

**THE ECONOMIC IMPACT OF FIXED VERSUS FLEXIBLE
PRICE MECHANISMS ON THE CANADIAN GOLD
MINING INDUSTRY**

**A Thesis
Submitted to the Faculty of Graduate Studies
in Partial Fulfillment of the Requirements
for the Degree of
Master of Arts
in the Department of Economics
University of Manitoba**

**by
William John Jobes
Winnipeg, Manitoba
December 1989**



National Library
of Canada

Bibliothèque nationale
du Canada

Canadian Theses Service Service des thèses canadiennes

Ottawa, Canada
K1A 0N4

The author has granted an irrevocable non-exclusive licence allowing the National Library of Canada to reproduce, loan, distribute or sell copies of his/her thesis by any means and in any form or format, making this thesis available to interested persons.

The author retains ownership of the copyright in his/her thesis. Neither the thesis nor substantial extracts from it may be printed or otherwise reproduced without his/her permission.

L'auteur a accordé une licence irrévocable et non exclusive permettant à la Bibliothèque nationale du Canada de reproduire, prêter, distribuer ou vendre des copies de sa thèse de quelque manière et sous quelque forme que ce soit pour mettre des exemplaires de cette thèse à la disposition des personnes intéressées.

L'auteur conserve la propriété du droit d'auteur qui protège sa thèse. Ni la thèse ni des extraits substantiels de celle-ci ne doivent être imprimés ou autrement reproduits sans son autorisation.

ISBN 0-315-76625-5

Canada

THE ECONOMIC IMPACT OF FIXED VERSUS FLEXIBLE
PRICE MECHANISMS ON THE CANADIAN GOLD MINING INDUSTRY

BY

WILLIAM JOHN JOBES

A thesis submitted to the Faculty of Graduate Studies of
the University of Manitoba in partial fulfillment of the requirements
of the degree of

MASTER OF ARTS

© 1990

Permission has been granted to the LIBRARY OF THE UNIVER-
SITY OF MANITOBA to lend or sell copies of this thesis. to
the NATIONAL LIBRARY OF CANADA to microfilm this
thesis and to lend or sell copies of the film, and UNIVERSITY
MICROFILMS to publish an abstract of this thesis.

The author reserves other publication rights, and neither the
thesis nor extensive extracts from it may be printed or other-
wise reproduced without the author's written permission.

Abstract

On August 15, 1971, the United States government abandoned the convertibility of the dollar for gold, the final in a series of acts which effectively terminated the monetary role of gold. Prior to 1971, gold functioned as the cornerstone of international trade, with its universally accepted fixed price serving as a trade settlement mechanism for exporters and importers. With the demonetization of gold complete, the gold mining industry was impacted by the transformation from a fixed to a flexible price regime, with the price of gold determined by the open market not by international monetary policy. This pivotal event in the historical development of the gold mining industry is the focus of this thesis.

The thesis examines the historical development of the Canadian gold mining industry, and provides a comparative analysis of its economic performance under the two distinct price regimes. The industry's economic performance is measured in terms of growth, stability and capital intensification. The international composition of the gold mining industry, wherein South Africa is identified as the dominant producer, is fundamental to the development of the theoretical framework from which the hypotheses are constructed and tested.

Acknowledgments

The completion of this study represents the consolidation of time and effort put forth by many individuals, whose contributions are sincerely appreciated.

I am deeply indebted to my adviser Professor Paul Phillips, whose invaluable guidance and direction laid the blueprint for the study.

To Professor Wayne Simpson, I extend special thanks for his assistance, encouragement, and genuine interest in my study.

To Walter Folliott, former Supervisor of the Winnipeg Commodity Exchange, I offer my appreciation for providing me with an insightful tour of the Winnipeg Commodity Exchange.

To my sister Leslie and my brother Stephen, I am grateful for their numerous hours of typing, editing and proof-reading.

Finally, to my wife Renee, I extend my sincere gratitude for her unrelenting encouragement, support and inspiration.

Table of Contents

	page
Introduction	1
Footnotes	3
Chapter	
I. Theory and Statement of Hypothesis	4
1.1 Introduction	4
1.2 Staple Theory	4
1.3 Price Theory	6
1.4 Pure Monopoly	10
1.5 Price Leadership Model With Price Determined by the Dominant Firm	14
1.6 Regulated Monopoly - Price Control	17
1.7 Price Leadership Model With A Government Regulated Price	19
1.8 Statement of Hypotheses	21
1.9 Methodology	24
1.10 Footnotes	26
II. Physical Characteristics of the Canadian Gold Mining Industry	28
2.1 Geological Features of Canada	28
2.2 Sources of Canadian Gold Production	32
2.3 Footnotes	34

	page
III. Historical Development of the Canadian Gold Mining Industry	35
3.1 Overview	35
3.2 Domestic and International Significance of Canadian Gold Production and Marketing	51
3.3 Footnotes	68
IV. The Gold Standard and its Abandonment	73
4.1 The Transformation From a Fixed to a Flexible Price Mechanism for Gold	73
4.2 Footnotes	89
V. Growth of the Canadian Gold Mining Industry	91
5.1 Introduction and Methodology	91
5.2 Growth of Production and Employment	99
5.3 Capital Intensification	117
5.4 Summary	122
5.5 Footnotes	126
VI. Stability of the Canadian Gold Mining Industry	127
6.1 Introduction and Methodology	127
6.2 Stability Analysis of Production and Employment	129
6.3 Summary	134

	page
VII. Conclusions	136
7.1 Summary of Growth and Stability Analysis	136
7.2 Resolution of Hypothesis	138
7.3 Summary	144
List of References	147
A. Books	147
B. Articles and Papers	149
C. Primary Sources and Government Documents	149
Appendix	
A-1 Gold Mine Production in the Non-Communist World	151
A-2 Nominal and Real Price of Gold	154
A-3 Consumer Price Index for Canada	156
A-4 Annual Production of Gold in Canada by Source	157
A-5 Gold, Mineral Production of Canada by Source	159
A-6 Value of Production in the Canadian Gold Mining Industry, Auriferous Quartz Sector	161

	page
A-7 Value of Production in the Mining Industry of Canada	163
A-8 Employment in the Canadian Gold Mining Industry, Auriferous Quartz Sector	165
A-9 Employment in the Mining Industry of Canada (1918-1985)	167
A-10 Weight and Purity of Gold	169
A-11 Calculation of the Real Value of Net Capital Stock (1921-1933) for the Auriferous Quartz Industry in Canada Using the Balance Sheet Method	170
A-12 Calculation of the Real Value of Gross New Investment (1950-1984) for the Auriferous Quartz Industry in Canada	171
A-13 Calculation of the Real Value of Net Capital Stock (1950-1984) for the Auriferous Quartz Industry in Canada Using the Cumulative Method	172

	page
A-14 Capital: Output and Capital: Labour Ratios (1921-1933) for the Auriferous Quartz Industry in Canada Using the Balance Sheet Method	173
A-15 Capital: Output and Capital: Labour Ratios (1972-1984) for the Auriferous Quartz Industry in Canada Using the Cumulative Method	174
A-16 Analysis of Stability Using Simple Regression	175

List of Tables

Table

2.2 Canada, Gold Production by Source, 1970, 1975, and 1979-85	33
3.1 Major Primary Canadian Gold Producers, 1986	45
5.1 Canadian Auriferous Quartz Industry- Growth and Development	123

	page
List of Figures	
Figure	
1.1 Short-run Equilibrium Price and Output for the Pure Monopolist	12
1.2 Long-run Equilibrium Price and Output for the Pure Monopolist	13
1.3 Price Leadership Model- Dominant Firm Sets the Price	15
1.4 Short-run Equilibrium Price and Output for the Pure Monopolist Under a Regulated Price	18
1.5 Price Leadership Model With A Government Regulated Price	20

List of Illustrations

Illustration

3.1 Principal Canadian Gold Producers and Developing Mines, 1986	49
3.2 Output of the Union of South Africa, 1900 to 1930	54

	page
List of Graphs	
Graph	
5.1 Nominal and Real Prices of Gold: 1918-33	101
5.2 Nominal and Real Value of Canadian Gold Quartz Production: 1918-33	102
5.3 Nominal and Real Wage per Employee of the Canadian Gold Quartz Mining Industry: 1921-84	104
5.4 Nominal and Real Prices of Gold: 1934-70	107
5.5 Nominal and Real Value of Canadian Gold Quartz Production: 1934-70	109
5.6 Nominal and Real Prices of Gold: 1971-85	113
5.7 Nominal and Real Value of Canadian Gold Quartz Production: 1971-85	114

	page
5.8 Real Value of Canadian Gold Quartz Production Compared to the Real Value of Production in the Canadian Mining Industry Excluding All Gold Production: 1918-85	116
5.9 Capital: Output and Labour: Output Ratios for the Canadian Gold Quartz Industry: 1921-33	119
5.10 Capital: Output and Labour: Output Ratios for the Gold Quartz Industry in Canada:1972-84	121

INTRODUCTION

The gold mining industry is one of many Canadian industries categorized as a resource industry. According to Professor John Gray, resource industries are defined as those industries that, "are involved in the extraction or first-stage processing of natural resources in close proximity to their extraction." 1

According to Professor Gray, the importance of resource industries to Canada is twofold. First, it provides employment for Canadians and contributes to Canadian exports, and secondly, it enhances regional employment and production. 2 Furthermore, the resource industries provide the economic base for the growth and development of other industries. The extent of diversification around the resource base is determined by the inducement to domestic investment, which in turn is derived from increased export activity. 3 In Canada, however, such diversification has been minimal, as most resource-based communities are single industry. 4 With the prosperity of a community or region tied directly to the fortune of a single industry, the stability and growth of that industry assumes significant importance. In competitive resource industries, the market determines the price of the export commodity and consequently, it dictates the economic growth or decline of the resource-producing regions. In a non-competitive resource industry where prices are fixed, one might expect that the growth of the industry would be minimal

but offset by the increased stability of the industry and producing regions. Two Canadian mineral industries which have experienced the economic impact of fixed versus flexible pricing mechanisms are the gold and silver mining industries. The fixed pricing mechanism for both resources was directly tied to world monetary policy. The flexible pricing mechanism associated with competitive markets impacted on both resources as the world withdrew from metallic-based international monetary systems.

This author will investigate the economic impact of fixed versus flexible pricing regimes on the Canadian gold mining industry. Specifically, the study will examine: the physical characteristics of Canadian gold mining; the historical development of the industry commencing with Canada's earliest gold discovery in 1534 up to the unprecedented discovery in the Hemlo region near Marathon Ontario in 1982; the domestic and international significance of Canadian gold production and marketing; the transformation from a fixed to a flexible pricing mechanism stemming from the demonetization of gold; and the industrial performance of Canada's gold mining industry under the two distinct price mechanisms.

First, this author will present a theoretical framework, from which the study will focus its analysis, followed by a statement of hypothesis and a description of the methodology of the analysis.

Footnotes - Introduction

1. John A. Gray, Stability of Employment and Production Within Canadian Resource-Based Industries (Winnipeg: Centre for Settlement Studies, University of Manitoba, June 1975), p.3
2. Ibid., p. 3.
3. Melville H. Watkins, "A Staple Theory of Economic Growth." The Canadian Journal of Economics and Political Science, XXIX (May, 1963), 144-145.
4. Gray, p. 4.

CHAPTER I

Theory and Statement of Hypotheses

1.1 Introduction

Chapter I presents an investigation of the staple theory and a determination of its relevance to the growth and development of the Canadian gold mining industry. Following the staple theory, Chapter I examines two specific cases of price theory: Price and output under pure monopoly, and price and output under the price leadership model of a dominant oligopolistic firm. The economic theories presented will lead to the formulation of a statement of hypothesis and will provide a framework from which an analysis of the economic impact of fixed versus flexible price regimes on the Canadian gold mining industry can be conducted.

1.2 Staple Theory

When studying the economic development of a Canadian resource industry, such as gold, one immediately draws upon the work of the late Harold Innis, a Toronto economist who initiated the staple approach to the study of Canadian economic history. In his studies of the Canadian fur trade and cod fisheries, Professor Innis recognized that developing countries, such as Canada during the 1800's, which possessed a

dominant export sector, achieved economic growth as a result of the expansion or linkage effects of the export sector.

According to Melville Watkins, "The fundamental assumption of the staple theory is that staple exports are the leading sector of the economy and set the pace for economic growth

Economic development will be a process of diversification around an export base." 1

Although gold qualifies as one of many mineral staples, the development of the resource was unique, influenced more by international monetary policy than by the producing regions' ability or inability to promote economic diversification.

Regional economies founded on the extraction and export of gold were immediate victims of a fixed nominal and declining real price of gold. Specifically, the period of decline, from 1942 to 1970, was the result of an international monetary policy which established a constant price for gold set at \$35.00 (U.S.) an ounce. Consequently, the economic decline of the Canadian gold mining industry is better explained by an examination of price theory than by the staple theory.

As the impact on economic development of an expanding resource sector is not the focus of this study, we will leave it to subsequent researchers to examine how the function of gold within international monetary policy has affected Canada's economic development. On the other hand, we will investigate how the special position of gold as an international reserve, and the pricing policies associated with that role, has influenced the development of the Canadian gold mining

industry. Thus, we will proceed with an examination of price theory.

1.3 Price Theory

The objective of economic theory is to predict and explain society's behavioural response to its myriad of problems. The study of economics is essentially the study of human problems. Alfred Marshall defined economics as follows: "Economics is a study of mankind in the ordinary business of life." 2 The problems facing society, though diverse, bear a common thread; scarcity. Thus, "The problems of economics arise out of the use of scarce resources to satisfy human wants." 3 The resources of a society consist generally of natural resources such as land, forest, water, air, minerals etc.; human resources which include mental and physical labour; capital resources such as factories, tools, machinery etc.; and entrepreneurship which is an intangible human quality associated with creating an innovative product or service to meet a specific human need or want in spite of the financial risk involved. The resources of a society are often referred to by economists as factors of production, while the goods and services produced are referred to as commodities. Similarly, the process of creating goods and services is termed production, while the act of utilizing

goods and services to satisfy human wants or needs is called consumption. 4

The resources of every society are limited or scarce. Consequently, the ability of society to produce enough goods and services to satisfy all human wants and needs is insufficient. Thus, scarcity compels society to make careful decisions regarding what to produce, how to produce, where to produce, for whom to produce, how to distribute the commodities, and how to ensure the stability and growth of the system. 5 The effect of scarcity upon society's preference for what to produce and what to consume is that society must have a mechanism for determining the optimal level of production for each good and service. According to Dominick Salvatore, "In a free-enterprise economy (ie., one in which the government does not control economic activity), all these problems are solved by the price mechanism." 6 Thus, the stability and growth of an industry, which produces a scarce commodity, can be studied effectively using Price Theory or Microeconomic Theory.

In the case of the Canadian gold mining industry, free enterprise was restricted by international government intervention in the price determination of gold. Thus, the industry's growth and stability were determined by government policy until 1971, and thereafter by the supply and demand factors of a free-enterprise economy. According to Dominick Salvatore, "Microeconomic theory, or price theory, studies the economic behaviour of individual decision-making

units such as consumers, resource owners, and business firms in a free-enterprise economy." 7 The individual decision-making units interact with each other during the course of the business activity. Households supply business firms with the resources to produce goods and services, which are then purchased or consumed by the households, using the income earned from the sale of their labour. Price theory studies the cycle of activity from businesses to households, the composition of the transactions, and the mechanism used to determine the price for the good or service provided. Price theory also examines the cycle of activity between resource owners and business firms, including studying the flow of the services of economic resources, the end product into which the resources were transformed, and the price mechanism used in determining the price of the resources. 8

The cycle of activity involving the purchase and sale of each good, service, and resource takes place in a market where buyers and sellers freely negotiate the terms of each transaction; ie. the price and quantity of the commodity. The market is said to be in equilibrium when the forces of market demand and market supply for a commodity are balanced and persistent over time. The market demand function specifies the quantity demanded of a commodity per time period at different price levels. The market supply function specifies the quantity of a commodity which a business firm or resource owner is willing to supply at a specific point in time depending on the negotiated price. The particular price and

quantity of a commodity, determined by equating the demand and supply functions, is known as the equilibrium price and quantity. The equilibrium point may change over time and by using comparative statics, one may compare the values of the variables which resulted in the new equilibrium point.

Comparative statics is concerned only with equilibrium points and thus assumes an immediate adjustment from one equilibrium to the next. Conversely, dynamics analyzes the process of change of the variables over time from one equilibrium to another. 9

The study of price theory is further specified in terms of partial or general equilibrium analysis. Partial equilibrium analysis is, "the study of the behaviour of individual decision-making units and the working of individual markets, viewed in isolation." 10 General equilibrium analysis is the study of, "the behaviour of all individual decision-making units and all individual markets, simultaneously." 11

The study of price theory and economics in general can be approached using positive or normative economics. The positive approach presents statements, theories, or assertions which address the actual economic problems facing a society and how to solve them. Normative economics is concerned with value judgements pertaining to how a society's economic problems should be solved. 12

The price theories to be presented, which are based on market structure, will focus on the change which occurred in the pricing mechanism for gold. The theories will be

structured using comparative statics, partial equilibrium analysis, and will employ a positive economic approach. The theories will provide a reference from which the change in gold pricing mechanisms can be viewed and from which a hypothesis can be constructed to predict and explain the resultant economic impact on the gold mining industry.

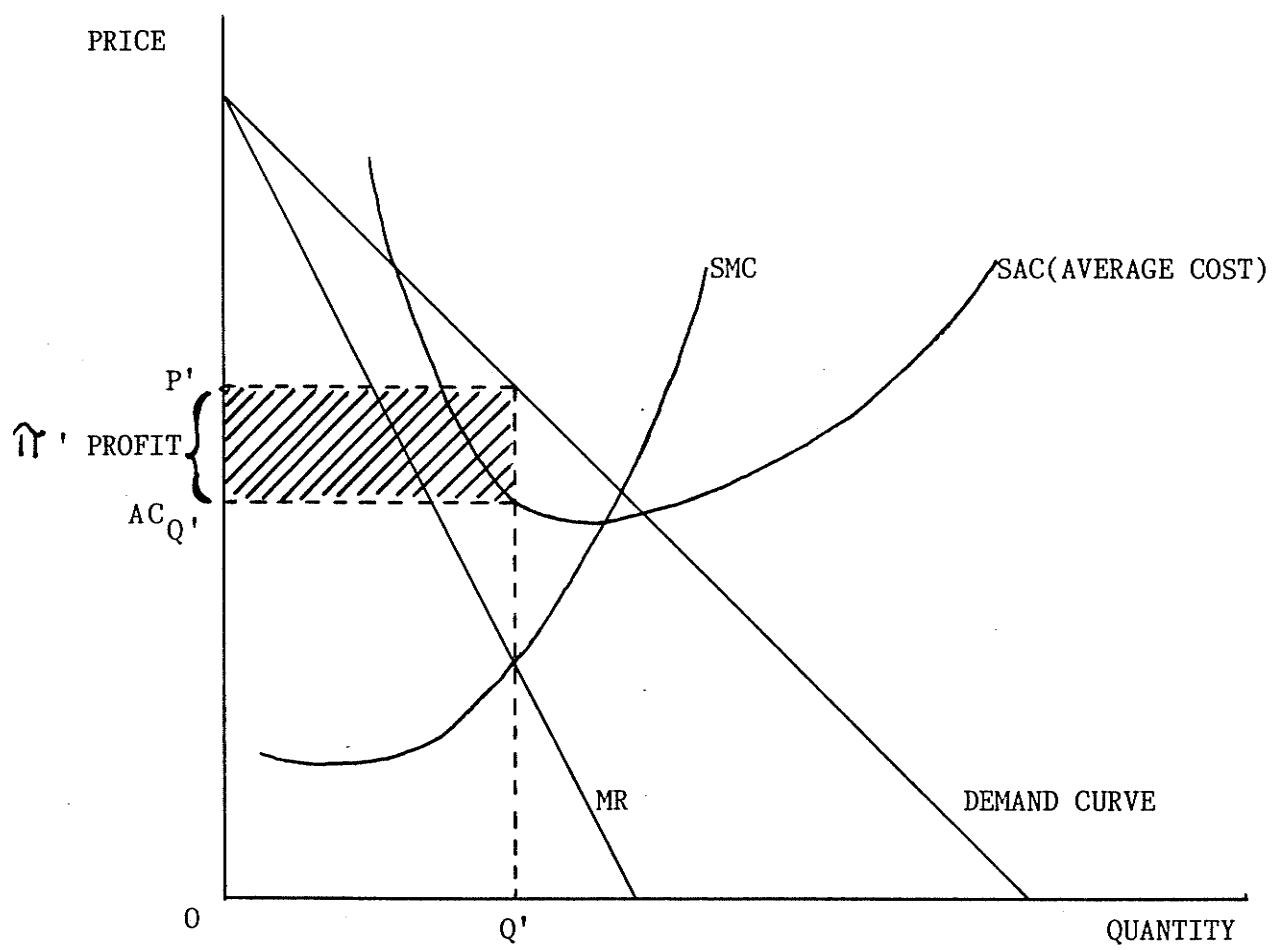
1.4 Pure Monopoly

The first form of market structure to investigate is the case of Pure Monopoly. Under this type of market organization, there is a single firm selling a homogeneous commodity, where there exists no close substitutes, and where entry into the industry is very difficult or impossible. ¹³ With only one firm, its activity represents the activity of the industry, and consequently is faced with the negatively sloped industry demand curve for the commodity. The monopolist must therefore lower his/her price to increase sales volume. Thus, the relationship between marginal revenue (MR) and price (P) for a monopolist is $MR < P$ and the MR curve lies below the demand curve, and has a negative slope two times greater than the demand curve, assuming that the demand curve is linear. ¹⁴ In the short run, the monopolist will produce a level of output which maximizes total profits or minimizes total losses. Thus, the short-run equilibrium output for the monopolist is the output at which $MR = SMC$ (short-run marginal cost). ¹⁵ At the point of intersection, profit is being maximized because

beyond that point the incremental cost of producing an additional unit is greater than the incremental revenue earned by selling an additional unit. Figure 1.1 illustrates the short-run equilibrium price and output level for the pure monopolist; ie. P' and Q' .

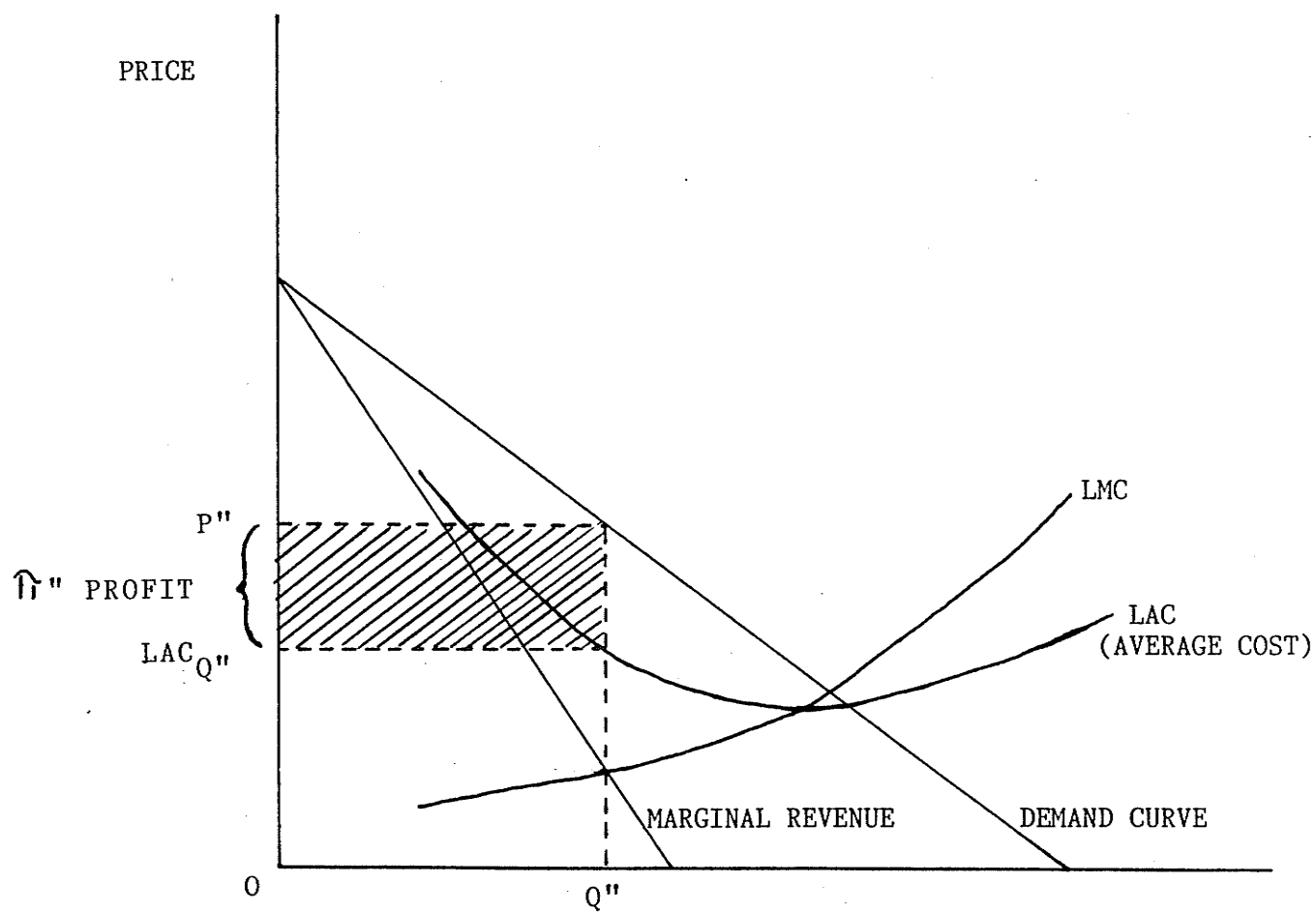
In the long-run, the monopolist will continue to operate provided that he/she achieves nothing less than breaking even. Thus, the monopolist will achieve an equilibrium price and output at a level where his/her incremental cost over the long-run (long-run marginal cost LMC) equals his/her incremental revenue MR. 16 Beyond this point of intersection, incremental costs exceed incremental revenue and thus profits will begin declining. Figure 1.2 illustrates the long-run equilibrium combination of price and output for the pure monopolist at P'' and Q'' .

FIGURE 1.1



$$\text{PROFIT} = (P' - AC_{Q'}) \times QQ'$$

FIGURE 1.2



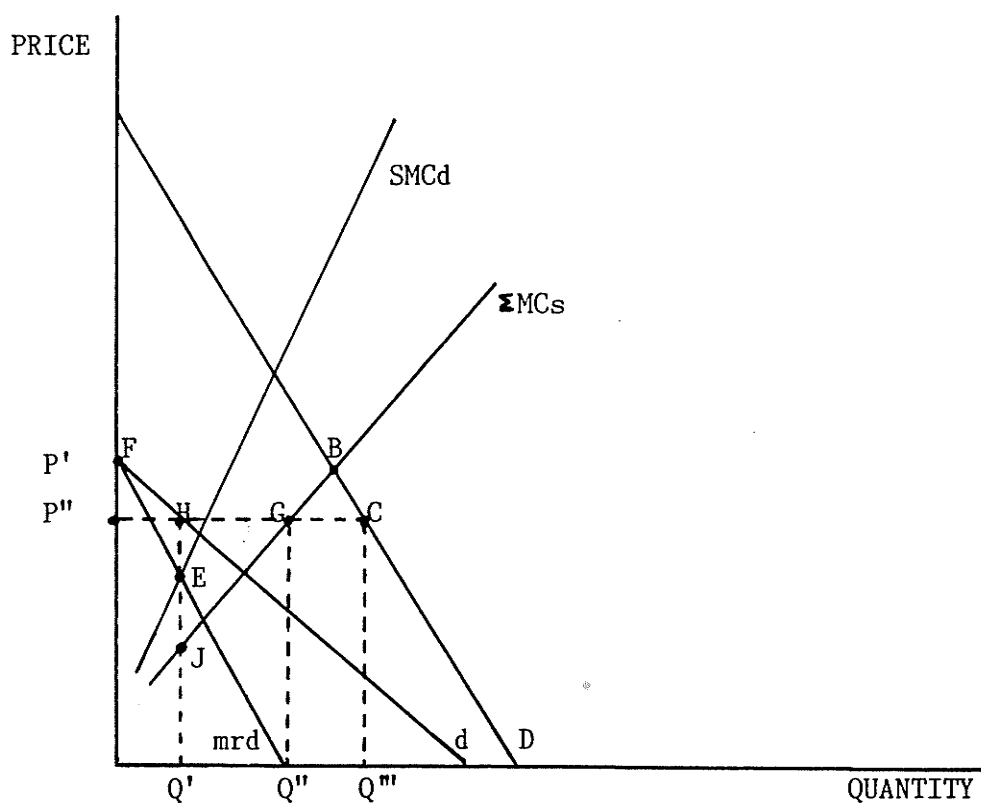
$$PROFIT = (P'' - LAC_{Q''}) \times OQ''$$

1.5 Price Leadership Model with Price Determined by the Dominant Firm

The next form of market organization to examine is the oligopolistic industry, which is a variation of the monopoly framework. Under the oligopolistic structure, a dominant firm establishes the price for the industry. The smaller firms within the industry accept the set price without collusion, thus creating a perfectly elastic demand curve. When equated with their individual marginal cost curves, their horizontal demand curves dictate the quantity of the commodity to produce. In effect, the smaller firms respond to the set price as perfect competitors; ie. where marginal revenue equals demand which equals marginal cost. In contrast, the dominant firm exercises monopoly control over the industry and seeks to maximize its profit by equating its marginal revenue to its marginal cost. 17

Figure 1.3 illustrates the price leadership model. Given the dominant position of South Africa, in terms of the output of gold, one can draw a parallel between its impact on world gold prices, and a dominant firm's impact on its industry's commodity price.

In figure 1.3, South Africa's demand curve is indicated by the letter d. It is derived by subtracting horizontally the cumulative short-run supply curves for all of the small producers (MCs) from the total market demand curve for gold (D), at all possible prices. If South Africa sets the price for

FIGURE 1.3**Price Leadership Model - Dominant Firm Sets the Price**

D - Total International Industry Demand Curve

d - South African Demand Curve (dominant firm)

mrd - South African Marginal Revenue Curve

SMCd - South African Marginal Cost curve (short-run)

ΣMCs - Short-run Supply Curve for all the Small Firms Together

gold at P' , indicated by point F in the diagram, the cumulative quantity supplied by the smaller gold producers equals the total quantity demanded in the market at that price, ie. at point B. Thus, we obtain South Africa's price intercept for its demand curve shown at point F. At the market price of P'' , the total market quantity demanded of Q''' (point c on the industry demand curve) minus the total quantity of Q'' supplied by the smaller producers at the price P'' (point G on the perfectly elastic demand curve) results in a quantity of Q' , which South Africa can sell at P'' (point H on curve d). The remaining points on South Africa's demand curve d are obtained in the same manner.

One can derive South Africa's marginal revenue curve mrd based on its relationship to the demand curve d. For a monopolistic firm, the slope of its marginal revenue curve is twice as steep as its demand curve. If South Africa's short-run marginal cost curve is indicated by SMC_d , it will establish a profit maximizing price of P'' , where its incremental costs SMC_d equals its incremental revenue mrd. At P'' , the smaller producers will sell Q'' units of output, and South Africa will supply the remainder of the industry demand by selling Q' units of output.

The short-run analysis presented above will persist in the long-run provided that the dominant firm can continue to profit, and provided that the oligopolistic conditions remain relatively unchanged.

