices. Therefore, the 1980s are unlikely to duplicate the gold rate of return seen in the 1970s.

Investment in diamonds and gold are made as a hedge against losses by inflation, currency devaluation, or sociopolitical unrest and as a source of capital gains. As a hedge against inflation and currency devaluation, diamonds are likely to retain their value in a manner similar to gold. Under conditions of sociopolitical unrest, diamonds are

popular for capital flight purposes because they retain their value across international boundaries and in different currencies. As a hedge, the role of diamonds is limited due to the difficulty of resale and the presence of other easier to use hedges such as gold.

As previously mentioned, diamonds are used for the stealthy transport of wealth. They are also used commonly in high level bribes. For these reasons, quantification of the portion of diamond demand incurred for secretive purposes can only be speculated at best.

According to the long-run annual average price increases issued by De Beers, (see Chapter 4 and Table 4.2) an investor's nominal long run rate of return on a D flawless diamond would have been 9.8% (not including transaction costs) rather than the 15.1% reported by Green (1981). On average, a diamond "investment" does not appear to offer superior investment potential in terms of capital gains. If De Beers in fact maintains a long-term 8% to 10% average annual price increase, there should be little incentive to invest in diamonds except during periods when inflation is high or increasing and gold prices are also climbing. After all, stocks on average produced a 7.5% nominal rate of return and are in many ways easier and safer to trade than diamonds.

While diamonds may be transportable and retain value

across national boundaries and currencies, they do not possess exact standards of quality and require subjective appraisal. Resale discounting also limits, their desirability as a store of value for any reason.

It is suspected that the percentage of gem diamonds used for investment varies according to the investment spirit of the times. Because people are likely to invest in diamonds for reasons similar to those for investing in gold, it is probable that the percentage of diamonds used for investment will increase if inflation increases, currencies devalue, or social strife increases. Speculators probably increase their holdings as the rate of upward price change increases or is sustained for a period of time.

Consumer demand for diamond jewelry is in part determined by the Veblen effect (Liebenstein, 1950). The Veblen effect refers to the phenomenon of conspicuous consumption in which demand is increased because a good's price is higher rather than lower. Figure 3.1 demonstrates how a downward sloping demand curve shifts out with an increase in price. Increased quantity consumed is divided between the price effect and the Veblen effect. The market demand curve becomes upward sloping for the range of prices that create a price effect less than the Veblen effect.

It is proposed that the demand curve for diamond jewelry

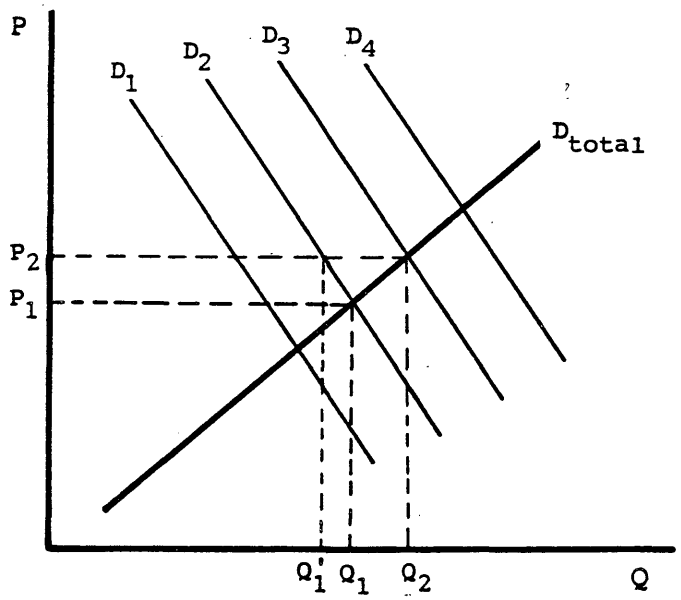

Figure 3.1

Veblen Effect Demand Curves

Note: $Q_1Q'_1$ = price effect
Q'_1Q_2 = Veblen effect

follows a curve as shown in Figure 3.2a. This unusual demand curve is divided into sections which describe different aspects of consumer behavior. Between points A and B, the demand curve is upward sloping according to the Veblen effect. Consumers increase their demand for diamonds as price increases for reasons of conspicuous consumption. Between points B and C the price effect is greater than the Vebeln effect due to income constraints. For prices above point C, demand for diamonds is restricted to very wealthy

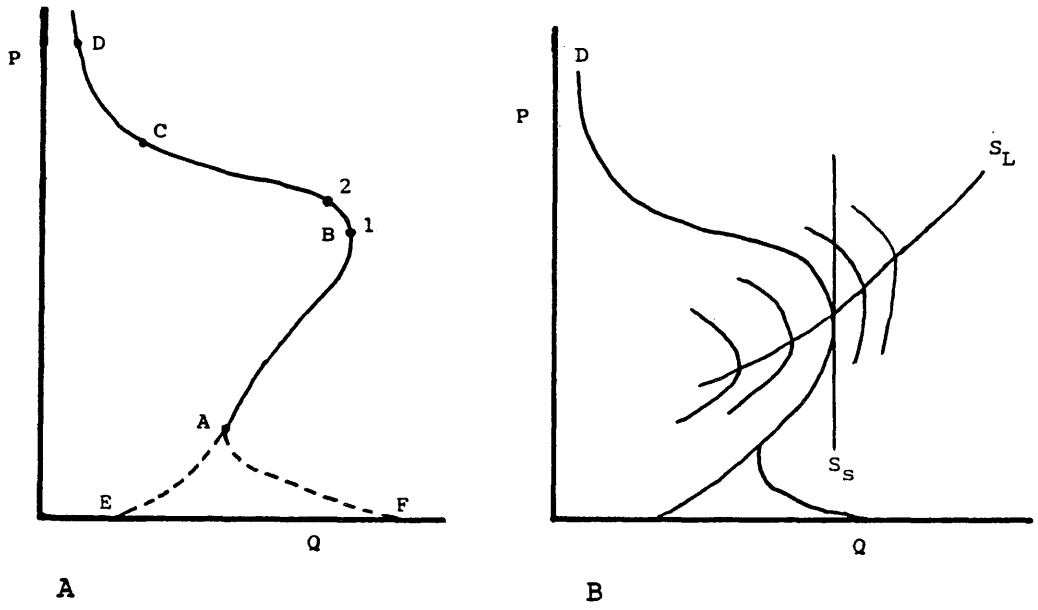

Figure 3.2

Hypothetical Diamond Demand Curve With
Short and Long-Run Supply Curves

consumers. Above point D, there is a price at which demand is zero. However, this point may be very high. Again, there is likely to be someone who will pay an extremely high price for reasons of conspicuous consumption or possibly some irrational reason (e.g., desire to own the most expensive diamond in the world). Below point A, the demand curve may taper off to point E or F depending upon consumer desire to hold diamonds which are worth only a small amount of money. It is conceivable that if diamond prices were, say, $5 per carat people would become disinterested in owning diamonds

because they lack value. In such a situation, consumer desire may shift to more valuable gems such as rubies or emeralds. In contrast, consumers may greatly increase quantity demanded (point F) and desire to own a complete line of diamond jewelry containing, say, 200 carats of diamonds just because they derive satisfaction from a diamond's beauty.

From the perspective of De Beers, diamond supply should be maintained at point 1 or between points 1 and 2, depending on the slope of the demand curve between points 1 and 2. This point lies along the traditional downward sloping portion of the demand curve where a monopoly would want to operate. In the long run, point 1 has moved upward and outward (Figure 3.2b). The evidence is that prices have increased at a rate of 8% to 10% per year and the quantity consumed has also increased. Variance from the long-run trend is minimized by the De Beers market control mechanism.

Supply

World annual gem diamond supply is the number of carats released to the market each year by the De Beers-controlled Central Selling Organization (CSO), plus the amount sold through the Antwerp and other "free" markets, plus an unknown amount of black market sales, plus an unknown number of

diamonds which are effectively recycled following deaths, divorces, and other events which cause people to sell their diamonds. The available supply statistics, however, are production figures which do not equate to the quantity sold by the CSO and the free market. Likewise, there are no available statistics which indicate the number of carats or grade of stones sold by the CSO.

Production is determined by the De Beers group and by independent producers who, to a large extent, are influenced in their production levels by five-year contracts with the Diamond Corporation. The quantity of diamonds distributed annually by the CSO is determined by De Beers according to long-term profit maximization and price stabilization goals. Therefore, production statistics are at best a weak proxy estimate of diamonds supplied by the CSO for any given year. In a general sense, the quantity of diamonds distributed by the CSO is set according to the standard monopoly demand model in which marginal revenue is set equal to marginal cost beneath a downward sloping demand curve (P>MC=MR) (Figure 3.3). The quantity supplied at the point where marginal cost equals marginal revenue however, does not equate to annual quantities produced. The difference between the annual quantity produced and the annual quantity distributed lies in De Beers' stockpile.

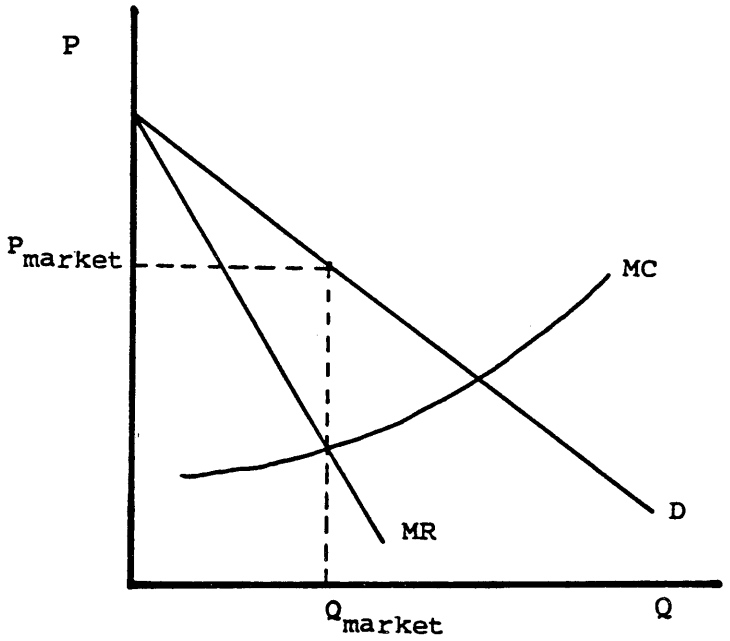

Figure 3.3

Demand, Marginal Revenue, and Marginal Cost Under Monopoly Conditions

One view of the diamond market suggests that the relevant supply is in fact the cumulative production total for all gem diamonds (Kaufmann, 1988, personal communication). This view is based on the concept that diamonds are not consumed but rather kept in the growing pool of cumulative production. Figure 3.4 indicates that between 1970 and 1987 annual gem production added 1.9% to 6.4% to the cumulative pool each year. This rate of growth is faster than the population growth rate suggesting, at least, that people are increasing the number of carats they own.

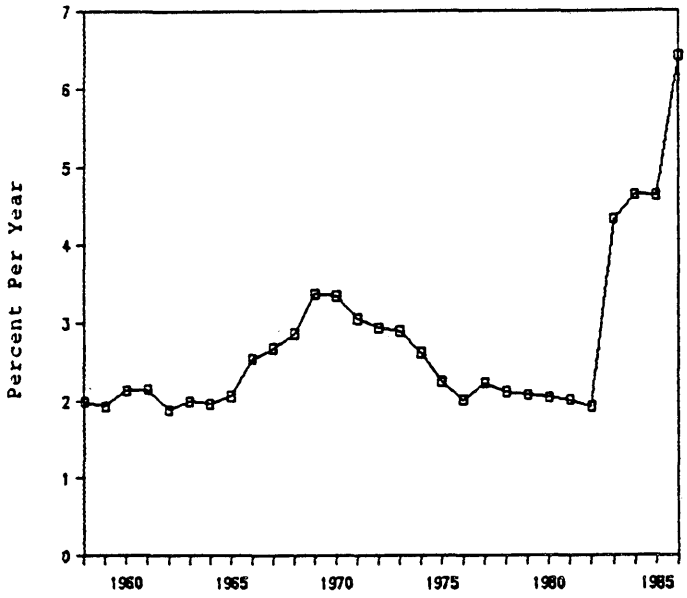

Figure 3.4

Annual Additions to Cumulative Gem Supply

Source: Calculated from data in USBM Yearbook, 1959 to 1987

The cumulative supply model is depicted in Figure 3.5. Supply is represented by a vertical line marking the quantity of diamonds in the cumulative pool rather than a traditional upward sloping supply curve. Annual production causes the cumulative supply curve to move outward each year at the additional output rate of 1.9% to 6.4% per year. In this view of the market, the demand curve must shift outward at a rate sufficient to maintain an 8% to 10% average annual price increase in the long run. In this case, the explanatory variables for demand would be total wealth, interest

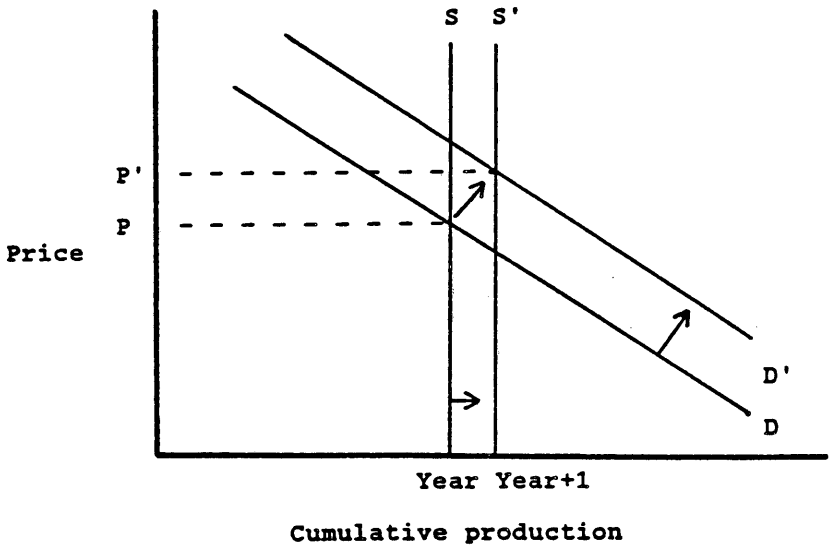

Figure 3.5

Cumulative Supply Model

rates, population, and expectations. A point to be made is that the annual apparent consumption model of this thesis is in fact the first difference of the cumulative supply model.

An important issue to consider is the availability of the cumulative supply to enter the market. Currently, one estimate attributes approximately one-third of U.S. retail sales to recycled diamonds (Feder, 1988, personal communication). In the opinion of this writer, Mr. Feder's estimate may be a little high for the market in general, but is probably accurate for the large stone market in which Mr. Feder deals. Diamonds are returned to the market when:

marriages break up, estate diamonds are sold, diamond holdings are pawned, stolen stones are sold, or diamonds are traded in for something else. Dramatic price increases as occurred in the late 1970s also can bring diamonds into the market. However, even with price increases ranging from 100% for low quality diamonds to over 600% for a one-carat D flawless diamond, the market did not see a flood of diamonds coming out of safe deposit boxes or off people's hands onto the market. This can be explained partly by the fact that the greatest price increases were for comparatively rare diamonds.

Another explanation is that people are sentimentally attached to their diamonds and require a greater price increase than was seen during the 1976 to 1980 period before they will part with them. Herein lies a fundamental difference between diamonds and other commodities such as silver or gold. Silver and gold goods generally lack the high sentimental attachment associated with diamonds. In the past, when gold and silver prices have risen at high rates or to high levels, scrap supply increased dramatically but only because the price level exceeded the sentimental value. For most people, diamond prices have not reached a similar level that exceeds the sentimental value.

Another factor affecting the recycling component of

supply is the large transaction cost of resale. As previously mentioned diamonds sold back to dealers are usually discounted by 25% to 50% of wholesale price (Koskoff, 1981; Epstein, 1982). This fact alone requires a 33% to 100% wholesale price increase for the seller to break even. Sellers also often find the appraised quality of the diamond is less when selling than when buying even if a stone is certified.

Chapter 4

PRESENT STATUS OF THE DIAMOND INDUSTRY

World Production

Diamonds are mined in 20 countries, although 95% of natural rough diamond production is from five countries: Australia, Zaire, Botswana, USSR and South Africa (Table 4.1). Present annual diamond production is approximately 100 million carats of which 44 million are of gem or cheap gem quality (Mining Annual Review, 1987).

With the establishment by the CRA-Ashton Joint Venture in 1985 of the world's largest diamond mine at Argyle in the Kimberley region of Western Australia, Australia became the world's leading producer. Production there increased from approximately 9% to 37% of world production between 1984 and 1987. Production of an additional 600,000 carats per year (.6% of 1987 world production) by Freeport of Australia began in February 1988 at the Bow River Mine near Argyle. It can be expected that Australia will increase its dominance in diamond production.

Botswana is the third largest diamond producer but is second in gem production. Mining at Botswana's three mines (Orapa, Jwaneng,and Letlhakane) is conducted by De Beers Botswana Mining Company and accounts for 68% of the total

Table 4.1

World Diamond Production by Country
(000 carats)

USBM Minerals Yearbook Table 13

COUNTRY	1986 TOTAL	1986 GEM	1987 TOTAL	1987 GEM	1991 TOT	1991 GEM
Angola		240		190	1300	1,215
Australia	29,245	13,245	36,350	18,150	34,662	17,321
Botswana	13,100	9,610	13,400	9,700	17,352	12,461
Brazil	600	300	600	300	1,500	600
Central African Republic	600	245		245	381	303
China	1,000	200	1,000	200	1,000	200
Ghana	550	60		60	637	191
Guinea		190		200	135	130
Guyana		3		3	8	3
India		14		14	15	3
Indonesia		5		5	30	7
Liberia	300	63		70	160	40
Namibia	1000	900		900	761	745
Sierra Leone	400	215		215	78	66
South Africa	10,355	4,635	10,900	4,700	8,708	3,826
Tanzania	300	210		210	85	59
U.S.	--	--	--	--	-	-
USSR	10-12,000	4,400	10-12,000	4,400	15,000	7,500
Venezuela		40		40	333	88
Zaire	23,261	4,661	23,661	4,661	19,427	2,914
World Total	92,000	39,157	100,202	44,302	101,566	47,401

Source: Mining Annual Review, 1988
U.S. Bureau of Mines, 1988

Note: Discrepancies and gaps in information result from different reporting methods between sources. 1987 figures are estimates.

production of De Beers. The 13.2 million carats produced in Botswana during 1987 accounted for 85% of the country's export earnings (Murray, 1988).

Zaire is the second largest producer of diamonds and the largest producer of industrial diamonds. Gem production is between 7% and 12% of total production. Approximately two-thirds of Zaire's production is from alluvial diggings and the remaining one-third from the MIBA Mine.

Production from South Africa's numerous mines is approximately one-half that of Zaire, yet gem production is nearly the same as Zaire's. The most significant South African mines include the Kimberley Mines, Bultfontein, Wesselton, Koffiefontein, Finsch, and Premier Mines (Figure A1.2). Additional production comes from Namaqualand mines and CDM mines in Namibia. Namibia is an autonomous territory under South African administration.

It is estimated that the USSR produced between 10 and 12 million carats in each of 1986 and 1987 of which 4.4 million carats were of gem quality. Unconfirmed reports suggest that gem production is increasing and that beach placer deposits may be discovered and exploited, resulting in increased world production (Mining Annual Review, 1988).

The remaining 15 countries collectively produce less than one million carats. However, exploration activity

suggests that new deposits may be discovered and exploited.

Within the 20 producing countries, there are only 17 major mines (excluding the Soviet Union) with the remaining production from small-scale operations in which local people recover diamonds through primitive alluvial techniques. The number of producing mines in the Soviet Union is unknown. Of the 17, De Beers maintains control of at least nine mines.

As of 1987, a total of approximately 2 billion carats of rough diamonds had been produced (Appendix 2). Of this quantity, between 26% and 40% has been gem production (Figure 4.1). Thus, cumulative world gem production is in the 450-750 million carat range with 1987 gem production of 44 million carats (U.S.Bureau of Mines, 1988) contributing between 5% and 9% to the cumulative gem total.

Market Structure

The process by which diamonds reach the retail buyer from the mine can be broken into four stages: 1) mining, 2) selling of rough diamonds, 3) cutting, polishing, and setting, 4) public wholesale and retail selling and trading. Of these, mining and selling of rough gem diamonds are controlled by the De Beers group of companies.

