EFFECT OF TAXATION ON THE BASE METALS INDUSTRY IN MEXICO

by

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Chairman, Departmental Committee
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April 11, 1960

Professor Philip Franklin
Secretary of the Faculty
Massachusetts Institute of Technology
Cambridge 39, Massachusetts

Dear Professor Franklin:

In accordance with the requirements for graduation, I herewith submit a thesis entitled "Effect of Taxation on the Base Metals Industry in Mexico". I should like to express my appreciation for the time and assistance granted me by officials from American Smelting and Refining Company, Anaconda Copper Company, and American Metals Climax Company. I should also like to thank Professor Roland Parks, Associate Professor of Mineral Industries, M.I.T., and Professor Victor Andrews, Assistant Professor of Finance, M.I.T., for their suggestions and assistance, both in research and in preparing the final draft of this thesis.

Sincerely yours,

Donald H. Shaw

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Submitted to the School of Industrial Management on April 11, 1960, in partial fulfillment of the requirements for the degree of Master of Science.

ABSTRACT

The hypothesis of this thesis is that high taxation on the base metals mining and smelting industry is likely to cause a decline in that industry in the near future, and such a decline would seriously affect the nation's economy.

Chapter I provides a summary of the question, method of investigation, conclusions, and suggested fruitful areas for further study.

Chapter II investigates the base metal resources of Mexico, as well as the structure of the base metal mining and smelting industry. Presently-known economic deposits of copper, lead, and zinc will last from five to ten years at present rates of production. Furthermore, mineral exploration is insignificant. The system of high taxes is blamed for the lack of exploration and low mineral reserves. The industry is concentrated in the hands of a few American corporations. A steadily increasing production of zinc would have warranted a tripling of refined zinc capacity fifteen years ago. The high taxes have evidently discouraged American corporations from further capital investment.

Chapter III provides a brief outline of Mexican taxes, and in particular the unusual taxes on the mining industry. By comparative examples of taxation of a hypothetical firm, it is shown that the only advantage to operations in Mexico is cheap labor. From an illustration drawn from financial reports, it is shown that taxes force companies to sustain a financial loss. The annual budget for the Mexican Government is reviewed, and it is noted that whereas a substantial portion of Mexican revenue comes from the mining companies, no money is reinvested in an area that would directly benefit the mining industry.

Chapter IV shows that United States investments in mining and smelting in Mexico are decreasing in comparison to similar investments in manufacturing. Furthermore, United States investment in mining is growing much more rapidly in other parts of the world than in Mexico. Exports of base metals are analyzed. It is discovered that lead exports are quite steady, copper is growing in value but declining in tonnage, and that zinc is increasing. The total value of base metals exports as a percent of total export value is distinctly declining.

Chapter V discusses production of base metals, showing that it is a very small part of Mexico's gross national product. Copper production is declining, lead is steady, and zinc is increasing rapidly. A correlation analysis is undertaken to determine if taxes had any effect on the year-to-year production pattern of the Mexican mining industry. The results are not conclusive.

The conclusions are that the Mexican mining and smelting industry is not likely to decline in the short term, that is, in the next ten years. High taxes on the mining industry are channeling United States investment into Mexican manufacturing, and United States mining investment into other areas of the world. Finally, even if base metals mining declines after ten years, it is not likely to have any adverse effect upon the Mexican economy.

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CHAPTER I

INTRODUCTION

The Problem and Background

Since 1900 Mexico has been a major world producer of copper, lead and zinc. In fact, until 1946 Mexico's economy has been dependent upon the production and export of these metals, as well as upon silver and gold. In turn, the mining and smelting industry has been dependent upon foreign investment for large-scale extraction of the base metals. Ninety percent of this investment may be attributed to American mining companies. Since World War II, however, Mexico has increased her pace in providing a stimulating environment for investment in manufacturing. In order to become a manufacturing nation, taxes have steadily increased, especially taxes upon the mining and smelting industry. The American mining companies bearing the brunt of the extraordinarily high taxes claim that the base metals industry will decline in terms of investment and output, and that this decline will seriously jeopardize the Mexican economy.

Mexican industry shared the world depression the early 1930's, although the agriculture-based economy did not suffer the bread lines common in the industrial nations. An upswing of business from 1933-1937 was general, although manufacturing enterprises benefited most. A number of factors caused the economic surge, including rising prices of silver, base metals, and petroleum, devaluation, good crops in 1933, growing tourist traffic, credit expansion, public works financed by current federal revenues and local bond issues, and advances from

government-controlled credit institutions. Mineral exports in 1934 were double those in 1933 with silver assuming unusual prominence. However, during the latter part of the Cardenas Administration (1934-1940), industrial development nearly halted. The reason was the expropriation of railroads, oil, and some manufacturing plants. (1937-1938).

The most active period of company organization and industrial expansion took place following the inauguration of General Manuel Avila Comacho on December 1, 1940. During the preceding thirty years, the government had concentrated on agrarian reform, social reform, and a policy of subordinating foreign economic influence. General Comacho, on the other hand, followed a policy of encouragement toward all industry and investment, foreign and domestic. During the war years, investment in mining accounted for 25 percent of the foreign direct investment.

At the outbreak of World War II, Mexican mineral production was substantially lower than it had been during the peak years of the twenties. The low production may be explained by the recent depression, loss of European markets in 1940, labor-management difficulties, and the reluctance of companies to invest in Mexico as a result of the oil expropriation. As soon as it became apparent that the United States might enter World War II, the U. S. Metals Reserve Company contracted with the Mexican government to purchase certain minerals for a period of eighteen months. The contract originally signed on July 15, 1941, was later extended for an indefinite period. The silver industry and the associated lead-zinc industry was stimulated

by a separate United States agreement in 1942 to purchase all newly mined Mexican silver for 45 cents per ounce.

The war resulted in opening new and inactive mines, as well as stimulating the exploitation of then operating mines. Legislation exempted new mines, whether nationally-owned or foreign-owned, from taxation for a period of five years, and allowed duty-free importation of certain items of machinery. After 1942 there was a marked increase in the production of arsenic, bismuth, chromium, coal, copper, graphite, iron, lead, manganese molybdenum, silver, tin, and zinc. Large amounts of foreign and domestic capital were invested in mills and smelters and in the improvement of transportation facilities. Most of the capital was private, although some was provided by the Export-Import Bank of the United States.

Hypothesis and Method of Research

The hypothesis is that high federal taxes in Mexico are causing a decline in the primary metals industry in Mexico, and that such a decline would be disastrous to the Mexican economy.

The method of research was primarily statistical. The material for Chapter III, including an outline of the Mexican tax law, was obtained by a survey of current literature. The illustrations of the tax law are purely hypothetical, although the comparative figures were based upon the advice of officials of several of the large mining and smelting companies.

Chapter IV draws heavily upon statistical data published by the United States Department of Commerce. Once the figures were obtained,

it remained only to present them in a comparative form in such a manner that they related to the topic in question.

Data included in Chapter V, also a statistical analysis, was collected from a wide variety of sources. Many of the statistics included were supplied upon written request from bank officials in the United States and Mexico, United States and Mexican government agencies, and from the American Smelting and Refining, American Metals-Climax, and Anaconda Copper Companies. Much of this data had to be converted from pesos to United States dollars using the published Department of Commerce exchange rates.

Conclusions

The conclusions reached are that: (1) the copper industry is slowly expanding, but that the next few years should show a much greater increase, (2) the lead industry is producing at capacity and will continue doing so for the next few years; however, no expansion is in sight, and (3) the zinc industry is showing a great increase in production, and that a major expansion should follow in the next decade. It is further concluded that any serious decline in the base metals industry would not have a disastrous effect upon the Mexican economy.

CHAPTER II

ORE RESERVES AND STRUCTURE OF THE MINING AND SMELTING INDUSTRY

Most of the mining districts, indeed most of the mines, were discovered and worked by the Spanish conquistadores early in the sixteenth century. The precious metal bonanzas are gone, the high-grade base metals deposits are depleted, and it is apparent that deposits of a minimum economical grade are rapidly disappearing. The major reserves and the greatest producing mines are concentrated in the hands of a few companies. The smelting capacity is even more concentrated, particularly in the lead industry where ASARCO controls 60 percent of the mine production and smelting capacity. Ownership is predominantly American, with one small English copper company, and a small Mexican lead producer. Lead and zinc reserves appear adequate for at least five years, and not more than ten years at present production. If a deposit currently being explored by Cananea Copper Corporation proves to be a major deposit of one million tons or more of extractable copper, then copper reserves have a life of about twenty years.

ORE RESERVES

Ore reserves may be defined as that material which will yield sufficient metal to produce a profit at a given price and a given set of costs. Mexico faces an acute problem of decreasing ore reserves. Mexico's major mining districts were discovered during the Spanish conquest in the sixteenth century, and the deposits have been

worked nearly continuously since that time. At first gold and silver were the major metals sought, but later modern corporations reopened the same districts to extract lead, copper, and zinc. Most of the deposits yielding these metals are rich epithermal[1] and mesothermal[2] ore bodies, located in volcanic rocks formed during the Tertiary Period.

During World War II, the mining industry was stimulated to such an extent that the historic metal deposits approached depletion. Even though copper, lead, and zinc prices have increased substantially since 1940-1945, costs of production and taxes have increased even more; hence, few additional known metal deposits have become economical.

Ore bodies being worked in Mexico fall into two categories. The first is that left behind by the Spaniards. They exploited only high-grade ore, and upon the reopening of the old workings it was found that much of the ore was rich enough to be mined. The cheapest source of these ores was old dumps, which contained low-grade ores sorted from the high-grade by the Spaniards. In addition, the dumps were rich in metals that the Spaniards didn't consider extracting, particularly copper, lead, zinc, arsenic, antimony, molybdenum, and bismuth. Another source of the same type of material was found in the broken

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[1]Epithermal refers to hydrothermal deposits formed near the surface of the earth at low temperatures (50°-200° C.).

[2]Mesothermal refers to hydrothermal deposits formed at intermediate depths (5-10,000 ft.) and at moderate temperatures (200°-300° C.).

rock used to fill stopes. For example, at Pachuca fill represents a large percentage of the total tonnage of lead and silver produced from that district. The old dumps and fills offered cheap extraction for the mining companies. A third source was the unmined portions of veins, represented by pillars, fringes around ore bodies, or wide veins from which only the rich streaks were mined. These three sources are practically exhausted today.

The second broad category of ore bodies is that developed by modern mining companies. Most of this is the downward continuation of ore bodies. The Spanish mines bottomed at around a thousand feet or less because of the lack of drainage and hoisting techniques. Present day companies have followed the same ore bodies to lower depths; however, the ore becomes poorer with increasing depth so most of these mines have now been economically exhausted.

The most important discoveries in recent years have been in faulted ore bodies that have escaped detection, or in deep ore bodies whose surface expression was weak or non-existent. These deposits have been discovered by underground exploration based on geologic considerations. Not only have these ore bodies represented the bulk of the additions to total reserves, but they are also the major source of future reserves. For example, at Pachuca, in the Real del Monte district, the ore occurs in epithermal, fissure type veins. Each vein may have several ore bodies along its length, occurring at about the same depth. The ore bodies are continuous along the dip, so once the elevation is established, additional exploration can be carried out at that level. Recently, it has been found that high-grade ore bodies

occur at certain dike and vein intersections, well below the normal ore horizon. Significantly, underground exploration has not been used extensively in Mexico.

Sizable tonnages of marginal ores are known in Mexico. These ores can be mined only at a loss during normal periods, and it is quite likely that they will remain untouched unless the government grants developing companies some sort of subsidy, costs decrease, or prices increase.

Copper

The principal copper deposits are located in the States of Sonora, San Luis Potosi, and Baja California. Minor occurrences are associated with other deposits scattered all over Mexico. The most important deposit is the one at Cananea, Sonora. This deposit was first worked by the Jesuits in the eighteenth century, and has been worked intermittently ever since. In 1928 the Anaconda company acquired control, and has continued the operation since. The deposit is a low-grade porphyry type, with an assay of about 1 percent copper. In 1947 it was estimated that 22 million short tons, copper content, of ore remained.[3] In 1957 a large body of copper ore was found below the present workings. In 1958 Cananea began exploration to determine the grade and extent of the new ore. Anaconda stated in their 1958

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[3]William P. Shea, "Foreign Ore Reserves of Copper, Lead, and Zinc," Engineering and Mining Journal, January, 1947, Vol. 148, p. 58.

annual report that the deposit gave indications of being a major copper deposit. A rough estimate would place reserves at about 1,000,000 tons of recoverable copper.

The mining district near San Luis Potosi has the second largest copper reserves in Mexico. The Boleo Copper Mines in Baja California were owned by French interests until recently when they were turned over to the Mexican Government in a depleted state. The mines subsequently shut down; however, there is some indication that they might be reopened. The Moctezuma mines, operated by Phelps Dodge, are still producing small amounts of copper, but are depleted under present economic conditions, for all practical purposes. In 1947 the San Francisco del Oro Mine had estimated reserves of 3.25 million tons of 0.8 percent ore. The Fresnillo company has reserves by the same estimate of three million tons of 0.6 percent ore.[4] Many smaller properties in the States of Zacatecas, Puebla, Oaxaca, Durango, and Sonora contain minor reserves of copper. In most instances, however, the copper content is subordinate to lead and zinc. Voskuil estimated in 1955 that 600,000 short tons of recoverable copper exist in Mexico, representing 0.5 percent of world reserves. Three hundred thousand tons are owned by American interests.[5]

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[4] Ibid., p. 58.

[5] Walter H. Voskuil, Minerals in World Industry, New York: McGraw-Hill, 1955, p. 210.

TABLE I

Summary of World Copper Reserves[6]

Country	Metal Content (000's Short Tons)	Percentage of World Total
United States	29,220	26.4
Canada	7,739	7.0
Mexico	600	0.5
Total: N. A.	37,559	33.9
Chile	25,900	23.38
Peru	2,526	2.28
Bolivia	40	0.04
Total: S. A.	28,446	25.70
Africa	28,648	25.9
USSR	9,000	8.1
Europe	4,806	4.3
Asia	1,880	1.7
Australia	419	0.4
Total	44,753	40.4
World Total	110,800	100.0

Lead

Virtually every state in Mexico produces some lead. The most important areas are in the States of Chihuahua, Zacatecas, Coahuila, and Nuevo Leon. The deposits are found both as simple lead ores and in association with sulfides of silver, zinc, copper, and gold. The simple lead ores are not abundant, but the metal produced is unusually pure.

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[6] Ibid., p. 210.

Chihuahua is the leading state in known lead reserves. The large producing mines include the Aquiles Serdan, owned by the Potosi Mining Company, the American Smelting and Refining Company's mines at Hidalgo del Parral, and the San Francisco Mines at San Francisco del Oro. The latter mine has reserves of at least 221,000 tons of recoverable lead. The Potosi mines contain a complex lead-zinc ore with assays of 10.8 percent and 10.4 percent respectively. No data on reserves for the Potosi mines or the ASARCO mines are available. Other large reserves in Chihuahua are owned by ASARCO at Aquiles Serdan and the Moctezuma Lead Company at Santa Barbara. The latter reserves are 1.8 million tons of 4 percent ore.