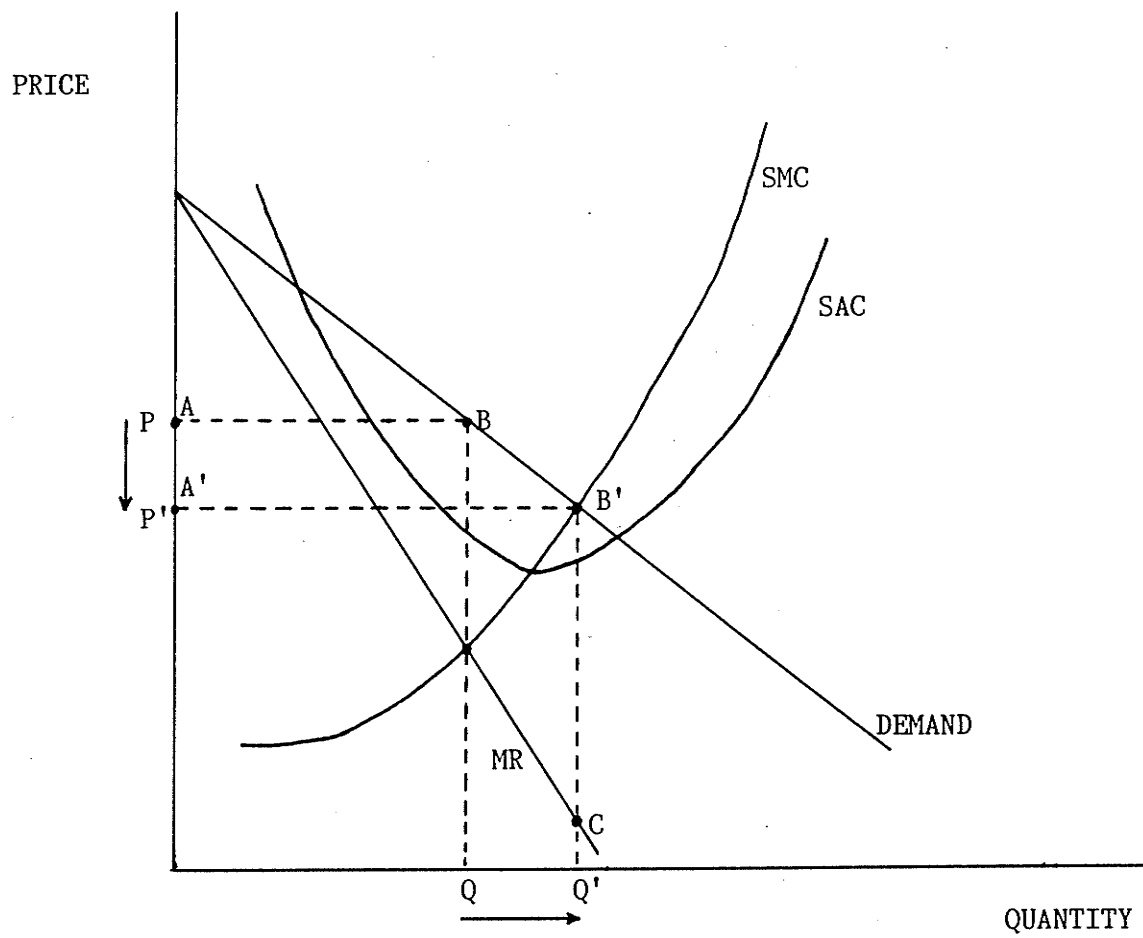
The monopoly and oligopoly models presented above

pertain to free-market situations, which are uninhibited by government regulations such as price controls. In terms of the price of gold, it was highly regulated prior to 1971 and deregulated thereafter. Consequently, we must impose a condition of price control on the monopoly and oligopoly models presented in order to explain the impact on the gold producers.

1.6 Regulated Monopoly - Price Control

A national government or an international body such as the International Monetary Fund (IMF) can impose regulations upon an industry which serves to create a maximum price for a specific commodity. In regard to the price of gold, the IMF established a policy in 1946 which allowed the 1934 price fix of gold to remain at \$35.00 (U.S.) an ounce and to continue unchanged until 1971. 18

In the situation of a monopolized industry, the establishment of a maximum price, below that normally charged by a monopolist, will force the monopolist to increase his/her output. If the regulated price is set where the monopolist's marginal cost is equal to demand, then the industry will have been transformed into a perfectly competitive structure. Such a transformation effectively increases production, lowers the market price and lowers the monopolist's profit. 19 Figure 1.4 illustrates the short-run response of a monopolist to a regulated price.

FIGURE 1.4

In figure 1.4, the government regulated price is shown at A1, which is less than the monopolist's price, shown at A. The regulated price at A1 is such that marginal cost equals demand. Consequently, the price control has eliminated the effect of the monopoly price and rendered the price and quantity subject to the conditions of a perfectly competitive market.

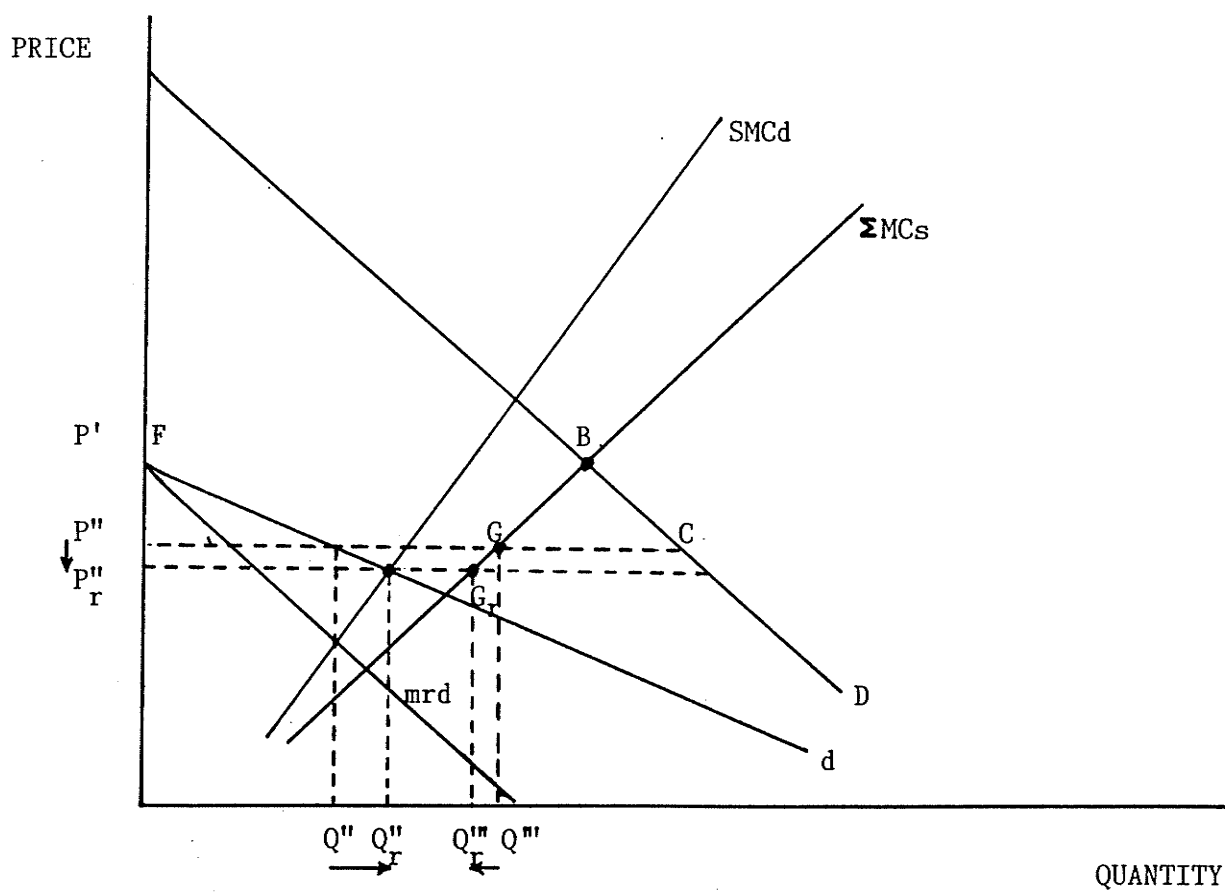
If the price control remains unchanged, in nominal terms over a number of years, the monopolist will be forced to lower its marginal costs at an annual rate equal to the annual rate of inflation in the market. If the monopolist is unable to increase its efficiency by lowering incremental costs, the firm will begin to accumulate losses and eventually it will become insolvent.

1.7 Price Leadership Model with a Government Regulated Price

The effect of a government regulated maximum price for a commodity in an oligopolistic market is similar to the monopoly case. The price control is implemented to eliminate the monopoly pricing of the dominant firm. However, the regulated price also reduces the price, quantity and profits of the smaller producers in the market, who prior to and following the price control, behave in a perfectly competitive manner. Figure 1.5 illustrates the impact on the dominant and smaller producers of price controls.

Figure 1.5 clearly demonstrates that the elimination of

FIGURE 1.5



monopoly pricing forces the dominant firm to increase production from Q to Q^r to compensate for the lower regulated price set at P^r . As the dominant firm was compelled to capture a larger portion of the total market demand, the smaller producers are left with a smaller quantity of sales and at a lower market price. Consequently, the price control greatly impairs the profitability of the smaller producer.

In the long-run, a continued policy of a fixed nominal commodity price would seriously impact on the viability of the smaller producers. Under such a policy, the smaller gold producer would be forced to continuously extract higher grade ore deposits and reduce operational costs. The smaller producers' gains in efficiency must at least match the annual rate of price inflation in the market to ensure their continued viability.

1.8 Statement of Hypotheses

The Canadian gold mining industry has been a significant although smaller producer in the international gold mining industry. The international industry, when restricted to non-communist countries, has been and remains dominated by South Africa. Appendix A-1 clearly demonstrates that in terms of total annual production, South Africa has rarely produced less than half of the world's total annual production from 1918 to 1985.

Given the dominant position of South Africa, under a free market situation, one would expect that South Africa could assume the role of an oligopolistic price leader and could establish a price which would equate its marginal cost and marginal revenue. The remaining smaller producers, which include: Canada, the United States, various African nations, Latin America, Asia, Europe and Oceania would respond to the price by producing an amount of gold which equates the sum of the smaller producers' marginal costs with the horizontal demand curve determined by the price leader.

Under a regulated price or fixed price regime, one would expect that the impact of a prolonged fixed nominal commodity price would force the dominant producer to continuously increase output. In regard to the smaller producers, one would anticipate a high degree of instability of production and employment as the smaller producers struggle to achieve greater operational efficiency to compensate for the steadily declining real price of the commodity.

The world gold-mining industry was subject to a regulated price for gold during the era of the gold standard, the gold bullion standard, and the gold exchange standard which extended from 1914 to 1971. From 1971 to the present day, the industry has operated under free market conditions.

Based on the structure of the international gold producing industry, which effectively functions as an oligopoly, with South Africa assuming the role of the dominant producer, and Canada assuming the role of a smaller producer, and based on

the Price theory mentioned above, this author will state the following hypotheses:

1. This author expects that the Canadian gold mining industry will exhibit a greater degree of growth and stability of production and employment under a free-market price mechanism than under a prolonged, regulated and fixed nominal price mechanism, during periods of general price inflation in the economy.

2. A second hypothesis is that this author expects that during periods when the real price for gold is increasing, stability and growth of the Canadian gold mining industry will be greater under a fixed price regime than under a flexible price regime.

1.9 Methodology

As previously stated, this study will provide an analysis of the economic impact of two distinct price regimes on the growth and stability of the Canadian gold mining industry. Chapter I provides the theoretical foundation from which the analysis will be constructed. It also contains this author's statement of hypotheses. The analysis will initially employ a descriptive investigation of the Canadian gold mining industry, as presented in Chapters II and III.

Chapter IV continues the analysis from a descriptive and historical context, with the focus directed towards examining the relationship between the monetary role of gold and the transformation from a regulated to an open market pricing mechanism for gold.

Chapters V and VI provide a test of the hypotheses presented in Chapter I. Chapter V provides a quantitative analysis of the growth of production and employment within Canada's gold mining industry, and compares the results to the Canadian mineral industry as a whole, (excluding gold). The growth of the gold mining industry will also be examined in relation to its trend towards capital intensification.

Chapter VI statistically examines the stability of production and employment within Canada's gold mining industry under the two price regimes. As in Chapter V, this chapter will compare the stability analysis of the gold mining industry to the stability of Canada's aggregate mineral

industry (excluding gold), over the same time interval; 1918 to 1985. The evaluation of stability will utilize simple regression analysis, with the coefficient of determination, r^2 , functioning as the statistical measure of stability. As the analysis of stability involves the examination of variation around a time trend, this study focusses on growth stability. A further discussion of the statistical stability analysis is presented in Chapter VI.

Chapter VII is the concluding chapter, which presents a summary of the analysis, the resolution of the hypotheses, and conclusions pertaining to the economic impact of the two price regimes on the Canadian gold mining industry.

1.10 Footnotes - Chapter 1

1. Melville H. Watkins, "A Staple Theory of Economic Growth," The Canadian Journal of Economics and Political Science, XXIX (May, 1963), p.145.
2. R.G. Lipsey, G.R. Sparks, and P.O. Steiner, Economics 2'nd Edition (Harper and Row Publishers, 1976), p. 6.
3. Ibid., p. 6.
4. Ibid., p. 6.
5. D. Salvatore, Theory and Problems of Microeconomic Theory, 2nd Edition (McGraw Hill, Inc., 1983), p. 1.
6. Ibid., p. 1.
7. Ibid., p. 1.
8. Ibid., p. 1.
9. Ibid., p. 2.
10. Ibid., p. 2.
11. Ibid., p. 2.
12. Lipsey, Sparks and Steiner, p. 17.
13. Dominick Salvatore, p. 229.
14. Ibid., p. 221.
15. Ibid., p. 223.
16. Ibid., p. 224.

1.10 Footnotes- Chapter I (continued)

17. Dominick Salvatore, p. 251.
18. Paul Einzig, p. 51.
19. Dominick Salvatore, p.225.

CHAPTER II

Physical Characteristics of the Canadian Gold Mining Industry

2.1 Geological Features of Canada

Canada has five major geological regions including: the Canadian Shield, the Plains Region, the Cordilleran Region, the Appalachian Region and the Innuitian Region. The Canadian Shield occupies nearly half of Canada's land mass and is the largest region. The Shield covers virtually all of Quebec and Labrador, most of Ontario, northern and eastern Manitoba, northern Saskatchewan, the northeastern tip of Alberta, and the southern half of the Northwest Territories including most of Baffin Island. Most of this region lies below 2,000 feet above sea level, although mountain ranges in Labrador and in Baffin Island range from 5,000 to 10,000 feet above the sea. Intense glaciation has resulted in the region being dominated by rounded rock outcrops divided by glacial deposits, muskeg and a seemingly infinite number and size of lakes joined by streams, rivers and rapids. Exposed rock only accounts for roughly 10 percent of the surface. The northern region of the Shield, which is north of the tree line, is characterized by its permanently frozen ground, although a thin layer on the surface thaws each summer.¹

The Canadian Shield offers the largest and most diverse

mineral resources in Canada. In his report to the Royal Commission on Canada's Economic Prospects, John Davis (1957, p. 22) noted that in 1955 the Canadian Shield accounted for approximately 77% of Canada's total mineral production. Furthermore, the region yielded 92% of the gold, 88% of the copper, 83% of the iron ore, and all of the nickel, platinum and platinum group metals, uranium, and cobalt produced in Canada. According to Davis, most of the metallic mineral deposits are located within the troughs, basins and other remnants of Early and Late Precambrian volcanic and sedimentary rocks, comprised predominantly of granite rock. Because of deep erosion of the Early Precambrian rocks, mineral deposits were formed at great to intermediate depths in the earth's crust. Minerals found at that depth include: gold quartz, copper-zinc, tungsten, and pegmatites containing beryllium and lithium.

Many of Canada's mines are deep, because as in other parts of the world, mineral deposits in Early Precambrian rock average greater depth than do younger rock formations. 2 In Canada, gold ores are generally located at a depth of 1,000 to 5,000 feet below the surface. However, the leading producer of gold in the non-communist world, South Africa, is forced to drill mine shafts at a depth exceeding 10,000 feet in order to extract their rich gold deposits. 3

The Plains Region, as described by John Davis (1957, p. 19), includes the Interior Plains, the St. Lawrence Lowlands, the Hudson Bay Lowlands, and the plains and plateaus of the Arctic Islands. The Interior Plains are comprised of a gently

rolling surface, which slopes unnoticeably uphill towards the Cordilleran foothills, up to an elevation of 4,000 feet. The southern part of the Interior region is virtually treeless and dominated by grasslands. The St. Lawrence Lowlands extend from Lake Huron to Quebec City and are primarily an area of gentle rolling hills. The Hudson Bay Lowlands occupy the southwest shores of Hudson Bay and James Bay, and are an area of swampy lowlands which slope gently upwards towards the Canadian Shield. The Arctic Islands present a diversity of topography ranging from rolling treeless lowlands to abrupt sea cliff plateaus of 500 to 1,500 feet in elevation. 4

John Davis has described the mineral deposits and potential of this region to be concentrated in the energy resources including: oil, natural gas, and coal. Other important minerals found in the Plains Region include: potash salts, common salt, gypsum, and lead zinc. 5

The Cordilleran Region occupies virtually all of British Columbia and the Yukon and the southwestern tip of Alberta, and lies between the Pacific Ocean and the Interior Plains. According to Davis, the Cordillera includes a western system of mountains, a central system of plateaus and mountains, and an easterly system of mountains. The highest peaks of the Canadian Cordillera reach an elevation of 12,000 feet, and the highest point is Mount Logan which is 19,850 feet above sea level. The eastern Cordillera includes the jagged Rockies, while the western Cordillera displays more rounded level uplands between intermittent sharp peaks. The valleys are

forested except in the northern area, where the ground is permanently frozen. Common to the region are: snowfields, icefields, and alpine glaciers. 6

The Cordilleran Region is rich in mineral deposits. It has heavy concentrations of silver, lead, zinc, asbestos, antimony, and tungsten. It also has substantial amounts of coal, oil, copper, gold, mercury, and iron. 7

The Appalachian Region is an area of rolling mountains and hills which rise in elevation up to 4,200 feet in the Gaspé Peninsula, but generally the region does not exceed 2,000 feet above sea level. The region includes the Atlantic provinces, the Gaspé Peninsula and part of the Eastern Townships of Quebec. 8

The Appalachians are primarily recognized for their non-metallic mineral deposits such as coal and iron-ore. However, the region also produces significant quantities of asbestos, barite, and fluorspar. Other minerals found in this region include: gypsum, common salt, petroleum, natural gas, oil shale, chromite, copper, lead, zinc, and gold. 9

Canada's fifth geological region is the Innuitian Region in the extreme north. The region extends west and south from Ellesmere Island to Melville Island in the northern Arctic. The ground in the region is permanently frozen and ice-covered. The land is mountainous reaching elevations of 10,000 feet. 10 The mineral content of the Innuitian Region is largely undeveloped, although vast quantities of petroleum and gas are known to exist and are being tapped. Other mineral deposits

include anhydrite-gypsum and coal. 11

2.2 Sources of Canadian Gold Production

Canada's gold production is derived from the following three sources: (1) auriferous quartz mines; (2) placer or alluvial operations; and (3) base-metal mines as an incidental product or by-product. 12

The auriferous quartz or gold quartz mines are mining operations which concentrate primarily on the extraction of gold, in contrast to gold which is recovered as an incidental product by base-metal mines. Most by-product gold is recovered from the mining of copper, and to a lesser extent from the mining of lead and zinc ores. Placer or alluvial operations sift through the auriferous gravels of glacier fed rivers using sluices, dredges or hydraulic excavation. 13

From 1970 to 1985, the vast majority of Canada's gold production was recovered from auriferous quartz mines. During that time auriferous quartz accounted for nearly 75 percent of total gold production. Over the same period, by-product gold recovered from base-metal mines contributed more than 20 percent of total production, while placer operations produced less than 5 percent. Table 2.2, below, illustrates Canada's gold production by source during the period mentioned above.

**TABLE 2.2 - Canada, Gold Production by Source, 1970, 1975 and
1979-85**

	Auriferous Quartz Mines		Placer Operations		Base-Metal Ores		Total	
	(grams)	(%)	(grams)	(%)	(grams)	(%)	(grams)	(%)
1970	58 591 610	78.2	228 890	0.3	16 094 525	21.5	74 915 025	100.0
1975	37 529 456	73.0	335 077	0.6	13 568 581	26.4	51 433 114	100.0
1979	33 794 332	66.1	899 202	1.7	16 448 825	32.2	51 142 359	100.0
1980	31 928 594	63.1	2 059 727	4.0	16 631 942	32.9	50 620 263	100.0
1981	35 876 992	69.0	1 632 720	3.1	14 524 569	27.9	52 034 281	100.0
1982	47 865 658	74.0	2 476 468	3.8	14 393 104	22.2	64 735 230	100.0
1983	55 521 686	75.5	3 235 019	4.4	14 755 774	20.1	73 512 482	100.0
1984	62 553 528	75.0	3 393 003	4.1	17 499 394	20.9	83 445 925	100.0
1985	67 241 163	76.8	3 463 684	4.0	16 857 311	19.2	87 562 158	100.0

Sources: Statistics Canada; Energy, Mines and Resources Canada.

Canada, Canadian Minerals Yearbook 1986 - Review and
Outlook, Centennial Edition 1886-1986 (Ottawa: Energy,
Mines and Resources, 1986), p. 29.7.

2.3 Footnotes- Chapter II

1. Canada, Royal Commission on Canada's Economic Prospects, Mining and Mineral Processing in Canada, by John Davis (Ottawa: October, 1957), p. 19.
2. Ibid., pp. 22-23.
3. Timothy Green, The New World of Gold (New York: Walker and Company, 1981), p. 72.
4. Canada, Royal Commission on Canada's Economic Prospects, Mining and Mineral Processing in Canada, by John Davis (Ottawa: October, 1957), pp. 19-21.
5. Ibid., p. 24
6. Ibid., p. 21
7. Ibid., pp. 25-26.
8. Ibid., p. 21.
9. Ibid., p. 26.
10. Ibid., p. 21.
11. Ibid., pp. 26-27.
12. Canada, Department of Mines, Mines Branch, Gold in Canada, by A.H.A. Robinson (Ottawa: 1932), p. 21.
13. Ibid., p. 21.

CHAPTER III

Historical Development of The Canadian Gold Mining Industry

3.1 Overview

The earliest account of the existence of gold in Canada was made by the Indians to Jacques Cartier in 1534. The Indians indicated that the precious metal had been sited along the Saquenay River of the Eastern region of present-day Quebec. ¹ However, the first genuine gold discovery in Canada took place nearly three hundred years later. In 1823, placer gold was found in the Chaudiere river valley of the Eastern Township south of Montreal, Quebec. However, a systematic approach to work the site was not introduced until 1947. ²

Following on the heels of the 1848 California gold rush and the 1851 Australia gold discovery, the excitement of prospecting spilled over into British Columbia. In 1852, Canada's first gold quartz discovery was made at Mitchel Harbour on the Queen Charlotte Islands. ³ Following that find, an intense search, primarily for placer or alluvial gold, was pursued in the interior of British Columbia. In 1855, placer gold was found at the mouth of the Pend d'Oreille River by a former employee of the Hudson's Bay Company. In 1857, placer gold was discovered at the crossing of the Fraser and Thompson Rivers of British Columbia, which opened up mining camps at Kamloops, Ashcroft, and Vernon and by 1858 extended

into Yale, Hope, and Canyon. By 1859 placer exploration penetrated successfully into the Caribou and Quesnel regions of British Columbia.

The influx of population into British Columbia, from the United States and other foreign countries, was important to the economic development of British Columbia in terms of the amount of gold extracted, but of greater significance was the contribution of former gold miners who stayed in the region to develop the agricultural and business foundation of British Columbia. 5 In his report prepared for the 1957 Royal Commission on Canada's Economic Prospects, (p.337) John Davis explained the significance of the immigrant gold miners to British Columbia as follows:

By attracting this unexpectedly large population to the west coast, and by giving rise to the roads, shipping, banks, trading centres, farms and sawmills which serviced them, the gold rushes might be said to have been indirectly responsible for the admission of the colony to Confederation and for the building of the Canadian Pacific Railway.

Following the establishment of a gold camp at Caribou, exploration spread into North Saskatchewan, the Peace, the Liard, the Stikine and the Yukon. News of the west coast discoveries influenced prospectors in eastern Canada, who began to comb their region for geological formations similar to that found in the west.

In 1857, placer gold was first discovered in the Halifax

region of Nova Scotia by John Campbell. Two years later, John Pulsiner uncovered a quartz deposit in the Tangier district of Halifax county, and in 1861 another placer gold operation was established in the Oldham district of Halifax county. 6

According to John Davis, (1957: p. 337), the Maritime gold quartz mines were typically underfinanced, employed crude mining techniques, extracted gold from small and narrow veins, and generally employed inexperienced miners.

Consequently, production was costly and inefficient, but the industry continued to progress. The painstaking process of developing a viable quartz extraction process in the Maritimes would later provide a valuable source of experience and knowledge to gold quartz miners in other areas of the country.

For the forty-year period from 1855 to 1895, the placer gold camps of British Columbia contributed most to Canada's total gold production, although the gold quartz mines of Nova Scotia made a significant contribution as well. From 1860 to 1876, the Chaudiere placer operations in Quebec produced an estimated \$2,000,000 of gold. 7

The exploration and discovery of gold and other mineral deposits was generally haphazard, but it continued to expand into new regions of Canada. 2 In 1866, a Dutch prospector named Powell, and his associates, made the first discovery of gold in the Canadian Pre-Cambrian shield near Madoc, Hastings county, Ontario. The discovery was substantial enough to open a quartz mine which was named the Richardson mine. A subsequent discovery of gold in Ontario took place in 1878 in

the Western region at Lake of the Woods. 9

The next significant period in the development of Canada's gold mining industry occurred in 1896 with the discovery of rich alluvial deposits in the gravels of the Klondike River in the Yukon. The excitement, focussed around the Bonanza Creek discovery, was comparable to that of the California gold rush of fifty years earlier. During the winter of 1897-98, thousands of prospectors made the arduous trip from the west coast over the White and Chilkoot Passes into the boom town named Dawson City. 10

The most extensive development took place between 1898 and 1905, during which time, gold valued at more than \$100,000,000, or the equivalent of 4,838,000 fine ounces, was extracted from the placers of the Bonanza, Eldorado, Hunker, Dominion, and Sulphur creeks. 11 The peak occurred in 1900 when Canadian gold production reached an output level of 1,350,000 fine ounces. By 1907, the multitude of small claims operators, who sifted through the sands using primitive and inexpensive dredges, gradually filtered out of the region in pursuit of higher grade ores, which could be found in the new fields of Alaska. The production level by 1907 was only 705,500 ounces and only more sophisticated operations, employing large scale hydraulic systems, remained in the Yukon in search of lower quality deposits. 12

The rapid expansion of gold mining in Canada during the period from 1880 to 1910 is largely attributable to the development of the transcontinental railroad, which enabled

the sudden penetration of both the Shield and the Cordilleran regions. The vitally important transportation links gave prospectors access to new undeveloped regions. It also facilitated the export of unprocessed metallic ores to the United States as Canada's industrial development was in its infant stage, rendering it incapable of processing many of her ores even for her own use. 13

The next major development in Canadian gold mining took place in Ontario in 1908 with the discovery of gold in the Porcupine district. This was the beginning of Precambrian mining, which would eventually surpass the B.C. placer and alluvial operations in terms of its contribution to total gold production. The Porcupine discovery was followed by a string of successful discoveries between 1911 and 1913 at Kirkland Lake, near Swastika. 14

The discoveries in northeastern Ontario were encouraged by the building of the Temiskiming and Ontario Railway. The purpose of its construction was to develop the agricultural potential of the northern clay belt. However, with the discovery of large silver deposits at Cobalt, the mining potential of the area came to light, and led to the development of the neighbouring gold belt. 15 The development of the Precambrian lode mining camps were further encouraged by advances in technology, which enabled the profitable extraction of complex and low grade ore. During the 1800's, the recovery of gold was limited to the extraction in its natural state as dust or alluvial nuggets, or by a process of

amalgamation with mercury. However, in 1909 the Cobalt operation employed a newly developed potassium cyanide solution to dissolve the gold and extract it from the surrounding ore bodies. This technique was also used in the lode mines in Kirkland Lake. Other technical advances in ore handling, crushing and concentrating methods gave the lode gold mining industry an invaluable boost. 16

The notable success of the Porcupine and Kirkland Lake mines led to an intensive search for gold in Manitoba and Quebec. In 1911, the first recorded discovery of gold in Manitoba took place at Rice Lake. In the same year, gold was discovered in the Dubuisson township of Quebec. 17 Two years later, gold was discovered near Flin Flon, Manitoba, but metallurgical difficulties postponed development until 1927. However, with the outbreak of World War I in 1914, metal mining was diverted to those metals of strategic importance, which were required for the manufacture of munitions.

Following the war, in 1918, the Premier mine of British Columbia, which was discovered in 1910 commenced production. In 1923 gold was unearthed in the Rouyn and Val d'Or regions of Quebec, which elevated Quebec's annual gold production to the second highest in Canada, behind Ontario. 18 The lode mining industry, which served as the primary source of gold in Ontario, continued to prosper and expand throughout the 1920's. The period from 1926 to 1929 was one of enormous industrial expansion in the United States, and the demand for minerals, especially base metals, rose

significantly. To meet the insatiable demand of American industries, the Ontario lode mines hastened their exploration and development of base metals. Consequently, the increased production of base metals had the direct effect of increasing the recovery of lode gold. 19 By 1931, Canada had surpassed the United States as the second largest producer of gold in the non-communist world, as shown in appendix A-1.

In 1929, the industrial stock market of the United States collapsed, with the Canadian stock market following suit. The unprecedented decline in stock prices on both markets resulted in a general decline in the economic activity of both nations. The price of base metals dropped to levels never before witnessed, and would remain low throughout most of the 1930's. As the world economies entered into a severe depression, the gold mining industry prospered. 20

The major stimulus to the strong performance of the gold mining industry occurred on January 31, 1934, when President Roosevelt of the United States issued a proclamation reducing the gold weight of the United States dollar from 25.8 to 15.2381 per .9 fine. 21 The effect of the devaluation of the U.S. dollar in relation to gold was an increase in the price of gold per ounce from \$20.67 to \$35.00. 22 In his report to the Royal Commission on Canada's Economic Prospects, (1957: 343-44) John Davis stated that, "Under this stimulation, a search began for new properties from Nova Scotia to British Columbia. New mines sprang up on the Shield like mushrooms."

The new price fixing for gold gave a tremendous impetus

to Canada's gold mining industry. The higher price enabled marginal producers to profit, and it allowed further exploration and development of lower grade ore deposits. Also, the higher price increased employment in the auriferous quartz industry by 183% or 14,789 jobs from 1934 to 1941, to a record level of 32,551 jobs which remains unsurpassed to this day. During that time, most mining and manufacturing industries were burdened with high unemployment. Finally, the new price fixing increased Canada's total annual gold production by 180% from 1934 to 1941, to a record level of 5,345,179 ounces, a record which stands to this day. The aforementioned employment and production figures are illustrated in appendices A-8 and A-4.

The outbreak of World War II put the brakes on an industry which was accelerating in terms of production, employment and profitability. As in the case of the previous world war, the emphasis, in terms of metal mining, was shifted from the extraction of profitable precious metals to more strategic base metals. The war revived the base metal industry, but it was the beginning of a prolonged downturn for Canada's gold mining industry. Over the next 30 years, from 1941 to 1971, the gold mining industry in Canada would shrink from a record high of 146 producing gold mines to only 15, a mere skeleton of its prime form. 23

During the first two years of World War II, gold production was needed by Canada to finance the purchase of war supplies manufactured in the United States. As the shift

towards base metal mining came into being, gold production began its steady decline. With growing operating costs for labour and materials, and with a fixed selling price for its product, profits began to erode. With marginal producers facing mounting losses and with the realization that numerous mines faced inevitable foreclosure, the federal government instituted the Emergency Gold Mining Assistance Act (EGMA), designed to provide financial support for marginal producers of gold quartz. 24

The EGMA Act poured nearly \$300 million into the ailing industry from 1948 to 1971. Approximately eighty percent of Canada's gold production could be attributed to the aid programme. Only one major mine during the period did not receive aid, and that was Campbell Red Lake, Canada's leading producer. 25 The purpose of the subsidy was not to strengthen the balance sheets of marginal producers, but to stave off the collapse of numerous communities, whose existence was directly tied to the fortunes or misfortunes of gold mining. These communities included Dawson in the Yukon, Kirkland Lake and Timmins in Ontario, and Rouyn, Malartic and Val d'Or in Quebec. 26

Despite the aid package, nearly four decades of decreasing real prices for gold, (as shown in appendix A-2), in conjunction with steadily increasing costs of production, left the gold mining industry paralyzed. However, the paralysis was not terminal. In August of 1971, the gold mining industry took its first step into its most significant stage of development. It

was on that date that the gold-exchange standard, which had bound the industry to a fixed price of \$35.00 per ounce, came to an end. 27 The industry had entered into a transitional stage, which marked the end of the fixed price regime and the beginning of the flexible or freely-floating price regime. This transitional event, which permitted the price of gold to reflect international supply and demand considerations, was a turning point for the industry and started a period of revitalization.