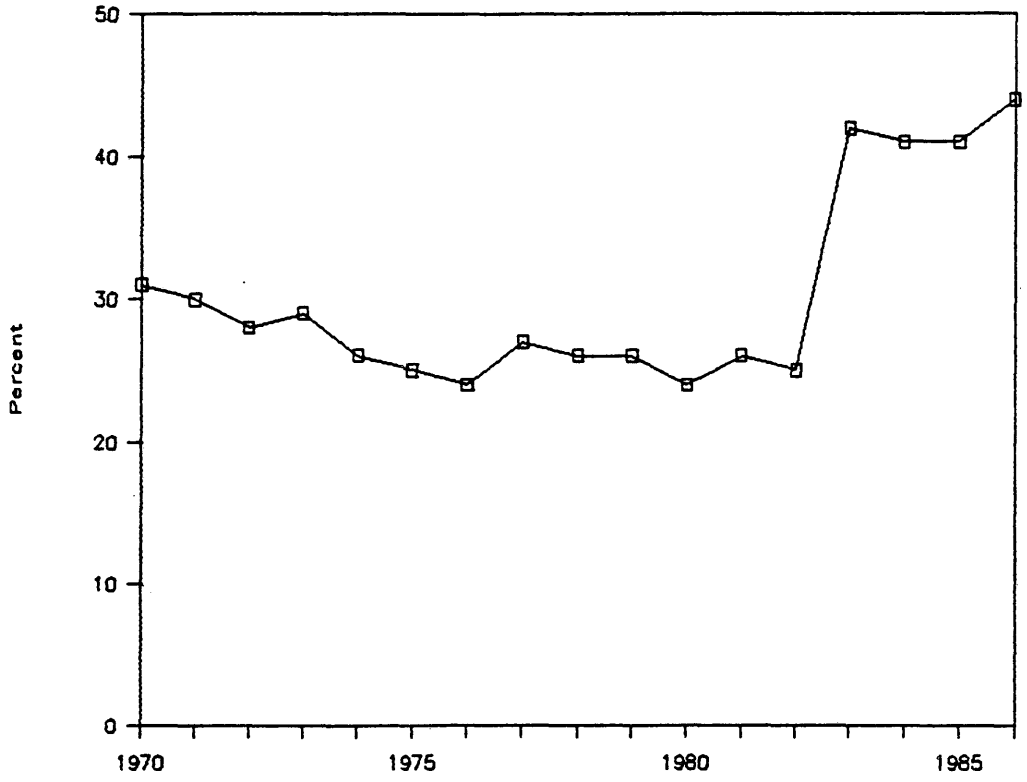

Figure 4.1

Gem Production as a Percent of Total Diamond Production

Source: USBM Yearbook data

Producer Market Structure

In 1987, De Beers produced diamonds from the Kimberley, Koffiefontein, Finsch, Namaqualand, Premier, CDM, Orapa, Letlhakane, and the Jwaneng mines. Of this production, 57% to 68% comes from Botswana through De Beers Botswana Mining Co. (Debswana), a company jointly owned with the government of Botswana. (De Beers, 1988; Murray, 1988).

De Beers controlled production in 1987 amounted to 23% of world diamond production. This is down from the 43.5% control De Beers enjoyed in 1982 (Figure 4.2). While control of production is not the primary goal of De Beers, this decrease reduces the company's ability to use production as a buffer in times of weak demand or over production by outsiders, i.e. Australia and Zaire.

In 1985, Argyle Diamond Mines, an Australian joint-venture group (consisting of CRA, 56.8%; Ashton, 38.2%; and West Australian Diamond Trust, 5%) put into production the AK1 deposit. In two years, Australia went from less that 10% to over 36% of world production and from 15% to over 40% of world gem production.

In 1981, when the Argyle project announced production plans, the news came at a time when the diamond market was in its worst recession in 50 years and public confidence in the ability of De Beers to manage the diamond market was low.

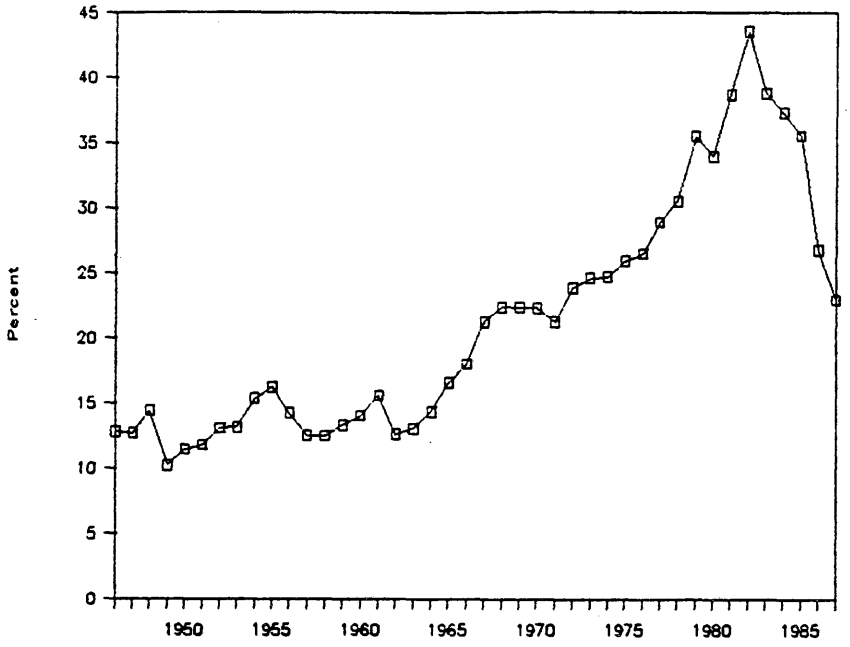

Figure 4.2

Diamond Production Controlled
by De Beers

Source: Computed from USBM Yearbook data
and De Beers Annual Report data

It is clear from readings of the period that the Australians wanted to market their own production. This option raised two problems. First, the joint venture group did not have the time or financial resources to take on such a task. Loan financing for mine development required a marketing contract that would limit market risk. Second, diamond dealers freshly burned by the displeasure of De Beers following the end of the investment speculation boom in 1980 were reluctant to create any alliance with the Australians for fear of

reprisals by De Beers. So, in 1982 out of necessity, De Beers and the Ashton joint venture group signed a five-year marketing contract to begin in 1985.

Portions of the contract are reported in a number of news releases and annual reports. However, percentages reported are inconsistent with one another in terms of carats, dollar value, and percentage of total production. Another complication is the subdivision of "gem" production into gem and cheap gem. Apparently the Australian government retains in Australia its 5% share of gem stones for cutting and sale in Australia. The remaining gem stones and 75% of combined cheap gem and industrial stones are sold through the CSO. The remaining 25% is marketed by Argyle Diamond sales, an organization that mimics the CSO. Argyle added a product development division to generate increased demand for Argyle diamonds through promoting the prestige value of Argyle diamonds. Argyle Diamond Sales cuts and polishes diamonds in Australia for sale in Australia and Antwerp (Ashton Mining, 1986, 1987; CRA, 1985, 1986).

Production from the west African countries of Ghana, Sierra Leone, Guinea, Ivory Coast, and the Central African Republic is through government corporations, individual diggers, and European companies, primarily Consolidated African Selection Trust (CAST). Smuggling is rampant between

these countries, but there is a particularly strong inflow into Liberia for ease of export to the Antwerp free market. Since the mid-1950s, diamonds have been Liberia's second major export after iron ore, yet less than one-third of its exports represent domestic production. West African countries have alternated between selling independently and through the CSO according to nationalizations and political sentiments of the period. Ghana has even used a portion of its diamond production for barter with China (Greenhalgh, 1985).

The production capacity of the USSR has been a subject of speculation and concern since the first kimberlite pipe was discovered in 1954 (Sobolev, 1981). Soviet production in 1987 is estimated at 12 million carats (Mining Annual Review, 1988). Concern stems from the unknown ability of the USSR to flood the market if it chooses. However, De Beers and the Soviets have allegedly had a marketing arrangement through the CSO since 1956. Supposedly the Soviets sell at least 80% of their yearly gem production through the Diamond Trading Company. This is most likely accomplished through Antwerp middlemen so that the Soviets can disguise their capitalistic dealings with a South African company (Shor, 1988).

Zaire, whose production is 90% to 93% industrial, broke

away from selling through the CSO and attempted to sell on its own in mid-1981. De Beers responded by flooding the already depressed market with industrial diamonds, thus driving the price down. Being independent created other domestic and financial problems, and within two years, Zaire resumed sales through the CSO.

Distribution Market Structure

Control of rough gem-diamond sales is maintained through the London-based Central Selling Organization (CSO) which markets diamonds on behalf of most of the world's diamond producing countries. About 80% of annual rough diamond sales are through the CSO (De Beers, 1987).

The Central Selling Organization is a De Beers and Oppenheimer-controlled collection of trading entities which operates through three arms: 1) the Diamond Corporation, 2) the Diamond Trading Company (DTC), and 3) Industrial Distributors, in conjunction with the Diamond Producers Association and the Diamond Purchase and Trade Company (Figures 4.3 and 4.4). De Beers, in combination with its control of the CSO, oversees a highly complex network of production, investment, sales, and holding companies. The complexity is no doubt in part designed to disguise sources and levels of income, managerial control, transfer pricing,

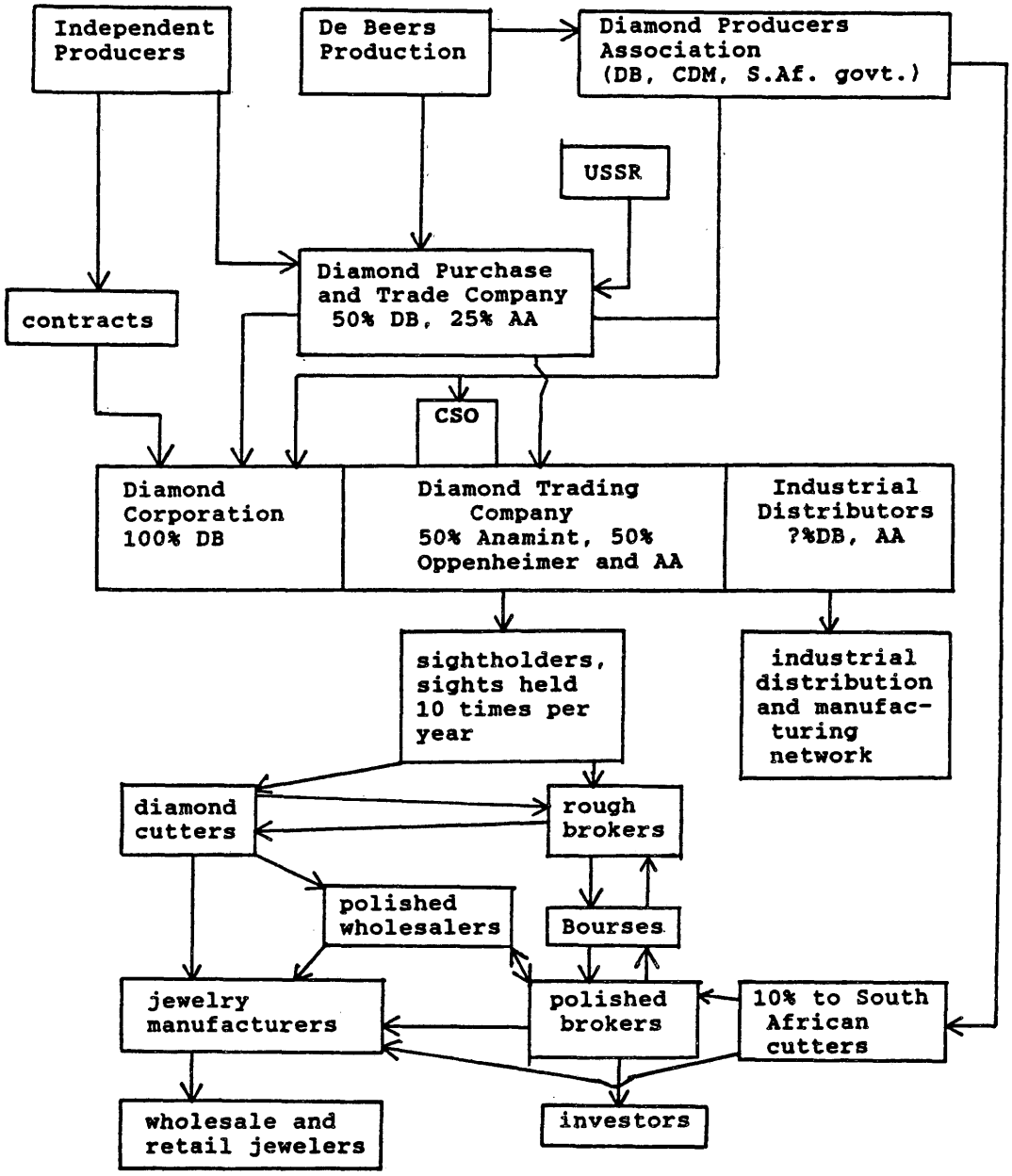

Figure 4.3

Central Selling Organization Structure

Source: Green, 1981
Koskoff, 1981
Brower, 1986

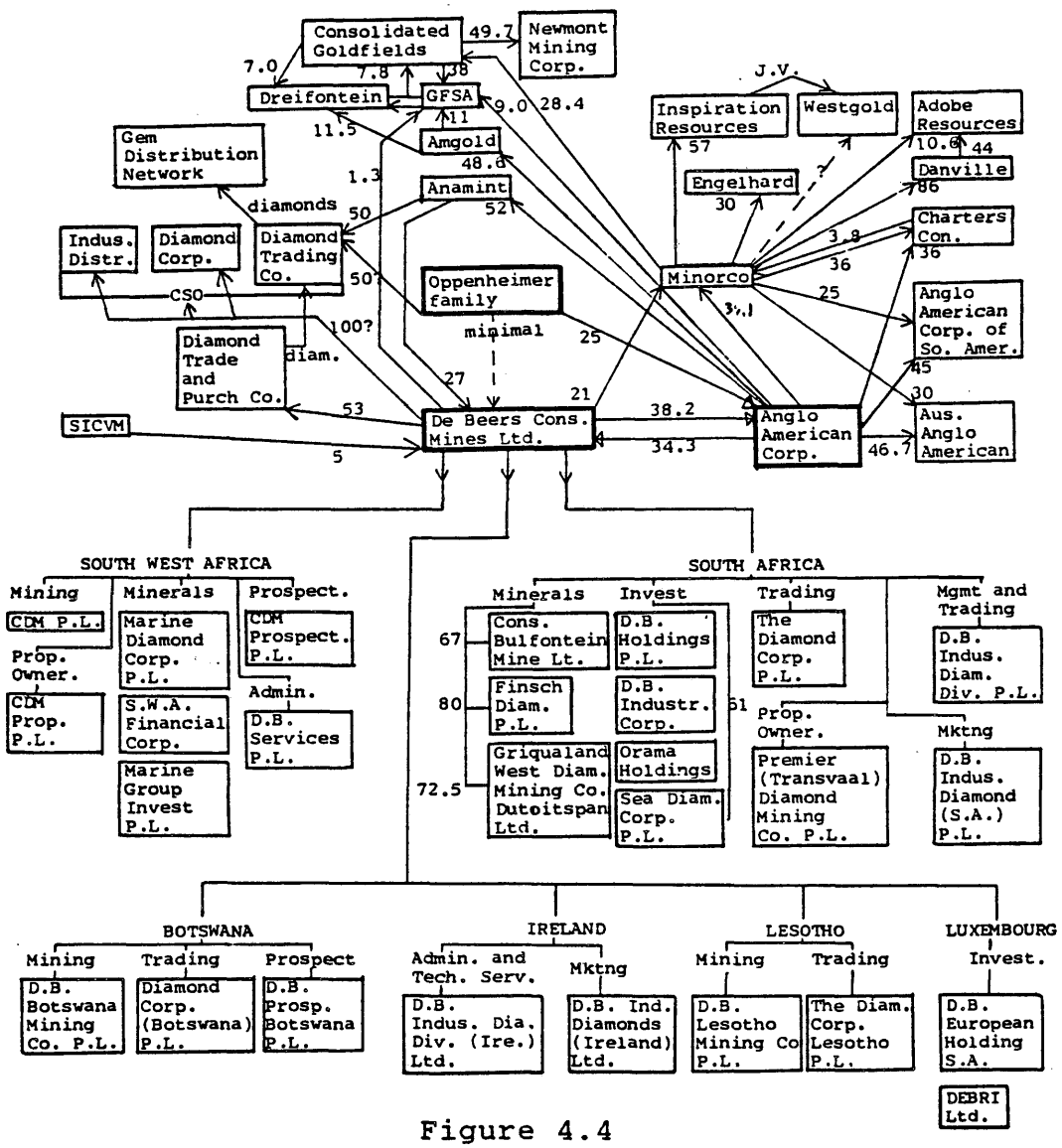

Figure 4.4

Corporate Structure of De Beers Consolidated Mines

Source: Koskoff, 1981
Schumach, 1981
De Beers, 1982-3

Note: Numbers indicate percent ownership.

and monopoly rents. In a less cynical view, the complexity of corporate structure no doubt gives De Beers the strength required to maintain its control of the diamond market. The corporate structure shown in Figure 4.4 indicates only major linkages within the De Beers empire. In its 1988 annual report De Beers shows listed and unlisted holdings in excess of seventy major subsidiary companies. Anglo American Corporation similarly has a lengthy list of holdings.

The Diamond Corporation, a wholly owned De Beers subsidiary, contracts for the output of producers other than those under the control of De Beers. Purchases are for agreed upon quantities at current and changing DTC list prices, minus a percentage commission (Koskoff, 1981). Diamond Corporation contracts are usually for five-year periods and guarantee purchase of production up to the agreed quota. This quota acts as a production control mechanism which is one of the steps De Beers uses in controlling supply. Quotas can be adjusted upward as sales volumes increase but are not supposed to be adjusted downward, regardless of market weakness. The Diamond Corporation in turn sells its diamonds to the DTC.

The Diamond Trading Company is the CSO entity which sells rough gem stones at sights to a select group of purchasers who are the first persons in the long chain of the

worldwide wholesale and retail gem distribution network. DTC is 50% owned by Anamint, with the remaining 50% partly traceable to Anglo American Corporation. The remaining unknown percentage probably belongs to other Oppenheimer-group companies or possibly the Oppenheimer family private holding company. De Beers owns no shares of the DTC. As the selling agent, DTC controls both the price and the flow of diamonds as they enter the market.

Industrial Distributors is the CSO arm that sells natural and synthetic industrial diamonds. De Beers owns 32% of Industrial Distributors.

The portion of diamonds not bought and sold by the CSO in addition to some DTC diamonds are marketed through a limited "free" market in Antwerp. Other "free market" outlets are in Kinshasha, Zaire; Monrovia, Liberia; Kankan, Guinea; Accra, Ghana; Abidjan, Ivory Coast (Greenhalgh, 1985). It is suggested that De Beers allows this market to exist and uses it as a price barometer. If Antwerp diamonds are sold at a premium over DTC prices, DTC raises prices if it feels that the premiums represent an actual changed state of the market. If premiums exist due to short-term situations or speculation, De Beers is reluctant to raise prices. The Antwerp market also provides an outlet for small independent producers, production over Diamond Corporation

purchase quotas, and smuggled diamonds.

Diamonds that do not enter the CSO from independent producers via the Diamond Corporation pass through the Diamond Purchase and Trade Company (Purtra) or the Diamond Producers Association (DPA). The DPA appears to be a quasi-governing body for the CSO. Its members are De Beers, CDM, and the South African government; its role is to offer producer representation in CSO affairs. It also provides diamond sorting and appraisal services between mine production and CSO sales (Koskoff, 1981; Brower, 1986).

The Diamond Purchase and Trade Company is 50% owned by De Beers, 25% owned by Anglo American Corporation with the remaining 25% ownership unknown. This company is another appraisal and sorting go-between company whose necessity is unclear. It is possible that foreign subsidiaries of Purtra offer a disguised or more discrete outlet for producers concerned with the political implications of dealing directly with a South African company.

CSO Operations

The CSO controls supply distribution by selling its diamonds through the DTC at sights ten times a year. Buyers are representatives of select diamond manufacturers and brokers, and attend sights on an invitation only basis.