The lead properties in the State of Zacatecas are located at Fresnillo, Mazapil, Chalchihuites, Concepcion del Oro, Zacatecas, Sombrerete, and Nieves. Fresnillo is the largest of these, with a copper-lead-zinc ore with a lead content of 4.8 percent and reserves with 144,000 tons of lead. Low-grade reserves, not yet exploited, are known at the Parroquia-Magistral and San Roberto properties at Zacatecas City. The San Roberto deposit is considered rich in zinc, but does not have the tonnage of the Magistral property. This deposit has proven reserves of two million tons with a lead content of 1.3 percent.

Most of the lead reserve and production in the State of Coahuila is located at Sierra Mojada. Smaller deposits are located at Cuatrocienegas, Monclova, Ramos Arizpe, and Saltillo.

ASARCO controls the principal reserves in San Luis Potosi. Major deposits are located at Cerro de San Pedro, La Paz, and Charcas. Shortly

after World War II ASARCO opened up a new ore body in the San Antonio and Concha mines which has been described as the most important new lead discovery in Mexico in recent years. The same company took over the Unity-Atlixtac mine about 1948. This mine is said to have large reserves which have been exploited on only a small scale. Unfortunately, exploitation is hampered by a difficult and expensive rail haul from Narajos over steep mountain grades to the smelter at San Luis Potosi.

Smaller quantities of lead come from mines in the States of Michoacan, Nuevo Leon, Sonora, Queretaro, Hidalgo, and Oaxaca. Most of Mexico's lead reserves are not too well-known, but apparently there are ample reserves for several years' production at capacity.

The American Bureau of Metals Yearbook of 1958 gave the following figures for the reserves of Fresnillo and San Francisco Mines.

TABLE II

Ore Reserves of the Fresnillo and San Francisco Mines

1958

Company	Location	Tonnage of Ore	Average Grade of Ore		
			Cu	Pb	Zn
Fresnillo	Zacatecas	5,786,300	0.4	3.5	5.1
San Francisco Mines	Chihuahua	5,548,080	0.6	5.3	7.7

These two companies represent about 25 percent of the lead production. If we assume that the proportion of reserves held by each company is the same as the ratio of each company's production to total production of lead, then it may be estimated that two million tons of proved lead

exist. This estimate would mean that at the current rate of production, about eight years' lead reserves are available.

Zinc

The largest known reserves and production of zinc are in the States of Chihuahua, Zacatecas, and San Luis Potosi. Generally speaking, the zinc ores are associated with the lead reserves. The sulfide mineral sphalerite is the principal zinc ore mineral.

In Chihuahua the most important deposits are in conjunction with the San Francisco Mines at San Francisco del Oro; the ASARCO mines, at Santo Barbara and El Parral; and the Potosi mine, at Chihuahua. The San Francisco deposit is a complex copper, lead, zinc ore with an assay of 7.77 percent zinc, 5.3 percent lead, and 0.6 percent copper. Total reserves are estimated at five million tons of ore.[7] No estimates are available for any of the American Smelting and Refining Company's mines. The El Potosi ore assays 10.4 percent zinc, and is a galena-sphalerite ore. In 1946 it was estimated that at least one hundred additional small operations were located in the State of Chihuahua.[8]

Two relatively new properties are located in the State of Zacatecas, near the city of Zacatecas. These mines, mentioned previously

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[7]American Bureau of Metal Statistics, Yearbook of the American Bureau of Metal Statistics, Thirty-eighth Annual Issue for the Year 1958, New York, June, 1959, p. 62.

[8]U. S. Tariff Commission, Mining and Manufacturing Industries in Mexico, Washington, D. C., 1946.

in the discussion of lead reserves, are the Parroquia-Magistral and the San Roberto. They contain reserves of 110,000 and 66,000 tons respectively of zinc.

ASARCO is the principal owner of lead-zinc mines and reserves in San Luis Potosi. They opened up a new ore body in the San Antonio and Concha Mines. Indications are that Mexico has large reserves of zinc, although they have not been satisfactorily explored. Transportation, prices, and the general economic conditions have inhibited zinc production and exploration. It is estimated that proven and probable reserves of zinc total approximately 1.5 million tons of zinc metal, recoverable under present conditions. This reserve estimate would give Mexico approximately six years' production at the present rate. The estimate is based on the proportion of reserves to production based on the known figures for San Francisco Mines and Fresnillo. William P. Shea states that much of Mexico's output of lead and zinc comes from a number of small deposits which are continually going into and out of production, but that they are probably able to maintain past production indefinitely.[9]

Figure 1 illustrates the major areas and deposits of these metals.

STRUCTURE OF THE INDUSTRY

The base metals mining and smelting industry in Mexico is dominated by a few American corporations. This is also true, incidentally, for the production of other mineral products, for example, gold, silver,

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[9]William P. Shea, "Foreign Ore Reserves of Copper, Lead, and Zinc," Engineering and Mining Journal, January, 1947, p. 57.

FIGURE 1

MEXICO

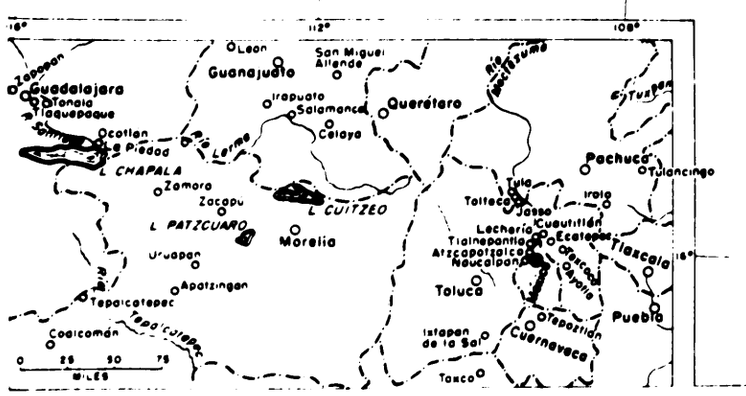
MAJOR COPPER, LEAD, AND ZINC DEPOSITS

COPPER
LEAD
LEAD, ZINC
COPPER, LEAD, ZINC

BOUNDARIES
International
State or Territory
National Capital
Capital of State or Territory
Other City

0 50 100 200 300 400
MILES

UNITED STATES
PACIFIC OCEAN
GULF OF MEXICO
GULF OF CALIFORNIA
BAJA CALIFORNIA
BAJA CALIFORNIA, SUR
SONORA
CHIHUAHUA
COAHUILA
NUEVO LEON
TAMAULIPAS
DURANGO
ZACATECAS
SAN LUIS POTOSI
NAYARIT
JALISCO
AGUAS-CALIENTES
GUANAJUATO
QUERETARO
HIDALGO
MEXICO
MICHOACAN
COLIMA
GUERRERO
MORELOS
DISTRITO FEDERAL
TLAXCALA
VERACRUZ
OAXACA
TABASCO
CHIAPAS
CAMPECHE
YUCATAN
QUINTANA ROO
BRITISH HONDURAS
GUATEMALA
HONDURAS
EL SALVADOR
(SEE INSET)
ISTHMUS OF TEHUANTEPEC
Tijuana
Mexicali
Ensenada
San Luis
Nogales
Ciudad Juárez
El Paso
Nueva Casas Grandes
Río Concepción
Altar
Río de Sonora
Hermosillo
Sahuaripa
Río Yaqui
Guaymas
Empalme
Ciudad Obregón
Navojoa
Huatabampo
Río Fuerte
Los Mochis
Topolobampo
Guamuchil
Culiacán
La Paz
Villa Cuauhtémoc
Cuauhtémoc
Camargo
Coyame
Ojinaga
Río Conchos
Río Grande
Piedras Negras
Nueva Rosita
Sabinas
Río Salinas
Nuevo Laredo
Monclova
Cuatro Ciénegas
Saltillo
Monterrey
Reynosa
Matamoros
Gómez Palacio
Lerdo
Torreón
Parras
Durango
El Salto
Mazatlán
Escuinapa
Río Mezquital
Zacatecas
Concepción del Oro
Saltillo
Ciudad Victoria
Linares
Tula
Mante
Río Tamesí
Tampico
Ciudad Madero
Aguascalientes
San Luis Potosí
Valles
Río Pánuco
Tamazunchale
Tepic
Lagos de Moreno
San Juan de los Lagos
Guanajuato
Querétaro
Tuxpan
Gutiérrez Zamora
Papantla
Misantla
Jalapa
Río Lerma
Guadalajara
Morelia
Colima
Manzanillo
Toluca
Pachuca
Tulancingo
Tuxpan
Veracruz
Alvarado
Córdoba
Orizaba
Ciudad Mendoza
Río Blanco
Tehuacán
Puebla
Río Balsas
Chilpancingo
Acapulco
Río Papaloapan
Río Coatzacoalcos
Minatitlán
Jesús Carranza
Matías Romero
Oaxaca
Tuxtla Gutiérrez
San Cristóbal de las Casas
Río Usumacinta
Río Grijalva
Río Chixoy
Río Tapachula
Puerto Angel
Puerto Soconusco
Progreso
Dzilam
Mérida
Celestún
Campeche
Champotón
Carmen
Frontera
Villa Hermosa
Chetumal
Zacatal
Isla de Mujeres
Cozumel
Tapachula
88-38-8



arsenic, antimony, molybdenum, and to some extent bismuth. These minerals are all produced from the same ore deposits that yield the base metals. The rich bonanza deposits of Mexico are gone, and her mineral wealth must come from the mining and processing of large, low-grade ore bodies--tasks amenable to large-scale operations.

Table III summarizes the production of copper over the eight years from 1951 to 1958. Cananea Copper Company has been the dominating producer, averaging 48.1 percent of Mexico's copper over this period. Boleo Copper Company went out of production in 1954, and Moctezuma is taking the last fraction of the metal remaining in their depleted mines. Fresnillo Company has increased production slightly over the period, whereas Howe-Sound's production is definitely declining. Only about 40 percent of copper production is accounted for. It is hypothesized that American Metals Climax and American Smelting and Refining Company make up most of the remainder.

Lead production is completely dominated by American Smelting and Refining Company, which has produced the bulk of Mexican lead for the past sixty years. American Metals Climax Company is probably the second largest producer, although their figures are not given. Both the Fresnillo Company and San Francisco Mines show a steady increase in lead production, and from 1951 to 1958 they have produced 12.5 percent and 14.9 percent respectively of Mexican lead. Santa Maria de la Paz, the only Mexican producer, produces an insignificant amount of lead. With low lead prices prevailing, it is doubtful if much, if any, lead production comes from very small companies.

TABLE III

Mexican Mine Production of Copper

Year	Total Mexican Production (000's S.T.)	Moctezuma Copper Co. Production (000's S.T.)	% of Total	Cananea Copper Co. Production (000's S.T.)	% of Total	Boleo Production (000's S.T.)	% of Total	Fresnillo Production (000's S.T.)	% of Total	Howe-Sound Production (000's S.T.)	% of Total
1951	74.2	2.5	3.4	33.0	44.5	4.6	6.2	1.8	2.4	3.9	5.3
1952	64.4	2.7	4.2	30.6	47.5	4.1	6.4	1.9	3.0	3.6	5.6
1953	66.3	2.5	3.8	32.1	48.4	3.7	5.6	3.5	5.3	3.7	5.6
1954	60.4	2.1	3.5	29.7	49.2	.9	1.5	3.4	5.6	3.5	5.8
1955	60.3	1.9	3.2	32.9	54.6	0	0	2.9	4.8	2.9	4.8
1956	60.5	1.9	3.1	34.2	56.5	0	0	2.6	4.3	2.8	4.6
1957	66.8	1.6	2.4	29.0	43.4	0	0	2.5	3.7	2.5	3.7
1958	71.6	1.4	2.0	30.6	42.7	0	0	2.3	3.2	2.3	3.2
Total	524.5	16.6		252.1		13.3		20.9		25.2	
Average	65.6	2.1	3.2	31.5	48.1			2.6	4.0	3.2	4.8

Sources: American Bureau of Metal Statistics and Corporation Annual Reports

TABLE IV

Production of Pb. (Pig)

Year	Mexican Pb. Production (000's S.T.)	ASARCO 000's S.T.	ASARCO % of Total	Howe-Sound 000's S.T.	Howe-Sound % of Total	Fresnillo 000's S.T.	Fresnillo % of Total	San Francisco Mines 000's S.T.	San Francisco Mines % of Total	Santa Maria de la Paz 000's S.T.	Santa Maria de la Paz % of Total
1951	248.5	147.1	59.2	14.6	5.9	20.4	8.2	32.5	13.1	2.6	1.0
1952	271.2	162.2	59.8	14.8	5.4	19.6	7.2	32.7	12.0	3.0	1.1
1953	244.2	149.2	61.1	14.8	6.1	27.1	11.1	32.4	13.3	3.4	1.4
1954	238.8	141.5	59.2	13.3	5.6	30.9	12.9	38.8	16.2	3.3	1.4
1955	232.4	139.1	59.8	14.7	6.3	34.3	14.8	35.9	15.4	3.0	1.3
1956	220.0	134.4	61.1	15.3	7.0	31.4	14.3	36.7	16.7	2.2	1.0
1957	236.9	131.0	55.3	12.5	5.3	36.9	15.6	38.3	16.2	2.1	0.9
1958	222.6	137.4	61.7	13.4	6.0	39.5	17.7	37.9	17.0	1.9	0.8
Total	1914.6	1141.9		113.4		240.1		285.2		21.5	
Average	239.3	142.7	59.6	14.2	5.9	30.0	12.5	35.6	14.9	2.7	1.1

Sources: American Bureau of Metal Statistics and Corporation Annual Reports

TABLE V

Production of Zinc in Mexico

Year	Mexican Production of Zinc 000's S.T.	Fresnillo		Howe-Sound		San Francisco Mines	
		Tons	% of Total	Tons	% of Total	Tons	% of Total
1951	198.5	24.3	12.2	29.4	14.8	41.6	21.0
1952	250.6	31.7	12.6	25.8	10.3	39.6	15.8
1953	249.7	29.2	11.7	22.0	8.8	40.0	16.0
1954	246.9	29.5	11.9	22.9	9.2	48.4	19.6
1955	296.9	32.6	11.0	22.7	7.6	49.1	16.5
1956	274.3	36.4	13.3	22.7	8.3	52.7	19.2
1957	267.9	39.0	14.6	21.4	5.8	56.9	21.2
1958	247.0	40.0	16.2	12.7	5.1	55.1	22.3
Total	2031.8	262.7		179.6		383.4	
Average	254.0	32.8	12.9	22.4	8.8	47.9	18.9

Sources: American Bureau of Metal Statistics and Corporation Annual Reports

The only breakdown on zinc production available is for Fresnillo, Howe-Sound, and San Francisco Mines. Fresnillo Corporation produces about the same percentage of zinc as they do lead. Similarly, Fresnillo Company and San Francisco Mines show steady increase in production. Howe-Sound's zinc production is declining just as was their copper and lead production. This trend implies that their deposits are nearing depletion. Since all of the zinc produced in Mexico comes from complex galena-sphalerite ores, it may be presumed that American Smelting and Refining Company is responsible for the bulk of the remaining production.