From 1971 to 1986, the nominal price of gold increased more than tenfold from \$35.00 to \$368.11 (U.S.), as shown in appendix A-2. (The appendix uses average annual prices, compiled by Statistics Canada). In 1980, the price of gold reached an all-time high of \$850. (U.S.) per ounce. 28 Over the fifteen year period, the number of producing gold mines doubled from 15 to 31, with an additional 31 mine sites being developed. Table 3.1 provides a list of Canada's primary gold producers and developing properties for 1986, and illustration 3.1 provides a diagram showing the location of Canada's producing gold mines and developing properties. The extent of the growth of the industry during that period will be examined in chapter 7.

TABLE 3.1MAJOR PRIMARY CANADIAN GOLD PRODUCERS, 1986

Yukon Territories:

1. Total Erickson Resources Ltd. - Mt. Skukum mine

Northwest Territories:

1. Echo Bay Mines Ltd. - Lupin mine
2. Giant Yellowknife Mines Limited - Salmita mine
3. Giant Yellowknife Mines Limited - Giant mine
NERCO Minerals Company - Con mine

British Columbia:

1. Total Erickson Resources Ltd. - Cassiar
2. Kerr Addison Mines Limited / Blackdome Mining Corporation
Blackdome Project

Manitoba:

1. Sherrgold Inc. - MacLellan mine

Ontario:

1. Red Lake Area
Campbell Red Lake Mines Limited
Dickenson-Sullivan Joint Venture
2. Hemlo Area
Lac Minerals Ltd. - Page-Williams mine
Noranda Inc. / Golden Giant Mines Ltd. / Golden
Sceptre Resources Ltd. Joint Venture - Golden
Giant mine
Teck-Corona Operating Corporation - David Bell mine
3. American Barrick Resources Corporation/Royex Gold Mining
Corporation Renabie mine
4. Timmins - Kirkland Lake Area
Dome Mines, Limited - Dome mine
Pamour Inc. (Jimberlana Minerals NL) - Pamour #1,
Timmins and Ross mines
Kidd Creek Mines Lt. (Falconbridge) - Owl Creek,
Hoyle Pond
Lac Minerals Ltd. - Macassa, Lake Shore mine
Inco Limited/Queenston Gold Mines Limited Joint
Venture - McBean mine
5. Campbell Red Lake Mines Limited/Amoco Canada Petroleum
Company Ltd. Joint Venture - Detour Lake mine

TABLE 3.1MAJOR PRIMARY CANADIAN GOLD PRODUCERS, 1986

(continued)

Quebec:

1. Agnico-Eagle Mines Limited - Telbel mine
2. Bachelor Lake Gold Mines Inc.
3. Muscocho Explorations Limited - Montauban mine
4. Noranda/Rouyn - Val d'Or Area
 - Lac Minerals Ltd. - Doyon mine/Bousquet mine
 - American Barrick Resources Corporation - Camflo
 - Belmoral Mines Ltd. - Belmoral mine
 - Kiena Gold Mines Limited - Kiena mine
 - Sigma Mines (Quebec) Limited - Sigma mine
 - Louvem Mining Company Inc. - Chimo mine

New Brunswick:

1. Gordex Minerals Limited - Cape Spencer mine

DEVELOPING PROPERTIES IN CANADA, 1986

Yukon Territories:

1. Canamax Resources Inc./Pacific Trans-Ocean Resources Ltd.
Ketz River Property

Northwest Territories:

1. Terra Mines Ltd. - Bullmoose Project
2. Echo Bay Mines Ltd./Petromet Resources Limited - Kim/
Cass Project

British Columbia:

1. Mascot Gold Mines Limited/International Corona Resources
Ltd. - Nickel Plate mine
2. Serem Inc. - Lawyers Project

TABLE 3.1DEVELOPING PROPERTIES IN CANADA, 1986

(continued)

Saskatchewan:

1. La Ronge Area
 - SMDC/Starrex Mining Corporation Ltd. - Star Lake mine
 - Canadian Premium Resources Corporation/Mahogany Minerals Resources Inc. Jolu Project
 - Placer Development Limited/Claude Resources Inc. - Seabee Project

Manitoba:

1. Granges Exploration AB/Abermin Corporation - Tartan Lake mine
- Granges Exploration AB/Maverick Mountain Resources Limited - Puffy Lake mine

Ontario:

1. Consolidated Professor Mines Limited - Duport
2. Echo Bay Mines Ltd./Nuinsco Resources Limited - Cameron Lake
3. Dome Mines, Limited/Campbell Red Lake Mines Limited - Dona Lake
- St. Joe Minerals Corporation - Golden Patricia
4. MacMillan Energy Corp., Granges Exploration Ltd. - Mishibishu Lake
- Canamex Resources Inc./Kremzar Gold Mines, Limited - Kremzar
5. Timmins - Kirkland Lake Area
 - Canamax Resources Inc./Consolidated CSA Minerals Inc. - Bell Creek
 - Getty Mines, Limited/Davidson Tisdale Mines Limited - Davidson Tisdale mine
 - Diepdaume Mines Limited - Diepdaume mine
 - Canamax Resources Inc./Bruneau Mining Corporation - Clavos Project
 - St. Andrew Goldfields Ltd. - St. Andrews mine

TABLE 3.1DEVELOPING PROPERTIES IN CANADA, 1986

(continued)

Quebec:

1. Noranda/Rouyn - Val d'Or Area
 - Dumagami Mines Limited - East & West Zones
 - D'Or Val Mines Ltd. - Beacon mine
 - Belmoral Mines Ltd. - Bourlamaque mine
 - Louvem Mining Company Inc. - North Pascalis
2. Casa Berardi Area
 - Inco Limited/Golden Knight Resources Inc. - Golden Pond Project
 - Teck Corporation/golden Hope Resources Inc. - Estrades Project

Nova Scotia:

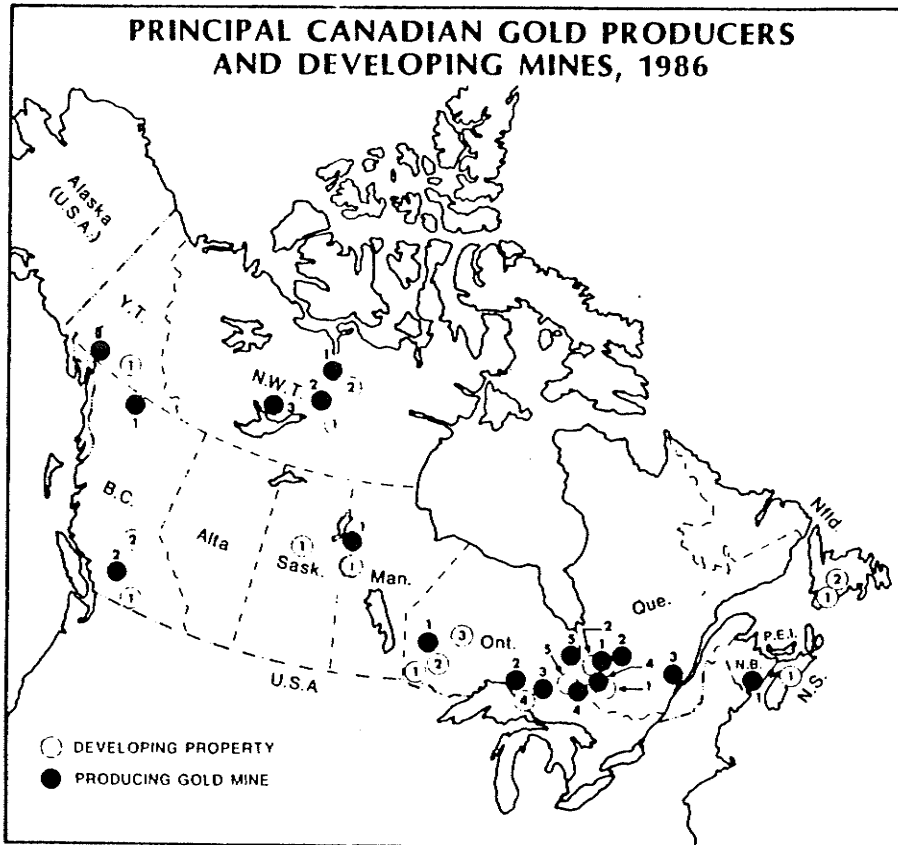
1. Seabright Resources Inc. - Beaver Dam mine
- Seabright Resources Inc. - Forest Hill mine

Newfoundland:

1. Hope Brook Gold Inc. - Chetwynd mine
2. Westfield Minerals Limited - Joint Venture

Canada, Canadian Minerals Yearbook 1986 - Review and Outlook, Centennial Edition 1886-1986 (Ottawa: Energy, Mines and Resources, 1986), pp. 29.11 - 29.12.

ILLUSTRATION 3.1



Canada, Canadian Minerals Yearbook 1986 - Review and Outlook, Centennial Edition 1886-1986 (Ottawa: Energy, Mines and Resources, 1986), p. 29.10.

In summary, the history of the development of the Canadian gold mining industry can be described as an industry which progressed through the following stages:

1. The period of discovery, 1823 to 1895;
2. The period of growth and development, 1896 to 1941;
3. The period of decline, 1942 to 1970; and
4. The period of recovery, 1971 to 1986.

3.2 Domestic and International Significance of Canadian Gold Production and Marketing

In his study of Canada's gold mining industry in 1932, A.H.A. Robinson (p.14-15) described the production of gold as being distinct from the production trends of base metals. Robinson noted that base metal production, when plotted against population figures over an extended period of time, is directly correlated to population increases. Thus, he concluded that base metal production depended more on demand than on supply. However, gold production did not exhibit a direct correlation to population increases. According to Robinson, gold has a constant and practically unlimited market with no economic barrier to its complete and rapid exploitation. Consequently, gold production has been dependent upon supply, not demand. Robinson further stated that, "... the long-time trend of gold production has on the whole been upward, minor ups and downs have corresponded with the making of new discoveries and their subsequent depletion rather than with changing rates of increase in population and periods of business activity and depression." 29

The primary sources of gold, prior to the discovery of America, were Asia and northern Africa. However, there are no records of production from that early period and the amounts produced were assumed to be minimal as compared to later periods. 30

With the discovery of America in 1492, gold production escalated to levels never before seen. However, much of the

production was the direct result of the employment of slave labour and the looting of palaces, religious sanctuaries, shrines and burial grounds in Central and South America. This dark era of gold production created such an over-supply of gold that the economic structure and political control of Europe became very unstable. 31

The next significant period in the development of the world's gold mining industry, began in 1850 following the major discoveries in California and Australia. The next twenty-five years produced more gold than the previous three-hundred and fifty-eight. 32

Following the California and Australia gold rushes, the next period of notable gold production commenced in 1890. With the development of a cyanide process, used to separate the gold from the rock core, exploration flourished. The major discoveries of that time included the Rand (South Africa), followed by discoveries in the Yukon, Alaska, Nevada, and Colorado. These discoveries brought the world's production to a peak of 22,718,223 ounces in 1915. Production gradually tapered off to 15,467,223 ounces in 1922 and began a steady increase over the next eighteen years, due primarily to rising production in South Africa and Canada. 33 From 1931 to 1933, Canada surpassed the United States, in terms of gold production, hence becoming the world's second largest producer. In 1933, Canada produced approximately 13% of the total gold production of the non-communist world. However, Canada's production was significantly lower than the

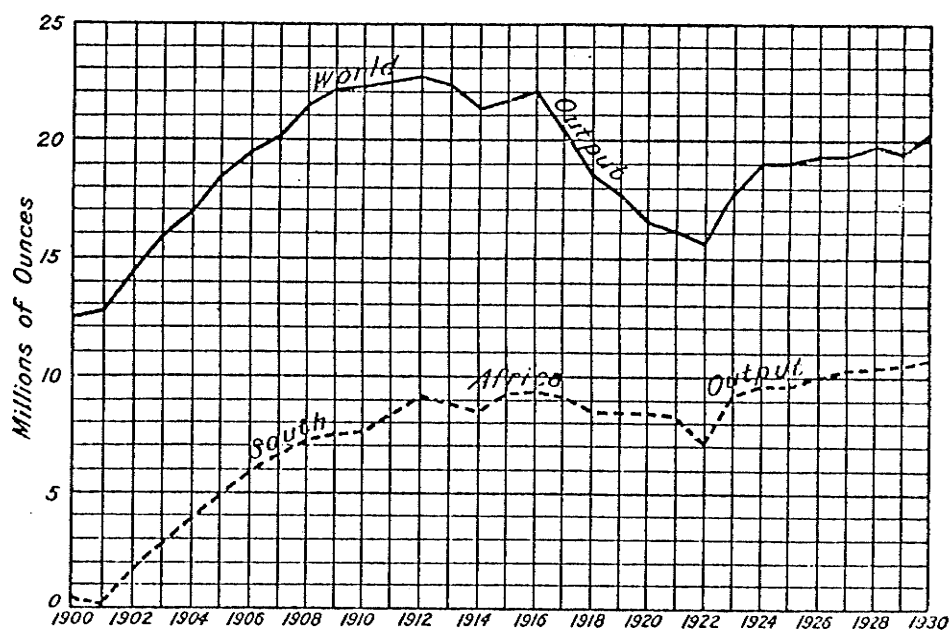
world's primary gold producer, South Africa, which contributed nearly 49% of non-communist production. 34 Clearly, the magnitude of South Africa's annual gold production was the predominant factor in forecasting world production, as graphically represented below in illustration 3.2.

From 1934 to 1941, the United States regained its position as the world's second largest producer of gold, which it lost to Canada during the early 1930's, as shown in appendix A-1. However, following 1940, the gold production of the United States began a steady decline from a peak of 6 million ounces to 1.7 million ounces by 1970. During the same thirty-year period, Canada's production also declined but at a slower rate. Canada's production fell from a peak in 1941 of 5.3 million ounces to a low of 2.3 million ounces by 1970. From 1942 to 1970, Canada was the second largest producer of gold, followed by the United States. Although Canada and the United States faced declining production from 1940 to 1970, South Africa's production grew dramatically from 14 million ounces in 1940 to 32.2 million by 1970, an increase of 130%. 35

The statistics, tabled in appendix A-1, provide production figures for the major gold producing regions in the world excluding communist countries. The reason for the exclusion of the gold output of communist nations is that the production figures are often unavailable or unreliable when made available. In the 1970's, estimates of the total gold production of the Soviet Union ranged from 270 to 450 tons per year. The estimates were provided by the U.S. Intelligence

ILLUSTRATION 3.2

OUTPUT OF THE WORLD AND OF THE UNION OF SOUTH AFRICA,
1900 to 1930



Canada, Gold in Canada (Ottawa: Department of Mines, Mines Branch, 1932), p. 15.

Agency and Michael Kaser, a gold analyst from Oxford University. A London mining house, Consolidated Gold Fields, has made elaborate studies of Soviet mining potential and has estimated production during the later portion of the 1970's to be in excess of 400 tons annually. For 1980, Consolidated Gold Fields estimated that Soviet gold production declined to a level between 280 to 350 tons. In his 1981 book, *The New World of Gold*, Timothy Green states that, "Though the truth is elusive, no one disputes that the Soviet Union is head-and-shoulders above any other gold producer, save South Africa...".
36 Furthermore, Green predicts that, "...it is possible that by the end of this century South Africa and Russia will be neck-and-neck, perhaps (producing) at around 400 to 500 tons a year each." 37 Green's prediction assumes a gradual and steady decline in South African production and a continuous gradual increase in Soviet production.

The period of time from 1971 to 1985 was one of recovery for most gold producing countries, as indicated in appendix A-1. The only significant decline in annual production was incurred by South Africa, who's production dropped substantially from 976.3 tonnes in 1971 to 673.3 tonnes in 1985, a drop of approximately 31%. However, the drop in production is not indicative of an industry in decline. The surge in gold prices from \$35.00 (U.S.) an ounce in 1970 to an average of \$612.56 (U.S.) an ounce in 1980, encouraged exploration and the opening of new lower-grade ore mines in all countries. South Africa was developing a more balanced

mining program during the fifteen year period, with the extraction of an even mix of high and low-quality ore. 38 Conversely, the decade of the 1960's saw the South African mines extracting high quality gold ore in order to remain financially viable under the tight squeeze of the restrictive \$35.00 an ounce gold fix. South Africa's future production, like that of all other gold-producing countries depends upon the price of gold, and according to Timothy Green, "...a high price encourages the mining of low grade ore, so annual output tends to decline while the actual life of mines is extended." 39

Since the freeing of the price of gold in 1971, other mining regions of the world have made substantial increases in their annual production. By 1985, countries in Latin America and Oceania have increased production by 377% and 280% respectively. Brazil has been the major contributor to the expansion of gold production in South America, by developing alluvial properties of exceptionally high purity in the Amazon Basin. 40 In contrast to South Africa's unique situation of having the deepest gold mines in the world, the Amazon Basin's wealth lies virtually on the surface of several mountains in the Amazon Delta. One of these mountains is the Serra Pelada. According to Green, it is conceivably the richest concentrated deposit of alluvial gold ever unearthed. With the alluvial deposits near to or on the surface, the extraction can be performed at low cost and with unsophisticated technology; ie. shovels, picks, pans, and sluices. Because of the low capital costs, the deposit sites have been inundated by thousands of

individual prospectors, giving the sites the semblance of a busy ant hill. 41 The country's extraction of surface minerals transforms the mountainous region into a series of open pits. The world's largest open-pit gold mine is located at Pueblo Viejo in the Dominican Republic. 42 South American gold production is also active in the countries of Venezuela, Colombia, Peru, Bolivia, and Chile.

The region of Oceania includes Papau/New Guinea, Australia, and New Zealand, with Australia being the major gold producer. The significant increase in annual production for the region is due primarily to development in Australia. Events which have contributed to the production surge include: the increased throughput of ore, the milling of high quality ore at producing mine sites, and the commencement or resumption of production at a number of old mine sites primarily in the Golden Mile district of Kalgoorlie. 43 In addition, the Kidston mine in Queensland, which is controlled by Placer Development Limited of Vancouver, commenced operations in 1985. The Kidstone is the largest producer in Australia, and along with a new site being developed for production in 1987, the Boddington gold project, Australia's production is expected to climb to over 100 tonnes by 1988. 44 With anticipated growth in production of Papau New Guinea, the Oceania region will continue to play a greater role in the growth and development of the world's gold mining industry.

Since 1971, the gold mining industry has been in a period of revitalization, inspired by a gold price determined by

market forces. For the United States and Canada, however, their annual production continued to decline until 1981, and 1982 respectively as shown in appendix A-1. Though the higher prices of the 1970's provided an enormous impetus to the industry, by staving off insolvency for borderline producers the average annual nominal U.S. gold prices remained below \$200.00 per ounce until 1979 as shown in appendix A-2. Consequently, the producers of the United States and Canada were contained in a period of recovery, and not yet in a financial position which would be conducive to the expansion of current facilities and the exploration of new properties.

In a 1978 interview with the Northern Miner, CEO of Dome Mines, J.B. Redpath, stated that, "The higher gold price is certainly going to aid present producers and extend their life."

45 But with escalating capital and operating costs, Redpath declared the idea of bringing a new mine into operation from scratch as being premature. However, Redpath advised that Dome was beginning to increase its exploration at that time. Another Canadian industry leader and president of the Cochenour Willians Gold Mines at Red Lake, Ontario, J.E.J. Fahlgren stated in the 1978 Northern Miner publication, entitled Gold Mining in Canada, that, "A considerably higher price - and with some stability - will be needed to attract the capital to develop new mines or even reopen existing ones." 46 At that time, (1978), Fahlgren along with J.J. Byrne, president of the Camlaren Mines at Yellowknife insisted that a minimum price of \$225.00 (Cdn.) per ounce, along with a greater degree

of price stability, would be required before the industry could attract the large amounts of new capital required for the exploration and development of new mines or for the reopening of old mine sites. 47

Thus, the 1970's proved to be a period of reorganization and revitalization within the gold mining industry. North American producers were reorganizing their production operations as higher bullion prices enabled the extraction of lower grade ore reserves, while saving their higher quality deposits for periods of depressed gold prices. For leading producers such as Canada's Campbell Red Lake, the higher prices encouraged investor appeal. With high grade ore deposits of .66 ounces per ton and ore reserves of 1,734,400 tons at the end of 1976, combined with a highly efficient operating staff which extracts the lowest cost-per-ounce of gold produced in Canada, Campbell Red Lake, was in the position to direct new investment into the exploration of new mining and oil and gas ventures. 48 For older and less-profitable mines such as Dome Mines at Porcupine, Ontario, which has been in continuous production since 1910, Harry Pyke (now deceased) of Dome Mines, attributed the higher prices of the late 1970's as having restored production to more equitable levels. In the latter half of the 1970's, Dome did not engage in the exploration of new properties, but did some follow-up assay work and testing in existing shafts that had been examined several years prior. 49

According to the Northern Miner, \$200.00 an ounce

Canadian was considered to be the benchmark for survival of borderline mining properties and for the development of new mine sites. By the close of 1978, the average annual price of gold per ounce was \$193.23 (U.S.) or \$220.41 (Cdn.). With the price continuing to increase during 1979 and holding well above \$200.00 (Cdn.), exploration activity began to gain strength in Canada and the United States, encouraged by the price stability. However, the November 1979 seizure of the American Embassy and the capture of American hostages by militant Iranian fundamentalists in conjunction with the Soviet Union's invasion of Afghanistan were viewed by Western investors as provocative acts which jeopardized world peace and economic stability. Consequently, investors turned to gold as an investment haven during the autumn of 1979 and winter of 1980. The freezing of Iranian assets by United States in November of 1979 further heightened the possibility of war and gold prices escalated. Investor excitement entered into the picture creating a snowball effect which culminated on January 21, 1980, when the price of gold reached an all-time high of \$850.00 (U.S.) an ounce. 50

Despite price volatility, the exceptionally high gold prices of 1981 contributed immensely to the profitability of the industry. As a result, production in the United States and Canada responded positively. From 1980 to 1985, gold production in the United States has increased by approximately 186% from 27.6 to 79.0 tonnes. Similarly in Canada, production increased by 77% from 49.5 to 87.5 tonnes; (refer to appendix

A-1).

With the high inflation rate of the late 1970's and early 1980's, the Canadian gold mining industry revised its assessment of the minimum price required to sustain production. Industry participants revised their break-even point in 1982 to be in the range of \$300 to \$400 per ounce (Canadian). Although the price of gold fell briefly below \$300 per ounce in 1982, it averaged \$465.10 in nominal Canadian funds, and it ensured the profitability of most existing mines. During 1982, there was only one major gold mine brought into production with the expectation of an additional mine to commence in 1983, which would bring the number of Canada's total operating lode gold mines to 40. The most promising development in terms of exploration during 1982 came from the Hemlo area on Highway 17 east of Marathon Ontario, with initial assay reports averaging .33 ounces of gold per ton, well within profitable limits. 51 The initial discovery was made by International Corona Resources Ltd., but it would develop into a questionable joint venture between Teck Corporation and Lac Minerals. The joint venture would eventually develop into a legal battle for control of Canada's richest gold discovery, and production would not commence until 1986. Teck Corporation would win the initial legal claim for control. However, the legal dispute between the two parties continued, with the Supreme Court of Canada rendering the final decision in favour of Teck Corporation during the summer of 1989.

With inflation in Canada running below 5% annually since

1983, as shown in Appendix A-3, the capital required for the exploration and development of new sites can more readily be obtained and afforded. However, the lower rate of inflation has been a major factor in the drop in gold prices from an annual average of \$520.79 (Cdn.) per ounce in 1983 to \$433.23 in 1985. Despite the lower price of gold, Canadian gold mining expectations for increasing production remained positive. 52

The use of newly processed gold in the Western World in 1985 for jewellery, coin, and industrial purposes totaled 1,233 tonnes, which closely approximated the 1984 usage of 1,221 tonnes. In 1985, nearly 898 tonnes of gold was used in jewellery fabrication, an increase of 10% over the previous year. The gold markets of Japan, India and the United States accounted for the largest increases in demand. In the electronics industry, the consumption of gold declined by approximately 10% from 122 tonnes in 1984 to 111 tonnes in 1985. The decline resulted from an oversupply of gold-bearing computer components produced during 1984. The decline was most prominent in the United States, because of the drop in sales of home computers. In the dental industry, demand remained stable at 52 tonnes. Despite the stability over the past few years, the industry is forecasting declining demand in future years. The reason for the expected reduction in the use of gold in the dental industry stems from the increasing use of ceramics and non-gold alloys, which are less expensive and appear more natural than gold. 53

Gold has many miscellaneous applications, such as gold

leaf, gold used for industrial and decorative plating, and liquid gold used to decorate glass and ceramics. The total use of gold for such purposes consumes an amount roughly equivalent to the dental industry's annual consumption. Other less-consumptive uses of gold include the fabrication of medals, medallions and fake coins, which are most popular in the Middle East. 54

The major producers of official coins in the 1980's included South Africa, Canada and the United Kingdom. The Canadian government entered the gold bullion coin market in 1979, when it commenced selling the one-ounce 999 fine gold Maple Leaf. The bullion coin market expanded in 1985 when both the United States and Australia commenced production of bullion coins. Sales of the Canadian Maple Leaf totaled approximately 1.8 million ounces in that year. 55

The hoarding of bullion coins and bars, the purchase of jewellery, the trading of gold futures, and the purchase of metal accounts constitute the variety of investment demand vehicles available. For institutional and large-scale investors, the development of metal accounts has made it possible to trade profitably on small price movements, as the accounts eliminate the necessity to hold physical metal and further eliminates transaction taxes on gold. 56

In terms of the markets for gold, the London Gold Exchange was established in 1919. It establishes "spot" and cash prices for gold on a daily basis, which the Central Banks use in their gold dealings. South African gold is marketed through a

central agency associated with the International Monetary Fund. In the early 1970's, the South African government sold nearly two thirds of its production on the open market, with the Zurich Gold Market transacting 80% of the sales and the London Market transacting 20%. 57 The Arab Shiekhdom of Dubai, which is one of the largest gold markets in the world, provides gold sales to India, Singapore, Saigon, and other Asian destinations. Other gold-trading markets of significance include: Accra, Amsterdam, Beirut, Brussels, Frankfurt, Geneva, Hong Kong, Macao, Manila, New York, Paris, San Fransisco, Singapore, Sydney, Victoria (Australia), Vienna, and Toronto. These markets facilitate the buying and selling of gold on a cash basis. In areas where no market exists, the trading of gold is clearly limited as is the valuation of gold holdings, which would be based on the daily price fix at the London Market. 58

With the goal of broadening the scope of participation in the marketing of gold, the Winnipeg Commodity Exchange announced in September of 1972, that it had established a futures contract for gold based on a 400 ounce gold bar. Hence, Winnipeg became the site of the world's first gold futures market. The exchange expanded in 1974 with the addition of a futures contract for a 100 ounce bar. 59

A futures contract for gold, like other commodities, binds the seller to deliver and the buyer to accept, "an agreed quantity, of a specified grade of the commodity, at a certain place, within a stated month in the future, for the price set at

the time the contract was made." 60 The futures market provides the buyer and seller of a commodity with an ongoing opportunity to avoid delivery by making an equal but reverse transaction prior to the delivery month. Most contracts are terminated in this fashion, which clearly distinguishes the futures market from the open cash market.

In terms of investment in gold futures, Winnipeg pioneered the trading of gold futures with a high measure of success. In a March 22, 1988 interview with Walter Folliott, who at that time was the Supervisor of the Winnipeg Commodity Exchange, this author toured the floor of the exchange. Mr. Folliott explained the inter-relationship between commodity futures trading in Winnipeg and trading in the dominant markets of New York and Chicago. After viewing a feverish resolution to another day's trade of various agricultural commodities, we walked past the precious metals trading pit, which was deserted, with no activity showing on the electronic trading board for the current week. Mr. Folliott explained that the world traders of precious metals "go where the action is," meaning New York or Chicago. 61 Consequently, Winnipeg is unable to attract gold commodity traders and has lost its significance as a world market place for the trading of gold.

The sudden obsolescence of the Winnipeg precious metal commodity exchange occurred on January 2, 1975, when after more than 40 years of prohibition, citizens of the United States became legally entitled to purchase gold. 62 "Once Americans could trade gold at home, the whole purpose of

Winnipeg vanished overnight. 63 The New York Commodity Exchange (COMEX) and Chicago's International Monetary Market (IMM) now account for nearly 95% of the North American trade in gold futures contracts. Three other exchanges in gold futures account for the balance of trade. They include: the New York Mercantile, the Chicago Mid America, and the Board of Trade. 64

The gold futures markets of COMEX and IMM have achieved enormous significance in the world trade of gold, as their volume of trade have far surpassed the conventional gold markets of London and Zurich. According to Timothy Green, the gold futures market is attractive on an international scale because, it offers a low-cost and financially efficient method of investing in gold, by eliminating the costs associated with delivery, storage, and reassay upon sale, which are imperative expenses incurred by investors who deal with the physical metal. According to A. Bailetti and J. Callahan of Carleton University, Ottawa, "Futures contracts offer investors the opportunity to realize large profits or losses relative to their investment. They also offer economic units within the real and financial sector the opportunity to transfer the risk of significant changes in the value of their assets and liabilities to others." 65 Bailetti and Callahan categorize futures traders as hedgers or speculators. Hedgers seek to eliminate or reduce the risk associated with the potential for the price of the commodity which they produce to decline. For example, a gold mining company would hedge against a possible decline in the

price of gold by selling a futures contract in the current period at conceivably a higher price and reversing his/her position by buying the futures contract at a later time, after the commodity price for gold has fallen.

The other category of futures investors is the speculator. According to Bailetti and Callahan, "Speculators are interested in profiting from price changes in futures contracts." 66 As a third party in the futures market, speculators serve a useful purpose. Their participation in buying and selling contracts assists the market by keeping it active and maintaining viable prices. With the absence of speculators, a bullion dealer attempting to protect his inventory by selling futures at a time when there are no users willing to buy, would be unable to place a hedge on his commitment. Consequently, the producer's only option would be to sell at a reduced price. With the participation of speculators in the market, the opportunity of making a contract would increase. 67

On a return visit to the Winnipeg Commodity Exchange, on May 17, 1988, this author met with Walter Folliott and Carol Klopko. They notified this author that the Winnipeg Commodity Exchange terminated the trading of gold futures on April 20, 1988. Thus, the market which once pioneered the trading of gold futures in the world could no longer compete with the highly active American markets.

3.3 Footnotes- Chapter III

1. Canada, Dominion Bureau of Statistics, Canada. One Hundred 1867-1967, (Ottawa: Queen's Printer, 1967), p. 143.
2. Canada, Department of Mines, Mines Branch, Gold in Canada, by A.H.A. Robinson (Ottawa: 1932), p. 17.
3. Canada, Dominion Bureau of Statistics, Canadian Mineral Statistics 1886-1956. Mining Events 1604-1956, (Ottawa: Queen's Printer, 1957), p. 6.
4. Ibid., p. 6.
5. Canada, Royal Commission on Canada's Economic Prospects, Mining and Mineral Processing in Canada, by John Davis, (Ottawa: October, 1957), p. 337.
6. Canada, Dominion Bureau of Statistics, Canadian Mineral Statistics 1886-1956. Mining Events 1604-1956, (Ottawa: Queen's Printer, 1957), p. 6.
7. Canada, Department of Mines, Mines Branch, Gold in Canada (Ottawa: 1932), p. 17.
8. William L. Marr and Donald G. Paterson, Canada: An Economic History, (Toronto: Gage Publishing Limited, 1980), p. 355.
9. Canada, Dominion Bureau of Statistics, Canadian Mineral Statistics 1886-1956. Mining Events 1604-1956, (Ottawa: Queen's Printer, 1957), p. 7.
10. Canada, Royal Commission on Canada's Economic Prospects, Mining and Mineral Processing in Canada, by John Davis, (Ottawa: October, 1957), p. 340.
11. Canada, Department of Mines, Mines Branch, Gold in Canada, (Ottawa: 1932), p. 17.

3.3 Footnotes- Chapter III (continued)

12. Canada, Royal Commission on Canada's Economic Prospects, Mining and Mineral Processing in Canada, by John Davis, (Ottawa: October, 1957), pp. 340-41.

13. Ibid., p. 339.

14. Ibid., pp. 341-42.

15. Ibid., p. 341.

16. Ibid., p. 342.

17. Canada, Dominion Bureau of Statistics, Canadian Mineral Statistics 1886-1956. Mining Events 1604-1956. (Ottawa: Queen's Printer, 1957), p. 9.

