Investment in Gold Futures:

An Empirical Investigation in Kerala

Thesis submitted to the

UNIVERSITY OF CALICUT

For the award of degree of

DOCTOR OF PHILOSOPHY IN COMMERCE

Under the Faculty of Commerce and Management Studies

By

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November 2023

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Acknowledgement

Ph.D. has been a truly life changing experience for me, and it would not have been possible to dwithout the support and guidance that I received from many people.

A book of words may fall short to express my heartfelt admiration and gratitude to my research supervisor and mentor, Dr. Biju John M, Professor and Dean, Research Department of Commerce, St. Thomas' College (Autonomous), Thrissur, who has offered the inspirational guidance, support, and encouragement during my research work. The subject knowledge and experience he possesses was phenomenally stimulating for me. I feel very fortunate to have pursued my Ph.D. under his benign supervision. I am deeply indebted to him for giving me an opportunity to pursue Ph.D. under his guidance.

I express my deep gratitude to the University Grants Commission for the financial assistance (JRF) extended for my research work during 2017-2020. I express my sincere thanks to the former Head of the Department, Dr. Thomas Paul Kattookkaran, the current Head of the Department Dr. Daisland Thattil and the entire faculty of the Research Department of Commerce for their valuable support and sincere co-operation throughout the period of my research work. I am extremely grateful to the former Principals, Dr. Joy K L, Dr. Ignatius Antony, Dr. Jenson P.O and the present Principal-in-charge Fr. Dr. Martin K A for arranging all facilities in the college for my research work.

I owe much to Dr. V M Chacko-Research Council Coordinator, Dr. Xavier Joseph, VC Nominee and Associate Professor, Department of Physics, Christ College, Irinjalakkuda and all other doctoral committee members for their constant support.

I am very thankful to Dr. Aparna Sajeev, Expert Member of the Doctoral Committee, Dr. B Johnson, Dean of the Department of Commerce and Management Studies and Dr. M A Joseph, Former Head, Department of Commerce and Management Studies, University of Calicut for the valuable directions and comments given during my research work. A special thanks to Dr. Vinod V. M., Librarian, C.H.M.K., for all the facilities and guidance provided for the plagiarism checking of my thesis. I also thank all other faculties in the Department of Commerce, University of Calicut.

I express my gratitude to the Director of Research of the University of Calicut and the whole team, for all the facilities provided for undertaking the research.

I would like to specially mention the selfless efforts of Dr. Tom Jacob, Assistant professor, Christ College (Autonomous), Irinjalakuda and Dr. Nishija Unnikrishnan whose guidance and suggestions enhanced the quality of my research work. I wish to extend my sincere thanks to the Librarian Mr. Sanjo Jose and all other administerial staff of St Thomas' College (Autonomous), Thrissur for all the facilities given during my research.

I would like to thank my friends, Dr. Anoop K G, Dr. Darsana Sudharsan, Dr. Urmila R Menon, Choondal Alfred Deepthi, Athira J, Harishma C, and Midhunlal M M for their unconditional support and motivation.

I would like to extend my gratitude to my reporting officers, colleagues, and administration division in National Highways Authority of India- Headquarters, who has offered support to balance research along with official duties at work.

My study would not have been completed without the pillars of support, blessings born as humans- my parents Mrs. Rajeswary S and Mr. Ramesh V. I remember with love the constant encouragement of my brother Mr. Vignesh R throughout my research. I would like to remember gratefully the love and support of my father-in-law Mr. Gopalakrishnan R G, mother-in-law Mrs. N S Usha and brother-in-law Mr. Ajith Subramanian R G.

I am extremely thankful to my husband, Mr. Ajay Ganesh R G, who stood by when I was in dire need of a hand to hold and without his love, support and tolerance, this work would not have been possible. I am immensely grateful to my beloved daughter Ms. Samruddhi Ajay who adjusted a lot with her time, her infanthood to support her mother in research.

Above all, I express my unlimited gratefulness to the Lord Almighty for the endless blessings showered upon me for the successful completion of my research work.

Remya R.

CONTENTS

Abbreviations

ADF	Augmented Dickey Fuller
AIC	Akaike Information Criterion
ANOVA	Analysis of Variance
ARIMA	Auto Regressive Integrated Moving Average
BBA	Bombay Bullion Association
BBE	Bombay Bullion Exchange Limited
BIC	Bayesian Information Criterion
BSE	Bombay Stock Exchange
CBOT	The Chicago Board of Trade
CMP	Current Market Price
COMEX	The Commodity Exchange Inc.
COVID-19	Coronavirus Disease of 2019
CTT	Commodity Transaction Tax
DGFT	Director General of Foreign Trade
ECM	Error Correction Model
ECT	Error Correction Term
ETF	Exchange Traded Fund
GDP	Gross Domestic Product
HQ	Hannan-Quinn's Information Criterion
IMF	International Monetary Fund
KMO	Kaiser-Meyer-Olkin
LBMA	London Bullion Market Association
LR	Log Likelihood Ratio
MCX	Multi-Commodity Exchange
MPCE	Monthly Per Capita Expenditure
NAV	Net Asset Value
NCDEX	National Commodity and Derivatives Exchange Limited
NMCE	National Multi Commodity Exchange of India
NSE	National Stock Exchange
NSSO	National Sample Survey Organisation
RBI	Reserve Bank of India
S.E	Standard Error
SD	Standard Deviation

SEBI	Securities Exchange Board of India
SIC	Schwarz Information Criteria
Sig.	Significance
SPDR	Standard & Poor's Depository Receipt
SPSS	Statistical Package for Social Science
UPA	United Progressive Alliance
USD	United States Dollar
VAR	Vector Auto Regression
VECM	Vector Error Correction Model
WGC	World Gold Council

Abstract

The commodity market of gold opens up excellent opportunities to benefit out of the market movements without really investing in physical gold like gold stocks, gold futures, gold options, gold exchange traded funds etc. Gold futures is the most popular way of investing in non-physical gold which has recorded glittery returns. Kerala is the largest gold consuming state in India. Despite the increasing returns at increasing rate yielded by gold futures in the long run, investors in Kerala are reluctant to make even a moderate share of their investment in non-physical gold like gold futures. The forecasted future of any investment is the product of investor expectations. The investment determinants of investors play an elementary role in expounding the trend of the market. The present study is intended to investigate the relationship between the gold prices and stock market returns in India, analyze the trend and performance of gold prices in India, analyze the efficiency of gold futures in price discovery of gold in India, study the perception and attitude towards gold futures and analyze the determinants of investment in gold futures among investors in Kerala.

Gold prices have been found to have a predominant bullish trend in its movements. The price of gold is forecasted to have a strong and linear growth at a uniform rate in India in upcoming years which indicates the growth in return on gold investments in the future. The role of futures in arriving these prices is not a negligible one since the unilateral causality to spot prices itself implies the domination of gold futures market in the price discovery.

Though the perception of investors in Kerala towards gold futures seems to differ pre and post investment. The relationship between determinants of investment taken into consideration by investors in Kerala leads to the belief the investor may upkeep towards the investment in gold futures and ultimately market is not free from investor irrationality. Investor attitude is hence a product of multiple dimensions of gold futures market and its characteristics as well as how the same is perceived by investors.

Key words: Gold, Gold futures, Price discovery, Investment Determinants and Investment Satisfaction.

സംഗ്രഹം

സ്വർണ്ണ സ്റ്റോക്കുകൾ, ഗോൾഡ് ഫ്യൂച്ചറുകൾ, ഗോൾഡ് ഓപ്ഷനുകൾ, ഗോൾഡ് എക്സ്ചേഞ്ച് ട്രേഡഡ് ഫണ്ടുകൾ തുടങ്ങിയ ഭൗതിക സ്വർണ്ണത്തിൽ യഥാർത്ഥത്തിൽ നിക്ഷേപിക്കാതെ തന്നെ വിപണി ചലനങ്ങളിൽ നിന്ന് പ്രയോജനം നേടാനുള്ള മികച്ച അവസരങ്ങൾ സ്വർണ്ണത്തിന്റെ ചരക്ക് വിപണി തുറക്കുന്നു ഇന്ത്യയിൽ ഏറ്റവും കൂടുതൽ സ്വർണം ഉപയോഗിക്കുന്ന സംസ്ഥാനമാണ് കേരളം. ദീർഘകാലാടിസ്ഥാനത്തിൽ സ്വർണ്ണ ഫ്യൂച്ചർ നിക്ഷേപം വഴി ലഭിക്കുന്ന വർദ്ധന നിരക്കിൽ വരുമാനം വർദ്ധിക്കുന്നുണ്ടെങ്കിലും, കേരളത്തിലെ നിക്ഷേപകർ തങ്ങളുടെ നിക്ഷേപത്തിന്റെ മിതമായ പങ്ക് പോലും സ്വർണ്ണ ഫ്യൂച്ചറുകൾ പോലെയുള്ള ഭൗതികേതര സ്വർണ്ണത്തിൽ നിക്ഷേപിക്കാൻ വിമുഖത കാണിക്കുന്നു.

ഏതൊരു നിക്ഷേപത്തിന്റെയും പ്രവചിക്കപ്പെട്ട ഭാവി നിക്ഷേപകരുടെ പ്രതീക്ഷകളുടെ ഫലമാണ്. വിപണിയുടെ പ്രവണത വിശദീകരിക്കുന്നതിൽ നിക്ഷേപകരുടെ നിക്ഷേപ നിർണ്ണായക ഘടകങ്ങൾ ഒരു പ്രാഥമിക പങ്ക് വഹിക്കുന്നു. നിക്ഷേപകർ സ്വർണ്ണ ഫ്യൂച്ചറുകൾ എങ്ങനെ കാണുന്നു, അതിനെ ഒരു നിക്ഷേപമായി അവർ എങ്ങനെ ചിത്രീകരിക്കുന്നു എന്നത് വിപണിയുടെ വ്യാപ്തി നിർണ്ണയിക്കും ഇന്ത്യയിലെ സ്വർണ്ണ വിലയും ഓഹരി വിപണി വരുമാനവും തമ്മിലുള്ള ബന്ധം അന്വേഷിക്കാനും, ഇന്ത്യയിലെ സ്വർണ്ണ വിലയുടെ പ്രവണതയും പ്രകടനവും വിശകലനം ചെയ്യാനും, ഇന്ത്യയിൽ സ്വർണ്ണത്തിന്റെ വില കണ്ടെത്തുന്നതിൽ സ്വർണ്ണ ഫ്യൂച്ചറുകളുടെ കാര്യക്ഷമത വിശകലനം ചെയ്യാനും, ധാരണയും മനോഭാവവും പഠിക്കാനും ഉദ്ദേശിച്ചുള്ളതാണ് ഇപ്പോഴത്തെ പഠനം.

സ്വർണ്ണ വിലയുടെ ചലനങ്ങളിൽ ഒരു പ്രധാന ബുള്ളിഷ് പ്രവണത ഉണ്ടെന്ന് കണ്ടെത്തിയിട്ടുണ്ട്. വരും വർഷങ്ങളിൽ സ്വർണ്ണത്തിന്റെ വില ഇന്ത്യയിൽ ഒരു ഏകീകൃത നിരക്കിൽ ശക്തവും രേഖീയവുമായ വളർച്ച ഉണ്ടാകുമെന്ന് പ്രവചിക്കപ്പെടുന്നു. ഇത് ഭാവിയിൽ സ്വർണ്ണ നിക്ഷേപത്തിൽ നിന്നുള്ള വരുമാനത്തിന്റെ വളർച്ചയെ സൂചിപ്പിക്കുന്നു.

സ്പോട്ട് മാർക്കറ്റിനെ ഒരു നിശ്ചിത കാലയളവിൽ ഫ്യൂച്ചേഴ്സ് മാർക്കറ്റ് ചലനങ്ങളുടെ ഒരു ഉൽപ്പന്നമായി കാണാനാകും. കൂടാതെ ഫ്യൂച്ചറുകളിലെ ആഘാതങ്ങളോട് ആദ്യത്തേത് അസ്ഥിരമായ രീതിയിൽ പ്രതികരിക്കുന്നു.

സ്വർണ്ണ ഫ്യൂച്ചറുകളോടുള്ള കേരളത്തിലെ നിക്ഷേപകരുടെ മനോഭാവം വളരെ പോസിറ്റീവോ പ്രതികൂലമോ ആയി തുടരുന്നു. സ്വർണ്ണ ഫ്യൂച്ചറുകളോടുള്ള നിക്ഷേപ മനോഭാവം രൂപപ്പെടുത്തുന്നതിൽ നിക്ഷേപ നിർണ്ണയകർക്ക് ഒരു പ്രധാന പങ്കുണ്ട്. കേരളത്തിലെ നിക്ഷേപകർ കണക്കിലെടുക്കുന്ന നിക്ഷേപത്തിന്റെ നിർണ്ണായക ഘടകങ്ങൾ തമ്മിലുള്ള ബന്ധം നിക്ഷേപകൻ സ്വർണ്ണ ഫ്യൂച്ചറുകളിലെ നിക്ഷേപം നിലനിർത്താമെന്ന വിശ്വാസത്തിലേക്ക് നയിക്കുന്നു, ആത്യന്തികമായി വിപണി നിക്ഷേപകന്റെ യുക്തിരാഹിത്യത്തിൽ നിന്ന് മുക്തമല്ല. അതിനാൽ നിക്ഷേപക മനോഭാവം സ്വർണ്ണ ഫ്യൂച്ചർ മാർക്കറ്റിന്റെ ഒന്നിലധികം അളവുകളുടെയും അതിന്റെ സവിശേഷതകളുടെയും അതുപോലെ തന്നെ നിക്ഷേപകർ അത് എങ്ങനെ മനസ്സിലാക്കുന്നു എന്നതിന്റെയും ആകെത്തുകയാണ്.

Chapter 1
INTRODUCTION

Contents

1.1 Introduction

Gold is one of the earliest precious metals that humans have ever encountered and has been utilized as a medium of exchange for thousands of years. Given its beauty and allure, gold has long held a special place in Indian history and has drawn people from all over the world. Across borders and oceans, its golden radiance could be seen, stirring sentiments in the hearts of millions of people. The majority of the gold consumed worldwide is consumed by Indians, a testament to the country's growing obsession with the metal over the years.

Gold has long been sought after, and this desire is unwavering. Yellow metal is extremely rare. It makes up just 0.000000002 of the Earth's crust—which determines its lasting value. A 22-meter-square cube could hold all of the gold that has ever been extracted. Bursts of nuclear energy within or between stars produced gold billions of years ago. While certain deposits have been on the planet's surface since

asteroids crashed into it, others have been at the planet's core since the planet's creation. It eventually found itself strewn throughout the world's streams, hidden beneath seas, and buried beneath mountains. Approximately 50,000 tonnes, or more than £2 billion, are estimated to still remain undiscovered. A typical bar of gold is almost twice as dense as lead and weighs around 12 kg. Gold is surprisingly agile for its weight. One ounce of it may be hammered into a sheet 100 times thinner than paper or pulled into a wire five miles long. Unlike the majority of other materials, it does not rust, corrode, or degrade and is infinitely recyclable. Numerous historical societies revered the metal as sacred. Some called it "sweat" or "tears" of the sun, while the Incas referred to it as "the flesh of the gods." The chemical symbol Au for gold comes from the Latin aurum, which is derived from Aurora, which means "dawn." These heavenly connections have not disappeared. Rulers have surrounded themselves with gold, from Tutankhamun to Midas, Augustus the Strong to Louis the Sun King, as its shining surfaces are the ideal symbol of immortality. This explains why gold was laid on a baby in a manger over 2,000 years ago—a baby who, like the rising sun, emerged from the dead.

India is one of the largest and rapidly growing gold market in the world. Gold and India have a deeply rooted cultural connect. Ever since the nation has a recorded history, gold has been playing an inevitable role since then. Gold has been the currency at one point of time, gold has been a wealth and status symbol, gold has been used in rituals and as a part of traditions, gold has been transferred to generations as ancestral property and gold has been an ornamental metal from time immemorial.

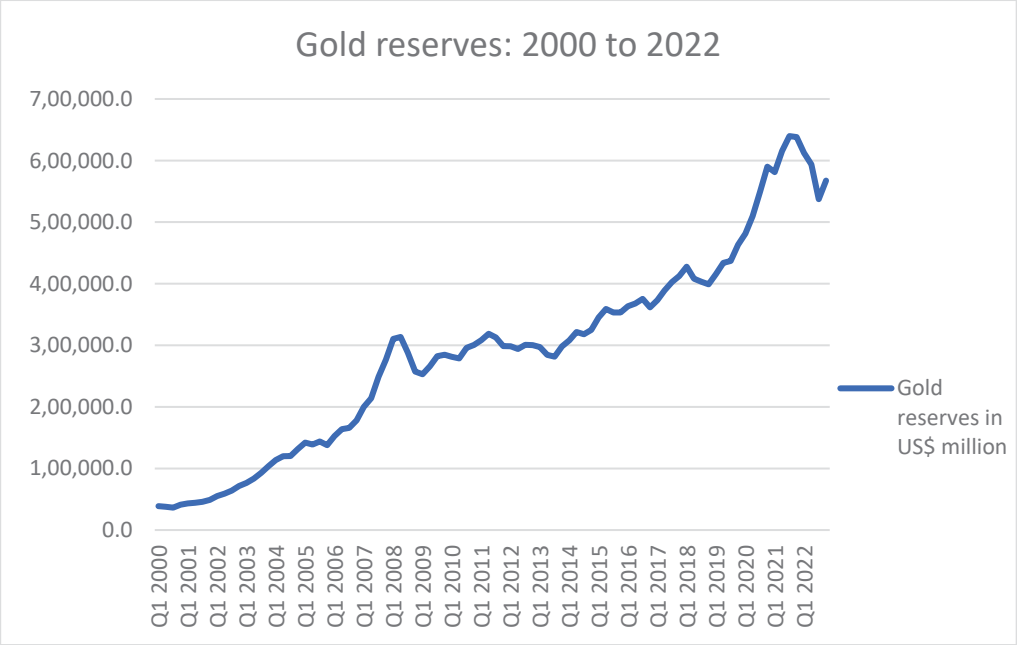
From an economic perspective, gold is an investment, gold is an economic indicator, gold decides interest rates, gold is universally accepted barter. Going beyond its investment aspect, central banks of all nations keep reserves of gold for its safety, liquidity, and return. It is one of the most important reserve assets in the world since it doesn't carry credit or counterparty concerns. It is a source of assurance for a nation and in all economic circumstances. Central banks are the significant holders of gold.

As per the World Gold Council, central banks account for one-fifth of total gold.

Figure 1.1 shows the trend of gold reserves kept by Reserve Bank of India since 2000. It is clearly seen that the reserves are increasing with time. It indicates that despite the supply constraints probable to occur being a natural resource, the purchasing pattern is always positive as far as India gold demand is concerned.

Figure 1.1

Gold reserves: Trend from 2000 to 2022



Source: World Gold Council

The importance of gold and gold prices has multiple facets which may fall too short for a study. However, it is capable of instilling curiosity in anyone to go deeper for insights.

1.1.1 Determinants of Gold Prices

Gold is always seen as an excellent choice of investment and as a safe haven. The determinants of international gold prices are given in this section.

- **Increasing Demand**

The gold market today is a shifting, expanding kaleidoscope. Since the early 1970s, the annual quantity of gold acquired has nearly tripled, and gold markets have grown globally. People buy gold for a number of reasons all over the world, with national sociocultural influences, local market conditions, investment perspectives and macroeconomic considerations all playing their respective parts. Gold is always read with its emotional, cultural, and financial worth. Due to the wide range of uses for which gold is employed, including jewelry, technology, central banks, and investment, distinct sectors of the gold market emerge at certain points in the global economic cycle. Gold's strong attributes as an investment asset are strengthened by the self-balancing nature of the market and the variety of gold demand.

- **Limited Supply**

Gold is not consumed like coffee or oil. Nearly all of the gold that has ever been extracted is still in existence, and more is added every day. On the other hand, annual demand requires more gold than can be extracted; the difference is filled by recycling. Changes in pricing do not immediately affect mine-production. There is typically a long wait between prospecting for and finding new gold reserves and a mine beginning production. Since gold is almost unbreakable, almost all of the gold that has ever been extracted is potentially still accessible and recyclable. The gold supply source that responds to shifts in the gold market and shocks the economy the quickest is recycling.

- **Interest Rates**

The monetary policy of the central bank is important to players in the financial markets, especially to those who trade and own gold. The increase in short-term interest rates drives up the cost of storing gold. The higher the interest rate, the less money that would have been made had gold been held in place of interest-bearing assets. Because of this, the market price of gold increases along with the fall in interest rates and rise in the desire for the metal.

- **Gross Domestic Product**

Gold prices are significantly influenced by GDP growth over the long term for a number of reasons. The demand for gold jewelry is positively correlated with rising incomes (World Gold Council, 2023). The need for gold in technological applications increases in lockstep with economic expansion. Additionally, the proportion of household savings allocated to gold increases with affluence. Moreover, GDP growth has historically had the greatest positive impact on long-term gold prices in emerging markets like Asia.

- **Hedge Against Inflation**

An inflation hedge refers to an investment strategy that aims to protect a currency from losing value owing to inflation or macroeconomic increases in expenses, ultimately leading to a decline in buying power. With its value increasing in line with the cost of living and frequently reaching its maximum point during periods of severe inflation, gold is arguably the only commodity that both maintains its value and guards against inflation.

- **Liquidity**

Because gold is so liquid, investors can exchange it in times of need for cash or in an emergency. This valuable metal is always in demand, making it simple to sell even under the most trying circumstances.

- **Tangible Asset**

Since gold is one of the handful tangible assets, investors tend to feel safer while investing in it. Purchasing gold is less complicated than buying other tangible assets, such as real estate.

- **Portfolio Diversification**

An investment portfolio needs to be diversified in order to assist balance out the risk. Gold's value is inversely correlated with conventional investment options like stocks. In this sense, gold investments in India might serve as a buffer against market instability.

- **Safe Haven**

When there is market instability, people typically prefer to place funds in or purchase gold as an asset. Political unrest or a downturn in the economy could be the cause of this. Gold is considered an attractive choice when other assets experience a decline in value due to its long-term stability. Furthermore, uncertainty is more behavioural in nature and cannot be measured, in contrast to other factors influencing the price of gold.

- **Demand from Central Bank**

Gold has been a major component of financial reserves of the government for many years, and for the next 10 years, central banks are expected to continue buying gold on a net basis, indicating that the asset's attraction is not abating. In fact, central banks already own more than 35,000 metric tons of gold, or about a quarter of all gold ever mined. Central banks purchase gold for a number of purposes, including diversification of their portfolio and use as a safe haven asset.

- **Cultural Significance**

Gold has religious and cultural connotations and relevance in India. Weddings, festivals, ceremonies, and so on are loaded with gold. Price increases may result from the increased demand for gold jewellery during certain periods.

Over the past few decades, a great deal of research has focused on analyzing a nation's capital market in terms of numerous macroeconomic and financial characteristics. According to empirical research, a nation's stock markets become more vulnerable to both internal and external forces after financial deregulation occurs. The cost of gold is one such element. The price of gold was controlled between 1900 and 1971 by the international gold standard and USD standard systems. However, gold has been decoupled from the USD since 1972. The Jamaica agreement which was passed by International Monetary Fund (IMF) in the year 1976 marked the beginning of gold's transition from currency to common goods. Ever since, the price of gold has been set by supply and demand in the market. Furthermore, India's government began the liberalization and globalization process in 1991, allowing market forces to set prices. Import parity prices, which are

determined by international gold spot prices, the exchange rate of Dollar in Rupee, and regional taxes and levies, have a significant impact on domestic gold pricing in India. Any change in global prices is immediately communicated and mirrored in domestic pricing, especially for countries like India that accept the gold price and import a significant portion of their requirements.

Subsequently, the government has been implementing a variety of measures to restructure the gold industry and guarantee that India gains from its demand-influence on the global gold market. The monopoly of State Trading Corporations was broken by first allowing a number of banks to import gold, which led to the significant reduction of import duties and the closure of a profitable illegal trade route. Currently, traders, manufacturers, and investors are able to trade in various investment alternatives related to gold within the borders of India.

1.1.2 Types of investment in gold

Although there are many different kinds of precious metals, gold is highly valued as an investment. Gold is one of the most favored investment options because of a number of influencing variables, including its high liquidity and ability to overcome inflation. The ideal investment strategy for exposure to gold will differ depending on the investor's objectives. Though there can be expenses for keeping and insuring physical gold, investors can directly buy the precious metal in physical form, such as coins or bullion. Moreover, gold can be purchased through the futures and options markets. Mutual funds and exchange-traded funds (ETFs), like SPDR Gold Shares (GLD), are popular choices for investors. Lastly, while the relationship between the performance of mining stocks and gold may differ, owning shares of these companies provides another way of access to gold. Gold has always held cultural significance and a special place in Indian homes and hearts, making it more than just a wise investment. In addition, gold's ‘status symbol’ and religious overtones have elevated it to a pedestal in India, where it is expected to remain for a very long time. Gold assets come in a variety of forms that can be traded or purchased. These consist of the following:

- **Gold Bullion**

Both private investors and banks frequently utilize physical gold in the form of bars and coins as a hedge of value. Nevertheless, more active investors are frequently discouraged from purchasing the physical form of metal outright because of its costly insurance and storage requirements.

- **Gold Spot**

The cost of acquiring gold up front, or "on the spot," is known as the spot price. It costs roughly as much as a single troy ounce of gold on average. One common way to gain access to bullion without having to purchase the precious metal is to invest in spot gold.

- **Gold Futures**

Setting the price of gold for a predetermined date is the crux of gold futures contracts. Traders are responsible for keeping their half of the bargain, whether that means settling in cash or in kind. The quantity and quality of futures contracts are standardized, while only the price is subject to market forces.

- **Gold Options**

Similar to futures, options contracts do not necessitate executing the trade when you buy. Options holders have the option to swap actual gold or gold futures at a pre-agreed price on a predetermined date. The right to purchase the precious metal is granted by call options, whilst the right to sell it is granted by put options.

- **Gold ETFs**

Exchange-traded funds, or ETFs, monitor the performance of a group of publicly traded companies that engage in the mining, processing, and production of gold. ETFs are a well-liked method of portfolio diversification because they provide you with far more exposure than a single position would. ETFs are passive, minimal trading vehicles that mimic the performance of the market rather than aiming to beat it.

- **Gold Stocks**

Investing in stocks or trading them can be excellent ways to have indirect access to gold. Exposure to all facets of the gold industry is possible, ranging from funding and sales to mining and production. It's crucial to remember that a variety of other factors influence share values, so gold stocks don't necessarily move in tandem with bullion.

1.1.3 Development of Commodity market of Gold

The development of an investment culture within a nation's populace is a necessary precondition for capital generation and speedier economic expansion. Investment culture describes the mindsets, perspectives, and propensities of people and organizations to invest their money in securities, or other financial assets. Therefore, a study on investor attitudes and preferences for gold futures takes on more importance when it comes to developing regulations and policies for the securities markets that safeguard and encourage small-scale household investors in particular.

1.1.3.1 Overview of Commodities Market

The foreign exchange market, stock market, and commodities markets provide the most comprehensive categorization of the Indian financial market. Commodity markets are marketplaces where basic goods are traded. The unprocessed commodities are purchased and sold under standardized contracts in regulated commodities exchanges. The modern commodities markets had their genesis in the trading of agricultural products. Commodities are of two categories: hard and soft commodities. While livestock and agricultural products are considered soft commodities, hard commodities are usually mined or extracted from natural resources. Regardless of whether a commodity is soft or hard, supply and demand always play a major influence in price. Nonetheless, there are some fundamental differences between these two types of commodities in terms of aspects like affordability, storability, renewability, transaction cost, degree of scarcity, and so forth.

The European exploration expeditions of the fifteenth century marked the beginning of the world trading era. This age showed signs of globalization in the sense of uniting the formerly divided markets of the old and new worlds. According to Flynn & Giráldez (1995), the founding of the city of Manila in 1571 marked the beginning of what is now known as "world trade," which connected trade between Europe, Asia, Africa, and America. However, trade across long distances was mostly limited to goods with a high value-to-weight and bulk ratio because transportation costs were still higher than manufacturing costs. Spices, silk, silver, and, not surprisingly, slaves were some of the common goods exchanged back then. However, the pathways were set up so that, in due course, the amount of global trade could grow due to a variety of circumstances, including population expansion, accumulation of wealth, and technical improvement. Between 1500 and 1780 AD, there was a steady change in the kinds of products that were exchanged. Bulkier items started to be shipped as time went on. However, intercontinental trade in homogenous bulk goods that could be produced anywhere did not start until the major advancements to transportation infrastructure in 19th century.

The 19th and 20th centuries saw the rise of integrated commodities markets, which were primarily fueled by advancements in technology and political upheaval. But this tendency toward increased market integration was not constant; endogenous political reactions to the distributional impacts of globalization itself, or shocks like wars and worldwide depressions, would occasionally halt it. Politics has had the impact of either amplifying or mitigating the consequences of technology across time. Because of politically induced hysteresis, there have been multitudinous instances where major shocks have had long-term consequences on the international integration of commodity markets.

1.1.3.2 The Ascent of Spot and Future Market

Trading in commodities futures developed out of the demand for a reliable, steady supply of seasonal crops. In Chicago, the idea of organized commodity trading

began to take shape in 1848. However, its origins can be found in Japan, where traders once kept rice in warehouses for later consumption. The warehouse holders bartered receipts against the rice they had stored in order to raise money. They were referred to as "rice tickets." These rice tickets got appealed as a kind of tender in the course of time. As time went on, regulations were established to harmonize the barter of rice tickets.

Midwestern wheat growers were drawn to Chicago in the 19th century as a result of the city's emergence as a significant commercial center, where they could sell their goods to wholesalers and dealers. The producers were frequently left to the whims of merchants due to issues including a lack of uniform weighing and grading systems, disorganized storage facilities, etc. Due to these circumstances, farmers and dealers needed to have a regular location where they could execute spot grain transactions in order to supply wheat and get payment.

With time, contracts for "futures trading" developed as buyers and sellers began agreeing to swap the produce for money at a later time. Under these agreements, the producer would promise to sell his produce at a predetermined price on a future delivery date. Such contracts would be priced based on changes in the wheat market's prices. These contracts then underwent changes to operate as a safety net against unfavorable events like unforeseen price swings and unfavorable weather conditions. Thus, traders were captivated to enter the futures market; their sole goal was to speculate on market price currents in order to make money, with hardly any intention to buy or sell wheat.

This, in reality, provided the groundwork for the creation of an organization to control and oversee these agreements. The Chicago Board of Trade (CBOT), founded in 1848, was one of the first organizations of this type. Buyer and seller availability determined the demand for traded commodities. Nonetheless, trading in agricultural goods was more widespread. The New York market was in disarray when a group of dairy merchants from Manhattan banded together in 1872 to create a system for the transfer, pricing, and storage of agricultural goods. Amidst the Great Depression in 1933, the National Metal Exchange, the Rubber Exchange of New

York, the National Raw Silk Exchange, and the New York Hide Exchange amalgamated to form the Commodity Exchange Inc. in New York.

