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An Investigation Into the Effectiveness of Using Silver Price Changes as an Economic Indicator

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INTRODUCTION

The subject of this paper is an investigation into the effectiveness of using changes in the price of silver as an economic indicator. To accomplish this investigation and to ensure that a common basis for understanding exists, the paper is divided into five main subject areas. The first is a brief introduction on the history of silver prices in the United States that will lay the groundwork for further investigations. The second area is also introductory and deals with the theory behind economic indicators; it defines them, explains their significance, and attempts to relate various characteristics of silver that should serve to classify it as a valid forecasting tool. The third area is a detailed study into the determinants of silver prices; it deals with an examination of the market and looks into the duel focus of supply and demand. In the fourth area, the actual test is performed using standard statistical correlation techniques; also contained in this section is an examination of the silver market in 1971, the year of the study. It is hoped that the market forces present in 1971 will help explain the results of the test. Finally, the fifth area of the text attempts to explain the significance of the results and to offer some valuable conclusions concerning

the future of silver prices and their relationship to the test of silver price changes as an economic indicator.

The major emphasis of the paper will be on the determinants of silver prices. Since the test to be used concerns silver price changes, a knowledge of silver prices must be gained in order to understand what makes them change and how these changes relate to the changes in the economy. With a full understanding of this area, the results, whether positive or negative, can be interpreted and become significant. Without this understanding, the results are inconclusive and explain nothing.

Throughout the text, various graphs and charts have been selected or prepared in order to present, in the most interesting fashion possible, long lists or detailed items that would, if included in written form, prove to be cumbersome and too boring. They have been inserted at places in the text following the page on which the subject matter has been covered.

HISTORY OF SILVER PRICES IN THE UNITED STATES

The history of silver prices in the United States offers many fascinating and revealing aspects of the regard with which silver has been held by the various segments of our population. These insights reveal the fact that silver has been regarded by many to be more than just a precious metal or commodity. Indeed, there almost appears to be something sacred about it, something undefinable and indeterminate. For many, the mere mention of its name can instantly conjure up visions of fantastic wealth and fortune. This unknown element surrounding silver has created many interesting and irrational legislative statutes that have regulated its price for almost the entire history of our country. While this survey of silver prices covers only the highlights, it does serve to illustrate the point that silver is not just another commodity whose price is governed by ordinary market forces, but rather one that has a mysterious element sharing in the determination of its price.

The first Continental Congress, in 1776, established silver as our country's first monetary standard when it passed its first financial law and the silver dollar was the unit of value. However, 1792 saw Congress adopt a bimetallic standard, gold and silver, for the country. The silver dol-

lar was defined as 371.25 grains of fine silver with a monetary value of $1.2929 per troy ounce.[1] Silver and gold were established at a ratio of 15:1; unfortunately, the ratio everywhere else was established at 15½:1, so in our country silver was overvalued and we discovered we had a de facto silver standard rather the a de jure bimetallic standard as was originally planned. Further, the silver dollars that were minted soon disappeared from circulation, having been traded for Spanish dollars of higher silver content.[2] To combat this drain on our monetary resources, President Jefferson had to suspend the coinage of silver dollars in 1806. Congressional legislation in 1834 and 1837 redefined the silver to gold ratio, this time at a ratio of 16:1, effectively undervaluing silver. Also as a result of the 1834 legislation, silver dollars were minted for the first time since 1806 and would be continued to be minted for the next thirty years at an annual rate of approximately 160,000 coins.[3]

It was not until 1853 that our silver coinage was made subsidiary when Congress reduced the silver content in all coins by 7%. This act had the effect of making the monetary value of silver greater than the bullion value. Consequently, silver coins remained in circulation.[4]

For the next twenty years, the bullion value of silver remained higher than the monetary value of $1.2929 per troy ounce. The coinage of silver dollars was again suspended

in 1873 and the price of silver began a long decline as a result of the decreased demand and increased supply (several bonanza silver ore deposits were discovered at this time in the Western States).[5] Also in 1873, a general business depression began, creating an outcry for the restoration of free silver coinage. A Free Silver Movement ensued, blaming the depression on the claim that a monetary system based on gold resulted in low prices due to the scarcity of money. Although this argument was not valid, it gained momentum and adherents, claiming William Jenning Bryan as their leader and spokesman. Bryan, known for his oratory, based his position upon his famous statement, "You shall not crucify labor upon this cross of gold".[6]

Thus, it can already easily be seen that a mystical quality has been attached to silver. The followers of the Free Silver Movement seemed to believe that the restoration of silver coinage would automatically restore economic prosperity. They obviously seemed to have forgotten that the silver market itself was very weak due to an increased supply and decreased demand.

In an effort to restore silver prices to a level comparable to those prevailing during the Civil War, Congress passed the Bland-Allison Act in 1878. The Bland-Allison Act was an attempt to increase the demand for silver by requiring the Treasury to purchase a minimum of two million dollars monthly. The silver acquired by the Treasury was to be

used for coinage or the backing for silver certificates. The Treasury found, however, that the public did not want or need all this money, so most of it wound up in the Treasury vaults. The price of silver failed to show any marked increase, largely because European countries were leaving the silver standard, sizeably reducing the worldwide demand for silver.[7]

The unsuccessful Bland-Allison Act was replaced by the Sherman Silver Purchase Act in 1890. According to the provisions of this act, the Secretary of the Treasury was directed to purchase 4.5 million ounces of silver per month at the existing market price. Silver purchased under the Sherman Act was paid for by issuing new, legal-tender Treasury notes that were redemable in gold or silver. During 1890, the price of silver rose to an average of $1.05 per troy ounce but then fell again until 1892 when the price was lower than it had been in 1889.[8] The 4.5 million ounces the Treasury had to buy monthly represented almost entire production of domestic silver. The peak United States production period for silver produced from silver ore was reached in 1892, when 63.5 million ounces were minded.

1893 was the last year the Sherman Act was in effect. At that time, a series of large gold withdrawals were made in exchange for the Treasury notes issued under the provisions of the act. As a result, the act was repealed in 1893 and silver was demonitized at the same time.[9]

Following the repeal of the Sherman Act, silver prices declined over a long period of time, forcing many of the domestic silver mines to close. Only during and immediately after World War I did silver prices show any increase. During the war, the Treasury sold silver to Great Britian at prices well above what it had paid for it during the forced purchases of the Bland-Allison and Sherman Silver Purchase Acts. On November 25, 1919, the price of silver reached a record high of $1.375 per ounce.[10] However, the strong silver lobby persuaded Congress to pass the Pittman Act that required the Treasury to purchase silver from domestic producers at an artificially high price. By this time, the market had again dropped but the Treasury was required to pay one dollar an ounce for the silver it purchased.[11] This high price acted as a subsidy to American silver producers. Obviously, with the market price low and with the Treasury required to purchase silver at a much higher price, silver flowed into the Treasury where it was uselessly stored in vaults. The Treasury had no need for all this silver, but due to the Pittman Act it had no choice but to go ahead and continue with the purchases.

Again strong political pressures were brought to bear upon the silver issue. With the silver market weak and failing, Congress was pressured into forcing a higher price than was needed until 1923 when the Treasury had repurchased the 200 million ounces which it had sold and the Pittman Act

became ineffective.

The great depression of the 1930's also had its effect upon the silver market, when the all-time low price of $0.2425 per ounce was published on December 29, 1932.[12] By 1933, the market price had risen to $0.44 per ounce. The same year, Congress enacted the Thomas Amendment that authorized the Treasury to purchase newly mined domestic silver with a seigniorage deduction of 50%, fixing the price at $0.6464 per ounce (one-half of $1.2929), or until the Treasury's stock of silver reached one-third the monetary value of its gold stock.[13]

Again in 1934, Congress took it upon itself to bolster the price of silver by passing the Silver Purchase Act that once again directed the Secretary of the Treasury to purchase silver domestically and internationally until the market price equaled the mint price of $1.2929 per ounce.[14] As with the Pittman Act, the forced purchase would automatically stop when the monetary value of the Treasury's silver stock reached one-third the value of its gold stock.

During the next ten years, the support price changed several times until it was set at $0.9050 per ounce by the Newly Mined Domestic Act enacted into law on July 31, 1946.[15]

The 1950's saw a great increase in the demand for silver. New industrial uses were being found and the need for coins was increasing rapidly along with the growing population; during this time, the supply of silver was not growing

as rapidly and the supply deficit had to be filled. The United States Treasury started to sell some of its accumulated stock. By the 1960's, though, the Treasury's supply was running low and in November of 1961, President Kennedy issued an order to suspend the sales of Treasury silver, curtail the use of free silver for coinage, and obtain silver needed for coinage by retiring five and ten dollar silver certificates from circulation.[16]

The effect of Kennedy's order was an increase in the market price of silver from November of 1961 until June of 1963. During this period, even with an increase in price, a snarp upsurge in usage took place. Thus, the demand had increased while the supply decreased.

To close the enlarging supply deficit, Public Law 88-36 was created on June 4, 1963. This act in effect repealed the Silver Purchase Act of 1934 by allowing the Treasury to redeem silver certificates at a price of silver of $1.2929 per ounce. Hopefully, this would free enough silver to meet the growing industrial demand. Additional quantities of silver were freed by the issuance of one-dollar Federal Reserve Notes to replace the silver certificates and eliminate the need for a quantity of silver to be held as backing for these certificates.[17]

Additional quantities of Treasury silver were made available to the public on July 23, 1965 when the Coinage Act of 1965 was signed into law by President Johnson. This

act created the clad coins, coins of negligible silver content. Thus, the first fundamental change in the nation's silver coins occurred since 1792 and at the same time made available the huge quantities of silver previously needed to supply the nation's coinage demand.[18] In effect, this action was entirely remedial since the Treasury's silver stocks were already threatened with a shortage that would eliminate its existing supply within three years.

Again faced by dangers of a shortage in supply, the Treasury halted all sales at the fixed price of $1.2929 per ounce on July 14, 1967 and on August 4, 1967 directed the General Service Administration to conduct weekly auctions of the Treasury's silver stocks. These auctions were finally halted on November 10, 1970.[19]

Over the history of our country, the price of silver has been largely maintained by Congressional statute; only in the past several years has the price been unregulated by governmental action and only since the last quarter of 1970 has it been free of any governmental intervention at all. Even with governmental intervention and public sympathy as evidenced by William Jenning Bryan and the Free Silver Movement, the price of silver has failed to live up to the public's expectations. Many feel and believe that a precious metal has its own intrinsic value that has absolutely nothing to do with its value on the market. It is this belief in the intrinsic value of silver that has

led people to defend and support the price of silver. However, due to its rather spotty performance of the past few years, many observers are referring to silver as a semi-precious metal.[20] Indeed, since silver's ties with our monetary system have been almost completely severed, the value of silver now lies in the areas of speculative and industrial demand, to be analyzed in a later section.

From this brief summary of silver prices in the United States, it is easy to determine that only since 1970 has the price of silver been unrestricted and therefore useful to this study. The analysis of any other year would only disclose what pressures were present in the legislative arena and what actions were taken by Congress. These have no effect upon this study except to reveal that a firm belief in the concept of silver as an item of undeniable value does exist in our country. This belief underlies much of the speculative demand in the silver market and will be of great interest later.

GENERAL THEORY OF INDICATORS AND ITS RELATIONSHIP TO SILVER

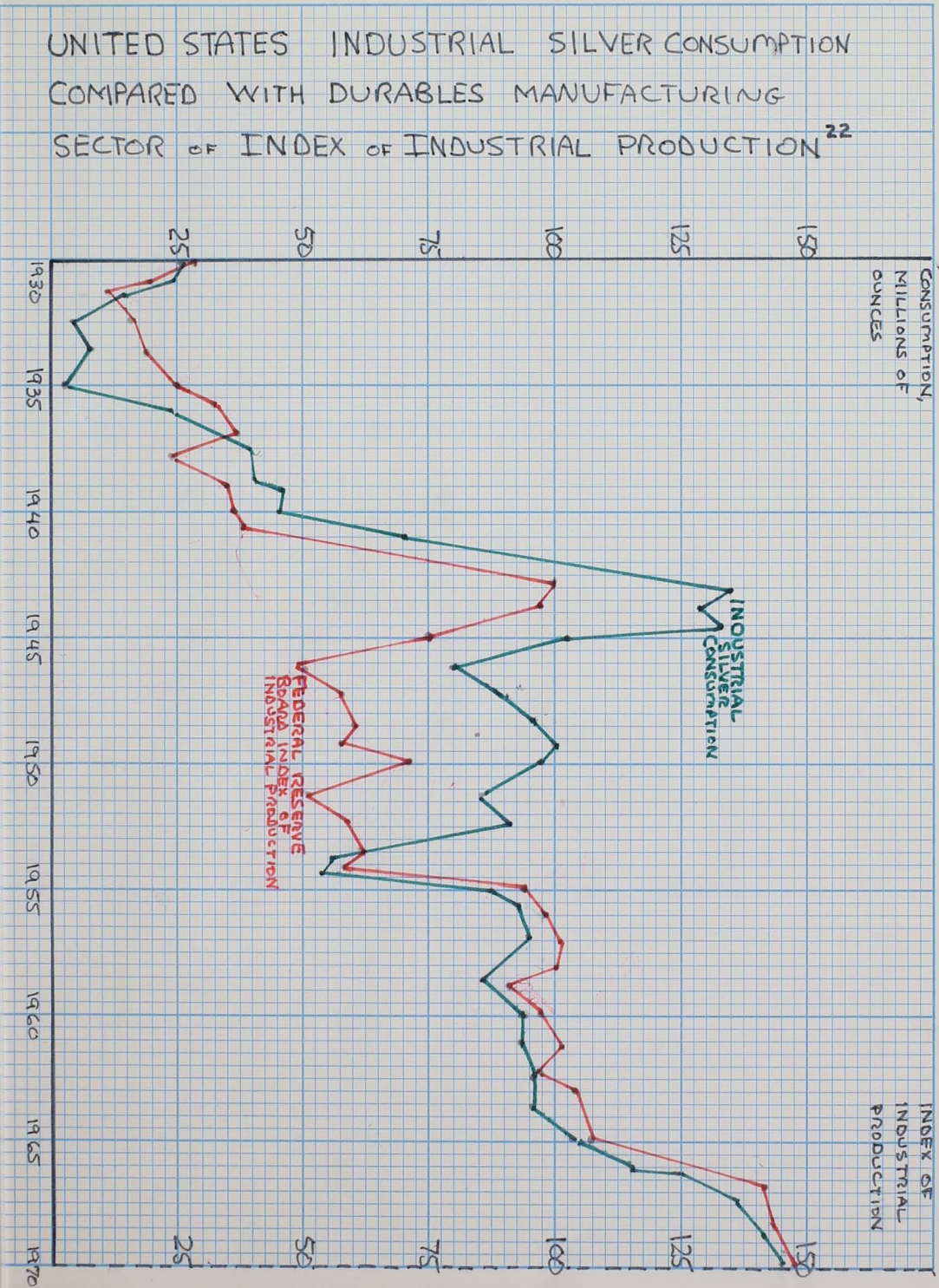
Indicators of the economy are used to predict changes in the level of economic activity; the exact magnitude of these changes cannot be forecast, but a general trend can be predicted. The use of indicators as a method of forecasting is based on the historical fact that a few series of economic factors have, in the past, shown upwards or downwards movements before the same in the general economy.[21]

Indicators are of two general types, either leading or lagging. Leading indicators tend to predict changes in the business cycle while lagging indicators occur after the fact. For this reason, the test of silver price changes as an economic indicator will be tested both ways, one with a one-year lag and the other with a one month lead. By using both methods, any effectiveness in using silver price changes as an indicator should be picked up.