Requests for diamonds are sent to the CSO in advance and the CSO allegedly endeavors to provide what is requested. In reality, the CSO provides diamonds according to its own marketing needs and plans.

Diamonds are sold to sight holders in boxes on a take-it-or-leave-it basis. There is no discussion over price. If a box is declined, it is unlikely that the sight holder will be invited to return to future sights. Sight holders who do not abide by the unwritten rules of proper marketing etiquette also may be dropped, as were some 25 to 40 in January 1979 (JCK, 1979a). These sight holders lost their buying privileges for having sold their purchased boxes unopened at a premium to speculators.

De Beers also uses the sights as a means of pushing stock on the manufacturing industry. At each sight, a percentage of stones may be undesirable, poor quality, or not the type in demand. Buyers who don't like the fact can decline to purchase the box, but only at the risk of losing future buying privileges. In this manner, De Beers can shift some of the stockpiling burden onto cutters and brokers as was done in the late 1970s. In this "carrot and stick" manner, De Beers is very successful at controlling the distribution of diamonds. The CSO also buys on the free market in an effort to stabilize prices when necessary.

Marketing

The gem marketing strategy of De Beers is summed up very well by the slogan coined in 1949 by N. W. Ayers, "A diamond is forever." Marketing policy is aimed at maintaining the long term stability and prosperity of the industry as a whole (Shor, 1988; De Beers 1988). This policy goal is achieved by perpetrating the illusion of value in a diamond. The following quote from the De Beers 1976 annual report describes well the overall goals of marketing strategy:

> A sale of diamond jewelry involves more than the consumer and the retailer. A third party is involved, the idea--that the diamond, because it is unique and rare, lastingly beautiful and valuable, is the perfect gift for those who wish to express love or affection, sentiment or just a special kind of thanks.
>
> The continuous, imaginative presentation of this idea is a responsibility that the Central Selling Organization accepted many years ago on behalf of the entire diamond industry and trade, and has been exercising on a steadily increasing scale ever since. Today De Beers' advertising and other market-support activities cover the world. The action naturally is concentrated in the largest and potentially most significant markets, but no country of consequence is overlooked. The rationale is that in an ever more competitive retail environment the pre-eminence of the diamond must be preserved, that new opportunities for giving diamond jewelry must be created and developed, so as to sustain and increase consumer demand and provide a stimulus and stability to sales from which everyone involved in the long and complex diamond "pipeline"--prospecting, research, mining, sorting and distribution, cutting and polishing, manufacturing and retailing--can benefit.

In 1987, De Beers spent $120 million on keeping the image alive (Financial Times, 1988).

In 1976, the United States composed 52% of the world's diamond jewelry market. Japan was second with 22% and Germany was third with 7%. The remaining 19% went to Canada, Australia, Brazil, and the rest of Europe (De Beers, 1976). Distribution of diamond jewelry sales in the United States is shown in Figure 4.5. De Beers targets each category and attempts to enlarge the demand as well as create new occasions and traditions for which it is desirable to give diamond jewelry. As a marketing strategy, De Beers strives to increase reasons for people to consume diamonds. This means that advertising is aimed at increasing the number of people who partake in diamond-giving traditions. For example, the eternity ring is now given on anniversaries to reaffirm the love that accompanied the betrothal diamond earlier in life. Diamond necklaces, pendants, and bracelets are becoming more popular as gifts for confirmation, graduation, sporting events, birthdays and Christmas.

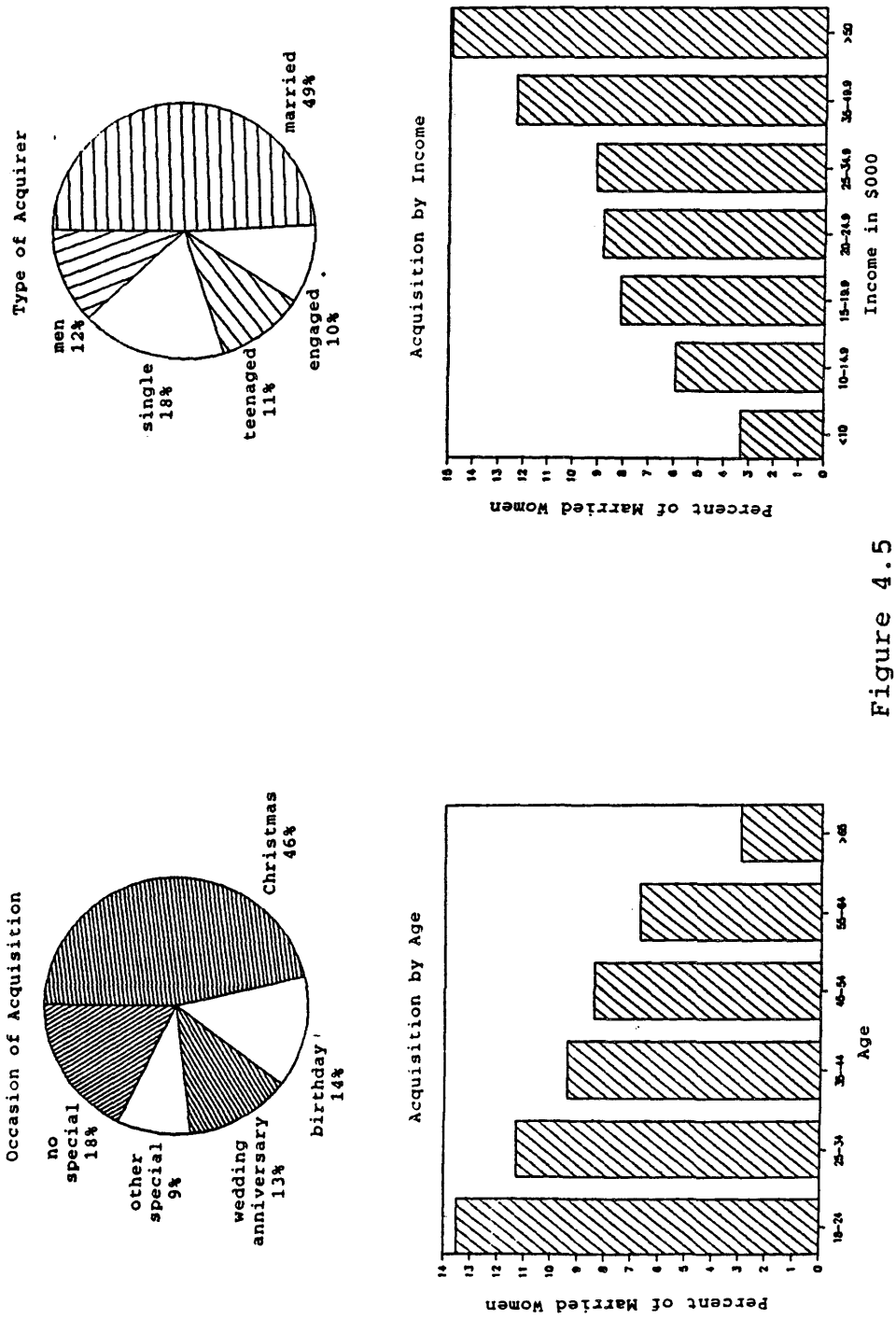

Figure 4.5

Distribution of U.S. Diamond Jewelery Sales

Source: De Beers, 1981

Costs

Prior to the sale of diamonds into the competitive wholesale and retail distribution network, costs are derived from two components: 1) costs attributable to mine-stage production and sale and 2) costs attributable to distribution and sales by the CSO.

Diamond production costs are not known. However, it is estimated that the cost basis of stones mined by De Beers operations is about 20 percent of the mine-stage sale price to the Diamond Corporation (Koskoff, 1981). In other words, the Diamond Corporation purchase price is approximately five times the cost basis of De Beers mining operations. Therefore, 20 percent of the mine-stage sale price can be interpreted as normal operating costs and 80 percent as transfer pricing gains owing to monopoly power. This price differential is no doubt one of the forces that compels independent producers to cooperate with the CSO instead of pursuing competitive tactics. It is possible that a portion of monopoly rents are Ricardian rents. However, rents owing to scarcity can not be distinguished from other rents.

Sales by independent producers to the Diamond Corporation are under the contract quota system and are subject to a 7.5% to 12% commission charge (Koskoff,1981). Even so, if it is assumed that contract prices paid by the

Diamond Corporation to independent producers are on par for equivalent stones purchased from the De Beers operations, then independent producers can mine diamonds at a cost of up to four times the cost basis of De Beers and still earn a profit.

CSO sales and marketing costs are not known but include substantial administrative and overhead expenses, interest expense of carrying stocks, advertising, and the costs incurred through internal transfer pricing between the Diamond Corporation and the Diamond Trading Company.

Price

Diamond prices are established in two ways: the DTC stated price at sights, and in the Antwerp "free" market. However, free market prices are influenced to a large extent by supply which De Beers has the ability to control.

The basic goal of De Beers's pricing policy is long-run profits. To achieve this goal, a large part of their marketing strategy is aimed at maintaining people's faith in the value of diamonds. Price volatility would shake public faith in the "forever" quality of a diamond's value. Therefore, De Beers withholds and releases supply according to the price the market will bear. That price appears to have increased at an average nominal rate of 8% to 10% per

year over the period 1949 to 1980 (Table 4.2). At the same time, average annual fluctuations in price ranged from 0.7% to 16.9% per year with all price changes in the positive direction. When prices are raised, it is usually not across the board. Rather, prices are increased in the particular categories which are in greatest demand. Usually this is indicated by premiums being paid in the free market.

Diamond prices are dictated by the four c's previously described. Figure 4.6 demonstrates how the per carat price increases with the number of carats. For stones larger than one carat, the trend continues in a similar fashion. However, for exceptionally large stones, prices are based on a subjective valuation and established through buyer-seller bargaining.

The historical price sensitivity to supply and economic conditions was demonstrated in Chapter 2. In discussions concerning the ability of De Beers to control prices, their dramatic climb between 1975 and 1980 and their subsequent decline through 1986 are used as examples of the inability of De Beers to control market forces (Figure 4.7).

Discussion usually surrounds the price history of the one-carat D flawless diamond. While of interest to investors and a source of high profits for sellers, the one-carat D flawless diamond represents a very small portion of the

Table 4.2

De Beers Price Increases 1949 to 1983

Date	Price Increase (%)	Average Annual Increase (%)
September 1949	25.0	12.5
March 1951	15.0	12.5
September 1952	2-2.5	1-1.5
January 1954	2.0	.7
January 1957	5.7	1.9
May 1960	2.5	.8
March 1963	5.0	5.0
February 1964	up to 10.0	up to 5.0
August 1966	7.5	7.5
November 1967	16.6	16.6
September 1968	2.5	.8
July 1969	4.0	4.0
November 1971	5.0	5.0
January 1972	5.4	
September 1972	6.1	6.1
February 1973	11.0	
March 1973	7.0	
May 1973	10.0	
August 1973	10.2	14.8
January 1975	10.0	10.0
January 1976	3.0	
September 1976	5.8	5.8
March 1977	15.0	
December 1977	17.0	16.9
August 1978	30.0	30.0
September 1979	13.0	13.0
February 1980	12.0	12.0
September 1981	2.5	2.5
March 1982	3.5	1.8
all 1983	0.0	0.0

Source: Koskoff, 1981
Jewelers Circular-Keystone

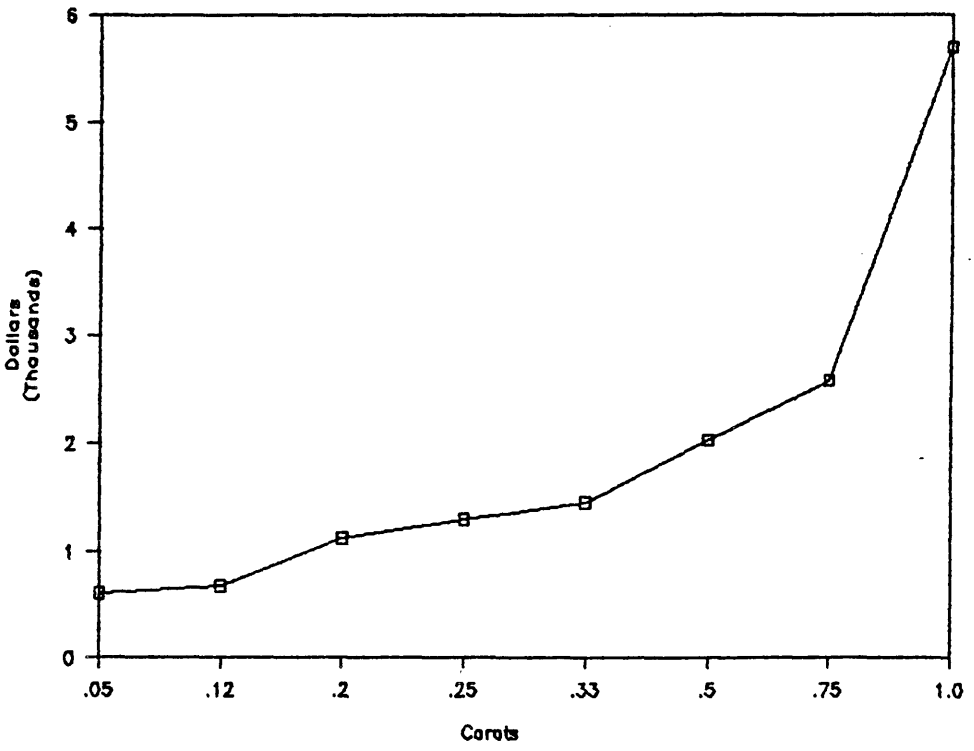

Figure 4.6

Price Per Carat for a G-VS1 Stone, 1979

Source: U.S. Bureau of Mines, Yearbook, 1979

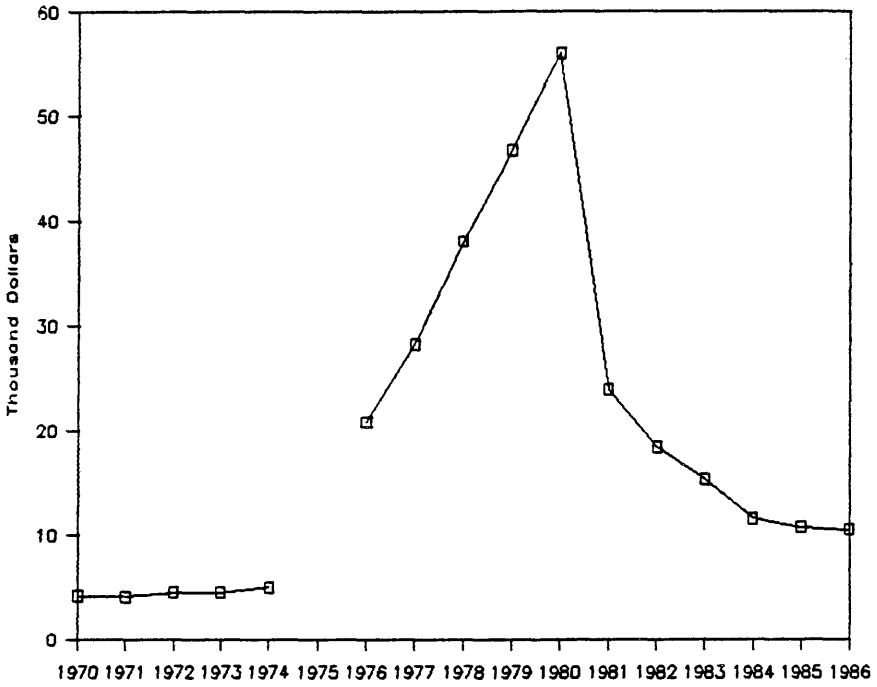

Figure 4.7

Average Annual Real Price of a One-Carat D Flawless Diamond, 1970-1986

Source: USBM Yearbook

Note: 1982 base year

diamond business. A much more representative stone to use is the 20-25 point G, VS1 which more closely represents the average type of stone bought by engaged couples. Attention paid to the one-carat D flawless has been out of proportion to the significance it carries in the market, leading industry analysts to arrive at erroneous conclusions concerning investment potential as they did in the late 1970s.

Although the D flawless diamond may not be the most representative category to use for price analysis, the most data available are for the D flawless. It does display a price trend which is similar to other categories albeit at a higher level and with wider fluctuations. A detailed discussion of the price history for the 1976 to 1983 period is presented in Chapter 6. Using the annual average real price (wholesale dealer price) of a D flawless diamond, as reported by the USBM, average annual prices increased at 9.8% per year over the period 1970 to 1985. However, the annual dealer price fluctuations ranged from a 35% increase to a 57% decrease (Figure 4.8). This information suggests that in the long-run, De Beers has been successful in achieving its goals. However, it would appear that the price peak of 1980 demonstrates temporary loss of control by De Beers over a portion of the market. It is interesting to note that diamond prices peaked (Figure 4.7) at approximately the same

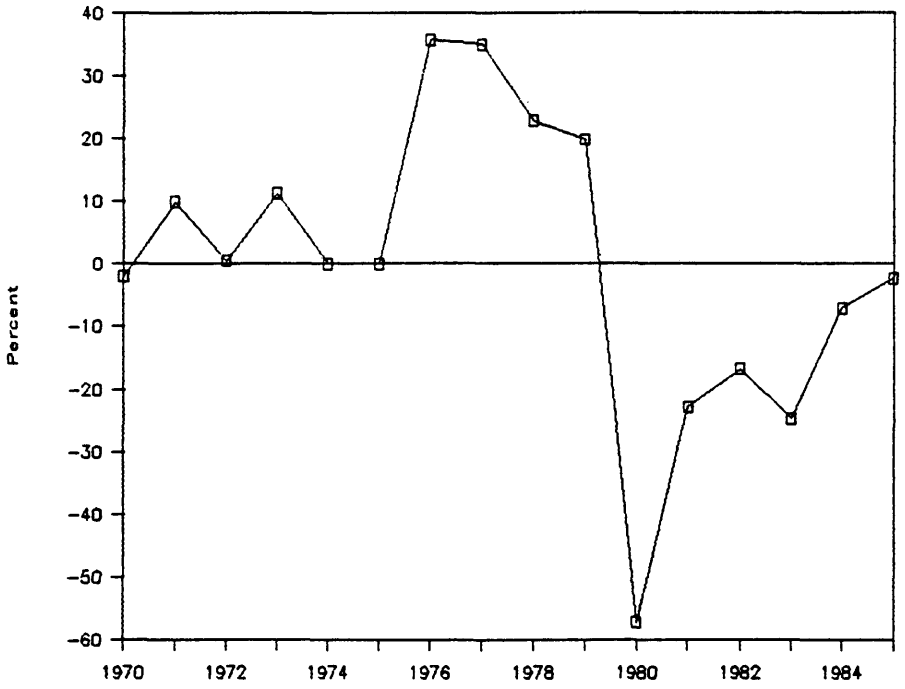

Figure 4.8

Percentage Change in the Price of a One-Carat D Flawless Diamond

Source: Calculated from USBM Yearbook data

time as gold prices (Figure 4.9). The subsequent decline in price was limited by the withholding and purchase of diamonds by De Beers.

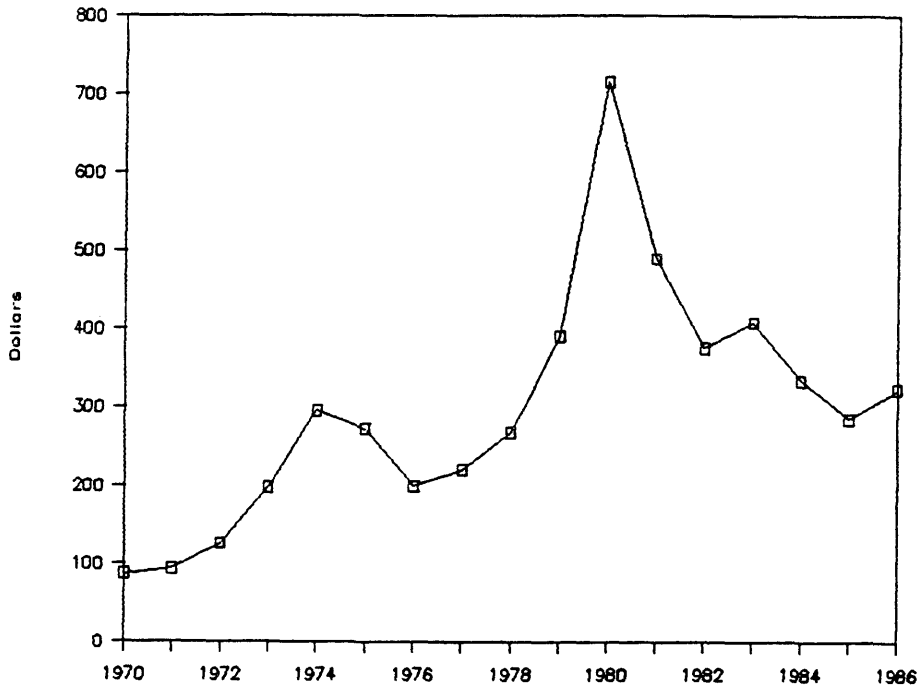

Figure 4.9

Average Annual Real Gold Price

Source: USBM Yearbook
Note: 1982 base year

Chapter 5

INDUSTRY ANALYSIS

In an effort to evaluate the effect on demand of economic factors of price, income, the business cycle, and the opportunity cost of holding diamonds, a simple econometric model has been developed.