The smelting and refining of the ores is even more concentrated in the hands of a few firms. The Yearbook of the American Bureau of Metal Statistics gives the following breakdown in the smelting and refining industry.[10]

TABLE VI

Copper Smelters and Refineries
Mexico

Smelters

Company	Location	Annual Capacity in Short Tons of Material
ASARCO	San Luis Potosi, S.L.P.	300,000
Cia Minera de Santa Rosalia, S. A.	Santa Rosalia, Baja California	120,000
Cananea Cons. Copper	Cananea, Sonora	290,000
Mazapil Copper Company	Concepcion del Oro, Zacatecas	200,000
Total Capacity		910,000
	Refineries	
Cobre de Mexico, S.A.	Atzcapotzalco, D.F.	43,000

[10] American Bureau of Metal Statistics, Yearbook of the American Bureau of Metal Statistics, Thirty-eighth Annual Issue for 1958, New York, June, 1959.

Cobre de Mexico, S. A. is a Mexican firm engaged in the refining and processing of copper. Much of their copper is purchased from the Cananea Copper Company. The Moctezuma Copper Company ships their production to the Phelps Dodge smelters and refineries in Douglas, Arizona. ASARCO smelts Howe-Sound's ore, and ships all of their production to their Barber, New Jersey plant for refining.

TABLE VII

Lead and Zinc Smelters
Mexico

Lead Smelting Works[11]

Company	Location	Annual Capacity Short Tons of Charge
American Metals Climax	Monterrey, Nuevo Leon	100,000
ASARCO	Monterrey, Nuevo Leon	180,000
		280,000

Zinc Smelting Works[12]

Mexican Zinc Company	Rosita, Coahuila	8 distillation furnaces 7200 retorts 113,400 MT Capacity 54,400 MT Zinc Production Capacity

American Metals and ASARCO control the lead industry by their control of the lead smelting capacity of Mexico. The pig lead is shipped out of the country for further processing and refining. Most of Mexico's zinc is shipped to the United States in the form of concentrates. The Mexican Zinc Company owns the only smelter and fuming plant, and that has been built in the last few years.

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[11] Ibid., p. 50.

[12] Ibid., p. 62.

TABLE VIII

Statistical Summary of Production, Reserves, and Smelting Capacity of Copper, Lead, and Zinc in Mexico

Company	Copper %			Lead %			Zinc %		
	Reserves	Production Capacity	Smelting Capacity	Reserves	Production Capacity	Smelting Capacity	Reserves	Production Capacity	Smelting Capacity
American Metals	10	10	0	10	10	36	10	10	0
American Smelting	10	10	33	40	60	64	40	40	0
Cananea	60	50	32	0	0	0	0	0	0
Fresnillo	4	4	0	12.5	12.5	0	13	15	0
Howe-Sound	4	4	0	6	6	0	9	9	0
Mayapil	5	5	22	Small	Small	0	0	0	0
San Francisco Mines	5	5	0	15	15	0	19	22	0

	Reserves (Short Tons)	Production Rate (Tons per year)	Life of Reserves (Tons)
Copper	1,500,000	65	20-25
Lead	2,000,000	239	8+
Zinc	1,500,000	263	5.5

FIGURE 2

MEXICO

SMELTERS AND REFINERIES

COPPER SMELTER
COPPER REFINERY
LEAD SMELTER
ZINC SMELTER

LEGEND

BOUNDARIES
International
State or Territory

National Capital
Capital of State or Territory
Other City

0 50 100 200 300 400
MILES

UNITED STATES

PACIFIC OCEAN

GULF OF MEXICO

BAJA CALIFORNIA

BAJA CALIFORNIA, SUR

GULF OF CALIFORNIA

SONORA

CHIHUAHUA

COAHUILA

NUEVO LEON

DURANGO

ZACATECAS

SAN LUIS POTOSI

NAYARIT

JALISCO

AGUASCALIENTES

GUANAJUATO

QUERETARO

HIDALGO

TLAXCALA

MICHOACAN

COLIMA

GUERRERO

OAXACA

TABASCO

CHIAPAS

CAMPECHE

YUCATAN

QUINTANA ROO

TAMAULIPAS

DISTRITO FEDERAL

MORELOS

GUATEMALA

HONDURAS

BRITISH HONDURAS

(SEE INSET)

Tijuana, Mexicali, Ensenada, Nogales, Agua Prieta, Naco, Nacozari, Moctezuma, Altar, Río Concepción, Río de Sonora, Hermosillo, Sahuaripa, Río Yaqui, Guaymas, Empalme, Ciudad Obregón, Navojoa, Huatabampo, Río Fuerte, Los Mochis, Topolobampo, Guasave, Culiacán, La Paz, El Paso, Ciudad Juárez, Nuevas Casas Grandes, Chihuahua, Río Conchos, Delicias, Camargo, Jiménez, Río Grande, Piedras Negras, Río Nadadores, Río Sabinas, Nueva Rosita, Sabinas, Monclova, Cuatro Ciénegas, Parras, Saltillo, Nuevo Laredo, Reynosa, Matamoros, Monterrey, Gómez Palacio, Lerdo, Torreón, Durango, El Salto, Mezquital, Escuinapa, Zacatecas, Concepción del Oro, Ciudad Victoria, Llera, Tula, Valles, Río Tamesí, Río Pánuco, Tampico, Ciudad Madero, Aguascalientes, Lagos de Moreno, Tepic, San Juan de los Lagos, Guanajuato, Guadalajara, Río Lerma, Querétaro, Pachuca, Tuxpan, Gutiérrez Zamora, Poza Rica, Papantla, Misantla, Morelia, Toluca, Tlaxcala, Puebla, Veracruz, Alvarado, Córdoba, Ciudad Mendoza, Orizaba, Río Papaloapan, Río Coatzacoalcos, Tehuacán, Iguala, Río Balsas, Chilpancingo, Acapulco, Oaxaca, Jesús Carranza, Matías Romero, Jalapa, Tuxtla Gutiérrez, San Cristóbal de las Casas, Istmus of Tehuantepec, Puerto Angel, Puerto Escondido, Frontera, Villa Hermosa, Carmen, Campeche, Progreso, Mérida, Motul, Celestún, Chetumal, Xcalac, Isla de Mujeres, Cozumel, Tapachula

0 25 50 75
MILES

CHAPTER III

MEXICAN TAXES ON THE MINING AND SMELTING INDUSTRY

General

Mexican taxes assume three forms. The schedular income tax includes all individuals and entities which are either residents of Mexico or which derive income from a source in Mexico. Seven schedules are used to differentiate among types of taxpayers, and an individual is taxed if his income is derived from one of the sources listed.

The excess profits tax is essentially a surtax on the profits of enterprises which are subject to schedular tax under the business income schedules (Schedules I, II, and III). The third tax, the distributable profits tax is a tax on income arising from capital investment in commercial companies. This tax is computed at 15 percent of the book profits of the entity, whether or not the profits are distributed.

The schedular income tax rates which apply to commercial and industrial income (Schedules I and II) range from a minimum of 3.8 percent in the lowest bracket (2,000 to 2,400 pesos) to a maximum of 39 percent in the highest bracket (income over two million pesos). The first two thousand pesos are exempt. The tax rates on agricultural income range from 1.9 percent on the portion of the income between 2,000 and 2,400 pesos to 16.5 percent

on the portion of the income exceeding one million pesos.

The excess profits tax is graduated tax, and varies with the ratio between the income subject to excess profits tax and the invested capital. The lowest rate, 5 percent, applies to the portion of income between 15 percent and 20 percent of invested capital. The highest rate, 50 percent, applies to income exceeding 50 percent of the invested capital; however, the tax may be not more than 10 percent of net income before the application of the excess profits credit.

The excess profits tax is levied on all taxpayers whose gross annual income exceeds 300,000 pesos. The taxable income for excess profits tax is the same as that for purposes of the income tax under Schedules I, II, and III, reduced by the income tax. An excess profits credit is allowed a taxpayer equal to 15 percent of the taxpayers invested capital. The invested capital of a corporation is represented by the total of its paid- in capital, capital reserves, and undistributed profits existing at the end of the preceding tax year. Only equity capital is affected. Mexican branches of foreign entities compute their invested capital at 40 percent of the net book value of their assets at the close of the preceding tax year.

Other Taxes Applicable to the Mining Industry

The federal Production Tax on mining enterprises applies to metals, metallic compounds, and nonmetallic minerals produced in Mexico. If these minerals are also exported, the export duty applies

in addition to the production tax. States and municipalities in whose area mining properties are located participate in the revenue from the federal production tax; however, they are not permitted to impose separate production taxes.

The production tax is computed as a percentage of the official price of the taxable product. The official price, applicable tax rates, and the amount of tax per kilogram of each taxable product are published every month by the Ministry of Finance in the official gazette.[1] The official price each month is computed by multiplying the average price of the product, as quoted on the New York Commodity Exchange during the preceding month, by the official rate of exchange for the United States Dollar. For example, the percentages applicable to copper, based on a price of twenty cents per pound on the New York Market are:

Refined	2.68%
Impure Bars	2.89%
Concentrates, matte, precipitates, and speiss	3.11%
Mineral	3.32%

If the price changes, the above percentages are changed by a factor determined by the product of the price difference in U. S. cents for one pound, and 0.1656.

For example, if the price of copper is 30 cents, quoted on the New York Exchange, the production tax on one pound of refined copper

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[1] Diario Oficial.

would be:

$$(10 \times .1656) + 2.68 = 4.34\%$$
$$.0434 \times 30 = 1.30 \text{ cents}$$

The export tariff is a single column duty. That is, the same rates apply to shipments to all countries. There are 1100 commodities listed, subject to export tariffs. Almost all manufactured items are duty-free. The rates on base metals range from 20 percent ad valorem on sheets and bars to 35 percent on ores, concentrates, and crude ingots. A recargo tariff of 2 percent is levied on all exports except those made by mail.

Mining concessions are taxed annually whether or not the mining property is operated. Concessions are granted for lots whose surface area is equal to one hectare,[2] and each hectare is taxed at the rate of fifteen pesos, if the concession is granted for metal mining. Although concessions are required for exploration, these concessions are not taxed.

The Ministry of Finance is empowered to reduce production tax rates in a number of cases, for example:

> "Enterprises which exploit new mines or mines which have not been operated for at least ten years may apply for a reduction in the rate of the production tax for the first five years. The reduction amounts to 50 percent of the tax for the first two years, 30 percent for the following two years, and 10 percent for the fifth year. The

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[2] 2.471 acres.

> Ministry of Finance decides whether the legal requirements for exemption exist in the individual case and it will consider proof submitted by the mining enterprise in addition to its own investigation."[3]

Another reduction is allowed on gold and silver amounting to 75 percent of the tax, if the metals are produced in concentrates with a zinc content of at least 75 percent.

A number of mineral products are exempt from the production tax. Those so favored include: coal used in the operation of the mine producing it; coal used for distillation and production of derivatives; unusually-low-content ores and minerals; samples of metals, ores, and metallurgical products for exports, within certain weight limits; iron and manganese in mineral form used in Mexican industry for the production of iron and steel; minerals metals and metallic compounds for which the industrial demand in Mexico exceeds the supply.

Taxpayers may apply to the Ministry of Finance for a reduction in the rate of the production tax. The formal agreements made are valid for a specified limited period. Agreements may be made for the following purposes:[4]

1. Exploitation of low-content minerals.
2. Continuation of mining and metallurgical operations in certain areas because of their social benefits.
3. The mining of deposits which can be operated only at high cost.

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[3]Harvard Law School World Tax Series, Taxation in Mexico, Boston: Little, Brown, and Company, 1957, p. 258.

[4]Ibid., p. 364.

4. The promotion of substantial prospecting activities in mines with limited reserves or in important mining districts.
5. The replacement of indispensable operating equipment if the mine is financially unable to make the replacement.
6. The construction of shafts.
7. The establishment of new metallurgical plants and the substantial extension or modernization of existing ones.
8. The promotion of mining and metallurgical operations supplying the national industry with raw materials which are necessary as well as scarce.
9. The processing of certain waste materials.
10. The equalization of operating losses or the realization of adequate profits for the benefit of enterprises which are technically efficient.

Determination of Income

Under article twenty-seven of the constitution of Mexico, the subsoil and all minerals, combustibles, and other natural deposits embedded therein are the property of the nation. As such, no individual or enterprise, foreign or domestic, may gain title to any of these resources. The right to operate a mine may be acquired by a concession granted by the Federal Government.

The cost of production is equal to the sum of the cost of materials and power consumed, the direct labor cost, and the overhead expenses, directly connected with mineral extraction. Entities which are involved in manufacturing as well as mining compute production costs according to the preceding methods and their manufacturing costs according to separate rules applying to the manufacturing industry. The cost of minerals extracted and sold, together with that of other assets sold during the year, represents the cost of sales.

DEDUCTIONS

Depletion

The Mexican tax code defines depletion as the estimated or computed permanent reduction or exhaustion of an irreplaceable natural deposit which affects the income of the year in which the reduction or exhaustion takes place. Only cost depletion is allowed for tax purposes. The rate is determined by dividing the total cost of acquisition of the mine or deposit by its known or computed tonnage or volume. This quotient represents the rate which is applied to each unit of production.

The costs of exploration and development incurred prior to the beginning of actual mineral production may be added to the cost of acquisition of the mine or deposit for purposes of the computation of the depletion allowances. Exploration and development expenses incurred during mining operations are currently deducted. Costs of repairs, maintenance, and conservation of property, and costs of adapting installations for a different use are also expensed, unless these expenditures add to the value of fixed assets.

Depreciation and Amortization

Depreciation and amortization is allowed in terms of the number of units of the natural product recovered. This is computed in the same manner as the depletion allowance. It is determined by dividing the cost of the assets by the total tonnage or volume of the recoverable mineral as known at the time the operations commenced. This rate is multiplied by the number of units recovered during the taxable year to give the amount of depreciation or amortization which is

deductible for the period. The depreciation and amortization for assets not used directly in mining operations follows the general rules that have been established for manufacturing industries. Depreciation for manufacturing is covered by the following percentages:

(a) 5 percent maximum for amortization of intangible assets, deferred expenses, and charges
(b) 5 percent maximum for depreciation of real property
(c) 10 percent maximum for depreciation of movable property
(d) 20 percent for vehicles and transportation equipment

Social Expenses

When an operation ceases, or a mine is shut down, employees must be indemnified according to Mexican labor legislation. Funds allocated for this indemnification may be charged to current operations if certain conditions are met.

> "A fund must be formed and invested either in government securities or other securities, bearing a fixed rate of interest. The selection of the securities must be approved by the National Securities Commission."[5]

> "The amount of the fund must equal the corresponding reserve set up on the books of the taxpayer. . . . The securities must be deposited with a credit institution designated for this purpose by the Ministry of Finance. They may be withdrawn only with the consent of the Ministry and only for the purpose of paying the indemnifications referred to."[6]

EXAMPLES OF MEXICAN TAXATION

As an example, let us assume a mining company producing 50,000 tons of copper. The purchase price was $15,000,000 based on annual

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[5] Comision Nacional de Valores.

[6] Ibid., pp. 221-222.

net income of two million dollars per year for twenty years. The copper content of the ore is 1.0 percent. Mexican operating costs are assumed to be 73.5 percent of United States costs, based on an average of estimates given by mining company officials during interviews. The product is unrefined copper bars, exported to the United States for further processing.[7] Examples of income statements for a hypothetical Mexican and United States firm are presented, assuming prices of copper of twenty, thirty, and forty cents per pound respectively.