The selection of the commodities or composite indexes to be used as indicators depends upon the characteristics of each separate one. Five basic groups of indicators exist, each designed to measure a different segment of the economy. The groups that are to be used in this paper comprise those based on inventories and inventory investments,

fixed capital investments, and prices. It is the assumption of this paper that changes in the price of silver will result from an increase in the demand for it. The increase in demand will be reflected by increased investments both in fixed capital assets and inventories. In the next section of the paper, this assumption will be tested and it will be shown that silver is an integral part of many commodities being manufactured today. Therefore, an increase in the demand for silver should predict an increase in the business activity of the economy. Whether or not this holds true will be demonstrated in the correlation tests. The analysis of the determining factors affecting the price of silver will show whether or not an increase in demand affects the price of silver or whether other economic factors play the dominant role. In any event, because of silver's uses in a wide variety of manufacturing and production, changes in its price should serve as a valid indicator to be used in predicting changes in economic activity.

UNITED STATES INDUSTRIAL SILVER CONSUMPTION COMPARED WITH DURABLES MANUFACTURING SECTOR OF INDEX OF INDUSTRIAL PRODUCTION[22]

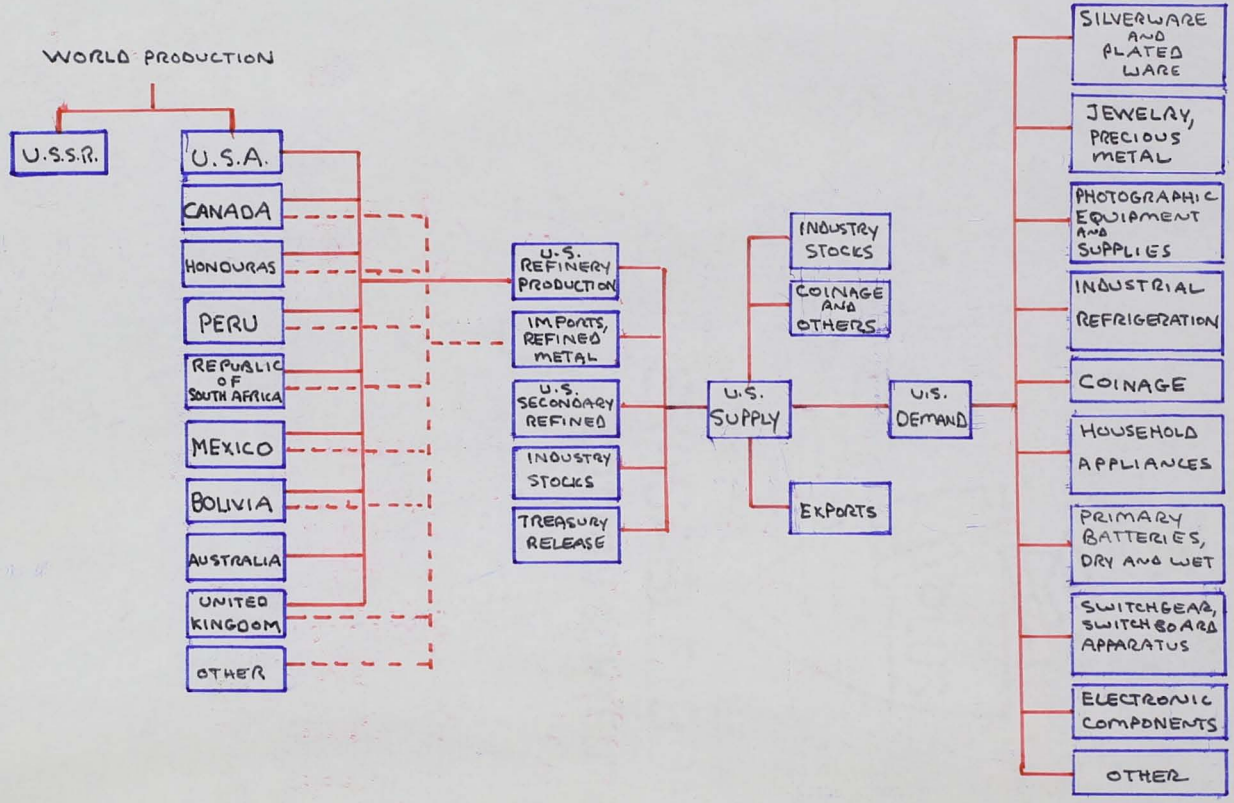


DETERMINATION OF SILVER PRICES

To fully understand and comprehend the results of the correlation tests, a knowledge of the determinants of silver prices is necessary. Basically, the market forces shaping the price of silver are the supply of and the demand for it. Each of these two must be broken down further and the individual units comprising it must also be analyzed. After that, the workings of the forces that determine the price of silver should be clear and understandable.

The actual expenses occurred in the mining and refining process of silver are relatively inconsequential. Because of the high value of refined silver, transportation and labor costs (less than 2,000 workers are employed in the mining and milling aspects of the silver industry) are basically unimportant economic factors.[23] Further, the depletion allowance for mining silver is established at 15% of gross income, not to exceed 50% of net income; also, the office of Minerals Exploration assists in the exploration for new deposits and provides funds for 75% of the costs incurred.[24] Therefore, the price of silver is primarily shaped by market forces and not from the costs of inputs into the production process.

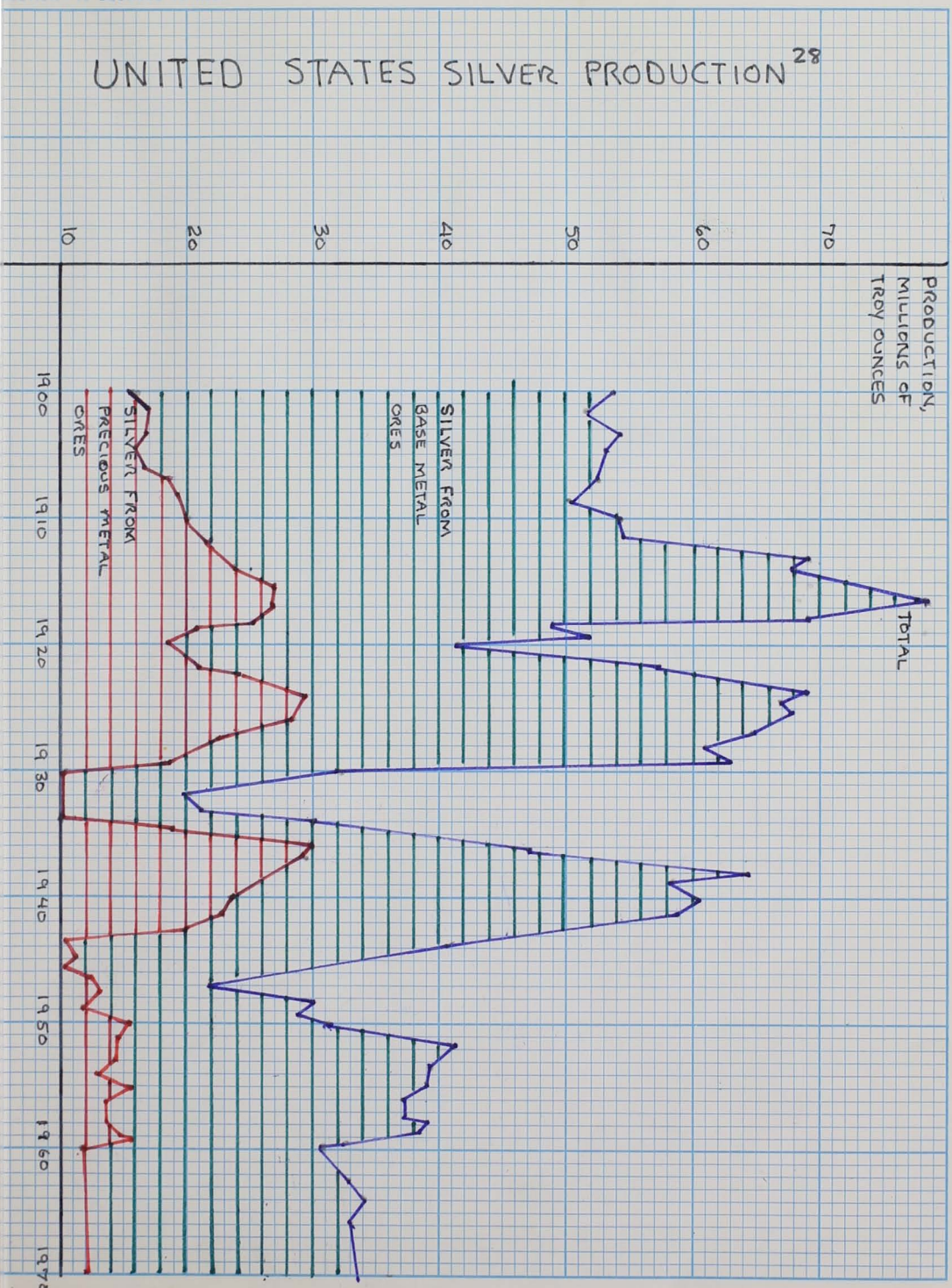
Five main sources supply the entire demand for silver



SUPPLY-DEMAND OF SILVER[25]

in the United States: new production, secondary production, government stocks, hoards, and imports. For the short-run, United States Treasury stocks, bullion sales by speculators, and downward inventory adjustments by industrial consumers provide the supply; long-run sources of supply come from new mine production and the release of foreign hoards. By far, newly mined silver yields a much more stable supply than can be realized from the disillusion of hoards. With that in mind, the supply of silver from new production will be examined first.

Silver was first discovered in the southwestern states in the sixteenth century; however, it was not until the early 1860's that silver deposits were extensively economically exploited. Large bonanza deposits at this time were discovered in Colorado, Utah, Montana, and Idaho, but the relative remoteness of these areas made only the mining of high grade ores feasible. It was not until the 1880's that the demand for metals associated with silver in nature, such as lead and zinc, that the mining of base metals became the principal source of silver.[26] Improved methods of milling, the extension of rail transportation, and the building of centrally located smelters soon followed and the South Western United States became the principal supplies of silver for the world. The peak year for total silver yield came in 1916 when 78.9 million troy ounces were produced in this country.[27]



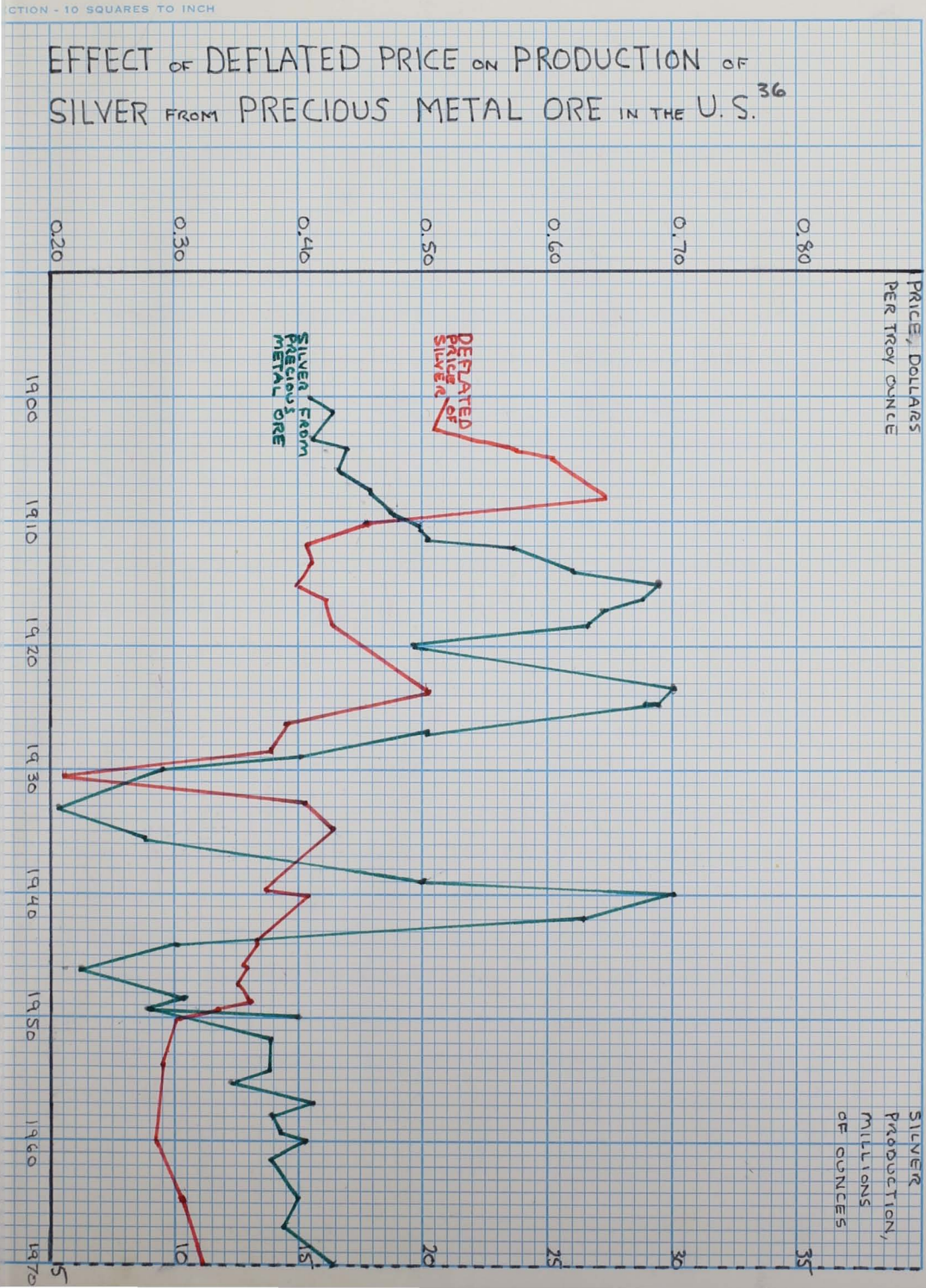
In the United States, there are approximately five hundred producers of primary silver with an annual estimated value of production of 79.6 million dollars.[29] These mines provide 35% of the total amount of silver consumed in the United States for industrial purposes. Of these five hundred producers, the largest four provide 51% of the total supply while ten mines each produce over one million ounces a year. Domestic production is centered in Idaho, where one-half of the nation's output comes from the Coeur d'Alene mining district in the northern part of the state, a small strip 20 by 30 miles in Shoshove County. In this region lies the largest domestic silver mine, the Sunshine, which produces 7.71 million ounces of silver annually along with various coproducts and byproducts.[30] Other large silver producing states are also located in the Western United States, Arizona, Utah, Montana, and Colorado, and produce approximately 40% of the nation's annual output.