1.1.3.3 Indian Commodity Market Scenario

Gold has always possessed a parallel connection with the indigenous culture of the country. India being second largest consumer of gold after China uses the yellow metal in & as investments, asset diversifiers, substitute for currency, insurance against financial stress, hedge against inflation, official reserves, jewellery manufacturing, industrial applications and medicinal ingredients. World Gold Council has drawn attention of the globe towards supply-demand patterns of gold in India considering mention-worthy over and above rest of the countries with a growth rate of 304% in annual demand for gold in India since 1987. Affinity for gold increased in India due to twin reasons- high propensity to save and lack of awareness regarding alternate financial instruments.

Although physical gold markets have marked its existence for a very long time, the facet of gold as a financial instrument has been a recent phenomenon. Active trading involved around the yellow metal since its evolution has paved its path to derivative floors since commodity derivatives pioneered.Since the early 2000s, when futures trading was revived in the nation, domestic exchanges have provided effective price risk management instruments, such as gold futures, to hedge against price volatilities and protect domestic stakeholders in the gold value chain from risk resulting from price fluctuations. Before this, in 1920, Bombay's bullion forwards market was among the biggest globally, since the establishment of the renowned Bombay Bullion Association (BBA) in 1919. Following this, on January 24, 1923, the Bombay Bullion Exchange Ltd. (BBE) was incorporated as a corporation that progressively expanded to provide dealers with vaults for deposits.

Nevertheless, gold derivatives trading has picked up steam again in the mid-2000s due to the resurgence of futures trading and the launch of internet trading platforms by the national multicommodity exchanges. In October 2003, the National Multi Commodity Exchange of India (NMCE) offered the first contract for gold futures,

and in November 2003, the Multi Commodity Exchange of India offered the second contract. Then, on October 17, 2017, gold options contracts were introduced for the first time on MCX. After experiencing a resurgence, gold futures volumes saw a robust growth of roughly 115% annually during the first ten years, from 2003 to 2012, reaching an average daily turnover of over Rs. 12 thousand crores. However, in 2014, these volumes sharply declined to roughly Rs. 4.6 thousand crores due to the imposition of the Commodity Transaction Tax (CTT) in July 2013, which significantly increased the impact cost of futures trading. Even though gold futures volumes significantly increased in 2019 to approximately Rs. 5.7 thousand crores, they were still far lower than they were before to the CTT era.

The MCX is at the forefront of discussion because it is the most traded gold futures market in India. On November 10, 2003, MCX was founded as a stand-alone, demutualized exchange for multiple commodities. Globally traded commodities like gold, silver, copper, crude oil, and natural gas are the main emphasis, which caters to a wide range of participants encompassing producers, traders, importers, and exporters. Opening hours for the market are Monday through Saturday. A computerized platform is used to pair incoming orders. Monday to Friday, trading sessions run from 10:00 a.m. to 11.30 p.m., and on Saturdays, they run from 10:00 a.m. to 2:00 p.m. An initial margin of 4% is needed to trade standard and micro gold futures. At the end of the day, all open positions must be marked to market. If more volatility occurs, a specific margin may be applied as appropriate. 99.5% purity is the minimum required for gold trading. The gold must be provided by suppliers who have been approved by the London Bullion Market Association (LBMA) or by MCX and have quality certificates. The gold bars must be serially numbered. The appendix contains information about standard and micro contracts. Numerous significant modifications have been made to the contract specifications over time.

1.1.4 Non-physical gold investments

Given the adage "all that glitters is gold," it should come as no surprise that gold is the preferred investment when investor confidence is shaken by market turbulence. Gold is a kind of safe haven because its price has usually increased after the largest

market crashes. This is due to the inverse relationship between the stock market and precious metals. The physical supply of the metal, which exceeds global reserves, is another factor contributing to gold's popularity. The World Gold Council asserts that discovering new gold and putting new mines into operation requires a lengthy time for gold explorers. However, the investor has a number of convenient and cost-effective options if they are unable to pay or choose not to buy the actual gold. Gold futures and exchange-traded funds (ETFs) are two examples of these.

a) Gold ETFs

In the US, the first exchange-traded fund (ETF) designed expressly to monitor the price of gold was released in 2004. One low-cost substitute for purchasing gold futures or actual gold was the SPDR Gold Trust ETF. However, the first gold ETF was introduced in Australia in 2003. ETFs have gained acceptance as a viable substitute since their launch. Like any other stock, ETF shares can be bought through fund management or a stockbroker. Investing in gold ETFs allows investors to participate in the gold market without having to purchase the actual metal. Gold exchange-traded funds (ETFs) offer a cost-effective and versatile way for investors with limited funds to increase the amount of diversification in their portfolios. ETFs, however, may expose investors to risks associated with liquidity.

As per the SPDR Gold Trust prospectus (SPDR Gold Trust, 2020), for example, the trust may be liquidated by consent of shareholders holding at least 66.6% of all outstanding shares, or when the trust's balance falls below a specific level or when the net asset value (NAV) decreases below a given level.5. Regardless of how high or low gold prices are, these steps can be taken. According to IRS laws, ownership of the ETF equates to ownership of a collectible, as investors are not able to claim any of the gold shares. This is so because managers of gold exchange-traded funds (ETFs) don't invest in gold for its numismatic value or chase after precious coins. This means that investing in gold ETFs for a year or longer will result in a comparatively high capital gains tax. Commodity investments have a maximum rate of 28%, as opposed to the 15% rate that applies to the majority of other long-term capital gains. The investor would pay a substantially greater short-term capital gains

tax if they left the position before the year ended in order to avoid the tax, in addition to losing out on any multiyear gains in gold.

The fees related to ETFs are one last item to think about. The ETF's administration is permitted to sell gold in order to pay for these costs because the gold itself doesn't generate any revenue. The trust's gold sales are all taxable to the shareholders. This implies that assets must be liquidated in order to cover a fund's management fee as well as any sponsor or marketing costs. As a result, investors may eventually have a representative share value of less than one-tenth of an ounce of gold. This lowers the total value of the underlying assets per share. This may cause differences between the reported value of the ETF and the real value of the underlying gold asset.

b) Gold Futures

A gold futures contract is a standardized derivatives agreement between two parties to purchase or sell gold on a given future date at a predefined price and quantity (lot size). To make trading on exchanges easier, gold futures are standardized in terms of both quantity and quality. The buyer and the seller must both maintain a margin in order to trade gold futures. Either cash or physical settlement is used.

A large number of pure speculators are drawn to the derivatives markets for gold futures. Those who anticipate a rise in gold's price will purchase gold futures to take a "long position" (buy). Those who believe there will be a decline will sell in a "short position' (sell). The day the buyer pays, and the seller delivers the gold is known as the settlement day. This is the real day of exchange. Usually, the agreement date/ contract date three months in advance.

The majority of futures traders take advantage of this wait to speculate in both directions. Before the settlement day arrives, they plan to sell whatever they have purchased or purchase back anything they have sold. After that, all they will need to do is settle their profits and losses. They are able to trade far more than they would be able to if they had to settle their transactions as soon as they are dealt, and they

can take bigger risks for higher gains.

- Cash Settlement

The trader must square off his position by the first of the expiry month in order to choose cash settlement. After calculating the difference between the strike price and the spot price, the profit or loss will be modified appropriately.

- Delivery Settlement

Physical delivery accounts for only a small portion of all commodity futures contracts, despite being a crucial method for some energy, metal, and agricultural products. Delivery will often be made in the form of a cash settlement.

1.1.5 Gold futures- An insight

A gold futures contract is an arrangement wherein a party pays a deposit and promises to accept delivery of gold on a mutually agreed-upon date. The remaining amount must be paid according to the terms of the contract. By purchasing and selling Gold Futures Contracts, miners, refiners, mints, traders, and buyers of gold can reduce the risk associated with the metal's volatile price. Buyers of "short" gold do so in order to fix the selling price of their gold. Customers of gold can acquire "long" to guarantee a price for the necessary commodity.

1.1.5.1 Types of Gold Futures in India

At present, four different gold futures variants are being traded in India:

- **Gold Guinea**

A popular gold futures product called Gold Guinea is traded on commodity exchanges in India. The Guinea coin, a gold coin made in Great Britain between 1663 and 1814, is the source of the contract's name. Investing in Gold Guinea contracts gives investors exposure to gold prices without requiring them to hold real gold. Each contract is worth eight grams of gold. It allows gold investors to make predictions about future prices. Small and medium-sized investors that want to hedge or speculate on changes in the price of gold can access Guinea due to its

smaller contract size.

- **Gold Mini**

With a more reasonable lot size of 100 grams, Gold Mini is a mid-range futures contract that may be found on India's commodity exchanges. Compared to the typical Gold contract, which has a lot size of 1000 grams, this makes it more affordable.

GOLDM symbol is widely recognized worldwide and is used on many trading platforms. Each contract represents 100 grams of gold with '995' quality. It has a maximum order quantity of 10 kg.

- **Gold Petal**

A special futures product called Gold Petal is traded on the commodity exchanges of India. While the Gold Mini lot size is 100 grams and the regular Gold contract lot size is 1 kilogram, each contract lot size of gold is only 1 gram. The purpose of India's Gold Petal contracts is to increase small investors' access to the futures market. Investing in this asset class is relatively cheap.

- **Gold**

This is a typical futures contract, meaning that each contract is for one kilogram, or one thousand grams, of gold. The symbol of this future is GOLD. Large institutional investors with substantial capital at their disposal typically like these contracts.

With daily trading of about 15,000 contracts worth over 4500 crores in rupees, it has a great deal of liquidity. Since all of these contracts call for delivery, it seems sensible to close them at least five days before they expire. When it comes to trading volume, number of contracts traded, and average daily trade value, the trade pattern across several gold futures contracts indicates that the GOLD and GoldM contracts dominate the market (Lingareddy, 2020). Together, GOLD and GoldM make up more than 99% of trading value and around 80% of all gold futures contracts traded on the market. GoldM leads in volume, making up more than 40% of all gold futures contracts traded on the exchange, even though GOLD leads in turnover on average,

accounting for over 85% of daily trade value.

Further, Ministry of Finance, the Director-General of Foreign Trade (DGFT), and the Reserve Bank of India (RBI) all have the power to veto who is permitted to import gold into India (Reserve Bank of India, 2012). Banks must obtain licenses from the RBI, and businesses must abide by international trade laws and obtain authorization from the DGFT to import gold. Gold is a major export good that is under the jurisdiction of the Ministries of Consumer Affairs and Commerce and Industry. Through its gold mines, the Ministry of Mines oversees domestic output in the nation. In order to control the possession and trade of gold, the Indian government passed the Gold (Control) Act of 1968. However, because of India's high demand for gold and its dearth of domestic production—which led to imports—the ordinance was eventually abolished. In 2012, the UPA Government of India levied a 2% ad valorem customs tax on imports of gold. Up until that point, 10 grams of gold could be purchased for a meager Rs 300. The purpose of this was to monitor all imports of gold. The gold tariff was increased from 4% to 6% on February 28 until January 21, 2013. On August 13, 2013, the UPA government increased import tariffs from 6% to 10% due to rising inflation. On July 5, 2019, the NDA administration increased tariff to 12.5%. The finance minister, in the Budget 2021, promised a 2.5% Agriculture Infrastructure and Development Cess and a 7.5% reduction in import customs on gold.

1.1.5.2 Factors affecting gold futures

Gold prices are influenced by factors such as central bank policy, inflation, interest rates, currency fluctuations, and economic growth. Exchange rates are not the only factors that affect gold prices; jewellery demand and domestic market investments also play a role. Gold jewelers, miners, and bullion traders can take precautions against commodity price risks by using gold futures. These days, ordinary investors can still have exposure to gold price swings through gold futures, even if they do not own real gold. Investing in gold can help diversify a portfolio. The factors affecting gold futures are:

- **Demand and supply**

China, South Africa, and Australia are among the world's leading producers of gold. However, one of the biggest importers of gold is India. During the wedding season and for important festivals like Diwali and Akshay Tritiya, gold is much sought after in India. Due in large part to demand from rural India, gold prices are impacted even by monsoon or a good harvesting season. Strong monsoons result in a bountiful harvest, high disposable income and thereby high sales. The price of the yellow metal fluctuates a lot because there is a limited supply and an endless demand.

- **Gold and US Dollars**

Since India imports gold, US dollars are used for payment. A depreciating currency allows you to purchase more gold for less money. So, when the dollar weakens, the demand for gold naturally rises. Central bank view this as an excellent time to purchase. Additionally, there is uneasiness in the markets when the world's largest economy's currency declines. Investors go from riskier investments to gold at this juncture, which raises the metal's price.

- **Mining and Distribution Cost**

Gold is extracted in remote nations and subsequently transported to India. Therefore, it has associated costs for mining, refining, transport, and distribution. The price of gold and gold futures will automatically climb in response to any increase in these parameters. Mining and distribution businesses have extracted simple gold since gold has been mined for generations. To discover good gold now, they must mine farther. Therefore, in order to find high-quality gold, mining companies will need to invest more capital and labor. The cost of gold and gold futures is another factor driving up prices.

- **Central Banks**

They are among the world's largest buyers of gold. Most central banks keep sizable gold reserves as a hedge of value and to preserve the currency value of the nation. Before issuing new currency, the Reserve Bank of India must keep a minimum reserve of Rs 200 crores in gold bullion. Currently, RBI has gold reserves of Rs. 382299 crores (Reserve Bank of India, 2023). Therefore, the price of gold and gold

futures naturally rises when central banks embark on a buying binge.

- **Interest Rates**

Interest rates and gold prices are inversely correlated. Investors prefer to invest in gold during periods of low interest rates because it is a good store of value and yields positive inflation-adjusted returns. In contrast, investors will switch from gold to fixed income products in order to increase their inflation-adjusted returns when interest rates are high.

- **Geopolitical Tensions**

Because gold is a store of value, investors turn to it during times of global unrest or conflict. Therefore, gold will appreciate in value even if currency depreciates, which is why demand for gold increases amid trade wars and other geopolitical unrest.

1.1.5.3 Benefits of gold futures

The following are the key benefits of investing in gold futures:

- **Trade Margins**

Using gold futures, one can take a leveraged position on actual gold prices with a minimal margin deposit. This increases the possibility of both upside earnings and downside risk.

- **Liquidity**

Since gold futures are based on 995 purity gold, investors can be confident of the purity of the gold, which makes them liquid. When considering exchanges, fair price discovery in relation to physical gold is made possible by the transparent pricing of gold futures.

- **No Storage Costs**

Obtaining, storing, and trading actual gold can be difficult because of security issues and the time required to determine the metal's purity. When a trader invests in gold futures, however, this is avoided because these are highly secure electronic contracts that are bought and sold using demat accounts.

- **Less Capital Requirement**

Gold is a levered financial instrument. Alternatively, a trader may choose to enter a position by paying the margin rather than the entire contract value. Because a buyer can pay part of the price at the time of creating a deal and the remaining amount after signing the contract, engaging in this trade requires less money.

- **Provision to Short Sell**

Selling first and purchasing later is known as short selling. This implies that a trader may initiate a short position in gold futures and subsequently cover it.

- **Portfolio Diversification**

Gold is still in use today because it has withstood the test of time. Because it has held its worth throughout millennia, investors view it as a good choice for diversifying their portfolios.

- **Hedging**

Typically, investors use gold futures investments as a hedge against their stock assets.

- **No Extra Charges**

When trading futures, investors can avoid paying as much for insurance, transportation, storage, and other expenses related to owning real gold.

- **Tax Benefit**

Profits on futures held for more than 36 months are taxed at a lower rate than short-term capital gains tax, which is advantageous to income taxpayers.

1.1.5.4 Limitations of Gold futures

The gold and precious metal futures markets offer significant opportunities for profit, but risks are also very high. Fluctuating price, large margins, default risk, and expensive roll overs are some of the risks associated to gold futures. Prices may significantly increase or decrease due to the time interval between the contract signing and settlement day. There is a large "margin" associated with gold futures

due to the possibility that one party will back out. Default risk is a real thing that might catch someone off guard when trading. Should the values of gold or silver take a negative turn, you can be exposed to large losses and margin calls. Because many traders choose to roll forward to longer-dated futures contracts as the expiration date approaches, futures trading also necessitates close attention to contract expiration.

1.2 Statement of the Problem

As per World Bank records, India has achieved 9.1% growth in Gross Domestic Product in the year 2021 (World Bank, 2023). Further, India has witnessed 18.8% growth in net savings to GDP and 20% growth in net capital formation to GDP in the year 2021-22 (Reserve Bank of India, 2023). Ranging from the classic fixed deposit to stocks, there are many forms of investment preferred by the Indian populace. Gold is also a preferred choice of investment beyond the class barriers of investor community. This yellow metal is viewed as a secure, tangible, and most liquid asset that acts as a safe haven, a hedge against inflation, and a portfolio diversifier. The cultural and religious significance of gold adds to its demand. It is also viewed as a symbol of abundance and wealth. Hence, an analogy between the gold futures market and the stock market will uncover the efficiency of gold futures as a hedger in a portfolio.

Further, it is worthwhile to mention that savings in the form of jewelry made of gold and silver increased by 14.3% between 2010 and 2020–21 (Reserve Bank of India, 2023). According to the World Gold Council, India's economy has become the second largest consumer of gold after China, with a consumption demand of 797.3 metric tons of gold in 2021 (World Gold Council, 2021). But most of the populace invests in gold ornaments, which makes the investment pointless. Expenses such as making charges, waste, and promotional expenses are all irrecoverable. Investments in the stock or derivatives market become relevant under these circumstances. The Indian derivative market, especially the gold futures market, does not seem to play the influential role it is expected to at the international level considering the demand the economy raises for gold. Indian gold futures market still seems untouched

compared to stock market. Instead, COMEX and LBMA are confirmed as the leaders in the world markets for gold at different time scales (Jena, Tiwari, & Roubaud, 2018). This paradox calls for a detailed study of the area. Further, this proves that the consumption demand for jewelry, bars, coins, etc., or any other form of physical gold has not had any significant corresponding effect on the popularity of the derivatives market for gold, with special reference to gold futures.

The Indian stock market is counted as one of the world's best-performing markets. One of the finest-performing stock markets in the world is thought to be the Indian one. In addition to being the third-largest stock exchange globally in terms of the volume of equity trades, the NSE is now the stock exchange with the fastest pace of growth. In addition to being recognized as the world's best-performing share market, the BSE is the eleventh largest stock exchange globally. Even though the bourses' prominence has improved the Indian stock market's global standing, gold futures still appear unexplored in comparison to stock markets. Though different vehicles of investment for gold are available in the market, people still prefer to buy ornaments in the form of investment. Therefore, a study analyzing the perception and attitude of investors would shed light on the reasons for hesitance shown by the people to invest their savings in a smarter way.

Forty percent of the nation's gold demand comes from South India. Kerala is said to have consumed the most gold out of all of these states (Herriges, 2018). Kerala is a part of the nation-state of India, which has witnessed the growth of its markets through economic liberalization since 1991. On the other hand, Kerala is unique in terms of the impact of emigrant remittances from other countries and transnational connections. The highest literacy rate in Kerala doesn't correlate with financial awareness or knowledge. Lack of financial knowledge stood as a stumbling block in the growth of derivative instruments in Kerala. A dedicated investor-centric study on the Indian gold futures market is needed to analyze their psychology of investing and to bring to light the satisfaction they attain out of their investment. Any investor-centric study on Indian gold futures addressing Kerala state is not only a need of hour but also an apt choice of regionally placing the research gap for study.

1.3 Research Questions

The present study is undertaken to resolve the following research questions:

1. Whether gold price is influenced by the stock market?
2. How is gold price expected to perform?
3. Do the futures prices help the spot market in its price discovery?
4. How do investors perceive gold futures as an avenue?
5. What are the key determinants of investment in gold futures for investors?

1.4 Objectives of the study

The present study is undertaken with the following specific objectives:

1. To investigate the relationship between gold prices and stock market returns in India.
2. To analyze the trend and performance of gold price in India.
3. To analyze the efficiency of gold futures in price discovery of gold in India.
4. To study the perception and attitude towards gold futures among investors in Kerala.
5. To analyze the determinants of investment in gold futures among investors in Kerala.

1.5 Hypotheses of the study

Based on the objectives, the following hypotheses are formulated:

H1	:	There exists a long run relationship between gold prices and stock market returns in India.
H2	:	The gold futures market efficiently perform price discovery function.
H3	:	There exists a significant difference between pre-investment perception and post-investment perception of investors towards gold futures.
H4	:	There exists a significant difference between attitude of investors towards gold futures with regard to their gender, age,

educational qualification, occupation, marital status, average monthly income and number of earning members in household.

H5 : There exists a significant relationship between investment determinants of gold futures and attitude of investors towards gold futures.

H6 : There exists a significant relationship between investment determinants of gold futures and investor satisfaction of gold futures.

1.6 Scope of the study

The study is an empirical investigation of investment in gold futures in Kerala. The study analyses this from two perspectives. It focuses on investigating the relationship between gold prices and stock market returns and analyzing the efficiency of gold futures in the price discovery of gold from secondary sources. It further focuses on examining the perception and attitude towards gold futures and analyzing the role of various factors determining investment among investors. These are studied from primary sources. The study combines the viewpoints of the individuals and secondary sources to produce pertinent conclusions.

The study is confined to analyse the relationship between gold prices and stock market returns in India. It focuses on the spot price-future price causality of gold in India. The study considers the past trends and hence forecasts future movements in gold prices. Additionally, it analyses the role of determinants of gold futures investment and the perception and attitude of investors in Kerala. The study provides a comprehensive framework for analysing the perception and attitude of investors towards gold futures in Kerala, which would provide an insight into the awareness and usage of derivative trading in the economy. The study considers the near-month futures price of 'GOLD' of NCDEX against the spot price of gold recorded by NCDEX. The study helps in analysing the penetration of gold futures among the investors in Kerala and investigates how people perceive gold futures. The variables of perception and attitude and the determinants of gold futures are taken from the

existing literature. Furthermore, the scope of the study has been limited to the investors of Gold Futures who reside in Kerala.

1.7 Significance of the study

The yellow metal is not only used to make gorgeous jewellery, but it is also an essential investment tool. Its ability to act as a buffer against inflation and to make returns even in periods of geopolitical tensions and other unrest has made it a preferable choice of investment. Liquidity and tangibility of this metal are also perceived as perks while choosing it as an investment. Additionally, the cultural and religious relevance of gold add to its demand in the country. It is also viewed as a safe haven and portfolio diversifier because of its capacity to generate a decent income even in periods of uncertainty. People always perceive gold as a method to reduce market risk. Consequently, analysis of the relationship between the gold futures market and the stock market will uncover the efficiency of gold futures as a hedger of portfolios. The study aims to check the dazzling properties of gold and verify whether it can be used as a hedger or diversifier.

The analysis of past trend and performance of gold price supposed to have an impact on investment decision on different investment alternatives of gold. The efficiency of futures contracts in price discovery emphasizes the property of futures as a leading indicator of the gold market.

Kerala has the highest monthly per capita expenditure (MPCE) on gold ornaments among all Indian states, according to an NSSO survey. Here, the consumption is four times higher than that of Tamil Nadu, which ranked second. Despite being the highest gold-consuming state in India, Kerala is no exception when it comes to investing in gold derivatives like gold futures. Individuals are purchasing gold ornaments as investments without realizing the additional expenses involved, which renders the investment pointless. Numerous potential investors are yet to invest in the gold futures market, and hence a background study regarding factors determining investment in gold futures will pave the way for focus areas. To understand a market means to understand its investors. Their perception and attitude

are what drive a market, say upward or downward. Strengthening of a market happens when cause is treated. Hence, the investor base needs to be analysed and their issues or barriers must be addressed.

1.8 Operational Definitions

1) Investors

Investors are individuals who invest their stake in gold futures with a specific objective.

2) Futures

A sort of derivative contract agreement known as a future stipulates the purchase or sale of a particular commodity asset or security for a predetermined price at a future date. Like an options deal, a futures contract has a buyer and a seller. When a futures contract expires, both the buyer and the seller of the futures contract are required to purchase and receive the underlying asset, in contrast to options, which may lose all of their value at that point.

3) Spot Price

The current market price (CMP) of a security is referred to as the spot price in the share market. It is reliant on the supply and demand dynamics in the market as well as the company's core values.

4) Future Price

The price agreed upon by two parties in a contract (referred to as a futures contract) for the sale and delivery of an asset at a future date is known as the futures price.

5) Margins

The first sum of money a trader needs to deposit into an account in order to initiate a futures position is known as the initial margin. The exchange determines the amount which is expressed as a percentage of the futures contract's value.

6) Quotation

The units used to display a contract's traded price are called price quotations. It is frequently determined by industry norms and practices and may differ from a contract's trading size.

7) Tick Size

The smallest price fluctuation of a trading instrument in a market is referred to as the tick size. Different trading instruments move in different ways in terms of price, and the smallest amount that they can move up or down on an exchange is represented by their tick sizes.

8) Tick Value

Tick Value refers to the minimum profit or loss that can arise from holding a position on one contract. The size of the contract and its minimum price change considered will determine the tick value of the position. Though it is meant to be mentioned as terms of contract, tick value can be calculated by the formula:

Tick Value = Contract Size x Tick Size

9) Delivery Date

The time frame provided by the exchange during which the seller must fulfill delivery obligations in compliance with the terms and regulations of the contract is referred to as the delivery date or delivery period. Delivery dates are frequently later than contract expiration dates, particularly when goods are being physically delivered.

10) Daily Settlement

The process by which the exchange settle entries to each account with the daily profits and losses determined by the mark-to-market (MTM) procedure is known as daily settlement. Recovering losses and crediting earnings to the appropriate accounts requires daily settlement.

1.9 Limitations of the Study

The present study is subjected to the following limitations:

- The researcher considers only the prices of big gold or GOLD (1 kg) with respect to and the data pertaining to the period 1st January 2011 to 31st December 2015 were considered.
- The study does not cover the entire investors in Kerala who invest in gold futures. The selection of sample investors 150 in number deploying a non-random sampling technique may not be free from sampling errors even though the researcher has taken maximum efforts to make the sample frame comprehensive.
- The researcher assessed the investment satisfaction which is subjective in nature as this has been assessed by asking sample investors to compare the actual with their expectation.
- The present study has not been conducted over an extended period as gold spot price and future price movements in the period of economic turbulences may be different which will have an impact on the opinion and response of the investors towards gold futures.

1.10 Structure of the Thesis

The whole thesis is divided into nine chapters which are as follows:

Chapter 1: Introduction

The chapter includes a brief introduction of the topic, scope and significance of the study, statement of the problem, research questions, objectives of the study, major hypotheses, operational definitions of important variables, and limitations of the study.

Chapter 2: Literature Review

The chapter includes the existing literature reviews based on the topic under study.

Chapter 3: Research Methodology

The chapter elucidates the detailed methodology adopted for the study including research design, sampling design and a brief explanation of the tools adopted for

analysis.

Chapter 4: Relationship between Gold prices and Stock Market Returns in India

The chapter analyses the relationship between gold prices and stock market returns in India.

Chapter 5: Trend and Performance Analysis of Gold Prices in India

The chapter analyses the trend of past gold prices and forecasts the price of gold for the upcoming years.

Chapter 6: Price Discovery Function of Gold Futures in India

The chapter makes a detailed analysis of the efficiency of gold futures in price discovery of gold in India.

Chapter 7: Perception and Attitude towards Gold Futures

The chapter covers the profile of investors, their perception and attitude towards gold futures in Kerala.

Chapter 8: Investment Determinants of Gold Futures and Investor Satisfaction

The chapter discusses the determinants of investing gold futures and investor satisfaction.

Chapter 9: Findings and Conclusion

The chapter presents the findings and conclusion emerging from the present study.

Chapter 10: Recommendations

The chapter includes the recommendations, implications and scope for further research.

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Chapter 2
REVIEW OF LITERATURE

Contents

2.1 Introduction

Beyond doubt, gold has always captivated the market in terms of demand and revenue which has impliedly led to the development of the nation. In today's economic environment, an investor usually favors investments that both grow and safeguard their capital. One asset that keeps becoming more and more popular among investors worldwide as a safe haven is gold. Purchasing gold is typically done by investors to diversify their risk, particularly when using futures and swaps in the capital market. Similar to other markets, the gold market is prone to speculation and fluctuations. A picture of diversity and expansion is the contemporary gold market. The derivatives market of gold has not failed to report an immense increase in its overall growth rate.

Gold futures are undeniably one of the best alternatives to physical gold or any similar commodity investment avenue. However, it may be seen from existing literature that despite its tempting pros, it fails to qualify even as one of choice for lion’s share of investor base. Investor centric studies with emphasis on gold futures do not seem common. Although remarkable studies focused on this area are very few, an extensive survey of existing literature has been undertaken as far as possible to dig deeper insights into the subject as well as to identify the gap to be bridged through further research.

2.2 Review of Literature

The existing literature reviews made for the present study are presented as follows:

2.2.1 Literature regarding gold investment

The socioeconomic principles of the Indian household have always included gold. For most Indians, gold is not an investment option but rather an emotional attachment. Its tendency to evoke sentimental and cultural attachments has made it a commodity that has always been consumed and invested in differently in India than in other nations (FICCI, 2014).

Baur (2012) illustrated the safe haven property of gold as an investment. The reason was that gold returns exhibited an asymmetric response to positive or negative changes which may not be the case for the rest of the markets, equity in particular. Gold market movements are invertedly interpreted with general market movements i.e. positive movements of gold returns indicate adverse conditions of other asset markets and this very reason contributes to higher volatility in the gold market. This is consistent with the findings of Baur & Lucey (2010).

Capie, Mills, & Wood (2005) explained the power of gold to hedge against the dollar. The reasons to demystify the heding capability of gold against exchange rates included gold being homogenous asset, control over supply etc. The temporary fluctuations of the private sector and attitudes of the official sector were found responsible for the extent to which the gold could serve as a hedge against currency fluctuations.

Kannan & Dhal (2008) probed into the effect of macro economic variables on demand for gold in India. They found that gold demand reacts inversely to gold prices and positively to real income, governement expenditure and financial wealth. Further, exchange rate and yield on government bonds share inverse relationship with gold demand whereas deposit interest rate having no statistically significant relationship with the same. They made use of ECM (Error Correction Model) to express mathematically the function of maroeconomic variable with respect to movements in gold demand. The study also putsforth that savings linke bank deposits are not enough to mobilise the potential savings of rural people towards

investment which also leads to increased consumption of gold in India as a whole.

Nawaz & Sudindra (2013) discussed alternate investments in gold. Gold futures & options is the least preferred by the investor community of all alternate investments in gold. High exposure and high risk have been identified by the investors attached to gold derivatives along with transaction cost, ease of transaction, over trading etc.

Studies like Caliskan & Najand (2015) have concluded differently that gold is rather it is a mere market saver in the events of temporary shocks whereas Dee, Li, & Zheng (2013) found gold as a good hedger in a long run and not so for a short run.

2.2.2 Literature regarding gold & stock market

Singh & Nadda (2013) compared the volatility comparison with standard deviation and returns comparison with compounded annual growth rate between stock index and gold. It was found that volatility is high for stock index which stands for high risk involved in comparison to gold. At the same time, even though gold was seen less volatile, it was promising a better CAGR over stock index which means that gold proves to be a better investment for both lesser volatility and higher return in comparison to stock market.

Mulyadi & Anwar (2012) found gold as a safe haven investment and a good portfolio diversifier. Further, they confirmed the inverse relationship between stock and gold. When stock goes to loss, return from gold tends to increase and vice-versa. Any change in gold return will impact on the stock market also.