Referring to Table IX, the net profit after taxes for each case is about the same magnitude for the American and the Mexican firm. However, it was assumed that Mexican costs were only 73.5 percent of United States costs. If the costs had been equal, then the Mexican company would have shown a substantial loss in each case. For example, with copper at thirty cents per pound, and equal costs, the Mexican income statement would appear as:

	Mexico
Gross Income	$30,000,000
Production Taxes (25.35%)	7,600,000
Income after Production Taxes	22,400,000
Operating Costs	22,500,000
Operating Loss	- 100,000
Depreciation	- 825,000
Depletion	- 750,000
Net Loss from Operations	- 1,675,000

[7] The valuation of the mine is based on the Hoskold formula, arbitrarily assuming a 10 percent risk rate, and a 4 percent redemption rate. A production of 50,000 tons of copper per year for twenty years, at an average price of twenty cents per pound is assumed.

TABLE IX

Comparison of Income Statements for a Hypothetical Mexican and United States Copper Mining and Refining Corporation

Copper Quoted at 20, 30, and 40 cents per Pound

	Copper - 20 cents per Pound		Copper - 30 cents per Pound		Copper - 40 cents per pound	
	U. S.	Mexico	U. S.	Mexico	U. S.	Mexico
Gross Income	$20,000,000	$20,000,000	$30,000,000	$30,000,000	$40,000,000	$40,000,000
Production and Export Taxes	0	5,000,000	0	7,600,000	0	10,936,000
Income after Taxes	20,000,000	15,000,000	30,000,000	22,400,000	40,000,000	29,064,000
Costs	15,000,000	11,000,000	22,500,000	16,500,000	30,000,000	22,000,000
Operating Profit	5,000,000	4,000,000	7,500,000	5,900,000	10,000,000	7,064,000
Depreciation	825,000	825,000	825,000	825,000	825,000	825,000
Depletion	2,087,500	750,000	3,337,500	750,000	4,587,500	750,000
Net Profit before Income Tax	2,087,500	2,425,000	3,337,500	4,325,000	4,587,500	5,389,000
Income Tax	1,043,750	945,000	1,668,750	1,690,000	2,293,750	2,101,710
	1,043,750	1,480,000	1,668,750	2,635,000	2,293,750	3,287,290
Excess Profits Tax (10 percent)	0	148,000	0	263,500	0	328,729
	1,043,750	1,332,000	1,668,750	2,371,500	2,293,750	2,958,561
Dividend Tax (15 percent)	0	199,800	0	355,725	0	443,784
Net Profit	1,043,750	1,132,200	1,668,750	2,015,775	2,293,750	2,514,777

If Mexican costs increase to the point where they are equal to the United States, a loss will be incurred because of the relatively inflexible production and export taxes. The avowed purpose of these two taxes is to stimulate domestic refining of Mexico's mineral production. The example assumed unrefined copper bars, and the applicable combined export and production tax rate was "only" 25.35 percent. If concentrates had been exported, rather than bars, the tax would have been 0.43 percent higher at 25.78 percent. The relatively small savings can hardly be called an incentive.

The United States tax code allows percentage depletion equal to 15 percent of the value of the metal produced, not to exceed 50 percent of net profit before taxes. The Mexican allowance for depletion, on the other hand, is computed on the basis of cost. The difference in the example is striking. The United States depletion allowance clearly stimulates reinvestment, whereas the Mexican depletion allowance is so small that reinvestment of that amount would be insignificant. Moreover, with inflexible tax rates reinvestment would be inhibited.

When copper was thirty cents per pound, the United States company paid $1,668,750, or about 5.5 percent of gross revenue. The Mexican operation paid a total of $9,373,389, or about 31 percent of gross revenue. Obviously the advantages of lower production costs are returned to the Mexican government at the expense of the entire Mexican mining industry.

In the example of copper price at twenty cents per pound, the corporations in both the United States and in Mexico earned slightly

more than 5 percent of gross. Again it is seen that if Mexican costs were as high as similar costs in the United States, the Mexican corporation would have suffered an operating as well as a book loss. Depletion in the case of the United States corporation declined, whereas in Mexico it remained fixed. However, the amount of depletion allowed in the United States is still nearly three times that of Mexico. The United States corporation paid taxes amounting to about 5.5 percent of gross revenue, and the Mexican operation paid taxes of about 32 percent of gross revenue.

When copper increases to forty cents per pound, the United States depletion allowance shows a corresponding increase, whereas the Mexican depletion allowance remains fixed. If Mexican operating costs were equal to United States operating costs, a considerable loss would be suffered by the Mexican firm.

It is assumed in the examples that the export tax is peculiar to Mexico because nearly all base metals must be exported in order to be marketed. The United States, on the other hand, is no longer self-sufficient in these metals, so no export costs are added in the example.

Since the illustrations are hypothetical, the significance of this analysis might be questioned. Perhaps the best "real life" illustration is to compare the income statements of San Francisco Mines of Mexico[8] for the years 1957 and 1958.

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[8]San Francisco Mines of Mexico, Limited, Annual Reports for 1957 and 1958.

TABLE X

San Francisco Mines of Mexico, Limited
Income Statements

	30 September 1957	30 September 1958
Gross Revenue	10,098,719	6,463,913
Costs	6,435,139	5,216,125
Earnings before Taxes	3,663,580	1,247,788
Mexican and British Taxes	3,094,241	1,455,747
Net Profit	569,329	- 207,959

These statements show a problem that did not appear in the hypothetical examples. In these examples, it was liberally assumed that operating costs remained a fixed percentage of gross revenue. However, as San Francisco unhappily proves, operating costs are relatively inflexible. San Francisco notes on their report that the Mexican law provides for a relief of losses by remission of export and production taxes up to a maximum of 75 percent of the Federal Government's share. However, such remissions, at least in their case, have been ignored.

In 1959 the United States Department of Commerce published U. S. Investments in the Latin American Economy.[9] From data published in the report, an income statement for American mining and smelting companies in Mexico can be put together. According to the report, the data includes 86 percent of American companies in the mining and smelting industry in Mexico, based on total assets.

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[9]U. S. Department of Commerce, U. S. Investments in the Latin American Economy, Washington, D. C.: U. S. Government Printing Office, 1959.

TABLE XI

Income Statement, 1955

United States Investment in Mining and Smelting in Mexico
(Millions of United States Dollars)

Total Sales			212
Local Payments			
Wages and Salaries	31		
Materials, Supplies, and Equipment	73		
Miscellaneous	43		
Total Local Payments		147	
Imports from United States			
Miscellaneous		12	
Total Costs			159
Income before Taxes			53
Total Mexican Taxes Paid			56
Net Loss			- 3

In addition, these companies paid dividends, interest, and royalties both in Mexico and in the United States:

Interest, Royalties, and Dividends Paid in United States	- 9
Interest, Royalties, and Dividends Paid in Mexico	- 4
Total Interest, Royalties, and Dividends	- 13
Loss from Operations	- 3
Total Book Loss from Operations	- 16

Sources of Federal Revenue

Table XIII outlines the sources of revenue of the Federal Government for the years 1950, 1952, and 1955. It may be noted that Income and Excess Profits Taxes, Production Taxes, and Export Taxes have, as a whole, nearly tripled in the six years, 1950

to 1955 inclusive, The metal mining and refining industry paid 197.9 million pesos in production taxes in 1952, or about 50 percent of such taxes from natural resources. In 1955 American mining and smelting firms paid an estimated 820 million pesos in Mexican taxes, or nearly 10.4 percent of the total Federal revenue, or 13.2 percent of the total tax revenue. Yet, in 1955 the mining and smelting industry accounted for less than 3 percent of Mexico's gross national product. The same companies paid approximately 600 million pesos in production and export taxes, or about 31 percent of the total of such taxes paid. On the other hand, the value of exports from the mining and smelting industry accounted for about 15 percent of the total value of Mexican exports. In contrast, let us examine the budget of the Federal Government.[10]

TABLE XII

Budget of the Federal Government, 1957

Item	Millions of Pesos	
Economic Development		
Communication and Transportation	1,498	
Agricultural and Livestock Development	649	
Industrial Promotion and Commercial Development	458	
Total Economic Development		2,606
Social Services		
Educational and Cultural Services	732	
Social Assistance and Hospital Services	296	
Social Security and Social Welfare	258	
Total Social Services		1,286
Army, Navy, and Military Services		563
General Administration		427
Public Debt		
Internal	369	
External	212	
Floating	218	
Total Public Debt		799
		5,681

[10]Harvard Law School World Tax Series, Taxation in Mexico, Boston: Little, Brown, and Company, 1957, p. 14.

The striking part of the budget is the amount alloted to Economic Development. The mining industry is alloted no part of the Federal revenue for 1955. Their benefit is indirect, only so far as transportation and general welfare will help. At the same time, Federal revenue spent in Economic Development and Social Services is bound to increase the standard of living; hence, increasing wages and salaries. As was pointed out, lower production costs are the only remaining stimulus to the mining industry in Mexico. Apparently the situation requires the minerals industry to pay for constructing the gallows which will eventually kill them.

THEORETICAL IMPLICATIONS

According to economic theory, when an ad valorem tax is imposed upon a producer, the burden of the tax is borne by the producer and the consumer. The world demand curve facing the base metals industry in Mexico can be assumed infinitely elastic. That is, no matter how little or how much copper, lead, or zinc the Mexican industry produces and markets, it cannot change the price of those commocities; moreover, the industry can sell as much of each of the metals as it wishes at the world demand price. This assumption is somewhat oversimplified, considering import tariffs and quotas imposed by the consuming countries. For an analysis, however, the relationship is representative. The production and export tax may be treated as any other cost because it is based upon gross value of production. The tax increases the cost of production, but it cannot be passed on to the consumer because the demand is infinitely elastic.

TABLE XIII

Tax Revenue of the Federal Government
1950-1955

Millions of Pesos

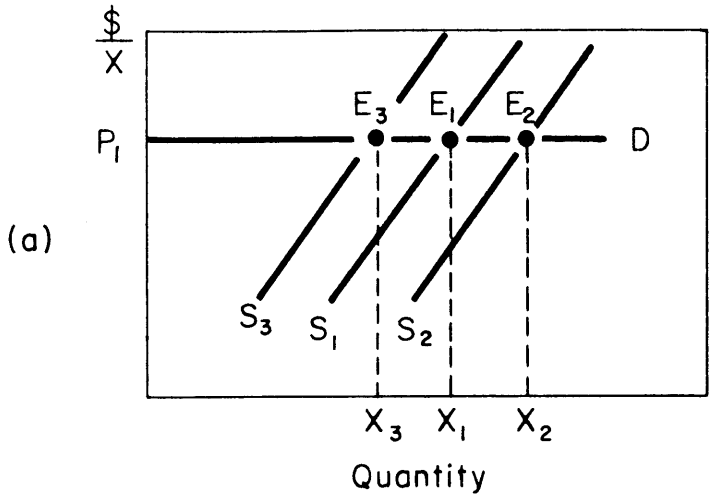
Tax	1950	1952	1955
Income and Excess Profits Taxes	766.2	1,448.5	1,999.7
Import Duties	432.3	620.0	1,010.4
Export Duties	470.3	711.9	1,575.7
Taxes on Production of Natural Resources	106.3	418.6	393.2
Taxes on Manufacturing, Commerce, and Services	256.8	442.7	1,097.0
Commercial Receipts Tax	385.5	548.7	635.3
Miscellaneous Taxes	69.5	96.9	204.2
Total Tax Revenue	2,486.9	4,287.3	6,915.5
Other Revenue	571.1	982.0	980.5
Total Government Revenue	3,058.0	5,269.3	7,896.0

Sources: Harvard Law School, Taxation in Mexico, Boston: Little, Brown and Company, 1957; U. S. Department of Commerce, Investment in Mexico, Washington, D. C.: U. S. Government Printing Office, 1956.

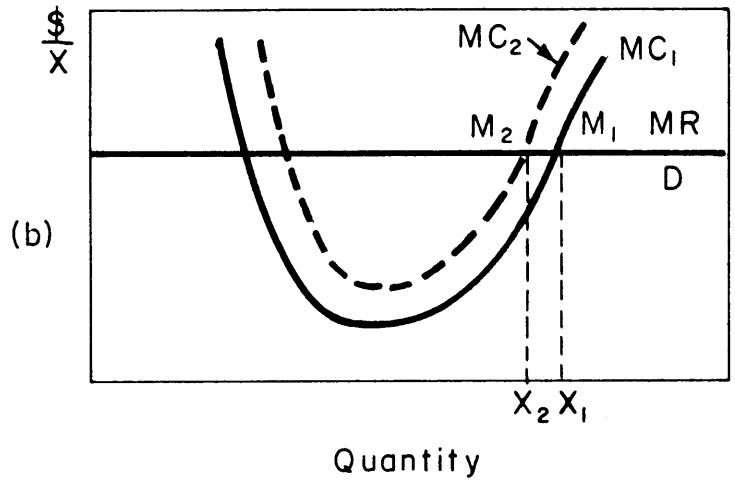
The situation may be depicted by Figure 3. Figure 3(a) shows the infinitely elastic demand curve intersected by the supply curve at point E, the equilibrium of supply and demand. At this point, x_1 units will be consumed at a price per unit of p_1. It may readily be seen that if supply shifts to the right or left, more or less units will be consumed, but the price remains fixed at p_1.

Figure 3(b) shows the relationship of marginal cost and marginal revenue. The point of maximum profit is the point where marginal revenue equals marginal cost, MC_1. In the figure, the point of profit maximization falls at M_1. In the unique case of perfect competition, the marginal revenue curve and the demand curve fall along the same points. If production and export taxes are levied, the original marginal cost curve will be shifted upward at all points by the amount of the tax. The new marginal cost curve will fall at MC_2, and the new profit maximization point will be at M_2. In order to maximize profits, production will be cut back from x_1 to x_2.

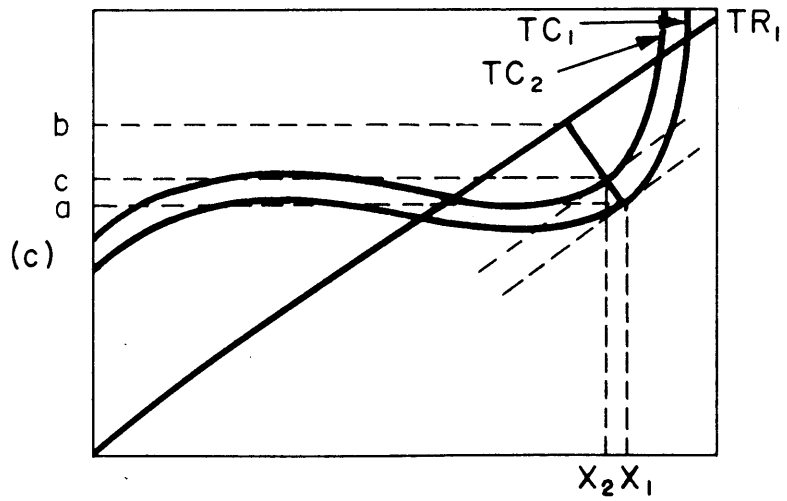
Figure 3(c) is another method of showing the firms maximum profit. In this figure, profit is maximized where the total revenue (TR_1), total cost (TC_1) spread is maximized. Geometrically this point is determined when the slope of the total cost curve is parallel to the total revenue curve. In Figure 3(c) this point falls at x_1, the quantity to be produced for maximum total profit. When production and export taxes are imposed, the total cost curve moves upward to TC_2, and the quantity produced decreases to x_2. The profit earned by the producer in the first instance is ab, and in the second, after the tax, the profit is cb. The amount of tax paid is ab.