Silver mines derive the major portion of their income from silver and various lesser amounts come from associated base metals such as lead, zinc, copper, and antimony. As a general rule, the real price of silver is the most important factor in the production of silver from silver mines. Prices have paralled production, with the exception of the period from 1934 to 1943 when extremely high grade deposits were mined from the Sunshine mine, for the

entire period of United States production.[31] The recent rise in the level of silver prices should stimulate exploration for new deposits. Including the active and inactive domestic silver mines, the nation's productive potential is estimated to be five billion ounces, of which 1.3 billion ounces are in mines currently under operation.[32] A small portion of the remainder is located in gold deposits, while the remaining 3.5 billion ounces lies in deposits requiring substantially higher silver prices to be mined economically. This submarginal resource should become available only if the price of silver rises to an estimated $3.50 per ounce, a price considerably higher than that existing at present.[33] Most of these submarginal resources are found in nature associated with other precious metal ores such as gold and platinum; the production of silver from these ores is directly related to the real price of silver.[34] The remainder of the potential production should result from the mining of large, low-grade deposits and narrow, deep-seated high grade deposits that require a lead time over five years from the start of exploration to the beginning of production.[35] Some of these deposits must await not only higher prices but more advanced technology to facilitate the extraction of their silver content.

Of the total domestic production of silver, a bit less than one-third comes from mines engaged solely in the recovery of silver; the largest portion of silver produced, two-

EFFECT OF DEFLATED PRICE ON PRODUCTION OF SILVER FROM PRECIOUS METAL ORE IN THE U.S.[36]



thirds, results from mines operated chiefly for their base metal ores such as copper, lead, and zinc. Silver and these base metals exist in either a coproduct or byproduct relationship, depending on the volume of silver present. A duel relation also exists concerning the economic feasibility of their production; while the value of the recoverable silver is an important factor in deciding whether or not the base metal operations are profitable, the future output of silver is dependent on the price of the base metals.[37] Therefore, if the price of silver rises, many base metal mines will be opened because the total product produces a profit, while in other cases, an increase in the price of base metals will result in increased production of them and an ensuing increase in silver production will occur. Of all mines producing over 100,000 ounces, a full fifty per cent of the domestic silver supply came from mines in which silver contributed less than 20% of the output.[38]

Of the silver produced as a result of base metal mining, two basic sources exist. The first comes from silver recovered as a byproduct of copper ores and depends on the amount of copper ore mined which in turn depends upon the demand for copper. Seventy-five to eighty per cent of the copper produced is consumed in the production of manufacturer's durable goods; this level of consumption fluctuates with the business cycle and has been subject to substitution

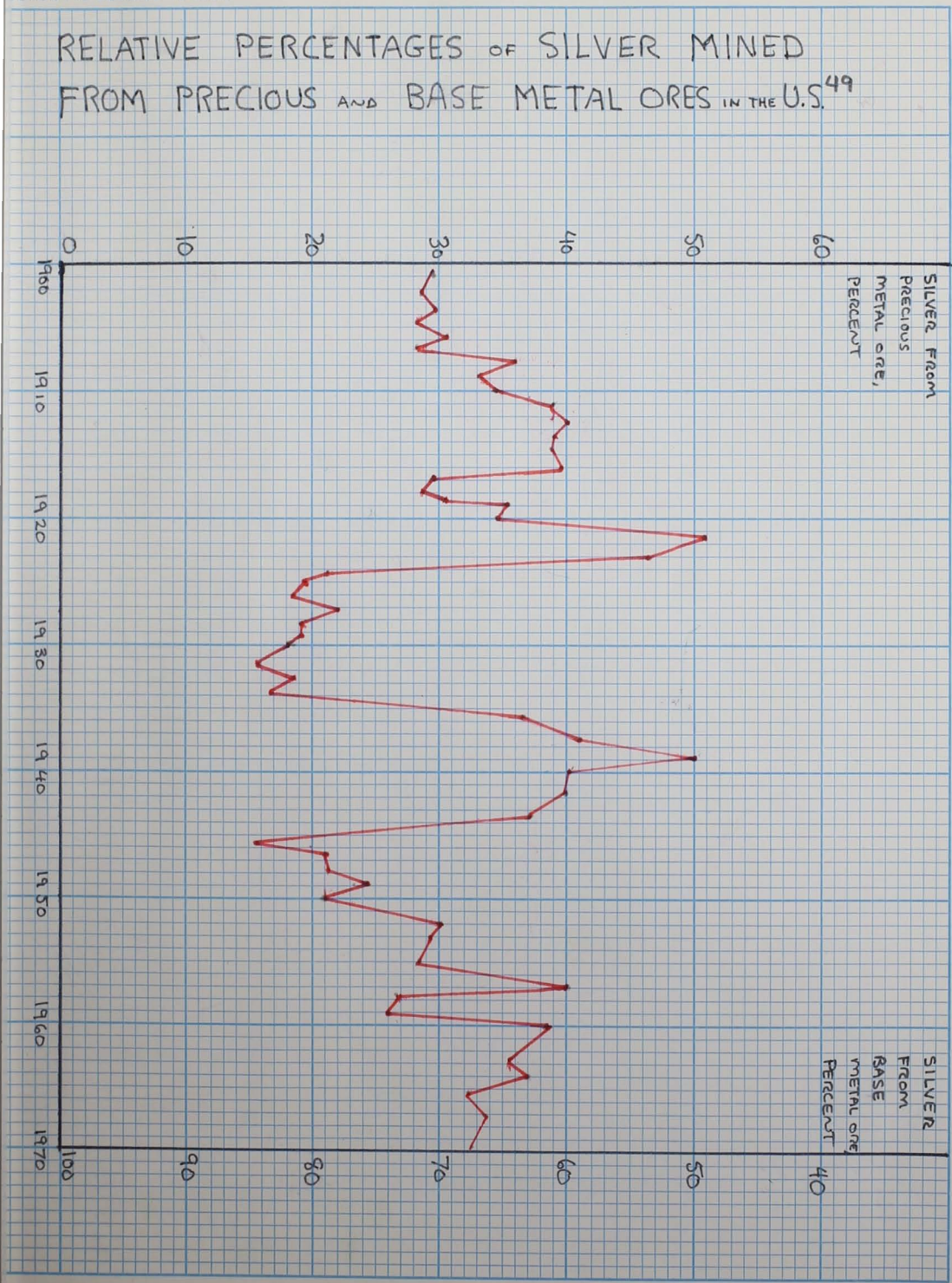
of other more plentiful resources since World War II.[39] The demand for copper has been estimated to increase at an annual rate of 3.8%.[40] The amount of silver recovered from copper ore varies with respect to both time and place. Since 1916, the average content of silver has dropped from 24.5 ounces of silver per ton of copper to 9.1 ounces of silver per ton of copper.[41] Copper mined in Montana contains an average of 24 ounces of silver per ton of copper while in Utah the ratio is 9 ounces of silver to a ton of copper and in Arizona 6 ounces of silver are recovered in every ton of copper produced.[42] Thus, the production of silver recovered from copper depends on the price of copper, the location of the copper mine, and the year in which it is produced. Presumably, as more and more marginal reserves of copper are mined to meet the demand, less silver is contained and recoverable in the ore. Conditions in the copper industry itself also have a marked effect on the supply of silver. Several labor strikes affecting copper mining and smelting companies have had dramatic effects on silver. Labor strikes occurring in the last half of 1967 and the first quarter of 1968 significantly reduced the production of coproduct silver while the copper industry strike in 1971 reduced silver output approximately ten per cent.[43]

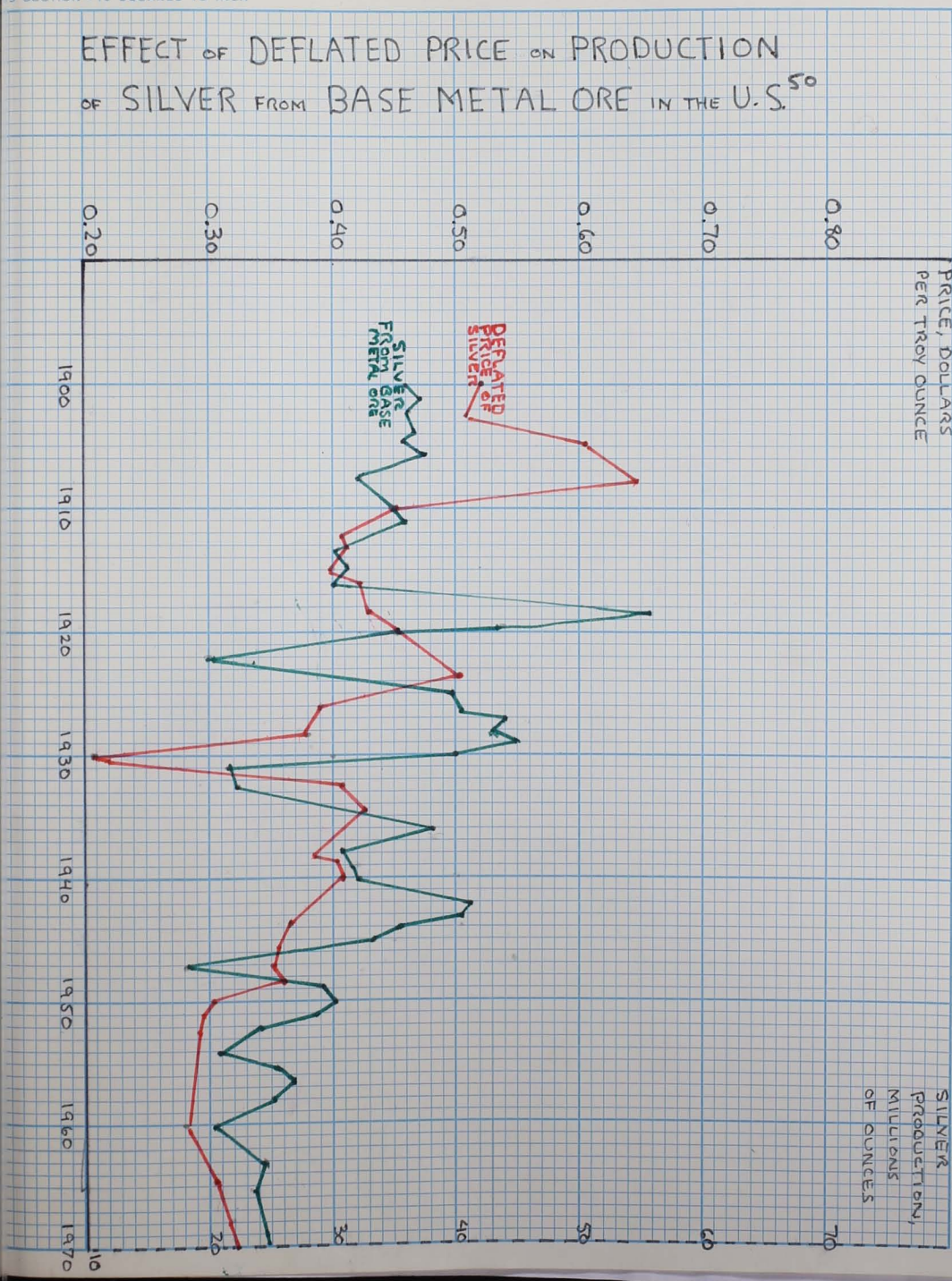
The second source of the silver supply from base metal production comes as a result of the mining of lead-zinc ores. Although a satisfactory relationship between

lead-zinc demand and silver production does not exist (only 43% of the zinc consumed in the United States and 27% of the lead consumed comes from domestic mines[44]), similar time-place relationships exist between silver and lead as exist between silver and copper. In 1916, 22.4 ounces of silver were recovered from every ton of lead-zinc ores while today only 15.2 ounces of silver are recovered for every ton of lead-zinc.[45] Sixteen ounces of silver are recovered from the production of every ton of lead ore in Idaho while only 0.5 ounces of silver are recoverable from each ton of lead mined in Missouri.[46] On the whole, the demand for lead is expected to increase at an average annual rate of 2.5%, while the demand for zinc is expected to rise at a 3.1% rate.[47]

Of the 5 billion ounces of silver estimated to be located in the United States, only 1.3 billion ounces are now available in mines in operation. This figure has been reduced substantially over the years, largely as a result of the growing imbalance between production and consumption.[48] As a result of this imbalance, an increase in the price of silver is almost inevitable. Such an increase would have an effect on base metal mining, raising the value of byproduct silver and making the whole base metal operation economically profitable. Higher prices will also induce mining companies to start new programs of exploration, but the lead time is long. The new mines may be base metal, gold, or

RELATIVE PERCENTAGES OF SILVER MINED FROM PRECIOUS AND BASE METAL ORES IN THE U.S.[49]