18. Canada, Department of Mines, Mines Branch, Gold in Canada, by A.H.A. Robinson, (Ottawa: 1932), p. 17.

19. Canada, Royal Commission on Canada's Economic Prospects, Mining and Mineral Processing in Canada, by John Davis, (Ottawa: October, 1957), p. 343.

20. Ibid., p. 343.

21. Canada, Dominion Bureau of Statistics, Canadian Mineral Statistics 1886-1956. Mining Events 1604-1956. (Ottawa: Queen's Printer, 1957), p. 13.

22. Timothy, Green, The New World of Gold. (New York: Walker and Company, 1981), p.25.

23. The Northern Miner, Gold Mining in Canada. A Feature Report. (Toronto: Northern Miner Press Limited, 1977), p. 1.

24. Canada, Royal Commission on Canada's Economic Prospects, Mining and Mineral Processing in Canada, by John Davis (Ottawa: October, 1957), p. 344.

3.3 Footnotes- Chapter III (continued)

25. Green, p. 73.
26. Ibid., p. 73.
27. Ibid., p. xxii.
28. Ibid., p. xxiv.
29. Canada, Department of Mines, Mines Branch, Gold in Canada, by A.H.A. Robinson (Ottawa: 1932), p.15.
30. Ibid., p. 15.
31. Ibid., p. 15.
32. Ibid., p. 15.
33. Ibid., p. 16.
34. Ibid., p. 10.
35. Ibid., p. 10.
36. Green, p. 66.
37. Ibid., p. 66.
38. Ibid., pp. 54-55.
39. Ibid., pp. 55.
40. Ibid., p. 80.
41. Ibid., p. 80-81.
42. Ibid., p. 100.
43. Canada, Mineral Policy Sector, Energy Mines and Resources, Gold 1982, by S.A. Hamilton (Ottawa: 1982), p. 19.

3.3 Footnotes- Chapter III (continued)

44. Canada, Energy Mines and Resources Canada, Canadian Minerals Yearbook 1986 Review and Outlook. Centennial Edition 1886-1986, (Ottawa: 1986), p. 29.4 and 29.5.
45. The Northern Miner, Gold Mining in Canada, (Toronto: Northern Miner Press Limited, 1978), p.1.
46. Ibid., p. 1.
47. Ibid., p. 1.
48. Ibid., p. 5.
49. Ibid., p. 6.
50. Green, p. xiii.
51. Canada, Mineral Policy Sector, Energy Mines and Resources, Gold 1982, by S. A. Hamilton (Ottawa: 1982), p. 19.15.
52. Canada, Energy Mines and Resources, Canadian Minerals Yearbook 1986 Review and Outlook. Centennial Edition. 1886-1986, by D. Law-West (Ottawa: 1987), p. 29.5.
53. Ibid., p. 29.5
54. Canada, Mineral Policy Sector, Energy mines and Resources, Gold 1982, by S. A. Hamilton (Ottawa: 1982), p. 19.18.
55. Green, p. 201.
56. Canada, Mineral Policy Sector, Energy Mines and Resources, Gold 1982, by S. A. Hamilton (Ottawa: 1982), p. 19.18.
57. The Winnipeg Commodity Exchange, The Gold Futures Market (Winnipeg: October 1972), p. 6.
58. Ibid., p. 7.

3.3 Footnotes- Chapter III (continued)

59. The Winnipeg Commodity Exchange, 100 Years of Fair Exchange! 1887-1987. Statistical Annual 1986/87 (Winnipeg: 1987), p. 1.

60. The Winnipeg Commodity Exchange, The Gold Futures Market (Winnipeg: October 1972), p. 8.

61. Walter Folliott, Former Supervisor of the Winnipeg Commodity Exchange (Interviewed at the Winnipeg Commodity Exchange on March 22, 1988).

62. Green, p. 135.

63. Ibid., p. 137.

64. Ibid., p. 137.

65. A. Bailetti and J. Callahan, Investments and Portfolio Management in Canada (Carleton University, Ottawa: 1981), p. 19-1.

66. Ibid., p. 19-4.

67. The Winnipeg Commodity Exchange, The Gold Futures Market (Winnipeg: October 1972), p. 9.

CHAPTER IV

The Gold Standard and its Abandonment

4.1 The Transformation From a Fixed to a Flexible Pricing Mechanism for Gold

In his book entitled, "The Destiny of Gold," Paul Einzig states that, "The most stable period in international monetary history was the century between the Napoleonic Wars and the First World War."¹ He attributes the stability to the increasing role of gold in controlling international monetary volatility. The Californian and Australian gold rushes dramatically increased the world's supply of gold which became increasingly used in business transactions. From 1870 to 1914, gold gradually replaced silver as the monetary standard of international trade. The increasing supply and its high value for weight, which reduced shipping costs, made gold the more attractive currency for international business transactions. ²

Britain was the first to adopt the gold standard, and did so following the Napoleonic Wars. In 1871, Germany issued a new currency which was directly tied to gold. With the increased demand for gold, the value of silver dropped relatively. The drop in silver prices reduced the purchasing power of countries whose currency was founded on the silver standard. Consequently, many countries were forced to revalue their currency in terms of gold. By the start of World War I, in

1914, fifty-nine countries were on a gold or gold-exchange standard, with China being the only major country still tied to silver. 3

According to Einzig, few countries prior to WWI were actually on an effective or true gold standard. Although numerous countries attempted to maintain stable exchange rates, they did so by adjusting their exchange rates in terms of the rates used by countries which were on the gold standard, not by adopting free convertibility of their notes into gold. Furthermore, many of the dominant economies, while nominally on the gold standard, employed policies which discouraged the exodus of gold and artificially encouraged its inflow. Despite the variances from a true gold standard, Einzig contends, that most advanced nations had structured monetary systems based on gold. 4

The pre-1914 gold standard introduced a monetary system which was far more stable than its predecessors. Previous metallic currencies were forced to sustain debasements and constant supply shortages. With the introduction of paper money in Europe, many countries initially encountered periods of high price volatility and inflation. However, the initial exchange turbulence, due to the ever-changing parity between the prices of gold and silver, eventually dissipated as the number of countries adhering to gold increased. 5

The fundamental benefit of the monetary use of gold was that it served to unify and stabilize the international monetary system. The gold standard demanded that member countries

exercise considerable self-discipline particularly in the realm of budget control and balance of payment control. Failure to do so, resulted in a depreciated exchange rate and the inevitable reduction of gold or foreign exchange reserves. However, the decline in the gold reserve carried with it a corrective feature. Specifically, as the reserve dropped, the supply of currency and credit also declined, leading to an improved balance of payments situation. 6

As World War One drew near, gold had become firmly entrenched as the foundation of the world's monetary system. The appeal of the gold-based monetary system stemmed from its stability, where movements of exchange rates were minimal with an automatic correction mechanism. The system was highly recognized for its widely accepted ability to settle balance of payment deficits. Gold was used as a trade-settlement mechanism for exporters and importers, as well as a safety net during periods of domestic economic recession . The possession of excessive gold reserves by any nation served to reassure its trading partners of its ability to pay, and facilitated the expansion of domestic industries without threatening the exchange rate of its currency. 7 According to Einzig, "It was substantially correct to say that the period of the pre-1914 gold standard had been (in more than one sense) the golden age of mankind." 8 During the gold standard era, a nation possessing large reserves of gold or vast sums of claims, that were convertible into gold such as British acceptance credits, was viewed as a nation of power and

prominence. The gold standard inspired confidence in international as well as domestic banking, which forged the creation of an extensive credit system in most advanced countries, a system which would not have been developed in the absence of a sound monetary system. 9

With the arrival of the First World War, the gold standard was immediately dropped by most European countries. Britain maintained full convertibility, at least in theory, but imposed insurmountable restrictions on the export of gold which virtually paralyzed the effectiveness of the gold standard. Britain formally prohibited the export of gold in 1919, when it announced that it had suspended using the gold standard. Similarly, when the United States entered the war in 1917, the currencies of neutral countries appreciated in value relative to the dollar, thus pressuring the United States to suspend the gold standard. Neutral countries responded by suspending their respective applications of the gold standard by foregoing any future gold purchases conducted by their Central Banks. 10

Following the war, the United States lead the return to gold. Other countries followed but their return was less than immediate, as circumstances associated with the war retarded their return. During the 1920's, most countries, which had previously been on the gold standard, made their return and stabilized their currencies in terms of gold either at their previous parities or by some new equivalence factor. Despite the return to gold by many countries, including Britain, in most cases, no coins were issued for domestic circulation simply

because residents were prohibited from holding large amounts of gold. The only gold payments authorized by the central bank were for export purposes. Consequently, the pre-war gold standard had not fully returned. Instead, the monetary system had transformed itself into a "Gold Bullion Standard" whereby gold bullion became increasingly used as a means of monetary arbitrage. The monetary system under the full gold standard permitted the uninhibited circulation of gold coins. The revised monetary system under the gold bullion standard limited the circulation of gold coins for use in export markets only, with most gold purchases and sales by Central Banks using gold bars rather than coins. Hence, the gold bullion standard, by virtually eliminating the domestic monetary use of gold, instituted the demonetization of gold. 11

The gold bullion standard effectively eliminated the role of gold in the domestic realm of monetary affairs, but the transformation of the role of gold continued in the international arena following an international conference at Genoa in 1922. The conference brought together bankers from around the world, who collectively established a resolution advocating the use of foreign exchange reserves as a supplement to the gold reserves of Central Banks. The objective of the resolution was to eliminate the excess demand for gold, a demand which far exceeded the supply. Under the resolution, the role that gold formerly played as a reserve and as a means of settling international trade transactions, was taken over by the holding of foreign

currencies, which were convertible into gold. Thus, the gold exchange standard came into being. 12

The gold exchange standard was widely accepted by Central Banks during the 1920's. Subsequent to the Genoa Resolution, the League of Nations Finance Committee reiterated the need to curtail the demand for gold. The committee stated that central banks, involved in financing the reconstruction of various war-torn economies, should revise their statutes authorizing the use of foreign currencies as a fully acceptable component of their official reserves. 13

With the stabilization of the German mark in 1924, the Reichsbank revised their statutes, authorizing the inclusion of foreign currencies in their official reserve up to a maximum of 25% of the total reserve. However, the progress of Germany's reconstruction in conjunction with the massive amount of foreign debt financing, spawned a dramatic growth in the gold holdings of the Reichsbank well in excess of statutory requirements. Furthermore, the holdings of foreign currencies increased beyond statutory levels stemming from the influx of short and long term debt financing from foreign investors. 14

For the Central Banks of Italy and France, the end of the war brought with it the return of capital, which had fled the war zone for safer havens. With the further enhancement of speculative direct foreign investment, the Banque de France experienced a sizeable increase in its foreign exchange holdings following the de facto stabilization of the franc in 1926. Although the central bank of France was eager to

convert its foreign exchange reserves into gold, it was encouraged to refrain from doing so by Britain and the United States, who were quite unwilling to exchange France's sterling and dollar holdings for gold. Such an exchange would have significantly reduced the gold reserves of both countries. Although France converted a substantial portion of its reserves, most of its foreign exchange holdings were redeemed following the suspension of the gold standard in Britain. 15

Central Banks which participated in foreign exchange markets were required to hold foreign currencies. The inflow of foreign exchanges increased the volume of credit in the exporting country. An increase in the volume of exports would consequently increase the volume of credit for the surplus country. Furthermore, if the exporting country included foreign exchange reserves in with its statutory reserves, it would be entitled to expand its note issuing and credit granting authority, by a multiple several times the amount of its exchange reserve. For this reason, the gold exchange standard was criticized as being a source of international inflation. Many opponents of the gold exchange standard, including M. Rueff, contended that the extensive utilization of the system had been a dominant factor in the international over-extension of credit, which fueled the Wall Street boom and subsequent crash of 1929, and which culminated in the economic depression of the 1930's. 16

The unprecedented decline in the value of stocks in 1929, which occurred in markets around the world, initiated an era

of crisis for gold. Britain abandoned the gold bullion standard in 1931, and sterling was depreciated, which established a new price for gold that fluctuated between £5.10s and £6 per ounce. The United States retained the gold exchange standard until March of 1933, when President Roosevelt, seeking to stabilize domestic banking, severed the link which had permitted the exchange of U.S. dollars for gold by legislating a ban on the hoarding and export of gold. In the autumn of 1933, President Roosevelt, and Jesse Jones of the Reconstruction Finance Corporation embarked on a policy of gradually increasing the price of gold by establishing a daily price fix. The objective of the policy was to lift the United States out of the depression. By the end of January 1934, Roosevelt realized that the policy was ineffective. Consequently, he revised his policy and boldly increased the price of gold by more than \$14.00 an ounce from \$20.67 to a fixed price of \$35.00 an ounce. Roosevelt's revised policy permitted the export of gold to central banks and government institutions, but the private purchase of gold by American citizens was prohibited and would remain until 1975. The new price fixing catapulted the gold industries of the world into a new realm of productivity and profitability, while most mining and manufacturing industries laboured. 17

During the Second World War, the exchange of currencies was strictly controlled, with all foreign exchange transactions in most countries being administered and approved by national and international authorities. The imposition of exchange

control, were it permitted to continue, would have virtually ended the monetary role of gold, according to Paul Einzig. However, the Bretton Woods Agreement of 1944 directed attention towards removing artificial barriers to free international trade and commerce, by replacing exchange control with the dollar standard, a form of gold exchange standard. The Bretton Woods System empowered the dollar with the same role as gold; the role of international currency. Another key feature of the agreement was the establishment of Special Drawing Rights for member countries of the International Monetary Fund, which facilitated another means of settling international trade transactions. 18

The principal feature of the Bretton Woods system was its clear focus on the maintenance of economic stability. The agreement, which was arrived at principally by Lord Keynes of the United Kingdom and Harry Dexter White of the United States, focussed on the abolition of exchange controls and the restoration of free exchange markets. The major difference between the two key players was that the American negotiators aggressively sought a rigid and stable monetary system, while the British delegation favoured a more flexible system which would encourage economic expansion. The resultant agreement leaned towards rigidity, and consequently earned it the analogy of a restored form of gold standard. 19

According to Einzig, the system paralleled the operations of a gold standard through its rigid gold-currency parities. However, Einzig, after years of opposition to Keynes' view that

Bretton Woods did not represent a return to a rigid gold standard, later conceded that the system was somewhat rigid. Einzig qualified his view of rigidity by stating that the Bretton Woods system did not bear the essential characteristics of free convertibility of currencies into gold nor free mobility of gold to offset balance of payments surpluses and deficits through the automatic adjustment mechanism. Einzig further conceded that the rigid monetary system devised bound governments to adopt unpopular though vitally important measures, which resulted in a high degree of stability and the abatement of rising prices and living costs. 20

The Bretton Woods System, which governed international exchange from 1946 to 1971, managed to keep inflation in check in most advanced nations, and effectively stabilized the purchasing power of most national currencies, in terms of goods and services, along with achieving significant stability in terms of gold. 21

In addressing the question of the similarity of the Bretton Woods system to the gold exchange standard, Einzig states that until the middle of the 1960's, the dollar was convertible into gold for official holders. As the stability of exchanges was maintained to a large extent through the purchase and sale of dollars, stability was indirectly achieved by the purchase and sale of gold. However, the dollar was inconvertible for private holders, and its convertibility diminished for official holders after the mid 1960's.

In referring to the Bretton Woods system, Einzig suggested that, "It would be more correct to describe the system as the dollar exchange standard, not only because currencies were convertible into dollars rather than into gold, but also because the dollar assumed the role of principal currency for international purposes. But, the main reason why the dollar came to gain such prominence was the maintenance of its fixed parity in relation to gold at \$35.00 per ounce." 22 In the latter half of the 1960's, the dollar gradually lost its convertibility into gold for official holders, and at the same time, the market price of gold rose well above the official American price. These events brought insurmountable pressure upon the Bretton Woods system, as the awareness of the fictional relationship between the dollar and gold grew. 23 The inevitable consequence was the breakdown of the Bretton Woods system.

The support of an artificially low official gold price following the Second World War, despite rising prices and production costs, perpetuated an increasing demand for hoarding and industrial purposes. In order to curb the demand growth, the United States and many other nations adopted policies aimed at curtailing the rise of the market price for gold above the official American price of \$35.00. To this end, a Central Banks' Gold Pool was established in 1961. The pool was created by the United States, which maintained a 50% contribution level. The remaining 50% was apportioned among the following countries: Britain, France, Germany, Italy,

Switzerland, the Netherlands, and Belgium. The operation of the pool was administered by the Bank of England. 24

In order to control the demand for gold, the pool purchased much of the newly mined gold from South Africa and other producing nations, and sold it on the London Market. The operation of the pool came under attack in 1965, stemming from the distrust of the dollar by the French government. The French converted their dollar holdings into gold and aggressively pursued a policy of convincing other central banks to follow suit. The action incited scepticism over the dollar's adequacy as "the" international currency. With the trust in the dollar shaken, the inevitable reaction was a massive increase in the private demand for gold. The action of the French Central Bank forced the pool to sell more gold than it purchased, in order to meet the demand and keep the market price down. The pool consequently ran a deficit during 1965 and 1966, and encountered further difficulties in 1967 with the withdrawal of the Bank of France from the Gold Pool. The withdrawal meant that the remaining member countries were forced to increase their participation in the fund in order to cover the accumulating transaction deficits. 25

The United States was determined to prevail over the French insurrection, and vowed to continue to follow the course of the policy to prevent a rise in the market price of gold. The policy resulted in a substantial decline of the gold reserves of the United States. With other member countries feeling squeezed under the weight of their declining reserves,

the viability of the pool was clearly in doubt. By the spring of 1968, many countries were prepared to follow the French lead, which would have left the remaining members of the pool in an insupportable position. The inevitable termination of the Gold Pool was announced at a meeting in Washington on March 18th, 1968. The dissolution of the Pool dictated to the market that the forces of supply and demand should be permitted to establish a price for gold. 26

The United States was far from feeling euphoric over the demise of the pool, and proceeded to exert considerable pressure on the world's central banks to refrain from dealing in gold on the free markets, or face the consequence of being prohibited from future gold transactions with the United States. The American retaliation resulted in a two-tier gold market with two groups of prices. The official market price remained unchanged for the Federal Reserve and for the small number of Central Banks which continued to sell gold, while the free markets established an independent price for gold which fluctuated with considerable volatility after its initial increase. 27

The fears of the United States, that central banks would be unwilling to abstain from participating in the lucrative free markets of London and Zurich, proved to be unwarranted, as the two largest producers of gold, South Africa and the Soviet Union conformed to American wishes by agreeing not to sell gold on the open market. However, their motive was to restrict the supply of gold on the free market to force gold

prices up, and to pressure the United States into devaluing the dollar. However, their expectations did not come to fruition, as the market price remained below \$44.00 in 1968 and declined further in the following year. Interest rates rose significantly, making it too costly to speculate on the rise in the American gold price. 28 Consequently, speculative demand and hoarding demand declined with the price.

By 1970, the market price had slipped below the official American price and continued to flounder for most of that year, until revived expectations concerning the devaluation of the dollar resurfaced. The speculation enhanced the price of gold. In a move to suppress the growing speculation over the dollar's unavoidable devaluation, the United States suspended the convertibility of the dollar for gold on August 15, 1971. The action was acknowledged for having lessened the eventual extent of the devaluation, which occurred on December 18, 1971. The devaluation was judged inadequate, as a major devaluation was anticipated. Gold responded accordingly with a substantial increase. The devaluation of the dollar, with its corresponding realignment of foreign exchange rates, was unsuccessful in achieving an improved balance of payments for the United States. Furthermore, inflation was permitted to increase in an attempt to bolster employment. The impact of these measures was negative for the dollar but positive for gold, as the price exceeded \$50.00 in May of 1972. Although confidence in the dollar remained low for some time, the steep decline in interest rates lessened the expense of hoarding gold

and diminished the expectations of a further devaluation of the dollar. 29 Despite the dismissal of a future devaluation, the price of gold remained high as industrial demand continued to increase.

According to Paul Einzig, the characteristic permissiveness of the late sixties and early seventies impacted upon all spheres of human relations including the monetary sphere. The 1970's effectively ended the process of the demonetization of gold which began following the First World War with the transformation of the gold standard into the gold bullion standard. In reference to the 1970's, Einzig expressed disheartenment and disillusionment with the policies and attitudes of government and society in general. He has stated that,

The virtues of stability and security, like those of self-control in every other sphere, are hopelessly out of fashion and are denounced by those eager to swim with the prevailing tide...Since the monetary use of gold imposes some degree of self-control it has become unpopular... Two generations ago the monetary circulation consisted of coins or of notes convertible into coins. Banking was subject to strict discipline, credits had to be well secured and self-liquidating, and banks had to maintain a certain proportion of liquid reserves. Today there is a gigantic inverted pyramid of unsecured non-self-liquidating credits." 30

In the 1970's, the monetary use of gold became superfluous. Furthermore, it was argued by opponents of the monetary use of gold, that gold had no intrinsic value, and that

the elimination of the monetary role of gold would have an enormous negative impact upon the price of gold. However, as in the case of the demonetization of silver, initially the market price of the metal declined but recovered with vibrance on the strength of ever-increasing industrial demand. With the increasing, non-monetary demand for gold, the open markets continuously pushed the price of gold upwards until 1980, and with it, the productivity and prosperity of the world's gold mining industry.

4.2 Footnotes- Chapter IV

1. Einzig, p. 1.
2. Ibid., p. 2.
3. Green, p. 22.
4. Einzig, p. 3.
5. Ibid., p. 4.
6. Ibid., p. 5.
7. Ibid., p. 6.
8. Ibid., p. 6.
9. Ibid., p. 8.
10. Ibid., p. 23.
11. Einzig, pp. 25-26.
12. Ibid., p. 36.
13. Ibid., p. 37.
14. Ibid., p. 37.
15. Ibid., p. 38.
16. Ibid., p. 39.
17. Green, pp. 24-25
18. Einzig, p. 40.
19. Ibid., pp. 48-49.
20. Ibid., pp. 49-50.

4.2 Footnotes- Chapter IV (continued)

21. Ibid., p. 51.
22. Ibid., p. 52.
23. Ibid., p. 52.
24. Ibid., pp. 70-71.
25. Ibid., p. 72.
26. Ibid., pp. 73-74.
27. Ibid., p. 74
28. Ibid., p. 74.
29. Ibid., p. 75.
30. Ibid., pp. 56-57.

CHAPTER V

Growth of the Canadian Gold Mining Industry

5.1 Introduction and Methodology

As previously stated, the historical development of the Canadian gold mining industry was uniquely different from the development of most Canadian resource industries. The growth of gold mining in Canada and throughout the world was subject to the usual development factors such as the availability of capital, the supply and associated cost of labour, the extent of the resource base, the access to transportation routes, the cost of exploration and the cost of technology and, the extent of managerial expertise. However, the survival of the gold mining industry was only partially affected by the forementioned factors of production. The critical factor, which most affected the success or failure of the industry, was the international gold pricing mechanism. The pricing mechanism was established to meet the demands of international trade and monetary policy, not to ensure the survivability of the gold industry. Thus, the pricing mechanism, which was focussed on preserving the stability of international currency relationships, was indifferent to the supply and demand considerations of the commodity, which are the determining factors under free market conditions.

Section 5.2 of this chapter will identify the impact of pricing policy upon the growth of production and employment

in the auriferous quartz industry of Canada since 1918. The production and employment levels of the gold quartz industry will be compared to the production and employment figures of the aggregate mineral industry of Canada. The aggregate mineral industry of Canada includes: metals, non-metals and fuels. Metals include: gold quartz, silver-lead-zinc, nickel-copper-gold-silver, iron, uranium, and miscellaneous metal mines. The non-metal industries include: coal, oil, crude, and natural gas. The statistical information is obtained from the annual Statistical Summary of the Mineral Industry in Canada, produced by the Statistics Section, Mineral Policy Sector of Energy, Mines and Resources Canada.

Gold mining activity is divided into three categories: placer gold, auriferous quartz mines, and base metal or by-product mines. The growth analysis of the industry in terms of production and employment will focus on the auriferous quartz sector, which is the dominant producer. The reasons for concentrating on the gold quartz sector are as follows: The placer or alluvial operations produce insignificant quantities, (4% of total gold production in 1985, as shown in appendix A-5). The placer operations are often small with few employees and utilize various extraction methods, unlike the technology employed in the gold quartz mines. The base metal mines extract different combinations of metals including nickel, copper, silver, zinc, and gold. Thus, it is virtually impossible to identify the exact number of employees involved solely in the extraction of gold. Also, base metal mines are affected by

the pricing mechanisms of many resources. Thus, the impact of gold prices on base metal mines is not as critical as the impact on gold quartz mines. Therefore, to obtain a 'true' measure of the impact of pricing policy on the gold mining industry, the analysis will be isolated to the gold quartz sector.

Section 5.3 of this chapter will examine the changes in the composition of capital and labour over time. The purpose of this section is to identify the magnitude of the gold mining industry's trend towards capital intensification. The analysis is limited by the lack of consistent data reporting techniques pertaining to the annual levels of capital stock within the gold quartz industry. Consequently, two different methods were used to calculate the industry's Capital/Output and Capital/Labour ratios; the balance sheet method and the cumulative investment method. Because the calculation of capital stock differs according to the method used, they are comparable only to the extent that they suggest a certain trend. The magnitude of the ratios cannot be compared. Gaps in the disclosure of annual capital stock have further constrained the analysis to two specific time periods: The period from 1921 to 1933 is analyzed using the balance sheet method, and the period from 1972 to 1984 is analyzed using the cumulative investment method. Both methods report the value of capital in real terms as shown in appendices A-11, A-12, and A-13. The calculation of the ratios is shown in appendices A-14 and A-15. The methodology of the Balance

Sheet Method and the Cumulative Investment Method is discussed below.

The two methods are presented in the 1957 Royal Commission on Canada's Economic Prospects entitled "Output, Labour and Capital in the Canadian Economy," written by William C. Hood and Anthony Scott.

The Balance Sheet Method for calculating annual capital stock valuations involves adding the fixed asset amounts reported in the balance sheets of all firms in an industry to arrive at the aggregate capital stock for the industry. This technique was used in Canada from 1920 to 1943. The data was obtained from corporations responding to questionnaires.¹

The reliability of the data is questionable, as firms used varying methods of valuing their capital. It is reasonable that firms may value their assets according to, "original cost, market price or replacement cost; they may show figures net or gross of depreciation; they may include or exclude land; they may unexpectedly write up or down the value of fixed assets to include the goodwill of the enterprise on the occasion of a financial reorganization." ² As the number of firms following each reporting procedure was unknown, the aggregation of their fixed assets according to their balance sheets was far from being perfect. Despite the imperfection, Hood and Scott stated that, "... in the absence of other estimates, such census aggregates of balance sheet figures have been fairly widely used by economic analysts with results that have been

incapable of independent verification, but apparently acceptable to their users." 3

The Cumulative Method of valuing an industry's annual net capital stock involves knowing two key parameters:

- (1) annual investment expenditure figures, and
- (2) estimates of the service life of each asset used by the industry. 4

For the auriferous quartz industry, annual investment expenditures for the purchase of new capital assets, including construction and machinery purchases and excluding repairs and maintenance costs are obtained from the annual Canadian Minerals Yearbook produced by Energy, Mines and Resources Canada.

The average service life of capital assets within the gold quartz industry have been equated to the service life estimates prepared for the metal mines industry, as published in the annual Statistical Summary of the Mineral Industry in Canada, produced by the Statistics Section, Mineral Policy Sector of Energy, Mines and Resources Canada. The nominal and real value of gross new investment in the Canadian gold quartz industry from 1950 to 1984 is presented in appendix A-12.

The weighted average service life of construction and machinery assets within the metal mines industry from 1966 to 1984 equals approximately 22 years, with construction equipment averaging 25 years and machinery averaging 16 years. 5

The weighted average service life of construction and machinery assets within the metal mines industry from 1966 to 1984 is calculated by taking the ratio of total construction equipment expenditures to total machinery expenditures, over the 19 year period, and multiplying the ratio by their respective standard service lives. The data is obtained from table 67, table 68 and table 81, of the 1976, 1981 and 1986 editions of the Statistical Summary of the Mineral Industry, respectively.

Given the annual capital investment expenditure figures, which are converted into real values, as shown in appendix A-12, and given the average life expectancy of capital assets in the industry, calculated as 22 years, then one can begin the cumulative investment process. We begin with the real expenditure in year 1 and add to it the real capital expenditure of year 2, and in each subsequent year add the capital expenditure of that year. This process is continued for 22 successive years. In the 23rd year, the service life of capital assets purchased in year 1, will have completely expired and therefore, we deduct the real value of the investment made in year one. Thus, as we approach each additional year, we add to the cumulated total the real investment expenditure of the new year and subtract from it the real value of obsolete expenditures made 22 years prior. The cumulative real value of gross capital stock shown prior to the 22nd year is not a meaningful figure as the capital stock figure is undervalued.

To be useful, a capital stock figure, must be accumulated over the average service life of 22 years. 6

To arrive at the cumulative real value of net capital stock, we merely take the cumulative gross capital stock and subtract from it the year-to-date accumulated depreciation. 7 The calculation of the real value of net capital stock for the auriferous quartz industry from 1972 to 1984 is shown in appendix A-13.

Based on the work of Hood and Scott, the cumulative method can be expressed algebraically for one or more industries as follows:

Let I_n^j = investment expenditure in year n by industry j ;
 L = service life of asset;
 J = number of industries
 G_K^j = gross stock in j th industry in year K ;
 G_K = gross stock in year K ;
 N_K^j = net stock in j th industry in year K ;
 $j = 1, \dots, J$

Then G for industry j in year L is:

$$G_L^j = \sum_{n=1}^{n=L} I_n^j$$

The next year it becomes:

$$G_{L+1}^j = I_{L+1}^j - I_1^j + \sum_{n=1}^{n=L} I_n^j = \sum_{n=2}^{n=L+1} I_n^j$$

The year L is the first one for which G covers all existing goods. For all industries the gross stock required in year L is:

$$G_L = \sum_{j=1}^{j=J} G_L^j = \sum_{j=1}^{j=J} \sum_{n=1}^{n=L} I_n^j$$

If we write the value of the gross stock as:

$$G_K^j = \sum_{n=1}^{n=K} I_n^j \quad \text{where } K < L$$

then depreciation in the next year is:

$$\frac{1}{L} G_K^I = \frac{1}{L} \sum_{n=1}^{n=K} I$$

and net investment (ΔN) for year n is:

$$I_n^I - \frac{1}{L} G_{n-1}^I$$

Where $K=L$, the net stock will be the cumulation from 1 to L of the net investments of the preceding L years:

$$N_K^I = \sum_{n=1}^{n=K} \left(I_n^I - \frac{1}{L} G_{n-1}^I \right) \quad \text{where } G_0^I = 0$$

For each year after $K=L$, the expression shown above in brackets applies. There is no need to drop discards from the investments of L years earlier; that operation is already implicit in calculating the gross stock G . The calculation merely involves a continuous cumulation of net investment: 8

$$\left(I_{K+1}^I - \frac{1}{L} G_K^I \right)$$

5.2 Growth of Production and Employment

As indicated in the previous section, section 5.2 describes and quantifies the economic impact of the two gold pricing regimes on the growth of production and employment in the auriferous quartz industry of Canada, following the end of World War I. The production and employment levels in the gold quartz industry are compared to the aggregate mineral industry. The analysis includes a time frame from 1918 to 1985. The time frame is divided into three separate periods which correspond to the gold pricing mechanism prevalent at the time. The time periods are:

1. 1918 - 1933, fixed gold price of \$20.67 (U.S.) per fine ounce;
2. 1934 - 1970, fixed gold price of \$35.00 (U.S.) per fine ounce; and
3. 1971 - 1985, flexible gold price determined by market forces.