Owing to the market's monopoly structure and the lack of statistics on the quantity of diamonds sold by the CSO, it is not possible to formulate a valid supply model. Attempts to model supply in terms of inflation, currency devaluation, costs and price are similarly subject to the problem of production statistics not equating to CSO-released supply.

Demand Model

Apparent gem diamond consumption (imports less exports less reexports) of the United States, accounted for 11% to 46% of annual world gem production by volume between 1970 and 1986. U.S. imports accounted for between 27% and 61% of world gem production during the same period. Because U.S. apparent consumption accounts for a large portion of world demand and because U.S. statistics are available, the demand model has been constructed based on U.S. apparent

consumption. This model is a refined version of a previously constructed partial stock adjustment model (Appendix 3).

The objective of the regression model is to develop a feel for the economic variables that influence U.S. apparent consumption. The demand equation developed describes U.S. apparent consumption of gem diamonds as a function of own price, income, and the price of close substitutes. The income variable is subdivided into one representing the level of income and one representing the state of the business cycle. Experimentation with the price variable demonstrates best performance by a lagged price variable. Variables tested to describe substitutes include the real and nominal price of gold, and real and nominal interest rates. Other economic variables which were tested but rejected on the basis of poor performance and lack of statistical significance include inflation, and changes in the price of gold and diamonds.

Other non-economic factors which are likely to influence demand such as population, the number of marriages per year, the quantity of diamonds recycled each year, changes in consumer preference, marketing ability of De Beers and antiapartheid sentiments are not included in the model for two reasons: 1) lack of data, and 2) because some of these trends are captured in the economic parameters used. In

Chapter 6, several of these factors are examined in their role of influencing diamond demand.

The best performing ordinary least squares equation of the large number examined is presented below (T statistics shown in parentheses). A transformed version based on the Cochrane-Orcutt procedure is used to test the equation's validity given the possible presence of serial correlation.

Model Regression Equation

U.S. apparent consumption = -17468 - 0.026 average
(-2.33) (-1.55)
annual real price (-1) + 4.06 real GNP
(7.82)
+ 120.37 Qreal/Qnatural - 311.48 nominal interest
(1.84) (-2.95)

Model Analysis

Statistical analysis of the equation is shown in Table 5.1 and elasticities are shown in Table 5.2.

A lagged price variable was selected because it performs better than the current price variable. The lagged price coefficient is -0.026 and is statistically the weakest variable, barely passing the T-test at the 90% level of significance. This observation is supported in an earlier analysis using a partial stock adjustment model (Klipfel,1988). The weak statistical significance indicates

Table 5.1

Statistical Analysis of the Model Equation

	constant	lagged price	real GNP	ratio	nominal interest
sign	?	ok	ok	ok	ok
size of coefficient	?	ok?	ok	?	ok
T-test 10%	pass	fail	pass	pass	pass
20%	pass	pass	pass	pass	pass

R squared = 91.7%
R squared adjusted = 87.2%
F-test = 23.04, pass at 5% significance; 4/9 degrees of freedom; F table = 3.63 at 5%.
DW = 1.98, indeterminate; for k=5 including the constant N=14 at 5% significance Dl=.632, Du=2.03
T-test for 9 degrees of freedom, T-Table at 10%=1.833 at 20%=1.383

Table 5.2

Elasticities for the Model Equation

	Elasticities			
	Price	Income	Ratio	Interest
OLSQ coefficient	-.148	3.59	3.18	-.856
rho transformed coefficient	-.258	3.59	2.80	-.599

that evidence about price is weak. Also, a price elasticity coefficient of -0.148 indicates relative price inelasticity (Table 5.2).

Real GNP is an important variable. In this model the coefficient is 4.06. It generally achieves a high level of significance at the 90% level and enhances the R squared value by 10% to 40%. An elasticity coefficient of 3.5 (Table 5.2) indicates that consumption is extremely sensitive to income. This suggests that people are relatively eager to spend their money on diamonds when the economy is growing and/or they have more disposable income. Such high elasticities are traditionally associated with luxury goods.

The ratio of real GNP to natural GNP is an indicator of the health of the economy or the business cycle and is useful in relating commodity consumption trends to overall economic welfare (Sarles, 1988; Tramm, 1988). In this model, the ratio coefficient is 120.37 and passes the T-test at a 90% level of significance but only barely (T-model = 1.8396; T-book = 1.833). Its elasticity coefficient is 2.80 (Table 5.2) indicating great sensitivity to the business cycle. This suggests that people more readily buy diamonds during periods of economic growth and prosperity than they do during periods of economic decline or stagnation. Again, this interpretation is consistent with the characteristics of

luxury goods.

The fourth variable, the opportunity cost of holding diamonds, should be a measure of the income forgone by owning diamonds. In theory, the variable selected should be real interest rates. However, a real interest variable generally does not perform as well as a nominal interest rate variable. Growth rate variables using the real price of gold and the real price of diamonds are also weak. In this model, the nominal interest coefficient is 311.48 and passes the T-test at a 90% level of significance (Table 5.2). The elasticity coefficient of -0.856 (Table 5.3) indicates relative inelasticity. This suggests that increases or decreases in nominal interest rates have little influence on the consumption of diamonds. The exception to this may be the purchase of investment grade diamonds. But since this category represents only a very small portion of apparent consumption, it plays only a limited role in influencing elasticity.

The Durban-Watson coefficient is 1.985 and lies within the indeterminate interval of .632 to 2.03. The lack of a clear statistical conclusion is due to the small sample of only 14 observations. For time series data, the possible presence of serial correlation is likely. Assuming that serial correlation may be present in the data series (Pindyk

and Rubenfeld, 1981), the Cochrane - Orcutt (C-O) procedure is used to reevaluate the model equation (Appendix D). The C-O procedure is an iterative process which uses the concept that rho is a correlation coefficient associated with errors of adjacent time periods. In the first step, the ordinary least squares technique is used to estimate the original model. The residuals are then used to perform the regression:

$$E_t = rE_{t-1} + v_t$$

where E = predicted error
r = correlation coefficient rho
v = error

The estimated value of r is used to perform the generalized differencing transformation process and a new regression is run. The transformed equation is:

$$Y^*_t = B_1(1-R)+B_2X^*_{2t}+\ldots+B_kX^*_{kt}+v_t$$

where $Y^*_t = Y_t - RY_{t-1}$

$X^*_{2t} = X_{2t} - RX_{2t-1}$

$X^*_{kt} = X_{kt} - RX_{kt-1}$

R = estimated rho

The revised parameter estimates from the transformed equation are substituted into the original equation and a second iteration is run. The process is continued until the new estimates of rho differ from the old ones by less than

1%. Convergence was achieved after three iterations and the new estimated equation with T statistics in parentheses is:

$$\begin{aligned}\text{Apparent consumption} = {} & -23591 - .04\ \text{price}_{(-1)} + 4.3\ \text{GNP} \\ & \quad (-2.88) \quad (-2.35) \qquad\quad (7.91) \\ & + 165.6\ \text{Ratio} - 177.5\ \text{nominal interest} \\ & \quad (2.44) \qquad\quad (-1.38)\end{aligned}$$

Statistical analysis of the transformed equation is shown in Table 5.3.

This equation is very similar to the original model suggesting that if serial correlation is present it is present only to a limited degree. Overall, the similarity of the transformed equation to the original model equation supports the validity of the model equation.

Although the model works well statistically and is theoretically reasonable, it is limited by the fact that it does not account for recycled or scrap diamonds in apparent consumption. On the other hand, the dependent variable, U.S. apparent consumption does not include in its measure, recycled diamonds. Rather, it is only a measure of U.S. net imports, so, even if the data were available, including the annual quantity of recycled diamonds as an independent variable to explain net imports would be misleading. The role of recycled diamonds is discussed further in Chapter 6.

Table 5.3

Statistical Analysis of the Rho Transformed Equation

	constant	lagged price	real GNP	ratio	nominal interest
sign	?	OK	OK	OK	OK
size of coefficient	?	OK?	OK	?	OK
T-test 10%	pass	pass	pass	pass	fail
20%	pass	pass	pass	pass	fail

R squared = 94
R squared adjusted = 90.6
F test = 27.6, pass at 5%; 4/7 degrees of freedom,
F table = 4.12 at 5% significance
T test, for 7 degrees of freedom, T table at 10%=1.895,
at 20%=1.415

Chapter 6

ANALYSIS OF ECONOMIC FACTORS

This chapter presents a discussion and analysis of the effect of increased production. The primary issue is whether new production from Australia will cause the demise of the De Beers diamond cartel. To a lesser extent, increased production by other producers is considered.

Under the assumption that a comparable production increase for most other commodities would cause a decrease in price, and given that De Beers attempts to control prices, a price response analysis (the first section) becomes an evaluation of the degree to which De Beers is capable of controlling prices.

If it is assumed that prices are controlled by De Beers and not allowed to react to increased production, then demand must increase to absorb the higher levels of production or production must be controlled. In the second section an analysis of demand attempts to assess the potential for demand growth through each of four categories of growth factors: economic variables (U.S. apparent consumption model), intensity of use, population, and new market development.

Alternately, if demand growth is slow, gem diamond sales

must be controlled either through producer cooperation or through stockpiling. In the third section, an analysis of the supply process attempts to assess the liklihood of producer cooperation in limiting production, De Beers's ability to stockpile, and the possibility of further increases in production resulting from new discoveries.

If demand growth is poor or supply actions are not taken to control total gem diamond sales, then the price will fall.

Price Analysis

The price history of the 1976 to 1983 period is useful in revealing the workings of De Beers and its ability to control the market. The following detailed account is presented here rather than in the historic section (Chapter 2) because it is felt to be more relevant to the price analysis of this section. Industry news and diamond price activity as reported monthly in Jewelers Circular-Keystone (JC-K) is used to establish a chronology of events for the period. This is followed by an interpretive section which attempts to bring together the facts within the chronology.

Price History

In May 1976, JC-K reported a 3% De Beers price hike at April sights under the unknowingly insight-filled caption "Diamond Price Rise Begins" as if a long price climb were

anticipated (JC-K, 1976a,). This suggests that free market conditions (premiums being paid) served as a good indicator both to De Beers and buyers that price increases were imminent. Two months later, further price hikes were rumored and desire by dealers for "investment" or hedge stones was reported, particularly in countries with shaky currencies such as England and Italy (JC-K, 1976b).

In October of 1976, a 5.7% price hike report began with the line "say goodbye to steady diamond prices" (JC-K, 1976c). After the price rise of October, some prices declined (Figure 6.1). This was explained by diamond dealers as "the lull before the storm." It is curious, though, to find at this point, an anticipatory mood toward an increasing price market yet no reaction to such a sentiment.

Another price increase of 15% in April 1977 was apparently directed toward Indian cutters who had to pay almost 70% more for small rough while general melee prices increased 26%. In general, jeweler prices increased 7% to 15%. Figure 6.1 shows the May JC-K median price index unchanged from April but increasing 9% in June (JC-K, 1977a).

For the next few months prices increased, sales slowed, then stabilized in time for the next anticipated increase. Reports of diamond investment also indicate the coming investment craze. By December 1977, complaints of reduced

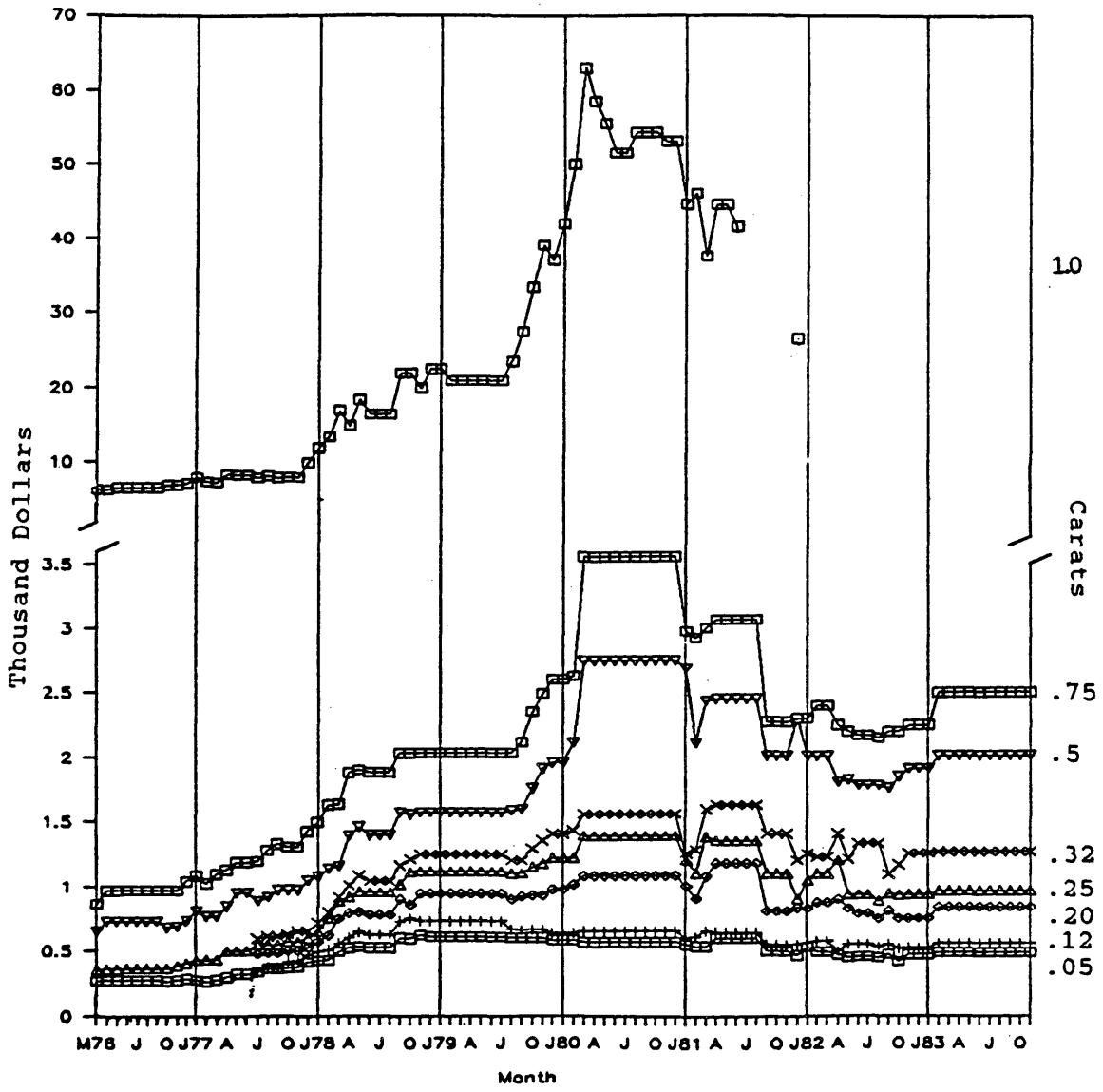

Figure 6.1

Monthly JC-K Median Prices for Selected Sizes, 1976-1983

Source: JC-K, 1976 to 1983

quantities of diamonds offered at sights fueled speculation that De Beers was withholding diamonds from the market (JC-K, 1977b).

By April 1978, the mood of the market was described as in a state of hysteria (JC-K, 1978a) as prices continued to increase rapidly (Figure 6.1). Dealers responded by hoarding diamonds in the hopes of unloading them later at higher prices and to maintain inventories that would only have to be replaced at higher prices. A protectionist Belgian law passed in March 1978 made it illegal to export rough diamonds valued in excess of $70 per carat. This effectively wiped out the export of all rough diamonds from Antwerp. Israeli cutters dependent on Antwerp for their supply of rough diamonds, hoarded stocks to prevent being caught by a supply shortage (JC-K, 1978b).

In response to dealers who were hoarding stocks and selling at a premium, De Beers imposed a 40% surcharge at the March 1978 sight. The strategy served a number of purposes. First, it was designed to capture premiums collected by dealers and force hoarded diamonds back onto the market. Second, the purpose of using a surcharge rather than an official price increase was so that after hoarded diamonds were back on the market, the surcharge could be reduced thereby lowering prices to a more appropriate level without

breaking marketing policy of never officially lowering prices. Third, the surcharge was meant to be a warning to Israeli banks, who, at the encouragement of the government, had been financing up to 80% of the market value of dealer's purchases. The possibility that market value could be dropped 40% at the removal of the surcharge reduced banks' willingness to lend. Fourth, the surcharge acted as a penalty charge against dealers who were breaking the honorary rules of diamond marketing. The high surcharge was also meant to force dealers to bear the burden of the price increase since the retail market could not withstand a price increase of 40% (JC-K, 1978b). It is clear in Figure 6.1 that the 40% surcharge, in fact, was not passed on to jewelers and consumers.

At the next sight in early May, the surcharge was reduced to 25% and in July was again reduced to 10%. Diamond prices showed a degree of stability for the following few months. The surcharge scheme successfully stabilized prices but it also brought stocks on to the market to the extent that small stones were oversupplied. De Beers in turn was forced to buy polished goods to avoid a price crash.

By September speculation was again increasing and prices began to climb. Dealers cited three major reasons for the renewed wave of speculation: 1) shortages due to small

sights, 2) anticipation of an official De Beers price hike, and 3) depreciation of the dollar. Again, the desire to increase inventories before prices climbed caused prices to be bid up (JC-K, 1978c).

In January 1979, De Beers stopped all sales of rough to between 25 and 40 of its more than 200 sightholders in retaliation for resale of unopened boxes at a premium. Also, other sightholders received lower quality stones. It is not known whether pushing lower quality stones was a means to unofficially raise prices or if stones were in short supply (JC-K, 1979a). The latter is suspected.

For the next few months, prices remained stable. However, general public interest in the potential investment opportunities of diamonds increased. On August 29, De Beers announced a 13% price increase for its September sights with larger sizes bearing most of the increase (JC-K, 1979b). This price increase initiated a new wave of rapid and persistent price increases for larger sizes (Figure 6.1). Another 12% increase was put into effect at February 1980 sights causing dealer prices to increase dramatically until March (Figure 6.1).

Articles in the following months describe the market for investment stones (1 ct D Fl) as soft rather than as a price crash mimicking that of gold. It is also interesting to note

that the high price levels attained by other categories in March 1980 remained stable at that level until November of that year. Prices for the .32 carat category did not peak until a year later and prices for the smallest two categories reached their highest levels in late 1978, 18 months earlier (Figure 6.1). For the remainder of 1981 and until at least November 1983, there was insufficient trading of investment stones to formulate a price index.

The later part of 1981 through 1984 marked a period described as the worst diamond recession in 50 years. This was largely produced by outside factors of high interest rates and reduced consumer spending in response to worldwide economic recession. Despite the recession for the market in general, the Indian manufacturing industry grew to new levels as diamond sales moved away from large to small stones which are the heart of the Indian cutting industry (Shor, 1988, personal communication; Gupta, 1987).