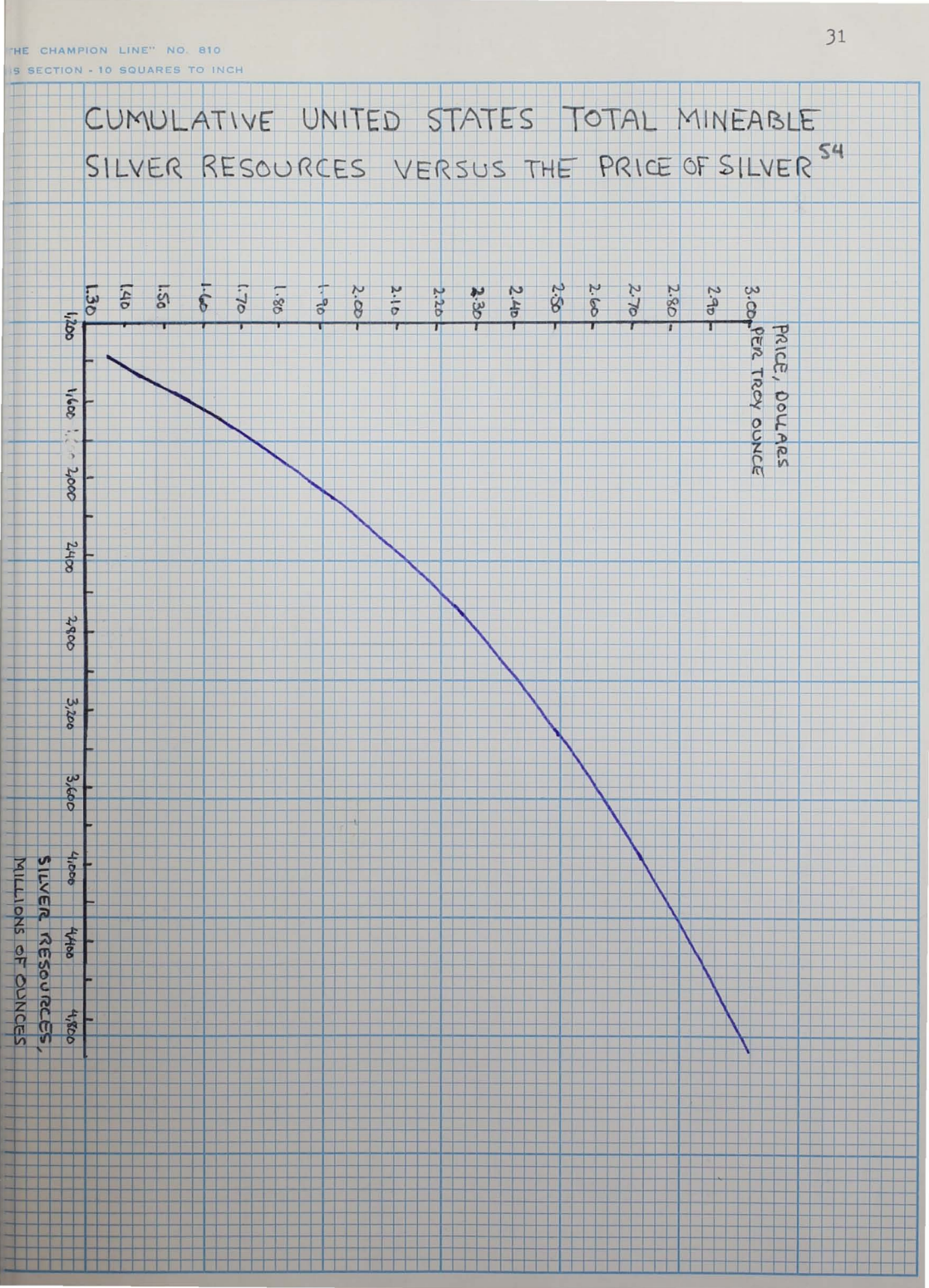




silver, but the exploration will occur only because of the higher revenues coming from the silver content of the ores. The silver price required for the profitable operation of these mines varies greatly among the various deposits because of the great differences in the quality of the ores, the accessibility, the mining method, and the metallurgical treatment.[51] In any event, substantial increases in the supply of silver produced from primary resources must come from undiscovered or undeveloped deposits. Recent explorations suggest that a significant ore deposit could exist in the black calcite zinc underlying the remnants of the Pilot Shale in White Pine County, Nevada.[52] This site is a former major area of silver mining, so if it does prove successful, larger deposits could be found in other old mines; their reexploitation depends on the improved discovery and mining techniques being developed today. Such improvements in mining technique enabled the Sunshine mine to increase its ore grade from 30.8 ounces of silver per ton of ore to 33.4 ounces per ton.[53]

The second source or the silver supply in the United States comes from the recovery of secondary silver. This is silver that has been used in production or consumed but is then recovered at the end of the products use. The increased market price of silver has added great emphasis to the recovery of secondary silver. On an annual basis, about 56 million ounces of silver are recovered from old

CUMULATIVE UNITED STATES TOTAL MINEABLE SILVER RESOURCES VERSUS THE PRICE OF SILVER [54]



INTERRELATION OF ADDITIONAL ANNUAL SILVER PRODUCTION WITH SILVER PRICE AND DIRECT INVESTMENT [55]

scrap and 24 million ounces are recovered from new scrap.[56] This amount is almost three times the volume of domestic mine production; so much has been recovered largely because of the pressure put on the decreasing supply due to labor strikes at mines and the backlog of silver scrap that has accumulated for labor disputes at copper smelters.[57] The amount of secondary silver recovered each year should increase as consumption increases, recovery facilities are improved, collection methods are sophisticated, and the pollution and environmental concerns over wasted scrap should also add impetus to increased recovery.

The secondary silver industry includes about 1,200 firms that process silver containing scrap. Most of the smelters utilized in the production of secondary silver are located on the eastern seaboard. Ag-Met, Inc., located in Lofty, Pennsylvania, plans to recover six million ounces of silver a year recovered from discarded photographic film and chemicals;[58] the Eastman Kodak Co. has a newly designed incinerator that can treat 4,500 pounds of old photographic film in an hour and recover over 99% of the silver present.[59] Even with massive efforts such as the above two, it is estimated that over thirty million ounces a year are lost as a result of use in the photographic industry.[60]

In recent years, a large part of the supply of silver consumed in the photographic, jewelry, electronics, and special alloys industry has been secondary silver. Its use

is expected to increase as new methods are developed that will aid in the recovery of secondary silver and hence increase the available supply.

The third main source of the supply of silver comes from the stocks held by the United States Treasury. Although this source does not have the impact today that it has had for the past decade, it is interesting to trace this pattern out for it gives us a good picture of the way in which silver stockpiles can be brought into the market and the impact they will have there. Under the provisions of the silver purchase legislation of the early 1930's, the Treasury bought nearly 3.2 billion ounces, approximately 2.2 billion ounces coming from purchases in foreign markets at the prevailing market rates.[61] During the period from the enactment of the legislation until 1956, almost all newly mined domestic silver was sold to the Treasury because the government's support price was higher than the market price; the domestic consumers during this time were supplied by foreign sources. In 1956, however, the world-wide coinage and industrial demand exceeded the current production and the price of silver on the market rose to the support price. To fill the deficit in the supply, the Treasury sold, at a price of $0.9050 per ounce, the portion of its stock that was not required as a backing against outstanding silver certificates. This free silver from the Treasury and the current production were absorbed

in the market. A high level of 222 million ounces of free Treasury silver was reached early in 1959, but the supply was nearly cut in half by the end of 1960.[62] The free silver supply was nearly exhausted by the end of 1961, with 1.7 billion ounces still held as backing for the silver certificates. On November 28, 1961, President Kennedy directed the Secretary of the Treasury to suspend the sale of free silver and to start a program of retiring five and ten dollar denominations of silver certificates in order to release an eventual 400 million ounces of silver to be used for coinage requirements.[63] As a result of this action, the market price soon jumped to $1.2929 per ounce in September of 1963.

The largest drain on the Treasury stocks came from the requirements of silver for coinage that had been growing fantastically as a result of the increase in the number of coin machines, coin collectors, and speculators. Finally, as a result of this pressure, Congress passed the Coinage Act of 1965 that created the clad coins of negligible silver content and effected the release of 90% of the Treasury's supply of silver that had been held in reserve to meet the coinage requirements of future years. Also included in this act was a provision prohibiting the melting or exporting of any United States coin.[64] Demonetization of the nation's silver was finally completed on June 24, 1968, when the right to redeem silver certificates for sil-

ver was terminated.

On July 14, 1967, the Treasury halted all government sales of silver at the old monetary rate of $1.2929 per ounce and transferred the sales of silver to the General Services Administration which would sell only two million ounces a week. From the start of this program until its termination on November 10, 1970, the General Services Administration sold 304,886,975 ounces of silver to foreign and domestic purchasers for a total payment to the Treasury of $561,864,722.[65]

The United States Treasury further reduced its supply of silver by 165 million ounces in 1968 by a transfer to the strategic stockpile. This is held as an emergency reserve for times of dire governmental needs, such as a war. However, this transfer was partially negated in 1971 when the General Services Administration transferred back 22.5 million ounces to the Treasury, leaving only 139.5 million ounces in the strategic stockpile.[66]

A Treasury program for melting old silver coins was begun in 1968 and was concluded on June 30, 1970. The yield of silver as a result of this program was the large sum of 212,269,681 ounces. Further reductions in the volume of coins was accomplished during this period when the General Services Administration was authorized to sell, on a bid basis, 2.9 million uncirculated silver dollars. These silver dollars had been stored in Treasury vaults

since they were minted between 1878 and 1891.[67]

With the conclusion of sales from the stockpile of the Treasury, no further sales or auctions from this source are anticipated. There does exist the strategic stockpile, but it is assumed that this silver will be held until needed for defense purposes. The cessation of sales from the government will create a definite void in the supply of silver and should put added emphasis on the production of newly mined silver, the recovery of secondary silver, and the liquidation of silver held in hoards. It should be remembered, however, that if the market price of silver does drop to $1.25 an ounce, the Treasury is required to buy silver at that price.

Hoards comprise the fourth part of silver supply. Although the exact amount of silver held in hoards is impossible to determine, the best estimates place the figure close to 370 million ounces in the United States.[68] Silver is hoarded for two primary purposes. The first is hoarding by industrial users who prefer to buy silver at a low price and create a stockpile which is a sufficient reserve to supply their operations for several months. The second type is largely composed of the hoarding of bullion and coins by individuals; here numismatists have held an ever increasing effect. Both types anticipate rising prices in silver and attempt to either save money by buying when the price is low or make money by selling when the price is high.

The undeterminable amount of silver held as speculative hoards makes it very hard to determine just what price of silver is required for a significant inflow of this silver into world markets to be obtained. It is this speculative overhang that is having such a great effect on the market today, creating great uncertainty and even more speculation.

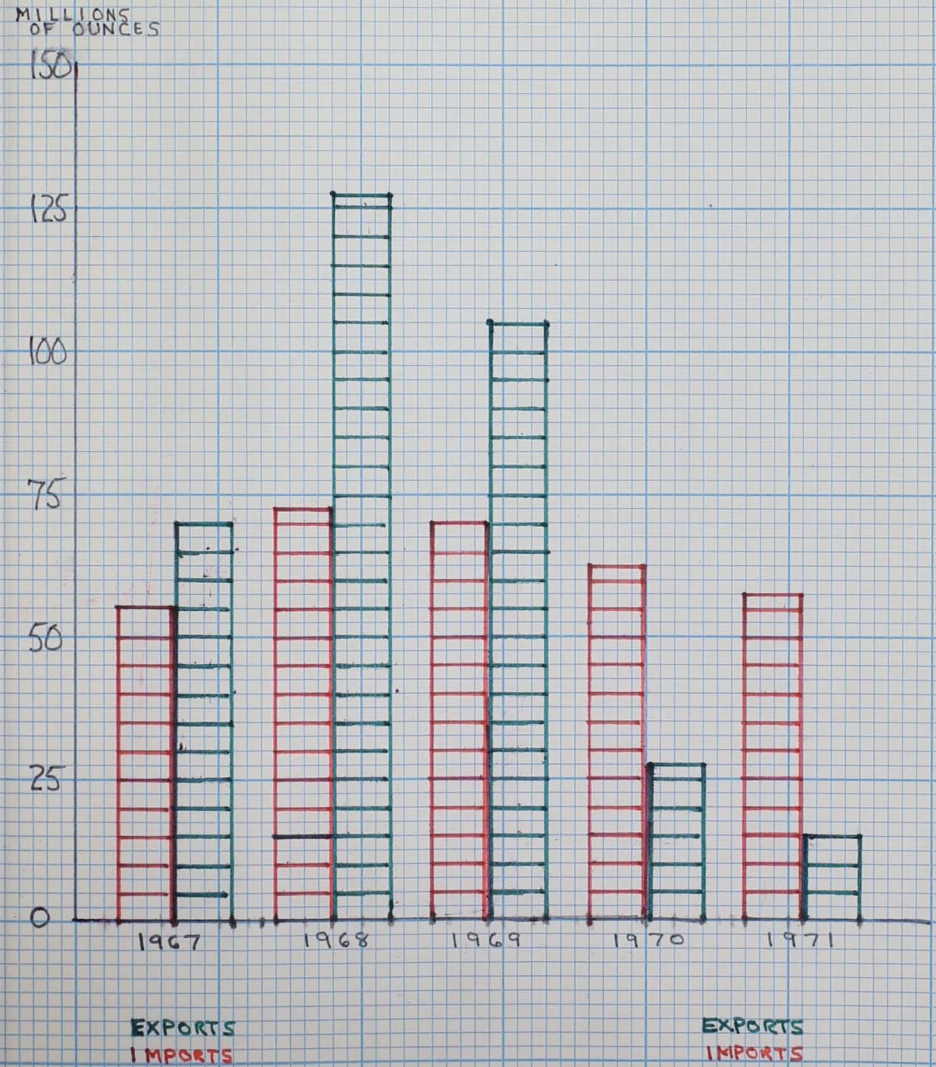
With the world coinage requirements for silver expected to decline to 25 million ounces by 1985, the melting of coins is becoming a major short-term source of silver supply. The 900-fine subsidiary coins estimated to be theoretically in circulation as of January, 1966, contain over 1.85 billion ounces of silver. There is, however, no way to determine the amount lost, destroyed, or placed in collections. Of this amount, 400 million ounces are in silver dollars which are, for the most part, collectors' items and not available to be melted down into bullion; 480 million ounces are in half-dollars; 720 million ounces are in quarters, and 651 million ounces are in dimes.[69] As this source is exploited, the amount is estimated to become negligible by 1980, with a total of one to 1.2 billion ounces recovered.[70] As the supply of coins dwindles, however, the remaining ones will be growing increasingly scarcer and can be expected to grow fairly valuable and become unavailable for melting.

The largest hoards of silver are located in India and China, with a full five billion ounces of silver estimated

to be in India alone.[71] These hoards are so widely dispersed among individuals that no count can be regarded as precise. Presently, the political situation with China and the Indian embargo on exports and imports of silver make these sources very remote from the world's supply. Besides very high prices to drive these hoards out, a changing political situation must come around, making it seem very unlikely that this source will become available in the near future.

The last major source of silver supply for the United States is world trade, which to be a supply must come in the form of imports. The United States is the leading country in the world trade of silver, with imports in 1968 of 70.7 million ounces and exports valued at 247 million dollars.[72] In World War II and again in1964, the United States became a net exporter of silver as foreign demands created a huge drain on Treasury stocks. These two times are the only two in recent history that this has occurred, the rest of the time the United States being a net importer of silver. No tarriff duties are imposed on imports of silver ore or bullion by the United States, largely reflecting the great need we have for this commodity. From 1967 to 1970, Canada supplied the United States with 59% of its imports, followed by Peru with 18%, Mexico with 9%, Honduras with 6%, and 8% coming from the rest of the world.[73] In 1971, the United States imported 52,800,000 ounces, a decline of 16% from 1970. Canada was again the largest supplier with

SILVER IMPORTS-EXPORTS[74]



a total of 31,800,000 ounces, with Peru supplying 11 million ounces, Mexico 3 million, and 4 million ounces from other countries in the Western Hemisphere and 3 million ounces supplied from the rest of the world.[75] While the supply is a major portion of the domestic supply, it must be remembered that as the standard of living increases throughout the world, their consumption of silver will increase, thereby reducing the quantity available for export.