1918 - 1933:

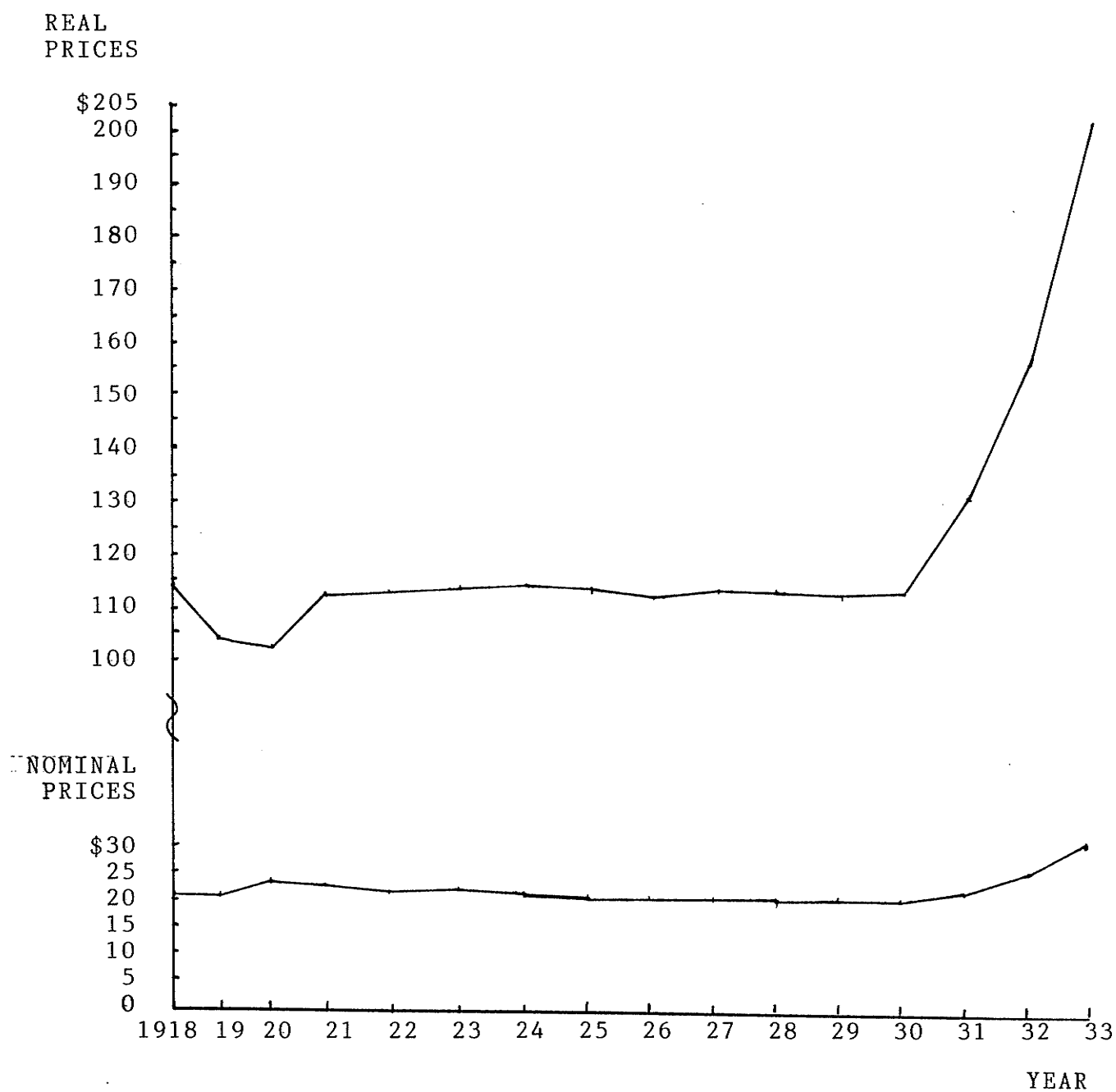
Production of gold from Canadian auriferous quartz mines increased dramatically during this period, despite the worldwide economic depression, which was reflected by the stock market crash of 1929. Production rose continually from 441,120 ounces in 1918 to 2,443,983 ounces in 1933, an increase of 454%. (Refer to appendix A-5). World production of gold excluding communist countries increased by 26% from 18,034,000 in 1918 to 22,700,000 in 1933.

In terms of the value of production, the nominal value of gold production increased from \$9,118,759 in 1918 to \$69,897,913 in 1933, an increase of 667%. In real terms, using the consumer price index as a measure of inflation with 1981 = 100.0, the value of quartz production rose from \$50,661,000 to \$485,403,000 from 1918 to 1933, a real increase of 858%. (The nominal and real price of gold, as well as the value of gold quartz production in nominal and real terms, is illustrated in graph 5.1 and graph 5.2 respectively. Also, refer to appendices A-5 and A-6).

In comparison to the increase in the value of production experienced by the gold quartz mining sector, the aggregate mining industry in Canada, over the same 16 year period, experienced only minimal gains. In 1918 the nominal value of production was \$211,301,000 and declined to \$171,923,000 in 1921. Peak production during this period occurred in 1929, when the mining industry produced \$310,850,000 of minerals in nominal terms. The effects of the subsequent economic depression resulted in the nominal value of mineral production dropping to \$221,743,000 by 1933. Thus, over the 16 year period, the nominal value of all Canadian mineral production increased by only 5%. In real terms, accounting for price inflation or deflation, the value of Canadian mining production increased by 31%. According to the consumer price index, aggregate consumer prices in 1933 were 20% lower in 1933 than they were in 1918. (Refer to appendix A-7 for the value of production in the mining industry of Canada).

GRAPH 5.1

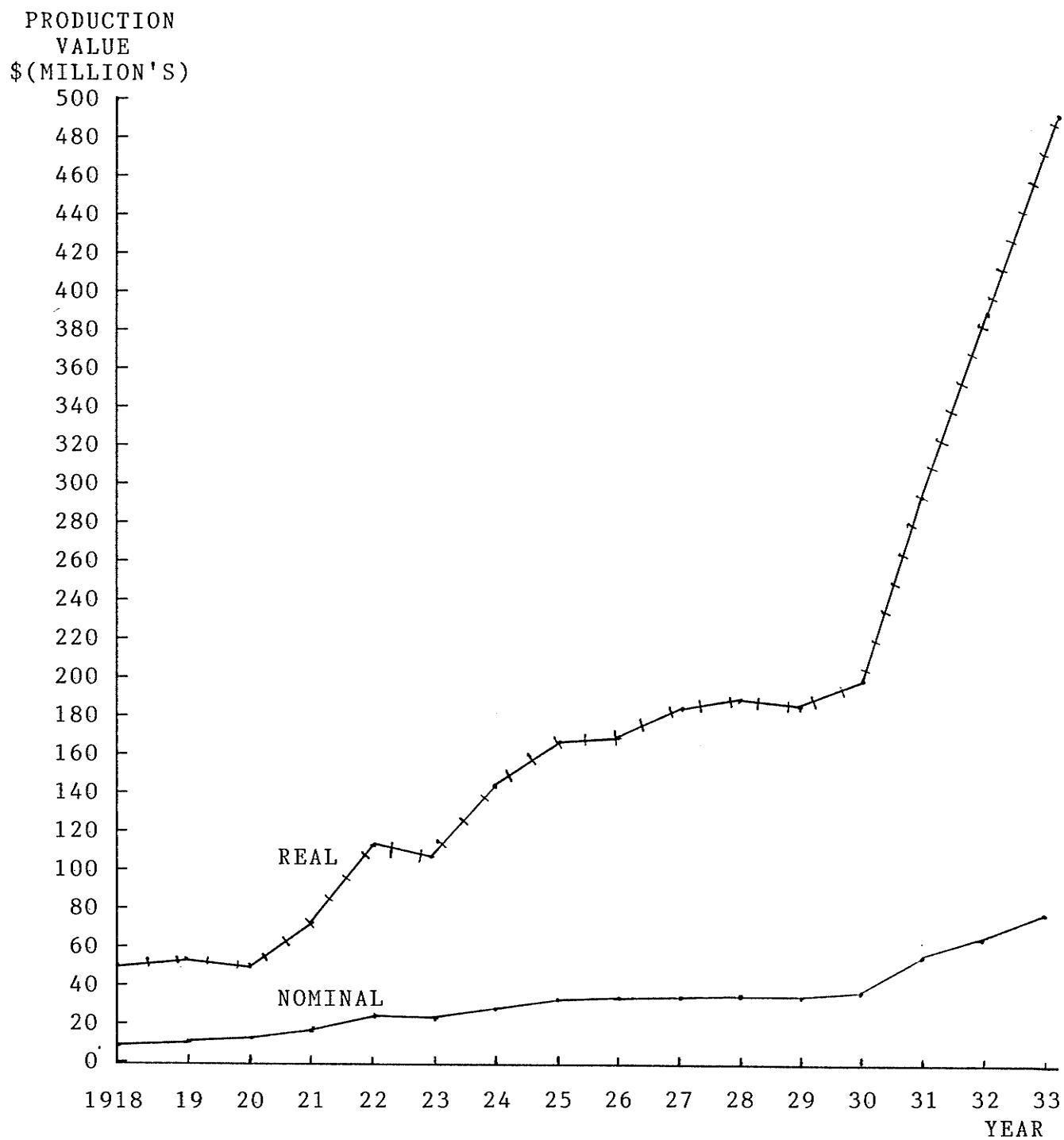
NOMINAL AND REAL PRICES OF GOLD: 1918 - 1933
(PER FINE OUNCE IN \$CANADIAN)



*Real prices were calculated using the Consumer Price Index using 1981 as the base year; (refer to appendix A-2).

GRAPH 5.2

NOMINAL AND REAL VALUE OF CANADIAN GOLD QUARTZ PRODUCTION: 1918-33



*Real values were calculated using the Consumer Price Index using 1981 as the base year; (refer to appendix A-6)

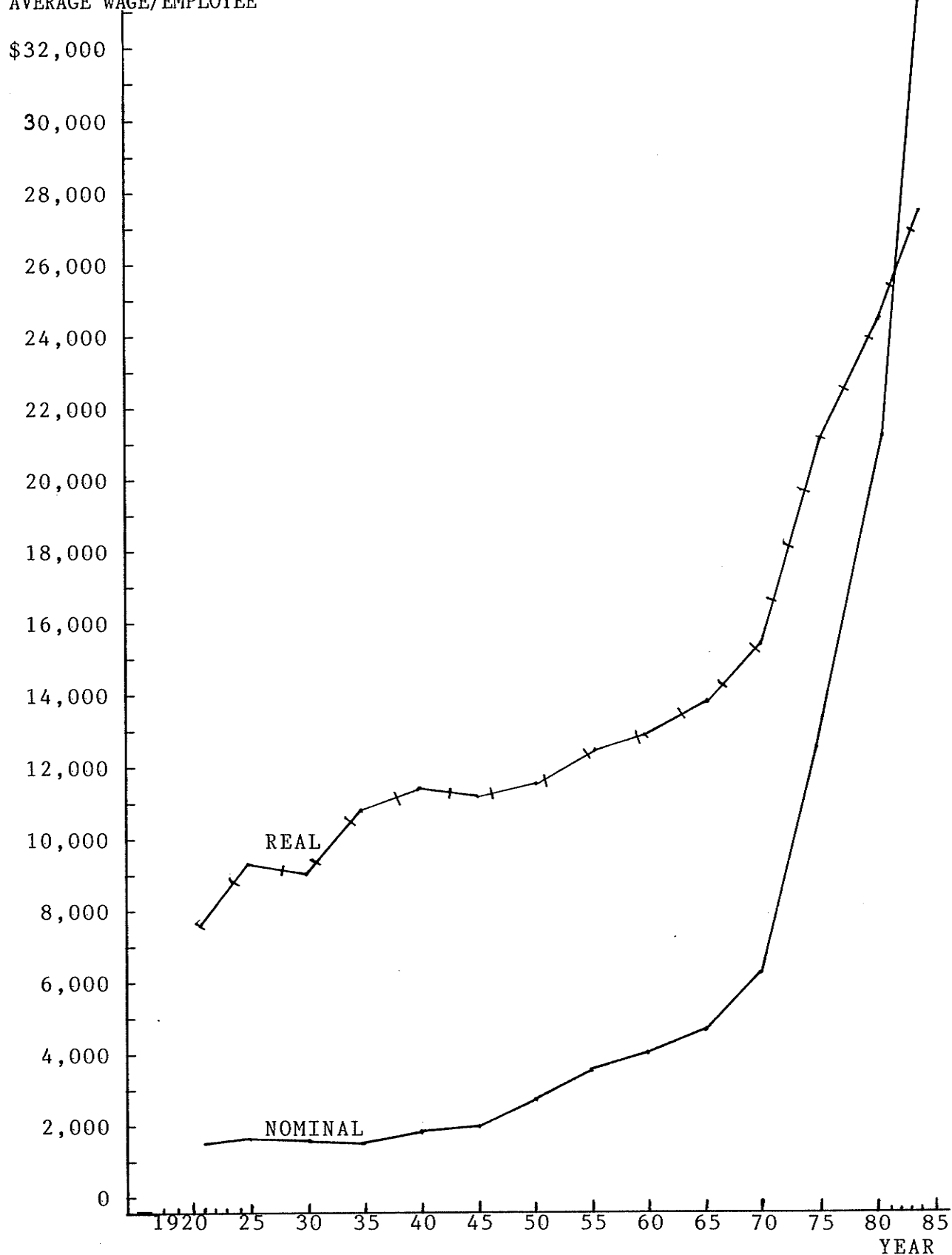
The nearly five-fold increase in gold quartz production created a positive employment situation in the industry. From 1918 to 1933, the total number of employees in the Canadian auriferous quartz sector increased from 2,779 in 1918 to 12,823 in 1933, an increase of 361%. Consequently, total salaries paid to all employees increased from \$6,070,000 in 1921 to \$20,536,000 in 1933, an increase of 238%. Over the 16 years, the average nominal wage per employee increased from \$1,561 to \$1,601 per annum. The effects of price deflation caused by the depression resulted in the average real wage of an employee increasing from \$7,727 to \$11,122 per annum, based on the consumer price index with 1981 as the base year. (The nominal and real wage per employee of the Canadian gold quartz industry is illustrated in graph 5.3. Also, refer to appendix A-8 for the employment data listed above).

The employment situation in the remainder of Canada's mining industry during this period, was less than positive, as net employment excluding the gold quartz sector decreased from 53,048 in 1918 to 50,511 in 1933. Average nominal and real wages in the aggregate mining industry lagged significantly behind the gold quartz sector. The average mining employee saw his nominal salary decrease from \$1,378 per annum in 1921 to \$980 per annum in 1933. In real terms, the average miner earned \$6,821 in 1921 and only \$6,805 in 1933, only 61% of the real wage earned by a gold quartz miner. (Appendix A-9 presents employment and wage statistics for Canada's mining industry including gold).

GRAPH 5.3

NOMINAL AND REAL WAGE PER EMPLOYEE OF THE CANADIAN GOLD QUARTZ
MINING INDUSTRY: 1921-1984

AVERAGE WAGE/EMPLOYEE



*Refer to Appendix A-8 for the statistical data.

In summary, the fixed price of gold of \$20.67 (U.S.) per fine ounce insulated the gold quartz industry from the negative impact of the world-wide economic depression. In real terms, the price of gold rose dramatically from \$114.83 (Cdn.) in 1918 to \$200.97 (Cdn.) in 1933, (as shown in appendix A-2). The 75% increase in the real price of Canadian gold encouraged the development of the gold quartz industry to the extent that physical production increased by 454%, the real value of gold quartz increased by 858%, employment increased by 361%, and the real value of a gold quartz miner's annual wage increased by 44%.

Overall, the period from 1918 to 1933 was extremely positive for the gold quartz industry. From 1931 to 1933, total gold production in Canada surpassed United States production, making Canada the second largest gold producer in the non-communist world, although a distant second to South Africa, who produced 49% of the world's gold in 1933. Canada produced 13% and the United States 11%. (Refer to appendix A-1 for statistics pertaining to the annual production of gold in the non-communist world).

1934 - 1970:

In January of 1934, the price fix of gold was increased from \$20.67 (U.S.) to \$35.00 (U.S.) per fine ounce. The short-term impact on the Canadian gold quartz industry was phenomenal. From 1934 to 1941, physical production increased from 2,487,823 fine ounces of gold to 4,644,911,

the highest annual production ever achieved by the industry. In 1940 and 1941, Canada had 146 producing gold mines. 9 However, 1941 would mark the end of the period of growth for the gold quartz industry, as the \$35.00 price fix would remain unchanged for the next 29 years. According to the consumer price index, (shown in appendix A-3), general prices in the economy would be 181% higher in 1970 compared to 1934. The impact of general price inflation on the fixed price of gold resulted in the enormous drop in its real price from \$236.71 (Cdn.) in 1934 to \$91.59 (Cdn.) in 1970, a real drop of 61%, as illustrated in graph 5.4 and appendix A-2.

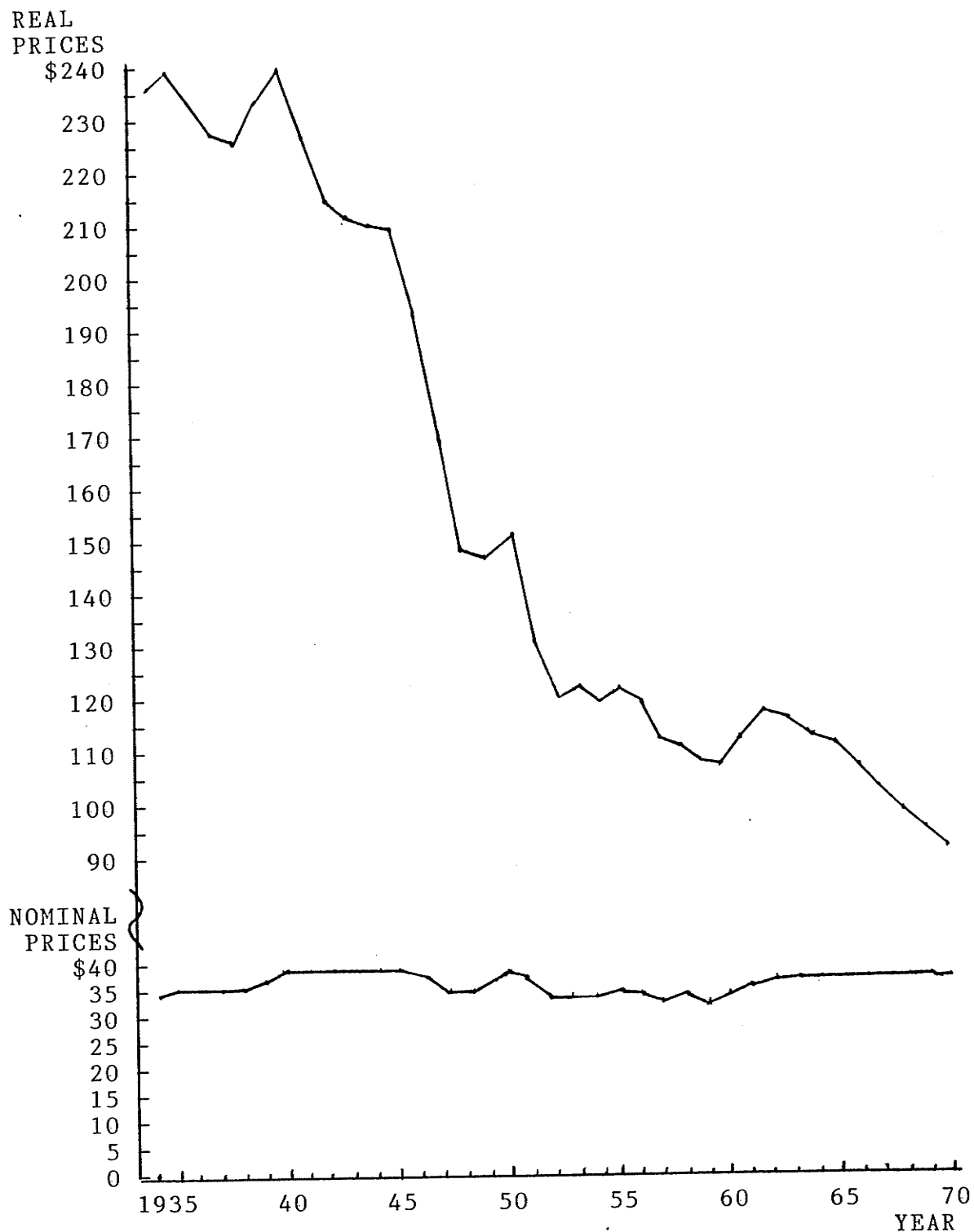
By 1941, the real value of Canadian gold quartz production had risen to \$1,051,935,000, an increase of \$464,058,000 or 79% over 1934's real production value of \$587,877,000. The short-term growth in production, caused by the new price fix for gold, had similar positive effects on employment and wages. During the 8 years from 1934 to 1941, employment in the gold quartz industry increased by 83%, from 17,762 to 32,551, the highest number of miners ever employed in the industry. Correspondingly, total nominal salaries increased from \$27,157,000 to \$62,151,000, an increase of 129%, and the average real annual wage per miner increased from \$10,472 to \$11,231, an increase of 7%.

The 8 year boom in the gold quartz industry was accompanied by a similar period of prosperity in the mining industry as a whole. From 1934 to 1941, the real value of aggregate mining production excluding gold increased by 70%

GRAPH 5.4

NOMINAL AND REAL PRICES OF GOLD: 1934 - 1970

(PER FINE OUNCE IN \$CANADIAN)



*Real prices were calculated using the Consumer Price Index using 1981 as the base year; (refer to appendix A-2).

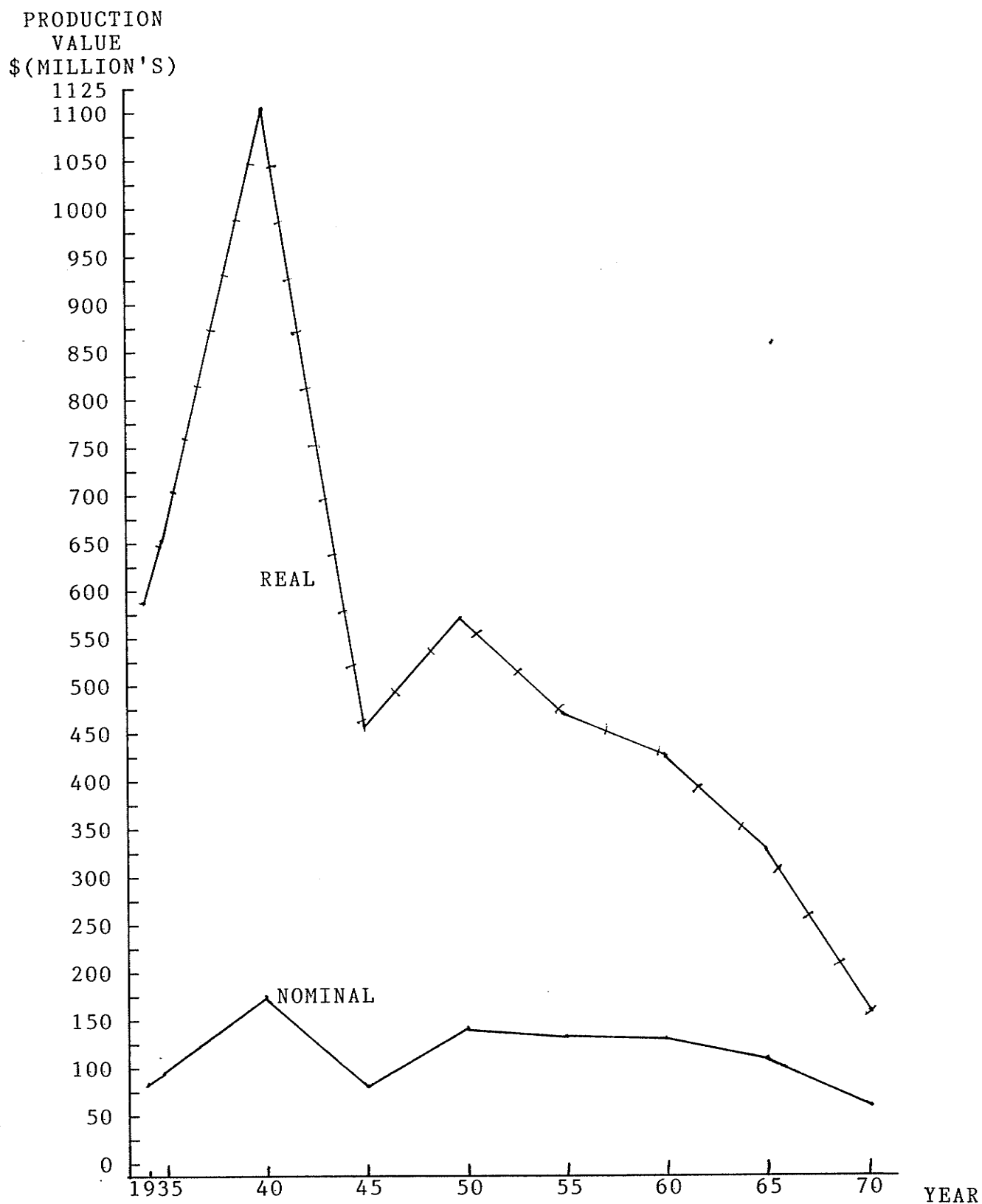
from \$1,318,431,000 to \$2,243,600,000. Employment increased by 45% from 55,743 to 80,676 and the average real annual wage per miner excluding gold increased by 21%, from \$7,491 to \$9,061. The increase in wage, although significant, still represented only 81% of the annual wage earned by gold quartz miners.

From 1942 to 1970, the gold quartz industry fell into a period of decline. Physical production in ounces dropped from 4,135,307 to 1,883,764, a decline of 54%. The real value of gold quartz production plunged from \$889,436,000 in 1942 to \$167,976,000 in 1970, a drop of 81%. Total employment plummeted from 26,030 to 7,175, a decrease of 72%, as illustrated in graph 5.5. Total real wages over the same period declined from \$303,849,000 to \$111,241,000, a negative change of 63%. The total number of operating mines dropped from 146 to 15, as only 10 percent of mines operating in 1941 survived the 37 year profit squeeze. The only gain achieved during the era of decline was enjoyed by the dwindling labour force, who realized an increased standard of living, as their average annual real wage increased from \$11,673 in 1942 to \$15,504 in 1970, a real increase of 33%, as shown in graph 5.3.

In contrast, the Canadian mining industry as a whole, excluding gold, revelled in a period of growth and prosperity from 1942 to 1970. The industry's real value of production increased from \$2,276,871,000 to \$12,315,916,000, an increase of 441%. Total employment increased from 86,013 to 102,919, representing a 20% improvement, while average

GRAPH 5.5

NOMINAL AND REAL VALUE OF CANADIAN GOLD QUARTZ PRODUCTION: 1934-70



*Refer to Appendix A-6 for the statistical data

annual real wages per miner increased by 140% from \$9,363 in 1942 to \$22,476 in 1970. Whereas the aggregate mining industry previously lagged behind gold mining in terms of real wages, by 1970 the average gold quartz miner was earning \$6,972 less per annum than other miners in Canada.

In summary, the fixed gold price of \$35.00 (U.S.) per fine ounce resulted in a short-term boom for the gold quartz industry, which continued until the end of 1941. From 1942 to 1970, the fixed nominal price of gold continuously squeezed the profitability of the industry, as real prices rose by 129% during that time. Although Canada maintained its rank as the second largest gold producer in the non-communist world during the entire period, from 1942 to 1970, its contribution dwindled from 14% of world production in 1947 to 6% in 1970. Significant gold discoveries in South Africa strengthened its first place ranking, as production increased from 11,200 ounces or 50% of world production in 1947 to 32,164 ounces or 79% of world production in 1970.

From 1942 to 1970, the physical production of Canadian gold quartz in ounces declined by 54%, the real value of production dropped by 81%, total employment dropped by 72%, total real wages decreased by 72%, and the average annual real wage per gold miner fell to only 69% of the average wage paid to other Canadian miners. In short, the gold quartz industry was devastated by the fixed price of gold which remained unchanged at \$35.00 (U.S.) for 37 years.

1971 - 1985:

Because the price of gold had been fixed at \$35. since 1934, while trade had expanded, gold accounted for scarcely one-third of international liquidity. The world was awash with dollars which the United States could not possibly redeem with gold while it remained pegged at \$35. an ounce. In August 1971, therefore, the United States declared that other nations could no longer redeem dollars for gold at the Federal Reserve Bank of New York. The gold-exchange standard was at an end, and the world was adrift in a sea of "floating" currencies not tied to any metal... . 10

This transitional event, which dramatically altered the pricing mechanism of gold by permitting the price to reflect international supply and demand considerations for the precious metal, revitalized an industry previously burdened by an ever-decreasing real value for its product. Since 1971, the gold quartz industry has entered into a period of recovery.

The price of gold responded positively to the open market by increasing from \$40.81 (U.S.) in 1971 to \$368.11 (U.S.) in 1986, in nominal terms. In nominal Canadian dollars, the impact was greater due to the favourable export exchange rate from Canada to the United States, (shown in appendix A-2). Thus, the nominal price of gold in Canada, over the same period, rose from \$41.21 to \$507.99, an increase of 1,133%. In real terms, accounting for price inflation, the price of gold in Canada rose from \$97.65 in 1971 to \$805.50 in 1980, and settled at \$383.68 during 1986. The extraordinary price recovery initiated a new sense of confidence within the

industry and its investors, and rescued an industry which had come face-to-face with impending termination. The nominal and real price of gold during this period is shown in graph 5.6.

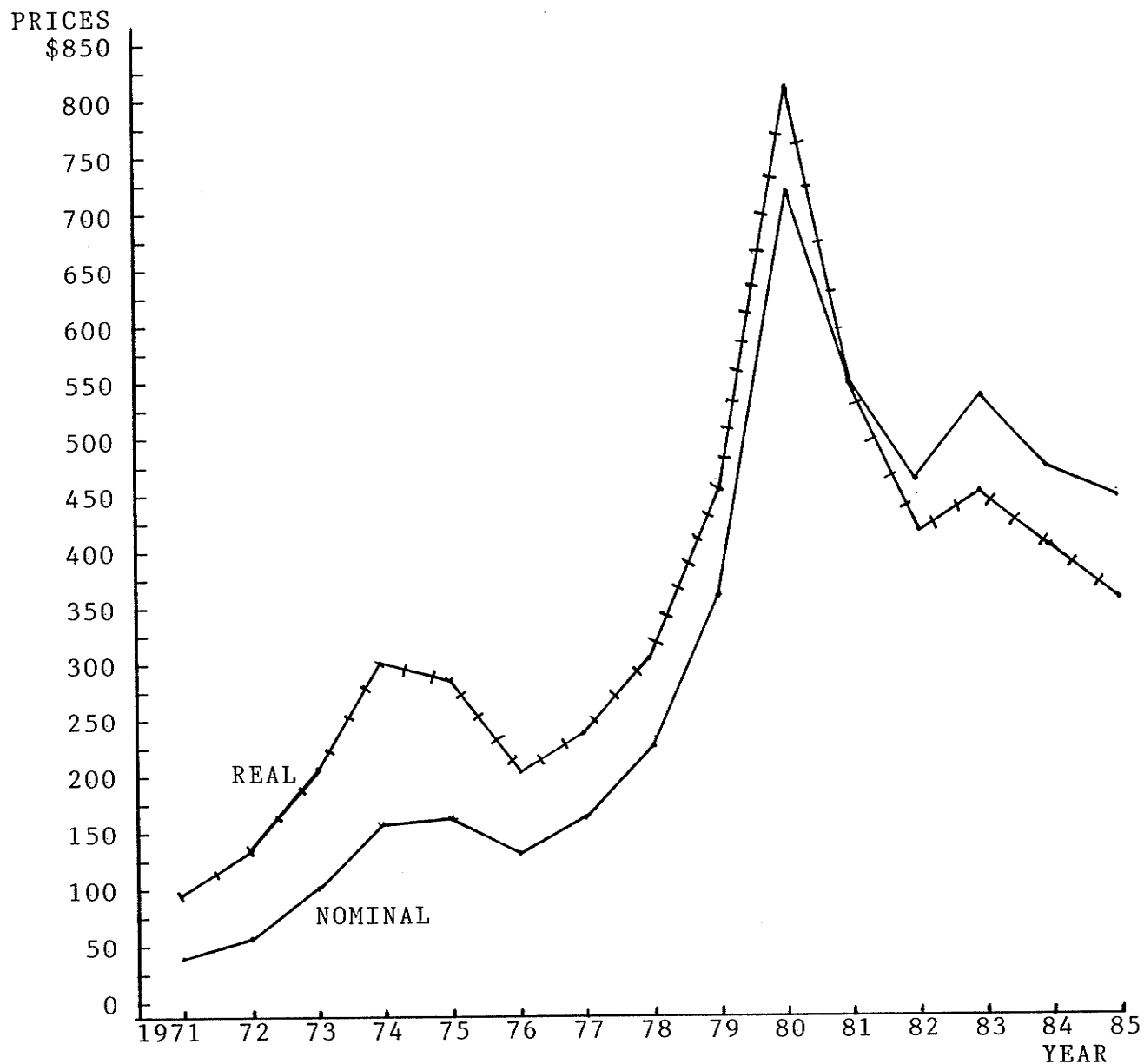
The physical production of gold quartz, in ounces, increased from 1,797,670 in 1971 to 2,162,095 in 1985, a healthy increase of 20%. All other gold producing regions in the non-communist world experienced increased production levels, with the exception of South Africa, who's production declined from 976.3 tonnes in 1971 to 673.3 tonnes in 1985 (refer to appendix A-1). Canada's rank among the leading gold producing regions slipped from second to fourth due to major gold discoveries in the regions of Latin America and Oceania. Canada's contribution to world production increased from 6% in 1971 to 7% in 1985, whereas South Africa's contribution declined from 79% to 56% over the same period of time.