Baig, Shahbaz, Imran, Jabbar, & Ul Ain (2013) considered gold prices and Karachi stock exchange market returns along with other variables for the study. They found that gold and stock market return have neither have causal relation with each other nor have any relationship in long run. Similarly, Al-Ameer, Hammad, Ismail, & Hamdan (2018) studied the relationship between gold and stock market in Germany which added to the literature that there is no causal relationship between gold prices

and stock market indices during the period of financial crisis. Johansen cointegration test and Granger causality test were used in the study.

Do & Sriboonchitta (2010) investigated the linkages among international gold market and ASEAN emerging stock markets applying Johansen cointegration test and Granger causality test. Vietnam stock market proved to have bidirectional causality with gold. It was also found that international gold markets will be independent of any stock market in the long run.

Bhunia & Ganguly (2015) probed into effect of various macro economic indicators including gold prices on stock market returns. The results of Johansen cointegration test showed the existence of relationship between gold prices and stock market in long run. It was observed that the stock market index causes gold prices and not vice versa. Variance decomposition results showed that the shocks in stock index is explained largely by itself rather than gold prices or any other macro economic indicator. This finding has been consistent with that of Seshaiah, Sarma, & Tiwari (2017) wherein the influence of other macro economic variables over variation in gold prices has been proven negligible and gold has been found largely explaining its own variances.

On the contrast, Bouri, Jain, Biswal, & Roubaud (2017) found that volatility of gold prices has a predictive power for volatility of stock market of the country and no feedback effect works vice-versa. Hence, the study putforth the possibility of monitoring and advance warning system regarding the expected volatility in stock market tracking the volatility of commodity market.

Patel (2013) investigated causal relationship between stock market indices and gold prices in India using VECM and Granger causality test. The study concluded that causality runs from gold price to Nifty but does not run vice versa. The study failed to establish any causality of gold prices with Sensex as well as BSE100. On the contrary, Mishra (2014) deployed the Toda-Yamamoto Granger causality test to run the causality between gold prices and capital market to reach at an inference that

there is a bilateral causality running between gold prices and stock index.

Bhuyan & Dash (2018) though confirmed existence of long-term relationship between international gold returns and stock market returns, denied any short-term relationship between two which aided to prove the hedger property of gold in a short-term portfolio against extreme negative shocks. The finding is similar to that of Gokmenoglu & Fazlollahi (2015). The study of Anand & Madhogaria (2012) may be tagged as an extension to the finding as they have explored the causality in detail and found that a unilateral causality exists which in turn depends upon the nature of economy – developed or developing. In developing economies, causality was found running from stock markets to gold prices and vice versa in developed economies.

Selvan & Raj (2020) reached at a similar finding after examining the relationship between gold price in India and Sensex. The long run relationship between sensex and gold prices was proved deploying Johansen Cointegration approach. Further, the causality was found unilaterally running from Sensex to gold prices consistent to Anand & Madhogaria (2012).

Kharusi & Başci (2019) investigated stock index-gold index relationship in the backdrop of Gulf Cooperation Council (GCC) countries. They have putforth strong evidence pinpointing hedging and safe haven properties of gold as an investment avenue. The study has also highlighted strong causality between gold indices and GCC stock indices. The study hence identified gold as an excellent diversifier of portfolio.

Mishra, Das, & Mishra (2010) analysed the causality between domestic gold prices and stock market returns in India and succeeded to establish long term relationship between gold prices and stock market returns. Also, they found that gold prices and stock market return in India granger causes each other. Further, they confirmed the possibility of prediction of one in terms of other.

At the same time, Tripathy & Tripathy (2016) found that there is no causal

relationship between gold prices and stock market return. Bhunia & Mukhuti (2013) observed the impact of gold prices on stock market indices. Causality results did not seem in support or denial of theory- causality as well as no causality shown with changing stock index. Multiple regression results were stated spurious.

Sujit & Rajesh Kumar (2011) studied dynamic relationships between multiple macroeconomic variables and putforth interesting findings with the help of tools like cointegration and vector autoregression. They found that changes in gold prices are largely dependent on gold prices itself rather than other macro economic indicators. The major factor influencing the exchange rate is gold and changes in exchange rate impact stock market returns. In a derivative market perspective, in time of financial instabilities, gold futures market moves opposite to stock market which makes the instrument better hedger (Junttila, Pesonen, & Raatikainen, 2018; Souček, 2013).

2.2.3 Literature regarding trend of gold prices

Singh (2013) explored trends in gold prices and demand in Indian economy. An average annual growth of 12.27% has been seen with respect to gold prices. The increasing trend in prices has been expected to continue rising inflation, rising middle class, weak financial markets, fluctuations in currency, scarcity in long term, rising production costs, tax implications, seasonal demand in India etc. The study divulges that the first position in global gold market as short term as India has independent domestic drivers of gold demand since ancient times and it is not expected to diminish in near future. The results are congruous with that of WGC report which expects India to dominate global gold demand by 2030 with rising wealth of largest middle class in the world (World Gold Council, 2017).

Gaspareniene et.al. (2018) employed Autoregressive Integrated Moving Average (ARIMA) method for the purpose of forecasting gold prices. Observing the trend of gold, they found the demand for gold to be declining and the decline being offset by growing demand for exchange traded funds. However, the negative growth in total demand for gold indicated the fall in demand for jewellery and industrial gold

applications.

Baber, Baber, & Thomas (2013) found that the trend of gold prices depends upon certain factors like decrease in supply, inflation, interest rates, currency fluctuations, geopolitical reasons, weakness in financial market and demand from central bank. They found that gold prices maintain a positive association with inflation and dollar prices.

Ali, et al. (2016) forecasted US gold market daily prices using Box-Jenkins ARIMA methodology. They found ARIMA methodology as best to forecast gold price than other methods. They considered Akaike Information Criterion (AIC) and Schwarz Bayesian Criterion (SBC) as criterion for appropriate model selection. Guha & Bandyopadhyay (2016) also applied ARIMA methodology to forecast the gold performance based on monthly gold prices.

2.2.4 Literature regarding price discovery

Kellard, Newbold, Rayner, & Ennew (1999) though focused on market efficiency, confirmed the existence of long run relationship between spot prices and futures prices using cointegration methodology. However, the markets were found inefficient in the study as to past information usable to predict spot prices. Holly Wang & Ke (2005) also confirms the nature of relationship with is contingent on time period under consideration. They also found that certain markets may be inefficient due to overspeculation by traders and government regulations.

Chinn & Coibion (2014) assessed the unbiasedness and analyzed the accuracy of prediction of futures prices of different commodity markets. It was observed that the futures market fails to satisfy the unbiasedness hypothesis due to low trading volumes. The more the trading volume, more the unbiasedness of futures prices in commodity markets. Out of all commodity markets, energy commodity markets were found unbiased predictors of futures prices.

Pavabutr & Chaihetphon (2010) conducted a study on price discovery of Indian Gold Futures market which employed Vector Error Correction Model (VECM) to confirm that futures market price led to spot prices of Gold. Electronic trading platforms in a way contributed to it through effective information dissemination.

Srinivasan & Ibrahim (2012) made use of Johansen's Vector Error Correction Model proved the orher way that spot market of gold played a prominant role of being a price discovery vehicle.The study also revealed about the capability of the spot market of gold to expose all new information in an effective manner with regard to price discovery.

Jin, Li, Wang, & Yang (2018) stood for the proved point that futures market carries price discovery rather than spot market of gold. Putting it into another words, the futures market of gold reflected updated information than spot market. Intraday sequential trading trend also revealed that price discovery process occurs in the night market of gold in both spot market and futures market of Gold.
Kumar & Sulphey (2015) confirmed the circular logic between spot market prices and futures market prices on a long term. This long-term equilibrium necessarily meant that there is feedback relationship between both i.e., spot price led to futures price in the way vice-versa. Error Correction Term (ECT) of Johansen's Vector Error Correction Model results led the way to such a finding.

Ahmad & Fun (2016) indulged in a study which focused on yellow metal market variants of Malaysia of which prime focus was to identify market efficiency. Econometric analysis further imprinted the fact that comparatively then-new gold futures market as inefficient and hence non-performer of price discovery function. This further meant that spot market and futures market of Malaysian gold segments were non-related. The Granger Causality test results showed that spot gold prices lead to Malaysian gold futures prices.

Gold spot and futures market has also been a part of those studies which extended its scope to multiple commodity markets with respect to price discovery and other

functionalitites. If we shift our focus from yellow metal market segments, other commodity markets are also performers of price discovery function which could equally contribute to the theoritical base of market integration. Arora & Kumar (2013) probed into copper and aluminium spot v/s futures market to reach a conclusion that long term equilibrium of first order cointegration exists in long term along with bidirectional causality.

Sridhar & Sathish (2011) found out spot price of Gold as price discovery tool. Granger Causality test results revealed that spot prices being independent from futures prices whereas futures prices being Granger caused by spot prices by 2 lags with respect to Gold. The study also confirmed that futures prices granger caused itself at certain points.

Iyer & Pillai (2010) turned out to be yet another theory provers of long-term relationship and bi-directional causality between spot and futures markets of gold. Convergence of spot market price to that of futures market is yet another significant finding of the study. Kappa and eta estimates were used to find out the existence of convergence and its direction.

Kumar & Arora (2011) used spot prices & futures prices data from MCX to test the interrelation between. Johansen's cointegration test was used and the study concluded that there exists long term relationship with spot and futures prices.

Chen & Tongurai (2023) found gold as a safe haven for its futures-spot cointegrated relationship during uncertainty disturbance in the economy. The gold market adjusted quickly and efficiently in terms of speed of correction.

Garbade & Silber (1983) found that the gold market is highly integrated even in a very short period. Further, it was also observed that most of new information is first reflected in the futures market and then the same flows to cash markets. This is considered as efficient price discovery as price changes in futures market leads to a price change in spot market. The same has been cited by Selvan (2021).

Figuerola-Ferretti & Gonzalo (2010) studied the cointegrated effect of gold and silver in different volatility conditions and stated that gold does not significatively react to changes in equilibrium which in turn makes it a better hedging instrument.

Gold futures has been found to be the prime instrument in price discovery by Sehgal, Sobti, & Diesting (2021). It was also a significant observtion that the price discovery leadership of gold futures is driven by transaction cost, trading volume and volatility-hedging effectiveness. Further, an increase was noted in price discovery under economically turbulent conditions or stock market uncertainities.

Kumar, Gupta, & Taneja (2018) used cointegration and causality tests to infer the price discovery in gold futures. Both gold and gold guinea contracts were analysed wherein both contracts were coitegrated which reflected efficiency of corresponding markets. Bi-directional causality was established in gold contracts for their larger trade volume while gold guinea did not show causality relationship due to smaller trading volumes out of which most were retail transactions. The influence of consumer psychology on prices of gold futures cannot be ignored. This may work positive as well as negative as per changing market conditions (Jiang, Luan, & Yang, 2014).

2.2.5 Literature regarding perception, attitude and behaviour of investors

Ravichandran (2008) found that the investors perceive the derivative market to be moderately or slowly growing fragment of capital market. The study clearly indicated that according to accustomed investor perception, market risks to be the major one prevailing in derivative market .The intention to offset the market risk is evident from the preference for stock index futures and options over the others.They rely over newspaper reports rather than expert advice from reputed professionals in this field. Inflated margins intuited investors to hold back from derivative market orientation.

Gautam & Kavidayal (2016) examined the perception of market participants towards derivative trading. They found that the risk-return profile of the investor has a signficant influence over participation, product innovation and return on investment with regard to derivative products. One way ANOVA was employed in the study to do hypotheses testing.

Mamtha & Srinivasan (2017) found that past performance, level of knowledge, satisfactory returns, risk tolerance etc. as higly influencing factors of investor behavior in derivative market and heavy fluctuations in prices possibly preventing positive perception towards derivative market. Exposure of limits and measuring its impact were reported as major concerns by the investors towards derivatives market. Low liquidity and heavy price fluctuations followed. The least ranked investor concern was low short-term profit. The study unveiled that a major share of investors was investing in derivative market for profit over hedging. Investors were of the opinion that commodities carried less risk than equities and currencies.

Nuruzzaman (2013) came up with the revelation that the intention with which the derivative instruments were formed i.e., hedging, was the primary intention for only a negligible number of derivative market investors. Most of the investors are attracted towards derivatives for their widened horizon for speculation. Self attribution bias was found to be strong in investors who choose the chance to be failure to be bad luck rather than a mistake.

Tripathi (2014) probed into notions of investors judging their rating towards risk diversification, safety, liquidity, return, past performance, future growth, and stock market movement out of which stock market movement and risk diversification turned out to be dominant in driving investments to derivative markets in general. The complex structure and lack of understanding are yet limiting its flourishing though it is probable to be exploited as an opportunity in the near future.

Ansari, Ubeja, Jain, & Pathak (2015) emphasized six inevitable factors on participant perception towards the very concept of derivative trading. The ability of

the investor to forecast accurately the probable income, confidence on buying-selling decisions, rational behaviour, adequate knowledge base, information credibility together with performance of the stock market constituted the basis for an investor to form an approach towards derivative trading. Factor analysis by rotating matrix was used to separate important and insignificant ones.

Rani & Gupta (2020) found that consumers perceive commodity markets as highly volatile over other markets. In commodity market, energy and metal markets are more volatile compared to bullion and agricultural commodities. Traders believe that volatility affects returns. At the same time, they are of the opinion that using appropriate techniques, commodities prove good as investment avenue.

Kumar & Balaji (2011) confirmed the influence of perception of investors in their investment proportion in commodity futures. The most preferred futures contract was of gold followed by crude oil futures, silver futures etc. Out of various reasons to invest in futures, profit making stood first over investment opportunity, arbitrage, hedging, speculation and market conditions. The majority of investors seemed reluctant to self research to invest in commodities and depended on external sources. One way ANOVA and weighted average method were the tools used to analyse the data.

Jain & Khokhawat (2012) analysed the obstructing factors of investment in the futures and options segment of capital market. Uncertainty in market performance, fear of risk, heavy investment and lack of knowledge were the significant factors of which risk was predominant.

Kukreja (2012) found out that the occupation of investor has got to do with his risk-taking ability with regard to futures and options as well as the size of investment in the same. The age of the investor also drives the wholesome attitude of investor towards futures and options.

Hon (2013) found that investment experience and holding period have a positive

relationship with average returns. High accesibility and updation was inferred as the most decisive factor of investment in derivatives. Small investors were also found interested in derivative investments. Online trading was observed to be popular due to low-cost trading, high privacy and lower commission. Educated and younger investors who trade for shorter holding periods were found sophisticated in online trading.

Pasha (2013), though in the context of financial derivatives, identified investors' take towards popular myths regarding derivative market. Of them, surprisingly, the most accepted one turned out to be that derivatives are absolutely speculative and leveraged. It was followed by another myth that derivative instruments are high-risk.

Rakesh (2014) worked out regression between perception of commodity market investors with significant factors like risk & volatility, informational network, profitability on investment and objective knowledge. Of these four, all except risk & volatility proved to have a higher degree of influence over perception of commodity market investors.

Khurana et. al. (n.d) considered the factors like risk management, liquidity, spot market trend, volatility, trading volume, stock popularity, capital requirement, margin and FII flows to assess perception of investors. Market risk and credit risk were the most cited issues with derivative market by the investors. Though the primary goal of formulating derivative instruments is for hedging, the study opened up that the instrument is exploited for speculative edge rather.

Sarathkumar & Dhandhayuthapani (2016) found gender, age, educational qualification and occupation as demographic factors which share an association with awareness level of investors.

Senthil (2015) emphasized commodity futures markets. Only 1/10th of total investment is channelized towards commodity futures. The primary goal behind such invesment is steady growth in investment i.e., minimum return in the short

term. Jha & Bhargav (2018), at the same time, observed that the prominent objective of trading in commodity futures is diversification of portfolio. Return comes after a lower risk attached to commodity futures in the order of investment goals.

Pandey & Kathavarayan (2015) took into consideration frequency of trading, level of awareness, attracting factors, preference of commodity and reason behind investment etc. while he made use of multiple regression analysis to frame a relationship between perception of investors regarding commodity derivatives and demographic variables such as age, educational qualification and income.

Thamotharan & Prabakaran (2016) were of opinion that investing activity depends on market behavior, return and market volatility. This study specifically found it applicable and valid among derivative market investors.

Melbha & Bhavan (2017) focused on commodity market and the concepts of investors regarding the same. Investors were found linking high risk and flexible income as per market condition factors to the commodity market. Protection against inflation was found driving investor willingness than investing in global economic growth and diversification. The study also observed transparency as the prominent feature of commodity market followed by hedging against inflation, diversification, leverage, risk management and liquidity. The risks factors like price risk, loss risk, leverage risk etc. were also considered. The study also pointed out the commodity market influenced the price of commodities.

Kadariya et. al. (2012) held up educational background of the investor as a principal deciding factor with respect to investment in derivatives. The investors also relied on brokerage firms and their services as a basis for such investment decisions.

Bhatt & Chauhan (2014) proposed hedging as the prime motive behind investment. Risk control, market knowledge and volatility were identified as other significant motives behind derivative trading. Other significant determinant factors also included cash generation, potential for capital gain, ease of transaction, less

transaction cost, return, past experience, future growth, liquidity risk, safety, margin, transparency, tax benefits etc.

Dassani, Manda, & Kumar (2020) found out that only 12% of derivative market investor community practically play in commodity derivatives market. Kaur (2019) found out of five commodity exchanges, MCX and NCDEX as most preferred and next preferred commodity exchange. The reasons to prefer a specific commodity exchange were volume of trade followed by easy to trade, profits etc. Out of all, metals and bullion are the preferred commodity markets. Chi-square test was used to test the association of demographics with pull factors to invest in commodities.

Prasad, Mahato, Kapoor, Vibha, Jayadatta, & Keerthi (2021) concluded that transferability of risk and high return were gilt factors of Indian derivative market. It also revealed that spot and futures prices are cointegrated in the long term. To arrive at it, Johansen's Cointegration test was made use of.

Gopinath, Vasan, & Sumathy (2019) found low risk to be the prime reason to invest in commodities and high return follows while market volatility as the most quoted problem in commodity market followed by unassured returns. They also recommended for proer learning for commodity nvestors for safe trading. Lack of awareness regarding non-physical forms of gold despite higher return in comparison to physical gold has been noted also by Agarwal (2022) & Saravanakumar, Gunasekaran, & Aarthy (2011).

At the outset, every investment decision is important, and it is not backed by one single factor or the like. Multiple factors are supposed to have varying degrees of influences over a single investment decision. The same applies to derivative markets and instruments, futures on a special note.

Indu & Kavidayal (2016) emphasized the following factors influencing derivative markets- Increased volatility in financial asset prices, global market integration, improvement in communication facilities and cut of costs, development of

sophisticated risk management tools and innovation. The study proved very keen to come up with the following issues of derivative markets remaining unresolved till the time being- Market instability, Standardisation, Cash versus physical settlement, Regulatory body, Lack of economies of scale, Tax and legal bottlenecks etc. has been found the area to be probed in to.

Venkatesha & Hiriyappa (2017) made it vivid the risk - return game which balances derivative market and the whole story of trading revolving around these two factors. Forthe risks physical settlement is prone to possess, the stock market investors were not interested towards investing in derivative market. The result shows that the tool for risk hedging was the derivatives and it was affected by the spot markets. SEBI and the Government have been actively involving awareness campaigns to flourish the reach of derivative investment and trading.

Pallavi & Raju (2014) considered four major factors for investment motivation: Return, liquidity, safety and low risk. Issues like transaction cost, broker services, level of volatility, regulation, recent market history and risk tolerance turned out to be significant in derivatives trading market. Liquidity and investment returns were found highly satisfactory and clearing & settlement, fairness of transactions, market data for trading were satisfactory.

Manrai (2015) made use of factor analysis to trickle down signifact ones from the list of factors identified which influence derivative trading decisions. Anu (2020) also followed the same methodology to shortlist significant factors. On a crux, the researcher divided various behavioural factors influencing investment namely, Market factors, Herding, Prospect, Diversification, Overconfident into three- Psychological, motivational and personal decision factors which has turned to be significant turning point for this study for selection of variables. In the study it was further mentioned that hedgers and speculators prioritized herding and diverification over market factors. Menaka (2019) also adopted factor analsis methodology.

Sashikala & Girish (2015) segregated the factors playing major role in investment

markets- investor analysis, advice of brokers, current stock prices, recommendations of financial experts, inclination towards online trading, confidence. Exploratory factor analysis was used to identify the same.

Gold as a commodity stake has its own drivers of investment. Thapa & Shah (2020) identified price, security of investment, liquidity, social status, advertisement and influences and seasonal demand as driving factors. Yongsanguanchai (2003) also considered the following reasons for buying – accumulation, social status, liquidity, investment, savings for the future etc.

Hundal, Grover, & Bhatia (2013) emphasized on behaviour of investors towards gold, and they found the following pull factors notable: profitability, safety, time value of money, conventional value, universal investment, future prospects, tax aversion, risk management and trustworthiness. Factor analysis was applied in the study to extract relevant variables to investment behaviour towards gold.

Garg (2021) explored the factors which influence buying behaviour of gold with the help of factor analysis. The investment security and high returns attached to the investment avenue was proven major factors influencing the purchase. A hedge against inflation, portfolio diversification, financial backup in times of geopolitical and macroeconomic disturbances, ease to invest, status etc. have been the major variables which was extracted as factors further.

Selvaraj & Sudha (2020) found that factors influencing investment in gold consisted of profitability, safety, time value of money, future prospects, risk management, trustworthiness, liquidity, dynamic market, assured return, mortgageable instrument etc. The study also identified problems faced by gold investors like less return, problems in physical storage, partial liquidity, changing Govt. policy, price fluctuation, loss of value, high risk in futures & options, high making charges, less tax benefit and transaction cost.

Bezzina & Grima (2012) focused on factors affecting the proper use of derivatives.

Settlement risk, market risk, liquidity, suffiecient resources, greed, political interference, inadequate controls, leverage, costs, hedging & speculation, profits etc. were the major factors considered and found attention-worthy. Mahmood & Kashif-ur-Rehman (2010) considered variables like trend of derivative usage, risk level, awareness, hedging, business cycle effect etc. to determine factors that influence usade of derivatives.

Napompech, Tanpipat, & Ueatrakunkamol (2010) conducted a vast study which classified various factors as below:

- Benefit factors: liquidity, ornament value, high return, portfolio diversification.
- Economical and political factors: fluctuating oil prices, bank interest rate, systematic risk, investment conditions in risk-weighted assets, inflation rate, political stability, financial policies of Govt.
- Service factors, promotional factors, trading channel factors, price factors, product factors etc. were also considered.

Emphasis of gold futures investment has been given by Thanyasunthornsakun (2018). Various driving factors were identified. Liquidity factor covered change to cash, alternative to cash security, mortgage security, forex trading etc. Return on investment factors, risk factors which included theft risk and price fluctuations, economic factors, political factors which included political stability and global factors also constituted the conceptual framework.

Gold as derivative instrument has been found to be one of safest investments by Baral (2012). The study states gold fabricators through portfolio holdings, gold producers through hedging and speculators through trading have been benefitted from gold derivatives.

Raghavendra & George (2022) found commodity as the last preferred option by investors. It is plausible to assess the perception of existing investors to understand

the target market of the investment avenue.

Saroha & Yadav (2013) discussed issues with respect to derivatives market segment in India and those included political pressure and regulatory restrictions, low average per capita income, insufficient physical and institutional infrastructure, primitive public services, uncertainty in tax rules and laws, lack of proper training to investors, inaccessibility to retail investors, lack of technologically adequate infrastructure, price recovery and narrow risk bearing capacity of option writers etc.

Narayanan & Harikumar (2019) inferred that the major limitation of derivative instruments is the complexity involved followed by formalities involved, deposits and margins involved, poor technological knowledge, risk involved, volatility, hidden costs and other reasons.

Gurbaxani et. al. (2023) conducted factor analysis with pull factors as well as push factors behind investment in non-physical gold investment options including gold exchange traded funds. The factors attracting or motivating investment included convenient trading, no storage required, high liquidity, electronic trading, regulatory authority, buy-sell convenience and volume economy. The push factors or demotivating factors included no match of satisfaction as in physical gold, lack of knowledge, uneasy conversion to physical gold, risk, lack of trust, financial literacy, trading expenses like brokerage, no proper regulation, confusing concept of instrument and unreliability.

2.3 Research Gap

The extensive literature review and the researchers' experience brought a sharp focus on the research gap, which is identified as follows:

- According to existing literature, derivative instruments seem to be the least preferred avenue of investment by the investor population in comparison to alternate sources.
- The trend of gold in the past and its forecasted future which is to have a direct

impact on the performance of its futures is left to be analyzed in detail.

- Research studies in India are yet to probe in detail into gold futures market.
- Though comparison between various commodity markets as well as financial futures market along with their volatility spillovers in the arena of different economies around the globe has formed research problems, dedicated studies in gold futures market in Indian perspective are lacking. Indian market of gold being a globally-looked-upto one, a room for inquisitiveness has been identified.
- Empirical studies are less focused even now, especially in Indian Gold market.
- Investor centric perspective which helps to have a bird-eye-view regarding the matter of study has been hardly investigated with reference to Gold Futures in India.
- Investment push-pull with focus to Gold Futures which is probable to validate or negate theory has hardly been a matter of study.

Thus, the findings of this study would fill the research gap identified above thereby contributing to the literature available so far in this domain.

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Chapter 3
RESEARCH METHODOLOGY

Contents

3.1 Introduction

The present study focuses on gold futures investment in Kerala. The empirical study may be divided into two parts based on methodology adopted- secondary data analysis & primary data analysis with three & two objectives pertaining to each respectively. First objective is to investigate the relationship between gold prices and stock market returns in India and the data required for fulfilling these objectives are collected from historical data of NCDEX, BSE database, NSE database etc. The second objective is to analyze the trend and performance of gold prices in India. The data required has been collected from the database of the World Gold Council and its official website. The third objective is to analyze the efficiency of gold futures in price discovery of gold in India. The fourth objective probes into the perception and attitude towards gold futures among investors in Kerala and the fifth objective analyzes the determinants of investment in gold futures among investors in Kerala. Primary data was collected for fulfilling fourth and fifth objectives from the investors in Kerala who have invested in gold futures. Various analytical tools and software for support were used based on nature of the data for fulfilment of objectives.

3.2 Research Design

The study is both descriptive and analytical in nature. The descriptive nature of the study concerns the description of characteristics the population possesses whereas analytical nature of the study comprehends analysis of the data

with appropriate tools and techniques. The study involves both primary and secondary data.

3.2.1 Source of Data

3.2.1.1 Secondary Data

The secondary data sources for the study include journals, books,publications and websites of the World Gold Council, websites of NCDEX, NSE, BSE, SEBI etc. Data from websites of RBI, MOSPI etc. were also referred for the purpose of the study.

3.2.1.2 Primary Data

Primary data for the study have been collected from individual gold futures investors. The gold futures investors residing in Kerala constitute the target population. Since the population is scattered over the target area and the complete frame of population is not available, a census survey is impractical. Hence, a sample survey has been employed.

3.2.2 Sampling Design

3.2.2.1 Selection of Gold Futures Investors

a. Population of Investors

The target population consists of individual gold futures investors in Kerala. Due to unavailability of an official database of gold futures investors in Kerala and their geographical distribution, the assistance of various stock broking companies involved in commodity market investment, such as Share Khan, Share Wealth, Motilal Oswal Financial Services, Geojit Financial Services, BNP Paribas has been sought. Furthermore, many investors introduced their peers in the investor community from whom requisite data was collected and accumulated.

b. Sampling Method

The snowball sampling method, also known as chain referral, has been deployed for collecting primary data from investors in Kerala. Lack of population frame and traceability issues led to selection of this non-random sampling method. Anieting & Mosugu (2017) prescribed snowball sampling to study deviant behaviour and in situation where the population is hard to reach. Investors taken as samples differ in gender, geographical location, and other demographics. The details of a set of investors were collected with the help of stockbroker firms and the rest of the sample was referred to by the respondents. The data was collected.

Exponential non-discriminative snowball sampling was adopted wherein the first sample investor gave multiple referrals. Each new referral/sample has been explored until sufficient primary data was collected from the referrals/samples.

c. Determination of sample size of Investors

The data relating to the number of investors and their geographical distribution is unavailable. Similar studies in related fields have taken a sample of 100 nos. (Paranjpye, Ambhore, & Raghuvanshi, 2020; Jahnavi & Bose, 2019). For the purpose of study, since the population is unknown, Cochran's formula has been employed with estimated proportion of 10% and 95% confidence level:

$$N = \frac{Z^2 \times p(1-p)}{e^2} = \frac{(1.96)^2 \times (0.1 \times 0.9)}{(0.05)^2} = 135 \text{ nos.}$$

However, the study has taken into consideration a sample of 150 nos. up to the satisfaction of responses.

3.2.2.2 Research Instrument

The researcher has deployed structured schedule as the data collection instrument for collecting the primary data from gold futures investors considered in the study. Experts in capital market and experienced professionals dealing with commodity investments were consulted while drawing the schedule and their comments were sought regarding the comprehensiveness of the schedule and content validity was ensured. Face validity has been confirmed with Cohen's Kappa Index of 0.75 which comes under substantial agreement as per Landis & Koch (1977). A Lawshe's Content Validity Ratio (CVR) of 1.0 has confirmed the content validity of the

structured schedule (Ayre & Scally, 2014). Prior to the survey, a pilot study was conducted among 30 gold futures investors in the Thrissur district. Based on the responses obtained in the pilot study, necessary modifications were made after finalizing the question statements. The researcher telephonically contacted the sample investors over phone and collected the required responses. The period of the actual survey was from January 2020 to December 2021.

The structured schedule consisted of four parts which are as follows:

Part 1: Questions related to the socio-economic profile of the respondents.

Part 2: Questions for collecting the responses related to the perception of the investors.

Part 3: Questions for collecting the responses related to the attitude of the investors.

Part 4: Questions for collecting responses related to the satisfaction of the investors.

3.2.3 Reliability Analysis

One of the most popular estimates of the reliability coefficient is Cronbach's Alpha Coefficient (Cronbach, 1971). The alpha coefficient is used to estimate the internal consistency of a composite score. Hence, Cronbach's alpha reliability coefficient is used in the present study to analyse reliability. The results of the reliability analysis arepresented in table 3.1.

Table 3.1

Reliability Analysis

Sl No	Variables	No of items	Alpha Value
1	Pre-investment perception	12	0.839
2	Post investment perception	12	0.813
3	Investor attitude	14	0.700
4	Investor satisfaction	6	0.784
5	Determinants of investment in gold futures	11	0.771

Source: Survey Data

George & Mallery (2003) stated that Cronbach's Alpha of 0.7 or more as acceptable. Hence, the instrument may be considered reliable in terms of internal consistency.