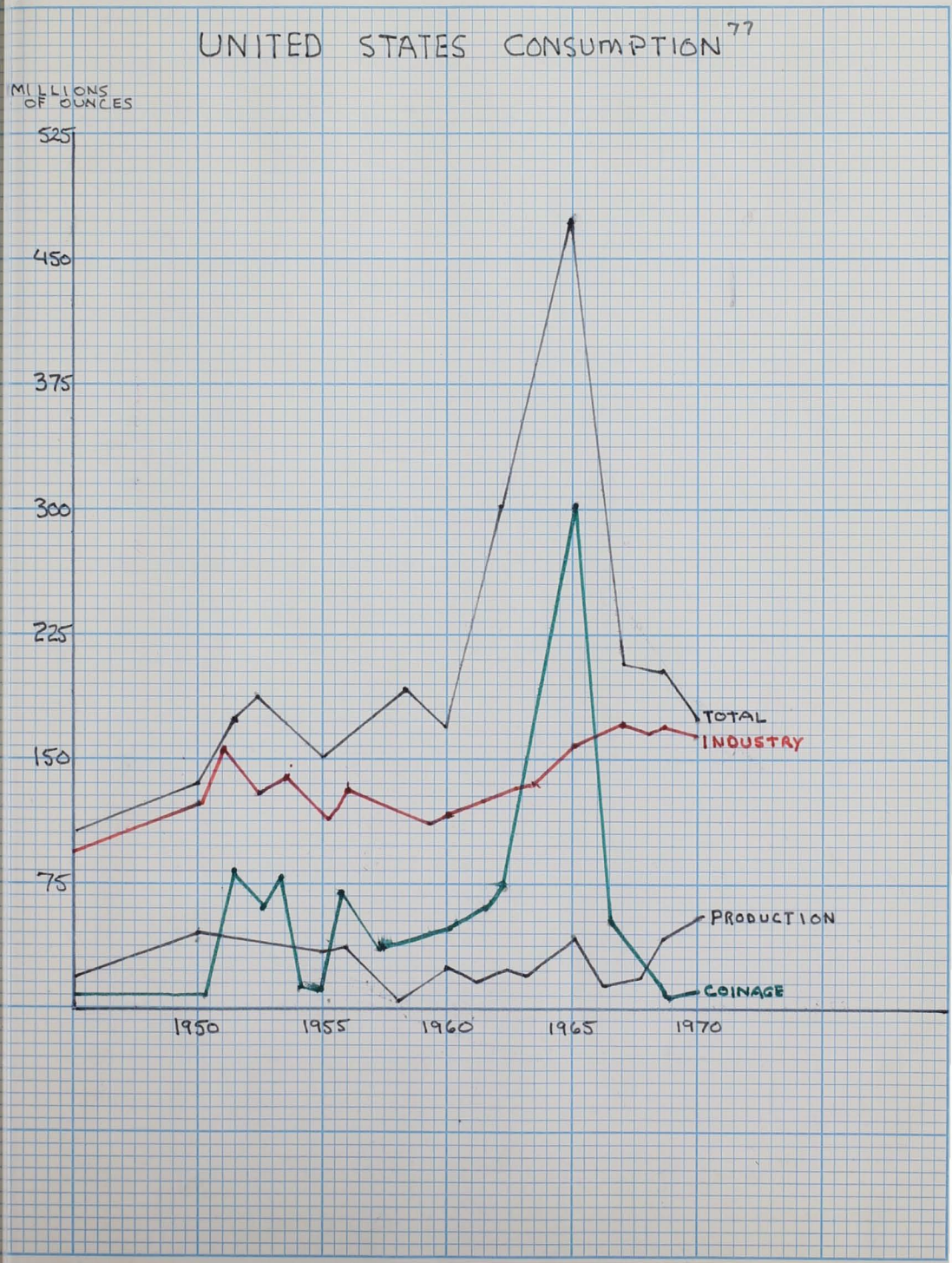
In order to effect a permanent increase on the supply of silver, improved extraction and processing techniques must be developed to lead to new sources. Improved underground mining methods must be derived in order to allow submarginal resources to become economically feasible. Many of the deep mines in operation today are adversely effected by environmental conditions. High temperatures and high rock pressures make mining uncomfortable and hazardous. More efficient ventilation and refrigeration techniques must be developed in order to combat the high temperatures, while efficient techniques of measuring rock pressures and methods prevent rock bursts must be developed in order to handle the problem of high rock pressures. The more the demand for silver grows, the more submarginal resources will be needed. Much research along the lines just suggested what must be done in order to allow the exploitation of these sources of silver.

The demand for silver can be separated into four dis-

tinct divisions. The first is speculative demand, for which no figures exist except those previously given; the second division is the demand for silver in use as coins; the third is exports, and; the last and largest area is the demand for silver for industrial purposes.

Exports of silver from the United States in 1971 totalled 14,700,000 ounces, down from 27.5 million ounces in 1970. West Germany received 3.9 million ounces, the United Kingdom 2.8 million ounces, France 2 million ounces, 1.7 ounces to Switzerland, and 1.5 million ounces to Japan.[76] Since the United States is a net importer of silver, the export of silver hardly seems practical. The growing supply deficit presents a major problem to all silver consumers and must be dealt with directly. The exportation of silver from the United States is a luxury that cannot be afforded and will soon have to stop.

The demand for silver to be used in the manufacture of coins has decreases dramatically since the passage of the Coinage Act of 1965. In 1870, only 0.7 million ounces were used for the production of domestic coins. This figure will increase over the next several years because of the passage of Public Law 91-607 that provided for the minting of commemorative Eisenhower silver dollars that will contain 40% and consume a total of 47.5 million ounces of silver over a five year period. These coins will be sold to the public as proof coins for ten dollars a piece and at



three dollars a piece for all others. Cupronickel Eisenhower dollars will also be produced and placed into genral circulation. Other commemorative coins and medals also have shown a marked increase in production, consuming seven million ounces in 1970. These coins are valued largely for their silver content and are purchased mainly for speculative reasons.[78]

Silver coins already in existence are in very great demand by the public and may not, for this reason, become available for melting down into bullion. Hoarding, coin collecting, use in vending machines, and general use by an ever increasing population have increased the demand for coins a very large amount. Twelve million vending machines in the United states use approximately thirty billion coins annually and contain twenty-two million dollars worth of coins at any one time.[79] Such a huge volume of transactions requires an equally large volume of coins; besides, vending machines cannot distinguish between silver coins and clad coins.

For the average man, an investment in silver coins is hard to beat. The coins can be purchased at face value with no tax paid on the investment; they are easy to store and do not wear out with age; when sold, capital gains taxes are paid and the investor has probably made a good profit.[80] With such a fine set of qualifications, it is no wonder so many people are hoarding silver coins until the day it be-

comes profitable to cash them in for their silver content. This is one of the problems that has led to a shortage in the supply of silver and may threaten to flood the market with bullion from melted down silver coins at a later date when the silver price is very high.

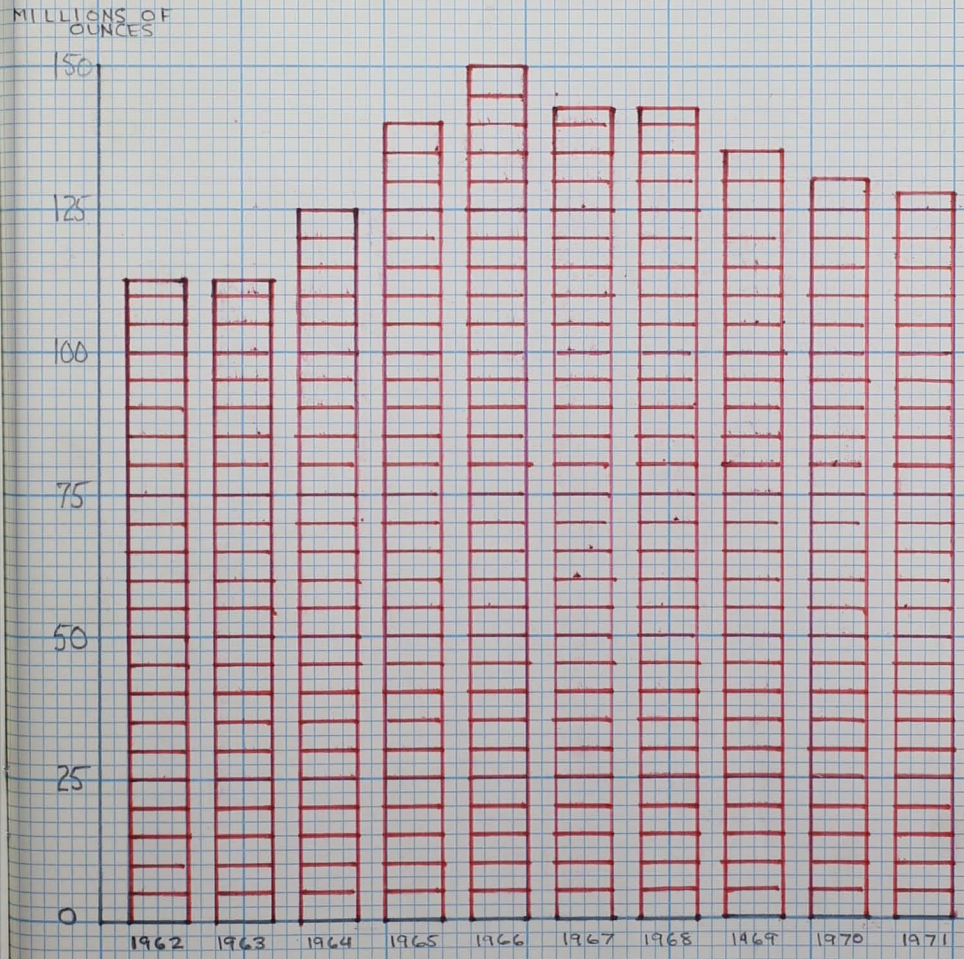
The total United States consumption of silver showed a very definite increase from 1960 when 148 million ounces were used; this figure then dropped to 136 million ounces consumed in 1970.[81] The increase in silver consumption was due largely to the increased number of uses found for silver during this period by the private industry sector of the economy, the defense sector, and the growing space agencies; the sharp decrease in consumption was due largely to the reduced demand for silver uses for coinage and because of the high prices quoted at the end of the decade. The decline in silver consumption during 1970 was largely a result of the general economic recession and its concomittant effect on the automotive, electronics, aerospace, and defense programs.[82] The industrial consumption of silver in 1971 was approximately 126 million ounces. This figure bears out the projected growth rate of industrial silver consumption at an annual average rate of 4.1%.[83] Its use has expanded largely as a result of the growing population and advancing technology, as well as from the increase in the electronics and electrical equipment segment of the economy. Even at substantially higher prices, the consump-

tion of silver is expected to remain constant because of two factors. In the first place, for many uses of silver, no known substitutes are available; secondly, the quantity of silver used in most commodities represents such a minor portion of the whole that it is insignificant to the total and therefore not likely to be substituted.

The qualities of silver that make it valued for industrial, coinage, and decorative purposes are many and varied. Its specific gravity, melting point, malleability, ductility, tensile strength, thermal conductiveness, acid resistance, resistance to corrosion, and the rensitivity to light of some of the silver salts make silver an ideal and indispensable part of many manufactured products; silver also has the highest electrical conductivity known, which makes it excellent as an off-on switch. For decorative and coinage uses, its durability, value, color, and polishing qualities make it perfectly suited for many items of beauty and quality.

Photographic materials consume about 30% of the industrial demand for silver, with electrical equipment and switching gear using 25%; the silverware industry consumes approximately 15% of the entire industrial demand. Other major uses for silver include use in electrical contacts in telephonic and aviational equipment, flourescent lamp controls, electromagnetic counters, protective devices for motors and thermostats, and varied uses in switchboard ap-

INDUSTRIAL CONSUMPTION OF SILVER IN THE UNITED STATES[84]



paratus. Defense requirements account for almost 20% of the average industrial consumption, an amount totalling approximately 27 to 30 million ounces.

The domestic supply for industrial consumption is obtained from new mine production, secondary silver, and imports of ore and bullion. A forecast of the growth in industrial demand predicts a volume of 140 to 280 million ounces of silver needed by the year 2000.[85] This figure is well above that of the new supply, so increased emphasis must come from submarginal resources, private hoards, and secondary silver.

The photographic industry, the leading industrial consumer of silver, is largely centered in New York. Eastman Kodak Company, the largest individual consumer, uses about fifteen tons of silver per week (29,166 troy ounces per ton).[86] Silver usage in the photographic industry is concerned with the silver halides as photographic receptors. These chemicals can amplify the effect produced by the original light exposure by 10" power. No known substitute is available as a use in photographic film development, but much research is underway. If the research is successful, a decrease in the demand of 20 to 25% could be expected.[87] Some reduction in consumption has come about as a result of the increase in the use of Xerography, a silverless electrostatic duplicating process. While this process has reduced the need for silver coated photographic paper

in office copy work, it is not adaptable to color and thus has no effect on the market there.

A full 75% of the silver consumed in the manufacture of electrical equipment goes into high and medium voltage connectors for which no known economic substitute exists. Further, its use in household electrical appliances as off-on switches makes it indispensible for their manufacture. Therefore, the silver consumed by the electrical industry is expected to grow with the population and wealth of the nation.

Other areas of silver use in industrial consumption are also expected to increase. The demand for silver used in jewelry is expected to increase as the affluence of the nation increases. Silverplated stainless steel used for dinner ware has found favorable customer acceptance and is now being manufactured widely as a less expensive substitute for sterling silverware.[88] Increasing quantities of silver are being used in solders and brazing alloys that are employed in airconditioning, refrigeration, and aircraft manufacture. Silver used for medicinal purposes is expected to remain constant because of its low sensitization, broad consistent activity, and because the development of organism strains resistant to silver containing medicine is unknown.[89] Another medicinal use for silver lies in its ability to provide good, strong foils and plates to replace missing bone fragments.