The real value of Canadian auriferous quartz production increased from \$150,562,000 to \$736,323,000 during the recovery period, an increase of 389%, due largely to the market-generated price of gold, as shown in graph 5.7. In terms of employment, the gold quartz sector hired an additional 2,305 miners by 1984, an increase of 38% over 1971. Total real salaries and wages grew from \$97,100,000 in 1971 to \$232,045,000 in 1984, an expansion of 139%. Average annual real wages of gold quartz employees increased from \$15,801 to \$27,461 per employee over the same period, an increase of 74%, as presented in graph 5.3.

GRAPH 5.6

NOMINAL AND REAL PRICES OF GOLD: 1971 - 1985

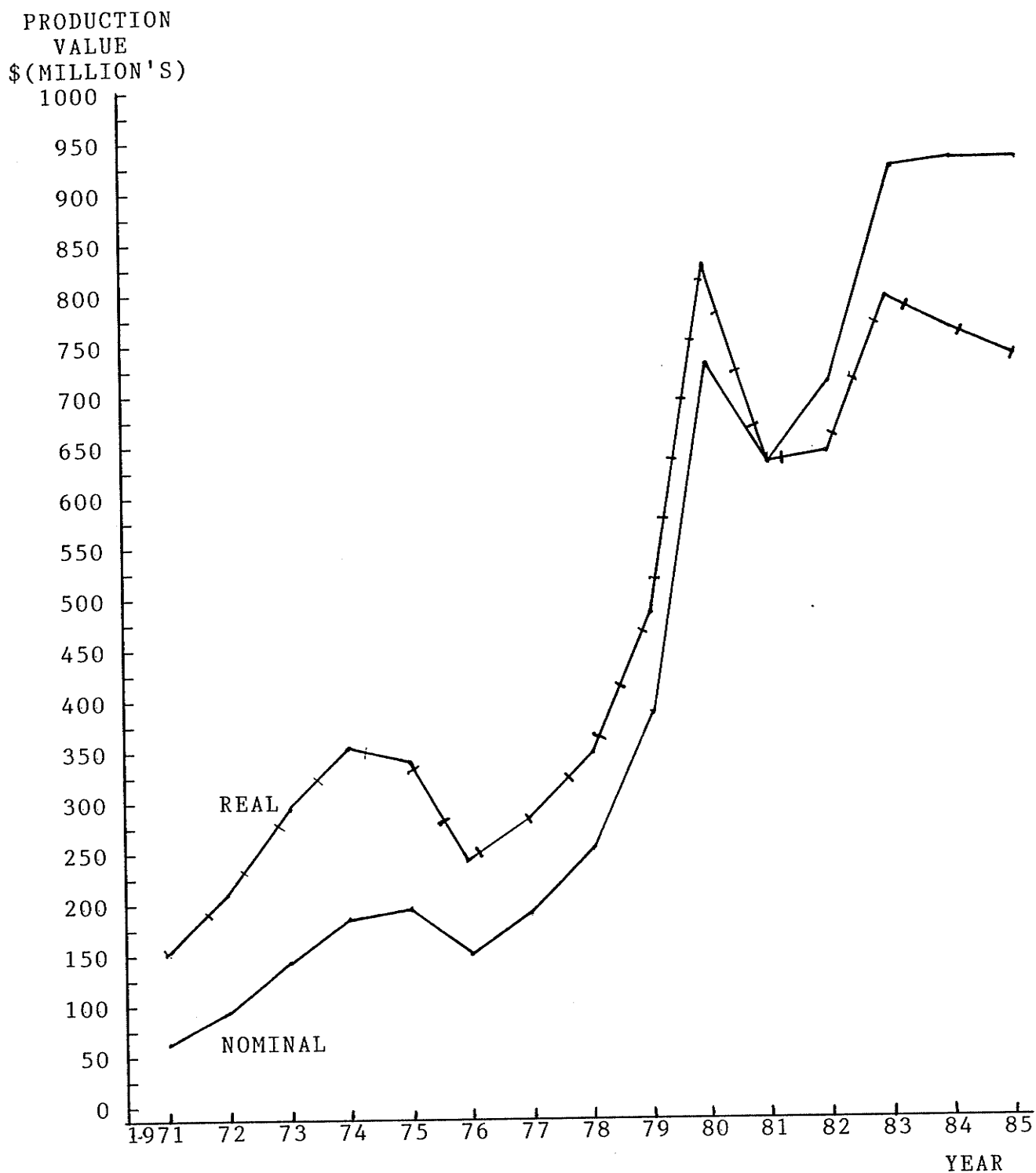
(PER FINE OUNCE IN \$CANADIAN)



*Real prices were calculated using the Consumer Price Index using 1981 as the base year; (refer to appendix A-2).

GRAPH 5.7

NOMINAL AND REAL VALUE OF CANADIAN GOLD QUARTZ PRODUCTION: 1971-85



*Refer to Appendix A-6 for the statistical data.

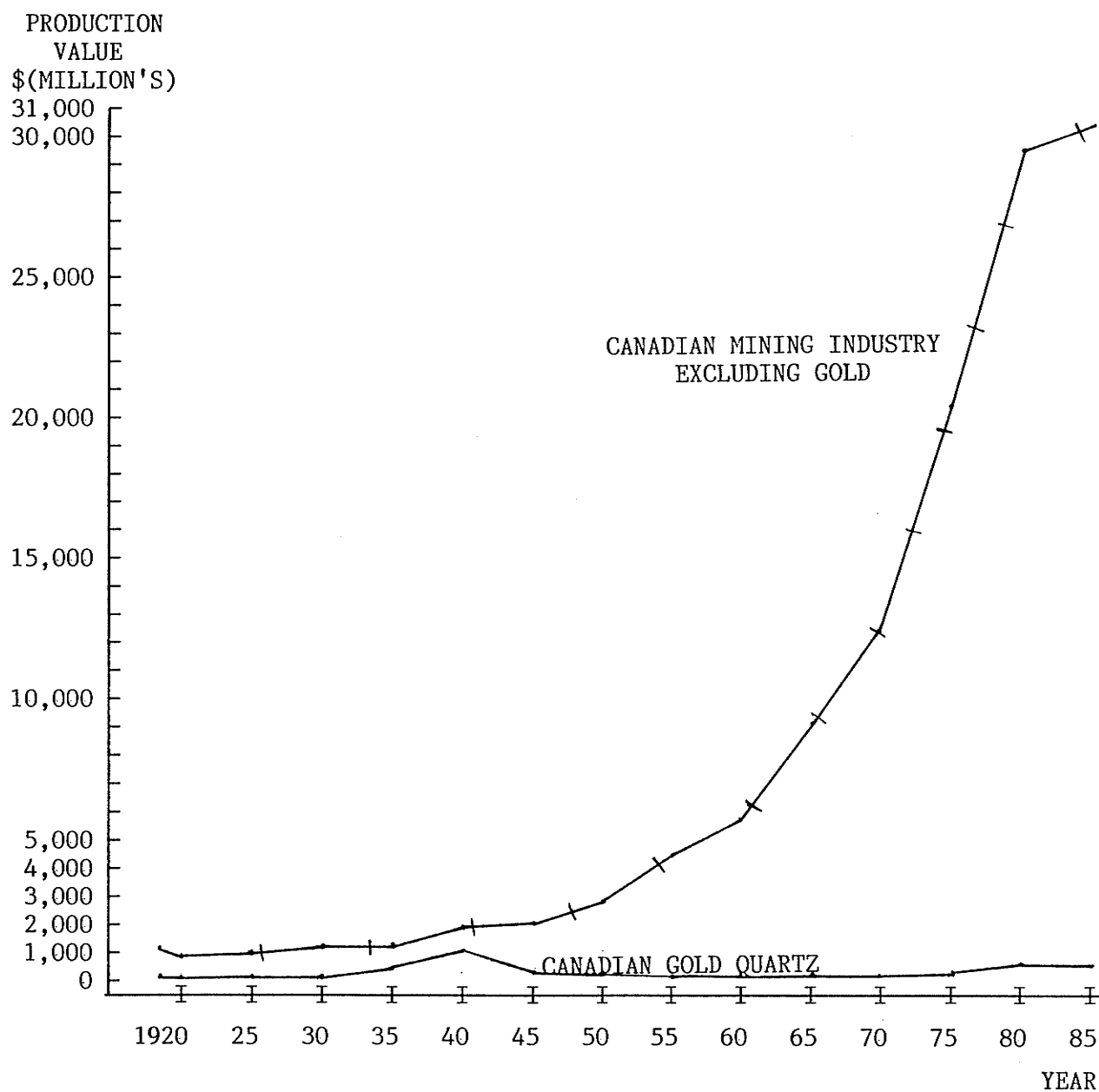
In comparison, the aggregate mining industry of Canada excluding gold, experienced an increase in the real value of its production from \$12,167,383,000 to \$30,315,205,000, an increase of 149%. Employment in the mining industry increased by 5% from 104,265 to 109,976 during the period. Total real wages in the mining industry increased by 38% from \$2,309,680,000 to \$3,192,313,000. In regards to average annual real wages per employee, an increase of 31% to \$29,027 in 1984 was experienced compared to the 1971 real wage rate of \$22,152. Thus, the average gold quartz employee's real wage was 95% of that paid to other Canadian miners by 1984.

In summary, the gold quartz industry outpaced the aggregate mining industry during the 14 years from 1971 to 1984. The increase in the real value of production, the growth of employment, and the increase in average real wages per employee were greater in the gold quartz industry than in the mining industry as a whole. The growth and development of the gold quartz industry was clearly a direct result of the change in pricing mechanisms for gold from a fixed to a flexible pricing system. Graph 5.8 compares the real value of Canadian gold quartz production to the real value of the Canadian mining industry production, excluding gold, from 1918 to 1985.

GRAPH 5.8

REAL VALUE OF CANADIAN GOLD QUARTZ PRODUCTION COMPARED TO THE REAL VALUE OF PRODUCTION IN THE CANADIAN MINING INDUSTRY EXCLUDING ALL GOLD PRODUCTION.

(1918-1985)



*Refer to Appendices A-3, A-4, A-6, and A-7 for the statistical data.

5.3 Capital Intensification

As discussed in section 1 of this chapter, two different methods were used to measure the extent of capital intensification in the auriferous quartz industry in Canada. Due to gaps in the consistency of reporting capital stock, the time periods, which were analyzed were: 1921 to 1933, using the balance sheet method, and 1972 to 1984, using the cumulative method. As two different methods were used, comparison of the two time periods is useful only to the extent that they suggest trends in capital growth.

Using the balance sheet method, (shown in appendix A-11), the real value of net capital stock in the gold quartz industry increased from \$186.93 million in 1921 to \$876.25 million in 1933, constituting an increase of 369% over 13 years. By taking the ratio of the real value of net capital stock to the physical output in troy ounces, and net capital stock to the number of employees, annual capital/output ratios and capital/labour ratios can be calculated, (as shown in appendix A-14).

The calculated capital/output ratio for the period from 1921 to 1933 reveals an increasing trend towards capital intensification. The ratio for 1921 indicates that a capital expenditure of \$263 was required to produce one ounce of gold. By 1933, \$359 was required to produce one ounce of gold, an increase of 37%.

Similarly, the capital/labour ratio over the 13 year period supports the same conclusion. In 1921, \$48,066 was spent on capital assets for each employee hired. In 1933, the ratio increased by 42% as \$68,334 of capital assets were purchased for each employee hired. In addition, when capital/output ratios and labour/output ratios are graphed together, as shown on graph 5.9, it is apparent that the relationship of the real cost of labour to output varies little from year to year, while the real cost of capital to output varies more from year to year with an increasing trend over the period. In summary, the ratios presented suggest an increasing trend towards capital intensification, in real terms, during the period from 1921 to 1933.

Using the cumulative method, (shown in appendices A-12 and A-13), the real value of net capital stock in the Canadian auriferous quartz industry increased from \$328.01 million in 1972 to \$1.807 billion in 1984. The difference represents an increase of \$1.479 billion or 550% over the 13 year period. By following the same process of calculating capital/output ratios and capital/labour ratios, which was used for the period from 1921 to 1933, using the balance sheet approach, a similar set of annual ratios can be calculated for the period from 1972 to 1984, using the cumulative method, (as shown in appendix A-15).

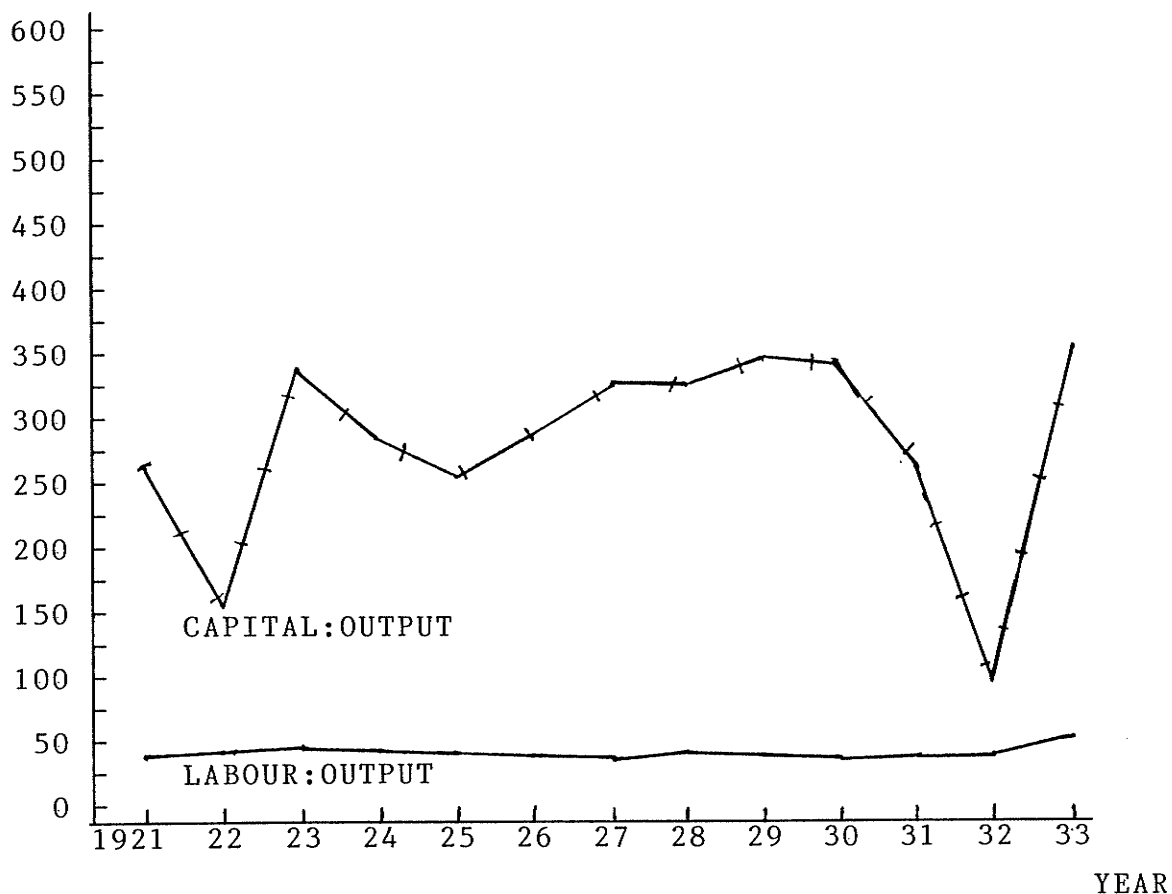
The calculated capital/output ratios, using the cumulative method show an increasing trend from 205:1 in 1972 to 899:1 in 1984. The magnitude of the ratio increased by 339% over the

GRAPH 5.9

CAPITAL: OUTPUT AND LABOUR: OUTPUT RATIOS (1921-1933)

FOR THE GOLD QUARTZ INDUSTRY IN CANADA

RATIOS
(\$: OUNCES)



*Capital Output ratios equal the real value of net capital stock (using the balance sheet method) divided by the annual physical output.

*Labour Output ratios equal the total real annual wages divided by the annual physical output.

*Refer to Appendices A-8 and A-14 for the statistical data.

period, suggesting a dramatic movement towards extracting gold using more capital intensive techniques.

An analysis of the capital/labour ratios over this time period reveals that \$58,836 of capital was purchased for every employee that was hired in 1972. By 1984, this relationship increased to \$213,903 of capital purchased for every employee hired, an increase of 264%. In addition to the above ratios, when capital/output ratios and labour/output ratios are graphed together, as shown on graph 5.10, it is apparent that the gold quartz industry has continuously invested more money in capital intensive production compared to labour intensive means, over the period.

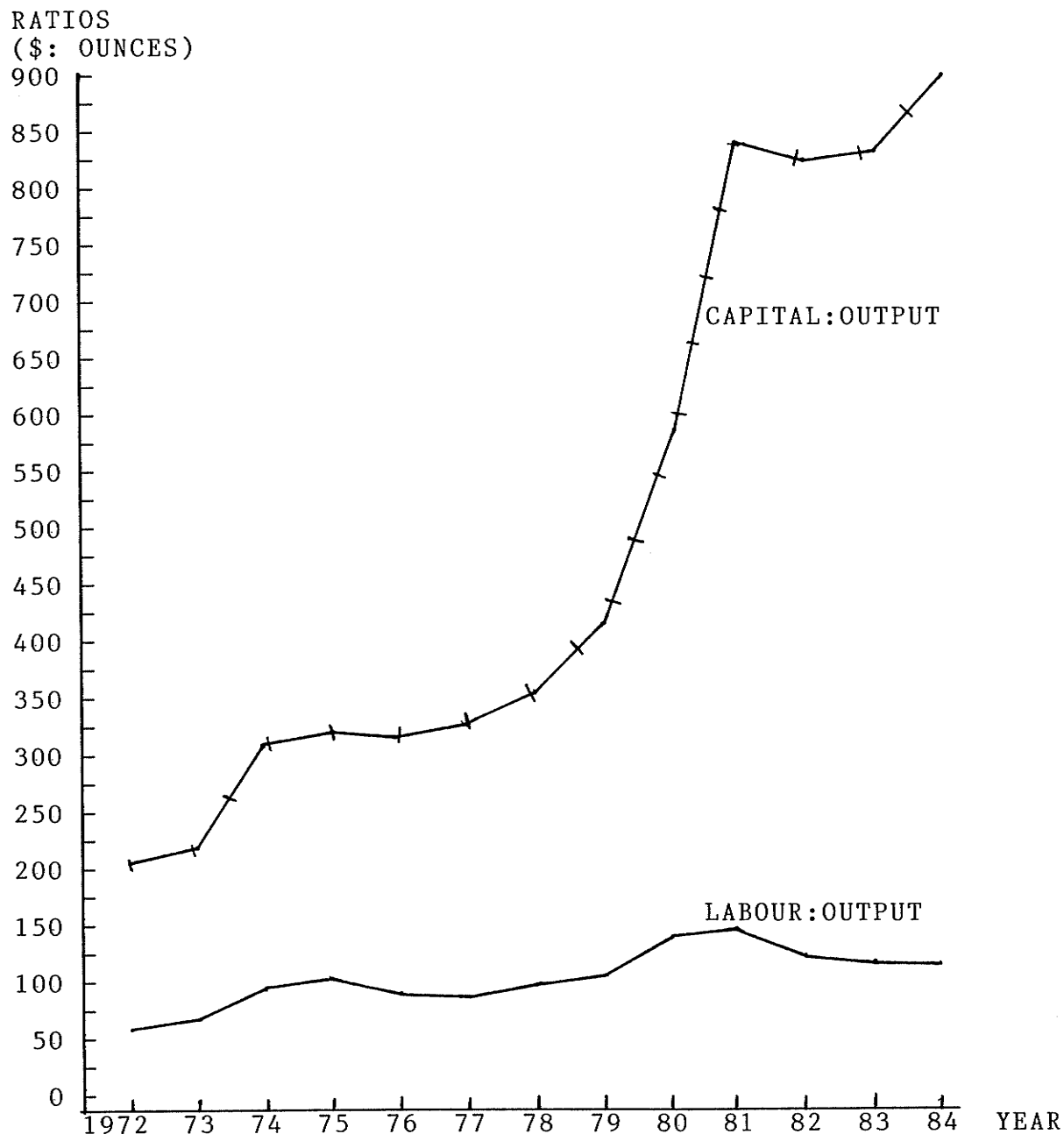
It is clear that the trend towards capital intensification during the period from 1972 to 1984 was more acute than the trend established for the period from 1921 to 1933. Thus, under two distinct periods of growth for the industry, one under a fixed price regime, and one under a flexible price regime, the industry followed the path of increasing its capital intensity with the objective of increasing its profitability.

From the above analysis, one could extrapolate that during a period of decline, such as that experienced from 1942 to 1970, the gold quartz industry would likely have continuously reduced its capital expenditures as profitability declined, or as losses accumulated. Thus, the gold quartz industry would likely adhere to a capital expenditure policy specified as follows: As profits or the potential for profits increase, then

GRAPH 5.10

CAPITAL: OUTPUT AND LABOUR: OUTPUT RATIOS (1972-1984)

FOR THE GOLD QUARTZ INDUSTRY IN CANADA



*Capital Output ratios equal the real value of net capital stock (using the Cumulative method) divided by the annual physical output.

*Labour Output ratios equal the total real annual wages divided by the annual physical output.

*Refer to Appendices A-8 and A-15.

capital expenditures will also increase, or conversely, as profits or the potential for profits decline, then capital expenditures should also decline.

5.4 Summary

Chapter V presented the methodology and analysis of the growth of production, employment, and capital within the Canadian auriferous quartz industry during the period from 1918 to 1985. The analysis investigated three distinct time periods based on the gold pricing mechanism prevalent at the time. The following table summarizes the industry's growth and development during the three periods, using eight different growth indicators. The indicators are expressed in terms of the aggregate percentage increase over the period, and in terms of the compound annual growth rate for each time period.

Based on the growth indicators presented in table 5.1, the period of time showing the greatest degree of growth and development is the period from 1918 to 1933. During that period, the price of gold was fixed at \$20.67 (U.S.) per ounce. However, that period experienced price deflation, primarily due to the world-wide depression which began in 1930. The effect of the price deflation was an increase to the real price of gold by 75%, which converts into a compound growth rate of 3.5%. The increase was very significant to an industry whose stability was assured by a fixed price. Consequently, enormous increases in physical production, in the real value of production, in employment, and in total real wages were realized.

TABLE 5.1
Canadian Auriferous Quartz Industry - Growth and
Development

<u>Growth Indicators:</u>	(1918-33)	(1934-70)	(1971-85)
A) % Increase-Real Price of Gold(Cdn.)	+ 75%	- 61%	+293%
Compound Annual Growth Rate	+3.5%	-2.5%	+8.75%
B) % Increase-Physical Production(oz)	+454%	- 24%	+ 20%
Compound Annual Growth Rate	+11.3%	-0.75%	+1.25%
C) % Increase-Real Value of Production	+858%	- 71%	+389%
Compound Annual Growth Rate	+15.2%	-3.5%	+11.2%
D) % Increase-Employment	+361%	- 60%	+ 38%
Compound Annual Growth Rate	+ 10%	-2.5%	+2.0%
E) % Increase-Total Real Wages	+375%	- 40%	+139%
Compound Annual Growth Rate	+12.7%	-1.375%	+6.25%
F) % Increase-Ave.Real Wage/Employee	+ 44%	+ 48%	+74%
Compound Annual Growth Rate	+2.75%	+1.0%	+3.75%
G) % Increase-Capital/Output Ratio	+ 37%	N/A	+339%
Compound Annual Growth Rate	+ 2.5%		+12.0%
H) % Increase-Capital/Labour Ratio	+ 42%	N/A	+264%
Compound Annual Growth Rate	+2.75%		+10.25%

In comparison, the period of recovery from 1971 to 1985, experienced a compound annual growth rate for the real price of gold of 8.75%, although the stability of the industry was no longer guaranteed, as the price of gold was free to determine its level based on international supply and demand.

Consequently, the enormous real increase in the price of gold, which was highly volatile and susceptible to large price swings, had less of a positive impact on the growth of the industry, when compared to the impact of the real price increase incurred during the period from 1918 to 1933. Thus, the growth indicators for physical production, real value of production, employment, and total real wages were greater during the period of 1918 to 1933 than the period of 1971 to 1985. Although the volatile price swings associated with the free-market gold price may have contributed to lower growth rates of production and employment, other factors such as capital-labour substitution and declining reserves may have been responsible also.

The period of decline for the gold quartz industry is clearly shown in table 5.1 as the interval from 1934 to 1970. The large decline in real prices over the 37 years crippled every aspect of the industry's growth and development, although the average real wage of the remaining employees achieved a notable gain. It should however be noted, that more significant gains in real average wages were achieved during the more prosperous periods of 1918 to 1933 and 1971 to 1985.

The prosperous periods, as previously mentioned, encouraged the increasing utilization of capital to foster the exploration and development of new properties, to research and develop new mining technologies, to upgrade facilities and equipment capable of extracting lower grade ores, and to

reduce average unit costs or variable costs for the purpose of increasing the profitability of the mining operations.

5.5 Footnotes- Chapter V

1. Canada, Royal Commission on Canada's Economic Prospects, Output, Labour and Capital in the Canadian Economy, by William C. Hood and Anthony Scott (Ottawa: February 1957), pp. 231-232.

2. Ibid., p. 232.

3. Ibid., p. 232.

4. Ibid., p. 234.

5. Ibid., p. 473.

6. Ibid., pp. 234-235.

7. Ibid., p. 236.

8. Ibid., pp. 235-236.

9. The Northern Miner, Gold Mining in Canada, A Feature Report (Toronto: Northern Miner Press Limited, 1977), p. 1.

10. Green, p. xxii.

CHAPTER VI

Stability of the Canadian Gold Mining Industry

6.1 Introduction and Methodology

The purpose of this chapter is to examine the impact of gold pricing policy on the stability of production and employment within Canada's gold quartz industry, and to compare the results with the stability of production and employment experienced by Canada's aggregate mining industry. The time frame of the analysis, from 1918 to 1984, is divided into the same three periods presented in chapter five, which correspond to the gold pricing mechanism in place at the time. The three time periods are: 1918 to 1933, 1934 to 1970, and 1971 to 1984.

The stability of the growth of production, including the real value of production and the physical quantity produced, along with the stability of the growth of employment will be statistically analyzed using simple linear regression analysis. The linear regressions for production and employment will be specified in terms of production or employment as a linear function of time. Thus, the production or employment values constitute the set of dependent variables and time represents the set of independent variables. The coefficient of determination (r^2) will represent the statistical measure of growth stability. Taking the case of production stability, stability is measured in terms of the ability of production forecasts to equal actually observed production levels. The

difference between the actual production figures and the forecast production amounts is represented by the r^2 value. The higher the r^2 value, which lies between 0 and 1, the lower the dispersion or error between the actual and predicted amounts, and the greater the stability of the growth of production for the industry.

As stated in chapter I, this study focusses on growth stability because of the examination of variation around a time trend. In other studies, stability is generally measured by examining the total variation or variance of production and/or employment over time. In this study growth stability was measured in terms of the linear relationship between the dependent and independent variables. Stability can also be analyzed by establishing a logarithmic functional relationship between the dependent and independent variables.

Regression analysis of the stability of employment, as it pertains to the real value of total salaries and wages within the gold quartz industry and total mining industry, are derived using the same format explained above for production. The annual gold production statistics in fine ounces are printed in appendix A-5. The real value of annual gold production and total mining production is presented in appendices A-6 and A-7 respectively. The annual real values of total employee salaries and wages, for the gold quartz and aggregate mining industries, are shown in appendices A-8 and A-9 respectively. The regression results showing the r^2 values for both

industries, for each of the three time periods, are presented in appendix A-16.

6.2 Stability Analysis of Production and Employment

1918 - 1933:

In terms of physical production, the auriferous quartz industry's annual production rose steadily from 441,120 ounces in 1918 to 2,443,983 ounces in 1933. Only on two occasions, did annual production decline from the previous year's output. In 1923, production was 36,662 ounces lower than the 1922 level of 1,017,961, and in 1933 production was 79,713 ounces lower than the 1932 level of 2,523,696 ounces. Given the almost uninterrupted increase in annual physical production, one would assume that stability of growth was present in the industry. By analyzing the annual levels of physical production as a function of time, over the 16 year period, using ordinary least squares, one arrives at an r^2 value of .9662. This result means that nearly 97% of the actually observed production amounts were predictable using ordinary least squares. Consequently, the auriferous quartz industry displayed a very high level of growth stability of physical production from 1918 to 1933.

The real value of annual gold quartz production as a function of time, also revealed a high level of stability based on an r^2 value of .8172. However, the situation for Canada's aggregate mineral industry was quite different. The real value

of annual mineral production excluding gold displayed enormous volatility based on its r^2 value of .1975.

Turning to employment stability, the regression analysis, which measured the annual real value of total salaries and wages as a function of time, produced the following results. The gold quartz industry displayed very stable growth according to the high r^2 value of .9149. The total mineral industry, on the other hand, showed nearly a complete absence of stability as it recorded an r^2 value of only .0011.

In summary, the internationally regulated pricing mechanism for gold, which fixed the price of gold at \$20.67 (U.S.) per fine ounce during the entire period of 1918 to 1933, induced a high degree of growth stability of production and employment within the gold quartz industry. The price fix was sufficiently high to warrant expansion of production and employment, and enabled the industry to pay its employees an annual wage that was 45% higher than the average wage paid to all other Canadian miners. The stability of the aggregate mining industry was greatly impaired by the economic depression of the 1930's. In contrast, the stability of the Canadian gold quartz industry was fully insulated as the price of the commodity was not subject to the depressed demand conditions prevalent in all open-market resource industries.

1934 - 1970:

The 37 year period from 1934 to 1970 was similar to the previous 16 year period, to the extent that the price of gold

remained fixed according to international monetary policy. However, in 1934, the gold fix was dramatically increased from \$20.67 to \$35.00 (U.S.) an ounce. The price increase was implemented by President Roosevelt as a measure aimed at lifting the United States out of the depression. The new price was a major impetus to the gold quartz industry of Canada, at least until the end of 1941. By 1942, the industry's profitability began to decline as the cost of production continued to increase. Also, given the nature of the industry, which was an industry involved in extracting a non-renewable resource, it was inevitable that the quality of ore deposits would continually decline. Consequently, as the assay quality declined, more ore would have to be extracted in order for the companies to prevent declining revenues. Thus, the 37 year period, which began on a very positive note, became a period of prolonged crisis as the profitability of the industry was steadily eroded by the ever-increasing cost of production and the ever-decreasing real value of gold, (as shown in appendix A-2).

The stability analysis of the gold quartz industry during this period reveals that physical production was highly volatile, evident by a very low r^2 value of .0638. The stability of the real value of production was higher with the r^2 value at .6755. However, the stability of Canada's total mining industry, in terms of the real value of production, was significantly higher than the gold quartz industry given its r^2 value of .8754.

In summary, the fixed nominal price of gold, over a 37 year period in which the cost of production was constantly rising and the quality of deposits was declining, brought the industry to its knees. As previously stated, the prolonged climate of instability reduced the industry from 146 operating mines in 1941 to only 15 by 1970. In comparison to the 1918 to 1933 period, when the price was fixed at a level which promoted growth during a deflationary period, the price established for the 1934 to 1970 period was set too low to promote or sustain growth during an inflationary period.

1971 - 1985:

The process of the demonetization of gold was completed on August 15, 1971, when the United States suspended the convertibility of the dollar for gold. Henceforth, the dollar would be compared to all other foreign currencies for the purpose of foreign exchange and international trade. Thus, the price of gold, was no longer regulated, but was subject to the open market pressures of supply and demand, like all other commodities.

The transition from a fixed to a flexible pricing mechanism was well received by the industry, and with the growing strength of industrial-use demand, the price of gold escalated to a high of \$850 (U.S.) by 1980. The volatility of the growth of the real price of gold during the recovery period was substantial as the stability analysis produced an r^2 value of only .3620.