Supply–Demand relationship showing constant price with changes in supply to S_2 or S_3.

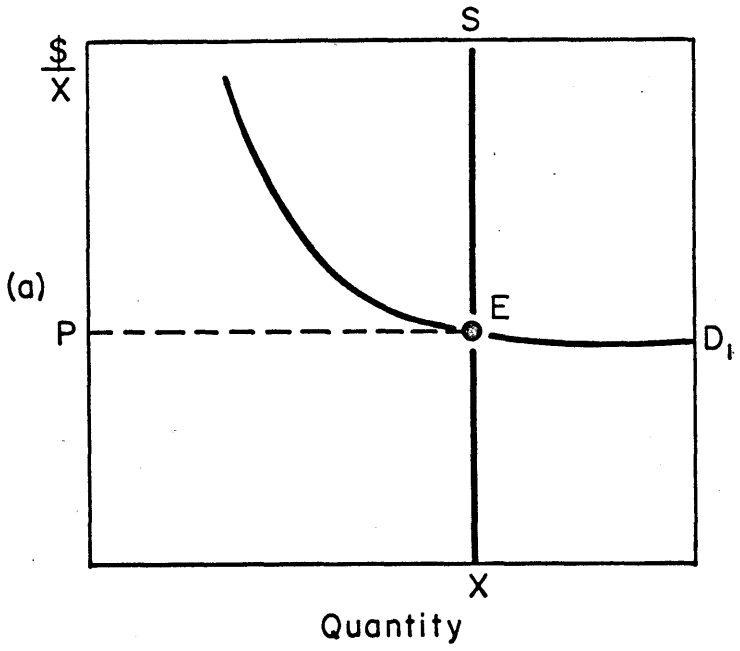


Marginal Cost–Marginal Revenue relationship showing quantity produced before and after imposition of Tax.

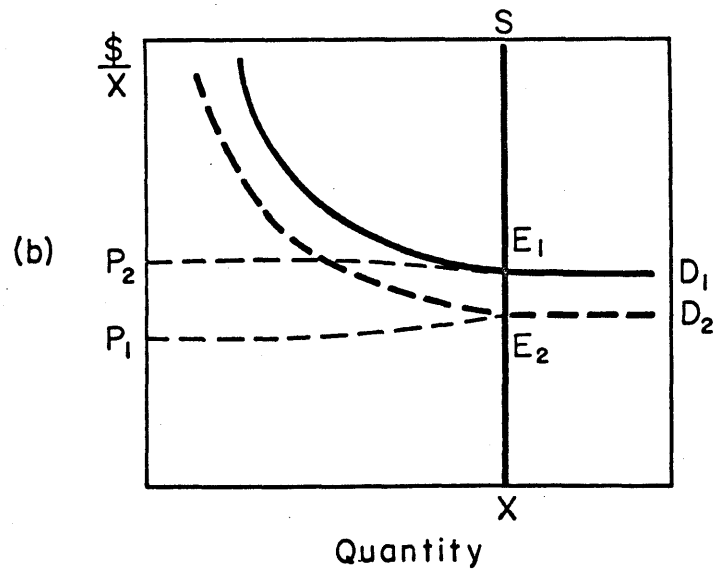


Total Revenue–Total cost relationship showing decrease in profit and subsequent decrease in production after imposition of a Tax.

FIG. 3 SHORT RUN ECONOMIC DIAGRAMS FOR COPPER–LEAD–ZINC INDUSTRY IN MEXICO



Supply curve of an ore deposit shown as inelastic.



Effective Demand to owner decreases from D_1 to D_2 if production and Export Tax is Imposed.

FIG. 4 LONG RUN SUPPLY-DEMAND RELATIONSHIP OF ORE DEPOSITS IN MEXICO

The illustration shows that the tax cannot be shifted to the consumer, at least as far as the original assumptions are concerned. The producer may, however, shift the tax to some other area. The only reasonable possibility would be to force labor to carry the burden. This may be done by decreasing wages or reducing the labor force. Mexican law, however, will permit firing an employee only under exceptional circumstances, so this can be a solution only over the long run. That is, not replacing an individual who voluntarily leaves his job. The other alternative, reducing wages, is effectively stopped by the strong labor union.

Figure 3 illustrated the short-run situation. Looking at the long-run supply and demand, mineral deposits may be considered in the same light as rental property, and the income derived as rent. The long-run supply in Figure 4(a) is inelastic. That is, over the long run, the ore deposits may be worked out and cannot be replaced, regardless of the demand. In Figure 4(b) an export and production tax has been imposed upon the producers equal to p_1p_2 per unit of material produced. It is seen that the equilibrium is established at E_1. Although the tax does not affect total demand, it will reduce the rent accruing to the owner, so the effective equilibrium, as far as the owner is concerned, moves downward to E_2.

CHAPTER IV

APPARENT EFFECT OF TAXATION ON INTERNATIONAL TRANSACTIONS

American Investment

Table XIV shows the direct foreign investment[1] in the mining and smelting industry in Mexico. According to the Bank of Mexico, this represents about 90 percent of the total investment in the nonferrous mining and smelting industry. Investment in the base

TABLE XIV

Direct Foreign Investment in Mexican Mining and Smelting[2]
1946-1958
(Millions of U. S. Dollars)

1946	147.6
1947	159.0
1948	160.0
1949	114.4
1950	111.8
1951	158.7
1952	160.2
1953	164.5
1954	182.8
1955	171.0
1956	127.0
1957	119.1

metals--copper, lead, and zinc--represents the major portion of such smelting, since most of the other nonferrous metals are derived from

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[1]The figures represent the book value of foreign assets in mining and smelting in Mexico.

[2]Ministry of Economy, Mexico, D.F., 1946-1955, and Bank of Mexico, Mexico, D.F 1956 and 1957.

these ores as by-products. Production in the nonferrous metals industry was low in 1946 as a result of a wave of pessimism following World War II. In 1948 and 1949 metals prices declined during a low in the business cycle. Following this, the Korean war encouraged investment in mining in Mexico, the peak having been reached in 1954. A decline in metals prices was accelerated by a recession in 1957. By 1955, production and export taxes had reached a new high in Mexico, further inhibiting investment. The volatility of the graph implies that there are some short-lived factors influencing the data. An interpretation of this implication could be that U. S. companies are merely trying to keep their producing assets at a status quo without making any real investment in terms of growth. Other explanations are that the fluctuation in direct investment is the result of inventories of metals that are being held to take advantage of favorable prices, or inventory fluctuations induced by the business cycle.

Table XV illustrates earnings, income, and undistributed earnings of U. S. subsidiaries, together with net outflow of funds. With the exception of minor adjustments, the undistributed earnings column plus the net outflow of capital indicates the change in book value of U. S. direct investments. In the years 1953, 1954, and 1955, capital flowed from the United States to Mexico. In the other four years, any increase in book value was due solely to undistributed earnings.

Tables XVI and XVII provide a comparative analysis of U. S. investment in the mining and smelting industry versus U. S. investment

TABLE XV

U. S. Direct Investments in Mining and Smelting in Mexico[3]

Earnings, Income, Undistributed Earnings of Subsidiaries, and Net Outflow of Capital (Millions of Dollars)

Year	Earnings	Income	Change in Book Value of U. S. Direct Investments: Undistributed Earnings of Subsidiaries	Change in Book Value of U. S. Direct Investments: Net Outflow of Capital	Change in Book Value of U. S. Direct Investments: Change in Book Value
1950	22	18	4	-8	-4
1951	30	19	11	-5	6
1952	30	21	9	-4	5
1953	17	13	4	8	12
1954	13	33	-20	18	-2
1955	18	14	4	5	9
1956	24	10	14	-3	11

in manufacturing, both in Mexico. From the first table it is seen that the book value of manufacturing is about half the value of mining and smelting in 1946, whereas in 1956 it is nearly twice the book value of mining and smelting. In the ten-year period, the book value of mining and smelting property has increased only $54 million, whereas the book value of manufacturing has increased $243 million. The totals column shows that U. S. investment in Mexican industry has grown by $359 million. Only $43 million has been invested in other segments of the Mexican economy. Investment in manufacturing has accounted for nearly 70 percent of the total American investment in Mexican industry. Table XVII illustrates this fact by showing

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[3]United States Department of Commerce, Balance of Payments, Statistical Supplement, Washington, D. C., 1958.

the nearly five-fold multiplication of the value of manufacturing in comparison to a modest increase of only 48.6 percent in mining and smelting.

A final comparison contrasts the net outflow of capital (Tables XVIII and XIX). In 1952, 1953, and 1954, there was a net flow of funds from Mexico to the United States from the manufacturing investments of only $19 million. This is a rather small sum compared to the opposite flow of $119 million in that industry. On the other hand, there was a total net flow of $20 million from Mexico to the United States for the mining industry compared to an opposite flow of $31 million. The average annual outflow of funds from the United States for the years 1950 to 1956 was $1.6 million for the mining industry, compared with $14.3 million in the manufacturing industry. These facts appear to bear out the earlier assumption that the mining and smelting industry is doing little more than maintaining status quo, contrasted to the manufacturing industry, which is engaged in a real build-up of producing assets.

Where are American Mining and Smelting Companies Investing Abroad?

Is the situation in Mexico unique? Perhaps United States companies are not making foreign investments in mining to any great extent in any part of the world. Table XX compares the book value of United States investment in mining and smelting in various Latin American countries. Using 1946 as a base year, the investment in all Latin American countries, except Chile, has increased more rapidly than Mexico. Total mining investment has more than doubled

TABLE XVI

Book Value of U. S. Direct Investment in Mexico
1946-1956
(Millions of U. S. Dollars)

Year	Mining and Smelting	Manufacturing	All Industries Total
1946	111	66	316
1950	121	133	415
1952	131	210	490
1955	154	274	607
1956	165	309	675

TABLE XVII

Index of Book Value of U. S. Direct Investment in Mexico
1946-1956
(1946=100.0)

Year	Mining and Smelting	Manufacturing	All Industries Total
1946	100.0	100.0	100.0
1950	109.0	201.5	131.3
1952	118.0	318.2	155.1
1955	138.7	415.2	192.1
1956	148.6	468.2	213.6

Source: United States Department of Commerce, U. S. Investments in the Latin American Economy, Washington, D. C., 1959.

TABLE XVIII

United States Direct Investments Abroad:
Earnings, Income, Undistributed Earnings
of Subsidiaries and Net Outflow of Capital
1950-1956

Manufacturing Industry in Mexico
(Millions of Dollars)

Year	Earnings	Income	Undistributed Earnings of Subsidiaries	Net Outflow of Capital	Increase in Book Value
1950	16	8	8	23	31
1951	29	8	21	42	63
1952	24	7	17	-3	14
1953	21	11	10	-7	3
1954	22	10	12	-9	3
1955	32	10	22	39	61
1956	37	13	24	15	39

TABLE XIX

Net Outflow of Capital: Mexico:
Mining and Smelting and Manufacturing
1950-1956
(Millions of U. S. Dollars)

Year	Mining and Smelting	Manufacturing
1950	-8	23
1951	-5	42
1952	-4	-3
1953	8	-7
1954	18	-9
1955	5	39
1956	-3	15
Total 1950-56	11	100
Average	1.6	14.3

TABLE XX

Book Value of United States Direct Investments
in Mining and Smelting Enterprises Operating in Latin America
(Millions of Dollars)

Country	1946	1950	1952	1955	1956
Latin America, Total	506	628	871	1024	1090
Chile	313	351	420	406	434
Mexico	111	121	131	154	165
Peru	44	55	143	191	221
Central America and West Indies	11	15	16	20	24
Other Countries	27	86	161	253	246

from 1946 to 1956, as has the investment in Central America and the West Indies. Mining investment in Peru has increased five-fold, and in "Other Countries" the 1946 value of mining investment has been multiplied by nine.[4] The percent of total investment in Latin America attributed to Mexico and Chile is decreasing and Central America and the West Indies remains about the same, whereas Peru and "Other Countries" have increased substantially. The largest investment, however, is still in Chile. The growth of U. S. direct investment in Latin American mining and smelting is summarized in Table XXI.

TABLE XXI

Total Investment from 1946 to 1956

Country	Millions of Dollars	Percent of Total
Chile	121	20.8
Mexico	54	9.2
Peru	177	30.3
Central America and West Indies	13	2.2
Other	219	37.5
TOTAL	584	100.0

U. S. Direct Investment in Mining and Smelting in the World

Shifting our attention to U. S. direct investment in mining and smelting throughout the world, we find, from Table XXII, that all areas enjoyed a general increase in such investment. Table XXIII,

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[4]Exact figures are not available, but evidence indicates that at least 90 percent of the investment in "Other Countries" is accounted for by Venezuela. Much of this investment is in the iron ore deposits in the Orinoco Valley.

the Index of United States direct investment, shows that the aggregate increase has been 2.1 times the value in 1950. Significantly, the growth of such investment in the Latin American Republics has been less than the aggregate and considerably behind Canada and "Other" countries. "Other" countries includes Australia as well as Asiatic nations, and a great portion of the increase in this category is in the mining and smelting investment in Australia. American Smelting and Refining Company, in particular, has acquired an impressive interest in the lead-zinc production of that continent.

United States investment in mining and smelting in Canada has grown about 10 percent, whereas similar investment in Latin America has declined by the same amount. Investment in Mexico as a percent of total Latin American investment has declined nearly 5 percent over the same period. Maybe some of the funds invested in Canada and Peru might have been invested in Mexico, had the business climate been better.

The total increase in American investment in the mining and smelting industry abroad from 1950 to 1956 was $1,243 million. A listing of the area's share in this investment is made as follows. Canada and Latin America absorbed the bulk of the investment. Since it has been shown that Mexico only received 9.2 percent of United States investment in Latin American mining and smelting, then Mexico received only 4 percent of United States total investment in mining and smelting.

The critic might claim that an ore body can only be worked in the country in which it is found and that a deposit in Peru, for

TABLE XXII

United States Direct Investment Abroad in Mining and Smelting
1950-1956
(Millions of Dollars)

	1950	1951	1952	1953	1954	1955	1956
All Areas, total	1,129	1,317	1,642	1,931	2,078	2,209	2,371
Western Europe	21	23	26	30	35	40	44
Western Europe dependencies	88	98	118	133	103	111	102
Canada	334	400	550	677	792	862	938
Latin American Republics	628	736	871	999	1,002	1,024	1,090
Other Countries	57	61	76	92	147	173	197

TABLE XXIII

Index of United States Direct Investment Abroad
in Mining and Smelting
1950-1956
(1950=100.0)

	1950	1951	1952	1953	1954	1955	1956
All Areas, total	100.0	116.6	145.4	171.0	184.0	195.6	210.0
Western Europe	100.0	109.5	123.8	142.8	166.7	190.5	209.5
Western Europe dependencies	100.0	111.4	134.1	151.1	117.0	126.1	115.9
Canada	100.0	119.8	164.8	202.7	237.1	258.1	280.8
Latin American Republics	100.0	117.2	138.7	159.1	159.6	163.0	173.6
Other Countries	100.0	107.0	133.3	161.4	257.9	303.5	345.6

Source: U. S. Department of Commerce, Balance of Payments Statistical Supplement, U. S. Government Printing Office, Washington, D. C., 1958, p. 153.