In the aerospace field, the degradation of component products cannot be tolerated, so silver is essential for use in switches. Also, silver is impregnated into the tungsten engine nozzles of missles to reduce damage from high temperatures that are encountered in flight. Each Polaris missile is estimated to contain 5,800 ounces of silver in its engine nozzle.[90]

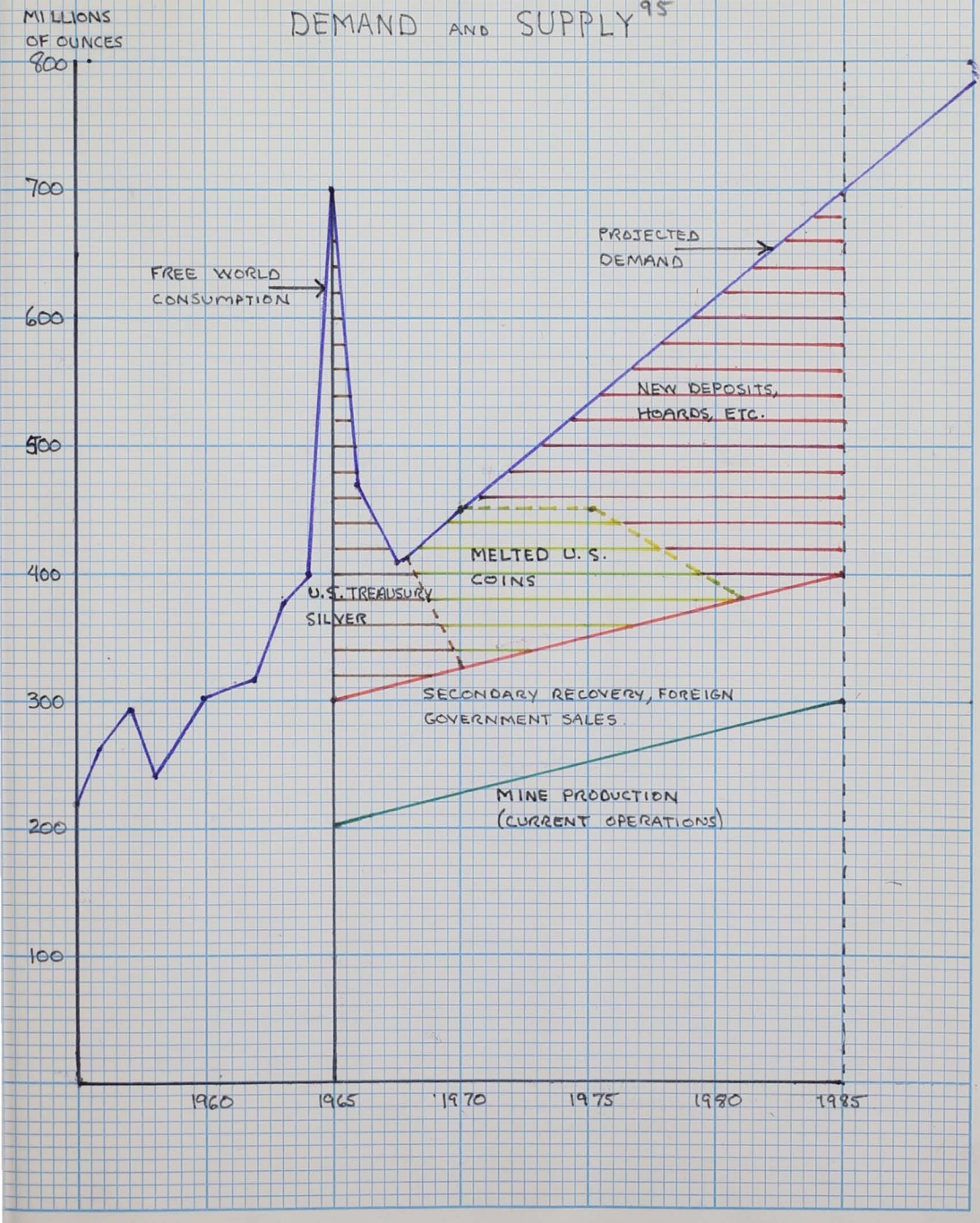
Other minor uses of silver are found in dental analgams, mirrors, catalysts, as use in nuclear reactor control rods, bearings, fuel cells, and epoxy compounds.

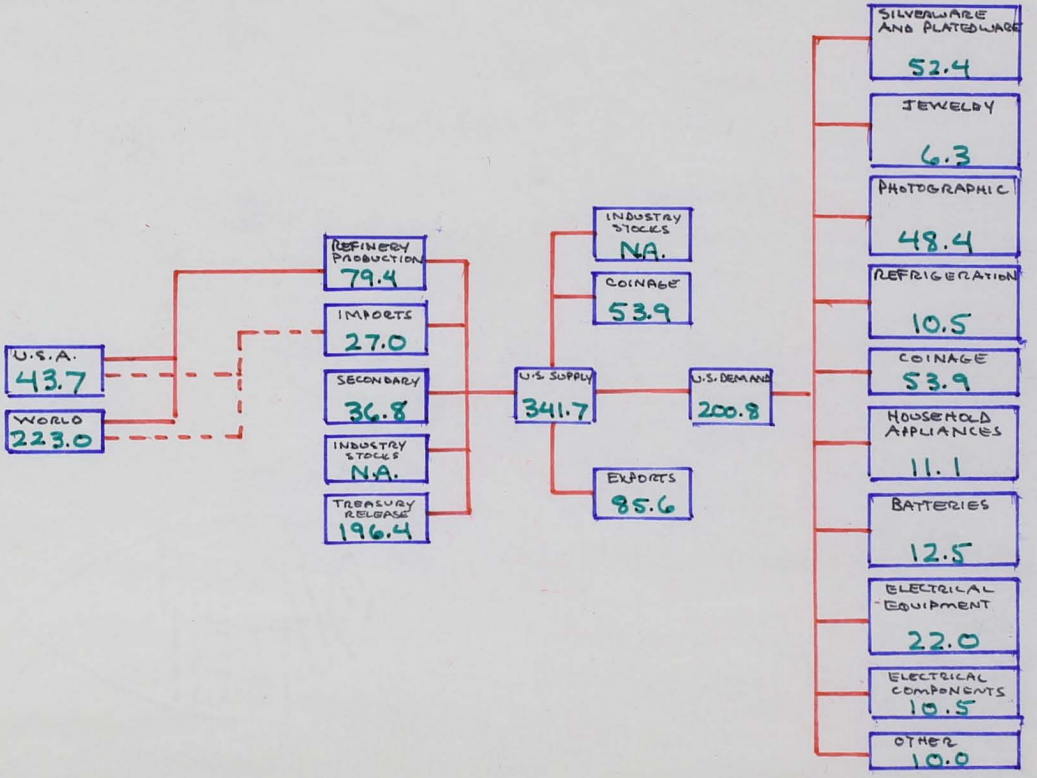
Increased consumption of silver is also to be realized as new products are developed and new uses for silver are found. Silver halide film used for reproduction is being prepared by CBS Electronic Video Recording Company in its new cassette TV system.[91] New silver and palladium inks are being marketed for use as conductors on electronic circuits.[92] Another recent use for silver has been to use silver iodate to diffuse hurricanes. One such experiment on Hurricane Ginger reported to have saved millions of dollars from property damage.[93] Electrically powered cars may provide the single largest increase in silver consumption yet. Silver is used in electrical batteries whenever size and weight are significant considerations. Recently, a car powered by silver-zinc batteries drove to twenty-one speed records for electric cars at the Bonneville Salt Flats.[94] Such a demonstration proved that electric cars are practical besides

being rechargeable, inexpensive, and non-polluting.

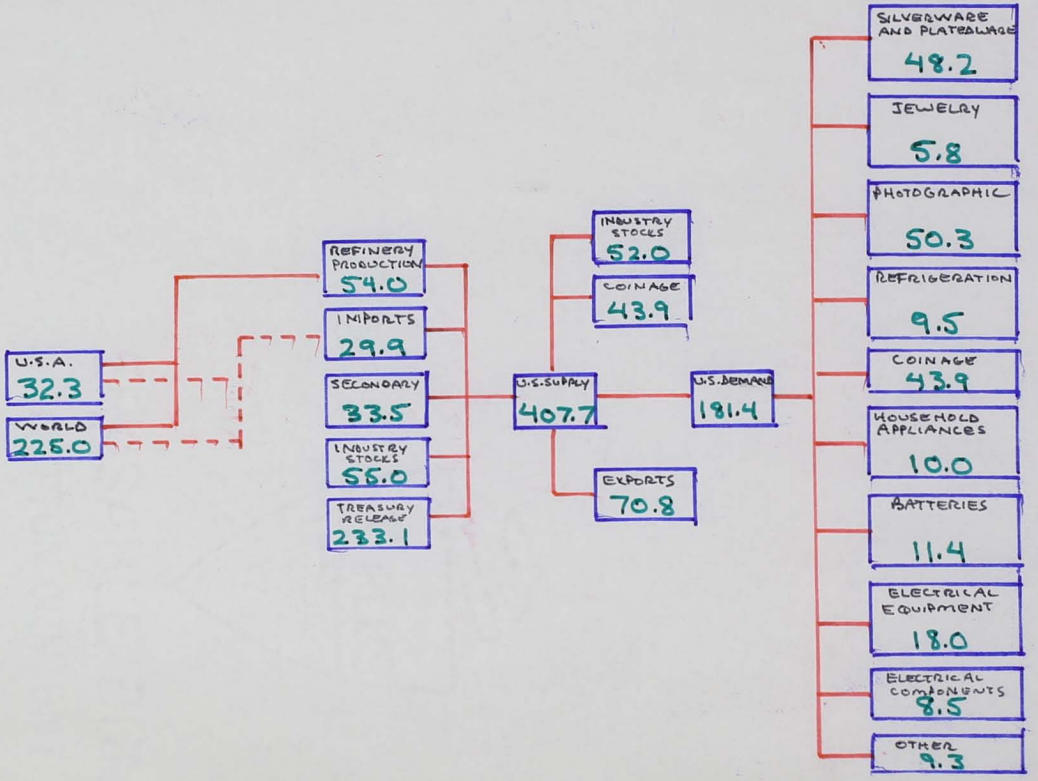
With the analysis of the market factors affecting the price of silver complete, the conclusions concerning this chapter will be presented in the last segment of the paper where they will be of much more value when used in analyzing the results of the correlation test that is presented next.

PROJECTED FREE WORLD SILVER DEMAND AND SUPPLY[95]