3.3 Data Analysis

3.3.1 Secondary Data Analysis

a. Unit Root Tests

In statistics, unit root tests are used to check the stationarity of the time series data. In the present study, the Augmented Dickey Fuller test and Phillips-Perron tests are employed to examine whether the data are non-stationary and possess a unitroot. Data are said to be stationary when their statistical properties such as mean, variance, etc. are constant over time.

b. Vector Auto Regression (VAR)

VAR is a widely accepted method adopted to determine the optimum lag length of each variable. Various criteria which are used for the selection of optimum lag length are the Likelihood Ratio, Akaike Information Criteria, Final Prediction Error, Hannan- Quinn Information Criteria and Schwarz Information Criteria.

c. Co-Integration tests

Co-integration is a statistical method used to find a possible correlation between time series processes in the long run. Johansen Co-integration test is used to determine the number of co-integrating equations among the variables (Johansen, 1988).

d. Vector Error Correction Models (VECM)

VECM is a co-integrated VAR model. It is used to examine the short-run dynamics and long-run equilibrium of the model. It is an altered VAR used to analyse the dynamics of a cointegrated relationship. It can be applied only wherever cointegrating relationship exists. It introduces error correction terms into autoregressive equations.

$$Correction\ move\ to\ equilibrium = adjustment\ coefficient\ (\alpha) \times errors\ (\beta \times t - 1)$$

e. Causality tests

If there is co-integration among the variables, the exogeneity tests areapplied based on VECM. Causality refers to the ability of one variable to predict and influence the value of another variable. It reveals which variable is endogenous and which one is exogenous. Engle & Granger (1987) found that a causal relationship exists among variables in one direction if they are co-integrated. Toda & Yamamoto (1995) suggested revised method of Granger causality test where pretest of integration and co-integration are not necessary. In this study, the Granger causality test and Toda-Yamamoto Granger causality test is applied to examine the causality between the variables.

f. Variance Decomposition Analysis

Variance decomposition is used to assess the proportion of the movementof dependent variables due to their own shock and due to the shock of otherindependent variables. In this study, Cholesky decomposition is used to obtain variance decomposition.

g. Impulse Response Function

The impulse response function is used to determine the direction, magnitude, and duration of the variables in the system which is affected by an external variable's shock. Cholesky decomposition is used to obtain the impulse response of linkages.

h. Autoregressive Integrated Moving Average

ARIMA is a statistical modelling tool used to build models for the purpose of understanding the trend of a time series data and forecasting the future values. It is elementarily based on the assumption that the future will imitate the past and hence the past values help to predict the future values.

3.3.2 Primary Data Analysis

i. Mean

Mean is a measure which represents the entire data by a single value. It is the average value of the given set of data.

ii. Standard Deviation

Standard deviation measures the deviation of values from the mean value.It is the degree of dispersion relative to its mean.

iii. Paired t Test

The paired sample t-test, also known as, dependent sample t-test, is used to determine whether mean difference of a pair of observations is zero or not. In paired t-test, each subject is tested twice which result in pairs of observations. These paired observations can represent things like measurement taken at two different times.

iv. One sample Kolmogorov Smirnov Z test

The One sample Kolmogorov Smirnov Z test compared two cumulative frequency distributions and tests whether a sample comes from a specific distribution. This is used in the study to test normality of data distribution.

v. Mann-Whitney U test

The Mann-Whitney U test, also known as Wilcoxon rank-sum test, is a non-parametric test used to test whether two independent variables differ significantly i.e., comparison of two sample means.

vi. Kruskal Wallis H test

The Kruskal-Wallis H test is a rank based non-parametric test used to test whether there are statistically significant differences between more than two groups of independent variables on a scale or ordinal variable. It is also popularly known as *one-way ANOVA on ranks*. It is an extended version of the Mann-Whitney U-test from two groups to multiple groups.

vii. Residual Analysis

Residual is the difference between observed values and expected values. Residual analysis is a post-hoc analysis test to analyse which combination of categories of variables contributes more to a statistically significant statistic. The larger the residual, the more it contributes to significant difference.

viii. Dunn-Bonferroni Posthoc test

Dunn's test is a non-parametric test to do pairwise comparison with two groups with statistically significant differences. It involves calculating mean rank differences and calculating Z values for each pair (Dunn, 1961). Bonferroni correction is a method to adjust the significance or p-value (also known as alpha) for multiple comparison.

Dunn-Bonferroni test is a post hoc test which is a combination of Dunn's test and Bonferroni correction. It calculates the Z value for each pair and adjusts p-value for multiple comparisons alongside.

ix. Multiple Regression Analysis

Multiple regression is a statistical test employed to analyze the relationship between a single dependent variable and many independent variables (Hair, Black, Babin, & Anderson, 2015).

3.3.3 Software used for data analysis.

E-views 9 has been used for secondary data analysis in the study. For analysis of primary data Statistical Package for Social Sciences, popularly known as, SPSS version 19 has been used.

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Chapter 4

RELATIONSHIP BETWEEN GOLD PRICES AND STOCK MARKET RETURNS IN INDIA

Contents

4.1 Background

Indian capital market is a pool of investment opportunities- stocks, bonds, mutual funds, derivatives, commodities, foreign exchange etc. Stock market is undeniably the quintessential section of Indian capital market. It would not be an exaggeration to say that the stock market acts as a barometer of performance of economy (Dagar, 2014) and Indian stock market is essentially one. As a fundamental economic pillar, the stock market has a big influence on how businesses and industries grow, which in turn has a major bearing on how well the country's economy performs generally. Most significantly, it is generally acknowledged that the growth of the stock market is essential to the expansion of the national economy because it: (a) offers a further avenue for stimulating and mobilizing domestic savings; (b) guarantees increase in investment productivity through the distribution of capital and resources; and (c) strengthens managerial discipline through the market for corporate control. The stock market helps to finance funding and incentives for corporations, allocate capital and resources, increase national savings, and ultimately pave the path for economic progress. The volatility and magnitude of stock market thus helps in predicting the direction of economic development.

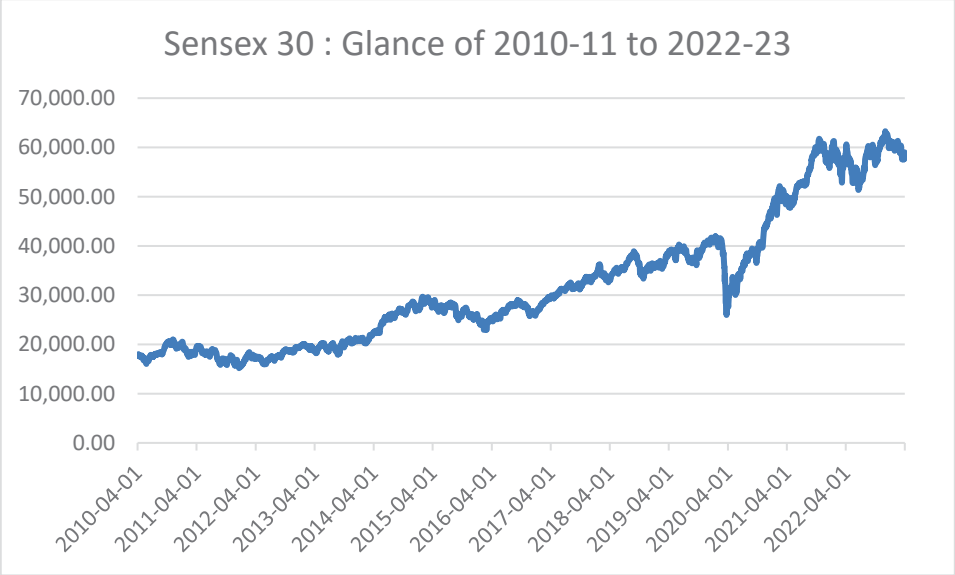
At the same time, India is one of developing economies considered successful in terms of vibrant market of derivatives traded through exchange floors

(Vashishtha & Kumar, 2010). NSE recorded a total futures volume of 1,45,554 lots worth Rs. 6,362 crores in the year 2019-20 whereas BSE recorded a total futures volume of 9,08,017 lots worth Rs. 46,439 crores for that year i.e., pre-lockdown time (Securities and Exchange Board of India, 2023). Commodity derivative contracts do strongly influence the derivative market turnover and the bullion derivative segment is no exception.

Indian stock market could be cited as a reflection of multiple macroeconomic indicators like exchange rate, interest rate, inflation, money supply etc. Various literature works support the statement (Pal & Mittal, 2011; Singh, 2014; Giri & Joshi, 2017).

Figure 4.1

BSE Sensex 30: Glance from 2010-11 to 2022-23

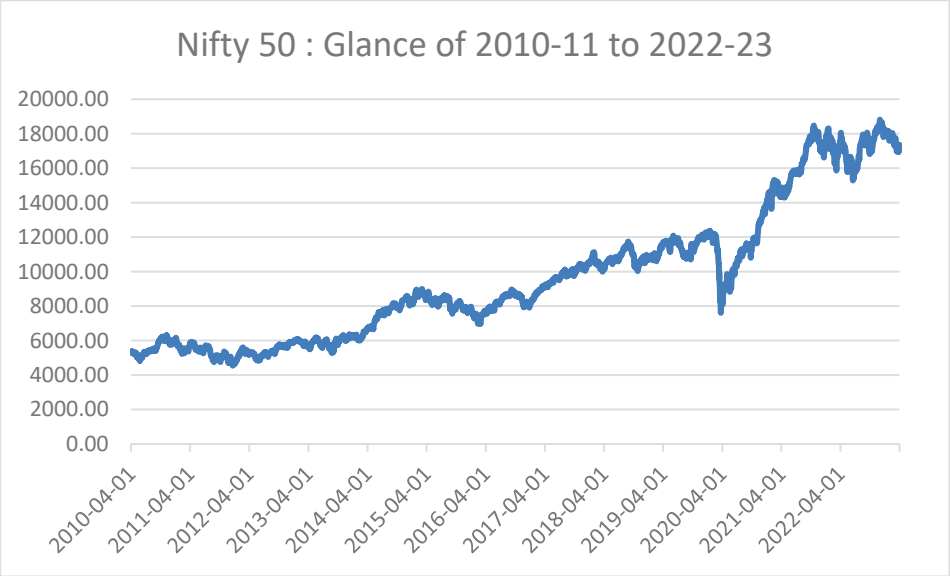


Source: RBI Database of Indian Economy

Figure 4.1 shows the trend analysis of Sensex 30 stock index of Bombay Stock Exchange (BSE). The returns or stock index seemed to experience notable booms of varying degrees during 2010-11, 2014-15, 2018-19 and 2021-22. It is also pertinent to note the crash in returns of market index 2015-16 and even major one during 2019-20.

Figure 4.2

NSE Nifty 50: Glance from 2010-11 to 2022-23



Source: RBI Database of Indian Economy

Figure 4.2 is all about the trend of NSE Nifty 50 index or, generally termed as NSE stock returns. It is pertinent to note that the trend followed by Nifty seems like a replica of that of Sensex for the time period. The ups and downs and their intensity almost match the same recorded by Sensex.

Gold in its physical form itself have had an inseparable journey with the indigenous culture of India. As an investment avenue, gold has been able to meet the expectations of its investors in times of uncertainties since it is popular as 'safe haven' among the investor community.

With passage of time, investment format for gold has been replaced by paperless form like Gold F&O, Gold ETFs, sovereign gold bonds etc. as physical gold is prone to depreciation, risk of theft and purity issues. However, in the long run, the price of gold has increased less like a commodity and more like a long-term asset.

Figure 4.3

Gold prices: Glance from 2010-11 to 2022-23

Source: World Gold Council

The price of gold has been volatile for decades. A graphical representation of gold price movements is shown in Figure 4.3. Gold price trend seems to be volatile with ups and downs random walk. Spikes in prices have been noticed during 2012-13, 2016-17 and even major spikes during 2020-21 and 2022. On a general note, it may be noticed that gold prices move in almost opposite trend to stock market during certain years of economic importance.

Often gold and stocks are deemed to be complementary investment avenues which has gained popularity at almost equivalent pace in India. Though both these segments have never failed to allure the market investors both seem to be preferred by them subject to circumstances then prevailing. The investors prompt and impulsive to the stock market movements treat gold to be safe haven in the times of recessive trends (Baur & McDermott, 2010; Jain & Biswal, 2016).

In this chapter, the relationship between gold prices and stock market return has been analyzed in detail.

4.2 Data & Methodology

The following data for a period of 5 years (01/07/2013-29/06/2018) has been considered for the study:

- Daily closing spot prices of gold (Big Gold or GOLD) recorded by National Commodity & Derivatives Exchange Limited (NCDEX) (hereinafter referred to as gold or spot prices of gold).
- Daily closing Sensex points recorded by Bombay Stock Exchange (BSE) (hereinafter referred to as Sensex)
- Daily closing Nifty points recorded by National Stock Exchange (NSE) (hereinafter referred to as Nifty).

The following tools are used for analysis of data in the study:

a. Augmented Dickey-Fuller Test

Augmented Dickey Fuller Test can be used to determine whether the time series is stationary or not. The Augmented Dickey-Fuller statistic of ADF test is usually negative. The more negative the statistic is, the stronger the rejection of the null hypothesis is i.e., there is unit root.

Mathematically, unit root can be represented as:

$Y_t = D_t + z_t + \varepsilon_t$; where

Dt is deterministic component; zt is stochastic component; and εt is error term. Unit root test checks whether there is unit root in stochastic component or not (zt).

b. Johansen Cointegration test

Johansen (1991,1995) devised VAR based Cointegration Test. This test assumes that no cointegrating relationship exists between all endogenous variables under consideration. It has 2 parts- Trace statistic and Max-Eigen statistic. Both these statistics give the number of cointegrating equation existing between the variables

under consideration. The level of significance is usually taken as 5%. The Johansen test allows more than one cointegration relationship.

c. Granger Causality Test

Granger (1969) developed the Granger Causality Test. The test is used to determine whether a particular time series helps in forecasting another series. The null hypothesis of Granger causality test assumes that lagged values of X do not explain the variance of Y. To test the null hypothesis that X does not Granger-cause Y, lagged values of Y need to be find out:

$$Yt = \alpha 0 + \alpha 1Yt\text{-}1 + \alpha 2Yt\text{-}2 + \ldots\ldots + \alpha mYt\text{-}m + \varepsilon t$$

Next, the autoregression is minimized by including lagged values of X:

$$Yt = \alpha 0 + \alpha 1Yt\text{-}1 + \alpha 2Yt\text{-}2 + \ldots.. + \alpha mYt\text{-}m + \beta 1Xt\text{-}1 + \ldots. + \beta qXt\text{-}q + \varepsilon t$$

Null hypothesis is $\beta 1 = \ldots. = \beta q = 0$

Toda- Yamamoto method of granger causality test is a modified Granger Causality test or modified Wald test and different from VECM based granger causality test since the former does not need pre-tests of unit root and cointegration. Toda and Yamamoto (1995) extra lag procedure (optimum lag + expected maximum integration order) of testing for Granger no causality yields an asymptotic chi-square (χ^2) for the Granger no-causality test statistic in a vector autoregression system irrespective of the integration order or cointegrating equations.

d. Vector Error Correction Model (VECM)

VECM is an extended version of Vector Autoregression method. The standard VAR model can be estimated only when the variables are stationary. To remove the unit root, time series need to be differentiated. However, in the case of cointegrated series, this would lead to over differencing due to non-level integration and losing information attached to the long-term co-movement of time series at their levels. Here the integrated VAR derives importance. VECM is an altered VAR used to analyze the dynamics of a cointegrated relationship. It can be applied only wherever cointegrating relationship exists. It introduces error correction terms into autoregressive equations.

Correction moves to equilibrium = adjustment coefficient (α) × errors ($\beta \times t\text{-}1$)

An appropriate VECM model can be formulated as follows:

$$\Delta Xt = C + \Pi Xt + \Gamma 1 \Delta Xt-1 + \cdots + \Gamma p-1 \Delta Xt-(p-1) + \eta t$$

4.3 Results and Discussion

Table 4.1

Gold & Stock: Descriptive Statistics of Variables

Variable	Mean	Maximum	Minimum	Standard Deviation	Skewness	Kurtosis
GOLD	28582.24	34130.00	24473.00	1763.031	-0.21679	2.19869
SENSEX	27320.88	36283.25	17905.91	4219.511	-0.02135	2.52788
NIFTY	8319.86	11130.4	5285	1371.162	-0.05569	2.42299

Source: Analysis by researcher

One to one relationship between two variables and two such relationships need to analyze in detail with the corresponding time series data of which the elementary stage is to infer the properties of the concerned data with descriptive statistics given in Table 4.1.

The spot price of gold quoted at NCDEX, which is here considered to be the dependent variable, follows a mean value of 28582.24 with a reliable deviation of 1763.031. The maximum and minimum values also confirm only a little possibility for highly volatile movements. Though Sensex too follows a mean value of 27320.88, near to that of gold, it seems to be highly volatile and thus less reliable with relatively higher standard deviation of 4219.511 and comparatively wider range while reading along the maximum and minimum values. Nifty is no exception. The standard deviation value of 1371.162 is relatively high when the central value itself is 8319.86.

Table 4. 2

Gold & Stock: Augmented Dickey-Fuller Test Results

Variable	Level			1st differencing			Order of Integration
	None	Intercept	Trend & Intercept	None	Intercept	Trend & Intercept	
GOLD	0.4153 (0.8027)	-2.3692 (0.1508)	-2.3966 (0.3811)	-36.1214 (0.000)	-36.115 (0.000)	-36.102 (0.000)	I (1)
SENSEX	1.7719 (0.9820)	-0.9157 (0.7836)	-2.0108 (0.5943)	-17.9767 (0.000)	-18.1005 (0.000)	-18.0932 (0.000)	I (1)
NIFTY	1.7495 (0.9811)	-0.9576 (0.7698)	-2.1121 (0.5380)	-18.0918 (0.000)	-18.2146 (0.000)	-18.2072 (0.000)	I (1)

**p–values are given in brackets*.

Time series data analysis demands unit root test of the variables considered in order to fulfill its stationarity requirements. The stationary series could be easily understood as a structure and the upcoming values could be foretold. Out of all the tests of unit root, Augmented Dickey-Fuller test is the prominent one. Results of ADF test have been shown in Table 4.2.

All the variables- gold, sensex and nifty- reject the existence of unit root at first differencing with p-values less than 0.05. Hence, it is inferred that all the variables under consideration follow the first order of integration.

Arltová & Fedorová (2016) stated ADF test of stationarity as a reliable unit root test and its results as relevant with bigger number of observations. They have also found the Phillips-Perron test as a suitable substitute. Hence, the Phillips-Perron test has also been applied to cross check the result with respect to existence of unit root.

Table 4.3 shows the result of Phillips-Perron test. All three variables- gold, Sensex and Nifty- fail to reject the null i.e. existence of unit root at level. However, p-values being less than 0.05, the null of unit root is rejected at first differencing for all three variables. The results match those of ADF test as all variables follow the

first order of integration.

Table 4.3

Gold & Stock: Phillips-Perron Test Results

Variable	Level			1st differencing			Order of Integration
	None	Intercept	Trend & Intercept	None	Intercept	Trend & Intercept	
GOLD	0.5649 (0.8382)	-2.6669 (0.0802)	-2.6501 (0.2580)	-36.0942 (0.000)	-36.0875 (0.000)	-36.0752 (0.000)	I (1)
SENSEX	1.7632 (0.9816)	-0.9051 (0.7870)	-2.0483 (0.5736)	-31.8194 (0.000)	-31.8847 (0.000)	-31.8708 (0.000)	I (1)
NIFTY	1.7472 (0.9810)	-0.9333 (0.7779)	-2.1354 (0.5249)	-31.8172 (0.000)	-31.8878 (0.000)	-31.8737 (0.000)	I (1)

**p–values are given in brackets*.

Since integration order has been found non-level, ordinary least squares may not serve the purpose of formulation of a model or system explaining how the variables react to each other and how far they impose an impact on each other. The relationship between gold and the stock market has been analyzed separately in the study i.e., Gold versus Sensex and Gold versus Nifty.

4.3.1 Gold and Sensex

Since both variables under consideration- Gold & Sensex- have been integrated in first order, Johansen's Cointegration test has been used. For the same, suitable lag order has to be selected. Vector Autoregression (VAR) has been used for the selection of lag order.

Table 4.4 gives the values of different criteria for lag selection. Out of the available criterion- Likelihood Ratio, Final Prediction Error, Akaike Information Criterion, Schwarz Criterion, Hannan–Quinn information criterion- Akaike Information Criterion has been considered for selection of lag order (Liew, 2004). As per Table 4 above, LR, FPE and AIC criteria indicates selection of lag order of 7. With lag order of 7, Johansen's maximum likelihood test of cointegration, developed by Johansen (Johansen, 1988) has been performed between spot prices of gold and

Sensex.

Table 4.4

Gold & Sensex: Lag Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-20805.93	NA	5.02e+13	37.22349	37.23247	37.22688
1	-15379.17	10824.40	3.08e+09	27.52266	27.54959*	27.53284
2	-15369.13	19.98247	3.04e+09	27.51186	27.55675	27.52883*
3	-15366.38	5.461439	3.05e+09	27.51410	27.57695	27.53786
4	-15365.67	1.410384	3.07e+09	27.51998	27.60079	27.55053
5	-15361.24	8.771376	3.07e+09	27.51922	27.61798	27.55655
6	-15353.29	15.71866	3.04e+09	27.51215	27.62887	27.55627
7	-15346.98	12.44878*	3.03e+09*	27.50802*	27.64270	27.55893
8	-15343.29	7.266079	3.03e+09	27.50857	27.66122	27.56627

**indicates lag order selected by the criterion*
LR: Sequential modified likelihood ratio test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Johansen's cointegration test was employed to test the causal relationship between gold prices and various macro-economic indicators (Patel, 2013; Sreekanth & Krishna, 2014; Šimáková, 2011; Gayathri & Dhanabhakyam, 2014; Shiva & Sethi, 2015; Banumathy & Azhagaiah, 2015). Johansen's Cointegration test is a combination of trace test and maximum eigen value test. Both tests assume null hypothesis of no cointegrating relationship between variables. The alternate hypothesis differs for trace test assumes at least one cointegrating equation whereas max-eigen test assumes only one cointegrating equation. As such, the number of cointegrating equations between the variables in a model is tested, which depends on the number of variables considered in a model.

For estimating the number of co-integrating equations, Trace test and Max-Eigen value statistics are used at a 5 percent level of significance. These tests are based on five alternative assumptions, which are:

- The model does not allow for any deterministic components in the data.

- The model does not allow for any linear trends in the data but allows for constants in the co-integrating equations.
- The model allows for linear trends in the data, but no trends in the co-integrating equations.
- The model allows both constants and linear trends in the co-integrating equations.
- The model allows for non-linear trends, and this is the least restrictive model on deterministic components.

The results of Johansen cointegration test run with gold and Sensex data are depicted in Table 4.5.

Table 4.5

Estimation of Association between Gold & Sensex

Johansen Co-integration Test							
Hypothesized No. of CE(s)	**Eigen Value**	**Trace test**			**Max-Eigen Value Test**		
		Statistical Value	Critical Value	Prob.*	Statistical Value	Critical Value	Prob.**
None *	0.014835	17.52583	15.49471	0.0244	16.71029	14.26460	0.0201
At most 1	0.000729	0.815540	3.841466	0.3665	0.815540	3.841466	0.3665

** Trace test denotes rejection of the hypothesis at the 0.05 level.*
*** Max-Eigen Value test denotes rejection of the hypothesis at the 0.05 level.*

The results of Johansen Co-integration test show that both tests have rejected the assumption of no cointegrating relation between the variables p-value being less than 0.05. P-values being more than 0.05, it has failed to reject the alternate hypothesis of at most one cointegrating relationship between variables. Hence, the existence of one cointegrating relationship has been confirmed at 5% level of significance.

Table 4.6 shows that normalized cointegrating coefficient is negative, showing the relationship between both variables is positive. It may be noted that it is different from the existing theory of negative relationship between gold and stock index (Jain & Biswal, 2018).

Table 4.6

Gold & Sensex: Normalised Cointegrating Coefficients

Variable	Coefficients	Standard Error
Gold	1.000000	---
Sensex	-0.072107	0.10070

Source: E-views output

The relationship can be put to a mathematical expression as follows:

Gold=-0.072107Sensex

The results reveal that, in the long run, the stock market i.e., Sensex influences gold prices positively which further means that gold prices will rise with an increase in Sensex points and fall with a decrease in Sensex points over the long run.

Table 4.7

Gold & Sensex: Error correction model

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.015238	0.004317	-3.529629*	0.0004
C(2)	-0.099712	0.030438	-3.275942*	0.0011
C(3)	-0.070610	0.032832	-2.150684*	0.0317
C(4)	-0.047153	0.030397	-1.551274	0.1211
C(5)	0.036431	0.032911	1.106975	0.2685
C(6)	-0.004291	0.030080	-0.142662	0.8866
C(7)	0.015101	0.032866	0.459457	0.6460
C(8)	0.044130	0.030061	1.467986	0.1424
C(9)	0.068565	0.032867	2.086157*	0.0372
C(10)	0.120868	0.029974	4.032466*	0.0001
C(11)	-0.003035	0.032905	-0.092227	0.9265
C(12)	0.089045	0.029864	2.981640*	0.0029
C(13)	-0.014776	0.032896	-0.449163	0.6534
C(14)	0.055760	0.029840	1.868643	0.0619
C(15)	0.071985	0.032603	2.207914*	0.0275
C(16)	2.943446	7.349475	0.400497	0.6889

Source: EViews Output
**significant at 5% level of significance*

Table 4.7 discusses error correction model of the long run relationship between gold and Sensex. The Error Correction Term (ECT) indicates the speed of adjustment by the variables, or the time taken by the process in the model to attain equilibrium by rectifying any disturbance caused. C(1) denotes the co-efficient of the speed of adjustment to the long run in a VECM. Provided the coefficient is negative and statistically significant, it is implied that the error correction term is consistent. Table 4.7 indicates that the coefficient is negative and statistically significant at a 5% level of significance (Prob<0.05). Hence, the results show that any disturbance caused to the temporary equilibrium of the variables in the model will be automatically corrected in the long run.

The negative value of ECT being near to zero indicates a long time period taken for correction of disequilibrium. It can be said that if a shock occurs in the system, equilibrium is restored at a rate of 1.524%.

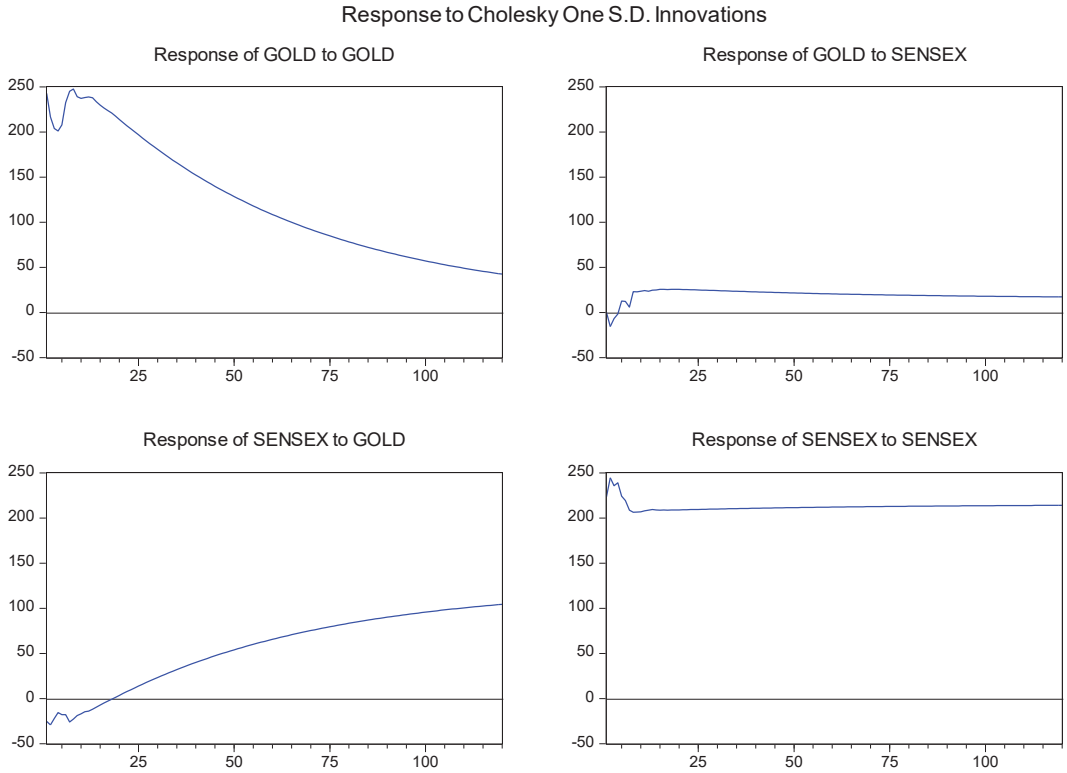
Impulse Response

Impulse response function describes evolution of variables in a model in reaction to a shock to any variable keeping all other variables constant. The impulse response function is employed here to trace the impact of shock in the system i.e., between spot prices of gold and stock market in India. It will help tracing the direction of change in one endogenous variable caused by one standard deviation shock to another endogenous variable. The persistence of shock will act as a key factor to the velocity of correction process to equilibrium. Cholesky decomposition is considered to obtain the impulse response function. The impulse response function for 120 days has been considered.

Figure 4.4 indicates the response of Sensex to its own shock and shocks in spot prices of gold and the response of spot prices of gold to shocks in Sensex and its own shocks.

Figure 4.4

Gold & Sensex: Impulse response function



Source: E-views output

It can be observed that spot prices of gold show negative response to its own shocks over time whereas it shows slightly positive response to shocks in stock market. Sensex reacts positively to shocks in spot prices of gold whereas it remains almost indifferent to its own shocks after initial negative response in case of its own shocks.

Variance Decomposition Analysis

Variance decomposition explains how a unit shock in one variable impact forecast error of another variable. In other words, it allows partitioning of total variance on the independent variable as to which variable- dependent variable or the independent variable itself- explains how much variance.

Table 4.8

Gold & Sensex: Variance Decomposition Analysis Results

Period	Variance decomposition of Sensex		Variance decomposition of Gold	
	Sensex	Gold	Sensex	Gold
1	100.0000	0.000000	1.262331	98.73767
30	98.75977	1.240226	0.885653	99.11435
60	93.90017	6.099830	0.785457	99.21454
90	88.38023	11.61977	0.739918	99.26008
120	83.58468	16.41532	0.716143	99.28386

Source: E views output

The results of variance decomposition analysis shown in Table 4.8 indicate that on the first day, the variance in the Sensex is explained by its own shocks. As the days progress, the variance in the Sensex is due to the influence exerted by spot prices of gold. After 120 days, 16% of the change in the Sensex is explained by the shock exerted on spot prices of gold. However, only 0.7% of the variance in spot prices of gold is explained by the shocks on the Sensex after 120 days.

Granger Causality Test

Once a co-integrating relationship is proven, it is imperative to analyse the direction of such relationship in the short run. Granger causality test has been employed by Bhunia & Mukhuti (2013), Ingalhalli et. al. (2016) and Comincioli (1996) for investigating causal relationships in different finance related backdrops.

Table 4.9

Gold & Sensex: Granger Causality Results

Causality direction	Chi-square	df	Prob.
Sensex>Gold	15.67219*	7	0.0283
Gold>Sensex	5.338482	7	0.6187

Source: E-views output
** significant at 5% confidence level.*

It can be seen in Table 4.9 that the Sensex granger causes gold prices since chi-square value has been found statistically significant at 5% level of significance. However, p-value being insignificant, it is inferred that gold prices do not granger cause Sensex.

However, the traditional Granger causality test is not free from limitations. A two-variable Granger-causality test is prone to specification bias as it does not consider the effect of other variables excluded in the model. Toda & Yamamoto (1995) proposed a procedure for estimation of basic VAR with extra lag which ensures asymptotic distribution of Wald statistic, and the test is indifferent to different integration and cointegration properties. Alimi & Ofonyelu (2013) tested causality with Toda-Yamamoto procedure between money market interest rate and expected inflation. The causality is reconfirmed by employing Toda-Yamamoto no-causality test and the results are shown in Table 4.10.