TABLE XXIV

Increase in U. S. Direct Investment
in Mining and Smelting, 1950-1956, by Area

Area	Millions of Dollars	Percent Share in Increased Investment
Western Europe	23	1.8
Western Europe dependencies	14	1.1
Canada	604	48.6
Latin America	462	37.2
Other Countries	140	11.3
TOTAL: All Areas	1,243	100.0

example, cannot be developed in Mexico. The point is, however, that money must be expended to look for ore, and even more funds must be available to develop the deposit. Certain unexplored regions in Mexico are known to contain ore deposits, yet the American companies in Mexico are making no attempt to explore these areas; however, in the last three years the trio of American Smelting and Refining, Phelps-Dodge, and Cerro de Pasco have expended $250 million exploring and developing a copper deposit in Southern Peru. The former two companies are two of the major producers in Mexico.

Exports

The major portion of the base metals produced in Mexico are exported for further refining or for manufacturing. Table XXV shows the quantity of the three metals exported from 1947 to 1956.

Copper and lead show a decreasing trend over the period, although there is a sharp increase in lead exports during the Korean war. Zinc, on the other hand, shows an increasing trend in the amount exported from 1947 to 1956.

TABLE XXV

Copper, Lead, and Zinc Exports
1947-1956
(Long Tons)

Year	Crude Copper Bars and Electrolytic Copper	Lead	Zinc
1947	42,520	184,411	184,672
1948	34,646	176,499	170,146
1949	50,945	N.A.	N.A.
1950	51,449	N.A.	N.A.
1951	44,475	154,847	158,471
1952	---	231,447	214,803
1953	22,616	204,991	218,029
1954	18,834	205,646	204,599
1955	21,873	174,983	246,539
1956	24,289	150,981	229,831

The value of these metals exported tells an entirely different story. Table XXVI shows that the value of copper exported is increasing rather rapidly, whereas the previous graph showed a sharp decrease in tonnage exported. The value and the tonnage of lead both show a decrease. The value of zinc exported, although subject to cyclical fluctuations, shows little if any increasing trend. The answer to the apparent differences between tonnage and value exported lies, of course, in the general increase in price for copper, and much less increase in lead and zinc prices.

Table XXVII and Figure 5 compare the value of copper, lead, and zince exports versus the value of total Mexican exports. In all cases these values have been adjusted for the exchange value of the Mexican peso for the applicable year, and converted into American dollars. The total value of zinc exports increases from 1947 to 1948, then falls in response to the general economic slump in 1949,

TABLE XXVI

Value of Copper, Lead, Zinc, and Total Mexican Exports, 1947-1956
(Thousands of U. S. Dollars)

Year	Copper	Lead	Zinc	Total Copper, Lead and Zinc	Total Value of Mexican Exports	Value of Mexican Exports less Copper, Lead and Zinc
1947	19,652	49,854	27,035	96,541	445,341	348,800
1948	17,244	79,531	25,446	122,221	477,059	354,838
1949	24,645	57,386	23,511	105,542	520,160	414,618
1950	24,882	60,588	24,971	110,441	592,381	481,940
1951	31,623	65,991	39,735	137,349	706,537	569,188
1952	N.A.	N.A.	N.A.	N.A.	686,175	N.A.
1953	40,527	51,267	21,046	112,840	584,315	471,475
1954	37,399	53,975	21,023	112,397	658,502	546,105
1955	49,769	48,637	27,747	126,153	788,666	662,513
1956	60,425	44,624	33,338	138,387	879,307	740,920

Sources: Foreign Commerce Yearbook; World Trade Information Service, Statistical Reports, "Foreign Trade of Mexico", 1951-1958.

TABLE XXVII

Index of Total Value of Mexican Exports;
Total Value of Copper, Lead, and Zinc Exports;
and of Value of Total Mexican Exports
Less Value of Copper, Lead, and Zinc Exports
(1947=100)

Year	Index of Total Value of Mexican Exports	Index of Value of Copper, Lead, and Zinc Exports	Index of Total Value of Mexican Exports Less Value of Copper, Lead, and Zinc Exported
1947	100.00	100.00	100.00
1948	107.12	126.60	101.73
1949	116.80	109.32	118.86
1950	133.01	114.39	138.17
1951	158.65	142.27	163.18
1952	154.07	---	---
1953	131.20	116.88	135.17
1954	147.86	116.42	156.56
1955	177.09	130.67	189.94
1956	197.44	143.34	212.41

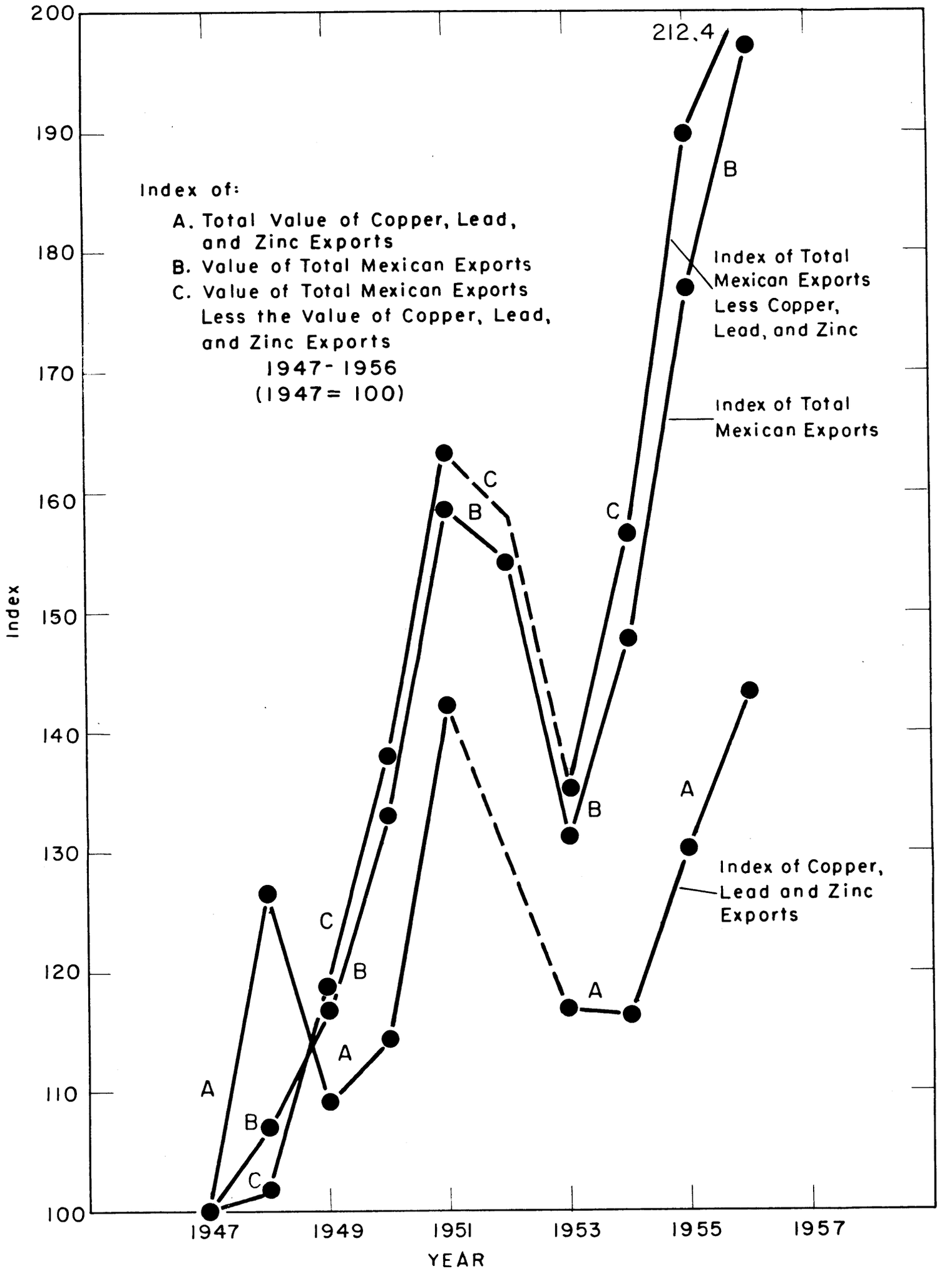
Index of:
A. Total Value of Copper, Lead, and Zinc Exports
B. Value of Total Mexican Exports
C. Value of Total Mexican Exports Less the Value of Copper, Lead, and Zinc Exports
1947-1956
(1947 = 100)
212.4
Index of Total Mexican Exports Less Copper, Lead, and Zinc
Index of Total Mexican Exports
Index of Copper, Lead and Zinc Exports
Index
YEAR
200
190
180
170
160
150
140
130
120
110
100
1947
1949
1951
1953
1955
1957

FIGURE 5

quickly regains its steep slope, and climbs to a high during the first year of the Korean war. A general decline occurs immediately following the Korean war, but base metal exports recover and are higher in 1956 than anytime since World War II.

From the preceding paragraph it may be surmised that the increase from 1954 to 1957 is due entirely to copper output and prices. Line B shows the value of total Mexican exports. With the exception of 1947 and 1948, this line is in all years greater than the value of copper, lead, and zinc exported. Lines B and C on Figure 5, total exports and total exports less base metals respectively, continue a steady increase from 1948 to 1951, whereas the value of base metals exported, line A, makes a rather sharp decline from 1948 to 1949. Copper, lead, and zinc apparently does not have a significant influence on total Mexican exports. Table XXVII shows that copper, lead, and zinc comprise a substantial proportion of total Mexican exports but that the proportion is declining. Inasmuch as total exports are increasing, it must be assumed that the decrease of base metals exports as a percent of total exports is due to a tremendous increase in other commodities, particularly agricultural products and manufactured items.

Total exports dropped off as a result of the post-Korean recession and hit bottom in 1953, only to begin a steeper rise that remained unchecked by 1956. Line C portrays the value of total Mexican exports less the value of copper, lead, and zinc exported. It shows that after 1949 the value of copper, lead, and zinc did not increase as

rapidly as other commodities exported. Furthermore, these other exports recovered more rapidly after the 1953 slump than did the base metals.

TABLE XXVIII

Value of Copper, Lead, and Zinc Exports as a Percent of Total Mexican Exports, 1947-1956

Year	Percent
1947	21.7
1948	25.6
1949	24.1
1950	18.6
1951	19.4
1952	N.A.
1953	19.3
1954	17.1
1955	16.0
1956	15.7

It may be inferred from Figure 5 that copper, lead, and zinc comprise a substantial portion of Mexican exports but that they are steadily becoming less important. That this statement is true, is shown by Table XXVIII. It shows that in 1948 the base metals comprised a high of 25 percent of the total value of Mexican exports, but that since that year these metals as a percent of exports have shown a steady, definite decline.

The effect of taxes on the total export of the base metals, of course, is secondary. It has been shown that United States investment in the mining and smelting industry has not been much greater than that required for the industry to maintain its present status. Thus in terms of tonnage, only zinc has shown a significantly increasing trend.

CHAPTER V

EFFECT OF MINING TAX ON THE MEXICAN ECONOMY, PRODUCTION, AND CONSUMPTION OF BASE METALS

Introduction

The purpose of this chapter is to answer three questions:

1. If high taxes result in a decline of the smelting and refining industry, would that decline seriously affect the general economy?

2. Do the production and export taxes influence the year-to-year pattern of smelter production?

3. Have high taxes on export of base metals stimulated the growth of base metals manufacturing facilities within Mexico?

General Economy

Figure 6 shows the respective values of smelter production of copper, lead, and zinc in a comparative format. Thus, in spite of the expected dips, the value of copper shows an increasing secular trend. Lead, on the other hand, decreases with signs of stabilizing after 1953. Zinc, although more volatile than copper, also increases in value of production. In terms of a general trend, the increases in zinc and copper appear to be about the same magnitude. Generally speaking, the three metals show about the same responses to fluctuations in the economic cycle, although the magnitude of the fluctuations in the value of copper are more stable.

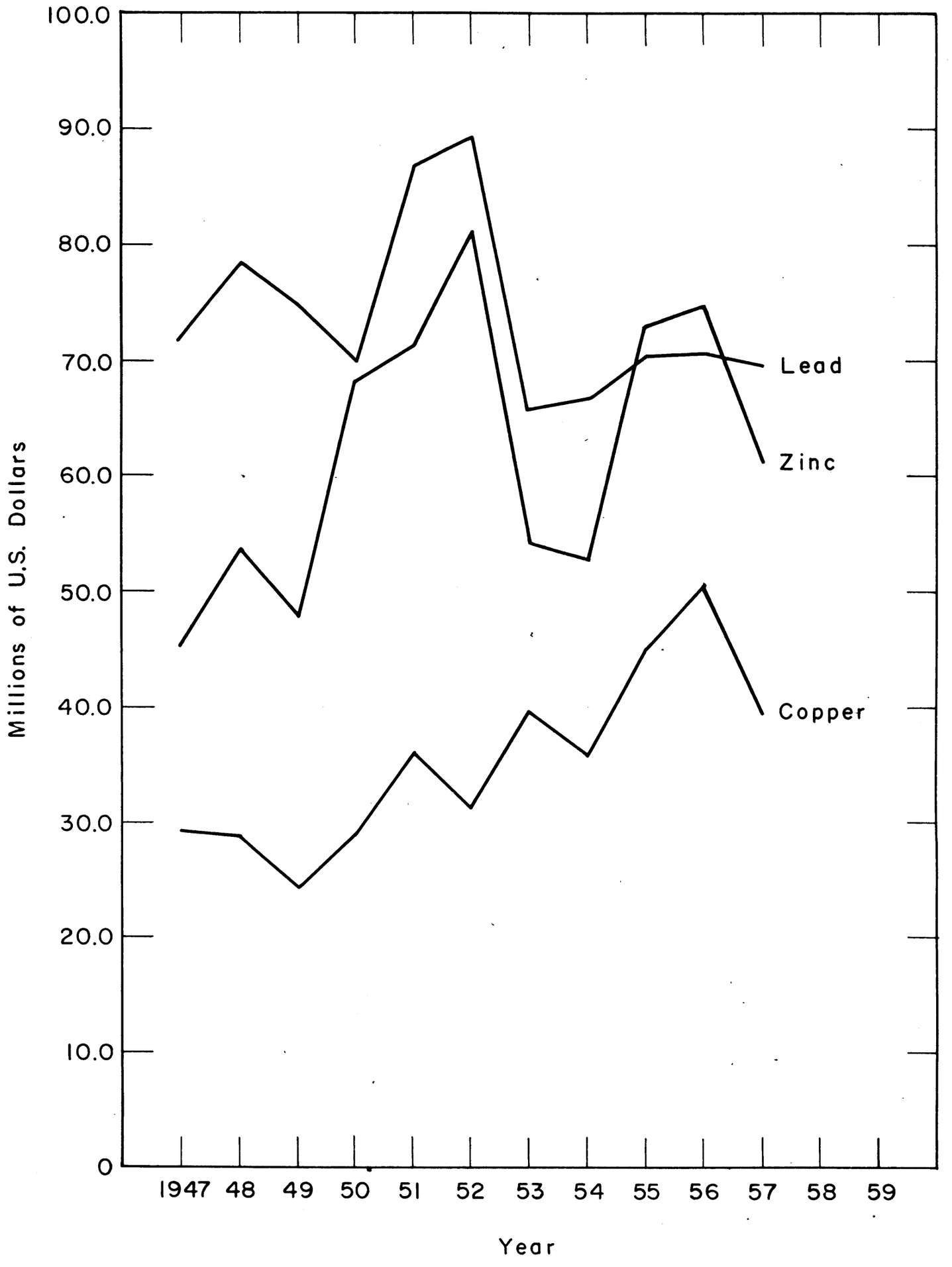

FIGURE 6 VALUE OF MEXICAN SMELTER PRODUCTION OF COPPER, LEAD, AND ZINC 1947 – 1957 MILLIONS OF U.S. DOLLARS

Table XXIX shows that the aggregate value of copper, lead, and zinc is generally increasing. From Figure 6 it may be assumed that the aggregate increase may be attributed to copper and zinc. For example, the 1947-1949 average values of copper, lead, and zinc were, respectively, 27.4, 75.1, and 48.9 million dollars. A 1955-1957 average of each of the three metals is, respectively, 45.1, 70.1, and 71.0. Thus, in these comparisons, the value of copper has increased 40 percent, zinc, 32 percent, and lead has declined 7 percent. On the same basis the aggregate value of the base metals has increased from 151.4 million dollars for a 1947-1949 average, to 184.6 million dollars for a 1955-1957 average, or an increase of 18 percent.