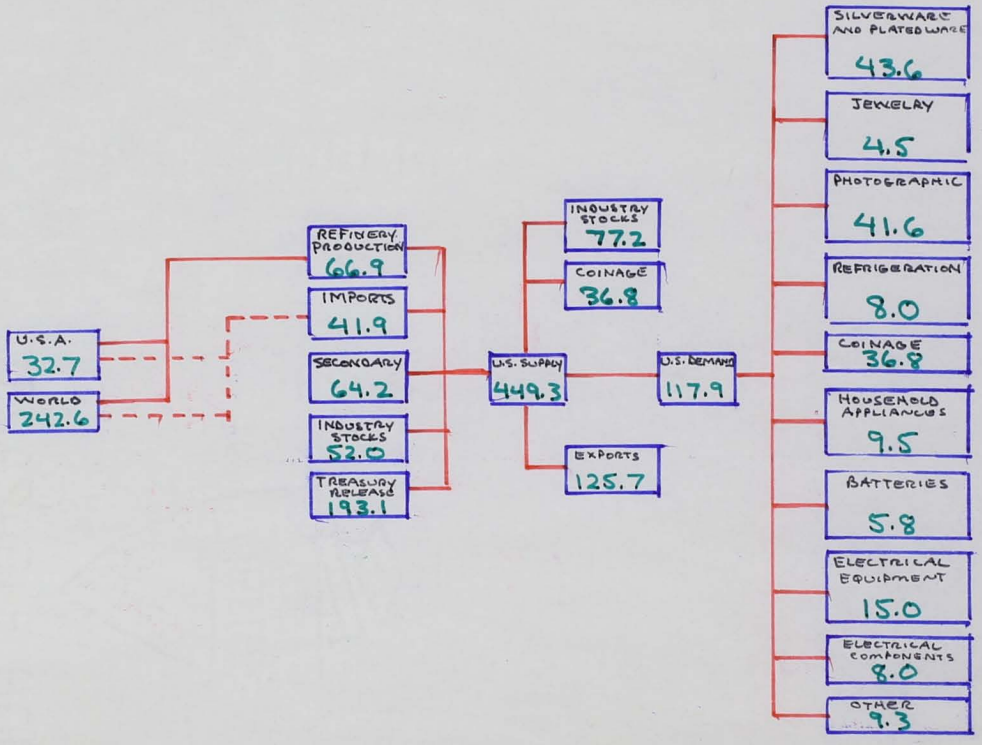




SUPPLY - DEMAND IN 1966

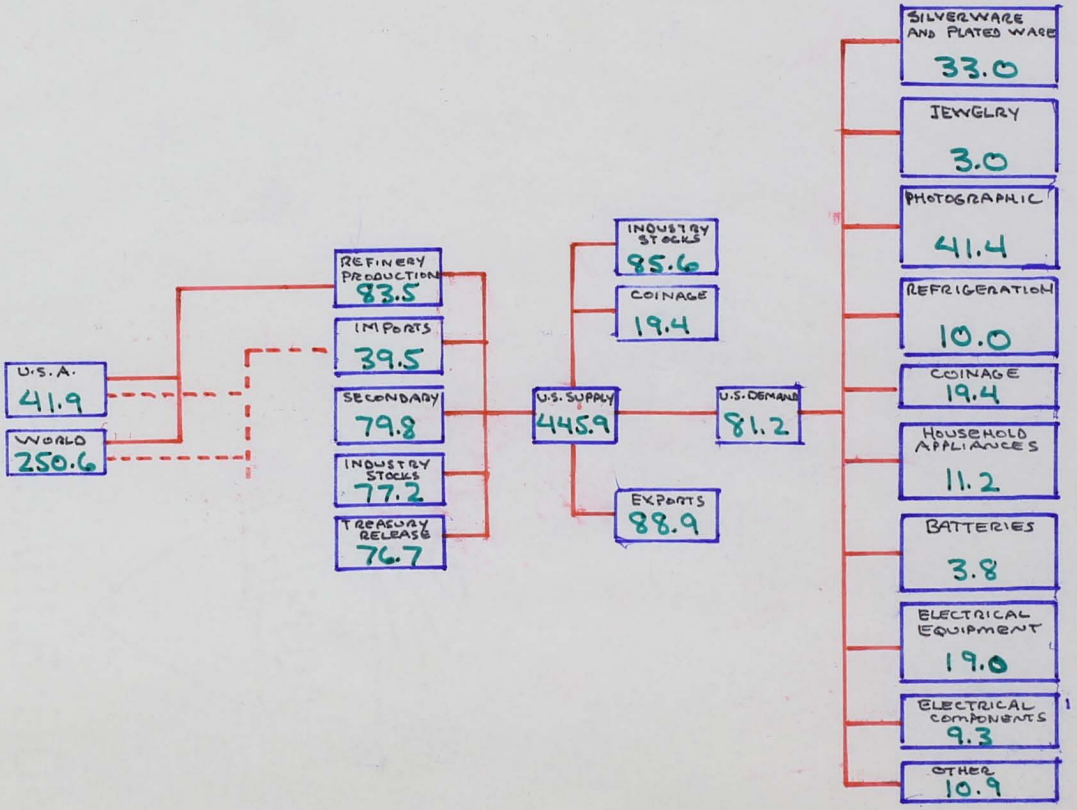


SUPPLY - DEMAND IN 1967



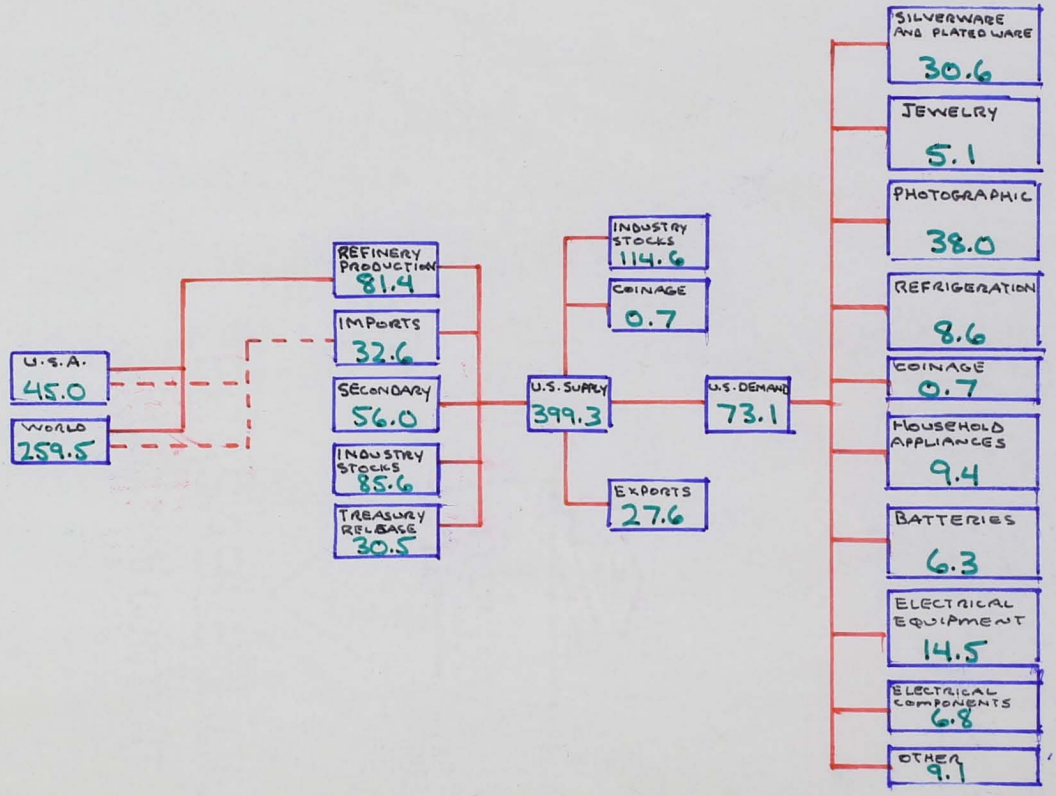
SUPPLY - DEMAND IN 1968

ALL VALUES IN MILLION OUNCES



SUPPLY - DEMAND IN 1969

ALL VALUES IN MILLION OUNCES



SUPPLY - DEMAND IN 1970

ALL VALUES IN MILLION OUNCES

TEST FOR CORRELATION

To determine the actual validity of using silver price as an economic indicator, standard correlation techniques will be used. As a measure of comparison, the percentage price changes in silver will be compared to the percentage price changes of three existing indicators. These indicators, copper, gold, and the Standard and Poor's price index of five-hundred composite stocks, were chosen because each is already in practical use (Business Week's "Figures of the Week") and because each, in some way, has a particular characteristic that relates it to silver.

Copper was chosen because of its industrial uses that make it an essential input into almost all durable good manufacturing. The previous section demonstrated that silver is also used widely in this category and is an indispensible part of most industrial manufacturing. Therefore, any increase in the demand for silver due to increased business activity should tend to drive the price up, assuming a constant supply.

Gold and silver are two of the world's precious metals. Individuals value these two commodities for their rises as a hedge against inflation as well as for their industrial value. Therefore, any increase in the price of one should

also be reflected in the price of the other.

Standard and Poor's price index was selected because it represents a composite of stocks that are traded daily on the New York Stock Exchange. Much of the buying of stocks is on a speculative basis, that is, buying with an expectation to make a capital gain on the purchase and resale of the stock. Therefore, it should serve as a good indicator of the speculative mood of the country. As previously explained, a large portion of the silver sales are conducted as a result of speculative demands, so the speculative mood of the country should also be reflected in the price of silver.

Therefore, in the three indicators chosen, each one embodies in itself a characteristic of silver that makes it valuable. Copper and silver are valuable because of their varied uses in industrial manufacturing; gold and silver are valued for their qualities as precious metals; and the stocks comprising the Standard and Poor's price index and silver are valued for the large gains that may result from their resale.

The percentage price changes of the various items are selected from two criteria. First, a one year lag is employed; this compares the price of one commodity in 1970 to the change of the price occurring at the same time period in 1971. In other words, the price of commodity X during January of 1970 is compared with the price during January,

1971, and the percentage increase or decrease is taken. The second method is to use a one month lag in determining the price change; using this method, the price of commodity X is taken in February, 1971 and the percentage increase or decrease is calculated by comparing it to March of 1971.

In both tests, twelve values are used, each representing the average price for the month. Consequently, enough degrees of freedom are used so as to allow sufficient validity for the calculations.

Since the year of the test is 1971, the price movements of silver during that year should be studied so as to further our understanding of the results.

A general upsurge in the price of silver was expected.[96] The supply of silver promised to be smaller than in previous years due to the cessation of sales from Treasury stocks and from the strikes at domestic copper mines that produce silver as a byproduct; on the demand side, the economic situation was improving and the great unrest in the international monetary arena threatened to create a heavy speculative demand. On November 10, 1970, the last of the weekly auctions of the United States Treasury's silver stock was held, thus making 1971 the first year since 1934 that the silver market was free of any governmental interference. However, the prices in the New York market continued to fluctuate widely with a range of $0.464 between the high and low prices of the year, and increase in that

range of $0.079 since 1970.[97]

For most of the first half of the year, the market was relatively steady with fluctuations between the high and low price at a range of $0.187.[98] Relative firmness developed in the market during April and the high price of the year, $1.752, was reached on April 18th. Much of the buying during April was due to nervousness over a threatened reduction in the silver supply due to a possible strike at all United States non-ferrous metal refineries on June 30, the date of the expiration of the labor contracts. Other buying was caused by the speculation resulting from the crisis developing in the international monetary area.[99] Thus, the buying in the first half of the year was mostly prompted by speculation surrounding the international monetary situation and a threatened shortage of supply.

The price dropped during June and the downward trend in price continued for the rest of the year with only sporadic and unsignificant increases. With President Nixon's announcement on August 15 of the temporary price freeze and the suspension of gold payments in international settlements, the market experienced confusion and disruption. On the 16th and 17th, no offers of silver were made pending assessment of the price freeze; consequently, no prices were publisned due to the lack of a basis upon which they could be computed.[100] The market quickly returned to normal in the next few days following minimal offerings on the 18th.

However, the volume of silver offered exceeded the demand and the downward price trend continued.[101] The surplus of supply was due largely to the heavy buying of the first half of the year, during which individuals stocked up to protect themselves against a possible reduced supply in the latter half of the year.

The low for the year, and the lowest published price since August 22, 1963, was reached on November 3, 1971, and was published as $1.288. This low price was near the $1.250 level the Treasury was required to buy newly mined domestic silver under the provisions of the Coinage Act of 1965.[102] Anticipated purchases by the Treasury were not realized because the market held steady and made some slight upward progress by the end of the year.

Trading on the New York Commodity Exchange, the principle market for future contracts in silver, paralleled that of the spot market. The high price was reached on April 7th for the July, 1972 contract at a price of $1.925 per ounce; the low of $1.274 occurred on November 3rd for the November, 1972 contract.[103] The volume of trade in the New York market was slightly down from the 6,939,700,000 ounces traded in 1970; the 1971 total reached 616,244 contracts of 10,000 ounces each for a total 6,162,440,000 ounces traded. The activity of the spot market was also reflected in the volume of vault stocks of silver in depositories licensed by the New York futures market. The

lowest volume, 106,050,000 ounces was reached on April 2, and the high in Vault stocks was reached on September 8th, when 119,220,000 ounces were stored,[104] thereby slightly anticipating the spot market low occurring in November.

Two other domestic futures markets, the Chicago Board of Trade and the West Coast Commodity Exchange (just recently opened on October 15, 1970), increased their volume of trade significantly. The volume of transactions on the Chicago Board of Trade increased 39% since 1970,[105] while no precise figures exist for the West Coast market.

Thus, the market for silver in 1971 was relatively steady for the six months of the year but then dropped steadily during the latter half. If there is to be any correlation between the price of silver and the activity of the domestic economy, then it should be expected that the level of economic activity also dropped during the latter half of the year. However, this is not what happened and the results of the correlation tests bear this out. It can easily be seen that the coefficients of determination of the six tests are all well below the maximum and ideal value of positive one and do approach zero, coming very close to exhibiting no correlation at all. On the average, the tests utilizing a one year time lag show the better correlation, but even the highest value in this group, 0.2820, is very poor. Therefore, the conclusion must be that there is no correlation between the changes

in the price of silver and the level of economic activity in the United States. An analysis of this finding will be carried out in the next section of this paper.

SILVER

	1970	1971	YEAR LAG	PER CENT CHANGE	MONTH LAG	PER CENT CHANGE
JAN	188.0¢	162.0¢	26.0	1.38	0.00	0.00
FEB	189.5	160.0	29.5	1.55	2.0	0.12
MAR	189.0	168.0	21.0	1.11	8.0	0.05
APR	186.0	172.0	15.0	0.80	4.0	0.23
MAY	166.0	167.8	1.8	0.10	4.2	0.24
JUN	163.0	160.0	3.0	0.18	7.8	0.46
JUL	169.0	158.0	11.0	0.65	2.0	0.12
AUG	179.2	158.0	21.2	1.18	0.00	0.00
SEP	180.0	141.0	39.0	2.16	17.0	1.07
OCT	174.8	133.0	41.8	2.39	8.0	0.56
NOV	177.0	128.8	48.2	2.72	4.2	1.00
DEC	162.0	138.5	23.5	1.45	10.3	0.74

COPPER

	1970	1971	YEAR LAG	PER CENT CHANGE	MONTH LAG	PERCENT CHANGE
JAN	54.9	52.4	2.5	0.45	2.2	0.40
FEB	56.5	50.4	6.1	1.08	2.0	0.38
MAR	56.5	50.4	6.1	1.08	0.0	0.00
APR	58.4	52.0	6.4	1.09	1.6	0.31
MAY	60.2	52.8	7.4	1.22	0.8	0.15
JUN	60.2	52.8	7.4	1.22	0.0	0.00
JUL	60.2	52.8	7.4	1.22	0.0	0.00
AUG	60.1	52.9	7.2	1.19	0.1	0.01
SEP	60.1	52.9	7.2	1.19	0.0	0.00
OCT	59.9	52.8	7.1	1.18	0.1	0.01
NOV	56.1	52.8	3.3	0.58	0.0	0.00
DEC	54.6	50.4	4.6	0.84	2.4	0.45

GOLD

	1970	1971	YEAR LAG	PER CENT CHANGE	MONTH LAG	PER CENT CHANGE
JAN	34.9	37.7	2.8	0.80	0.3	0.08
FEB	34.9	38.8	3.9	1.11	1.1	0.29
MAR	35.0	38.8	3.8	1.08	0.0	0.00
APR	35.5	38.9	3.4	0.95	0.1	0.02
MAY	35.9	40.2	4.3	1.19	1.3	0.33
JUN	35.1	40.2	5.1	1.45	0.0	0.00
JUL	35.3	40.7	5.4	1.53	0.5	0.12
AUG	35.3	42.8	7.5	2.12	2.1	0.51
SEP	36.3	41.6	5.3	1.46	1.2	0.28
OCT	37.3	43.6	6.3	1.68	2.0	0.48
NOV	37.3	42.7	5.4	1.44	0.9	0.20
DEC	37.4	43.4	6.0	1.60	1.3	0.30

STANDARD AND POOR'S INDEX

	1970	1971	YEAR LAG	PER CENT CHANGE	MONTH LAG	PER CENT CHANGE
JAN	91.08	92.70	1.7	0.18	3.6	0.40
FEB	86.20	97.00	10.8	1.25	4.3	0.46
MAR	89.00	99.10	10.1	1.13	2.2	0.22
APR	87.90	101.90	14.0	1.59	2.8	0.28
MAY	77.10	102.40	25.3	3.28	0.5	0.04
JUN	76.00	99.90	23.9	3.14	2.5	0.24
JUL	75.20	99.10	23.9	3.17	0.8	0.08
AUG	77.30	96.10	18.8	2.43	3.0	0.30
SEP	82.00	100.10	18.1	2.29	4.0	0.41
OCT	84.60	98.40	13.8	1.63	1.7	0.17
NOV	83.80	93.30	9.5	1.13	5.1	0.51
DEC	89.10	97.20	8.1	0.90	3.9	0.41

SILVER (X) vs. COPPER (Y)

	YEAR LAG	MONTH LAG
$\bar{X}$	0.1306	0.0420
$\bar{Y}$	0.1028	0.0143
ΣX^2	0.2790	0.0359
ΣY^2	0.1348	0.0062
ΣXY	0.1508	0.0050
N	12.0000	12.0000
ΣX	1.5670	0.5040
ΣY	1.2340	0.1710
$\Sigma(x-\bar{x})^2$	0.0743	0.0148
$\Sigma(y-\bar{y})^2$	0.0080	0.0038
$\Sigma(x-\bar{x})(y-\bar{y})^2$	0.0109	0.0010
r^2	0.2820	0.0178

SILVER (x) vs. GOLD (Y)

	YEAR LAG	MONTH LAG
$\bar{x}$	0.1306	0.0420
$\bar{y}$	0.1368	0.0218
Σx^2	0.2790	0.0359
Σy^2	0.2387	0.0091
Σxy	0.2206	0.0111
N	12.0000	12.0000
Σx	1.5670	0.5040
Σy	1.6410	0.2610
$\Sigma(x-\bar{x})^2$	0.0743	0.0148
$\Sigma(y-\bar{y})^2$	0.0143	0.0035
$\Sigma(x-\bar{x})(y-\bar{y})^2$	0.0063	0.0002
r^2	0.0367	0.0007

SILVER (X) VS. STANDARD AND POOR'S

	YEAR LAG	MONTH LAG
$\bar{X}$	0.1306	0.0420
$\bar{Y}$	0.1843	0.0293
ΣX^2	0.2790	0.0359
ΣY^2	0.5196	0.0129
ΣXY	0.2377	0.0171
N	12.0000	12.0000
ΣX	1.5670	0.5040
ΣY	2.2100	0.3480
$\Sigma(X-\bar{X})^2$	0.0743	0.0148
$\Sigma(Y-\bar{Y})^2$	0.1123	0.0028
$\Sigma(X-\bar{X})(Y-\bar{Y})^2$	0.0509	0.0025
r^2	0.1923	0.1387