Table 4.10

Gold & Sensex: Toda-Yamamoto Causality Results

Causality direction	Chi-square	df	Prob.
Sensex>Gold	15.76920*	7	0.0273
Gold>Sensex	4.598208	7	0.7089

Source: E-views output
***** *significant at 5% confidence level.*

Toda-Yamamoto method of Granger causality confirms the results of VECM based Granger causality method since the result confirms that there is unidirectional causality from Sensex to spot prices of gold. It can be inferred that gold does not granger cause sensex since chi-square value is statistically insignificant and the no-causality hypothesis failed to reject.

4.3.2 Gold and Nifty

The relationship between spot prices of gold and stock market returns cannot be deducted or generalized from the cointegrating relationship between the former and Sensex. Hence, the existence of a long-term relationship between the spot price of gold and stock market returns has been re-tested, replacing Sensex with Nifty. Since both gold price and Nifty are integrated in first order, Johansen's cointegration test is apt to use of which selection of lag length is first step.

Table 4.11

Gold & Nifty: Lag Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-19548.22	NA	5.30e+12	34.97357	34.98255	34.97696
1	-14063.68	10939.65	2.92e+08	25.16938	25.19632*	25.17956
2	-14053.51	20.26035	2.89e+08	25.15833	25.20323	25.17530*
3	-14050.56	5.859357	2.90e+08	25.16021	25.22307	25.18397
4	-14050.00	1.119149	2.92e+08	25.16636	25.24717	25.19691
5	-14045.63	8.648782	2.91e+08	25.16570	25.26447	25.20304
6	-14037.64	15.78543	2.89e+08	25.15857	25.27530	25.20270
7	-14031.04	13.03465*	2.88e+08*	25.15391*	25.28860	25.20482
8	-14027.15	7.663134	2.88e+08	25.15411	25.30675	25.21181

**indicates lag order selected by the criterion*
LR: Sequential modified likelihood ratio test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Table 4.11 implies that all the criteria except Schwarz information criterion and Hannan-Quinn information criterion is minimum for a lag length of 7 and hence the lag length with minimum AIC is being taken as the optimum lag length. Therefore, 7 is considered as the optimal lag length for the further analysis of the relationship between Nifty and spot prices of gold.

Table 4.12 presents the results of the Johansen cointegration test. The trace test results, and the Max-Eigen test results imply that there exists one co-integrating equation at a 5% level of significance. Therefore, the results indicate the existence of a long-run relationship between spot prices of gold and Nifty.

Table 4.12

Estimation of Association between Gold & Nifty

Johansen Co-integration Test							
Hypothesized No. of CE(s)	**Eigen Value**	**Trace test**			**Max-Eigen Value Test**		
		Statistical Value	Critical Value	Prob.*	Statistical Value	Critical Value	Prob.**
None *	0.014511	17.10128	15.49471	0.0284	16.34192	14.26460	0.0231
At most 1	0.000679	0.759356	3.841466	0.3835	0.759356	3.841466	0.3835

** Trace test denotes rejection of the hypothesis at the 0.05 level.*
*** Max-Eigen Value test denotes rejection of the hypothesis at the 0.05 level.*

Table 4.13

Gold & Nifty: Normalised Cointegrating Coefficients

Variable	Coefficients	Standard Error
Gold	1.000000	---
Nifty	-0.245240	0.31215

Source: E-views output

In order to find out the long run coefficients between gold and nifty, normalized cointegration coefficient is used and its result is depicted in Table 4.13. It reveals that in the long run, nifty has a positive influence over gold prices. The relationship can be put to a mathematical expression as follows:

Gold= 0.24524Nifty

The results reveal that, in the long run, the stock market influences gold prices positively, which further means that gold prices will rise with an increase in stock returns and fall with a decrease in stock returns over the long run. The finding is similar to that of the relationship between gold & Sensex. The first major hypothesis hence proved.

The co-integrating relationship could be confirmed only if the error correction term is negative and statistically significant. The Error Correction Term (ECT) measures the speed of adjustment or time taken by the system to reattain equilibrium after occurrence of a shock in the system.

Table 4.14

Gold & Nifty: Error correction model

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.015280	0.004324	-3.533639*	0.0004
C(2)	-0.099274	0.030446	-3.260630*	0.0011
C(3)	-0.221167	0.106589	-2.074946*	0.0382
C(4)	-0.046816	0.030403	-1.539830	0.1239
C(5)	0.127013	0.106860	1.188585	0.2349
C(6)	-0.004293	0.030090	-0.142669	0.8866
C(7)	0.047012	0.106723	0.440506	0.6597
C(8)	0.043912	0.030075	1.460074	0.1446
C(9)	0.213338	0.106761	1.998276*	0.0459
C(10)	0.120336	0.029989	4.012684*	0.0001
C(11)	-0.007849	0.107005	-0.073351	0.9415
C(12)	0.088818	0.029876	2.972841*	0.0030
C(13)	-0.056816	0.106974	-0.531121	0.5954
C(14)	0.056726	0.029859	1.899813	0.0577
C(15)	0.240946	0.105989	2.273314	0.0232
C(16)	2.955456	7.348491	0.402185	0.6876

Source: E-views output
**significant at 5%*

The error correction model of cointegrating relationship between gold and Nifty is shown in Table 4.14. C(1) is found negative and statistically significant which means that there is long run causality running between spot prices of gold and Nifty. The negative value of ECT i.e., C(1) being -0.01528 and near to zero indicates an extensive time period taken for correction of shock. It can be said that if a shock occurs in the system, equilibrium is restored at a rate of 1.528%.

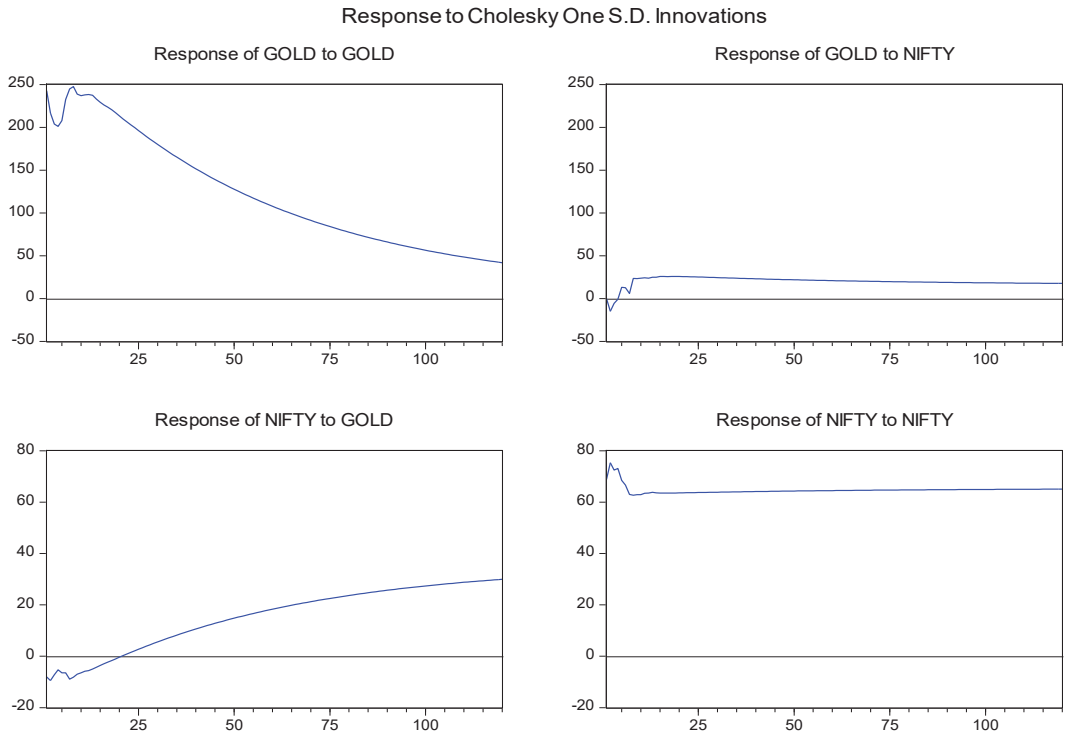
Impulse response function

Impulse response analysis studies the reaction of a system to an external change or shock. It is usually used to trace the response of variables in a VECM model to shock caused by a particular variable. Impulse response function (IRF) may be

positive or negative depending upon the direction of response and shocks of endogenous variables. X-axis (horizontal axis) represents time horizon and Y-axis (vertical axis) represents trend and magnitude of the response of variable.

Figure 4.5

Gold & Nifty: Impulse response function



Source: E-views output

The graphical plot of impulse response function between gold and nifty is given in Figure 4.5. From Figure 4.5, it is clear that gold responds negatively to its own shocks and slightly positive response is shown to shocks in Nifty which further shows slow convergence over a period of time. At the same time, Nifty responds very much positively to shocks in gold prices whereas it shows slightly negative response its own shocks over a period of time. From the impulse response function results, it can be concluded that the findings are consistent with the results of Johansen's cointegration tests, which indicate the cointegrated nature of the gold prices and stock market returns.

Variance Decomposition Analysis

Variance decomposition analysis is used to understand the proportion of variation in one variable explained by variation in its own past values and variation in other variables. In other words, variance decomposition is used to analyze the proportion of variation in spot prices of gold caused by its own shocks versus shocks in Nifty. The results of Variance Decomposition are depicted in Table 4.15.

Table 4.15

Gold & Nifty: Variance Decomposition Analysis Results

Period	Variance decomposition of Nifty		Variance decomposition of Gold	
	Nifty	Gold	Nifty	Gold
1	100.0000	0.000000	1.855944	98.14406
30	98.82192	1.178079	4.748434	95.25157
60	94.98345	5.016545	5.061804	94.93820
90	89.94956	10.05044	5.320807	94.67919
120	84.75695	15.24305	5.545424	94.45458

Source: E-views output

The results in Table 4.15 suggest that the variance in Nifty is wholly explained by its own shocks on the first day. Thereafter, the forecast error variance shows an increasing trend due to movements in gold prices. After 120 days, 15.24% of the variance in the Nifty is explained by the shocks in the spot prices of gold. However, variance in gold prices is almost explained by its own shocks on 120th day leaving only 5.5% to be explained by Nifty. This shows that the stock market plays only a negligible role in explaining movements in gold prices.

On the basis of results yielded, VECM based Granger causality test has been run to analyze the nature of short-term relationship between the spot prices of gold and the Nifty. The results are shown in Table 4.16. It can be seen that Nifty granger causes gold prices since chi-square value has been found statistically significant at 5% level of significance. However, p-value being insignificant, it is inferred that gold prices do not granger cause Nifty.

Table 4.16

Gold & Nifty: Granger Causality Test Results

Causality Direction	Chi-square	df	Prob.
Nifty>Gold	15.47893*	7	0.0303
Gold>Nifty	5.651644	7	0.5810

Source: E-views output
***** *significant at 5% confidence level.*

The causality is reconfirmed by employing Toda-Yamamoto no-causality test and the results are detailed in Table 4.17.

Table 4.17

Gold & Nifty: Toda-Yamamoto Causality Test Results

Causality Direction	Chi-square	df	Prob.
Nifty>Gold	15.59679*	7	0.0291
Gold>Nifty	4.664138	7	0.7009

Source: E-views output
***** *significant at 5% confidence level.*

Toda-Yamamoto method of Granger causality confirms the results of VECM based Granger causality method since the result confirms that there is unidirectional causality flowing from Nifty to spot prices of gold. It can be inferred that gold does not granger cause stock market index i.e., Nifty since chi-square value is insignificant with p-value less than 0.05.

The rejection of null hypothesis provides room for alternate hypothesis- There exists a long run relationship between gold prices and stock market returns in India- to stand right.

In short, gold prices show a cointegrating relationship with stock market returns since Sensex as well as Nifty confirms the relationship except for minor differences in error correction or speed of convergence to equilibrium.

4.4 Conclusion

Empirical evidence is there, though a few in number, in support of no or bidirectional relationship between gold prices and stock returns. This study went in detail to leading two stock market indices and their dynamic relationship with commodity spot price (gold).

The time series data considered in this study is found integrated at the first difference. The cointegrating relationship between gold prices and stock market returns in India has been uncovered applying Johansen co-integration approach. Further, VECM results expose the long run positive impact of stock market on gold prices in India. It is found that the rate of correcting the disturbances and attaining equilibrium is comparatively slow process which is statistically significant.

Granger-causality test results confirm the unidirectional causality i.e., Sensex/ Nifty granger causes gold prices, indicating that an increase or decrease in stock market return could cause the gold price to change. Toda-Yamamoto method of causality test was also run to confirm the results obtained through traditional Granger causality test to ensure integration order free and cointegrating condition free causality.

The impulse response function puts forth the existence of a close relationship between gold prices and stock market returns- Sensex and/or Nifty- for future periods, which indicates that, in India, movements in stock market index can cause gold prices to change and vice-versa. Variance decomposition analysis helps to discover the capability of gold prices to explain a major share of its own variance. However, variances in stock market returns have been found explained by gold prices though with a minimum percentage. It is noted that results are similar with both Sensex and Nifty which means both respond almost in the same way to gold prices movements. It can be said that gold cannot be considered as a complementary investment avenue to stock market or safe haven asset over stock market with a positive relationship in the long run. With gold prices, the stock market movements may not be foreseen though it works the other way around.

Since gold has engraved its position in the financial system, the derivative segment of yellow metal is also deemed to be indulged in the process of upkeeping the strength of gold market.

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Chapter 5

TREND & PERFORMANCE ANALYSIS OF GOLD PRICES IN INDIA

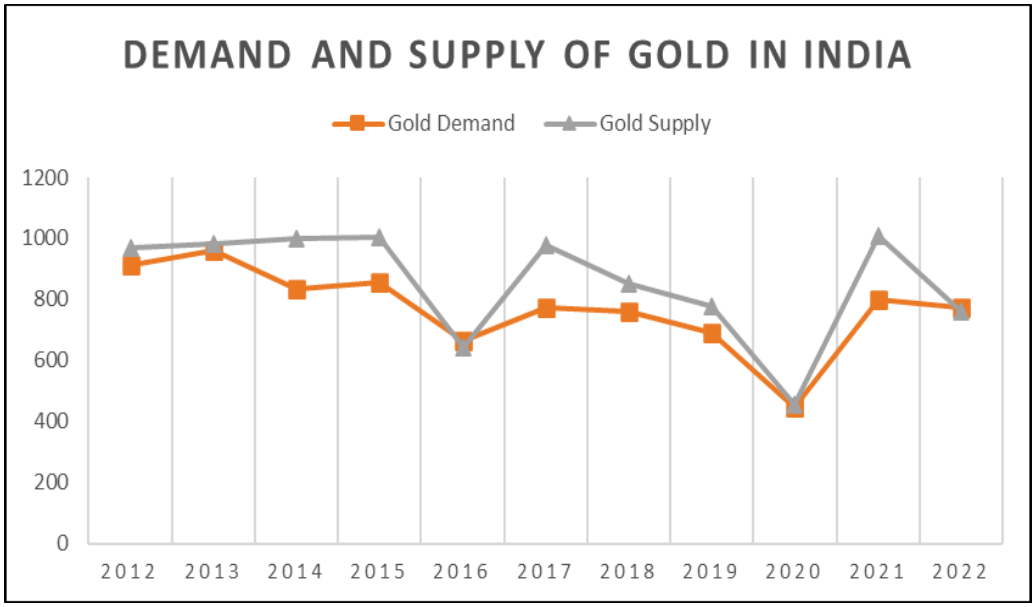
Contents

5.1 Introduction

As per existing literature, several macroeconomic indicators like exchange rate, inflation rate, interest rate, stock market indices, oil prices etc. have a connection which are probable have an impact on gold prices. International gold prices are also no exception. However, like every commodity, gold prices are driven by demand for gold and supply of gold. Gold, being a storable commodity for a relatively long period, is counted as long term asset in any portfolio with way more liquidity compared to real-estate etc.

Figure 5.1

Demand and Supply of Gold in India



Source: World Gold Council

A glimpse of long-term demand and supply trend of gold is presented in Figure 5.1. It depicts the trend of consumer demand for gold and supply of gold in India for the period 2012-2022. Prima facie, it can be observed that consumer demand for gold is almost matched by supply during the years 2013, 2016, 2020 and 2022. In all other years, supply of gold seems exceeded its corresponding consumer demand in India.

Unlike other commodities, gold demand and gold supply are peculiar in nature. Unlike oil or other commodities, gold rarely gets perished while being used. Gold supply is unique in a way that supply is not meant for consumption in the same year and lion's share of supply is accumulated reserves from the past (Haubrich, 1998). Hence, the price of gold needs to be analyzed in detail with regard to its trend and performance which will be dealt with in this chapter.

5.2 Data and Methodology

The following data pertaining to the period of 20 years i.e., data pertaining to 10 November 2003 – 31 October 2023 has been considered for performance analysis:

- Daily gold prices in Indian Rupee per troy ounce published by World Gold Council for the period.

Trend analysis and the Box-Jenkins ARIMA model have been used to analyze the trend and pattern of gold prices in India.

5.3 Analysis, Results and Discussion

First, the descriptive analysis of the data needs to be done. The descriptive statistics of the time series data are given in Table 5.1.

The data seem to vary in nature and the range of the data is quite large. The kurtosis value greater than +2 indicates that the data is too peaked. Since the skewness is 0.3386 (between -0.5 to 0.5) the distribution is approximately symmetric.

Table 5.1

Descriptive Statistics of Gold

Variable	Mean	Maximum	Minimum	Standard Deviation	Skewness	Kurtosis
Gold	76198.82	167324.4	16886.25	39996.23	0.3386	2.3103

Source: E-views output

5.3.1 Trend Analysis

Trend analysis has been deployed to explore the performance of gold prices and gold futures in India. The daily turnover for the period of 20 years- 2003-2023 has been taken for the study. Data were gathered from the official website of Multi Commodity Exchange.

Figure 5.2

Performance of Gold Prices during 2003-2023

Source: World Gold Council

The performance of gold prices during 2003–2023 is depicted in Figure 5.2.

Figure 5.2 implies that over the decade, gold prices have shown an obvious upward

trend though with notable ups and downs. During 2003-05, the gold price seems to be increasing at a slightly positive rate.

In 2006, the price suddenly surges in comparison to their immediate previous years with 39.55% and the year 2007 marks only a small increase in gold price with 4.8% from that of the year 2006. 2007 is the year where economic performance of the nation went down to 7.7% from 8.1% in 2006 (World Bank, 2023).

During the 2008-2010 period, gold prices seem to move upward at almost uniform growth rate. It may be inferred that the Great Recession of 2008 to 2009 did not affect gold prices very much as the gold price hiked in 2008 & 2009 by 31.63% and 24.48% respectively.

In 2011, the price surge gained momentum increasing at an increasing trend with 31.25%. It may not be out of context to state that the economic growth rate fell to 5.2% in 2011 from 8.5% in 2010. In 2012, the average gold price increased at the rate of 21.22% only.

From 2013, the price of gold shows a clear fall at the rate of -7.65% and this continued in the year 2014 and 2015 with -6.09% and -3.78% respectively. The economic downturn of 2015 was a result of depreciation of the Chinese Yuan which obviously had an effect on other major currencies as well. Even though the price of gold moved upward in the year 2016 (13.04%), a slight fall can be seen in 2017 (-2.56%). After the stock market crash due to demonetization in November 2016, in 2017, economic growth fell to 6.8% from 8.3% in 2016.

After 2017, the gold prices slowly started to increase with 5.86% growth in 2018 and 13.2% growth in 2019. A sudden hike is noticeable during the year 2019-2020. Despite the effect of COVID-19 on the nation as well as its economy, average gold price hiked by 33.75% in 2020 from that of 2019.

In 2021, the year of recovery of the economy from COVID-19 and from its unprecedented shock on economy, the price of gold recorded a negligible growth of

1.36%. It may be read along that after a negative economic growth of -3.1% in 2020, India grew by 6% in 2021.

In 2022, when India grew at a slow-paced rate of 3.1%, the gold price seems to increase at 6.24%.

5.3.2 Application of Auto Regressive Integrated Moving Average (ARIMA) Modelling in the Performance of Gold Prices in India

Autoregressive Integrated Moving Average (ARIMA) is a time series analytical tool to forecast the future values on the basis of historical data. The 'AR' portion of ARIMA stands for Auto- Regressive, 'I' for Integrated and 'MA' stands for Moving Average. A time series may be termed autoregressive if its future values are predictable on the basis of its past values. Integration refers to the differencing of a time series in order to make it stationary- without trend or seasonal components. Moving average means predictability of future values on the basis of past forecast errors. The method was first introduced by two famous mathematicians- Box & Jenkins (1976) and hence known as Box-Jenkins method.

Malhotra & Sinha (2021) used the ARIMA method to forecast fund flows in the mutual fund market. Yurdakul & Sefa (2015) used ARMA method to model monthly returns of gold prices of the Istanbul Gold Exchange. In this study, ARIMA is used to model the daily gold prices published by World Gold Council for the period 01/11/2003 – 31/10/2023.

5.3.2.1 Unit Root Test

Stationarity means that the statistical properties such as mean, standard deviation and covariance do not change over time. A stationary series is free from any trend or seasonal variations. Assessing stationarity is the primary step for any time series analysis. A stationary series is predictable to an extent.

Unit root test allows to check whether a time series data possesses a unit root. Unit root is a property of a stochastic process that can hinder precise statistical inference from a time series model. If a time series data possesses unit root, it means the data

is non-stationary which may or may not have trend component to it.

Out of different test to check unit root like Dickey-Fuller test (DF test), Kwiatkowski-Phillips-Schmidt-Shin test (KPSS test), Augmented Dickey Fuller test (ADF test), Phillips-Perron test (PP test), Elliott–Rothenberg–Stock test etc., ADF test is applied as the literature confirms its reliability in case of bigger number of observations and its feasibility (Arltová & Fedorová, 2016).This test was introduced by Dickey & Fuller (1979).

Table 5.2

Gold Augmented Dickey-Fuller Test Results

Variable	Level			1st differencing			Order of Integration
	None	Intercept	Trend & Intercept	None	Intercept	Trend & Intercept	
Gold	2.7092	0.4667	-1.7262	-14.099	-14.3877	-14.4239	I (1)
	(0.9986)	(0.9856)	(0.7397)	(0.000)	(0.000)	(0.000)	

**p–values are given in brackets.*
Lag order criterion: AIC

Table 5.2 shows the ADF test results of the performance of gold prices in India. It is vivid from the results that there is the presence of unit root at levels. After differentiating the data once, the data has no presence of unit root since p-values are less than 0.05 and hence the statistic is significant at 95% confidence level. In other words, data becomes stationary at first difference.

5.3.2.2 ARMA Model Specification

As the gold price data became stationary at the first difference, the order of integration is found to be I(1). The next step is to find out the values of AR and MA in ARIMA, for which the following steps are to be followed. Table 5.2 presents the ARMA models of gold prices and their corresponding values for different selection criteria. Of various criteria used for model selection such as the Akaike Information Criterion (AIC), Bayesian Information Criterion (AIC) and Hannan-Quinn Information Criterion (HQ), AIC has been used for ARMA model selection.

Table 5.3

ARMA Model Selection Criteria of Performance of Gold Prices

Model	LogL	AIC*	BIC	HQ
(2,2)	16251.12554	-6.234936	-6.227384	-6.232295
(3,2)	16251.95627	-6.234871	-6.226061	-6.231790
(2,3)	16251.92195	-6.234858	-6.226048	-6.231776
(2,4)	16251.55904	-6.234718	-6.224650	-6.231197
(4,2)	16252.47762	-6.234687	-6.224619	-6.231166
(3,3)	16252.11018	-6.234546	-6.224477	-6.231025
(4,4)	16253.88018	-6.234458	-6.221872	-6.230056
(3,4)	16252.72576	-6.234399	-6.223071	-6.230437
(4,3)	16252.65357	-6.234371	-6.223044	-6.230409
(0,0)	16238.14656	-6.231490	-6.228973	-6.230609
(0,1)	16238.45478	-6.231224	-6.227448	-6.229904
(1,0)	16238.44514	-6.231221	-6.227445	-6.229900
(2,0)	16239.08785	-6.231083	-6.226049	-6.229323
(0,2)	16239.07045	-6.231077	-6.226042	-6.229316
(1,1)	16238.72690	-6.230945	-6.225911	-6.229184
(3,0)	16239.08945	-6.230700	-6.224407	-6.228499
(2,1)	16239.08845	-6.230700	-6.224407	-6.228499
(0,3)	16239.07812	-6.230696	-6.224403	-6.228495
(1,2)	16239.07306	-6.230694	-6.224401	-6.228493
(4,0)	16239.50148	-6.230475	-6.222923	-6.227833
(0,4)	16239.44258	-6.230452	-6.222900	-6.227811
(3,1)	16239.08854	-6.230316	-6.222765	-6.227675
(1,3)	16239.07356	-6.230310	-6.222759	-6.227669
(4,1)	16239.54125	-6.230106	-6.221296	-6.227025
(1,4)	16239.46732	-6.230078	-6.221268	-6.226996

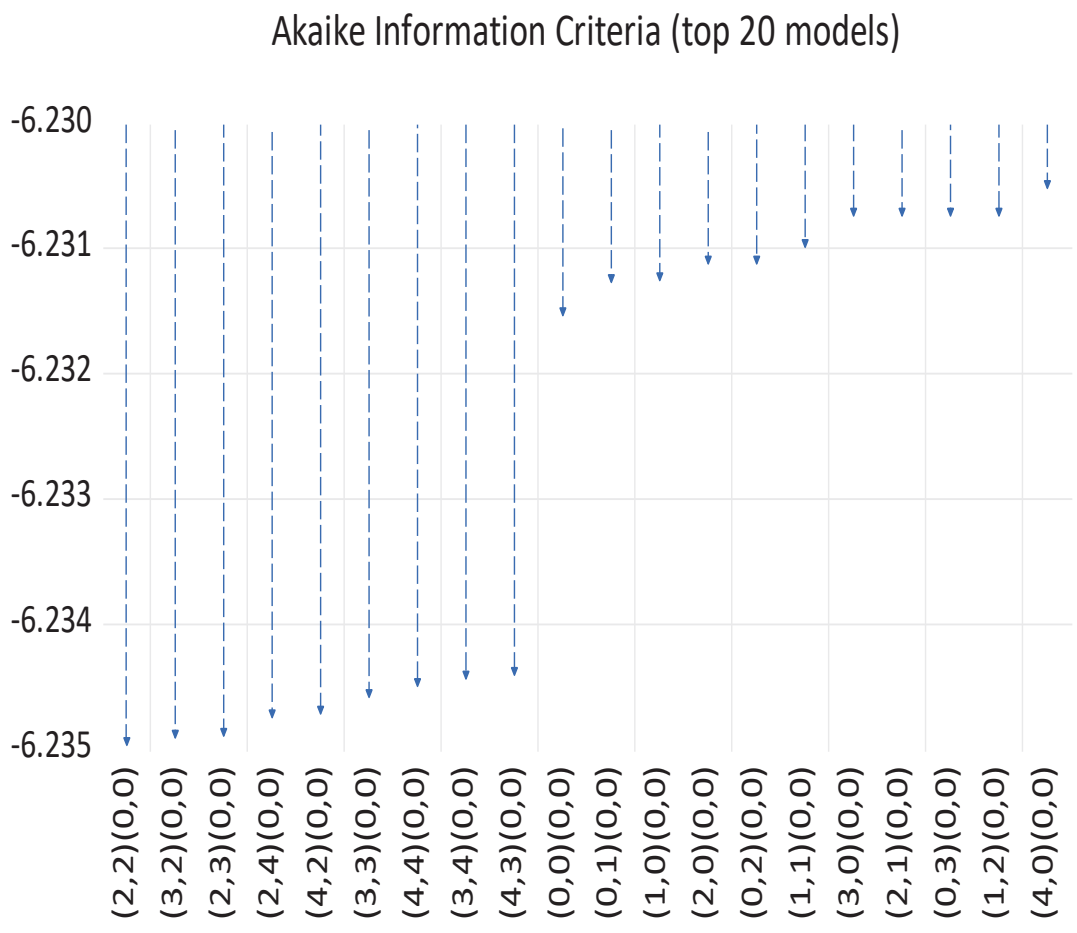
Source: EViews Output

Jain & Mallick (2017) found Akaike Information Criterion (AIC) as best criterion. The lower the AIC, the better the model. Akaike Information Criterion scores represent probabilistic ranks of the models that are likely to minimize the loss of information. AIC measures the information lost. The model corresponding to the lowest value of AIC is chosen as the ARMA model. It is noteworthy that the model has the lowest BIC as well as lowest HQ which again stands for the goodness of fit of the model.

Table 5.3 shows the ARMA models of the performance of gold price, which indicates that the ARMA (2,2) is the best model that can be used to forecast the future values of gold prices. The AIC of ARMA (2,2) is minimum with value -6.234936.

Figure 5.3

ARMA Model of Performance of Gold Prices



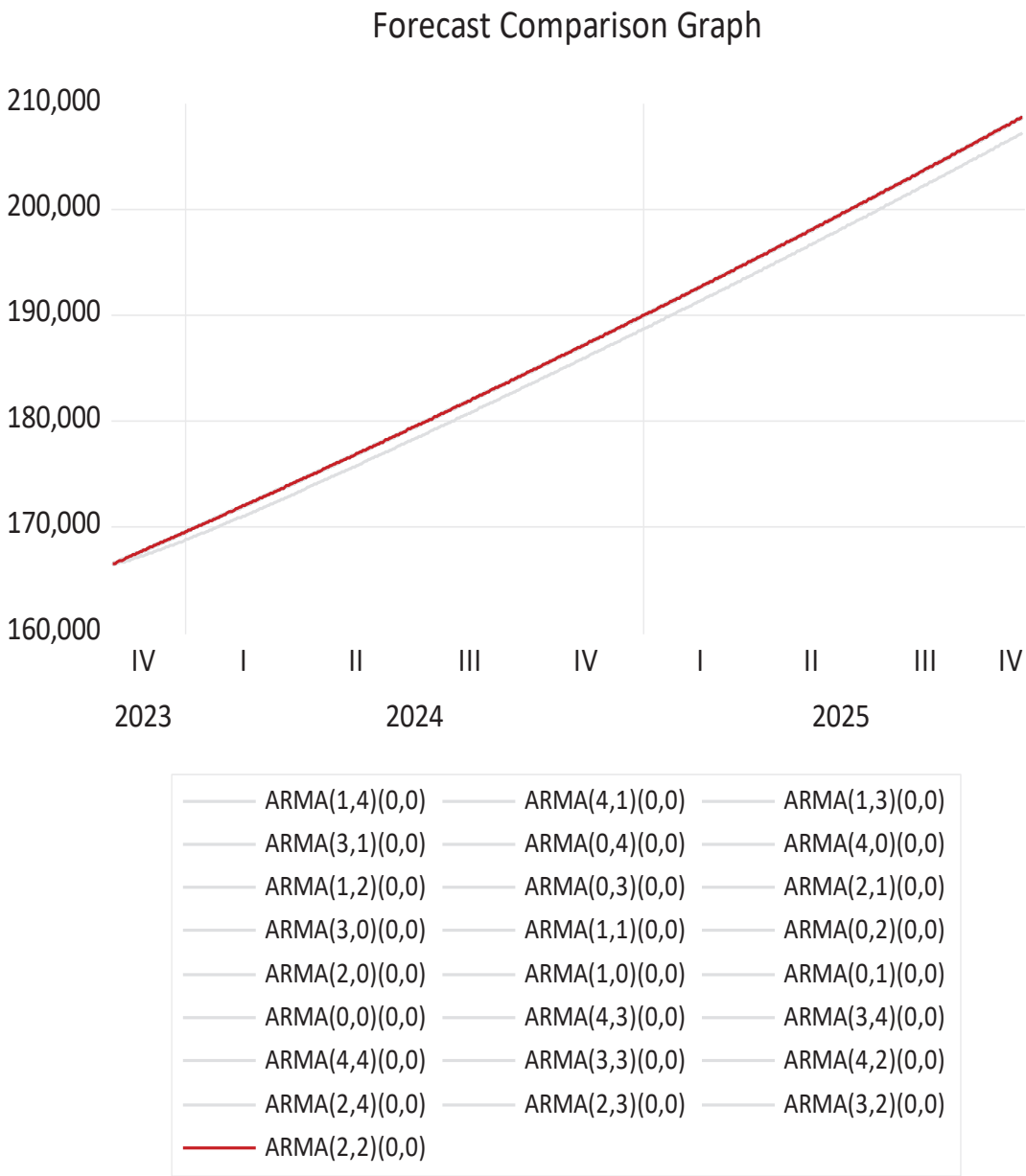
Source: EViews Output

Figure 5.3 represents the top 20 models generated by ARMA forecasting with their respective AIC values. The model corresponding to the lowest AIC value is (2,2). Hence, ARMA (2,2) is selected as the best model.