Given the price volatility, gold quartz producers were forced to juggle their production sites. During periods of low gold prices, producers would be forced to extract reserves of known higher quality and during periods of higher prices, producers could return to the extraction of lower grade deposits. This process would essentially serve to stabilize revenues, and it is supported by the regression analysis results. The stability of the growth of physical output in ounces was only .1097 (r^2), while the stability of the value of production growth was much higher with an r^2 value of .8050. In comparison, the aggregate mining industry achieved slightly greater growth stability based on its r^2 value of .8314.

The growth stability of the real value of total salaries and wages was low for both industries. The r^2 value for the gold quartz industry was .4018, and for the aggregate mining industry it was .2219. The lack of stability of employment growth in the gold quartz industry is attributable to the increase in real wages, which rose by 74% since 1971, and it is due to the enormous move towards capital intensification. From 1970 to 1984, the annual real value of gross new capital expenditures rose from \$33.17 million to \$410.14 million, an increase of 1,367%, (as shown in appendix A-12).

In summary, the new mechanism for determining the price of gold, which is based on the rules of the open market, has revitalized the gold quartz industry by returning stability to the industry's production. The stability of the industry's real value of total annual salaries and wages has not been achieved

as at 1984. It is largely due to an industry which is increasing its emphasis on the extraction of gold using high technology and capital-intensive modes of production.

6.3 Summary

Chapter VI presented the methodology and analysis of the growth stability of production and employment within the Canadian auriferous quartz industry during the period from 1918 to 1985. The analysis provided growth stability information for each of the three distinct time intervals, which corresponded to the price mechanism in effect at the time. The regression results of the stability analysis are summarized in appendix A-16.

Based on the regression analysis, the most stable period of time for the gold quartz industry, both in terms of production growth and employment growth, was during the 1918 to 1933 period. The second most stable period of time for the industry was from 1971 to 1984, and the period of least growth stability was the period from 1934 to 1970. The regression results suggest the following:

- 1) An industry operating under the condition of a regulated price can achieve as much or more stability than an industry operating under a market-determined price, provided that the real price is not declining and provided that the nominal price is set sufficiently high to promote growth; and
- 2) An industry operating under a fixed price regime should reevaluate its price frequently to ensure that the real value of

the commodity is not declining. If the real price is permitted to decline, the stability of the industry's growth will be threatened.

CHAPTER VII

Conclusions

7.1 Summary of Growth and Stability Analysis

From 1918 to 1985, the auriferous quartz industry of Canada has experienced three diverse periods, as a direct consequence of the changes in the pricing mechanism for gold. The period from 1918 to 1933 witnessed a fixed price of gold, set at \$20.67 (U.S.) per fine ounce. The period from 1934 to 1970 revealed a single price for gold set at \$35.00 (U.S.) per fine ounce. However, commencing in 1971, the price of gold was quoted twice daily, as the gold bullion markets of the world established morning and afternoon price fixings for gold based on the supply and demand considerations of an open international market.

The impact of the price mechanisms on the gold quartz industry has been crucial to the very survivability of the industry. The 1918 to 1933 fixed price of \$20.67 per ounce was set sufficiently high during a recessionary period. This enabled the gold mining industry to achieve its highest level of stability and its highest growth rates for physical production, real value of production, employment, and total real wages.

In contrast, the 1934 to 1970 fixed price of \$35.00 an ounce was able to promote growth at a declining rate for only eight years from 1934 to 1941. The prolonged fixed nominal price caused a drop in the real price of gold by 61% over the 37 years. Consequently, the gold quartz industry incurred ever-

increasing costs of production induced by price inflation which rose 129%, and by the increase in the average real wage per employee which climbed 48%. During this period of decline, the industry experienced its highest level of instability and negative growth in physical production, in the real value of production, in the level of employment, and in the level of total real salaries and wages. The industry had been ravaged by the fixed price mechanism, which ignored the impact of inflation.

Beginning in 1971, the fixed price regime was replaced by a flexible market oriented price regime. Previously, the fixed price systems established prices for gold according to its role in international monetary policy. In 1971, the flexible price regime was independent of international monetary policy and was dependent on the supply and demand structure of an international commodity. From 1971 to 1985, the Canadian gold quartz industry regained a high degree of production growth stability, although the stability of the labour force's growth of total real wages had not recovered to the level experienced in 1918 to 1933. The industry rebounded in terms of growth in physical production, in the real value of production, in employment, and in total real wages. However, the industry's growth was not as significant as the growth achieved from 1918 to 1933. The industry has returned to a state of profitability, evident by the massive increase in capital expenditures. Provided that the market price for gold remains above the industry's break-even cost, further capital

expenditures will continue as the industry modernizes its equipment to enable the lower cost per unit extraction of lower grade ore bodies. Thus, modernization of equipment and technology will promote greater stability and growth for the gold quartz industry.

7.2 Resolution of Hypotheses

The period of fixed gold prices from 1918 to 1933 was considerably shorter than the fixed price period of 1934 to 1970. However, the factor which most distinguishes the two periods of fixed prices, is that the latter price fix was implemented during a period of general price inflation in the economy, while the former price fix was implemented during a time of general price deflation. Consequently, the latter period witnessed a declining real price of gold, while the former experienced an increasing real price of gold.

Hypothesis I addresses two separate time intervals; 1934 to 1970 and 1971 to 1985; with both time periods encountering general price inflation. Given price inflation, the hypothesis seeks to determine how well the gold mining industry fared under a fixed price regime from 1934 to 1970 compared to the flexible price regime of 1971 to 1985. As the period from 1918 to 1933 was not a period of price inflation, it was not examined for the purpose of resolving the first hypothesis.

Hypothesis II addresses two separate time periods, also; 1918 to 1933 and 1971 to 1985. However, the second hypothesis differs from the first because Hypothesis II examines the impact on the gold mining industry of the fixed and flexible price regimes during intervals of time when the real price of gold was increasing. As 1918 to 1933 was a period of price deflation under a fixed price regime, therefore the real price of gold was increasing. Conversely, as 1971 to 1985 was a period of general price inflation, with the nominal price of gold increasing faster than the annual price increases in the economy, then the real price of gold was increasing over the period. As 1934 to 1970 was a time when the industry experienced a declining real price of gold, as stated above, this is not pertinent to the resolution of the second hypothesis.

Hypothesis I:

This author expects that the Canadian gold mining industry will exhibit a greater degree of growth and stability of production and employment under a free-market price mechanism than under a prolonged, regulated and fixed nominal price mechanism, during periods of general price inflation in the economy.

The Canadian auriferous quartz industry is one of many significant smaller producers of gold participating in an oligopolistic market dominated by South Africa. The oligopolistic conditions have prevailed relatively unchanged

from 1918 to 1985. However, the price mechanism has changed from a regulated fixed price to a free-market flexible price.

The period from 1934 to 1970 was one in which the nominal fixed price of gold remained unchanged for 37 years. Because of the presence of price inflation in the economy, the real price of gold fell by 61% during that interval. Consequently, the dominant producer, South Africa was compelled to increase production to compensate for the lower real price of gold. (Refer to figure 1.5 of chapter 1.7). As the dominant producer was compelled to capture a larger portion of the total market; ie. from 45% in 1934 to 79% in 1970, the smaller producers including Canada were left with a smaller quantity of sales and at lower real price. Consequently, the profitability of the smaller producer was profoundly impacted upon by the prolonged continuously declining real price of gold.

During the period of recovery for the industry, from 1971 to the present day, the international gold mining industry has resumed its normal oligopolistic market activities, unrestrained by government price controls. According to the unregulated price leadership model, the dominant producer, which behaves as a monopolist, establishes a price for the industry which maximizes its profit by equating its marginal revenue to its marginal cost, (as shown in figure 1.3 of chapter 1.5). Consequently, the dominant producer, South Africa, reduces the supply of gold in the market, ie. from 976.3 tonnes in 1971 to 673.3 tonnes in 1985, in order to command a

monopoly price. The smaller producers including Canada respond to the monopoly price as perfect competitors; ie. where marginal revenue equals demand which equals marginal cost.

The statistical analysis presented in chapters V and VI supports hypothesis I, based on the oligopolistic composition of the international gold mining industry. Under the free market conditions which existed since 1971, the Canadian industry exhibited greater stability and growth of employment and production than it did during the period from 1934 to 1970, when the fixed nominal price for gold was steadily eroded in real terms by inflation.

For the gold mining industry to have avoided the negative impact of price inflation, the regulated price fix should have been in real dollars, not nominal dollars. However, the function of gold as an international medium of exchange demanded that gold counteract inflation and maintain international price stability. Consequently, a real rather than nominal price fix for gold was out of the question. Had the time frame of the \$35.00 (U.S.) price fix been shorter, it is obvious that the gold mining industry would have fared much better. For instance, from 1934 to 1941, the \$35.00 price fix was set sufficiently high to promote growth and development within the industry inspite of price inflation.

Hypothesis II:

A second hypothesis is that this author expects that during periods when the real price for gold is increasing, stability and growth of the Canadian gold mining industry will be greater under a fixed price regime than under a flexible price regime.

The period from 1918 to 1933 was one in which the nominal price of gold remained fixed at \$20.67 (U.S.) per fine ounce. However in real terms, the period experienced a series of short-term increases in the real price of gold. Over the entire 16 year period, the real price rose by 75%. Given the oligopolistic structure of the international industry, a government regulated price, which is set above the price determined by an unregulated market will enable the dominant firm to reduce its output if its goal is to maximize profits. However, this did not occur as South Africa's production increased by 31% over the 16 years. It is conceivable that gold production was encouraged for purposes of international trade, in response to the increased hoarding of gold which occurred during World War I, and during the reparation period which followed the war. The hoarding of gold was highly recognized at the Genoa conference of 1922, which advocated the use of foreign exchange reserves as a supplement to the gold reserves of Central Banks.

Thus, the period from 1918 to 1933 saw the real price for gold increase, which in conjunction with a perfectly elastic

demand for gold, resulted in the increased production of gold by the dominant producer, South Africa, and by the smaller producers such as Canada. The increased real price was very significant to an industry who's short-term stability was assured by a minimum nominal price. The increased real price was so substantial, that the Canadian gold mining industry achieved its highest rate of growth and development compared to the latter periods.

The statistical analysis disclosed in chapter V indicates that from 1918 to 1933 the Canadian gold quartz industry achieved its highest growth rates as physical production increased by 454%, the real value of production increased by 858%, employment increased by 361%, and the real value of a gold quartz miner's wage increased by 44%. The regression analysis presented in chapter VI reveals that the period from 1918 to 1933 was the period of greatest stability of production and employment for the gold quartz industry.

The period from 1971 to 1985 experienced a much greater increase in the real price of gold compared to the period from 1918 to 1933. However, the price volatility associated with the free market price mechanism resulted in the gold mining industry achieving less growth and stability under the flexible price regime than under the fixed price regime, although there may have been other contributing factors. Therefore, the statistical analysis supports hypothesis II. Thus, during periods when the real price of gold was increasing, the stability and growth of the Canadian gold mining industry was

greater under a fixed price regime than under a flexible price regime.

7.3 Summary

Today, the Canadian auriferous quartz industry, like all other non-renewable resource industries, must address the continuing dilemma of extracting lower grade deposits in the face of mounting production costs. The industry is attempting to achieve greater efficiencies of production through modernization of its equipment and technology. The industry has clearly demonstrated its continuous move towards capital intensification, which it believes will permit the more rapid extraction of gold, thus reducing the variable cost per ounce extracted. The gold quartz industry like other industries is subject to the price swings associated with international supply and demand for the commodity. The Canadian gold quartz industry, like the Canadian oil industry, is a small producer whose price is determined by a dominant producer or cartel in an oligopolistic market. However, the historical development of the industry is unlike the development of other Canadian resource industries.

The gold mining industry of Canada, until 1971, was an industry whose fate was determined by international monetary policy. The oligopolistic nature of the market was impacted by a fixed price mechanism, which established a price for gold without consideration for the impact on the industry. The

price fix of \$20.67 (U.S.) per ounce established during the period from 1918 to 1933 proved to be a major impetus of growth and stability to the industry, as a consequence of the price deflation which prevailed during that period. In contrast, the price fix of \$35.00 (U.S.) per ounce was insufficient to extend the growth of the industry beyond 1941. Subsequently, price inflation transformed the once prosperous Canadian industry into a welfare candidate supported by programs such as the Emergency Gold Mining Assistance Act. By 1970, only 15 of the 146 mines which operated in 1941 resisted the profit squeeze and survived to greet the new era of an open market and non-regulated price.

It is apparent that the economic impact of the prolonged fixed price regime, on the Canadian gold mining industry from 1934 to 1970, was extremely detrimental to its growth, development, and stability. However, the reason the industry suffered so greatly, was not because of the imposition of a regulated price. It was due to the continuous presence of general price inflation in the economy. As witnessed in the period from 1918 to 1933, the Canadian gold mining industry achieved its highest growth rates and greatest growth stability of production and employment, during a period when gold was fixed at \$20.67 (U.S.) an ounce and general prices in the economy were decreasing.

Thus, the experience of the Canadian gold mining industry from 1918 to 1933 underscores the point, that a fixed price regime, which governs the price of a commodity, can inspire confidence, growth, and stability within that industry, provided that the real price of the commodity is not diminished over time by inflation, and provided that the price fix is set at a level where producers can expect to earn a reasonable return on their investment.

LIST OF REFERENCES

A. BOOKS

- Bailetti, A. and Callahan, J. Investments and Portfolio Management in Canada. Ottawa: Carleton University, 1981.
- Ball, R. J. Money and Employment New York: Halsted Press, 1982.
- Caves, Richard E. "Vent for Surplus, Models of Trade and Growth" published in Trade, Growth and the Balance of Payments. Chicago: Rand McNally & Company, 1966.
- Committee of Inquiry into the Economics of the Gold Mining Industry. Gold Mining in Ontario, an Economic Study 1955. Toronto: Northern Miner Press Limited, 1955.
- Cooke, Gilbert W. The Stock Market. Cambridge Massachusetts: Schenkman Publishing Co., 1969.
- Einzig, Paul. The Destiny of Gold. Toronto: The MacMillan Press Ltd., 1972.
- Gray, John A. Stability of Employment and Production Within Canadian Resource-Based Industries. Winnipeg: Centre for Settlement Studies, University of Manitoba, June, 1975.
- Green, Timothy. The New World of Gold. New York: Walker and Company, 1981.
- Jamieson, A. B. Chartered Banking in Canada. Toronto: The Ryerson Press, 1957.
- Kinney, William P. The Monetary Maze. United States: Kent / Hunt Publishing Company, 1977.
- Lipsey, Richard G., Sparks, Gordon R., and Steiner, Peter O. Economics, Second Edition. New York: Harper & Row, Publishers, 1976.
- MacMillan, J. A., Tulloch, J. R., O'Brien, D., and Ahmad, M. A. Determinants of Labor Turnover in Canadian Mining Communities. Winnipeg: Centre for Settlement Studies, University of Manitoba, May, 1974.

- Malkiel, Burton G. A Random Walk Down Wall Street. New York: W. W. Norton and Company, Inc., 1973.
- Mark, William L., and Paterson, Donald G. Canada: An Economic History. Toronto: Gage Publishing Limited, 1980.
- Mirer, Thad W. Economic Statistics and Econometrics. New York: MacMillan Publishing Co., Inc., 1983.
- Morgan, E. Victor, and Morgan, Ann D. Gold or Paper? Great Britain: The Institute of Economic Affairs, 1976.
- Pindyck, Robert S., and Rubinfeld, Daniel L. Econometric Models and Economic Forecasts, Second Edition. Toronto: McGraw-Hill Book Company, 1981.
- Pomfret, Richard. The Economic Development of Canada. Toronto: Methuen Publications, 1981.
- Reilly, Frank K. Investment Analysis and Portfolio Management. Hinsdale, Illinois: The Dryden Press, 1979.
- Salvatore, Dominick. Theory and Problems of Microeconomic Theory, Second Edition. Toronto: McGraw-Hill, Inc., 1983.
- Samuelson, Paul A. , and Scott, Anthony. Economics, Third Canadian Edition. Toronto: McGraw-Hill Company of Canada Limited, 1971.
- Tan, Ronald H. L. The Gold Market. Kent Ridge, Singapore: Singapore University Press, 1981.
- The Northern Miner. Canadian Mines Handbook, 1984-1985. Toronto: Northern Miner Press Limited, 1984.
- The Northern Miner. Gold Mining in Canada, A Feature Report. Toronto: Northern Miner Press Limited, 1977.
- Thompson, R. W. International Trade and Domestic Prosperity: Canada 1926-38. Toronto: University of Toronto Press, 1970.
- Vane, Howard R., and Thompson, John L. Monetarism; Theory, Evidence and Policy. Liverpool: Martin Robertson, 1979.

B. ARTICLES AND PAPERS

- Bertram, Gordon W. "Economic Growth in Canadian Industry, 1870-1915: The Staple Model and the Take-Off Hypothesis," Canadian Journal of Economic and Political Science, Vol. XXIX, no.2, (May, 1963), pp. 159-184.
- Buckley, Kenneth. "The Role of Staple Industries in Canada's Economic Development" The Journal of Economic History, XVIII (1958), pp. 439-452.
- The Winnipeg Commodity Exchange. Statistical Annual 1978/79. Winnipeg, (1979).
- The Winnipeg Commodity Exchange. The Gold Futures Market. Winnipeg, (October, 1972).
- Watkins, Melville H. "A Staple Theory of Economic Growth," The Canadian Journal of Economics and Political Science, XXIX (May, 1963), pp. 141-158.

C. PRIMARY SOURCES AND GOVERNMENT DOCUMENTS

- Canada, Canada 1930-40, A Handbook of Present conditions and Recent Progress in the Dominion. Ottawa: Dominion Bureau of Statistics, 1930-40.
- Canada, Canada, One Hundred Years 1867-1967. Ottawa: Queen's Printer, 1967.
- Canada, Canadian Mineral Statistics 1886-1956, Mining Events 1604-1956. Ottawa: Dominion Bureau of Statistics, 1957.
- Canada, Canadian Mineral Survey 1983. Ottawa: Energy, Mines and Resources, February, 1984.
- Canada, Canadian Minerals Yearbook 1986 - Review and Outlook, Centennial Edition 1886-1986. Ottawa: Energy, Mines and Resources, 1986.
- Canada, Gold (1970- 1986). Ottawa: Energy, Mines and Resources, Mineral Policy Sector, 1970-1986.
- Canada, Gold in Canada. Ottawa: Department of Mines, Mines Branch, 1932.

- Canada, Historical Statistics of Canada. Ottawa:
Statistics Canada, 1986.
- Canada, Mineral Production of Canada, 1918-1938.
Ottawa: Department of Mines, Mines Bureau, 1920-1940.
- Canada, Royal Commission on Canada's Economic Prospects,
Mining and Mineral Processing in Canada. By John Davis.
Ottawa: October, 1957.
- Canada, Royal Commission on Canada's Economic Prospects,
Output, Labour and Capital in the Canadian Economy. By
Wm. C. Hood and Anthony Scott. Ottawa: February, 1957.
- Canada, Statistical Summary of the Mineral Industry in Canada
1986. Ottawa: Energy, Mines and Resources, Mineral Policy
Sector, 1986.
- Canada, Summary Review of the Gold Mining Industry in Canada 1946.
Department of Trade and Commerce, 1948.
- Canada, The Manufacturing Industries of Canada, 1941. Ottawa:
Dominion Bureau of Statistics, 1943.

GOLD MINE PRODUCTION IN THE NON-COMMUNIST WORLD (fine ounces - '000's)

Year	South Africa	Canada	United States	World Total
1918	8,418	700	3,321	18,034
1919	8,331	767	2,920	17,166
1920	8,158	765	2,476	16,073
1921	8,129	926	2,422	15,932
1922	7,010	1,263	2,363	15,305
1923	9,149	1,233	2,503	17,540
1924	9,575	1,525	2,529	18,073
1925	9,598	1,736	2,412	18,041
1926	9,955	1,754	2,335	18,357
1927	10,122	1,853	2,197	18,370
1928	10,354	1,891	2,233	18,500
1929	10,412	1,928	2,208	18,500
1930	10,716	2,102	2,286	19,403
1931	10,878	2,694	2,396	20,629
1932	11,558	3,044	2,449	22,161
1933	11,012	2,949	2,556	22,700
1934	10,479	2,972	3,091	23,514
1935	10,773	3,285	3,609	25,215
1936	11,335	3,748	4,357	26,431
1937	11,735	4,096	4,805	29,218
1938	12,161	4,725	5,090	31,903
1939	12,821	5,094	5,611	34,534
1940	14,038	5,311	6,003	37,067
1941	14,386	5,345	5,976	(o)
1942	14,121	4,841	3,742	(o)
1943	12,800	3,651	1,395	(o)
1944	12,277	2,923	1,002	(o)
1945	12,214	2,697	915	(o)
1946	11,927	2,828	1,462	(o)

(o) Omitted due to incomplete data.

Source: Canada, Summary Review of the Gold Mining Industry in Canada 1946 (Ottawa: Department of Trade and Commerce Dominion Bureau of Statistics, 1946), p. 10.

GOLD MINE PRODUCTION IN THE NON-COMMUNIST WORLD (fine ounces - '000's)

Year	South Africa	Canada	U.S.A.	Other Africa	Latin America	Asia	Europe	Oceania	Total
1947	11,200	3,085	2,321	1,614	1,656	807	400	1,203	22,286
1948	11,585	3,542	2,099	1,729	1,519	860	300	1,164	22,798
1949	11,708	4,124	1,996	1,786	1,623	790	400	1,171	23,598
1950	11,664	4,440	2,375	1,775	1,595	947	400	1,130	24,326
1951	11,516	4,393	1,997	1,732	1,655	902	300	1,158	23,653
1952	11,819	4,472	1,938	1,721	1,710	1,042	300	1,245	24,247
1953	11,940	4,056	1,990	1,773	1,682	1,082	300	1,315	24,138
1954	13,237	4,366	1,867	1,852	1,523	1,003	400	1,318	25,567
1955	14,601	4,542	1,891	1,727	1,526	1,017	400	1,220	26,924
1956	15,897	4,384	1,838	1,673	1,502	1,018	400	1,203	27,915
1957	17,031	4,434	1,817	1,830	1,397	959	400	1,262	29,130
1958	17,656	4,571	1,801	1,891	1,450	1,017	400	1,255	30,041
1959	20,067	4,483	1,390	1,981	1,368	1,002	400	1,242	31,933
1960	21,386	4,629	1,680	1,953	1,401	1,011	600	1,237	33,897
1961	22,946	4,474	1,567	1,833	1,357	1,073	700	1,230	35,180
1962	25,492	4,178	1,556	1,808	1,278	1,146	700	1,217	37,375
1963	27,432	3,972	1,469	1,884	1,283	1,078	700	1,189	39,007
1964	29,137	3,811	1,469	1,809	1,213	1,135	800	1,112	40,486
1965	30,554	3,587	1,675	1,566	1,214	1,184	800	1,031	41,611
1966	30,880	3,274	1,802	1,535	1,108	1,234	800	1,066	41,699
1967	30,533	2,986	1,584	1,534	1,035	1,170	240	951	40,033
1968	31,169	2,743	1,479	1,516	1,070	1,189	215	929	40,310
1969	31,276	2,545	1,733	1,464	981	1,227	222	827	40,275
1970	32,164	2,338	1,743	1,443	910	1,264	237	756	40,855

Sources: Annual Report of the American Bureau of Metal Statistics and
the Dominion Bureau of Statistics, Canada.

GOLD MINE PRODUCTION IN THE NON-COMMUNIST WORLD (tonnes)

Year	South Africa	Canada	U.S.A.	Other Africa	Latin America	Asia	Europe	Oceania	Total
1971	976.3	68.7	46.4	44.6	34.1	33.7	7.6	24.4	1235.8
1972	909.6	64.7	45.1	42.3	34.8	32.7	13.2	39.4	1181.8
1973	855.2	60.0	36.2	44.8	35.2	30.3	14.3	40.3	1116.3
1974	758.6	52.2	35.1	43.6	36.9	27.7	11.6	38.9	1004.6
1975	713.4	51.4	32.4	40.0	41.8	26.5	11.0	36.4	952.9
1976	713.4	52.4	32.2	39.2	55.0	27.1	11.4	38.2	968.9
1977	699.9	54.0	32.0	41.4	55.9	30.0	13.2	43.3	969.8
1978	706.4	54.0	30.2	34.2	62.7	30.7	12.5	44.6	975.3
1979	705.4	51.1	30.2	28.3	66.6	29.0	10.0	39.0	959.6
1980	675.1	50.6	27.6	35.2	85.9	31.0	8.6	32.3	946.3
1981	657.6	49.5	40.6	40.4	96.1	34.5	8.5	34.5	961.6
1982	664.3	64.7	45.0	44.6	105.3	37.0	12.4	46.4	1025.1
1983	679.7	73.5	60.9	46.9	141.9	44.2	14.1	50.8	1112.0
1984	683.3	83.4	68.5	51.1	142.5	45.5	15.0	59.6	1148.9
1985	673.3	87.5	79.0	51.7	162.7	52.3	15.1	92.7	1212.8

Sources: Energy, Mines and Resources Canada;
 Consolidated Gold Fields PLC, Gold 1982, p. 16.
 Consolidated Gold Fields PLC, Gold 1985, p. 16.

NOMINAL AND REAL PRICE OF GOLD (1918 - 1986)

Year	Price of Gold per Fine Oz. in \$U.S.	Exchange Rate \$Cdn to \$U.S.	Price of Gold per Fine Oz. in \$Cdn	Consumer Price Index (1981 = 100.0)	Real Price of Gold per Fine Oz. in \$Cdn
1918	20.25	1.02	20.67	18.0	114.83
1919	19.75	1.04	20.58	19.8	103.94
1920	21.00	1.12	23.42	22.9	102.27
1921	20.25	1.12	22.69	20.2	112.33
1922	20.67	1.01	20.88	18.5	112.86
1923	20.50	1.02	20.94	18.5	113.19
1924	20.50	1.01	20.79	18.2	114.23
1925	20.67	1.00	20.67	18.4	112.34
1926	20.67	1.00	20.67	18.6	111.13
1927	20.67	1.00	20.67	18.3	112.95
1928	20.67	1.00	20.67	18.3	112.95
1929	20.50	1.01	20.76	18.6	111.61
1930	20.67	1.00	20.69	18.4	112.45
1931	20.75	1.04	21.57	16.6	129.94
1932	20.50	1.14	23.46	15.1	155.36
1933	26.50	1.09	28.94	14.4	200.97
1934	35.00	.99	34.56	14.6	236.71
1935	35.00	1.01	35.15	14.7	239.12
1936	35.00	1.00	35.03	15.0	233.53
1937	35.00	1.00	34.98	15.4	227.14
1938	35.00	1.01	35.19	15.6	225.58
1939	35.00	1.04	36.20	15.5	233.55
1940	34.67	1.11	38.50	16.1	239.13
1941	34.67	1.11	38.50	17.0	226.47
1942	34.67	1.11	38.50	17.9	215.08
1943	34.67	1.11	38.50	18.2	211.54
1944	34.67	1.11	38.50	18.3	210.38
1945	34.67	1.11	38.50	18.4	209.24
1946	34.67	1.06	36.75	19.0	193.42
1947	35.00	1.00	35.00	20.8	168.27
1948	35.00	1.00	35.00	23.7	147.68
1949	35.00	1.03	36.00	24.5	146.94
1950	35.00	1.09	38.05	25.2	150.99
1951	35.00	1.05	36.85	27.9	132.08
1952	35.00	.98	34.27	28.5	120.24
1953	35.00	.98	34.42	28.3	121.63
1954	35.00	.97	34.07	28.5	119.54
1955	35.00	.99	34.52	28.5	121.12

NOMINAL AND REAL PRICE OF GOLD (1918 - 1986)

Year	Price of Gold per Fine Oz. in \$U.S.	Exchange Rate \$Cdn to \$U.S.	Price of Gold per Fine Oz. in \$Cdn	Consumer Price Index (1981 = 100.0)	Real Price of Gold per Fine Oz. in \$Cdn
1956	35.00	.99	34.45	28.9	119.20
1957	35.00	.96	33.55	29.8	112.58
1958	35.00	.97	33.98	30.6	111.05
1959	35.00	.96	33.57	31.0	108.29
1960	35.00	.97	33.95	31.4	108.12
1961	35.00	1.01	35.46	31.6	112.22
1962	35.00	1.07	37.41	32.0	116.91
1963	35.00	1.08	37.75	32.6	115.80
1964	35.00	1.08	37.75	33.2	113.70
1965	35.00	1.08	37.73	34.0	110.97
1966	35.00	1.08	37.71	35.2	107.13
1967	35.00	1.08	37.75	36.5	103.42
1968	35.00	1.08	37.71	38.0	99.24
1969	35.00	1.08	37.69	39.7	94.94
1970	35.97	1.04	37.55	41.0	91.59
1971	40.81	1.01	41.21	42.2	97.65
1972	58.13	.99	57.53	44.2	130.16
1973	97.22	1.00	97.25	47.6	204.31
1974	159.26	.98	155.67	52.8	294.83
1975	161.02	1.02	163.78	58.5	279.97
1976	124.84	.99	123.11	62.9	195.72
1977	147.72	1.06	157.09	67.9	231.35
1978	193.23	1.14	220.41	73.9	298.25
1979	306.69	1.17	359.29	80.7	445.22
1980	612.56	1.17	716.09	88.9	805.50
1981	459.72	1.20	551.18	100.0	551.18
1982	376.88	1.23	465.10	110.8	419.77
1983	422.60	1.23	520.79	117.2	444.36
1984	360.00	1.30	466.78	122.3	381.67
1985	317.44	1.36	433.23	127.2	340.59
1986	368.11	1.38	507.99	132.4	383.68

Sources: Statistics Canada; Energy, Mines and Resources Canada.

CONSUMER PRICE INDEX FOR CANADA (1918 - 1986)
1981 = 100.0

Year	Annual Average	Year	Annual Average
1918	18.0	1953	28.3
1919	19.8	1954	28.5
1920	22.9	1955	28.5
1921	20.2	1956	28.9
1922	18.5	1957	29.8
1923	18.5	1958	30.6
1924	18.2	1959	31.0
1925	18.4	1960	31.4
1926	18.6	1961	31.6
1927	18.3	1962	32.0
1928	18.3	1963	32.6
1929	18.6	1964	33.2
1930	18.4	1965	34.0
1931	16.6	1966	35.2
1932	15.1	1967	36.5
1933	14.4	1968	38.0
1934	14.6	1969	39.7
1935	14.7	1970	41.0
1936	15.0	1971	42.2
1937	15.4	1972	44.2
1938	15.6	1973	47.6
1939	15.5	1974	52.8
1940	16.1	1975	58.5
1941	17.0	1976	62.9
1942	17.9	1977	67.9
1943	18.2	1978	73.9
1944	18.3	1979	80.7
1945	18.4	1980	88.9
1946	19.0	1981	100.0
1947	20.8	1982	110.8
1948	23.7	1983	117.2
1949	24.5	1984	122.3
1950	25.2	1985	127.2
1951	27.9	1986	132.4
1952	28.5		

Source: Statistics Canada.

ANNUAL PRODUCTION OF GOLD IN CANADA FROM ALL SOURCES
(1918 - 1985)

Year	Troy Ounces	Nominal Value \$('000's)
1918	699,681	14,464
1919	766,764	15,850
1920	765,007	15,814
1921	926,329	19,149
1922	1,263,364	26,116
1923	1,233,341	25,495
1924	1,525,382	31,532
1925	1,735,735	35,881
1926	1,754,228	36,263
1927	1,852,785	38,300
1928	1,890,592	39,082
1929	1,928,308	39,862
1930	2,102,068	43,454
1931	2,693,892	58,093
1932	3,044,387	71,479
1933	2,949,309	84,350
1934	2,972,074	102,537
1935	3,284,890	115,595
1936	3,748,028	131,293
1937	4,096,213	143,326
1938	4,725,117	166,206
1939	5,094,379	184,116
1940	5,311,145	204,479
1941	5,345,179	205,789
1942	4,841,306	186,390
1943	3,651,301	140,575
1944	2,922,911	112,532
1945	2,696,727	103,824
1946	2,832,554	104,096
1947	3,070,221	107,458
1948	3,529,608	123,536
1949	4,123,518	148,447
1950	4,441,227	168,989
1951	4,392,751	161,873
1952	4,471,725	153,246
1953	4,055,723	139,598
1954	4,366,440	148,765
1955	4,541,962	156,789

ANNUAL PRODUCTION OF GOLD IN CANADA FROM ALL SOURCES
(1918 - 1985)

Year	Troy Ounces	Nominal Value \$('000's)
1956	4,383,863	151,024
1957	4,433,894	148,757
1958	4,571,347	155,334
1959	4,483,416	150,508
1960	4,628,911	157,152
1961	4,473,699	158,637
1962	4,178,396	156,314
1963	4,003,127	151,118
1964	3,835,454	144,788
1965	3,606,031	136,052
1966	3,319,474	125,177
1967	2,986,268	112,732
1968	2,743,021	103,439
1969	2,545,109	95,925
1970	2,408,574	88,057
1971	2,260,730	79,903
1972	2,078,567	119,742
1973	1,954,340	190,376
1974	1,698,392	263,794
1975	1,653,798	270,830
1976	1,691,998	208,302
1977	1,733,805	272,363
1978	1,735,271	382,471
1979	1,644,448	590,766
1980	1,627,661	1,165,417
1981	1,673,128	922,081
1982	2,081,519	968,012
1983	2,363,481	1,230,886
1984	2,682,849	1,252,283
1985	2,815,189	1,219,653

Source: Statistics Canada; Energy, Mines and Resources Canada.