Discussion and Summary

For the period 1976 to 1983, the dramatic price fluctuations possibly began as a result of supply problems for De Beers. Buffer stocks were declining (Figure 6.2) and De Beers controlled only about 13% of gem production. Although the Soviet Union had a selling contract with the

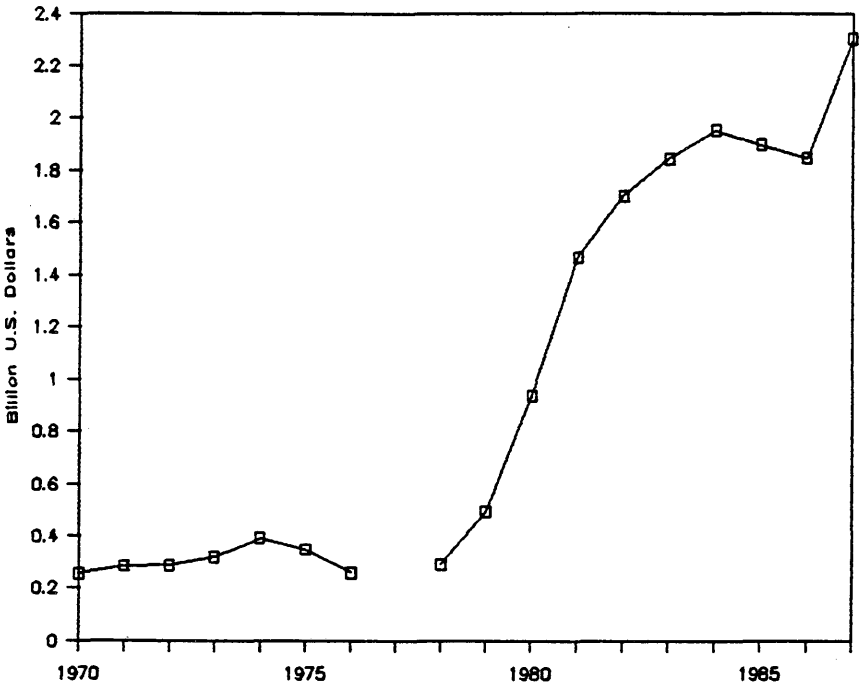

Figure 6.2

Diamond Stocks Held by De Beers

CSO, it began withholding rough and selling polished diamonds independently as the price spread between rough sight prices and market polished prices widened sufficiently to make it profitable to sell independently in spite of the contract. Dealers in the United States and Antwerp were solicited by the Soviets for purchases of Russian polished diamonds. This further aggravated supply problems for De Beers. It is also thought that the Soviet Union pursued this strategy to gain bargaining strength and better terms in its contract with the CSO upon renewal in 1979 (Federman, 1979).

In addition to increased sight prices for fewer stones of lesser quality, a general world recovery from the post oil-shock recession and an abundance of petro dollars available for investments, helped cause diamond prices rise. The Israeli cutting market, concerned for its own welfare and employment, began hoarding diamonds with the assistance of easy credit from government encouraged bank lending. With credit for diamond purchases available up to 80% of market value, Israeli dealers outbid others in all markets until De Beers squelched bankers willingness to lend with the 40% surcharge. At that point, the Israeli industry had incurred $850 million in debt, to finance its hoarding; more than the diamonds were worth at market prices. Many small firms soon went into bankruptcy (Federman, 1979).

Following the ouster of sightholders in January 1979, De Beers overwhelmed remaining sightholders with the largest sight in several years. This created a cash shortage for dealers resulting in decreased buying on the free market. Simultaneously, De Beers withdrew its free market purchasing agents so that independent sellers lost virtually all customers. The result was a 20% decrease in the price of free market stones (Federman, 1979).

While the main marketing thrust of De Beers is directed at the control of rough, it does buy polished stones and supports its own cutting factories. Partial control of the cut market gives De Beers just enough leverage to keep India, Israel, and the Soviet Union in line (Federman, 1979).

From review of this period, three observations are made. First, prices increase as demand increases. Second, prices decrease only after they have been inflated to unrealistic levels by investment or hoarding speculation. Third, prices do not decrease in response to over supply. Rather, De Beers increases its buffer stockpile which grows in times of over supply.

When considering the present increased level of world production, observation three appears to be the most relevant in assessing the price response. Based on this observation, it is reasonable to conclude that prices are not likely to

fall in response to current increased levels of production. If this is true, then De Beers is faced with the task of increasing demand to absorb increased production or controlling supply through stockpiling or production limitations.

Demand Analysis

Growth in demand may occur as a function of the economic variables set out in the U.S apparent consumption model presented in Chapter 5 or through other factors not directly included in the model such as growth in the intensity of use, growth in population, or development of new product and customer markets.

Economic Variables

The U.S. apparent consumption model utilizes the lagged average annual price, real GNP, the ratio of real GNP to real natural GNP, and nominal interest rates to explain U.S. demand. These variables, most likely, will show little change over a ten year period except possibly income and price.

Results shown in Table 5.2 indicate that demand is relatively price inelastic and that a one percent increase in the previous year's average annual real price of diamonds should cause a 0.15 to 0.26 percent decrease in purchases.

Average annual nominal price increases by De Beers in the long run tend to be on the order of 8% to 10% per year. Therefore, the demand response is expected to be a mere 1.5% to 2.5% decline. This level of demand reaction is likely to be outweighed by other demand-increasing factors.

Interpretation of price effects on demand for this model assumes the existence of a downward sloping demand curve. According to Figure 3.2, this is true for the portion of the curve in which the market now operates (between points 1 and 2). However, if a decrease in price is sufficient to move the market equilibrium point downward to where the demand curve is upward sloping, then model interpretations will be incorrect. For this situation a decrease in price will in fact decrease purchases.

Income, as measured by GNP, appears to be the most important variable for increasing demand. As shown in Table 5.2, a 1% increase in GNP will create a 3.6% increase in U.S. demand for gem diamonds. At an average growth rate of approximately 3%, growth in GNP could account for as much as a 10.8% increase in demand each year. This response to income is extremely large, but not unreasonable for luxury goods.

The ratio variable measures the general well-being of the economy. Based on the model elasticities shown in Table

5.2, a 1% increase in the ratio will generate approximately a 3% increase in demand. Similarly, a 1% decrease in the ratio will be associated with a 3% decrease in demand. One conceivable problem in interpreting the ratio in this manner is that it assumes a ratio starting position of 1.0. If the ratio is above or below 1.0, there may be a slightly different demand response. For example, a 1% increase in the ratio from a starting point of 1.03 may create a greater increase in demand than a 1% increase in the ratio when it is at .95, the difference being that the economy is in an overheated state or a recessionary condition. If the economy is overheated, people are more likely to buy than during conditions of recession.

The final variable, nominal interest rates, indicates that a 1% increase in nominal interest rates will be accompanied by a .6% to .8% decrease in U.S. demand. This implies that increased interest rates will draw some of the public's disposable income from diamond purchases to an interest paying investment expenditure; e.g. savings accounts or bonds. Similarly, a decrease in interest rates will cause diamond demand to increase by .6% to .8%.

Overall, we see that for the economic variables, increases in demand will be driven primarily by increases in income followed to a lesser extent by favorable changes in

the real GNP/natural real GNP ratio. Price increases will reduce purchases slightly. Similarly increased interest rates will reduce demand slightly if they occur.

Although the economic variables predict the effect on demand by each variable, they do not indicate the nature of demand increases or decreases. Examination of per capita consumption patterns of the world, U.S., and Japanese populations indicates increased per capita holdings for each group (Figures 6.3, 6.4, and 6.5). In 1970, the number of carats held per person for the world, U.S., and Japan were 0.0117, 0.0128, and .0025 respectively. In 1986, annual per capita consumption had grown to 0.0182, 0.0276, and 0.0087 (1985 for Japan) carats per person for each country. Although erratic in growth, the increase in per capita consumption is about 56%, 116%, and 248% for the 17 (16 for Japan) year period. For the U.S., the growth rate in per capita holdings is approximately 6.8% per year for the period. This figure is somewhat lower than the 10.8% growth in apparent consumption predicted by the model for a 3% growth rate in GNP. The difference may be explained in part by GNP growth rates of less than 3% or by the demand reducing effects of the price and interest rate variables.

Regardless of the reasons that might explain the discrepency, the per capita consumption figures indicate

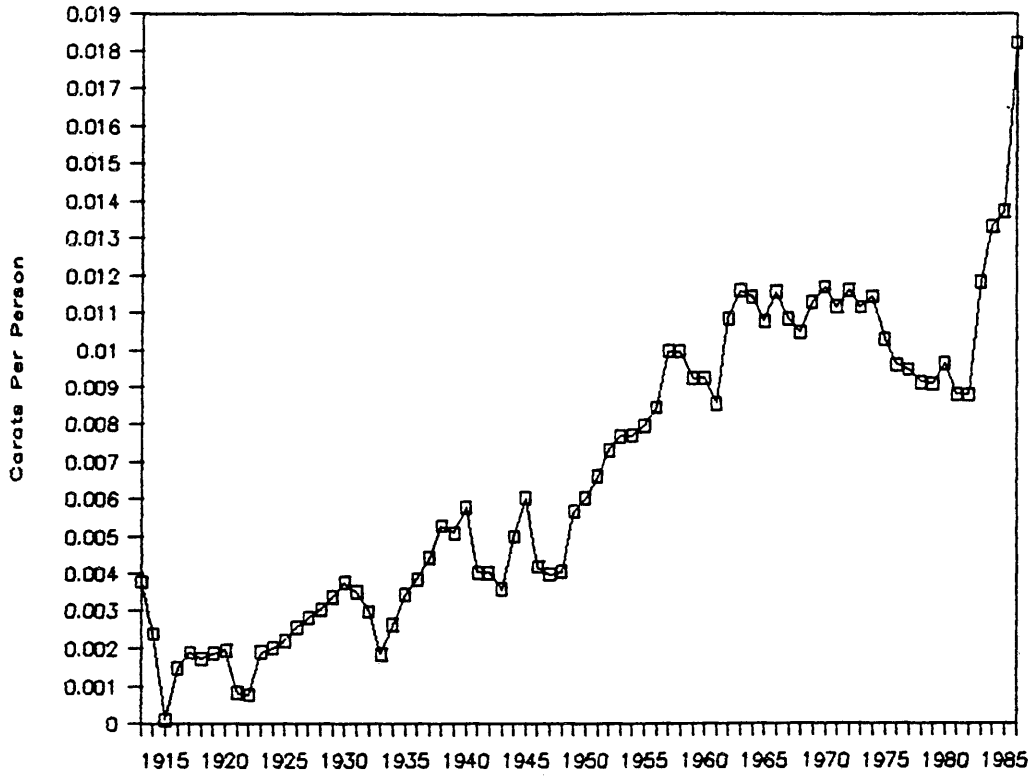

Figure 6.3

World Per Capita Consumption of Diamonds

Source: Computed from USBM Yearbook data and UN Statistical Yearbook

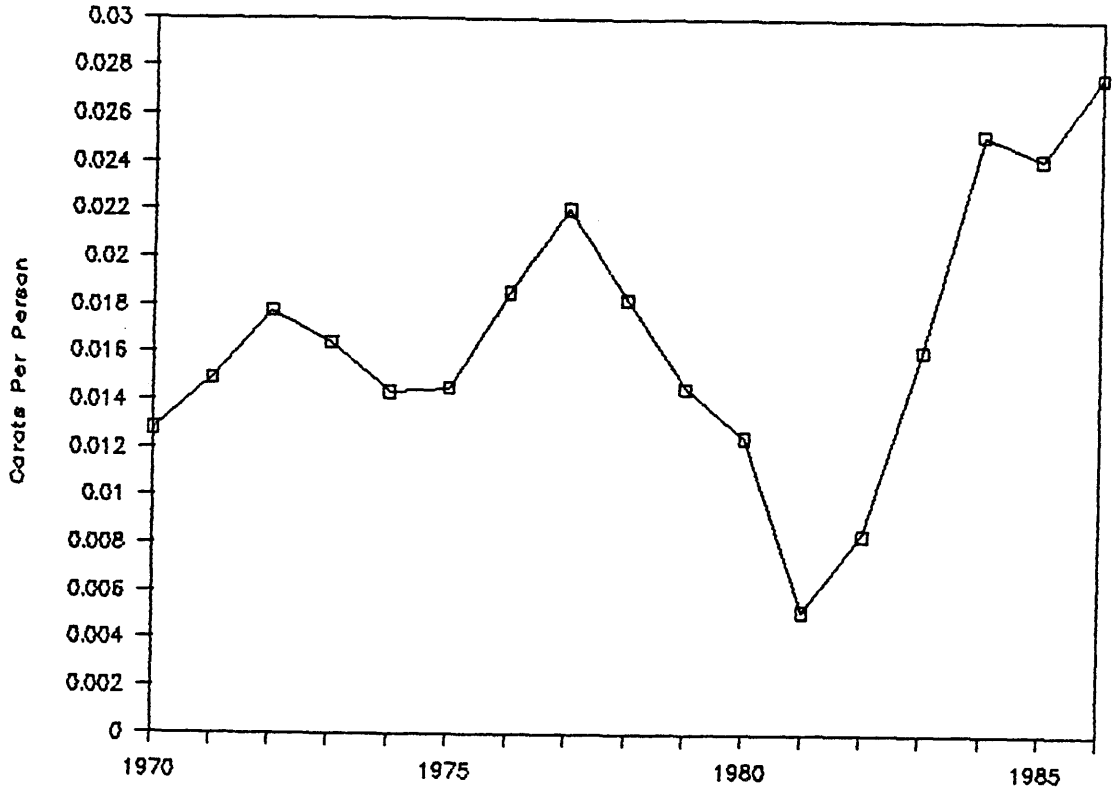

Figure 6.4

U.S. Per Capita Consumption
of Gem Diamonds

Source: Computed from USBM Yearbook data and US Dept. of Commerce, Statistical Abstracts of the United States

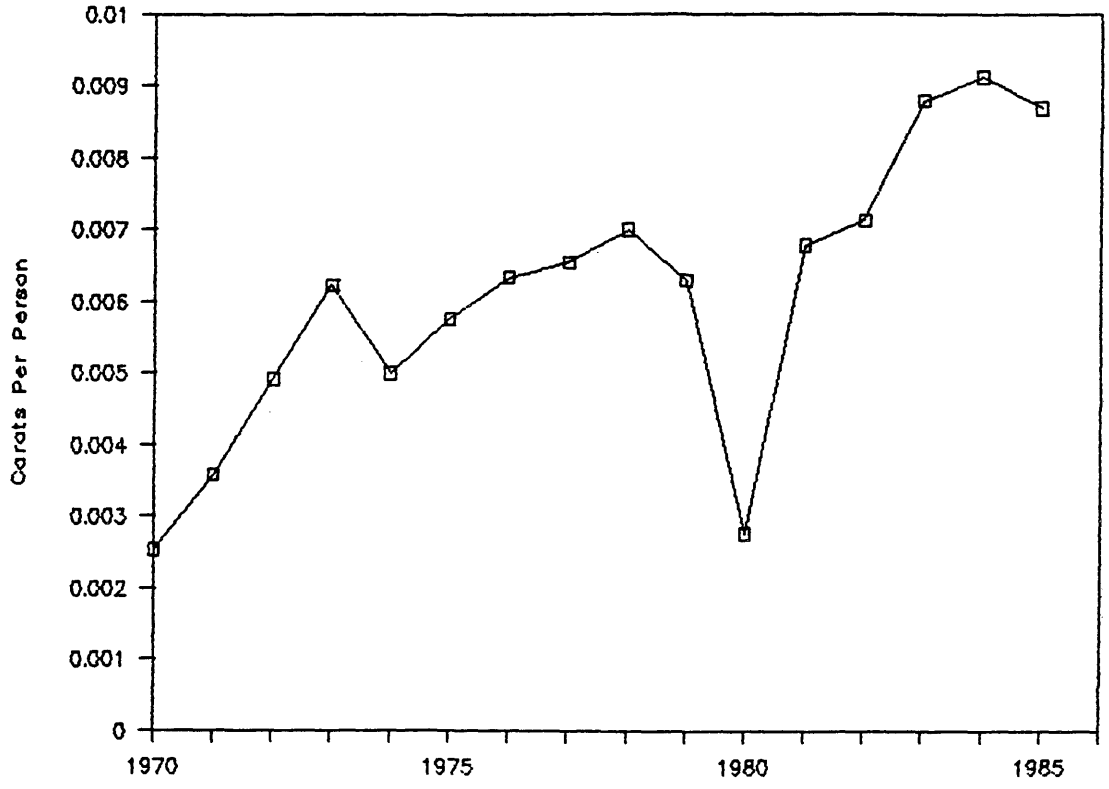

Figure 6.5

Japanese Per Capita Consumption
of Gem Diamonds

Source: Computed from USBM Yearbook data
and Japan Statistical Yearbook

that the popularity of owning or giving diamonds has increased at a rate that would be the envy of many businesses. People are buying more diamonds on an annual basis.

Intensity of use of gem diamonds for the world, U.S. and Japan was computed, however the erratic nature of the yearly estimates prohibits a valid trend interpretation (Figure 6.6). Intensity of use is the ratio of gem diamond apparent consumption to a country's real GNP.

A second way in which increased holdings per person are possible is through diamonds being handed down from one generation to the next. What was formerly a 1920 engagement ring may now be remounted in a necklace or used in other jewelry belonging to a second or third generation daughter who also has her own jewelry. In this manner, per capita holdings may increase through initial purchases plus inheritances.

Population Growth

World population in 1980 grew at approximately 1.7% per year. This growth rate falls short of the pre-1982 2.6% growth rate of gem production. These figures indicate that growth in world population could account for absorption of 65% of the 2.6% pre-1982 gem production growth rate

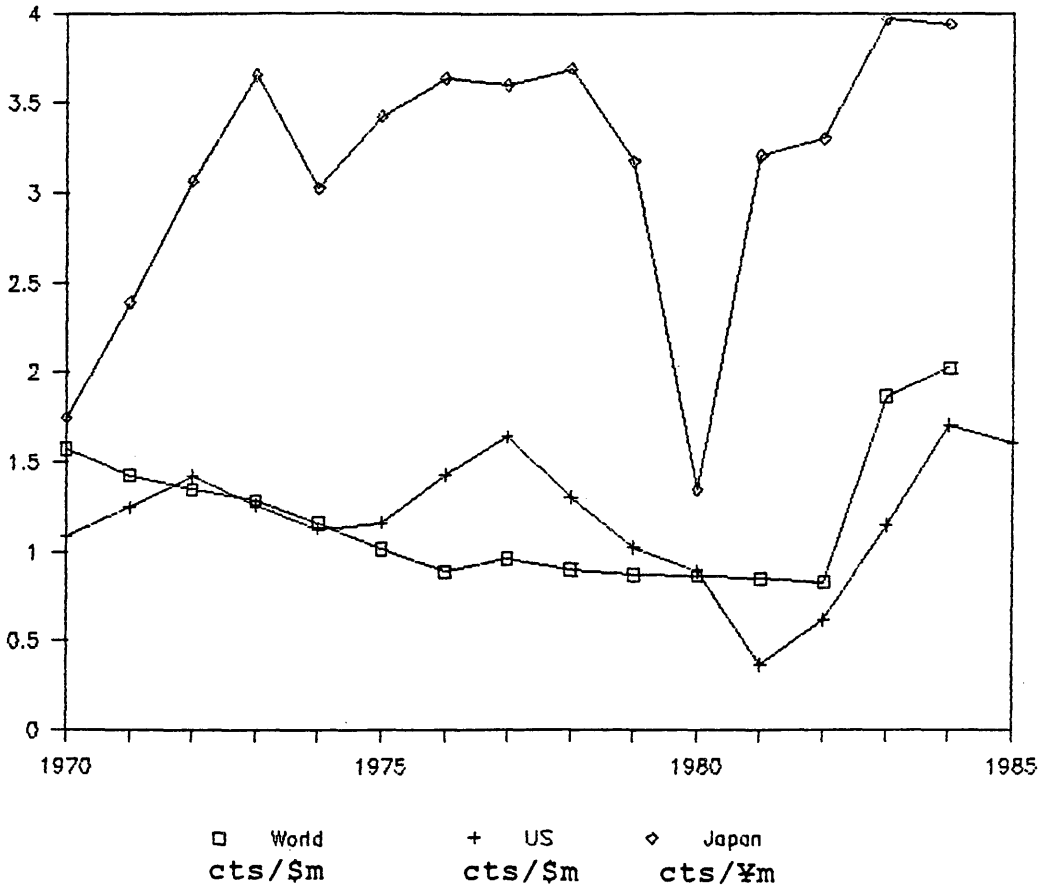

Figure 6.6

World, U.S., and Japanese Intensity of Use

Source: Computed from USBM Yearbook data, Gordon, 1987 (GWP and US GNP), and IMF, 1985 (Japanese GNP)

(1.7/2.6). However, when considering post-1982 production increases, population growth can at most account for absorption of 3.6% (1.7/47) of post-1982 production.