Figure 5.4 shows the forecast comparison graph of performance of gold prices using AIC criteria. It can be confirmed that ARMA (2,2) is the best model.

Figure 5.4

Forecast Comparison Graph of Performance of Gold Prices



Source: EViews Output

Table 5.4 shows the maximum likelihood estimation of performance of gold prices. The results given in the table itself explain why the particular model is the best fit meeting all the necessary criteria. Hence, ARMA (2,2) can be stated as the best model indicating the performance of gold prices in India. As the integration order is found to be 1, the ARIMA model can be written as ARIMA (2,1,2).

Table 5.4

ARMA Maximum Likelihood Estimation of Gold Price Performance

Variable	Coefficient	Std. Error	t-statistic	Prob.
C	0.000434	0.000147	2.952870	0.0032
AR(1)	0.129445	0.024841	5.211058	0.0000
AR(2)	-0.930800	0.024388	-38.16675	0.0000
MA(1)	-0.128456	0.028955	-4.436393	0.0000
MA(2)	0.905016	0.028624	31.61794	0.0000
SIGMASQ	0.000114	1.13E-06	101.4590	0.0000
R-squared	0.004979	Mean dependent var		0.000434
Adjusted R-squared	0.004024	S.D dependent var		0.010727
S.E of regression	0.010706	Akaike Information Criterion		-6.234936
Sum squared resid	0.596546	Schwarz Criterion		-6.227384
Log likelihood	16251.13	Hannan-Quinn Criterion		-6.232295
F-Statistic	5.209455	Durbin-Watson statistic		2.024566
Prob(F-statistic)	0.000090			
Inverted AR roots	.06+.96i	.06-.96i		
Inverted MA roots	.06+.95i	.06-.95i		

Source: EViews Output

5.3.2.3 Analysis of Actual, Fitted and Residual Values of ARIMA Models

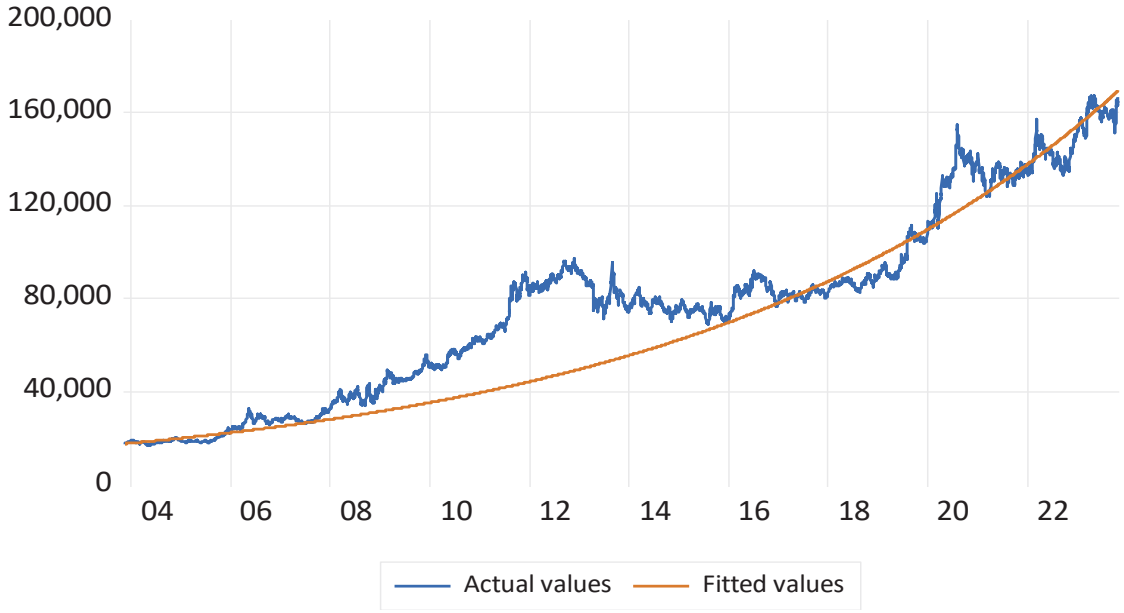
The nature of the performance of equity funds can be identified by analysing the actual, fitted and residual values of the variables using ARIMA modelling. Actual values are those that are already available in the dataset, whereas fitted values are

those generated by the system by applying ARIMA modeling. Residual values are the deviation of actual values from the fitted ones.

Figure 5.5 presents the actual and fitted comparison graph of gold prices for the period 2003-2023 and figure 5.6 presents the residual plot of gold prices for the same period.

Figure 5.5

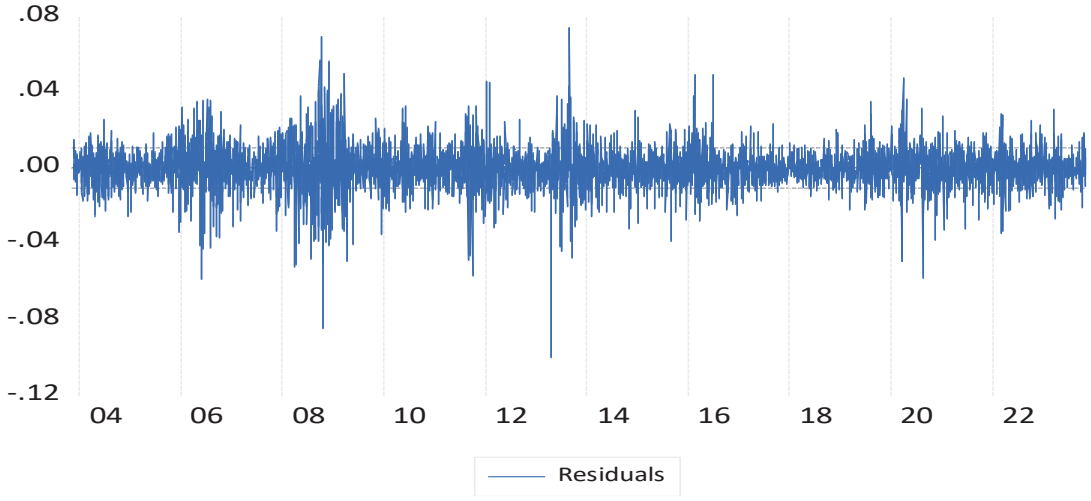
Actual and Fitted Comparison graph of Gold Prices



Source: EViews Output

Figure 5.6

Residual Plot of Gold Prices



Source: EViews Output

While analyzing the actual, fitted and residual values, it is crystal clear that gold prices tend to deviate from the fitted values. This deviation seems to fluctuate between both positive and negative with changing time. Negative deviation occurs when the actual values fall below the fitted values. In the initial years (2003-2004), actual gold prices seem to almost match the fitted values. During 2005, the actual gold prices seem to have undergone a slight negative deviation.

During 2006, the deviation of actual gold prices from its fitted value seems positive and the former matches the latter in 2007. During 2008-2015, the actual gold prices seem to have significantly deviated from its fitted values. Out of these years, the year 2012 marks the peak of deviation from fitted values.

Though positive, the deviation of actual gold prices in 2016 from its fitted values does not seem large when compared to its previous surge. In 2017, the actual gold prices match its fitted values, and this continues till a slight negative deviation is able to be observed in the year 2018-19. Afterwards, a significant positive deviation is resulted in the year 2020. Post 2020, a wave trend seems to continue with alternate positive and negative deviation of actual gold prices from the fitted values of gold prices.

5.3.2.4 Forecasting of Gold Prices using ARIMA Model

Application of ARIMA methodology works out the model of best fit enabling forecasting of future values of gold prices. The gold prices for the years November 2003- October 2023 were taken as samples for the study, and forecasts were made for the years November 2023 - October 2024 and November 2024 - October 2025.

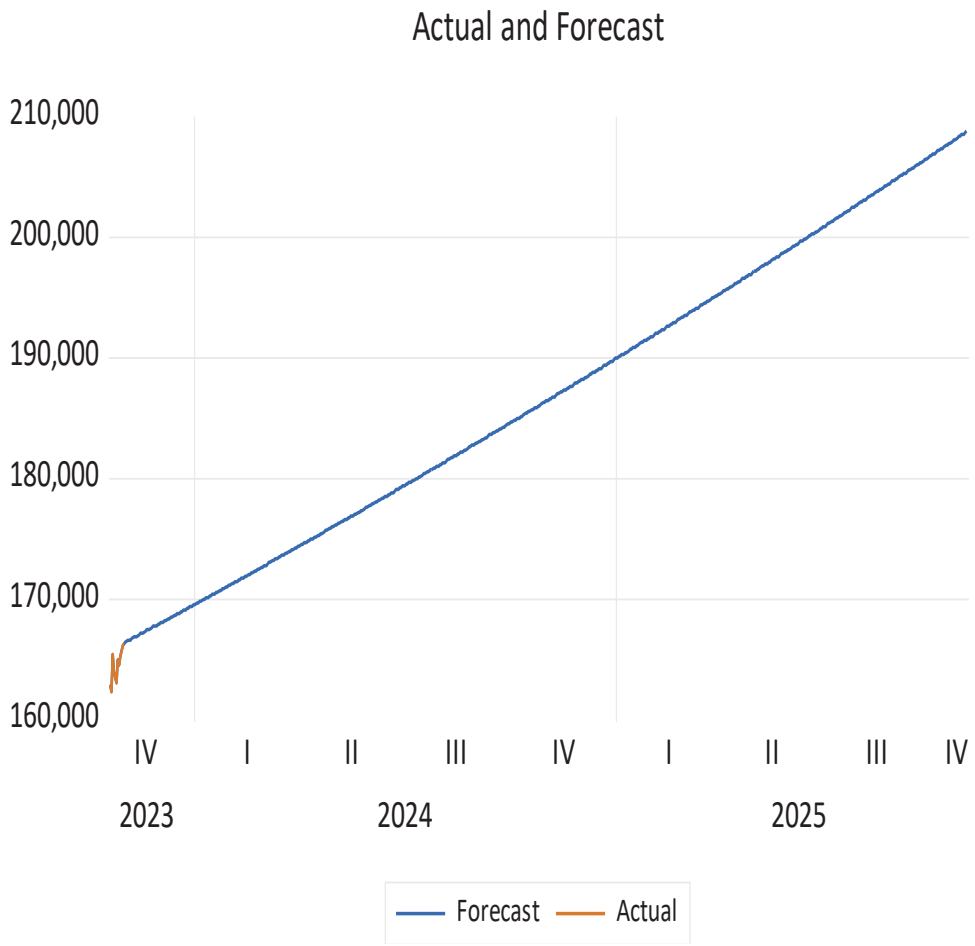
The actual and forecast graph of gold prices is presented in Figure 5.7. Figure 5.7 makes it evident that the gold prices are forecasted to increase sharply in the upcoming period up to 2025. The returns from gold are expected to be remarkable in the coming years.

The price of gold per troy ounce is expected to go beyond Rs.200000/- by the third quarter of the year 2025. It can be said that the gold prices are expected to increase

at a uniform rate till 2025.

Figure 5.7

Actual and Forecast graph of Gold Prices



Source: EViews Output

5.4 Conclusion

The findings imply that despite wavery trends from time to time, gold prices have followed an apparent upward trend over the past 20 years. The trend analysis of gold prices indicates that the gold price is almost independent of the ups and downs of economic performance of the nation.

The deviation of gold from its expected values has been found to vary positively and negatively with changing times and the deviations seem to be

getting corrected and resulting in the opposite once the actual values match the expected values.

The forecast shows that the gold prices will witness a steep rise. The returns from gold investments are hence, consequently anticipated to increase and the upcoming years are expected to be remarkable.

♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦

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Chapter 6

PRICE DISCOVERY FUNCTION OF GOLD FUTURES IN INDIA

Contents

6.1 Background

Gold as a commodity has always magnetized the heed and riches of investors in India. Despite the fluctuations in annual growth rate of the market, it has been successful to cultivate ascending demand and turnover in India over a period of time. The cash and derivatives markets of gold are equally resolute for the inelasticity in its demand among the consumers in India. Gold has always been unique with its uses as well as the nature of the markets. The demand by Indians for gold is one of major drivers of world gold market. India is second largest consumer of gold after China which together accounts for 55% of global demand for gold. World Gold Council reports a growth rate of 304% in annual demand for gold in India since 1987 (World Gold Council, 2017). Gold bars and coins are as preferred as deposit accounts as far as Indian investors are concerned (World Gold Council, 2017).

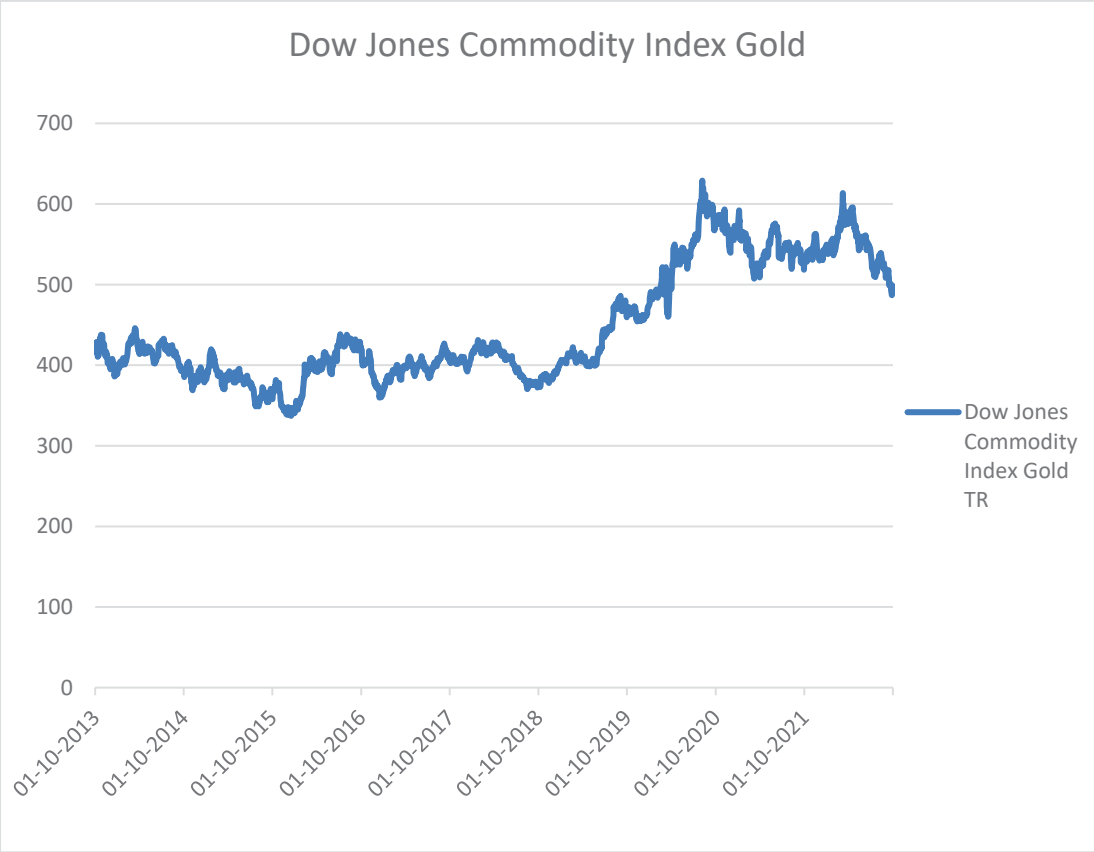
Undoubtedly, the price of gold has spin-off effect on every major determinant of an economy. Gold prices affect and are affected by numerous factors. World stock prices, dollar index, IMF's world price index, US consumer price index, crude oil prices and volatility of stock price indices show an explicit relationship with international gold prices (Mishra & Jagan Mohan, 2012).

Figure 6.1 gives the graphical representation of S&P Dow Jones Commodity Index Gold. Over a period of 10 years, the index recorded annualized returns of 3.47%

(S&P, 2023). It is noted that returns are usually positive in the years global GDP recorded low and vice versa majority of time. For e.g., returns are high in 2016, 2020 and 2022 when GDP growth globally recorded only 2.8%, -3.1% and 3.1% respectively (The World Bank, 2023).

Figure 6.1

Dow Jones Commodity Index Gold 2013-2022



Source: S&P Dow Jones Commodity Index Gold data

This could be considered validation that gold futures prices perform well in the times of economic disturbances or in the times of downfall in performance, which further means when spot market face a crash. However, the downside is hedged by commodity market which inclines to investigate the lead-lag relationship between futures market and spot market.

Figure 6.2

Growth trend of gold prices: 2003-2022

Based on World Gold Council data

The trend of gold prices after the introduction of futures in gold in India is shown in Figure 6.2. The growth rate of gold prices can be seen stabilizing with ups and downs- a downward growth in gold price is followed by a correcting upward growth. This is in consonance with the finding of Turnovsky (1983) which confirmed that introduction of futures will stabilise the spot prices of storable commodities in the long run. It also helps in lowering the long run mean of such commodity prices.

The price discovery process is not limited to spot and futures prices only, but also the consumption pattern and price inelasticity as influence is bidirectional. Despite certain market corrections, gold prices shows an increasing trend over the time (Nath & Dalvi, 2014). The second most populous country has gold, being deeply rooted in its culture and tradition which prevents its prices from dropping below a cap. The futures market of gold too injects stability to its spot prices. This avenue of investment has proved itself to be immune to stock market crashes, dollar hike or like (Gaur & Bansal, 2010). Gold prices, sometimes, also act as a predictive indicator of inflation indices (Mahdavi & Zhou, 1997). The immense influence of this commodity must be exploited to the most for the better forecasting of economic growth of the nation with respect to other umpteen economic variables.

Zhang & Wei (2010) emphasized the relationship between crude oil market and gold market as these two shared a strong positive correlation for relatively long duration. The profound influence of crude oil prices on gold futures in terms of price discovery was come up with.

There still exists an inhibition towards using econometric techniques for analysis of time series data which may prove highly constructive when it comes to capital market data analytics. Though slow, a trend has emerged wherein such tools are made use of for better inference of the alternative solutions. Gold as a futures market commodity has not obtained priority as much it deserves in recent times. A step in this regard would aid to unlock the actual influence of spot prices of gold on futures and vice versa which will crack better forecasted values regarding the gold market.

The research question is whether the spot-futures relationship of gold is helpful in its price discovery or not.

6.2 Empirical Strategy

The cointegration approach is popularly adopted to prove a long-term association between two aspects when they are non-stationary and the error term is stationary instead (Engle & Granger, 1991). This particular methodology has brought insights in various aspects including hedging, price dynamics and spillovers, price discovery etc. especially with stock index futures (Ghosh, 1993; Wahab & Lashgari, 1993; Pizzi, Economopoulos, & O'Neill, 1998). As far as commodity markets are concerned, cointegration has put forth identifying the efficiency of the same as the rationale of the literature (Wang & Ke, 2005; Ali & Gupta, 2011; Beck, 1994; Chowdhury, 1991; Malliaris & Urrutia, 1996; Crowder & Hamed, 1993; Kellard, Newbold, & Ennew, 1999).

To bring into light the long-term relationship between spot and futures returns, cointegration approach was found more reliable in existing literature. Such a relationship can be written as:

$Ft - \beta 0 - \beta 1 St = et$

Ft and St being futures price and spot price at maturity t. β1 is the cointegrating parameter which cannot be tested with OLS if futures and spot price series are non-stationary. According to Engle & Granger (1987), cointegration approach can be applied once the St and Ft are non-stationary but the deviations i.e., et is stationary. In this study, hence, Johansen's cointegration approach is applied to bring out the relationship between near month futures contract prices of Gold (also known as Big Gold) and spot prices of gold in National Commodity & Derivatives Exchange Ltd. (NCDEX) for the period of five years i.e., 2011-2015. NCDEX offered gold futures contract for trading till 2016. Further, to estimate the direction of causal relationship, Engle- Granger causality test is performed. The causality has been cross checked using Toda-Yamamoto method of Granger causality.

6.3 Analysis, Results and Discussion

The spot and near month futures prices of yellow metal during the period 2011-2015 are taken into consideration for the study. From the descriptive statistics shown in Table 6.1, it may be inferred that the market is following a bullish trend throughout the aforesaid period i.e., the mean value of futures prices (27340.67) is equal to that of spot prices. When coefficient of variation is also read along with standard deviation, mean value of futures prices seems to be relatively more reliable than that of spot prices.

Table 6.1

Spot & Futures: Descriptive Statistics of Variables

Variable	Mean	Maximum	Minimum	Standard Deviation	Skewness	Kurtosis
SPOT	27340.67	34130	19735	3005.112	-0.7589	2.994
FUTURES	27340.68	34430	19591	3103.454	-0.80	2.961

Source: E-views output

The test assumes its null hypothesis as there is no relationship between spot prices

of gold and futures prices of gold in the long run. This hypothesis needs to be tested whether correct or not. In every analysis of time series data, the elementary step is to check stationarity.

When unit root is to be tested for the time series data which shows a specific trend as well as potential turning around over a non-zero value, the following equation is used.

$\Delta zt = \alpha 0 + \theta zt\text{-}1 + \Upsilon t + \alpha 1 \Delta zt\text{-}1 + \alpha 2 \Delta zt\text{-}2 ... + \alpha p \Delta zt\text{-}p + at$

$\alpha 0$= constant

Υt= trend element

p= number of augmented lags

Augmented Dickey-Fuller test is used to check the stationarity of both the time series data used in this study as the initial review found this to be most used (Kumar, Taneja, & Gupta, 2017).

Table 6.2

Spot & Futures: Augmented Dickey-Fuller Test Results

Variable	Level			1st differencing			Order of Integration
	None	Intercept	Trend & Intercept	None	Intercept	Trend & Intercept	
SPOT	-0.0301 (0.6718)	-2.2933 (0.1750)	-3.859 (0.0152)	-5.801 (0.000)	-5.784 (0.000)	-5.7961 (0.000)	I (1)
FUTURES	0.1551 (0.1137)	-2.109 (0.2413)	-1.6676 (0.7646)	-29.8683 (0.000)	-29.9135 (0.000)	-29.9743 (0.000)	I (1)

**p–values are given in brackets.*

The results obtained by minimizing Akaike Information Criteria are shown in Table 6.2.

Unit root test results shown in Table 6.2 suggest that the null hypothesis that the series need to be differentiated to the next order is rejected at 5% level of significance enunciating the order of integration to be 1 i.e., p-values do not outstrip 0.05 at first order differencing. There is an urge from the part of similar research articles to review the unit root results given by ADF with PP test (Jumbe,

2004; Narayan, 2005; Asafu-Adjaye, 2000).

Table 6.3 manifests the unit root results of Phillips-Perron test. As if to very well supplement the ADF test outcome, PP test also comes up with a codicil that both the series follow an integration order of 1 rejecting then the null hypothesis that the series need to be differentiated to make it stationary.

Table 6.3

Spot & Futures: Phillips-Perron Test Results

Variable	Level			1st differencing			Order of Integration
	None	Intercept	Trend & Intercept	None	Intercept	Trend & Intercept	
SPOT	-0.6452	-1.8019	-1.8534	-31.084	-31.1533	-31.1309	I (1)
	(0.4377)	(0.3798)	(0.6776)	(0.000)	(0.000)	(0.000)	
FUTURES	0.9591	-1.4754	-0.9522	-29.468	-29.5155	-29.5753	I (1)
	(0.3015)	(0.5457)	(0.9480)	(0.000)	(0.000)	(0.000)	

**p–values are given in brackets.*

As both the spot price series and near month futures price series of gold are integrated at first order, we need to check the long run cointegration between these two using the aid of Johansen approach for cointegration.

The next step is to select the optimal lag length with the order of vector autoregression (Wolde-Rufael, 2004). The study observed five criteria for selection of optimum lag length- Likelihood Ratio (LR), Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz information Criterion (SC) and Hannan-Quinn criterion (HQ). The lag length with minimum Akaike Information Criteria (AIC) is considered worthy for the lag order selection will shape the resulting cointegration approach (Ozcicek & McMillin, 1999; Liew, 2004).

Table 6.4 gives the values of various criteria for lag selection. The lag order with minimum value of Akaike Information Criterion is considered good for further analysis.

Table 6.4

Spot & Futures: VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1204.795	NA	4.34e+10	30.16988	30.22943	30.19376
1	-1080.864	238.5680*	2.17e+09*	27.17160*	27.35025*	27.24322*
2	-1080.533	0.621208	2.37e+09	27.26331	27.56107	27.38269

** Indicates lag order selected by the criterion.*

Along with Akaike Information Criterion, various lag length selection criteria including Likelihood ratio, Final prediction error, Schwarz information criterion and Hannan-Quinn criterion has unanimously ensued 1 as the optimum lag order.

Johansen Cointegration Test

Johansen derives likelihood ratio from the long run relationships or cointegrating vectors. (Johansen, 1991).

$yt = \mu + A1yt\text{-}1 + ... + Apyt\text{-}p + \varepsilon t$ where p being selected lag order.

Table 6.5

Estimation of Long run Association between Spot and Futures of Gold

Johansen Co-integration Test							
Hypothesized	**Eigen**	**Trace test**			**Max-Eigen Value Test**		
No. of CE(s)	**Value**	Statistical Value	Critical Value	Prob.*	Statistical Value	Critical Value	Prob.**
None *	0.136715	54.57584	15.49471	0.0000	52.18888	14.26460	0.0000
At most 1	0.006701	2.386962	3.841466	0.1223	2.386962	3.841466	0.1223

** Trace test denotes rejection of the hypothesis at the 0.05 level.*
*** Max-Eigen Value test denotes rejection of the hypothesis at the 0.05 level.*

Table 6.5 gives out the result of Johansen Co-integration test. Cointegration relies on both trace test and maximum eigen value test. Trace Statistic and Maximum Eigenvalue Statistic have a specific use to reach the number of co-integrating vectors.

With 1 as optimum lag length, the null hypothesis that there is no cointegration equation has been rejected at 5% level of significance. Hence the presence of 1 cointegration equation has been confirmed.

Table 6.6

Spot & Futures: Normalised Cointegrating Coefficients

Variable	Coefficients	Standard Error
Futures	1.000000	---
Spot	-0.995436	0.00958

Source: E-views output

The estimated equation of cointegrating relationship is:

Futures=0.995436Spot

While interpreting the normalized cointegrating coefficients from table 6.6, it should be noted that signs should be reversed to infer the nature of association between variables. The coefficient of spot is -0.9954 i.e., the relationship between spot prices and futures prices is very much positive and strong as spot price seems significantly explained by futures price. The observation is in consonance with that of Chang & Lee (2015).

The long term relationship between spot and futures prices of gold indicates that the hypothesis- the gold futures market efficiently perform price discovery function- can be deemed true since the null hypothesis that there is no long term relationship between spot price and futures price of gold has been rejected.

Since the cointegration test has confirmed the existence of a long run relationship between spot and futures prices of gold, Vector Error Correction Model (VECM) is used to analyze causality in the long run as well as short run dynamics. The results are shown in Table 6.7.

The Error Correction Term (ECT) measures the speed of correction or otherwise interpreted as time taken by the co-integrated variables to regain the long run equilibrium if a temporary disequilibrium emerges. The Error Correction Term is statistically significant with a negative sign (Table 6.7). The negative value of coefficient of ECT or C(1) which is (-0.2496), indicates speed of convergence

towards equilibrium.

Table 6.7

Spot & Futures: Vector Error Correction Model results

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.249552	0.061061	-4.086903**	0.0000
C(2)	-0.272496	0.057884	-4.707617**	0.0000
C(3)	0.401028	0.062346	6.432284**	0.0000
C(4)	-21.06105	12.44901	-1.691785	0.0911
C(5)	0.157416	0.059897	2.628090**	0.0088
C(6)	-0.075254	0.058246	-1.291989	0.1967
C(7)	-0.018402	0.062671	-0.293634	0.7691
C(8)	-8.450496	12.32478	-0.685651	0.4931

*** significant at 1%*

Since ECT is found negative and significant it is possible to say that the causality runs from futures prices to spot prices of gold in India in a relatively long run. In the event of temporary disequilibrium, the system automatically corrects itself at a speed of 24.96%.

6.3.1 Impulse response analysis

Impulse response function results are depicted in Figure 6.3. Impulse response has put out graphical representation of trend of error correction or restoration to equilibrium in the event of shock to one variable.