SUMMARY AND CONCLUSIONS

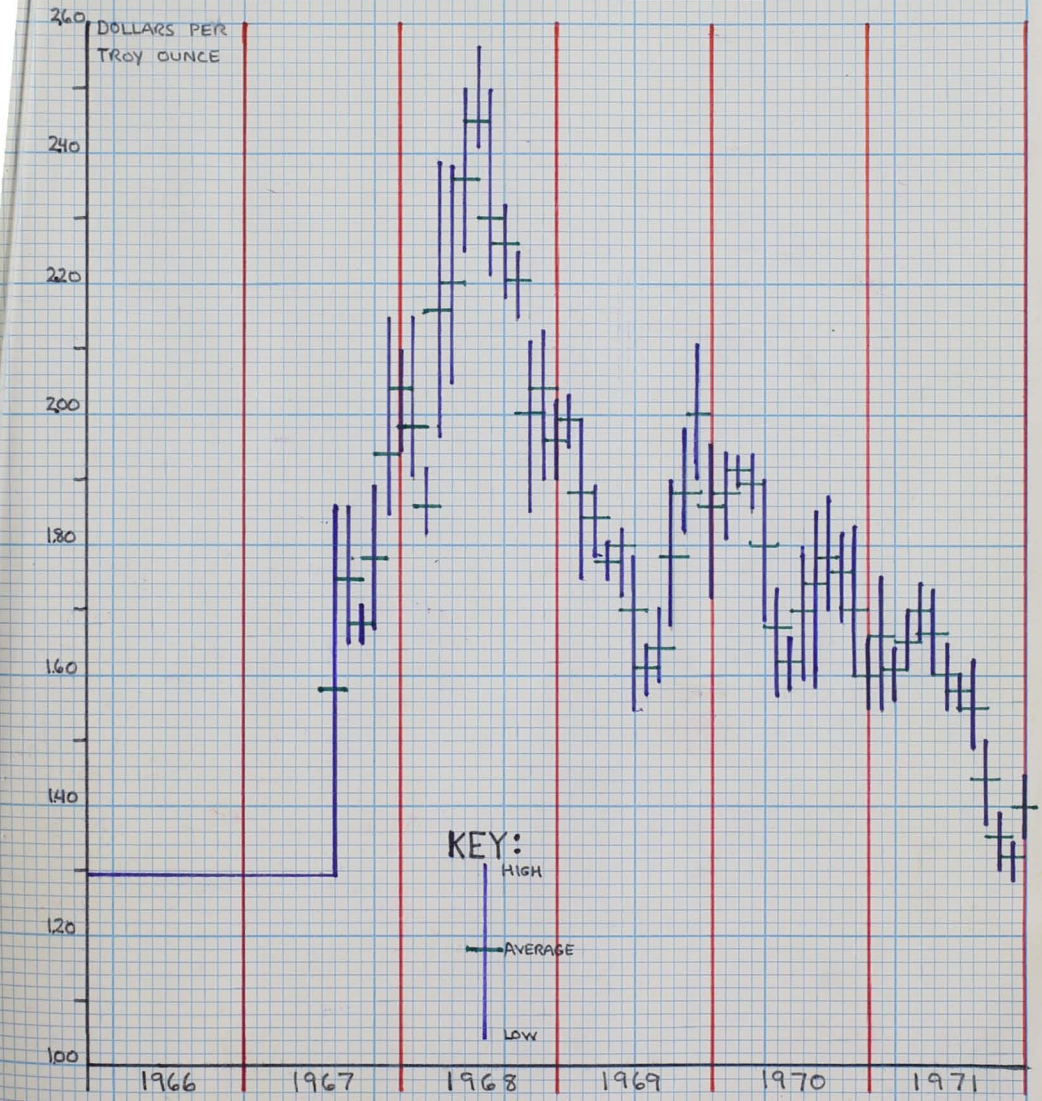
From the results of the tests for correlation, it is obvious that the changes in silver prices do not serve as a good indicator for the level of economic activity. While this test includes only figures obtained from the domestic economy, a brief survey of other world markets should indicate that the trends in silver prices are not confined solely to United States shores. A brief glance at the chart on the next page will indicate the close similarity to silver prices paid in New York and London, the world's two leading markets for trading in this commodity.

Prices on the London market for silver so closely paralleled those existing in the United States both as to levels of prices and times those were reached, that it should be obvious to conclude that the world's trading in silver is, indeed, a worldwide process and not one limited to the borders of each separate country. The economic conditions throughout the world seem to shape the price of silver more than does our domestic economy; perhaps this is one reason for the failure of the correlation tests. The high for the year on the London market of 72.6 pounds (equivalent to $1.754) was reached on April 8; the low price for the year was quoted at 51.0 pounds ($1.272)

SILVER QUOTATIONS[106]

	NEW YORK			LONDON		
	HIGH	LOW	AVERAGE	HIGH	LOW	AVERAGE
1971	175.200¢	128.800¢	154.564¢	72.600p	51.000p	62.969p
1970	193.000	157.200	177.082	192.250d	156.750d	176.876d
1969	202.500	154.000	179.067	205.500	156.500	180.698
1968	256.500	181.000	214.460	259.000	185.000	219.479
1967	217.000	129.300	154.967	221.000	111.500	141.978
1966	129.300	129.300	129.300	112.125	111.375	111.878
1965	129.300	129.300	129.300	112.125	109.750	111.578
1964	129.300	129.300	129.300	112.250	111.625	111.923
1963	129.300	121.000	127.912	111.750	103.875	110.126
1962	129.200	101.000	108.374	104.250	84.375	91.510

NEW YORK SILVER PRICES
MONTHLY RANGES [107]



on November 2, 1971. By the end of the year, the market had shown a slight rally with the closing price published as 53.7 pounds ($1.371). Such a close parallel to prices in the United States seems more than coincidental and the similarity becomes increasingly obvious when a comparison is made of the prices for the past several years.

Thus, silver appears to be an international commodity rather than a solely domestic ore. Further investigations into the world picture should provide more insight into the problem of deciding what determines silver price movements.

As is the situation in the United States, foreign production of newly mined silver exceeded consumption since the years from World War I, but in the decade of the 1960's a sharp reversal took place and consumption greatly exceeded new production, with only 171 million ounces produced during 1965 but with 252 million ounces consumed during the same year. A 2% annual increase in the mine production of silver has been predicted for the entire world, while at the same time a 5% annual increase in industrial consumption alone has been predicted.[108] The annual free world deficits in silver supply has been estimated to be 275 million ounces by 1980 and 375 million ounces by 1985.[109] The only area of silver demand that is anticipated to decrease lies in the requirements for coinage. 1971 saw 19 million ounces of silver consumed for coinage purposes, a drop of nearly 1.3 million ounces since 1970. At a time when the

demand for silver far exceeds the new supply created from production, the world can hardly afford the luxury of minting silver coins.

The long term deficits in silver supply that have been predicted should be balanced by silver hoards being liquidated and their contents flowing into world markets and silver exploited from new production. World silver mine reserves are estimated to be approximately 5,500 million ounces.[110] Much of this, however, is in submarginal reserves and undiscovered deposits. A great deal of research and exploration must be carried on in order to realize the potential yield of silver from these sources.

Much of the United States supply of silver has been supplied by imports for a number of years. With the demand in the rest of the world expected to increase as the standard of living increases, the cumulative demand should reach 9.2 to 14.1 billion ounces by the year 2000.[111] With a present availabe supply of 4.2 billion ounces, the rest of the world could very well be faced with a crisis in supply and be forced to curtail exports to the United States. Predictions have been made that claim the sum total of domestic and world resources should meet the demand until the year 2000.[112] After that, new production must increase to meet the demand or the price of silver will skyrocket.

The single most important factor affecting the price of silver at present is the tremendous volume of specula-

tive stocks that have been built up over the past several decades. Estimates place the volume of these holdings in billions alone at about 350,000,000 to 450,000,000 ounces.[113] Such large speculative holdings should considerably restrain any marked or significant price increases until the holding can be liquidated. Another form of hoarding that overhangs the market comes from inventory accumulations by industrial consumers at a time when they feel the price is low or about to increase. The demand they create when purchasing large volumes of silver drives up the price but then, afterwards, their consumption is satiated for the present and the price drops because of the excess supply created by the small demand. Higher prices will definitely be needed to force the liquidation of these stocks, but how much higher nobody seems to know. Even during 1971, with an average silver price of $1.54564, about 60 million ounces of this speculative overhang were absorbed in the market.[114] Continued reductions in these speculative holdings can be expected, but at what rate or what price is unknown. A modest price increase should take place over the next few years due to the excess of consumption over production; the level of the increase depends to a large extent on the reactions of the speculators.

Thus, the price of silver today seems to be affected to a great degree by the large speculative holdings that overhang the market. These holdings are the dominant

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TIME - PRICE RELATIONSHIP[115]

market force today and serve to create a great deal of uncertainty. This uncertainty is what makes the changes in silver prices unacceptable as an economic indicator. Once these speculative holdings are absorbed, the price of silver should be determined mainly from the relationship between the supply of new silver production and the industrial demand for it. At that time, the use of silver price changes should serve as a valid and valuable economic indicator.

FOOTNOTES

FOOTNOTES

[1]"Silver", Mineral Facts and Problems, U. S. Department of the Interior, 1971, p. 729.

[2]Eugene S. Klise, Money and Banking, 1968, p. 52.

[3]Klise, p. 52.

[4]Klise, p. 53.

[5]D'Arcy Bannister and Richard Knostman, Silver in the United States, 1969, p. 2.

[6]Klise, p. 59.

[7]Bannister and Knostman, p. 3.

[8]Bannister and Knostman, p. 3.

[9]Bannister and Knostman, p. 3.

[10]Bannister and Knostman, p. 3.

[11]Klise, p. 64.

[12]Bannister and Knostman, p. 3.

[13]"Silver", p. 729.

[14]"Silver", p. 729.

[15]Bannister and Knostman, p. 3.

[16]"Silver", p. 729.

[17]"Silver Coins and the Space Age", Federal Reserve Bank of San Francisco Monthly Review, October, 1966, p. 3.

[18]"Silver Coins and the Space Age", p. 3.

[19]"The Silver Market 1971", Handy and Harman, 1972, p. 6.

[20]"The Semiprecious Metal", Federal Reserve Bank of San Francisco Monthly Review, December, 1971, p. 205.

[21]David H. McKinley, Murray G. Lee, Helene Duffy, Forecasting Business Conditions, p. 21.

[22]Bannister and Knostman, p. 24.

[23]"Silver", p. 730.

[24]"Commodity Data Summaries", Bureau of Mines, January, 1972, p. 135.

[25]"The Silver Market 1971", p. 10.

[26]Bannister and Knostman, p. 9.

[27]Bannister and Knostman, p. 9.

[28]Bannister and Knostman, p. 9.

[29]"Commodity Data Summaries", p. 134.

[30]"Silver", p.724.

[31]Bannister and Knostman, p. 10.

[32]Bannister and Knostman, p. 1.

[33]"Silver", p. 736.

[34]Bannister and Knostman, p. 18.

[35]Bannister and Knostman, p. 7.

[36]Bannister and Knostman, p. 19.

[37]"Silver", p. 723.

[38]Bannister and Knostman, p. 18.

[39]Bannister and Knostman, p. 12.

[40]Bannister and Knostman, p. 13.

[41]Bannister and Knostman, p. 12.

[42]Bannister and Knostman, p. 11.

[43]Gold and Silver Monthly, U. S. Department of the Interior, September, 1971, p. 1.

[44]Bannister and Knostman, p. 16.

[45]Bannister and Knostman, p. 12.

[46]Bannister and Knostman, p. 11.

[47]Bannister and Knostman, p. 16.

[48]"Silver Coins in the Space Age", p. 3.

[49]Bannister and Knostman, p. 10.

[50]Bannister and Knostman, p. 12.

[51]Bannister and Knostman, p. 28.

[52]"Silver", Minerals Yearbook, 1970, p. 9.

[53]Minerals Yearbook, p. 3.

[54]Bannister and Knostman, p. 6.

[55]Bannister and Knostman, p. 7.

[56]Minerals Yearbook, p. 3.

[57]"Silver", p. 728.

[58]Minerals Yearbook, p. 3.

[59]Minerals Yearbook, p. 9.

[60]"Silver", p. 736.

[61]Bannister and Knostman, p. 3.

[62]"The Silver Market 1971", p. 4.

[63]"Silver Coins and the Space Age", p. 3.

[64]"Silver", p. 729.

[65]Minerals Yearbook, p. 2.

[66]Minerals Yearbook, p. 2.

[67]Minerals Yearbook, p. 1.

[68]"Silver", p. 736.

[69]Bannister and Knostman, p. 19.

[70]Bannister and Knostman, p. 31.

[71]"Silver", p. 736.

[72]"Silver", p. 728.

[73]"Commodity Data Summaries", p. 134.

[74]"The Silver Market 1971", p. 11.

[75]"The Silver Market 1971", p. 12.

[76]"The Silver Market 1971", p. 12.

[77]"The Semiprecious Metal", p. 205.

[78]Minerals Yearbook, p. 1.

[79]Bannister and Knostman, p. 21.

[80]The Silver Institute Letter, The Silver Institute, October, 1971, p. 4.

[81]"The Semiprecious Metal", p. 205.

[82]"The Silver Market 1971", p. 1.

[83]Bannister and Knostman, p. 21.

[84]"The Silver Market 1971", p. 10.

[85]"Silver", p. 723.

[86]Bannister and Knostman, p. 21.

[87]"Silver", p. 724.

[88]Minerals Yearbook, p. 4.

[89]"Silver", p. 734.

[90]Bannister and Knostman, p. 23.

[91]Minerals Yearbook, p. 4.

[92]Minerals Yearbook, p. 4.

[93]The Silver Institute Letter, p. 1.

[94]Bannister and Knostman, p. 30.

[95]"The Semiprecious Metal", p. 205.

[96]"The Silver Market 1971", p. 5.

[97]"The Silver Market 1971", p. 5.

[98]"The Silver Market 1971", p. 7.

[99]"The Silver Market 1971", p. 7.

[100]"The Silver Market 1971", p. 5.

[101]"The Silver Market 1971", p. 8.

[102]"The Silver Market 1971", p. 8.

[103]"The Silver Market 1971", p. 9.

[104]"The Silver Market 1971", p. 9.

[105]"The Silver Market 1971", p. 22.

[106]"The Silver Market 1971", p. 6.

[107]Bannister and Knostman, p. 26.

[108]Bannister and Knostman, p. 31.

[109]"Silver", p. 726.

[110]"Silver", p. 724.

[111]"Silver", p. 723.

[112]"The Silver Market 1971", p. 17.

[113]"The Silver Market 1971", p. 18.

[114]"Silver", p. 730.

[115]"Silver", p. 730.

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