Perhaps a more accurate assessment of the role of population growth can be made by using U.S. statistics. In 1986, the U.S. population grew at a rate of 1.2%, yet apparent consumption of gem diamonds grew at an average annual rate of 9.1% between 1970 and 1986 despite wide annual fluctuations. These statistics indicate that population growth may have accounted for up to 13% of the growth in apparent consumption.

By contrast Japan's population grew at a rate of 0.5% in 1986, yet apparent consumption has grown at an average annual rate of 12.4% between 1965 and 1986. Again, growth in apparent consumption is highly variable and in fact, fell by 4% in 1986. However, a population growth rate of 0.5% apparently accounts for absorption of only 4% of the growth in apparent consumption.

These estimates consistently indicate that world, U.S. and Japanese population growth at best accounts for a low percentage of increased apparent consumption.

Development of New Markets

Demand can increase through development of new product and new customer markets.

New product markets are developed by promoting new styles and concepts in jewelry. For example, the creation of the eternity ring concept for anniversaries offers the market a complete line of jewelry that did not exist a few years ago.

Men are now targeted as a growth sector for new jewelery products and as new customers. Most jewelry stores carry a selection of men's diamond rings, tie tacks, cuff links and watch bands. Younger unmarried women, older women and independent single business women are also targeted clientele for new styles of diamond jewelry.

Other marketing ploys include promotion of name brand diamonds and laser encryption. The concept behind a name brand diamond is simple. A person buying a name brand is sold the idea that purchase of, say, a Lazare[1] diamond guarantees the quality of the stone. This marketing concept has met with moderate to poor success (Forbes, 1986).

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[1] The name Lazare is from Lazare Kaplan International Inc., a U.S. diamond cutting and wholesale firm known well among diamond dealers.

Laser encryption is a process by which a diamond is coded by laser with an invisible microscopic number. The number is observed only with a microscope under special lighting. The alleged advantages of buying an encrypted diamond are security and knowledge of where the diamond came from for people concerned about supporting apartheid with the purchase of a South African stone. This marketing gimmick has also had mixed success. Many dealers refuse to deal with encrypted stones on the grounds that microscopic or not, a marked stone is a defaced stone and therefore less valuable. Unfortunately, no data that may offer insight to the effectiveness of these two marketing techniques has been located.

It is also possible to consider different categories of diamonds as different products. Sale of larger or better quality stones is promoted through step-up trade-in sales programs. Such programs are only one aspect of the marketing effort directed at upgrading the size and quality of diamonds that consumers own. The success of instilling desire in consumers to own larger and better quality diamonds is demonstrated in Figure 6.7.

Here it can be seen that the real per carat value of U.S. apparent consumption has increased from $218 to $378 during the period 1970 to 1985. This represents an overall

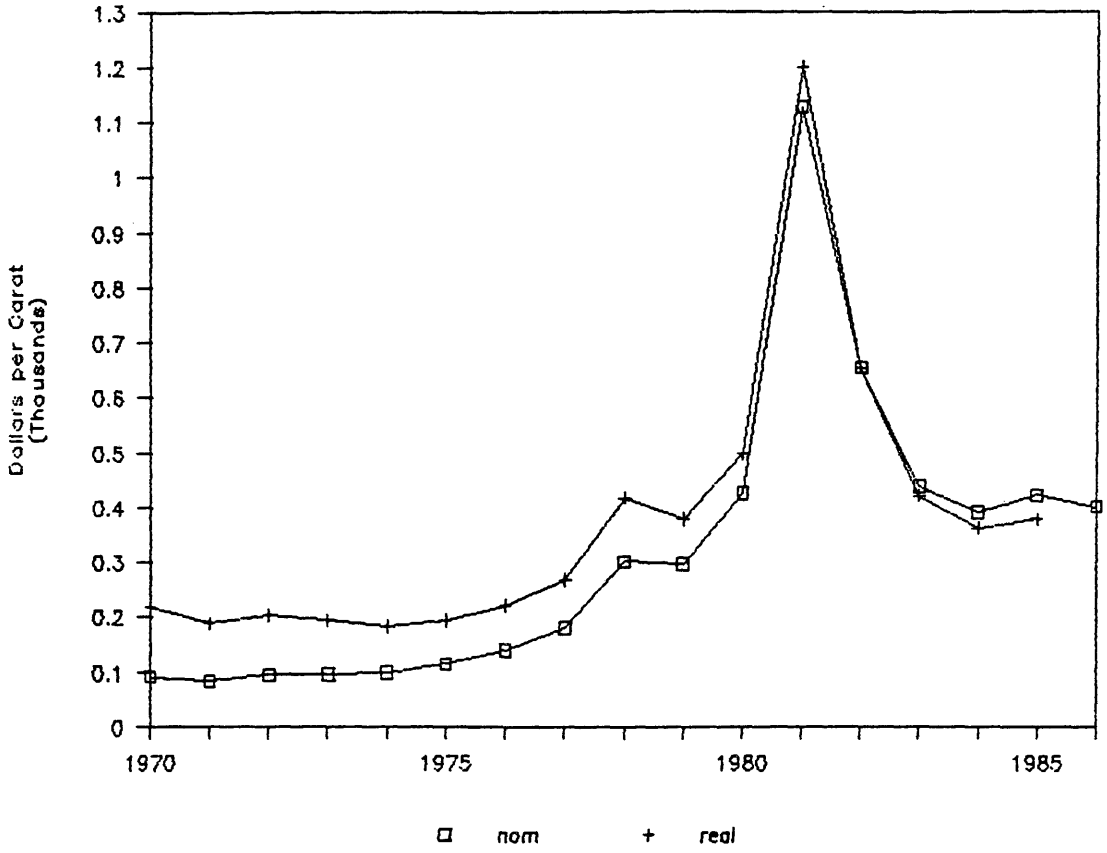

Figure 6.7

Per Carat Value of U.S. Apparent Consumption

Source: Computed from USBM Yearbook data

appreciation of the per carat value of approximately 73% for the period, or, over the long term, an average of 4.6% per year. If a 9% nominal average annual increase in the price of diamonds by De Beers is considered, less an average inflation rate of 4% to 6%, a 3% to 5% real increase in the price of diamonds is suggested. This estimate approximates the 4.6% increase in the real per carat value of U.S. apparent consumption, suggesting that people have increased the size of diamonds that they purchase but not by very much. This observation is consistent with the marketing problems described in Chapter 2, in which the 1970's saw an advertising-induced increased preference for small diamonds.

The conclusion of this section is that the demand for diamonds will continue to increase rapidly. If production does not continue to increase through more new discoveries, the problem for De Beers should be temporary as rapid demand growth will soon remove the problem.

Supply Analysis

De Beers has a number of options available to offset excess production and maintain a steady supply flow through the CSO. First, it can attempt to increase demand through advertising and expanding markets. This strategy has been discussed in the previous demand analysis. Second, it can

stockpile diamonds until demand catches up with supply. Third, it can pressure independent producers to reduce their output. And fourth, it can reduce production at its own mines.

Stockpiling of Diamonds

The ability and willingness of De Beers to carry inventories is based on its financial status, its ability to distribute the stockpiling burden among the many corporate arms under its control, and its view of future potential to maintain a viable cartel. In 1987, diamond stocks were $2.314 billion (Figure 6.1) of which De Beers-controlled mining companies held $20.8 million and other related companies held $2.29 billion. De Beers Consolidated Mines Ltd itself carries $19.8 million in diamond stocks. In other words, De Beers controlled mining companies hold a relatively small proportion of total diamond stocks and other De Beers affiliated companies retain the majority of the stockpile.

The most likely "other companies" are the Diamond Corporation (100% De Beers owned) and the Diamond Purchase and Trade Company (50% De Beers owned)(De Beers, 1988). The Diamond Trade Company (the CSO sales agency) no doubt carries large stocks. But since De Beers owns no shares of the DTC, a significant stock of diamonds could be controlled by De

Beers through DTC's Anamint and Anglo American ownership ties but go unreported on De Beers's consolidated balance sheet. Diamond inventories are not reported by Anglo American. Diamonds held by the DTC conceivably could be financed entirely by CSO operations without contributions from De Beers.

Another point to be considered in evaluating De Beers's diamond holdings is the accounting method. Mining companies carry stocks at average production costs on a LIFO basis. The "other companies" value their stocks at the lower of cost or valuation (De Beers, 1988). This means that the reported value of diamond inventories is understated.

If we examine the financial status of the De Beers group of companies as reported on the consolidated balance sheet we find cash assets of $560 million. Determination of the value of liquid assets is difficult since their value is listed in two ways, as market value and at cost less amounts written off. These investments include listed and unlisted holdings but exclude shares in subsidiary companies. Reported market value of listed and unlisted holdings is $4.37 billion. The borrowing capacity of De Beers and its subsidiaries totals $3.7 billion.

As an example of the ability of De Beers to stockpile production, we can examine the value of Australian

production. If we use $6.80, the average per carat sales value of Argyle diamonds as stated in Ashton's 1986 Annual Report (Ashton Mining Ltd., 1986), and assume this value is the CSO's cost basis, it can be estimated that the 20.6 million carats sold to the CSO in 1986 could be stockpiled at a value of $140 million. This amount represents approximately 5.5% of the CSO's 1986 revenue and a very small portion of De Beers's liquid assets.

Another point to be made is that even if De Beers or the CSO needed to stockpile Australia's entire annual production (which they probably do not need to do), there appears to be sufficient funds remaining to absorb a considerable volume of diamonds. Assuming De Beers has access to at least $8 billion in liquid assets ($.56 billion cash and $4.37 billion in non-subsidiary stock holdings) and loan availability ($3.7 billion), it could purchase 20 million carats at an average price of $400 per carat (average per carat value of U.S. apparent consumption in 1986) from the public. This volume is approximately 50% of world annual gem production or 3% to 4% of the cumulative pool of diamonds in existence.

The stockpiling burden can also be forced on the cutters and wholesalers. By offering more diamonds at sights than can be cut at current cutting capacity, cutters and wholesalers are forced to increase their stocks. Refusal to

purchase the diamonds results in loss of sight privileges, a situation most buyers will try very hard to avoid. Even after cutting, wholesalers may be forced to hold stocks if retailers and buyers do not absorb supply. Realistically, forcing stocks on the cutters and distributors can only be a short-term solution. The limited resources of cutters and distributors places a limit on their ability to absorb stocks.

It is conceivable that maintaining a stockpile is profitable for De Beers. If excess supply is temporary, and if prices increase in real terms, future stockpile reductions could cover holding costs or even be profitable. The willingness of De Beers to continue stockpiling diamonds seems to indicate a positive outlook for its ability to continue to maintain a viable cartel and a healthy diamond market. Without such a view, it seems unlikely that De Beers would want to continue stockpiling diamonds.

Production Limitation

The ability to limit production requires that major producers cooperate to maintain a stable market. As long as independent producers stand to gain through cheating, they will be tempted to do so. However, the threat of independent producers not cooperating with De Beers and seeking their own

market share through competitive behavior is thought to be an unlikely scenario because De Beers does posses the ability to extract cooperation from producers.

Currently, independent producers can sell their output either on the free market or through sales contracts with the Diamond Corporation. From the independent producers side, contract negotiations will be aimed at gaining the the best sales terms. From De Beers side, contracts will be aimed at keeping the producer satisfied, yet maintaining a ceiling on production levels. Satisfied producers are important to holding the cartel together. At the same time, market share must be distributed among producers equitably if not in favor of De Beers controlled production.

Factors that make dealing with De Beers attractive for an independent producer include revenue benefits of monopoly prices which may be very large, a guaranteed sales outlet for production over the duration of the contract, other free-rider benefits that accompany the successful operation of a cartel, (e.g. advertising, management of a buffer stock and in depth market knowledge and management), and fear of reprisal actions by De Beers for non cooperation. Since De Beers and affiliated companies exert significant power over the diamond processors, individual cutters are reluctant to rely on non-cartel sources for fear of being removed from

participation at De Beers's sights.

Factors that reduce the desirability of working with De Beers include the urge to operate competitively to gain greater market share (sell a higher level of output), nationalistic sentiment that seeks to operate independently, and political reasons for not dealing with a South African company.

Among these factors, the opportunity to gain monopoly derived profits by cooperating with De Beers is the most important motivating force. Security of sales outlet is a close second. Fear of reprisals for noncooperation and cheating should not be ignored either. Zaire is a case in point. When Zaire broke away from the cartel for nationalistic reasons, De Beers flooded the market with industrial diamonds (Zaire's production is approximately 90% industrial) inflicting heavy losses on the country when prices dropped. Within 18 months Zaire was again selling through the CSO.

Currently, the fact that De Beers stockpile is growing suggests that there is excess production. This could be construed as lack of cooperation on the part of independent producers to limit production and that sometime in the future De Beers will have to bargain down its contract quotas with independent producers. This may be true, but the writer views the current situation in which Australia and the USSR

sell their output largely through the CSO as a sign of healthy cooperation. From the Australian perspective, Argyle production consists of low quality gems which may or may not have sold well on the free market. With the discovery of Argyle diamonds, the specter of a new producer with a potential for nearly doubling gem production and gaining 40% of the gem production market brought De Beers to the bargaining table. From the Australian side, the potential market share gave them a strong bargaining position but the quality of the stones made them vulnerable to marketability risk if they did not sell through the CSO. In the eyes of the Australians, through the sales contract, it is the responsibility of De Beers to create the market for Australian diamonds. Any stockpiling of Australian diamonds on the part of De Beers is De Beers's problem because they are responsible for sales.

Although this view may carry bargaining strength for Australia, Australia must acknowledge that it needs to cooperate with cartel actions if it is to reap cartel benefits. Pursuing a competitive strategy probably could work for a while as long as De Beers stockpiles excess production, but there are limits. Australia might also have problems in marketing their production if it was against the will of De Beers. De Beers could retaliate against

competitive actions by Australia by denying sight privileges to any sight holders who deal in Australian diamonds. Another form of retaliation might be an advertising campaign designed to steer the market away from undesirable "cognac" colored diamonds that Australia produces.

In the writers opinion, the present growth in De Beers's stockpile represents a temporary cost of doing business under dynamic market conditions, the price paid to maintain control rather than a sign of noncooperation from independent producers.

In the event that stockpiling becomes an excessive or undesirable financial burden, De Beers can cut back its own production. This action has been taken in the past as described in Chapter 2. In 1982, operations were suspended at Koffiefontein Mine and the Letseng-la-Terai Mine in Lesotho was closed. At nearly the same time (1981), the Jwaneng Mine in Botswana was brought on line and in 1982, the Australian CRA-Ashton group announced mining plans for its AK-1 deposit. In 1988, with the restoration of diamond demand, the Koffiefontein Mine was reopened.

Until 1982, De Beers enjoyed control of up to 43% of world production. In 1987, with about 23% of production under its control, the ability of De Beers to limit supply through production reduction has been lessened.

Output of various mines is maintained at a level according to the type and grade of diamonds produced. Cost factors may not necessarily be as significant as the type of diamonds produced. For example, a more costly mine may be kept in production if it produces large clear diamonds and this particular category is in short supply or high demand. Conversely, a low cost mine with a higher number of carats per 100 tonnes of rock may be closed down if it produces small yellow lesser quality diamonds.

Another relevant issue is that of further increases in production through new discoveries or expanded output. Currently, there are a number of companies exploring for diamonds throughout, Australia, southeast Asia, the United States, Canada, Brazil, and Africa. The Soviet Union and China are also reported to be exploring for diamond deposits. To date, no new discoveries have been reported. However, with the level of exploration being conducted, it is reasonable to assume that discoveries will be made. Long lead times from discovery to production suggest that no new mines are likely to come on line for at least the next five years. Therefore, the present status of De Beers does not appear to be threatened by new production for the foreseeable future. However, a new major discovery by an independent producer, particularly in Australia, could present new

challenges to De Beers.

Other issues that are likely to influence the production control abilities of De Beers are local politics, labor issues and production arrangements with host country governments such as Botswana and Namibia.

Chapter 7

SUMMARY

The history of man's involvement with diamonds shows a propensity to produce and market diamonds under some form of monopoly control. The most recent effort is that of De Beers Consolidated Mines Ltd. For the past one hundred years, De Beers has endeavored to control production and marketing of rough diamonds, particularly gem diamonds. During this one hundred years, De Beers has faced numerous challenges to its efforts at maintaining control. Competitive pressure from independent producers, wars, economic cycles, and politics are factors which have challenged De Beers. However, despite the parade of events, De Beers has continued to meet its goal of maintaining stable and upward trending prices in an expanding market.

The control De Beers possesses is derived primarily from its control of the distribution of rough diamonds to the world's competitive wholesale and retail distribution network. Control is through direct and indirect ownership and management of the Central Selling Organization (CSO), a producer cartel with three corporate arms; the Diamond Trading Company (DTC), the Diamond Corporation (DC), and Industrial Distributors. The Diamond Corporation purchases

rough diamonds from independent producers under contract. It then transfers diamonds internally to the Diamond Trading Company for sale. Industrial Distributors manages distribution of industrial diamonds.

Together, the three arms of the CSO market approximately 80% of the world's rough diamonds. The remaining 20% of rough diamond sales are conducted under "free market" conditions in Europe, Israel, India, South Africa, and west Africa. De Beers tolerates the existence of a "free market" because it serves as a spot market to absorb short-term supply and demand fluctuations. "Free market" prices in turn act as a barometer for the DTC in selecting its sight prices. De Beers also buys and sells on the "free market" to help manipulate supply and price levels.

Sales of diamonds to sightholders is by invitation only. Diamonds are presented at sights for a non-negotiable price on an accept or decline basis. However, to decline a sight purchase will almost certainly guarantee revocation of sightholding privileges. Sightholders generally receive not only diamonds they request but also diamonds that De Beers wants to push. In this way De Beers can push diamonds on to the market to rid itself of undesirable stones and to force the marketing burden onto dealers. The sight system works because De Beers controls a large percentage of the market

along with a substantial stockpile. In this capacity, it is the only supplier that can meet the needs of the major diamond cutting firms. Attempts have been made by various countries to circumvent the system by selling their production directly to a distributor. The resulting reprisals by De Beers have generally brought stray buyers and producers back to the fold.

Recent increases in world production and a shift in production domination away from De Beers to Australia raises questions concerning the limits to which De Beers is capable of holding together the cartel and maintaining control of distribution. Will the De Beers system withstand a doubling of world production in five years along with a 50% reduction in its ability to control production? Based on the information used in this study, the writer feels that the answer is probably yes.

The conclusion that the cartel will most likley continue to be successful is based on assessing the method and ability of De Beers to control price, demand, and supply factors. Based on the analysis of Chapter 6, and supported by other information in this study, De Beers is apparently very capable of controlling prices, influencing demand, and maintaining a stable supply flow. The history of De Beers's efforts at controlling these factors is not perfect, but does

demonstrate a continuing ability to maintain a disciplined and stable market in the long-run. It is concluded that De Beers is successful in achieving control because of its skill and ability to manipulate each interdependent factor according to an overall long-run strategy. The loss of ability to influence any one factor could result in overall loss of control over the diamond market.

Prices are controlled through sales and distribution of rough diamonds at sights. In addition, buying and selling on the free market serves to buffer price volatility resulting from short-term fluctuations in supply and demand. It appears that De Beers strives to maintain a long-run 8% to 10% annual increase in the price of diamonds.

It is concluded that prices are unlikely to decline as a result of increased production because De Beers is capable of controlling prices. Review of the price history of diamonds shows prices decline only when they are at high unsustainable levels as a result of speculation. An exception is when prices declined in eighteenth century Europe in response to increased supply from Brazil. However, the situation was quickly stabilized as soon as the Portuguese crown took control of production. Under competitive supply conditions, diamond prices would certainly fall as individual producers underbid each other to gain

market volume.

Given increased production levels, De Beers must attempt to promote demand growth. Demand growth is dependent on economic factors, population growth, and market expansion. Although, De Beers has little control over economic factors or population growth, it does have significant ability to promote market expansion.