Table XXIX and Figure 6 show lows in the recession of 1949, and the post-Korean recession of 1953 and 1954. As expected, highs are shown at the peak of the Korean war and in the general business upswing in 1956. After 1956 the metals market began a sharp decline, hitting bottom in 1958. The gross national product follows the same pattern; Table XXIX shows an increasing trend in gross national product and in the value of base metals produced. Yet the value of copper, lead, and zinc as a percent of gross national product steadily declines.

Production

Table XXX compares Mexican and World mine production of copper, lead, and zinc from 1945 to 1947. The volume of copper and lead production has remained steady over the period, implying that mine production is probably the same as smelter production. Furthermore, it is concluded that this production is probably at capacity. This conclusion is based on two facts:

TABLE XXIX

Gross National Product of Mexico versus
Value of Copper, Lead, and Zinc Produced in Mexico

Millions of U. S. Dollars

1947-1957

Year	GNP*	Value of Copper, Lead, and Zinc Produced	Value of Copper, Lead, and Zinc Produced as a Percent of GNP
1947	5974.0	146.8	2.46
1948	5682.5	160.7	2.83
1949	4532.0	146.8	3.24
1950	4797.4	167.0	3.48
1951	5988.1	194.4	3.25
1952	6739.5	201.8	2.99
1953	6508.3	159.6	2.45
1954	5966.4	155.7	2.61
1955	6720.0	188.6	2.81
1956	7520.0	195.1	2.59
1957	8320.0	170.0	2.04

Source: Bank of Mexico, D. F.

*GNP has been converted from pesos, as given by the Bank of Mexico, to United States Dollars, using the annual average conversion rate as published by the United States Department of Commerce (see appendix).

TABLE XXX

Mexican and World Mine Production of Copper, Lead, and Zinc

1945-1957

(000's of Metric Tons)

Year	Copper		Lead		Zinc	
	World Production	Mexican Production	World Production	Mexican Production	World Production	Mexican Production
1945	2,177.1	60.7	1,101.1	202.1	1,253.8	206.6
1946	1,848.5	60.1	1,023.4	137.9	1,384.2	137.3
1947	2,254.8	62.5	1,288.6	219.6	1,570.8	192.7
1948	2,356.6	58.1	1,328.8	190.3	1,665.4	176.2
1949	2,365.6	56.3	1,538.6	217.3	1,781.5	175.6
1950	2,603.1	60.7	1,652.0	234.3	1,937.8	220.0
1951	2,754.9	66.3	1,687.8	221.9	2,062.8	177.2
1952	2,772.8	57.5	1,803.9	242.1	2,161.1	223.8
1953	2,938.0	59.2	1,839.6	218.0	2,321.8	223.0
1954	2,929.9	53.9	1,964.6	213.2	2,411.1	220.2
1955	3.232.7	53.8	1,982.5	207.5	2,652.2	265.1
1956	3,563.1	54.0	2,116.4	196.5	2,786.2	245.0
1957	3,607.7	59.6	2,223.6	211.5	2,884.4	239.2

1. An insignificant amount of copper and lead ores and concentrates have been exported throughout this period;

2. Lead and zinc are produced from the same ore. A steady increase in zinc production without an increase in lead production would imply that lead concentrates are thrown on the dump. If there were excess lead capacity, then it would be economical to extract lead from these tailings.

Assuming that lead smelters are operating at capacity, it is concluded that neither mine production will increase nor will smelter capacity be expanded. Export taxes are so high on lead ores and concentrates that these exports are discouraged; hence, discouraging increases in mine production. Five to eight years of lead reserves would not justify a substantial investment in lead smelting capacity. It follows then that high taxes have inhibited exploration and development of new reserves, which in turn discourages investment in increased lead capacity.

If Cananea's copper reserves prove out to expectation, and if the Mexican Government grants tax concessions for mining a lower-grade deposit, then additional copper smelting capacity would undoubtedly be added. A twenty year increase in reserves might justify additional investment in smelting capacity, giving Mexico a long-run increase in copper production. This possibility, however, rests upon any tax concessions that the Mexican Government might allow.

Zinc capacity is 54,400 tons, one smelter owned by the Mexican Zinc Company. Zinc mine production is about four times smelter capacity, and production is increasing. The Mexican Government has

organized a new company, "Zincamex," to produce refined zinc. The capacity of the plant is estimated at 25,000 tons per year.[1] A privately-owned zinc smelter will be constructed at Tlalnepantla.[2] These three plants will more than double smelter production, but will fall short of providing smelter capacity equal to mine output by about 50 percent. The suggestion is that high taxes and low reserves have prevented smelting companies from building needed zinc refineries.

Besides inhibiting or stimulating production and smelting capacity, taxes could have the effect of distorting year-to-year production. Production and export taxes are ad valorem. Therefore, a producing company might produce and export more metal and concentrates in a period when prices are low than when prices are relatively high. A book loss might be incurred by the producing subsidiary, but the metal products would, in most cases, be sold to the parent in the United States for additional refining. Coupled with the fact that base metals and concentrates are easily stored and suffer practically no deterioration from weather, a company could be tempted to speculate in inventories. In an effort to investigate this possibility, a correlation study was undertaken to compare the production pattern of Mexico with major firms and countries producing copper, lead, and zinc.

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[1] The Chase Manhattan Bank, Latin American Business Highlights, Vol. 9, No. 4, p. 14.

[2] Ibid., p. 14.

The United States, Canada, South America, Mexico, The Anaconda Company, and The Kennecott Company were compared on the basis of production versus price, showing the following results:

TABLE XXXI

Correlation of Copper Mine Production
versus Copper Price
1947-1957

Producer	t+1[3]	t-1[4]	t
United States	.35	.60	.61
Canada	.56	.94***	.81**
South America	.27	.82**	.73**
Mexico	-.60	-.50	-.56
Anaconda Company	-.02	.37	.44
Kennecott Company	-.02	.11	.20

* Significant at the 5 percent level of significance
** Significant at the 1 percent level of significance
*** Significant at the 0.1 percent level of significance

The foregoing results are inconclusive, showing that there is a rather high correlation for production of the United States, Canada, and South America versus price for price at both t and t-1. The only conclusion is that apparently production has little or no effect on price; rather, just the converse is indicated, that price influences

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[3] "t+1" refers to production in one year correlated with the price for the following year; hence, investigating the influence of production on price.

[4] "t-1" refers to production in one year correlated with the price for the preceding year, investigating the influence of price on production.

production. Throughout the correlation Mexico maintains a negative correlation coefficient, which is not significant. Apparently, Mexican production is not geared to the year-to-year price fluctuations of copper.

In order to make a further analysis of production patterns, the production of the four countries and two corporations were inter-correlated, with the following results:

TABLE XXXII

Copper Production Correlation

Producer	U. S.	Canada	S. A.	Mexico	Anaconda Co.	Kennecott Co.
United States	-	.67*	.67*	-.10	.29	.51
Canada	.67*	-	.81**	-.43	.40	.20
South America	.67*	.81**	-	.44	.70**	.48
Mexico	-.10	-.43	.44	-	-.17	.39
Anaconda Company	.29	.40	.70**	-.17	-	-.04
Kennecott Company	.51	.20	.48	.39	.04	-

*Significant at the 5 percent level of significance
**Significant at the 1 percent level of significance

Results show that the major producing countries, the United States, Canada, and South America, show a significant production correlation among one another. Anaconda shows a significant correlation with South America, which would be expected; whereas Kennecott does not correlate with South America, which would not be expected. Mexico's pattern of production does not conform with production from the other countries or of the two major copper-producing concerns. In summary, it has been shown that Mexican copper production does not correlate

with other companies or countries. Statistically, there is no justification for the observation that copper price and copper production in Mexico bear an inverse relationship to one another. In fact, Mexican copper production in no way appears to respond to price.

A similar analysis for lead was performed, showing the following results:

TABLE XXXIII

Correlation of Lead Production versus Lead Price
1947-1957

Producer	t+1	t-1	t
United States	.36	.05	.20
Canada	-.08	-.19	-.30
Australia	-.44	.15	-.24
American Metals	-.05	.57	-.35
ASARCO	.38	-.13	-.26
Mexico	-.44	.11	-.45

The study correlating lead production and lead price showed no significant results. The production used in all cases was mine production rather than smelter production.

Three possible hypotheses present themselves as a possible explanation of the preceding lack of correlation. One is that lead prices fluctuate too much on a monthly or at least a quarterly basis, so that a correlation based on average annual prices would not be sensitive enough. A second hypothesis is that smelter production or lead sales would have provided more relevant data--except that these figures are not available. The third reason is the more obvious. Perhaps there is no direct relation between lead mine production and lead price.

Following this study with an intercorrelation among the producing entities, a more interesting relationship was uncovered.

TABLE XXXIV

Lead Production Correlation
1947-1957

Producer	U. S.	Canada	Australia	American Metals	ASARCO	Mexico
United States	-	-.66*	-.82**	-.33	.79**	.38
Canada	-.66*	-	.38	.06	-.55	.56
Australia	-.82**	.38	-	.62*	-.47	-.34
American Metals	-.33	.06	.62*	-	-.24	.32
ASARCO	.79**	-.55	-.47	-.24	-	.56
Mexico	.38	-.56	-.34	.32	.56	-

* Significant at the 5 percent level of significance
** Significant at the 1 percent level of significance
*** Significant at the 0.1 percent level of significance

This set of data shows that American Smelting and Refining Company's production correlates closely with that of the United States; however, there is an inverse relationship among ASARCO, Canada, and Australia. This is not surprising because ASARCO controls 63 percent of the smelting capacity in the United States. The surprising fact is that ASARCO and Mexico do not correlate, nor do ASARCO and American Metals. Evidently American Metals' production pattern is quite unlike that of ASARCO.

The results of the analytical study of lead production and prices show that there is no apparent correlation between production and price, and only a slight intercorrelation. It must be concluded, therefore, that high taxes have no effect on the pattern of production, so far as a year-to-year variation is concerned.

As far as price correlation is concerned, a third analysis for zinc bears a great resemblance to the lead study.

TABLE XXXV

Correlation of Zinc Production versus Zinc Price
1947-1957

Producer	t+1	t-1	t
United States	.42	.18	.68*
Canada	-.43	.14	-.02
Australia	-.41	.14	-.20
American Metals	-.12	.53	-.26
ASARCO	-.36	.12	-.18
Mexico	-.31	.07	-.19

* Significant at the 5 percent level of significance

Except for the United States, there is no apparent correlation between price and production. An analysis of production among these same entities is more significant, however.

TABLE XXXVI

Zinc Production Correlation

Producer	U. S.	Canada	Australia	American Metals	ASARCO	Mexico
United States	-	-.67*	-.78**	-.10	-.72**	-.66*
Canada	-.67*	-	.92***	.20	.88***	.84**
Australia	-.78**	.92***	-	.29	.92***	.83**
American Metals	-.10	.20	.29	-	.25	.34
ASARCO	-.72*	.88***	.92***	.25	-	.79**
Mexico	-.66*	.84**	.83**	.34	.79**	-

* Significant at the 5 percent level of significance
** Significant at the 1 percent level of significance
*** Significant at the 0.1 percent level of significance

It is discovered that the United States mine production of zinc correlates with price, but has a significant negative correlation with the other countries and ASARCO. When ASARCO production is high, United States production is low. Mexico bears an inverse relation with the United States and a positive relation to ASARCO. Some force other than price is at work influencing production. Whatever the force, Mexico follows the same pattern as Canada, Australia, and American Smelting. This fact leads to the conclusion that high taxes in Mexico are not distorting Mexico's production pattern from year-to-year.

Base Metals Consumption

If Mexican industry could consume a large portion of the copper, lead, and zinc produced within the country, it would have a great stimulating effect on the mining and smelting industry. Markets within Mexico would eliminate the onerous export taxes, which range from 20-30 percent of the gross value of metal produced. Such a saving would again place the mining and smelting industry on a profitable basis.

Copper

Copper is utilized mainly for its heat and electrical conducting properties, resistance to corrosion, and ease of casting, fabricating, and alloying. The major uses of copper are divided between wire and cable manufacturing and brass and bronze foundries.

During the fiscal year, September, 1957 to August, 1958, approximately 24.5 thousand metric tons of electrolytic copper was produced by Mexico's single electrolytic refinery. About 5.6 thousand metric

tons were exported, leaving 19 to 20 thousand metric tons available for Mexican industry. During this period, 20.5 thousand tons of copper were purchased by the Mexican metal working industry; 13.6 thousand tons of wire bars for the manufacture of electric wire and cable, and the remainder in the form of cathode went to twenty-five firms for a variety of uses. Slightly more than six thousand tons of the latter, or 90 percent of all cathode copper was purchased by six principal users.

TABLE XXXVII

Distribution among Six Principal Users

	Amount (000's of Metric Tons)	Percent
Firm No. 1: Manufacturer of copper tubing, copper shapes and forms, brass sheet, bronze tubes, shapes and forms.	4.33	63.0
Firm No. 2: "Casa de Moneda" (Mexican Mint) for coinage.	.662	10.0
Firm No. 3: Manufacturer (alloyer) of sheet brass, brass wire and rod, and coiled brass.	.579	8.5
Firm No. 4: Manufacturer of brass rod, shapes, forms, tubing, and pipe.	.396	6.0
Firm No. 5: Bronze valve factory doing own alloying and casting.	.157	2.5
Firm No. 6: Manufacturer of brass sheet, coils, strip, and wire.	.050	1.0

Source: U. S. Department of State, Mexican Embassy, Foreign Service Dispatch, December 9, 1958, p. 2.

Information on the production volume of extruded products is jealously guarded by the firm in that industry. However, information on the location and capacity of presses is well known.

TABLE XXXVIII

Extrusion Presses in the Copper and Copper Base Alloy Industry in Mexico

	Capacity	Location	Products
Firm No. 1	1,200 tons/in^2	Mexico, D.F.	Copper tubing and pipe, copper shapes and forms, brass tubing, pipe, shapes, and forms.
Firm No. 2	1,200 tons/in^2	Mexico, D.F.	Brass bars, shapes, forms, tubing, pipe, sheets, and strip.
Firm No. 3	800 tons/in^2 1,200 tons/in^2	Mexico, D.F.	Brass tubes and architectural shapes.
Firm No. 4	900 tons/in^2 300 tons/in^2	Monterrey, N.L.	Brass solids and some tubing.