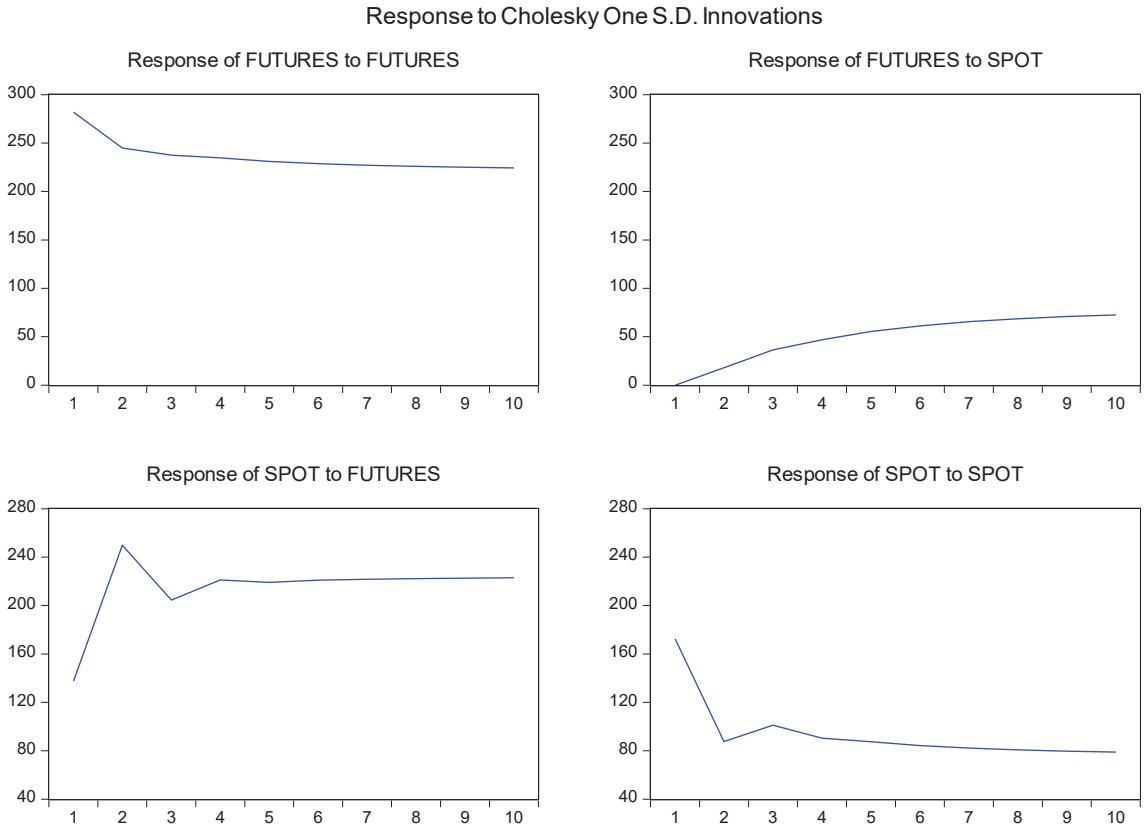
It can be observed that futures prices react negatively to their own shocks whereas the reaction of futures price will be positive towards any shock in spot prices. When a shock occurs in futures prices, spot prices will result in a sudden spike in the 2nd period or the 2nd day which will further lead to a downfall in the 3rd period or 3rd day. This will resultantly converge back to equilibrium in the following period.

The juxtaposed response of spot price to its own shocks carries over a complete opposite trend to its response to shocks in future prices. A steep downfall will

result immediately, which will further lead to a slight improvement afterwards leading to restoration of equilibrium.

Figure 6.3

Spot & Futures: Impulse Response Function



Source: E-views output

The results show that the response of spot prices to a shock is more volatile than that of futures prices. In other words, the futures prices will affect the spot prices than the other way around.

6.3.2 Variance Decomposition Analysis

It is a part of structural analysis of a system wherein the forecast error variances are decomposed into contribution from exogenous shocks. It gives the extent of future uncertainty in one variable which is due to future shocks in another variable in the system. It shows how variables adjust to a shock occurring in the system and

explains the variances caused thereby. It is also helpful to identify long run-short run classification of impact of shocks which will be responsible to explain the variance of corresponding period only.

Table 6.8

Spot & Futures: Variance Decomposition Analysis Results

Period (in days)	Futures prices		Spot prices	
	Futures	Spot	Futures	Spot
1	100.000	0.000	38.632	61.368
30	91.121	8.879	86.007	13.993
60	90.125	9.875	87.032	12.968
90	89.807	10.193	87.355	12.645

Source: E-views output

Table 6.8 shows how stronger the variable is in explaining the variance in the other. The shock of one in the market reverberates to equilibrium in the above-shown manner. The percentage of forecast error in futures price is explained by the spot price and vice versa. On the first day, the futures price is explained completely by its own shocks. On the 90th day, it is explained by its own past values by 89.81% and for rest of 10.19%, spot prices stand responsible by its shocks. This clearly shows that major shocks in futures prices are explained by their own shocks rather than spot market prices.

Whereas, on the very first day, futures prices explain 38.63% forecast error variance of spot price which is more than one-third. Over the period, on 90th day, spot prices of gold is explained by its own shocks only by 12.65% and it is considerably driven by shocks in futures prices with forecast error variance of 87.355%. Hence it is inferred that such influence shows an expanding trend over a while.

This simply augments the property of price discovery attached to futures in driving

spot market of yellow metal.

6.3.3 Granger Causality test

Whenever there is a causal relationship between two variables, Engle- Granger causality test is used to establish the same (Engle & Granger, 1987).

A circular logic persists between spot market prices and future market prices (Nirmala & Swarna, 2017; Debasish, 2011) and granger causality test is prevalently used method to analyze the same (Jackline & Deo, 2011). The Granger causality test analyses the short run impact of one variable on another.

Table 6.9

Spot & Futures: Granger Causality Test Results

Causality direction	Chi-square	df	Prob.
Futures>Spot	48.02795**	1	0.000
Spot>Futures	1.102387	1	0.2937

Source: E-views output
***Significant at 1%*

Table 6.9 presents the results of the Engle-Granger Causality test. The causality flow from futures price to spot price is confirmed with a statistically significant chi-square value at 5% level of significance (p-values less than 0.05). The causality flow from spot price to futures price has been failed to establish as the chi-square value is insignificant at 5% level (p-value not less than 0.05).

This implies that futures prices granger causes spot prices, and the short-term relationship therein is intact. However, causality flow from spot prices to futures prices is insignificant and hence it is understood that spot prices does not have any short-term impact on futures prices.

Since the variables are integrated at first difference and not at level, the Granger Causality test will analyse the causal effect between differentiated time series data.

Hence, to analyse the causal effect between time series data at levels, Toda-Yamamoto has been applied to eliminate any chance of error in interpreting causality due to its integration properties.

Toda-Yamamoto test is a modified Granger causality test which takes extra lags up to maximum integration order of its variables irrespective of its stationary properties (Toda & Yamamoto, 1995). This method eliminates the possibility of errors traditional Granger causality test possesses and probable errors in testing of unit root and cointegration properties.

Table 6.10 depicts the results of Toda-Yamamoto method of Granger Causality test. The results have confirmed the findings of Granger causality test since unidirectional causality has been established wherein futures price granger causes spot price and not vice-versa.

Table 6.10

Spot & Futures: Toda-Yamamoto Causality Test Results

Causality direction	Chi-square	df	Prob.
Futures>Spot	137.2185**	1	0.000
Spot>Futures	1.734242	1	0.1879

Source: E-views output
***Significant at 1%*

6.4 Conclusion

The study has focused on the price discovery aspect of gold futures. Price discovery means the process of setting spot price of a specific commodity, currency or any such asset. For the purpose of this study, it means process of determining spot price of gold with the use of futures price of gold and its movements. The study has gone into detail to analyze the efficiency of gold futures in price discovery of gold.

The spot prices have been found following futures prices prima-facie since both

time series followed same average. The time series data used in the study are found integrated at first order. The relationship in the long run has been established deploying Johansen cointegration test with the optimum VAR lag order with minimum Akaike Information Criterion (AIC).

The existence of a cointegrating equation has been confirmed between spot prices and futures prices of gold with statistically significant VECM results. A strong long run relationship between spot and futures prices of gold has been unveiled with spot prices reacting intensely than futures prices to shocks as per the results of impulse response function. Variance decomposition also substantiated that forecast error in futures price will be largely explained by itself whereas in spot, the major explaining factor will be the futures price than the spot itself. Toda-Yamamoto test of causality found the short run relationship or causality direction from futures to spot as statistically significant and spot to futures as insignificant thereby confirming the results of Engle-Granger causality test. This is clear evidence of the efficiency of gold futures in price discovery and the futures market of gold dominates spot market. The causality flows from the futures market to spot market of gold and not the other way around.

It is found that price discovery transgress to spot market from futures market and the finding is in consonance with the findings of Behera, 2015 wherein price discovery function and market efficiency of metal and energy futures market in India was analyzed and found that futures market efficiently utilizes information and leads price discovery in spot market. Raju & Shirodkar (2020) also yielded similar results when the lead-lag relationship in spot and futures markets of energy sector was analyzed.

The futures price paves a way to spot price that the discovery of gold prices becomes convenient.

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Chapter 7

PERCEPTION AND ATTITUDE OF INVESTORS TOWARDS GOLD FUTURES

Contents

7.1 Introduction

Perception is defined in Cambridge dictionary as '*a belief or opinion, often held by many people and based on how things seem'* (Cambridge University Press, 2003). It is a process of attaining awareness through selection, organizing and interpretation of sensory information (Qiong, 2017). Investor perception hence means the opinion or apprehension an investor holds towards the investment. The plethora of investment avenues do imply equally varying perceptions of the investor community. Investor perception is simply how the market feels towards an investment opportunity which in turn helps stakeholders to better serve the market. Market reflects perception and perception, in turn, is driven by market itself.

Perception of investors depends upon various factors. Every investment aims at high returns. The more the returns, the more the market will be able to raise investment. Return always comes with risk. Risk and return share a positive relationship which is popularly known as risk-return spectrum. Beyond risk and return, another essential factor influencing investor perception is liquidity. Liquidity varies between near cash and real estate, antiques etc. Liquidity goals of investors also tend to differ according to which perception of investors may vary about an investment avenue.

Commodity investors are also influenced by a set of variables other than those stated above which is crucial in forming perception. Volatility, brokerage fee, profitability etc. are some of major factors which not only influences perception of investors but also act as driving factors towards investment in commodity market (Ilyas, 2015; Srinivasan & Pon, 2022). Diversification of portfolio, role of stock exchange, settlement of contracts etc. also form a basis for investor perception towards commodity market (Ahamed & Bharathy, 2019).

Attitude can be defined as viewing or evaluating a person or an idea, an object or a situation and the tendency to react- positively or negatively- to it (Vargas-Sánchez, Plaza-Mejía, & Porras-Bueno, 2016).

Along with risk and return, elimination of uncertainty and safety of investment plays a major role in driving attitude of investors (Tamil Selvi, 2015). Attitude of the investors towards commodity market is driven by multiple factors like market conditions, investment in global economic growth, hedge against inflation, leverage, transparency, market risks etc. (Melbha & Bhavan, 2017).

This chapter deals with the analysis of collected data through structured schedule from 150 gold derivative market investors in accordance with the objectives specified. The study is mainly concerned with the factors affecting investment perception and attitude of individual investors in gold futures markets with special reference to Kerala state. This chapter focuses on the study from two perspectives: first, representing the demographic profile of the investors, and second, dealing with the hypotheses testing. The primary data collected were analysed using statistical tools like percentage, mean, standard deviation, paired t-test, Kruskal-Wallis H test etc. The tools are used according to the nature of data distribution.

7.2 Profile of Sample Investors

The social background of the individual investors has an invisible, yet undeniable influence over investment decision. Hence, the same is analysed. It is crucial to

analyse these factors and put up a classification to identify the earthed trends in investment behaviour on the bases of gender, age, educational qualification, occupation etc. The following demographic variables are considered in this study which is obvious as influencing over yellow metal investment and also on the basis of review of relevant literature:

a. Gender
b. Age
c. Education
d. Occupation
e. Marital status
f. Average monthly income.
g. Number of earning members in household

7.2.1 Gender-wise distribution of sample investors

Gender is an important variable that influences the investment behaviour of an individual. Men and women approach investment decisions differently. The gender-wise classification of the sample investors is presented in Table 7.1.

Table 7.1
Gender-wise distribution of sample investors

Gender	Frequency	Percent (%)
Male	119	79.3
Female	31	20.7
Total	**150**	**100**

Source: Primary data

From Table 7.1 it can be observed that, 79.3 percent of sample investors are male, and 20.7 percent of sample investors are female. Thus, majority of sample investors are male. So, it may be considered that the study is going to focus the perception, attitude and investment behaviour of male than female.

7.2.2 Age-wise distribution of sample investors

Age is yet another crucial factor influencing his / her investment behaviour as well as knowledge. Usually, people who belong to the young age group seem to be inclined towards investment in stock market and are more probable to be attracted towards derivative market due to their risk welcoming nature compared to elder age groups. The age-wise distribution of sample investors is given in Table 7.2.

Table 7.2

Age-wise distribution of sample investors

Age	Frequency	Percent (%)
20-30	12	8
30-40	38	25.3
40-50	36	24
50-60	50	33.3
60-70	14	9.3
Total	**150**	**100**

Source: Primary data

From Table 7.2 it is evident that 8 percent of the investors come under below 30 years of age group, 25.3 percent of investors fall under 30 to 40 years of age group and 24 percent of investors fall under next age group category of 40 and 50. It is pertinent to note that one-third of investors belong to the age group of 50-60 which is marked highest. Rest of age group combined constitutes only 9.3%. It can be concluded that comparatively a large group of individual investors are middle aged.

7.2.3 Educational qualification-wise distribution of sample investors

The educational qualification of the respondents is supposed to have a direct impact over investment decisions as well as information processing in connection with

investments. Especially for a complex concept like derivatives, education of individual investors is considered to be the most influencing factor as per several empirical studies. So, this demographic variable has an unquestionable influence over portfolio and its constituents. The education-wise distribution of investors is given in Table 7.3.

Table 7.3

Educational qualification-wise distribution of sample investors

Educational qualification	Frequency	Percent (%)
Intermediate	5	3.3
Graduate	65	43.3
Postgraduate	70	46.7
Others	10	6.7
Total	**150**	**100**

Source: Primary data

From Table 7.3, majority - over 96% of the sample investors are graduates and above. 6.7% of the sample investors, belonging to other educational qualification) were either diploma holders or professional degree holders. Only 3.3% of sample investors consists of individual investors whose educational qualification is up to intermediate/higher secondary schooling.

7.2.4 Marital status-wise distribution of sample investors

For a socio-cultural background India is deemed to possess, several studies till date have confirmed marital status of the investor as an influencer variable. This is probed into vide the following distribution and the same is presented in Table 7.4.

It is inferred from table 7.4 that most of the investors are married. Unmarried investors constitute 12.7% whereas 16% of the investors are widowed. Married investors constituted the lion's share with 71.3%.

Table 7.4

Marital status-wise distribution of sample investors

Marital Status	Frequency	Percent (%)
Unmarried	19	12.7
Married	107	71.3
Widowed	24	16
Total	**150**	**100**

Source: Primary data

It can be inferred that unmarried investors who tend to invest in gold futures are less in number compared to married investors.

7.2.5 Occupation-wise distribution of sample investors

Occupation and its nature of the investor are obvious to imprint the significance in investment in futures. For the purpose of the study, occupation is classified as- self-employed, salaried and retired. Mostly, people who do invest in gold futures are businessmen, especially those who are into physical dealing of gold and they prefer more. The relevant data are presented in Table 7.5.

Table 7.5

Occupation-wise distribution of sample investors

Occupation category	Frequency	Percent (%)
Salaried	47	31.3
Self employed	68	45.3
Retired	35	23.3
Total	**150**	**100**

Source: Primary data

Occupation-wise classification of the sample investors indicates that, 31.3 percent of the investors are employees/ salaried, and 23.3 percent of the investors are retired

from their profession/ employment. Almost 45.3% of the gold futures investors constituting the sample are self-employed.

7.2.6 Average monthly income-wise distribution of sample investors

Average monthly income of the investors has a major role in determination of the investment volume & behaviour of individual investors. Results of strive to examine the average monthly income level of gold futures investors is herewith and the relevant data is presented in Table 7.6.

Table 7.6

Average monthly income-wise distribution of sample investors

Average monthly income (in Rs.)	Frequency	Percent (%)
Up to 50000	7	4.7
50000-100000	58	38.7
100000-150000	58	38.7
Above 150000	27	18
Total	**150**	**100**

Source: Primary data

From Table 7.6 it can be observed that, 4.7 percent of the investors have average monthly income below Rs. 50000, about 39 percent of them falls under the monthly income level 50000-100000 category and under 100000-150000 category each and rest of 18 percent of the investors earn more than Rs. 150000 per month. It means that majority of the investors have a cushion of income from their respective occupations for investment in gold futures.

7.2.7 Earning members in household-wise distribution of sample investors

In an Indian context, every economic variable is to have impact on a unit called

family rather than on an individual. For an investment instrument like futures, trend of earnings from derivative solely depending on movement of market, family opts to have a safer side of yielding from more than one income sources.

From Table 7.7 it can be inferred that 27.3 percent of the investors have their own income as the source of investment in gold futures. Only 4.7% of the investors have more than three earning adults in their households.

But it is not surprising to find that rest of about 72 percent of investors have more than one earning adults in their family which is probable to boost the confidence of the investor to invest in a risky avenue like gold futures.

Table 7.7

Earning members in household-wise distribution of sample investors

Number of earning members in household	Frequency	Percent (%)
One	41	27.3
Two	71	47.3
Three	31	20.7
More than three	7	4.7
Total	**150**	**100**

Source: Primary data

7.3 Perception of investors towards Gold Futures

Devi & Karthikeyan (2018) observed that individual investors are affected by psychological and emotional factors and hence their investment decisions could be irrational. Hence, perception regarding an investment opportunity does affect the investment decision of investors.

7.3.1 Pre-investment perception towards gold futures

The perception of individual investors towards gold futures before entering into investment will be different from post investment perception. This

crucial part of study zooms in on analysing both pre-investment and post-investment perception investors tend to have towards gold futures.

Table 7.8 presents the descriptive statistics of pre-investment perception of the investors towards gold futures. The same has been arrived at from the primary data collected from the investors.

Table 7.8
Pre-investment perception towards gold futures

Statement	Mean	SD
Gold futures helps to accumulate gold over a period of time.	3.04	1.330
Gold futures eliminate issues like theft and lack of storage space.	3.18	1.424
Gold futures can be traded at transparent prices.	3.68	1.292
Gold futures are exempt from wealth tax, VAT, sales tax etc.	2.79	1.115
Gold futures diversify the investment portfolio.	2.98	1.272
Gold futures can be easily traded at different exchange floors.	3.40	1.502
Margin is applicable to gold futures investment.	2.41	1.280
Gold futures can be sold at short.	2.57	1.281
Gold futures track market indices.	3.12	1.492
Gold futures have promising returns.	4.36	.900
It hedges against currency fluctuations.	3.38	1.185
Gold futures are tradable at any brokerage firm.	3.57	1.328
Pre-Investment Perception	**38.47**	

Source: Primary data

Table 7.8 shows that, the aggregate pre-investment perception in favour of gold futures is 38.47 as against the maximum score of sixty. Promising returns has the highest mean value of 4.36 and applicability of margin has the lowest mean value of

2.41. It can be inferred that the sample is slightly in favour of gold futures as an investment avenue.

7.3.2 Post-investment perception towards gold futures

For any avenue of investment, the perception hardly remains indifferent after facing the market wide participation. The following table shows the mean values and standard deviation values of the same variables after investment in gold futures.

Table 7.9

Post-investment perception towards gold futures

Statement	Mean	SD
Gold futures helps to accumulate gold over a period of time.	2.30	1.015
Gold futures eliminate issues like theft and lack of storage space.	2.89	.942
Gold futures can be traded at transparent prices.	4.05	.979
Gold futures are exempt from wealth tax, VAT, sales tax etc.	2.56	1.179
Gold futures diversify the investment portfolio.	3.39	1.514
Gold futures can be easily traded at different exchange floors.	3.70	1.325
Margin is applicable to gold futures investment.	4.51	0.749
Gold futures can be sold at short.	4.53	0.800
Gold futures track market indices.	3.57	1.266
Gold futures have promising returns.	2.17	1.241
It hedges against currency fluctuations.	2.64	1.271
Gold futures are tradable at any brokerage firm.	3.34	1.442
Post-Investment Perception	**39.65**	

Source: Primary data

It can be noticed from Table 7.9 that aggregate post investment perception in favour of gold futures is 39.65 with a maximum score of sixty. The standard deviation value of perception has fell to 7.97 in post investment scenario which further increases the validity of mean value. The post investment perception of the investors is slightly positive. However, it is inferred that there is no significant change in mean value of both groups. However, for a statistical finding to be generalised, the hypothesis needs to be tested. Hence, an attempt is made to compare means of two groups.

7.3.3 Pre-investment perception v/s Post-investment perception

The appropriate method to test whether investor perception significantly differs before and after investment in gold futures has been selected. The nature of distribution has been tested as choice of test depends upon the assumption of normality.

H0: Pre-investment perception and post investment perception of gold futures investors are normally distributed.

For testing normality, Shapiro-Wilk test is used. Studies have proved that Shapiro-Wilk test as most powerful normality test over Anderson-Darling Test, Lilliefors test etc. (Razali & Wah, 2011; Ghasemi & Zahediasl, 2012).

Table 7.10

Pre-investment perception and Post-investment perception

Normality results

	SHAPIRO-WILK TEST RESULTS		
	Statistic	Df	Sig.
Pre-investment perception	.987	150	.198
Post-investment perception	.983	150	.071

Source: Analysis by the researcher

It can be seen from Table 7.10 that significance values of both the distributions are above 0.05 which means it has been failed to reject the null hypothesis. Therefore, based on these results, distribution is assumed normal for further hypothesis testing.

For a normally distributed sample, where one group pre-test post-test design is followed, paired t-test is apt for comparison of means.

H0: There is no significant difference between mean values of pre-investment perception and post-investment perception of gold futures. The following are the results of paired T-test conducted between these two pairs of different variables in pre-investment and post-investment scenarios.

Table 7.11

Pre-investment perception v/s Post-investment perception: Paired t-test results

Statement	Correlation	t-val	Sig.
Gold futures helps to accumulate gold over a period of time.	0.137*	5.984	0.000
Gold futures eliminate issues like theft and lack of storage space.	0.169**	2.379	0.019
Gold futures can be traded at transparent prices.	0.241**	-3.227	0.002
Gold futures are exempt from wealth tax, VAT, sales tax etc.	0.474***	2.360	0.20
Gold futures diversify the investment portfolio.	0.366***	-3.315	0.001
Gold futures can be easily traded at different exchange floors.	0.184**	-1.919	0.057
Margin is applicable to gold futures investment.	0.028	-17.93	0.000
Gold futures can be sold at short.	0.190**	-17.45	0.000
Gold futures track market indices.	0.38***	-4.2	0.000
Gold futures have promising returns.	-0.8	16.66	0.000
It hedges against currency fluctuations.	0.123	5.65	0.000
Gold futures are tradable at any brokerage firm.	0.205**	1.498	0.136

Source: Analysis by the researcher
**Correlated at 10% significance level*
***Correlated at 5% significance level*
****Correlated at 1% significance level*

Table 7.11 clearly remarks which perception variable has significant difference before investment and after investment in gold futures and which do not. To put it in other words, t-test results bring out the perception variables which have significantly different values in pre-investment and post-investment scenarios. Thus, the null hypothesis has been rejected for those variables.

Analysing the results given in Table 7.11, it can be inferred that only a few variables share no significant correlation between pre-investment and post-investment scenario: Applicability of margins, promising returns and hedging against currency fluctuations. The rest of the variables show a positive or negative correlation with valid P-value.

However, the paired t-test results imply that accumulation of gold, elimination of storage risks, transparency in prices, diversification of portfolio, applicability of margins, short selling, track of market indices, promising returns and hedge against currency fluctuations caused the significant difference before and after investment in the perception of investors towards gold futures. High significance of these variables implies rejection of null hypothesis that there is no significant difference between pre-investment and post-investment perception of investors towards gold futures. Rejection of null hypothesis is an indication that perception of investors has significantly changed towards gold futures after investment compared to the perception they kept before investment in gold futures. Hence, the correlation between the perception of investors before and after investment possesses an actual effect for the variables considered. The third major hypothesis of the research hence proved.

7.4 Attitude of investors towards Gold Futures

American Psychological Association Dictionary of Psychology defines attitude as "a relatively enduring and general evaluation of an object, person, group, issue, or concept on a dimension ranging from negative to positive". The perception of an investor leads to the development of an attitude towards investment. Various factors

influencing the attitude of investors are identified. As such, to identify the attitude towards investment in gold futures, an attempt is made to measure the attitude of investors.

From Table 7.12, it can be traced out that the aggregate score of attitudes of the investors is 49.86. The sample investors have, prima facie, a positive attitude towards investment in gold futures. The mean score is maximum for adherence to SEBI guidelines and minimum for marketing strategy.

Table 7.12

Attitude of investors towards gold futures

Attitude factors	Mean	SD
Past satisfactory performance of gold instruments.	4.23	0.942
Comparatively less-volatile prices at international arena.	4.21	1.046
Image of gold.	3.28	1.529
Performance during volatility.	4.00	1.204
Services from Brokers.	2.47	1.185
Marketing Strategy.	2.28	1.075
Transparency.	4.10	1.054
Strict adherence to SEBI guidelines.	4.27	0.882
Strong possibility for capital appreciation.	4.01	1.226
Returns	4.21	1.097
Administrative expenses	2.45	1.283
Risk	4.25	1.118
Liquidity	3.17	1.203
Guarantee	2.91	1.099
Attitude towards investment	**49.86**	

Source: Primary data

On the basis of the measurement of attitude based on variables influencing gold

futures investors, attitude of investors has been classified into- Negative, Positive and Neutral. The frequency distribution of such classification of trader attitude is calculated and given in Table 7.13.

Table 7.13

Nature of attitude of investors towards gold futures

Nature of attitude	Frequency	Percent
Negative	39	26
Neutral	73	48.7
Positive	38	25.3
Total	**150**	**100**

Source: Analysis by the researcher

It can be observed from Table 7.13 that about 49% of investors exert a neutral attitude towards gold futures i.e., their opinion regarding investment in gold futures may neither be too positive nor too negative. Comparing extreme attitudes of positive and negative, it can be inferred that negative attitude supersedes the other, though for a negligible proportion.

7.4.1 Investor profile v/s Investor attitude towards gold futures

Literature suggests that socio-economic or demographic variables play a salient role in investor behaviour (Patel & Modi, 2017; Jain & Mandot, 2012). Hence, the relationship between gender, age, educational qualification, occuptaion category, marital status, average monthly income, number of earning members in household with attitude of investors needs to be analyzed so as to infer the impact of these variables on investor attitude.

Pearson's Chi-square test of independence, a non-parametric hypothesis test, reveals whether two categorical variables are likely to be related or not. It is an inferential statistical test which helps to generalize the hypothesis regarding population on the

basis of sample. Senda, Rahayu, & Rahmawati (2020) used chi-square test to analyse the effect of financial literacy and demographic variables on investment decision. Subramaniam & Athiyaman (2016) also confirmed correlation between demographic factors and risk tolerance using chi-square test of independence.

Chi-square test of independence has been deployed in the study to check whether investor attitude changes with demographic variables.

H0: There is no significant relationship between gender, age, educational qualification, occuptaion category, marital status, average monthly income, number of earning members in household with type of attitude of investors towards gold futures.

Chi-square test results establishes the existence of statistically significant relationships but fails to identify the combination of variables which impacts desired level of significance. When statistically significant association of variables have been identified, a post-hoc analysis with residual analysis will help to segregate the combination of variables which contribute to such statistical significance. Ali et. al. (2020) used post hoc residual analysis to analyse the SME financial growth cycle model- to identify the combination of demographic variable and source of capital after reaching statistically significant chi-square values. Porter & Golan (2006) also deployed post hoc residual analysis when chi-square test results showed significant association. Positive residual stands for overrepresentation and negative value stands for underrepresentation. Residual analysis helps us to identify which association contributes the most to significant difference proved. The larger the residual is, the more surprising observed count is compared to its expected value. As a rule of thumb, a standardized residual value greater than 2 indicates lack of fit of asymptotically normal expected count in that cell (suggested by Haberman, 1973).

Table 7.14 unleashes the significant relationship of nature of attitude of investors with gender, age, educational qualification, marital status, occupation category, average monthly income, and number of earning adults in investor household with chi-square values along with significance at 95% confidence level.

Table 7.14

Demographic factors v/s Investor attitude towards gold futures

Demographic variable	χ^2 Statistic	Df	Prob.	Result
Gender	11.767	2	0.003	Rejected
Age	68.451	8	0.000	Rejected
Educational qualification	13.649	6	0.034	Rejected
Marital status	3.143	4	0.534	Failed to reject
Occupation category	18.622	4	0.001	Rejected
Average monthly income	34.068	6	0.000	Rejected
Number of earning members in household	8.222	6	0.222	Failed to reject

Source: Analysis by researcher

a) Gender v/s Investor attitude

The result of the chi-square test of independence has confirmed that there is a significant association between gender and attitude of investor with p-value less than 0.05. Hence, it is inferred that the latter tends to change with the gender of the investor. Since it is clear that the gender of the investors is associated with the nature of attitude they possess towards gold futures, a post hoc analysis is run to find out which association is more significant. The results of post hoc residual analysis are given in Table 7.15.

Table 7.15

Gender v/s Investor Attitude: Residual Analysis Results

	Negative	Neutral	Positive
Male	0.02 (31.98)	**3.62** (60.00)	**-4.62** (27.02)
Female	-0.02 (7.02)	**-3.62** (13.00)	**4.64** (5.98)

Source: Analysis by researcher
Values: Standardized residual (expected count)

Expected counts given in parentheses are what would be anticipated if there was no association between gender and attitude. From Table 7.15, it can be observed that males overrepresent neutral attitude over females with standardized residual of 3.62 whereas females overrepresent positive attitude over males with standardized residual of 4.64. The actual proportion of males exceed the expected proportion in case of neutral attitude whereas the actual proportion of women exceed the expected proportion in case of positive attitude.

b) Age v/s Investor attitude

The result of the chi-square test rejects the null hypothesis that there is no significant association between age of the investors and their attitude towards gold futures.

Table 7.16

Age v/s Investor Attitude: Residual Analysis Results

	Negative	Neutral	Positive
20-30	**5.13** (3.65)	**2.74** (6.96)	**3.50** (1.39)
30-40	**-2.68** (9.60)	-0.34 (18.24)	**-2.34** (3.60)
40-50	**-2.39** (9.20)	**-2.04** (17.52)	**3.38** (3.48)
50-60	**2.07** (12.80)	0.54 (24.32)	-1.32 (4.80)
60-70	-1.45 (3.75)	-0.84 (7.12)	1.33 (1.42)

Source: Analysis by researcher
Values: Standardized residual (expected count)

It is inferred that the age of investors poses a strong impact on their attitude towards gold futures and the post hoc residual analysis results are given in Table 7.16.
Expected counts given in parentheses are what would be anticipated if there was no association between age and attitude. From Table 7.16, it can be observed that investors under the 20-30 years age category overrepresent over other age categories irrespective of nature of attitude with standardized residual more than +2.

The investors belonging to the 30-40 years age category underrepresent significantly, especially extreme attitudes- negative and positive with standardized residual of -2.68 and -2.34 respectively. The investors belonging to the 40-50 years age category overrepresent others with positive attitude with standardized residual of 3.38 and underrepresent with negative and neutral attitude. Those belonging to the 50-60 years age category have a strong association with negative attitude as their standardized residual is more than +2 therein. Investors of 60-70 years of age are not significantly varying in proportion in comparison to expected proportion.

c) Educational qualification v/s Investor attitude

The chi-square test result unleashes that there is significant association between educational qualification of the investor and attitude of the investor towards gold futures as the p-value is less than 0.05 which rejects the null hypothesis. In short, the educational qualifications of the investors influence their investor attitude. Since the association has been found statistically significant, a post hoc residual analysis has been deployed to identify which categories of educational qualification contribute more to the statistically significant association.

The results of post hoc residual analysis are given in Table 7.17. Expected counts given in parentheses are what would be anticipated if there is no association between educational qualification of the investor and attitude.

From Table 7.17, it is evident that graduate investors overrepresent neutral attitude with standardized residual of 15.12 and underrepresent positive attitude significantly with standardized residual of -15.74. This means graduate investors are more prone towards neutral attitude than expected and the actual proportion of graduate investors with positive attitude is significantly less than expected.