The U.S. apparent consumption model reveals that income is the most significant determinant of demand. The condition of the economy as measured by the ratio of real GNP/natural real GNP is also significant with very high elasticity. While nominal interest rates appear to be significant, they are moderately inelastic indicating that demand responds weakly and inversely to changes in interest rates. Price is the least significant explanatory variable and is relatively inelastic indicating that increases in price will only slightly reduce purchases.

Overall the apparent consumption model points toward a direction of continued growth in demand, in that continued income growth (GNP) under conditions of a healthy economy will outweigh any demand reducing effects resulting from increasing prices or interest rates. Reasonable growth in the world economies can be expected to eliminate the current problem of excess supply.

The contribution of population growth to demand growth is estimated to be low. Estimates consistently indicate that world, U.S., and Japanese population growth, at best, accounts for a low percentage of increased apparent consumption.

Growth in demand through expanding customer markets can take place in countries such as Japan where the desire to westernize has increased apparent consumption. For example, in the last 20 years the tradition of giving a diamond engagement ring has grown from nonexistent to encompass 60% of betrothed couples. Similar market expansion is targeted for other Asian, Latin American, and European countries. Customer markets can also be expanded to encompass men, younger women not yet married, older women, and a larger percentage of people who partake of the diamond giving tradition.

Growth in demand through expansion of product markets is achieved through creating new traditions for giving diamonds and by creating new styles of jewelry for changing tastes while maintaining already established markets. For example, eternity rings are now given on anniversaries, tennis bracelets are promoted as prestige items for sports stars, and adornment jewelry may contain more diamonds per unit of jewelry than a few years ago.

Historical review of the growth of the diamond industry attests to the skill with which De Beers has created the tradition of giving diamond jewelry as a symbol of love and in establishing the prestige value and desirability of owning diamonds.

The analysis of supply concerns the ability of De Beers in maintaining a stable supply flow. The most powerful tool at its disposal for this purpose is its buffer stockpile. Now reported to be worth $2.3 billion, diamond stocks are at their highest level since at least 1970. The ability of De Beers to finance diamond purchases is vast. In 1987, liquid assets and borrowing ability exceeded $8 billion. Further resources are likely to be available through many of its related companies such as Anglo American and Minorco. Also, considerable unreported (off balance sheet) stocks could conceivably be held by the CSO.

If all of Australian production is considered excess supply and in need of being stockpiled to maintain supply balance, this could be achieved for approximately $150-$200 million per year at current production rates and at the current Diamond Corp. purchase price. On this basis, there does not appear to be a significant financial burden for De Beers even if it had to retain all Australian production by itself, which it does not need to do. Also, production from

Botswana, the second largest gem producer is controlled by De Beers. This means that even though De Beers has lost a share of production control, its remaining 23% is largely of gem quality (Debswana in Botswana and CDM in Namibia).

Another supply issue concerns De Beers ability to control the cumulative supply which is held by the world today. The writer believes that cumulative supply does not represent a threat to De Beers's control. Because diamonds tend to be held rather than resold, it is not likely that diamond holders will flood the market with supply unless prices increase very rapidly to levels in excess of two to ten times their current value. The 1976 to 1980 period saw a tenfold increase in the price of D flawless diamonds and a lesser increase for smaller sizes. Many people sold their diamonds for gains. However, even with dramatic price increases, diamonds did not flood the market. Larger price fluctuations are considered to be unlikely as long as De Beers has sufficient finances to buy diamonds in times of over-supply and has sufficient stocks to flood the market in the event of drastic price increases. The present financial status of De Beers and its estimated present stock of between 5% and 10% of the cumulative pool are believed to be sufficient to maintain market control.

The ability of De Beers to extract cooperation among

competing independent producers is not considered to be a problem at the present time. The fact that the two dominant competitors to the cartel, Australia and the Soviet Union, sell through the CSO implies that there is cooperation at present. Apparent excess supply as indicated by De Beers's growing stockpile is considered to be a temporary situation that reflects the price of maintaining control of the market rather than a sign of lack of cooperation on the part of competitors.

In the event that the conclusion of this thesis is incorrect and the cartel breaks down, it is not clear what would happen. The estimated price elasticity of demand is very small so a large price decrease would be needed to effect demand. But the breakdown of the cartel and resulting competition between producers would most likely destroy the diamond image and market created over the past 50 years. The great uncertainty over the outcome of noncooperation between producers is a force that helps to keep the cartel together.

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APPENDIX A

Location of Diamond Producing Areas

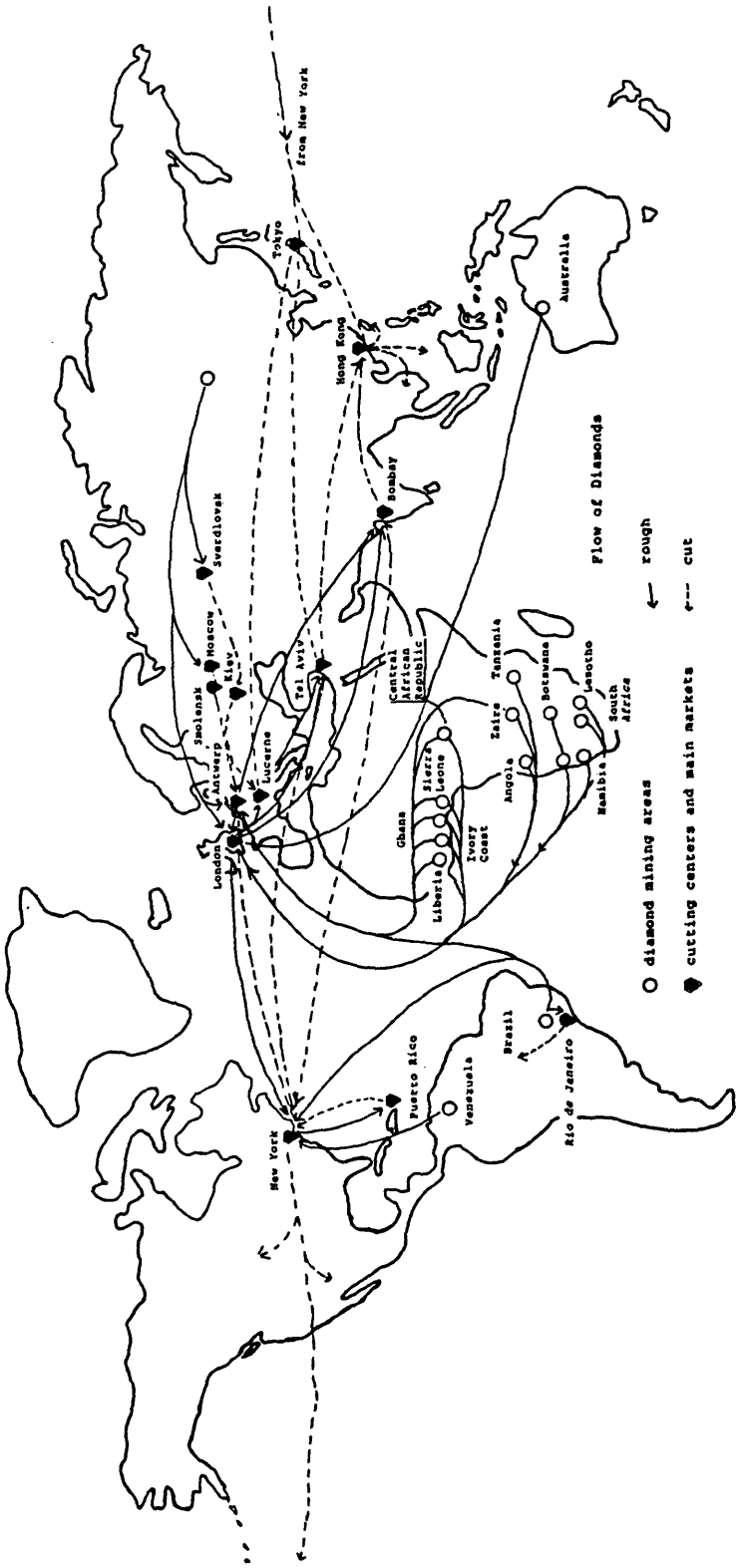

Figure A1.1

Main Diamond Mining Areas, Cutting Centers, and Markets

Source: Green, 1981

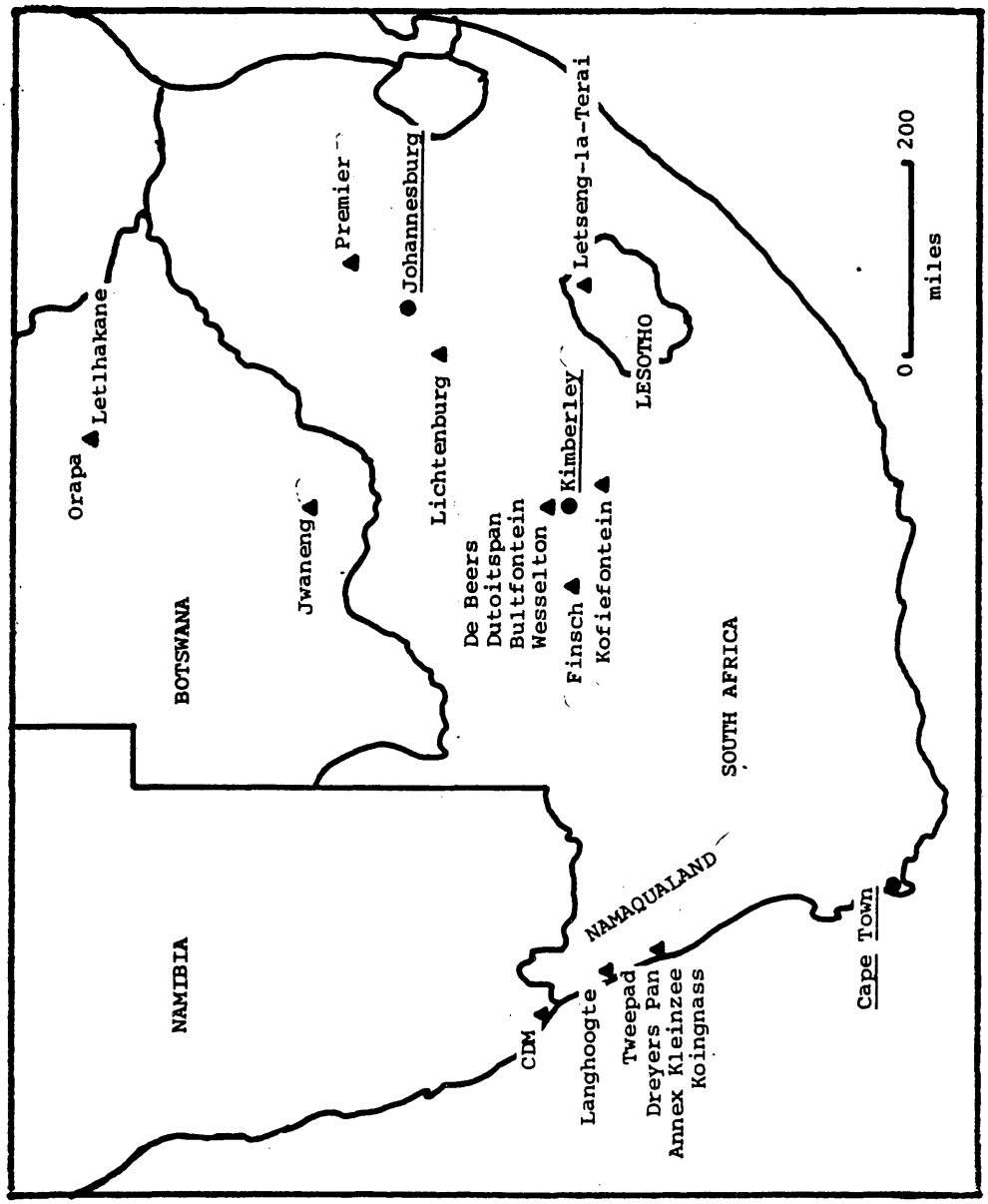

Figure A1.2

Southern African Diamond Mining Locations

APPENDIX B

World Production

Year	Carats
1616	550
1621	1,788
1624	1,561
1629	63
1636	9,113
1642	16,828
1643	20,000
1652	20,000
1668	23,239
Total	93,142

1730-1740	20,000/year
1740-1772	52,000/year
1772-1806	26,800/year
1811-1822	12,000/year
1822-1870	200,000/year
Total	12,507,200

Year	Carats (000)
1870	103
	269
	1,080
	1,100
	1,314
1875	1,380
	1,513
	1,765
	1,920
	2,110
1880	3,140
	3,090
	2,660
	2,410
	2,264
1885	2,440
	3,135
	3,599
	3,842
	2,962
1890	2,416
	2,838
	2,898
	2,814
	2,738
1895	3,102
	3,211
	3,366
	3,620
	2,915
1900	2,113
	3,059
	2,025
	2,305
	2,810
1905	2,799
	2,864
	3,962
	3,554
	496
1910	891
	5,105
	5,428
	6,570
	4,230
1915	185
	2,650
	3,400
	3,140
	3,402
1920	3,615
	1,500
	1,435
	3,605
	3,840
1925	4,250
	5,000
	5,500
	6,000
	6,700
1930	7,530
	7,106
	6,118
	3,839
	5,520
1935	7,307
	8,258
	9,617
	11,620
	11,330
1940	13,016
	9,188
	9,282
	8,352
	11,764
1945	14,384
	10,127
	9,742
	10,028
	14,157
1950	15,232
	16,917
	18,964
	20,096
	20,445
1955	21,450
	23,135
	27,834
	28,391
	26,823
1960	27,700
	26,241
	34,006
	36,661
	36,815
1965	35,513
	38,791
	37,053
	36,551
	40,172
1970	42,495
	41,367
	43,937
	43,067
	44,522
1975	40,864
	38,891
	39,082
	39,291
	39,430
1980	42,977
	39,768
	40,431
	55,392
	63,517

Year	Carats (000)
1985	66,371
	89,600
	100,202
Total	1,842,744

Years	Carats (000)
1616-1668	93
1730-1870	12,507
1870-1987	1,842,744
Total	1,855,344

APPENDIX C

Partial Stock Adjustment Model

```
MTB > REGR C44 4 C46 C23 C33 C29

The regression equation is
APP CON = - 4093 + 0.243 LAG USC + 3.43 REALGNP - 0.0070 PDAVR - 420 TB INT

13 cases used 4 cases contain missing values

Predictor        Coef          Stdev      t-ratio
Constant        -4093           1808        -2.26
LAG USC        0.2434         0.1909         1.27
REALGNP        3.4234         0.8211         4.18
PDAVR       -C.00697        0.C1254        -0.56
TB INT         -419.8          103.9        -4.04

s = 624.3        R-sq = 85.7%      R-sq(adj) = 78.6%

Analysis of Variance

SOURCE          DF            SS             MS
Regression       4      18725468        4681367
Error            8       3118363         389795
Total           12      21843830

SOURCE          DF         SEQ SS
LAG USC          1        9268819
REALGNP          1         482237
PDAVR            1        2612636
TB INT           1        6361774

Unusual Observations
Obs. LAG USC    APP CON        Fit Stdev.Fit   Residual   St.Resid
 15      3776       5955       4688       348       1267      2.44R

R denotes an obs. with a large st. resid.


MTB > REGR C44 4 C46 C28 C33 C32

The regression equation is
APP CON = - 10301 + 0.286 LAG USC + 4.79 REALGNP - 0.0462 PDAVR - 438 ADJ INT

13 cases used 4 cases contain missing values

Predictor        Coef          Stdev      t-ratio
Constant       -10301           8640        -1.19
LAG USC        0.2858         0.4629         0.62
REALGNP         4.785          3.590         1.33
PDAVR       -C.04625        0.02456        -1.88
ADJ INT        -438.3          417.0        -1.05

s = 1020         R-sq = 61.9%      R-sq(adj) = 42.8%

Analysis of Variance

SOURCE          DF            SS             MS
Regression       4      13513936        3378484
Error            8       8329894        1041237
Total           12      21843830

SOURCE          DF         SEQ SS
LAG USC          1        9268819
REALGNP          1         482237
PDAVR            1        2612636
ADJ INT          1        1150244

Unusual Observations
Obs. LAG USC    APP CON        Fit Stdev.Fit   Residual   St.Resid
 12      2836       1194       2992       491      -1798     -2.01R

R denotes an obs. with a large st. resid.
```

APPENDIX D

Regression Equations

EQUATION 7
****

METHOD OF ESTIMATION = ORDINARY LEAST SQUARES

DEPENDENT VARIABLE: Q

SUM OF SQUARED RESIDUALS =	0.271147E+07
STANDARD ERROR OF THE REGRESSION =	548.335
MEAN OF DEPENDENT VARIABLE =	3852.70
STANDARD DEVIATION =	1531.28
R-SQUARED =	0.911049
ADJUSTED R-SQUARED =	0.871515
DURBIN-WATSON STATISTIC (ADJ. FOR 1 GAPS) =	1.9849
F-STATISTIC(4, 9) =	23.0449
LOG OF LIKELIHOOD FUNCTION =	-105.083
NUMBER OF OBSERVATIONS =	14

VARIABLE	ESTIMATED COEFFICIENT	STANDARD ERROR	T-STATISTIC
C	-17468.	7499.4	-2.3292
P(-1)	-0.25956E-01	0.16724E-01	-1.5520
GNP	4.0627	0.51943	7.8214
RATIO	120.37	65.432	1.8396
NI	-311.48	105.68	-2.9473

EQUATION 8
****
FIRST-ORDER SERIAL CORRELATION OF THE ERROR

MAXIMUM LIKELIHOOD ITERATIVE TECHNIQUE
****
MAXIMUM LIKELIHOOD ESTIMATION IS NOT
IMPLEMENTED FOR DISCONTINUOUS SMPLS,
UNLESS THE TSCS (TIME SERIES CROSS
SECTION) OPTION IS USED.
METHOD OF ESTIMATION IS CHANGED TO
COCHRANE-ORCUTT ITERATIVE TECHNIQUE

CONVERGENCE ACHIEVED AFTER 3 ITERATIONS

FINAL VALUE OF RHO = -0.643967E-01
STANDARD ERROR OF RHO = 0.288076
T-STATISTIC FOR RHO = -0.223541

STATISTICS BASED ON RHO-TRANSFORMED VARIABLES
****
DEPENDENT VARIABLE: G

SUM OF SQUARED RESIDUALS =	0.186680E+07
STANDARD ERROR OF THE REGRESSION =	516.417
MEAN OF DEPENDENT VARIABLE =	4045.05
STANDARD DEVIATION =	1687.40
R-SQUARED =	0.940397
ADJUSTED R-SQUARED =	0.906338
DURBIN-WATSON STATISTIC (ADJ. FOR 1 GAPS) =	2.1544
F-STATISTIC(4, 7) =	27.6108
LOG OF LIKELIHOOD FUNCTION =	-88.7562
NUMBER OF OBSERVATIONS =	12

VARIABLE	ESTIMATED COEFFICIENT	STANDARD ERROR	T-STATISTIC
C	-23591.	8187.0	-2.8808
P(-1)	-0.43167E-01	0.18362E-01	-2.3509
GNP	4.3425	0.54989	7.9114
RATIO	165.59	67.856	2.4404
NI	-177.49	128.32	-1.3831

	G	P	GNP	RATIO	NI
1970	2625.26001	4196.42871	2417.85718	100.05616	6.45800
1971	3091.11011	4110.36035	2483.55835	99.34233	4.34800
1972	3704.37012	4516.12891	2608.17212	100.85739	4.07100
1973	3454.64990	4536.29053	2740.52441	102.44951	7.04100
1974	3071.72998	5046.29639	2727.40747	98.66183	7.88600
1975	3133.64990	MISSING VALU	2695.44702	94.69338	5.83800
1976	4039.34009	20815.87305	2829.84131	96.57832	4.98900
1977	4854.37012	28231.79688	2957.65210	98.05888	5.26500
1978	4056.80005	38088.64453	3115.92798	100.36165	7.22100
1979	3271.48999	46755.72656	3191.09424	99.86838	10.04100
1980	2836.25000	56009.33594	3187.86475	97.15249	11.50600
1981	1194.01001	23961.66016	3250.90527	96.53191	14.02900
1982	1952.94995	13500.00000	3166.00000	91.59820	10.68600
1983	3776.44995	15399.42188	3277.86328	92.39925	8.63000
1984	5955.49023	11584.80078	3489.34204	95.83735	9.58000
1985	5773.08008	10762.33203	3585.73999	95.95750	7.48000
1986	6664.99023	10517.09082	3711.65649	96.77869	5.98000