Source: U. S. Department of State, Mexican Embassy, Foreign Service Dispatch, December 9, 1958, p. 4.

It has been estimated that 3300 to 3400 metric tons of products are presently extruded by the extrusion industry. Copper tubing accounts for the bulk of extruded products. This estimate is made as follows:

TABLE XXXIX

Tonnage of Extruded Shapes and Forms
1956-7-8 Average

Total tonnage extruded	3400 metric tons
Copper extrusions	3050 metric tons
Brass extrusions	1350 metric tons

Source: U. S. Department of State, Mexican Embassy, Foreign Service Dispatch, December 9, 1958, p. 4.

Mexico is not self-sufficient in the production of copper products. Imports include machinery, industrial equipment (valves, motors, electrical equipment, etc.), all containing significant quantities of copper or brass components. In addition, component parts for assembly operations are imported, many of them copper or copper alloys.

Zinc

In 1956, 15,318 metric tons of refined zinc remained in Mexico, and in 1957, 14,299 metric tons of zinc remained. During 1957, 13,336 metric tons of Mexican zinc was purchased by the metals working industry in the following proportions:

TABLE XL

Zinc Used in Metalworking in Mexico
1957

End Use	Amount (Metric Tons)	Percent
Galvanizing	5,255	39.4
Oxides and Dust	4,860	36.4
Shape, Strip, and Extrusions	1,198	9.0
Brass and Bronze Shapes	357	2.4
Coinage	130	1.0
Miscellaneous	1,536	11.8
	13,336	100.0

Source: U. S. Department of State, Mexican Embassy, Foreign Service Dispatch, December 9, 1958, p. 10.

There are ten galvanizing plants in the Federal District, and at least four more dispersed throughout Mexico. Four firms manufacture zinc oxide, one in Monterrey, N. L., and the remainder in

Mexico, D. F. A firm manufacturing zinc white is located in Tampico. The capacity of these firms approximates the consumption figures noted.

The most important extruded zinc shapes are battery casings. There are four manufacturers of dry cell batteries in Mexico, although the casings are extruded for them on a custom basis by other firms.

Mexican exports of manufactured zinc products show a tendency to rise and can be expected to show moderate increases each year. The total tonnage is not large, 114 metric tons in 1956, tripling to 360.7 tons in 1957. Most of the production is represented by non-specialized objects and photo-lithography plates. The latter are exported to Guatemala, the former sent to the United States.

Lead

Consumption of lead in Mexico is practically nonexistent. Small amounts are used for battery manufacture, the chemical industry, and manufacture of solder and type metal. No reliable data are available detailing Mexican consumption of lead; however, it is known that use of lead is a minute percentage of lead production. Furthermore, consumption apparently is growing quite slowly.

Although increasing amounts of copper and zinc are used by Mexican manufacturers, the total amounts are far below the mining industry's capacity to produce these metals. A market for non-ferrous metals within Mexico would ease the export tax burden, but a large market is not likely to develop in the near future.

CHAPTER VI

CONCLUSIONS

Ore Reserves and Structure of the Industry

At the present time the ore reserves are low. Present proved reserves of copper, lead, and zinc will last less than ten years at present production rates. Copper may be the only exception, but a newly-discovered deposit is not yet proved and it will be some time before the deposit begins producing. A large mining company would not consider developing a deposit unless a minimum of fifteen to twenty years' production could be assured. After developing an ore body, the usual procedure is to conduct exploration so that one ton of new ore is blocked out for every ton removed. With very low reserves of lead and zinc, it may be presumed that exploration has declined or ceased altogether. Officials of several mining companies have admitted that exploration has almost ceased. One officer, when questioned, exclaimed, "It would even be embarrassing if we found an ore deposit by accident."

This is borne out by the smelting segment of the industry. Lead production, for example, has remained steady at what must be presumed capacity operation. On the other hand, zinc production has increased. The ores are complex lead-zinc sulfides, so zinc could not be mined without mining about the same tonnage of lead. It must be concluded that either lead ore is being exported or that it is being stockpiled. Examination of Mexico's exports shows that

insignificant quantities of lead ore and concentrates leave the country, so it must be concluded that the ore is stockpiled. Evidently ASARCO or American Metals-Climax feel that it isn't worthwhile to expand smelting capacity, even though there is production to support it. Mine production of zinc is several times smelter production, and large quantities of zinc concentrates are exported annually. Until 1960 only one zinc refinery has been in operation. Two are being built, one by the Mexican Government, the other by a Mexican corporation. It is significant to note that production would have supported another refinery since the end of World War II, yet none of the American corporations in Mexico has undertaken such a project.

Tax Structure

Production and export taxes are established so that the greater the amount of processing of a mineral, the less the tax. It must be noted, however, that the production tax decreases no more than two percentage points from concentrates to refined metal. This can hardly be considered an incentive to refine metal.

In answer to the mining companies' complaints that taxes are too high and inequitable, the Mexican Government points out that the taxes apply equally to Mexican and foreign mining corporations. The law does, indeed, make no distinction between Mexican and foreign companies; however, this observation is idle. The point is that 90 percent of investment in mining is foreign capital. The remaining 10 percent attributed to Mexican companies is composed of very small

operations which can easily fall under special concession categories in the tax code.

The philosophy of the Mexican Government is apparently to take away all profits from the mining companies, and then grant tax rebates so that the mining companies earn what the Mexican Government believes is a fair return on capital. In addition, the Government is making no effort to stimulate the mining industry. It was noted that in the Federal budget no funds were destined for the benefit or encouragement of the mining industry.

Effect of Taxes on Foreign Investment

In Chapter IV it was shown that foreign investment in mining in Mexico is increasing, but at a slow rate. Foreign investment in Mexican manufacturing, on the other hand, is surpassing that in Mexican mining. In other Latin American countries, however, American investment has been increasing steadily. The same scene is observed elsewhere. Two possibilities exist: either no more ore exists in Mexico or corporations are conducting exploration in more favorable investment climates. The tax situation must be blamed.

Base Metals Exports

Although the total value of base metals exports is increasing, it is mostly attributable to increasing prices. Zinc is the only metal showing a distinct increasing trend in tonnage exported. As a percent of total export value, base metals are rapidly decreasing. At the present time, the total value of copper, lead, and zinc exported is only about 15 percent of total exports. It must be assumed

that even if the mining and smelting industry appreciably declines in about ten years, at that time it would not have a serious effect on the Mexican economy.

Effect of Taxes on Production

A correlation analysis was presented to determine if production patterns had been in any way altered by high taxes. Although the evidence was not conclusive, there apparently is no distortion of the time pattern of production.

Consumption of Base Metals

Reliable data on consumption of copper, lead, and zinc in Mexico are impossible to obtain. It is inferred, however, that lead consumption is almost nonexistent. Copper and zinc, on the other hand, are being used in increasing quantities. If a large proportion of the copper and zinc produced in Mexican mines and smelters were consumed in Mexico, then mining might again be stimulated. Internal sales would eliminate the costly production and export taxes and place the industry on a profitable basis.

Mexican Policy

Before hazarding final conclusions, some observations must be made concerning the policy of the Mexican Government. The tax code provides for a great many broad concessions that may be offered to the mining companies. For example, unprofitable mines, low-grade ores, socially or economically desirable activities, etc., may all be subsidized by the Government in the form of tax rebates up to 75

percent of the production and export taxes. These are all factors that could be subject to broad interpretation. The tax law itself, then, is not harsh, it is only the interpretation by present and past Governments. A tentative hypothesis is that the Mexican Government is deliberately trying to force American mining companies out of Mexico, so that the industry may eventually be nationalized. Expropriation would arouse the ire of foreign governments. Such an event would undoubtedly prevent Mexico from obtaining needed loans from the International Bank for Reconstruction and Development or the Import-Export Bank. However, a policy of taxing the mining companies "to death" would make them leave voluntarily as soon as present reserves are exhausted.

One point must be made in Mexico's favor. She is outgrowing her role as an agricultural-mining economy. In order to stimulate manufacturing, funds must be obtained. The only industry in Mexico able to provide the tax portion of those funds is the mining and smelting industry. The Federal Government has evidently decided that manufacturing is more valuable than mining and would destroy one to build the other.

An investigation of federal policy and nationalistic attitude would prove a fruitful area for investigation. Such an investigation would provide a welcome addition to the substance of this thesis.

APPENDIX

STRUCTURE OF THE MAJOR MINING AND SMELTING COMPANIES OPERATING IN MEXICO

Source: Moody's Industrials, 1958, and Materials Survey--Copper, Materials Survey--Zinc, and Materials Survey--Lead.

American Metals-Climax

Incorporated June 19, 1887, in New York

Mexican Subsidiary	Percent Owned
Compania Minera de Penoles, S. A.	98.6
Compania Metalurgica Penoles, S. A.	65.0
Compania Minera "La Occidental", S. A.	Inactive
Compania Minera "La Campana", S. A.	100.0
Compania Minera Amcosa, S. A.	100.0
San Francisco Mines of Mexico	75.0

Principal Operating Properties

Name	Location	Activity
Avalos Unit	Avalos, Zucatecos	lead, zinc mine and mill
Calabaya Unit	Etzatlan, Jalisco	lead, zinc mine and mill
Topia Unit	Topia, Durango	silver, lead, zinc
Guadalupe Unit	Villaldama, Nuevo Leon	lead

The Compania Metalurgica de Penoles owns a lead smelter at Monterrey, Nuevo Leon, with an intake capacity of 25,000 tons per month producing 9,000 tons of lead and 75 tons of silver monthly. The Compania de Torreon owns a lead smelter at Torreon, Coabuila, and a plant for the production of white arsenic.

American Smelting and Refining Company

Incorporated April 4, 1899, in New Jersey

Mexican Subsidiary	Percent Owned
Acidos Asarco, S. A.	100.0
Compania Carbonifera de Sabinas, S. A.	100.0
Compania Metalurgica Asarco, S. A.	100.0
Compania Minera Asarco, S. A.	100.0
Compania de Tenenos e Inversiones de San Luis Potosi, S. A.	27.9
Compania Minera de Alarcon, S. A.	100.0
Compania Minera Nacional	100.0
Compania de Terrenos e Inversiones de San Luis Potosi, S. A.	0.7
Compania Minera y Beneficiadora de San Antonio y Anexas, S. A.	100.0
Euthone de Mexico, S. A.	100.0
Mexican Zinc Company, S. A.	100.0
Compania de Combustibles "Agujita", S. A.	99.9
Compania Metalurgica Mexicana	
Cia Minera La Loteria, S. A.	100.0
Mexican Lead Company	90.1
Mexican Smelting and Refining Company	100.0
Montezuma Lead Company	99.7
Potosi and Rio Verde Rwy. Company	100.0
Compania Minera de Jesus Minera	77.1
Compania Minera de San Isidro y Anexas	55.6
Compania de Terrenos e Inversiones de San Luis Potosi, S. A.	71.4
La Descubridora Mining Company	99.8
Minas de La Alianza, S. A.	100.0

American Smelting and Refining Company (continued)

Mexican Mines Owned or Operated by ASARCO

Name	Location	Activity
Santa Barbara Mine	Santa Barbara, Chile	gold, silver, copper, lead, zinc
Charcas Unit	Charcas, S. L. P.	silver, copper, lead, zinc
Santa Eulalia Mine	Santa Eulalia, Chile	silver, lead, zinc
Montezuma Lead Company	Santa Barbara, Chile	gold, silver, copper, lead, zinc
Concepcion del Oro	Zacatecas	copper
Parral Mines	Parral, Chile	gold, silver, copper, lead, zinc
Rosita, Agujita, and Cloete Mines	Rosita, Chile	coal, coke
Taxco Mine	Taxco, Guerrero	gold, silver, lead, zinc
Aurora-Xichu Mines	Xichu, Guanajuato	silver, lead, zinc
Plomosas Mines	Picachos, Chile	silver, lead, zinc
Nuestro Senora Unit	Cosala, Sinaloa	lead, zinc
Encantada Unit	Ansita, Coahuila	fluorspar

ASARCO owns two lead smelters with a capacity of 752,000 tons and a copper smelter with a capacity of 316,000 tons and a zinc smelter with a capacity of 125,000 tons. It owns a lead refinery with a 216,000-ton capacity and a zinc refinery of 54,000-ton capacity.

Anaconda Company

Incorporated June 18, 1895, in Montana

Mexican Subsidiary	Percent Owned
Greene Cananea Copper Company (Minnesota)	99.41
Cananea Cons. Copper Company, S. A.	99.97

Cananea Cons. Copper Company owns a group of copper mines near Cananea Sonora.

Eagle Picher Company

Incorporated January 10, 1867, in Ohio

Mexican Subsidiary	Percent Owned
Eagle Picher de Mexico, S. A. de C. V.	100.0
Minas de Ignala, S. A.	100.0

The principal mine is the Esmeralda Lead-Zinc Mine.

Fresnillo Corporation

Incorporated September 8, 1910, in New York

Mexican Subsidiary	Percent Owned
Cia National Minera, S. A.	100.0
Round Mountain Gold Dredging Corporation	100.0
Cia Minera Nueva Esperanza Company, S. A.	100.0
Minas de Durango, S. A.	100.0
Cia Candelaria-Canoas, S. A.	100.0
Sombrerete Mining Company	55.0
Cia Minera de San Augustin y Auexo, S. A.	52.8

Mines and metallurgical operations located at Fresnillo, Zacatecas, and Naica, Chile. Mines and treats copper, lead, zinc, silver, gold.

Howe-Sound Company

Incorporated June 30, 1958, in Delaware

Mexican Subsidiary	Percent Owned
Compania Industrial "El Potosi", S. A.	100.0

Principal mine is the Potosi Mine located in the Santa Eulalia district in Chihuahua, producing lead, zinc, and silver.

Phelps Dodge Company

Incorporated August 10, 1885, in New York

Mexican Subsidiary	Percent Owned
Moctezuma Copper Company (West Va.)	100.0
Moctezuma Copper Company (Mexico)	100.0

Only producing copper mine located at Nacozari, Sonora.

San Francisco Mines of Mexico, Ltd.

Incorporated March 27, 1913, in Mexico

Owns lead, silver, gold, and copper mines near Parral, State of Chihuahua, Mexico. The principal producing mines are the San Francisco and Clarines Mines.

Santa Maria de la Paz

Incorporated in Mexico

Operates the Santa Maria de la Paz Mine at Malchula, S. L. P., and a 350-ton flotation plant. Produces lead and zinc.

Table XLI

Copper, Lead, and Zinc Reserves in Mexico--by Mine

Mine or District	Estimated ore (000's of S.T.)	Assay Cu	Pb	Zn
Cananea	22,000	1.0	--	--
Chihuahua, N. L.	no data	--	--	--
El Potosi	no data	--	10.8	10.4
Fresnillo	3,005	0.6	4.8	5.2
Moctezuma	1,800	2.8		
Parral	no data	--	--	--
Parroquia-Magistral	2,000	--	1.3	5.5
San Francisco del Oro	3,250	0.8	6.8	9.4
San Pedro	no data			
San Roberto	500		1.2	13.1
Santa Barbara	1,800		4.0	
Santa Eulalia	no data			
Taxco	no data			
Tezuitlan	130	0.5	5.0	6.0

Source: William P. Shea, "Foreign Ore Reserves of Copper, Lead, and Zinc", Engineering and Mining Journal, Vol. 65, January, 1947, pps. 53-58.

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