GOLD
MINERAL PRODUCTION OF CANADA BY SOURCE

Year	PLACER		AURIFEROUS QUARTZ MINES		BASE METAL MINES	
	Ounces	Dollars Cdn.	Ounces	Dollars Cdn.	Ounces	Dollars Cdn.
1918	117251	2423793	441120	9118759	141310	2921137
1919	104495	2160104	529296	10941521	132973	2748798
1920	83469	1725457	581455	12019740	100083	2068901
1921	77246	1596815	711121	14700173	137962	2851932
1922	72017	1488722	1017961	21043119	173386	3584209
1923	80344	1660856	981299	20285248	171698	3549317
1924	55862	1154769	1254737	25937714	214783	4439960
1925	60998	1260938	1479095	30575605	195642	4044283
1926	35085	725262	1526178	31548905	192965	3988943
1927	37056	766009	1639715	33895910	176014	3638545
1928	37812	781640	1673174	34587574	179606	3712791
1929	38566	797233	1677628	34679646	212114	4384784
1930	42324	874912	1782875	36855293	276869	5723396
1931	57997	1250697	2256233	48676661	379662	8166038
1932	56776	1333047	2523696	59254428	463915	10891898
1933	58640	1677104	2443983	69897913	446686	12775220
1934	59284	2045297	2487823	85829895	424967	14661361
1935	60599	2132550	2731861	96134188	492428	17328541
1936	85011	2977935	3098592	108543680	564425	19771808
1937	90047	3150744	3489214	122087600	516952	18088150
1938	117896	4146991	4052104	142533170	555117	19525828
1939	125791	4546212	4421031	159780420	547557	19789317
1940	112320	4324319	4607452	177386900	591373	22767861
1941	106187	4088200	4644911	178829070	594081	22872118
1942	109564	4218214	4135307	159209320	596435	22962747
1943	52858	2035033	3018074	116195850	580369	22344206
1944	33274	1281049	2435796	93778146	453841	17472878
1945	41799	1609260	2179731	83919644	475197	18295086
1946	60925	2238994	2382484	87556287	389145	14301078
1947	53519	1873165	1707302	94755570	309400	10829000
1948	78821	2758735	3081113	107838950	369674	12938590
1949	96614	3478104	3566152	128381470	460752	16587072
1950	105143	4114843	3764757	143249000	568327	21624842
1951	96441	3553851	3709601	136698800	586709	21620226
1952	92843	3181730	3823747	131039810	555135	19024476
1953	77505	2667722	3509527	120797920	468691	16132344
1954	89571	3051684	3738955	127386200	537914	18326730
1955	78621	2713997	3866124	133458600	597217	20615931

MINERAL PRODUCTION OF CANADA BY SOURCE

Year	PLACER		AURIFEROUS QUARTZ MINES		BASE METAL MINES	
	Ounces	Dollars Cdn.	Ounces	Dollars Cdn.	Ounces	Dollars Cdn.
1956	74919	2580960	3704870	127632770	604074	20810349
1957	76303	2559966	3766285	126358860	591306	19838316
1958	71955	2445031	3928187	133479790	571205	19409545
1959	72974	2449737	3852074	129314120	558368	18744414
1960	80804	2743295	3930366	133435920	617741	20972307
1961	69240	2455250	3774522	133844550	629937	22337566
1962	57760	2160801	3494821	130741250	625815	23411739
1963	57905	2185914	3324907	125515240	620315	23416891
1964	58512	2208828	3151593	118972630	625349	23606925
1965	44598	1682638	2958874	111635360	602559	22733948
1966	43369	1635445	2676381	100926330	599724	22615592
1967	9411	355266	2426137	91586672	550720	20789680
1968	9564	360658	2208184	83270618	525273	19808045
1969	8725	328845	2030680	76536329	505704	19059984
1970	7359	269045	1883764	68870412	517451	18918008
1971	4988	176296	1797670	63536849	458072	16190097
1972	4454	256586	1598460	93200526	475653	26284974
1973	9804	955027	1432680	139560224	511856	49860917
1974	9803	1522602	1212911	188389333	475678	73882310
1975	10774	1764409	1206735	197618160	436289	71447820
1976	16636	2047760	1232573	151721360	442789	54532750
1977	16945	2661558	1216459	191070950	500401	78630910
1978	17867	3937567	1168487	257713870	548917	121019637
1979	28913	10387051	1086634	390372210	528901	190007067
1980	66229	47420602	1026643	735084380	534789	382911891
1981	52499	28933104	1153601	635768990	467028	257386993
1982	79629	37031624	1539089	715754470	462801	215225906
1983	104020	54166909	1785263	929650830	474198	247068261
1984	109100	50919220	2011367	938748610	562382	262615349
1985	111372	48245682	2162095	936602690	541722	234804925

Sources: Statistics Canada; Energy, Mines and Resources Canada.

VALUE OF PRODUCTION IN THE CANADIAN GOLD MINING INDUSTRY
AURIFEROUS QUARTZ SECTOR (1918-1985)

Year	Nominal Gross Value of Production \$('000's)	Consumer Price Index (1981 = 100.0)	Real Value of Production \$('000's)
1918	9119	18.0	50661
1919	10942	19.8	55263
1920	12020	22.9	52489
1921	14700	20.2	72772
1922	21043	18.5	113746
1923	20285	18.5	109649
1924	25938	18.2	142516
1925	30576	18.4	166174
1926	31549	18.6	169618
1927	33896	18.3	185224
1928	34588	18.3	189005
1929	34680	18.6	186452
1930	36855	18.4	200299
1931	48677	16.6	293235
1932	59254	15.1	392411
1933	69898	14.4	485403
1934	85830	14.6	587877
1935	96134	14.7	653973
1936	108544	15.0	723627
1937	122088	15.4	792779
1938	142533	15.6	913673
1939	159780	15.5	1030839
1940	177387	16.1	1101783
1941	178829	17.0	1051935
1942	159209	17.9	889436
1943	116196	18.2	638440
1944	93778	18.3	512448
1945	83920	18.4	456087
1946	87556	19.0	460821
1947	94756	20.8	455558
1948	107839	23.7	455017
1949	128381	24.5	524004
1950	143249	25.2	568448
1951	136699	27.9	489961
1952	131040	28.5	459789
1953	120798	28.3	426848
1954	127386	28.5	446968
1955	133459	28.5	468277

VALUE OF PRODUCTION IN THE CANADIAN GOLD MINING INDUSTRY
AURIFEROUS QUARTZ SECTOR (1918-1985)

Year	Nominal Gross Value of Production \$('000's)	Consumer Price Index (1981 = 100.0)	Real Value of Production \$('000's)
1956	127633	28.9	441637
1957	126359	29.8	424023
1958	133480	30.6	436209
1959	129314	31.0	417142
1960	133436	31.4	424955
1961	133845	31.6	423560
1962	130741	32.0	408566
1963	125515	32.6	385015
1964	118973	33.2	358352
1965	111635	34.0	328338
1966	100926	35.2	286722
1967	91587	36.5	250923
1968	83271	38.0	219134
1969	76536	39.7	192786
1970	68870	41.0	167976
1971	63537	42.2	150562
1972	93201	44.2	210862
1973	139560	47.6	293193
1974	188389	52.8	356797
1975	197618	58.5	337809
1976	151721	62.9	241210
1977	191071	67.9	281401
1978	257714	73.9	348733
1979	390372	80.7	483732
1980	735084	88.9	826866
1981	635769	100.0	635769
1982	715574	110.8	645825
1983	929651	117.2	793218
1984	938749	122.3	767579
1985	936603	127.2	736323

Sources: Statistics Canada; Energy, Mines and Resources Canada.

VALUE OF PRODUCTION IN THE MINING INDUSTRY OF CANADA
(1918 - 1985)

Year	Nominal Gross Value of Production \$('000's)	Consumer Price Index (1981 = 100.0)	Real Value of Production \$('000's)
1918	211,301	18.0	1,173,894
1919	176,686	19.8	892,354
1920	227,860	22.9	995,021
1921	171,923	20.2	851,104
1922	184,297	18.5	996,200
1923	214,079	18.5	1,157,184
1924	209,583	18.2	1,151,555
1925	226,583	18.4	1,231,429
1926	240,437	18.6	1,292,672
1927	247,357	18.3	1,351,678
1928	274,989	18.3	1,502,672
1929	310,850	18.6	1,671,237
1930	279,874	18.4	1,521,054
1931	230,435	16.6	1,388,163
1932	191,228	15.1	1,266,411
1933	221,743	14.4	1,539,882
1934	278,321	14.6	1,906,308
1935	312,758	14.7	2,127,605
1936	362,524	15.0	2,416,827
1937	458,236	15.4	2,975,558
1938	442,869	15.6	2,838,904
1939	474,602	15.5	3,061,948
1940	529,825	16.1	3,290,839
1941	560,241	17.0	3,295,535
1942	566,769	17.9	3,166,307
1943	530,054	18.2	2,912,385
1944	485,819	18.3	2,654,749
1945	498,755	18.4	2,710,625
1946	502,816	19.0	2,646,400
1947	644,870	20.8	3,100,337
1948	820,249	23.7	3,460,966
1949	901,110	24.5	3,678,000
1950	903,818	25.2	3,586,579
1951	1,049,806	27.9	3,762,746
1952	1,085,831	28.5	3,809,933
1953	1,111,401	28.3	3,927,212
1954	1,239,726	28.5	4,349,916
1955	1,456,825	28.5	5,111,667

VALUE OF PRODUCTION IN THE MINING INDUSTRY OF CANADA
(1918 - 1985)

Year	Nominal Gross Value of Production \$('000's)	Consumer Price Index (1981 = 100.0)	Real Value of Production \$('000's)
1956	1,672,830	28.9	5,788,339
1957	1,807,562	29.8	6,065,644
1958	1,823,432	30.6	5,958,928
1959	1,961,335	31.0	6,326,887
1960	1,972,796	31.4	6,282,790
1961	2,057,452	31.6	6,510,924
1962	2,279,854	32.0	7,124,544
1963	2,596,166	32.6	7,963,699
1964	2,931,700	33.2	8,830,421
1965	3,222,441	34.0	9,477,768
1966	3,417,868	35.2	9,709,852
1967	3,831,808	36.5	10,498,104
1968	4,195,930	38.0	11,041,921
1969	4,400,637	39.7	11,084,727
1970	5,118,396	41.0	12,483,892
1971	5,198,173	42.2	12,317,945
1972	5,652,775	44.2	12,789,083
1973	8,030,314	47.6	16,870,407
1974	11,187,764	52.8	21,188,946
1975	12,240,016	58.5	20,923,104
1976	14,178,010	62.9	22,540,556
1977	16,400,460	67.9	24,153,843
1978	18,201,459	73.9	24,629,849
1979	23,626,730	80.7	29,277,236
1980	27,566,272	88.9	31,008,179
1981	28,204,485	100.0	28,204,485
1982	29,101,618	110.8	26,264,998
1983	32,771,401	117.2	27,961,946
1984	37,976,019	122.3	31,051,528
1985		127.2	

Sources: Statistics Canada; Energy, Mines and Resources Canada.

EMPLOYMENT IN THE CANADIAN GOLD MINING INDUSTRY
AURIFEROUS QUARTZ SECTOR (1918 - 1985)

Year	Total Number of Employees	Total Nominal Salaries and Wages \$('000's)	Consumer Price Index (1981 = 100.0)	Total Real Salaries and Wages \$('000's)	Real Wage per Employee \$
1918	2779		18.1		
1919	2521		19.8		
1920	2526		22.9		
1921	3889	6,070	20.2	30,050	7,727
1922	5441	8,012	18.5	43,308	7,960
1923	5524	8,961	18.5	48,438	8,769
1924	6738	10,500	18.2	57,692	8,562
1925	7052	11,932	18.4	64,848	9,196
1926	7663	12,341	18.6	66,349	8,658
1927	8022	12,936	18.3	70,689	8,812
1928	9066	14,616	18.3	79,869	8,810
1929	8660	14,259	18.6	76,661	8,852
1930	8401	14,035	18.4	76,277	9,080
1931	9636	16,467	16.6	99,199	10,295
1932	10442	17,687	15.1	117,132	11,217
1933	12823	20,536	14.4	142,611	11,122
1934	17762	27,157	14.6	186,007	10,472
1935	19834	31,524	14.7	214,449	10,812
1936	25097	39,827	15.0	265,513	10,579
1937	29140	48,219	15.4	313,110	10,745
1938	29647	50,462	15.6	323,474	10,911
1939	30622	53,206	15.5	343,265	11,210
1940	30353	55,205	16.1	342,888	11,297
1941	32551	62,151	17.0	365,594	11,231
1942	26030	54,389	17.9	303,849	11,673
1943	19038	40,665	18.2	223,434	11,736
1944	17226	37,024	18.3	202,317	11,745
1945	18388	37,690	18.4	204,837	11,140
1946	21973	47,211	19.0	248,479	11,308
1947	22896	54,612	20.8	262,558	11,464
1948	22566	59,516	23.7	251,122	11,128
1949	22358	61,293	24.5	250,176	11,190
1950	22491	64,533	25.2	256,083	11,386
1951	22126	68,740	27.9	246,380	11,135
1952	20757	69,005	28.5	242,123	11,665
1953	18751	60,920	28.3	215,265	11,480
1954	18479	63,578	28.5	223,081	12,072
1955	18032	63,962	28.5	224,428	12,446

EMPLOYMENT IN THE CANADIAN GOLD MINING INDUSTRY
AURIFEROUS QUARTZ SECTOR (1918 - 1985)

Year	Total Number of Employees	Total Nominal Salaries and Wages \$('000's)	Consumer Price Index (1981 = 100.0)	Total Real Salaries and Wages \$('000's)	Real Wage per Employee \$
1956	17031	62,701	28.9	216,958	12,739
1957	16911	63,709	29.8	213,789	12,642
1958	16811	64,208	30.6	209,830	12,482
1959	16777	65,519	31.0	211,352	12,598
1960	16542	66,553	31.4	211,952	12,813
1961	15788	65,560	31.6	207,468	13,141
1962	15211	64,910	32.0	202,844	13,335
1963	14408	62,436	32.6	191,521	13,293
1964	13807	63,192	33.2	190,337	13,786
1965	12979	61,345	34.0	180,426	13,901
1966	11560	58,133	35.2	165,151	14,286
1967	10319	54,412	36.5	149,074	14,447
1968	8983	50,495	38.0	132,882	14,793
1969	8208	48,805	39.7	122,935	14,977
1970	7175	45,609	41.0	111,241	15,504
1971	6145	40,976	42.2	97,100	15,801
1972	5575	41,022	44.2	92,810	16,648
1973	5603	46,097	47.6	96,842	17,284
1974	5665	59,366	52.8	112,436	19,847
1975	5798	72,094	58.5	123,238	21,255
1976	5051	70,221	62.9	111,639	22,102
1977	4643	72,753	67.9	107,147	23,077
1978	4943	81,776	73.9	110,658	22,387
1979	5013	93,926	80.7	116,389	23,217
1980	5839	127,869	88.9	143,835	24,633
1981	6809	169,138	100.0	169,138	24,840
1982	7350	213,190	110.8	192,410	26,178
1983	7956	249,912	117.2	213,235	26,802
1984	8450	283,791	122.3	232,045	27,461
1985			132.4		

Sources: Statistics Canada; Energy, Mines and Resources Canada.

EMPLOYMENT IN THE MINING INDUSTRY OF CANADA
(1918 - 1985)

Year	Total Number of Employees	Total Nominal Salaries and Wages \$('000's)	Consumer Price Index (1981 = 100.0)	Total Real Salaries and Wages \$('000's)	Real Wage per Employee \$
1918	55,827		18.0		
1919	57,227		19.8		
1920	60,843		22.9		
1921	60,804	79,162	20.2	391,891	6,445
1922	62,249	75,027	18.5	405,551	6,515
1923	66,952	91,335	18.5	493,703	7,374
1924	64,328	82,787	18.2	454,874	7,071
1925	65,090	85,103	18.4	462,516	7,106
1926	77,931	94,217	18.6	506,543	6,500
1927	84,674	104,221	18.3	569,514	6,726
1928	89,448	115,954	18.3	633,628	7,084
1929	95,102	124,491	18.6	669,306	7,038
1930	89,200	113,975	18.4	619,429	6,944
1931	72,809	91,969	16.6	554,030	7,609
1932	61,470	71,772	15.1	475,311	7,732
1933	63,334	70,032	14.4	486,333	7,679
1934	73,505	88,126	14.6	603,603	8,212
1935	80,256	100,081	14.7	680,823	8,473
1936	90,999	116,766	15.0	778,440	8,554
1937	105,414	144,292	15.4	936,961	8,888
1938	107,275	145,644	15.6	933,615	8,703
1939	107,759	152,353	15.5	982,923	9,121
1940	108,886	164,490	16.1	1,021,677	9,383
1941	113,227	186,423	17.0	1,096,606	9,685
1942	112,043	198,550	17.9	1,109,218	9,900
1943	112,140	207,576	18.2	1,140,527	10,171
1944	104,878	204,808	18.3	1,119,169	10,671
1945	96,250	185,279	18.4	1,006,951	10,462
1946	99,196	196,749	19.0	1,035,521	10,439
1947	104,519	229,561	20.8	1,103,659	10,559
1948	112,855	282,002	23.7	1,189,882	10,543
1949	116,507	309,647	24.5	1,263,865	10,848
1950	100,525	274,696	25.2	1,090,063	10,844
1951	106,057	321,687	27.9	1,153,000	10,872
1952	109,508	365,012	28.5	1,280,744	11,695
1953	104,923	358,520	28.3	1,266,855	12,074
1954	103,397	362,710	28.5	1,272,667	12,309
1955	105,030	384,406	28.5	1,348,793	12,842

EMPLOYMENT IN THE MINING INDUSTRY OF CANADA
(1918 - 1985)

Year	Total Number of Employees	Total Nominal Salaries and Wages \$('000's)	Consumer Price Index (1981 = 100.0)	Total Real Salaries and Wages \$('000's)	Real Wage per Employee \$
1956	111,772	435,908	28.9	1,508,332	13,495
1957	116,256	476,397	29.8	1,598,648	13,751
1958	112,581	479,418	30.6	1,566,725	13,916
1959	106,960	479,468	31.0	1,546,670	14,460
1960	103,556	480,011	31.4	1,528,697	14,762
1961	99,644	469,983	31.6	1,487,288	14,926
1962	98,959	485,984	32.0	1,518,700	15,347
1963	95,531	508,816	32.6	1,560,785	16,338
1964	96,457	530,727	33.2	1,598,575	16,573
1965	100,820	582,101	34.0	1,712,062	16,981
1966	102,063	629,232	35.2	1,787,591	17,515
1967	102,678	700,678	36.5	1,919,666	18,696
1968	104,916	772,453	38.0	2,032,771	19,375
1969	102,088	804,839	39.7	2,027,730	19,863
1970	110,094	994,014	41.0	2,424,424	22,021
1971	110,410	1,015,661	42.2	2,406,780	21,799
1972	107,322	1,068,783	44.2	2,418,061	22,531
1973	111,443	1,214,871	47.6	2,552,250	22,902
1974	118,730	1,450,330	52.8	2,746,837	23,135
1975	115,715	1,655,278	58.5	2,829,535	24,453
1976	117,694	1,902,682	62.9	3,024,932	25,702
1977	119,061	2,137,523	67.9	3,148,046	26,441
1978	109,948	2,118,343	73.9	2,866,499	26,071
1979	115,245	2,492,715	80.7	3,088,866	26,803
1980	126,422	2,979,470	88.9	3,351,485	26,510
1981	129,251	3,439,945	100.0	3,439,945	26,614
1982	123,486	3,648,004	110.8	3,292,422	26,662
1983	113,831	3,687,912	117.2	3,146,683	27,643
1984	118,426	4,187,990	122.3	3,424,358	28,916
1985			127.2		

Sources: Statistics Canada; Energy, Mines and Resources Canada.

WEIGHT AND PURITY OF GOLD

WEIGHT

The weight of gold is customarily measured in troy ounces or in metric units.

1 oz. troy	=	31.103477 grams
32.15 oz. troy	=	1 kilo
100 oz. troy	=	3.11 kilos
32,150 oz. troy	=	1 metric ton
1 oz. Imperial	=	28.349523 grams

PURITY

The purity of gold is described by its fineness (parts per 1,000) or by the karat (or carat in Europe) scale.

Fine Gold		Karat
1,000	=	24
916	=	22 (customary for most coin)
750	=	18 (high quality jewelry)
583.3	=	14
417.7	=	10
375	=	9
333.3	=	8 (normally lowest acceptable purity in jewelry)

Sources: Timothy Green, The New World of Gold
(New York: Walker and Company, 1981), p. XI.

Canada, Canadian Minerals Yearbook 1980
(Ottawa: Energy, Mines and Resources Canada, 1980), p. vii

CALCULATION OF THE REAL VALUE OF NET CAPITAL STOCK (1921 - 1933)
FOR THE AURIFEROUS QUARTZ INDUSTRY IN CANADA
USING THE BALANCE SHEET METHOD

Year	Nominal Value of Capital Employed (Excluding Operating Capital and Current Assets) (\$ Million)	Consumer Price Index (1981 = 100.0)	Real Value of Net Capital Stock (\$ Million)
1921	37.76	20.2	186.93
1922	29.29	18.5	158.32
1923	61.69	18.5	333.46
1924	64.36	18.2	353.63
1925	69.26	18.4	376.41
1926	81.75	18.6	439.52
1927	96.68	18.3	528.31
1928	99.41	18.3	543.22
1929	107.92	18.6	580.22
1930	112.43	18.4	611.03
1931	98.82	16.6	595.30
1932	38.15	15.1	252.65
1933	126.18	14.4	876.25

Sources: Canada, Mineral Production of Canada
(Ottawa: Dominion Bureau of Statistics, 1921-1933).

William C. Hood and Anthony Scott, Output, Labour and Capital
in the Canadian Economy (Ottawa: Royal Commission on Canada's
Economic Prospects, February, 1957).

CALCULATION OF THE REAL VALUE OF GROSS NEW INVESTMENT (1950 - 1984)
FOR THE AURIFEROUS QUARTZ INDUSTRY IN CANADA

Year	Nominal Value of Gross New Investment (\$ Million)	Consumer Price Index (1981 = 100.0)	Real Value of Gross New Investment (\$ Million)
n	i_n		I_n
1950	7.3	25.2	28.97
1951	5.8	27.9	20.79
1952	8.1	28.5	28.42
1953	7.9	28.3	27.92
1954	9.7	28.5	34.04
1955	9.8	28.5	34.39
1956	9.1	28.9	31.49
1957	9.4	29.8	31.54
1958	7.1	30.6	23.20
1959	8.8	31.0	28.39
1960	9.2	31.4	29.30
1961	8.2	31.6	25.95
1962	6.8	32.0	21.25
1963	7.5	32.6	23.01
1964	7.1	33.2	21.39
1965	6.9	34.0	20.29
1966	6.5	35.2	18.47
1967	11.2	36.5	30.68
1968	14.9	38.0	39.21
1969	19.6	39.7	49.37
1970	13.6	41.0	33.17
1971	11.8	42.2	27.96
1972	9.0	44.2	20.36
1973	23.1	47.6	48.53
1974	30.4	52.8	57.58
1975	26.0	58.5	44.44
1976	21.8	62.9	34.66
1977	24.8	67.9	36.52
1978	36.7	73.9	49.66
1979	57.0	80.7	70.63
1980	160.9	88.9	180.99
1981	409.5	100.0	409.50
1982	397.4	110.8	358.66
1983	337.3	117.2	287.80
1984	501.6	122.3	410.14

Source: Statistics Canada

CALCULATION OF THE REAL VALUE OF NET CAPITAL STOCK (1950 - 1984)
FOR THE AURIFEROUS QUARTZ INDUSTRY IN CANADA
USING THE CUMULATIVE METHOD

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Year	Real Value of Gross New Invest. (\$ Mill.)	Discard Obsolete Invest. (\$ Mill.)	(1) - (2) (\$ Mill.)	Cumulate (3) (\$ Mill.)	(4) ÷ 22 Depr. (\$ Mill.)	(1) - (5) Net Investment (\$ Mill.)	Cumulate (6) Real Value of Net Capital Stock (\$ Mill.)
n	I_n	$I_n - L$	ΔG	G_n	$\frac{1}{L} G_{n-1}$	$I_n - \frac{1}{L} G_{n-1}$	N_n
1950	28.97	-	-	28.97	-	28.97	28.97
1951	20.79	-	-	49.76	1.32	19.47	48.44
1952	28.42	-	-	78.18	2.26	26.16	74.60
1953	27.92	-	-	106.10	3.55	24.37	98.97
1954	34.04	-	-	140.14	4.82	29.22	128.19
1955	34.39	-	-	174.53	6.37	28.02	156.21
1956	31.49	-	-	206.02	7.93	23.56	179.77
1957	31.54	-	-	237.56	9.36	22.18	201.95
1958	23.20	-	-	260.76	10.80	12.40	214.35
1959	28.39	-	-	289.15	11.85	16.54	230.89
1960	29.30	-	-	318.45	13.14	16.16	247.05
1961	25.95	-	-	344.40	14.48	11.47	258.52
1962	21.25	-	-	365.65	15.65	5.60	264.12
1963	23.01	-	-	388.66	16.62	6.39	270.51
1964	21.39	-	-	410.05	17.67	3.72	274.23
1965	20.29	-	-	430.34	18.64	1.65	275.88
1966	18.47	-	-	448.81	19.56	(1.09)	274.79
1967	30.68	-	-	479.49	20.40	10.28	285.07
1968	39.21	-	-	518.70	21.80	17.41	302.48
1969	49.37	-	-	568.07	23.58	25.79	328.27
1970	33.17	-	-	601.24	25.82	7.35	335.62
1971	27.96	-	-	629.20	27.33	.63	336.25
1972	20.36	28.97	(8.61)	620.59	28.60	(8.24)	328.01
1973	48.53	20.79	27.74	648.33	28.21	20.32	348.33
1974	57.58	28.42	29.16	677.49	29.47	28.11	376.44
1975	44.44	27.92	16.52	694.01	30.80	13.64	390.08
1976	34.66	34.04	.62	694.01	31.55	3.11	393.19
1977	36.52	34.39	2.13	696.76	31.57	4.95	398.14
1978	49.66	31.49	18.17	714.93	31.67	17.99	416.13
1979	70.63	31.54	39.09	754.02	32.50	38.13	454.26
1980	180.99	23.20	157.79	911.81	34.27	146.72	600.98
1981	409.50	28.39	381.11	1,292.92	41.45	368.05	969.03
1982	358.66	29.30	329.36	1,622.28	58.77	299.98	1,268.92
1983	287.80	25.95	261.85	1,884.13	73.74	214.06	1,482.98
1984	410.14	21.25	388.89	2,273.02	85.64	324.50	1,807.48

Sources: Canada, Canadian Minerals Yearbook
(Ottawa: Energy, Mines and Resources)

William C. Hood and Anthony Scott, Output, Labour and Capital in the Canadian Economy (Ottawa: Royal Commission on Canada's Economic Prospects, February, 1957).

CAPITAL : OUTPUT AND CAPITAL : LABOUR RATIOS (1921 - 1933)
FOR THE AURIFEROUS QUARTZ INDUSTRY IN CANADA
 USING THE BALANCE SHEET METHOD

Year	(1) Real Value of Net Capital Stock (\$ Million)	(2) Physical Output (Millions of Troy Ounces)	(3) Number of Employees	(4) Capital Output Ratio (\$: Ounces)	(5) Capital Labour Ratio (\$: Employee)
1921	186.93	.711	3,889	263 : 1	48,066 : 1
1922	158.32	1.018	5,441	156 : 1	29,098 : 1
1923	333.46	.981	5,524	340 : 1	60,366 : 1
1924	353.63	1.255	6,738	282 : 1	52,483 : 1
1925	376.41	1.479	7,052	255 : 1	53,376 : 1
1926	439.52	1.526	7,663	288 : 1	57,356 : 1
1927	528.31	1.640	8,022	322 : 1	65,858 : 1
1928	543.22	1.673	9,066	325 : 1	59,918 : 1
1929	580.22	1.678	8,660	346 : 1	67,000 : 1
1930	611.03	1.783	8,401	343 : 1	72,733 : 1
1931	595.30	2.256	9,636	264 : 1	61,779 : 1
1932	252.65	2.524	10,442	100 : 1	24,196 : 1
1933	876.25	2.444	12,823	359 : 1	68,334 : 1

Sources: Canada, Mineral Production of Canada
 (Ottawa: Dominion Bureau of Statistics, 1921-1933).

William C. Hood and Anthony Scott, Output, Labour and Capital
in the Canadian Economy (Ottawa: Royal Commission on Canada's
 Economic Prospects, February, 1957).

CAPITAL : OUTPUT AND CAPITAL : LABOUR RATIOS (1972 - 1984)
FOR THE AURIFEROUS QUARTZ INDUSTRY IN CANADA
USING THE CUMULATIVE METHOD

Year	(1) Real Value of Net Capital Stock (\$ Million)	(2) Physical Output (Millions of Troy Ounces)	(3) Number of Employees	(4) Capital Output Ratio (1):(2) (\$: Ounces)	(5) Capital Labour Ratio (1):(3) (\$: Employee)
1972	328.01	1.598	5,575	205 : 1	58,836 : 1
1973	348.33	1.432	5,603	243 : 1	62,168 : 1
1974	376.44	1.213	5,665	310 : 1	66,450 : 1
1975	390.08	1.207	5,798	323 : 1	67,278 : 1
1976	393.19	1.232	5,051	319 : 1	77,844 : 1
1977	398.14	1.216	4,643	327 : 1	85,751 : 1
1978	416.13	1.168	4,943	356 : 1	84,186 : 1
1979	454.26	1.087	5,013	418 : 1	90,616 : 1
1980	600.98	1.027	5,839	585 : 1	102,925 : 1
1981	969.03	1.153	6,809	840 : 1	142,316 : 1
1982	1,268.92	1.539	7,350	825 : 1	172,642 : 1
1983	1,482.98	1.785	7,956	831 : 1	186,398 : 1
1984	1,807.48	2.011	8,450	899 : 1	213,903 : 1

Sources: Canada, Canadian Minerals Yearbook
(Ottawa: Energy, Mines and Resources)

William C. Hood and Anthony Scott, Output, Labour and Capital
in the Canadian Economy (Ottawa: Royal Commission on Canada's
Economic Prospects, February, 1957).

ANALYSIS OF STABILITY USING SIMPLE REGRESSION

(Stability increases as the coefficient of determination (r^2) approaches 1.0)

<u>PRODUCTION (Real Value)</u>		r^2 (1918-33)	r^2 (1934-70)	r^2 (1971-84)
1.	Auriferous Quartz Industry - using the real value of annual gold quartz production.	.8172	.6755	.8050
2.	Total Mineral Industry - using the real value of annual mineral production, excluding the real value of all gold production.	.1975	.8754	.8314
<u>PRODUCTION (Physical)</u>		(1918-33)	(1934-70)	(1971-85)
1.	Auriferous Quartz Industry - using the annual level of gold production in troy ounces.	.9662	.0638	.1097
<u>EMPLOYMENT</u>		(1918-33)	(1934-70)	(1971-85)
1.	Auriferous Quartz Industry - using the real value of total annual salaries and wages.	.9149	.5621	.4018
2.	Total Mineral Industry - using the real value of total annual salaries and wages.	.0011	.9076	.2219
<u>PRICE (Real)</u>		(1918-33)	(1934-70)	(1971-86)
1.	Gold - using the real value of the average annual gold prices.	FIXED PRICE		.3620