APPENDIX E

Data

Year	Q Diamonds carats	Population World million	Carats/ Person	Population US
1913	6,570	1,736	0.0038	97.2
1914	4,230	1,750	0.0024	99.1
1915	185	1,765	0.0001	100.5
1916	2,650	1,780	0.0015	102.0
1917	3,400	1,794	0.0019	103.3
1918	3,140	1,809	0.0017	103.2
1919	3,402	1,824	0.0019	104.5
1920	3,615	1,840	0.0020	106.5
1921	1,500	1,855	0.0008	108.5
1922	1,435	1,870	0.0008	110.0
1923	3,605	1,886	0.0019	111.9
1924	3,840	1,901	0.0020	114.1
1925	4,250	1,917	0.0022	115.8
1926	5,000	1,933	0.0026	117.4
1927	5,500	1,949	0.0028	119.0
1928	6,000	1,965	0.0031	120.5
1929	6,700	1,982	0.0034	121.8
1930	7,530	2,000	0.0038	123.2
1931	7,106	2,024	0.0035	124.1
1932	6,118	2,047	0.0030	124.9
1933	3,839	2,072	0.0019	125.7
1934	5,520	2,096	0.0026	126.5
1935	7,307	2,121	0.0034	127.4
1936	8,258	2,146	0.0038	128.2
1937	9,617	2,171	0.0044	129.0
1938	11,620	2,197	0.0053	130.0
1939	11,330	2,223	0.0051	130.0
1940	13,016	2,249	0.0058	132.6
1941	9,188	2,275	0.0040	133.9
1942	9,282	2,302	0.0040	135.4
1943	8,352	2,329	0.0036	137.3
1944	11,764	2,357	0.0050	138.9
1945	14,384	2,385	0.0060	140.5
1946	10,127	2,413	0.0042	141.9
1947	9,742	2,441	0.0040	144.7
1948	10,028	2,470	0.0041	146.2
1949	14,175	2,499	0.0057	149.8
1950	15,232	2,529	0.0060	152.3
1951	16,917	2,559	0.0066	154.9
1952	18,964	2,589	0.0073	157.6
1953	20,096	2,619	0.0077	160.2

Year	Q Diamonds carats	Population World million	Carats/ person	Population US
1954	20,445	2,652	0.0077	163.0
1955	21,450	2,691	0.0080	165.9
1956	23,135	2,737	0.0085	168.9
1957	27,834	2,795	0.0100	172.0
1958	28,391	2,852	0.0100	174.9
1959	26,823	2,905	0.0092	177.8
1960	27,700	2,995	0.0092	180.7
1961	26,241	3,069	0.0086	183.7
1962	34,006	3,135	0.0108	186.5
1963	36,661	3,160	0.0116	189.2
1964	36,815	3,220	0.0114	191.9
1965	35,513	3,295	0.0108	194.3
1966	38,791	3,354	0.0116	196.6
1967	37,053	3,420	0.0108	198.7
1968	36,551	3,483	0.0105	200.7
1969	40,172	3,561	0.0113	202.7
1970	42,495	3,632	0.0117	204.9
1971	41,367	3,706	0.0112	207.1
1972	43,937	3,782	0.0116	208.8
1973	43,067	3,860	0.0112	210.4
1974	44,522	3,890	0.0114	213.9
1975	40,864	3,967	0.0103	216.0
1976	38,891	4,044	0.0096	218.0
1977	39,082	4,124	0.0095	220.2
1978	39,291	4,300	0.0091	222.6
1979	39,430	4,336	0.0091	225.1
1980	42,977	4,453	0.0097	227.8
1981	39,768	4,508	0.0088	230.1
1982	40,431	4,586	0.0088	232.5
1983	55,392	4,685	0.0118	234.2
1984	63,517	4,763	0.0133	236.1
1985	66,371	4,837	0.0137	238.7
1986	89,600	4,917	0.0182	241.5
1987	100,202			

Year	US Imports cut 000 cts	US Imports value nom $000	US Imports total 000 cts	US Imports value nom $000	US exports 000 cts	US reexports 000 cts
1970	1,642	190,733	4,275	424,897	391,599	1,258,146
1971	1,925	208,667	4,667	463,242	349,136	1,226,755
1972	2,410	288,055	5,506	626,679	371,381	1,430,244
1973	2,360	360,987	5,181	821,185	259,119	1,467,234
1974	2,083	347,362	4,533	760,040	285,136	1,176,132
1975	2,236	374,237	4,577	722,119	264,873	1,178,482
1976	3,087	549,182	5,551	1,011,839	312,853	1,198,805
1977	3,502	806,332	6,411	1,444,537	316,160	1,240,469
1978	3,193	1,112,907	5,656	1,962,558	332,199	1,266,998
1979	2,347	902,755	4,467	1,859,095	213,481	982,027
1980	2,567	1,255,983	4,161	2,251,195	210,643	1,114,110
1981	3,474	1,796,908	4,409	2,201,262	197,110	3,017,877
1982	3,745	1,641,035	4,636	1,917,612	184,871	2,498,178
1983	5,239	1,982,686	6,265	2,275,373	324,373	2,164,176
1984	7,143	2,579,466	8,228	2,905,317	385,162	1,887,348
1985	7,108	2,689,178	8,151	3,006,762	438,045	1,939,878
1986	7,885	3,024,902	9,192	3,459,931	561,059	1,965,950

Year	Pop Japan	Gem Production %	World Gem Production 000 cts	US Imports rough 000 cts	US Imports value nom $000
1970	104.7	31	13,173	2,633	234,164
1971	106.1	30	12,410	2,742	254,575
1972	107.5	28	12,302	3,096	338,624
1973	109.1	29	12,489	2,821	460,198
1974	110.6	26	11,576	2,450	412,678
1975	111.9	25	10,216	2,341	347,882
1976	113.1	24	9,334	2,464	462,657
1977	114.2	27	10,552	2,909	638,205
1978	115.2	26	10,216	2,463	849,651
1979	116.1	26	10,252	2,120	956,340
1980	117.1	24	10,314	1,594	995,212
1981	117.6	26	10,340	935	404,354
1982	118.7	25	10,108	891	276,577
1983	119.5	42	23,265	1,026	292,687
1984	120.2	41	26,042	1,085	325,851
1985	120.8	41	27,212	1,043	317,584
1986	121.4	44	39,424	1,307	435,029

Year	US Exports total	US Apparent Consumption total	US Apparent Consumption cts/000 people
1970	1,650	2,625	13
1971	1,576	3,091	15
1972	1,802	3,704	18
1973	1,726	3,455	16
1974	1,461	3,072	14
1975	1,443	3,134	15
1976	1,512	4,039	19
1977	1,557	4,854	22
1978	1,599	4,057	18
1979	1,196	3,271	15
1980	1,325	2,836	12
1981	3,215	1,194	5
1982	2,683	1,953	8
1983	2,489	3,776	16
1984	2,273	5,955	25
1985	2,378	5,773	24
1986	2,527	6,665	28

Year	Japan Imports 000 cts	Japan Exports 000 cts
1970	266	0
1971	384	4
1972	534	6
1973	689	9
1974	562	7
1975	648	3
1976	719	2
1977	749	1
1978	808	0
1979	732	1
1980	774	450
1981	798	0
1982	848	1
1983	1,051	1
1984	1,098	2
1985	1,051	1

Year	Japanese Apparent Consumption total	/person	De Beers Production 000 cts	De Beers % of World Pr	De Beers Inventory $million
1946			1,300	12.84	
1947			1,240	12.73	
1948			1,450	14.46	
1949			1,450	10.23	
1950			1,750	11.49	
1951			2,000	11.82	
1952			2,490	13.13	
1953			2,650	13.19	
1954			3,150	15.41	
1955			3,500	16.32	
1956			3,300	14.26	
1957			3,500	12.57	
1958			3,550	12.50	
1959			3,580	13.35	
1960			3,900	14.08	
1961			4,100	15.62	
1962			4,300	12.64	
1963			4,800	13.09	
1964			5,300	14.40	
1965			5,900	16.61	
1966			7,000	18.05	
1967			7,900	21.32	
1968			8,200	22.43	
1969			9,000	22.40	
1970	265.7	0.0059	9,500	22.36	257
1971	379.6	0.0036	8,800	21.27	286
1972	528.4	0.0049	10,500	23.90	289
1973	680.2	0.0062	10,600	24.61	321
1974	554.5	0.0050	11,000	24.71	392
1975	644.8	0.0058	10,600	25.94	350
1976	717.3	0.0063	10,300	26.48	261
1977	748.2	0.0066	11,300	28.91	
1978	807.8	0.0070	12,000	30.54	294
1979	731.0	0.0063	14,000	35.51	495
1980	323.5	0.0028	14,600	33.97	936
1981	797.7	0.0068	15,400	38.72	1,467
1982	847.0	0.0071	17,600	43.53	1,702
1983	1,050.4	0.0088	21,500	38.81	1,845
1984	1,095.8	0.0091	23,700	37.31	1,952
1985	1,050.4	0.0087	23,600	35.56	1,898
1986			24,000	26.79	1,847
1987			23,000	22.95	2,303

Year	CSO Sales $m nom	Nominal GNP $m	Real GNP $m	Qn Real 1982	GNP deflator
1970	528	1,015.5	2,416.2	2,416.5	42.0
1971	626	1,102.7	2,484.8	2,500.0	44.4
1972	848	1,212.8	2,608.5	2,586.0	46.5
1973	1,331	1,359.3	2,744.0	2,675.0	49.6
1974	1,254	1,472.8	2,729.3	2,764.4	54.0
1975	1,456	1,598.4	2,695.0	2,846.5	59.3
1976	1,788	1,782.8	2,826.7	2,930.1	63.0
1977	2,070	1,990.5	2,958.7	3,016.2	67.3
1978	2,552	2,249.7	3,115.2	3,104.7	72.2
1979	2,598	2,508.2	3,192.3	3,195.3	78.6
1980	2,723	2,732.0	3,187.2	3,281.3	85.7
1981	1,472	3,052.6	3,248.7	3,367.7	93.9
1982	1,257	3,166.0	3,166.0	3,456.4	100.0
1983	1,599	3,405.7	3,279.1	3,547.5	103.9
1984	1,613	3,865.0	3,489.9	3,640.9	107.9
1985	1,823	3,998.1	3,585.2	3,736.8	111.5
1986	2,557				
1987	3,075				

Year	Per Carat R Value US Apcon $	% Change in Real per Carat Value	Population Growth Rate World	US	Japan
1970	218.1	-0.1377	0.0204	0.0107	0.0134
1971	188.1	0.0880	0.0205	0.0082	0.0133
1972	204.6	-0.0502	0.0206	0.0077	0.0149
1973	194.4	-0.0583	0.0078	0.0166	0.0137
1974	183.0	0.0654	0.0198	0.0098	0.0118
1975	195.0	0.1347	0.0194	0.0093	0.0107
1976	221.3	0.2114	0.0198	0.0101	0.0097
1977	268.0	0.5613	0.0427	0.0109	0.0088
1978	418.5	-0.0943	0.0084	0.0112	0.0078
1979	379.0	0.3135	0.0270	0.0120	0.0086
1980	412.8	1.4135	0.0124	0.0101	0.0043
1981	1,201.6	-0.4549	0.0173	0.0104	0.0094
1982	654.9	-0.3567	0.0216	0.0073	0.0067
1983	421.3	-0.1391	0.0166	0.0081	0.0059
1984	362.7	0.0431	0.0155	0.0110	0.0050
1985	378.4		0.0165	0.0117	0.0050

Year	Real Price D Flawless	Cumulative Gem Prod 000 cts	Value Export m$	Value Reexport m$	Per Carat Nom Value US apcon
1970	4,196	406,967	117	68	91.6
1971	4,110	419,377	125	80	83.5
1972	4,516	431,680	172	102	95.2
1973	4,536	444,169	314	174	96.4
1974	5,046	455,745	305	152	98.8
1975		465,961	237	123	115.6
1976	20,816	475,295	306	143	139.4
1977	28,232	485,847	336	233	180.4
1978	38,089	496,062	457	280	302.2
1979	46,756	506,314	623	262	297.9
1980	56,009	516,629	643	398	426.7
1981	23,962	526,968	441	413	1,128.3
1982	18,500	537,076	293	346	654.9
1983	15,399	560,341	373	250	437.8
1984	11,585	586,383	363	212	391.4
1985	10,762	613,595	385	186	421.9
1986		653,019	526	262	400.9
1987		697,321			
1989	15,000 ±				

$\frac{15,000}{4196} = 3.57$ OR 7% ANNUAL GROWTH OVER 19 YEARS.

Year	Japan Nom GNP	Japan Real GNP 1980 B Y	Japan IOU cts/m Y
1970	73,188	152,208	1.75
1971	80,592	158,777	2.39
1972	92,401	172,318	3.07
1973	112,520	185,923	3.66
1974	133,997	183,285	3.03
1975	148,170	188,189	3.43
1976	166,417	197,215	3.64
1977	185,530	207,738	3.60
1978	204,475	218,522	3.70
1979	221,825	230,074	3.18
1980	240,098	240,098	1.35
1981	256,817	248,726	3.21
1982	269,097	256,395	3.30
1983	280,577	264,704	3.97
1984	298,589	278,119	3.94

Diamond Prices
$

Date	Sizes .04-.08 carats	.09-.16	.17-.22	.23-.28
M76	265			350
A	270			360
M	270			360
J	270			365
J	270			365
A	270			365
S	270			365
O	260			365
N	270			384
D	280			404
J77	273			431
F	260			433
M	275			435
A	295			500
M	320			500
J	320			500
J	335	365	477	548
A	364	379	484	549
S	364	379	484	549
O	369	420	500	575
N	372	425	500	575
D	412	470	525	603
J78	425	497	575	650
F	429	511	620	755
M	496	562	750	885
A	525	606	794	920
M	533	648	800	960
J	525	625	780	955
J	525	625	780	955
A	525	625	780	955
S	600	729	900	1,015
O	596	750	856	1,109
N	622	731	945	1,115
D	611	731	945	1,115
J79	611	731	945	1,115
F	611	731	945	1,115
M	611	731	945	1,11
A	611	731	945	1,115
M	611	731	945	1,115
J	611	731	945	1,115
J	611	731	945	1,115
A	605	666	900	1,100

Date	.04-.08	.09-.16	.17-.22	.23-.28
		carats		
S	605	663	925	1,104
O	607	666	935	1,150
N	607	666	935	1,177
D	587	640	980	1,220
J80	587	640	980	1,220
F	587	640	1,015	1,220
M	570	655	1,080	1,385
A	570	655	1,080	1,385
M	570	655	1,080	1,385
J	570	655	1,080	1,385
J	570	655	1,080	1,385
A	570	655	1,080	1,385
S	570	655	1,080	1,385
O	570	655	1,080	1,385
N	570	655	1,080	1,385
D	570	655	1,080	1,385
J81	550	605	1,000	1,200
F	536	612	903	1,100
M	537	657	1,075	1,375
A	600	645	1,175	1,345
M	600	645	1,175	1,345
J	600	645	1,175	1,345
J	600	645	1,175	1,345
A	600	645	1,175	1,345
S	501	552	810	1,100
O	501	552	810	1,100
N	501	552	810	1,100
D	467	550	832	900
J82	532	565	829	1,050
F	495	580	875	1,100
M	495	580	875	1,100
A	475	500	900	1,200
M	450	550	826	936
J	456	550	791	936
J	456	550	791	936
A	450	535	750	888
S	477	550	812	945
O	420	520	750	935
N	475	525	750	940
D	475	525	750	940
J83	475	525	750	940
F	490	560	835	965
M	490	560	835	965
A	490	560	835	965
M	490	560	835	965

Date	.04-.08	.09-.16	.17-.22	.23-.28
		carats		
J	490	560	835	965
J	490	560	835	965
A	490	560	835	965
S	490	560	835	965
O	490	560	835	965
N	490	560	835	965

Diamond Prices
$

Date	Carats			
	.29-.35	.46-.55	.69-.79	1-1.15
M76		650	867	6,200
A		725	974	6,200
M		725	974	6,500
J		725	975	6,500
J		725	975	6,500
A		725	975	6,500
S		725	975	6,500
O		679	975	6,800
N		688	975	6,825
D		730	1,044	7,045
J77		806	1,088	7,865
F		767	1,029	7,350
M		767	1,100	7,200
A		844	1,134	8,322
M		950	1,188	8,200
J		950	1,188	8,200
J	596	885	1,200	7,875
A	613	918	1,280	8,138
S	613	970	1,330	7,925
O	630	970	1,308	8,000
N	652	970	1,308	8,000
D	656	1,045	1,426	10,000
J78	715	1,075	1,495	12,000
F	800	1,135	1,630	13,500
M	917	1,155	1,635	17,000
A	1,006	1,385	1,880	15,000
M	1,080	1,450	1,900	18,500
J	1,038	1,388	1,883	16,500
J	1,038	1,388	1,883	16,500
A	1,038	1,388	1,883	16,500
S	1,157	1,565	2,033	22,000
O	1,205	1,548	2,033	22,000
N	1,242	1,565	2,035	20,000
D	1,242	1,565	2,035	22,500
J79	1,242	1,565	2,035	22,500
F	1,242	1,565	2,035	21,000
M	1,242	1,565	2,035	21,000
A	1,242	1,565	2,035	21,000
M	1,242	1,565	2,035	21,000
J	1,242	1,565	2,035	21,000
J	1,242	1,565	2,035	21,000
A	1,200	1,577	2,035	23,500

WHY DON'T THESE PRICES TRACK PAGE 154?

Date	Carats			
	.29-.35	.46-.55	.69-.79	1-1.15
S	1,200	1,589	2,120	27,500
O	1,287	1,753	2,355	33,350
N	1,350	1,905	2,494	39,000
D	1,400	1,950	2,605	37,000
J80	1,400	1,950	2,605	41,875
F	1,425	2,105	2,630	50,000
M	1,550	2,738	3,556	63,000
A	1,550	2,738	3,556	58,500
M	1,550	2,738	3,556	55,500
J	1,550	2,738	3,556	51,500
J	1,550	2,738	3,556	51,500
A	1,550	2,738	3,556	54,250
S	1,550	2,738	3,556	54,250
O	1,550	2,738	3,556	54,250
N	1,550	2,738	3,556	53,000
D	1,550	2,738	3,556	53,000
J81	1,250	2,675	2,975	44,500
F	1,275	2,100	2,925	46,000
M	1,585	2,425	3,000	37,500
A	1,620	2,440	3,065	44,500
M	1,620	2,440	3,065	44,500
J	1,620	2,440	3,065	41,500
J	1,620	2,440	3,065	NA
A	1,620	2,440	3,065	NA
S	1,400	2,000	2,275	NA
O	1,400	2,000	2,275	NA
N	1,400	2,000	2,275	NA
D	1,200	2,300	2,300	26,500
J82	1,250	2,000	2,300	NA
F	1,225	2,000	2,400	NA
M	1,225	2,000	2,400	NA
A	1,400	1,800	2,250	NA
M	1,206	1,816	2,200	NA
J	1,325	1,775	2,170	NA
J	1,325	1,775	2,170	NA
A	1,325	1,775	2,150	NA
S	1,090	1,750	2,200	NA
O	1,162	1,840	2,200	NA
N	1,250	1,900	2,250	NA
D	1,250	1,900	2,250	NA
J83	1,250	1,900	2,250	NA
F	1,260	2,000	2,500	NA
M	1,260	2,000	2,500	NA
A	1,260	2,000	2,500	NA
M	1,260	2,000	2,500	NA

Date	Carats			
	.29-.35	.46-.55	.69-.79	1-1.15
J	1,260	2,000	2,500	NA
J	1,260	2,000	2,500	NA
A	1,260	2,000	2,500	NA
S	1,260	2,000	2,500	NA
O	1,260	2,000	2,500	NA
N	1,260	2,000	2,500	NA

Prices of G VS1 Diamonds
1979

Carats	Price High	Price Low	Price Average
0.04	450	755	602.5
0.09	475	872	673.5
0.17	740	1,495	1,117.5
0.23	840	1,745	1,292.5
0.29	935	1,980	1,457.5
0.46	1,600	2,488	2,044
0.69	2,000	3,185	2,592.5
0.95	NA	NA	NA
1.00	4,428	7,500	5,964

1989 4000 ±