Table 7.17

Educational qualification v/s Investor Attitude: Residual Analysis Results

	Negative	Neutral	Positive
Intermediate	1.33 (0.67)	0.08 (1.92)	-1.47 (2.47)
Graduate	0.62 (8.38)	**15.12** (23.88)	**-15.74** (32.74)
Postgraduate	-1.33 (9.33)	**-12.57** (26.57)	**13.91** (34.09)
Others	0.8 (1.33)	-1.40 (3.8)	**4.6** (4.87)

Source: Analysis by researcher
Values: Standardized residual (expected count)

At the same time, postgraduate investors are exceptionally positive with their attitude as residual stands for overrepresentation i.e., standardized residual more than +2. However, they underrepresent with neutral attitude as expected proportion of postgraduate investors with neutral attitude is higher than actual. Investors with professional diploma/degree or any other qualification are more probable to maintain positive attitude towards gold futures since standardized residual is more than +2.

d) Marital status v/s Investor attitude

The chi-square test of independence has been performed to test the association between marital status of the investors and their attitude towards gold futures. The statistic has been found statistically insignificant (p-value greater than 0.05) failing to reject the null hypothesis. Therefore, it can be interpreted that the marital status of the investors possesses no significant influence on their attitude towards gold futures.

e) Occupation category v/s Investor attitude

The result given in Table 7.14 makes it evident that there is significant association between occupation category and investor attitude towards gold futures since chi-

square test statistic has been found statistically significant at 5% level of significance (p-value less than 0.05). The attitude towards the investment also depends upon whether the investor is salaried, self-employed or retired. The results of post hoc residual analysis are given in Table 7.18.

Table 7.18

Occupation category v/s Investor Attitude: Residual Analysis Results

	Negative	Neutral	Positive
Salaried	**6.91** (11.91)	**2.43** (19.43)	**-9.33** (15.67)
Self employed	**-3.77** (17.22)	-0.89 (28.11)	**4.67** (22.67)
Retired	**-3.13** (8.87)	-1.53 (14.47)	**4.67** (11.67)

Source: Analysis by researcher
Values: Standardized residual (expected count)

Expected counts given in parentheses are what would be anticipated if there is no association between occupation of the investor and attitude. From Table 7.18, it is clear that salaried investors may be largely negative (standardized residual of 6.91) or possibly neutral (standardized residual of 2.43) with their attitude towards gold futures. This justifies the heavy underrepresentation of salaried investors with a positive attitude (standardized residual of -9.33).

Both self-employed and retired categories of investors are probable to have positive attitude towards gold futures with standardized residual more than +2. With standardized residual value less than -2, both self-employed and retired categories of investors are less prone to negative attitude.

f) Average monthly income v/s Investor attitude

From Table 7.14, it is also evident that there is a significant association between average monthly income and investor attitude towards gold futures. The chi-square

statistic has been found statistically significant with p-value less than 0.05. This means that with the changing average income of the investor a corresponding impact is prone to occur on the attitude of the investor towards gold futures. The results of investigation regarding the major contributor to this association yield the results given in Table 7.19.

Table 7.19

Average monthly income v/s Investor Attitude: Residual Analysis Results

Income (in Rs.)	Negative	Neutral	Positive
Upto 50000	0.05 (2.05)	-1.09 (1.91)	1.03 (3.03)
50000-100000	**-3.99** (17.01)	**4.85** (15.85)	-0.87 (25.13)
100000-150000	**7.01** (17.01)	**-4.15** (15.85)	**-2.87** (25.13)
Above 150000	**-3.08** (7.92)	0.38 (7.38)	**2.7** (11.7)

Source: Analysis by researcher
Values: Standardized residual (expected count)

Expected counts given in parentheses are what would be anticipated if there was no association between the average income of the investor and attitude. Table 7.19 unleashes that the investors with average monthly income between Rs. 100000-150000 have a strong association with negative attitude with standardized residual of +7.01 which means actual count of investors is more than expected from that combination. Consequently, they underrepresent with neutral and positive attitude with standardized residuals less than -2.

Investors with an average monthly income between Rs. 50000-100000 overrepresent neutral attitude with standardized residual of 4.85 and underrepresent negative attitude with standardized residual of -3.99.

The actual proportion of investors who earn more than Rs. 150000 per month on average is less than expected proportion with negative attitude (standardized residual

less than -2) and vice versa with positive attitude (standardized residual more than +2).

g) Number of earning members in household v/s Investor attitude

From Table 7.14, it is also evident that there is no significant association between the number of earning adults in investor household and investor attitude towards gold futures since chi-square test result has been found statistically insignificant at 5% level of significance. This means that the number of earning adults in the household does not possess any significant impact on the attitude of investor towards gold futures.

The fourth major hypothesis of the research hence proved.

7.5 Conclusion

The chapter deals with investor-centric aspects of the futures contracts of the yellow metal and has come up with some relevant findings.

The perception of the investors before investment and after investment is found slightly positive. Comparing pre-investment perception and post investment perception, certain perception parameters like accumulation of gold, elimination of storage risks, transparency in prices, diversification of portfolio, applicability of margins, short selling, track of market indices, promising returns and hedge against currency fluctuations show up significant difference and it can be inferred that the overall perception of the investors have changed after investment in gold futures.

Almost half of investors have a neutral attitude towards gold futures. The second half may be divided almost equally between investors with negative attitudes and those with positive attitudes. When gender, age, educational qualification, occupation category and average monthly income are different, the attitude of the investor towards gold futures will also be different.

The nature of the attitude of the investors towards gold futures has been proven influenced by the gender of the investor. Males overrepresent neutral attitude over females whereas females overrepresent positive attitude over males. It can be observed that the age of the investor plays a significant role in the forming investment attitude towards gold futures. The young investors overrepresent other age categories irrespective of nature of attitude. After a surge of positive attitude and middle-aged investors tend to significantly underrepresent extremities with exceptions.

There exists a significant association between the educational qualification of the investor and the attitude of the investor towards gold futures. Graduate investors seem to stick to neutral attitude largely whereas postgraduate and other investors having technical or professional qualifications seem to be biased to positive side of the instrument above their expected proportion.

An analysis of occupation-wise investor attitude towards gold futures, it can be inferred that salaried investors significantly reflect negative or neutral attitude which result in underrepresentation of positive attitude. Self-employed or retired investors reflect more of positive attitude.

With income-wise analysis, it has been found that the average income of the investors has a strong influence over their attitude towards the investment avenue. It can be observed that the investors earning between 6 lakhs and 12 lakhs per annum tend to be significantly neutral with their attitude towards gold futures whereas when the income increases beyond that, the investors have a strong inclination towards reflecting negative attitude towards gold futures. However, marital status and number of earning members in have no significant effect on investor attitude towards gold futures.

Given the investor perception and attitude, the factors driving investment in gold futures remain area imbibing curiosity.

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Chapter 8

INVESTMENT DETERMINANTS OF GOLD FUTURES AND INVESTOR SATISFACTION

Contents

8.1 Introduction

The commodity market has captivated major market attention in recent years. It is yet to broaden its sphere in comparison to the financial market with regard to certain terms like robust liquidity of the market. However, the need to identify the investor dynamics in the process of investment is inarguably a need of hour. The perception and attitude of investors do affect the investment in any avenue. Along with these investor centric factors, certain investment centric factors and a few external factors are also bound to influence the investment decision of any investor since every investment has an aim.

Risk and return are two sides if a coin is an investment. Higher the risk, higher the return and if one declines, the other follows is a basic theory of Capital Asset Pricing Model (CAPM) (Sharpe, 1964). Gold futures are less preferred by the investors due to high exposure and high risk involved (Nawaz & Sudindra, 2013). Liquidity, price factor, security of investment etc. has also been cited as factors influencing investment in gold (Thapa & Shah, 2020). Gold has been concluded as an excellent diversifier of a portfolio (Šoja, 2019) and gold futures is no exception (Jaiswal & Uchil, 2018). Profitability and tax aversion also play push factors towards gold investment (Hundal, Grover, & Bhatia, 2013). Less volatility is also

an attraction of commodity (Hymavathi & Kalpana, 2019). Gold has also been identified by the investors as hedge against inflation (Godbole & Arekar, 2014).

The satisfaction of investors towards an investment like gold can be measured in terms of safety, liquidity, exchange value, hedge against inflation, expected return etc. (Ramachandran & Dayanasajjanan, 2014). The liquidity and risk performance also qualify as a measure of satisfaction towards an investment. However, the most crucial factors are the way investors perceive the investment and how they are being led to take investment decisions.

There emerges a strong need to unleash the factors which determine the investment in gold futures- the factors which drive the investors towards gold futures. The satisfaction of investors which motivate them to make repeated investment or repel from investment also makes sense with driving factors. The intertwined association between these two aspects, if any, needs to be explored. Thus, the chapter discusses the determinant factors of, and the satisfaction attached to, the investment – gold futures in detail.

8.2 Determinant factors of investment in gold futures

There are certainly some factors which determine the investment decision of investors in gold futures. Such factors have been analysed in detail. Determining factors of investment in gold futures have been identified on the basis of existing literature and eleven relevant variables have been considered for the study. The descriptives of investment determinants are given in Table 8.1.

'Extremely liquid' variable has the highest mean score of 4.27 and the lowest standard deviation of 0.882. It implies that almost 85% of the investors believe gold futures are liquid and they consider liquidity as one of the determinant factors to invest in gold futures. The second highest mean score of 4.24 has been secured by the variable – portfolio diversification with a standard deviation of 1.028. 'Electronic form' has the lowest mean score of 2.29 and a standard deviation of

1.083. This clearly depicts that only 45.8% of investors consider the electronic form of investment as a factor determining their investment decision with regard to gold futures. The majority of variables are either moderately skewed (-0.5 to -1) or highly skewed (more than -1). Kurtosis is negative for the majority of the variables which stands for light tails (platykurtic).

Table 8.1

Factors determining investment in gold futures: Descriptive analysis

Variable	Mean	SD	Skewness^	Kurtosis#
No worry about adulteration	4.23	0.942	-0.908	-0.331
Portfolio diversification	4.24	1.028	-1.024	0.330
Global asset class	3.27	1.523	-0.253	-1.446
Hedge	4.01	1.204	-0.961	-0.225
Less volatile than equities	2.45	1.167	0.375	-0.505
Electronic form	2.29	1.083	0.307	-0.813
Safe method of keeping gold	4.09	1.058	-0.913	-0.434
Extremely liquid	4.27	0.882	-1.162	0.666
Daily/ real time disclosure of portfolio	4.01	1.226	-0.934	-0.361
Low-cost intraday trading	4.21	1.090	-1.033	-0.436
Return	2.43	1.266	0.383	-0.944

Source: Survey data
^Standard error=0.198
#Standard error=0.394

Since variables are many in number and for further effective analysis, factor analysis is used to reduce the larger number of variables to fewer number of factors extracting maximum common variance from all variables and putting them into a common score. Sultana & Pardhasaradhi (2012) used factor analysis to identify the factors that influence Indian individual equity investors' behaviour in selection of

investment. Muhammad & Abdullah (2009) used factor analysis to identify the factors influencing investment decision of Malaysian investors.

Principal component analysis with varimax rotation has been used for extraction of factors. The eigen value greater than one criterion as given by Kaiser & Rice (1974) has been adopted for deciding the number of factors. The results of PCA with varimax rotation are given in Table 8.2.

Table 8.2

Investment Determinant Factors of Gold Futures: Rotated Component Matrix

	Component 1	Component 2	Component 3
No worry about adulteration			
Portfolio diversification		**.592**	
Global asset class		**.826**	
Hedge		**.832**	
Less volatile than equities		**.609**	
Electronic form	**.614**		
Safe method of keeping gold	**.826**		
Extremely liquid	**.596**		
Daily/ real time disclosure of portfolio			**.832**
Low-cost intraday trading			**.773**
Return			**.632**

Extraction method: Principal component analysis
Rotation method: Varimax with Kaiser normalization

The factor analysis based on varimax rotation with Kaiser normalization has retained only three factors with eigen values greater than one. Each factor has been condensed to one constituting all those variables with loadings greater than 0.5. The factors have been labelled- investment format, portfolio image and trading benefits.

Table 8.3

KMO and Bartlett's Test Results

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.823
Bartlett's Test of Sphericity	Approx. Chi square	681.66
	Df	55
	Sig.	0.000

Source: Analysed using SPSS

The appropriateness of factor analysis has been assessed by checking the significance of Bartlett's test of sphericity and by examining sampling adequacy through Kaiser-Meyer- Olkin (KMO) Measure of Sampling Adequacy (Hair, Black, Babin, Anderson, & Tatham, 2006). Kaiser & Rice (1974) recommends accepting values greater than 0.5 as acceptable. From Table 8.3, it is evident that KMO measure of sampling adequacy is 0.823 which can be considered meritorious. This implies that only 17.7% sampling error is probable. Bartlett's Test of Sphericity has been found statistically significant at 1% level of significance which further supports the validity of the factor analysis of the data set.

8.2.1 Determinants of investment in Gold Futures v/s Investor attitude

Since the results of factor analysis has extracted three determinants of investment – investment format, portfolio image and trading benefits- the relation between investment determinants and investor attitude has been tested to investigate whether these determinants of investment in gold futures play any role in framing investors' attitude towards gold futures. Regression analysis has been used to frame the model. The determinant factors of investment have been taken as independent variables of which impact on dependent variable- investor attitude- has been tested. The results are presented in Table 8.4.

Table 8.4 indicates all three investment determinants are significant at the 1% significant level with a positive co-efficient. This implies that the relationship between determinants of investment in gold futures and attitude of investors towards gold futures is positive- any change in dependent factors will have a corresponding change in investor attitude in the same direction. Further, all three investment

determinant factors have a positive and significant effect upon investor attitude towards gold futures.

Table 8.4

Determinants of investment in Gold Futures v/s Investor Attitude

Variable	Co-efficient	Standard error	t-statistic	Prob.
Intercept	49.782	.544	91.547**	0.000
Investment format	2.261	.546	4.144**	0.000
Portfolio image	1.419	.546	2.600**	0.010
Trading benefits	0.472	.546	0.864**	0.009
F-statistic	8.228**			
Prob (F-statistic)	0.000			
R-squared	0.6471			
Adjusted R-squared	0.6398			

Source: Primary Data

***Statistically significant at 1% significant level*

The overall significance of the estimated model given by the F statistic is 8.228 and significant at 99% confidence level. It means that all of the independent variables taken together are significant in explaining the dependent variable. The R-squared of the model is 0.6471, which means that all the independent variables (investment format, portfolio image and trading benefits) taken together explain 64.71% of the total variation of the dependent variable (investment attitude). The adjusted R-squared of the model is 63.98%.

The fifth major hypothesis of the research hence proved.

8.3 Investor satisfaction towards gold futures

Rutkowska (2015) defined investor satisfaction as the comparison between expectation of an investor and perceived performance of the investment. Gopinath, Vasan, & Sumathy (2019) considered return, risk, diversified investment, liquidity etc. to measure investors' satisfaction with performance of commodity trading.

Table 8.5

Investment satisfaction towards gold futures: Descriptives & Normality test results

Variables	Mean	SD	Z-value	P-value
Affordability	3.52	1.214	0.234	.000
Transaction ease	2.85	.833	0.340	.000
Manageable risk	1.73	1.105	0.365	.000
Liquidity	2.03	1.295	0.299	.000
Transparency in price	3.63	1.138	0.306	.000
Return Potential	2.65	1.327	0.167	.000
SATISFACTION	16.4	4.878	0.098	.001

Source: Primary data

Investor satisfaction has been assessed on the basis of six parameters in this study. Purwaningrat, Oktarini, & Saraswathi (2019) used Kolmogorov-Smirnov Z test to test normality of data in their study. Hence, the normality of data has been tested with Kolmogorov-Smirnov Z test results along with descriptives of satisfaction parameters are given in Table 8.5.

The price transparency aspect has recorded the highest mean score of 3.63 (SD 1.138) which indicates that approximately 72% or more investors are satisfied with transparency of price in gold futures investment. The management risk aspect has the lowest mean score of 1.73 (SD 1.105). This implies that less than 35% find the risk attached to gold futures contracts manageable to their risk acceptance level. From the results shown in Table 8.5, it can be noted that most of the investors remain neutral to their satisfaction from investment in gold futures- neither too satisfied nor too unsatisfied.

The normality of data has been tested with Kolmogorov-Smirnov test. Since p-values of all satisfaction dimensions individually as well as that of overall investor satisfaction is less than 0.05, it can be concluded that the normality hypothesis has been rejected and the data distribution is not normal.

8.3.1 Demographic variables v/s Investor satisfaction

Kalra Sahi (2013) found that demographic and socio-economic indicators like age, marital status, occupation, income etc. have an impact on individual investor satisfaction in general. An attempt has been made to find out how well this theory stands for investment in gold futures. To check whether there exists any association between various demographic variables and satisfaction of investors towards gold futures, appropriate tests have been applied and the results have been given in Table 8.6.

H0: There is no significant association between demographic variables- sex, age, educational qualification, marital status, occupation category, average monthly income and number of earning adults in household- and investor satisfaction towards gold futures.

Table 8.6

Demographic variables v/s Investor satisfaction: Hypotheses testing

Sl. No.	Demographic variable	Test used	Statistic	df	Sig.*	Result
a)	Gender	Mann-Whitney U test	-0.186	-	0.852	Insignificant
b)	Age	Kruskal-Wallis H test	1.452	4	0.835	Insignificant
c)	Educational qualification	Kruskal-Wallis H test	9.079	3	0.028	Significant
d)	Marital status	Kruskal-Wallis H test	0.847	2	0.655	Insignificant
e)	Occupation category	Kruskal-Wallis H test	0.634	2	0.728	Insignificant
f)	Average monthly income	Kruskal-Wallis H test	4.738	3	0.192	Insignificant
g)	Number of earning adults in household	Kruskal-Wallis H test	11.482	3	0.009	Significant

Source: SPSS output
**Significance at 5% level*

Mann-Whitney test and Kruskal Wallis H test have been used according to number

of sets in categorical variable- two or more. Since data distribution is not normal, non-parametric tests have been used.

The results given in Table 8.6 are interpreted as follows:

a) Gender v/s Investor satisfaction

The result of Mann-Whitney U test has confirmed that there is no significant difference between mean ranks of male and female with p-value greater than 0.05. Hence, the gender of the investor does not have any significant impact on the satisfaction level of the investor towards gold futures and satisfaction of investors towards gold futures will not change with the gender of the investor.

b) Age v/s Investor satisfaction

Since the variable involves more than two categories, the Kruskal-Wallis H test is used for testing of hypothesis. The result shows that there is no significant difference among mean ranks of all age categories as the H value is found statistically insignificant (p-value more than 0.05). It is inferred that the age of investors does not pose any impact on their satisfaction towards gold futures.

c) Educational qualification v/s Investor satisfaction

The results of the Kruskal-Wallis H test unleashes that there is significant difference between mean ranks of different investors with different educational qualification levels as the p-value is less than 0.05 which rejects the null hypothesis. This further means that there is significant difference between various educational qualification categories of investors with respect to satisfaction towards gold futures. It may be put that educational qualification of the investor influences his level of satisfaction.

Since the association between satisfaction and educational qualification of the investors has been found statistically significant, a post hoc test has to be done to

identify which categories of educational qualification causes statistically significant difference in sample means. Dunn-Bonferroni post hoc test has been employed to do pairwise comparison so as to arrive at which pair of means significantly differ from each other. It is often used after conducting a statistical test to compare means. The result of the post hoc test is given in Table 8.7.

From Table 8.7 it can be observed that investors having postgraduate qualification differ significantly in terms of their investment satisfaction from investors having other qualification- diploma or professional courses since adjusted p-value of the pair is less than 0.05.

Table 8.7

Educational qualification v/s Investor Satisfaction: Post-hoc test results

Comparison	Mean rank diff.	Std. test statistic	Adj. Sig.*
Intermediate-Graduate	-15.26	-0.759	0.99
Intermediate-Postgraduate	-3.99	-0.199	0.99
Intermediate-Others	-45.40	-1.914	0.334
Graduate-Postgraduate	11.27	1.512	0.784
Graduate-Others	-30.14	-2.049	0.243
Postgraduate-Others	-41.41	-2.829	0.028

Source: Analysed using SPSS
**significance at 5% level*

From Table 8.7 it can be observed that investors having postgraduate qualification differ significantly in terms of their investment satisfaction from investors having other qualification- diploma or professional courses since adjusted p-value of the pair is less than 0.05. Postgraduate investors have significantly lower mean rank than technically or professionally qualified investors. Since adjusted p-values of all other pairs are more than 0.05, the corresponding mean ranks do not differ significantly at 5% level of significance. Technically or professionally qualified investors outperform postgraduate investors significantly.

d) Marital status v/s Investor satisfaction

The Kruskal-Wallis H test has been performed to test the association between marital status of the investors and their satisfaction towards gold futures. The statistic has been found statistically insignificant (p-value greater than 0.05) failing to reject the null hypothesis. Therefore, it can be interpreted that the marital status of the investors possesses no significant influence on their satisfaction level.

e) Occupation category v/s Investor satisfaction

The result given in Table 8.6 makes it evident that there is no significant association between occupation category and investor satisfaction towards gold futures since Kruskal-Wallis H test has been found statistically insignificant at 5% level of significance (p-value greater than 0.05). The investor be salaried, or self-employed or retired, the satisfaction towards the investment does not tend to change or seem to be influenced by it.

f) Average monthly income v/s Investor satisfaction

From Table 8.6, it is also evident that there is no significant association between average monthly income and investor satisfaction towards gold futures since Kruskal-Wallis H test has been found statistically insignificant at 5% level of significance. This means that average income of investor does not possess any significant impact on the satisfaction of investor towards gold futures.

g) Number of earning members in household v/s Investor satisfaction

It can be inferred from Table 8.6 that there is significant association between investor satisfaction towards gold futures and number of earning adults in household as p-values for these two demographic variables are less than 0.05.

Table 8.8

No. of earning adults in household v/s Investor Satisfaction: Post-hoc test results

Comparison	Mean rank diff.	Std. test statistic	Adj. Sig.*
One-Two	0.17	0.02	0.99
One-Three	-27.79	-2.697	0.042
One-More than three	-14.80	-0.835	0.016
Two-Three	-27.63	-2.963	0.018
Two-More than three	-14.97	-0.872	0.015
Three-More than three	-42.59	-2.35	0.001

Source: Analysed using SPSS
**significance at 5% level*

The number of earning adults in their household possesses a significant impact on the satisfaction of investors towards gold futures. Dunn-Bonferroni post hoc test has been employed to do pairwise comparison so as to arrive at which pair of means significantly differ from each other. The result of the post hoc test is given in Table 8.8.

From Table 8.8 it can be observed that investors having single earning adult in household differ significantly in terms of their investment satisfaction from investors having three earning adults in household with latter having higher mean rank and thus higher since adjusted p-value of these pairs is less than 0.05. Similarly, the investor being single earner has lower satisfaction compared to an investor having three earning adults in the family.

Similarly, investors who have two earning adults differ significantly in terms of satisfaction from investment in gold futures from those with three earning adults in household or more than three earning adults. Investors who have three adults in the household also tend to differ from those who have more than three earning adults in the household. In both the cases, satisfaction will be more for the latter since mean rank differences are negative.

The comparison between one earning adult and two earning adults, the mean rank of former seems higher as the rank difference is positive. However, the difference is statistically insignificant. However, rest all the pairs have negative mean rank differences which are statistically significant which means latter have higher mean ranks than the former in a pair. It means that satisfaction from investment in gold futures increases with increasing number of earning adults in the household to investors.

The hypothesis is rejected regarding the association of investor attitude towards gold futures with demographic variables like educational qualification of the investors and the number of earning adults in investor household as the results show a strong association these two variables share with investor attitude towards gold futures. The association of attitude of investor towards gold futures with demographic variables like gender, age, marital status, occupation category and average monthly income are found statistically insignificant and the hypothesis with regard to these variables have been failed to reject.

8.3.2 Investor Attitude and Investor Satisfaction

The effect of demographic variables on investor satisfaction has been analysed. Now the impact of other variables on investor satisfaction needs to be analysed. A few studies have discussed the effect of investor attitude and perception on satisfaction or similar objectives on the backdrop of a different investment arena (Das, 2012; Umamaheswari & Kumar, 2014).

Kruskal Wallis H test has been used to the following hypothesis:

H0: There is no significant association between investor attitude and investor satisfaction towards gold futures.

From Table 8.9 it is clear that the attitude of investors towards gold futures have significant impact on satisfaction of investors with regard to dimensions like affordability, transaction ease, transparency in price and return potential since p-value is significant at 5% ($p<0.05$).

Table 8.9

Investor Attitude and Investor Satisfaction towards Gold Futures

Dimensions	H value	Df	p-value*	Inference
Affordability	43.586	2	.000	Significant
Transaction ease	7.414	2	.025	Significant
Manageable risk	1.248	2	.536	Not significant
Liquidity	1.228	2	.541	Not significant
Transparency in price	27.305	2	.000	Significant
Return Potential	15.714	2	.000	Significant

**significance at 5% level*

However, the attitude of investors does not share any significant association with satisfaction in terms of risk manageability and liquidity of gold futures as p-values are more than 0.05. This means that a change in attitude may result in a change in satisfaction level with respect to affordability, transaction ease, transparency in price and return potential dimensions. But a significant effect will be absent on risk manageability and liquidity dimensions.

8.3.3 Investor Perception and Investor satisfaction

The effect of perception on satisfaction has already been occupied a niche in existing literature (Wang, Shi, & Fan, 2006; Arathy, Nair, Sai, & Pravitha, 2015). Kruskal-Wallis H test has been applied to test the effect of investment perception on satisfaction of investors towards gold futures. The non-parametric alternative of ANOVA is being used as per normality test results.

H0: There is no significant association between investor perception and investor satisfaction towards gold futures.

From Table 8.10 it is evident that the post investment perception of investors towards gold futures have significant impact on satisfaction of investors with regard to all satisfaction dimensions like affordability, transaction ease, risk manageability, liquidity, transparency in price and return potential since p-value is significant at 5%

($p<0.05$).

Table 8.10

Investor Perception and Investor Satisfaction towards Gold Futures

Dimensions	H value	df	p-value*	Inference
Affordability	63.591	27	.000	Significant
Transaction ease	70.487	27	.000	Significant
Manageable risk	53.722	27	.002	Significant
Liquidity	67.204	27	.000	Significant
Transparency in price	76.862	27	.000	Significant
Return Potential	78.373	27	.000	Significant

**significance at 5% level*

This imply that a change effected in perception of investors towards the instrument will have a resultant significant effect on the satisfaction level towards the instrument.

8.3.4 Investor Determinants and Investor satisfaction

Satisfaction of investor is a psychological feeling of fulfilment of perceived expectations. An attempt is made to identify the impact of factors determining investment in gold futures on investor satisfaction. Regression analysis is applied to work out a model of the impact of determining factors on investor satisfaction. The model statistics are given in Table 8.11.

Table 8.11 depicts that all three investment determinants are significant at the 1% significant level with a positive co-efficient. Hence, it is implied that investment determinants possess a positive influence over investment satisfaction and a change in independent variable will be followed by similar change in dependent variable. Further, all three investment determinant factors have a positive and significant effect upon investor satisfaction towards gold futures.

Table 8.11

Determinants of investment in Gold Futures v/s Investor Satisfaction towards Gold Futures

Variable	Co-efficient	Standard error	t-statistic	Prob.
Intercept	16.272	0.336	48.397**	0.000
Investment format	2.157	0.337	6.393**	0.000
Portfolio image	0.384	0.337	1.137**	0.007
Trading benefits	1.429	0.337	4.235**	0.000
F-statistic	20.035**			
Prob (F-statistic)	0.000			
R-squared	0.6962			
Adjusted R-squared	0.6899			

Source: Primary Data

*** Statistically significant at 1% significant level*

The overall significance of the estimated model given by the F statistic is 20.037 which stands statistically significant at 1% level of significance. It means that all of the independent variables taken together are significant in explaining the dependent variable. R-squared of the model is 0.6962, which means that all the independent variables (investment format, portfolio image and trading benefits) taken together explain 69.62% of the total variation of the investment satisfaction towards gold futures. The adjusted R-squared of the model is 68.99%.

The sixth major hypothesis of the research hence proved.

8.4 Conclusion

The present chapter identifies the major determinants which drive the investment decisions of the investors and the investment behaviour being indulged in.

Of various determinant variables of investment in gold futures, liquidity, portfolio diversification and low-cost intraday trading have been found prominent. The

principal component analysis with kaiser normalisation gives three factors- – investment format, portfolio image and trading benefits. While analysing the influence of determinant factors of investment on the attitude of investors, it has been found that all three investment determinants are significant at the 1% significant level with a positive co-efficient. A positive coefficient means that the corresponding factor has a positive influence on investor attitude. The better the factors are, the positive the attitude of investors will be.

The satisfaction of the investors with gold futures as a whole can be observed as neutral. Of all the parameters of satisfaction, price transparency stands upfront.

In gender-wise analysis, there exists no significant difference between investment satisfaction of males and that of female counterparts. In age-wise analysis, it can be found that the varying age category possesses no significant impact on their respective satisfaction level to the investment in gold futures.

With educational level, a significant difference can be observed between investment satisfaction and the respective academic qualifications of the investors. A detailed posthoc analysis unveils that investors having postgraduate qualification differ significantly in terms of their investment satisfaction from investors having other qualification- diploma or professional courses. Technically or professionally qualified investors outperform postgraduate investors significantly.

Analysing the marital status of investors, the results show that there is no significant difference among marital status of investors with regard to satisfaction from investment in gold futures. Similar gives the occupation-wise analysis of investor satisfaction. Occupation is hence inferred to exert no influence of its own on satisfaction level of investors in gold futures. Also, there exists no significant association between average monthly income and investor satisfaction towards gold futures. Therefore, the satisfaction of an investor is not influenced by his income.

However, the number of earning members in the household of investors has been found to have significant influence over their investment satisfaction. All the pairs except one earning adult v/s two earning adults in the investor household differ significantly in terms of investment satisfaction towards gold futures. The crux of the post-hoc analysis implies that satisfaction increases with the increasing number

of earning adults in the household.

The effort to track the parameters of satisfaction on which attitude of investors towards gold futures possesses significant impact on gives that the attitude of investors towards gold futures have significant impact on satisfaction of investors with regard to dimensions like affordability, transaction ease, transparency in price and return potential. With changing attitude hence, the satisfaction of investors also tends to change with regard to investment in gold futures.

How do investors' perceptions have an influence on their satisfaction from investment in gold futures? The post investment perception of investors towards gold futures has a significant impact on satisfaction of investors with regard to all parameters of satisfaction.

While analysing the influence of determinant factors of investment in gold futures on respective investor satisfaction, the results show that investment format, portfolio image and trading benefits possess a significant positive influence on the satisfaction of the investor from gold futures.

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Chapter 9

FINDINGS AND CONCLUSION

Contents

9.1 Introduction

The present study is intended to investigate the relationship between the gold prices and stock market returns in India, analyze the trend and performance of gold prices in India, analyze the efficiency of gold futures in price discovery of gold in India, study the perception and attitude towards gold futures and analyze the determinants of investment in gold futures among investors in Kerala. The major findings and conclusion of the study are presented in the chapter.

9.2 Findings of the study

The major findings of the study are discussed in this section.

8.1.1 Relationship between the gold prices and stock market returns in India.

- Johansen cointegration test results indicate that a long run relationship exists between Sensex and gold prices in India. Normalized cointegrating coefficient shows the speed of correction to equilibrium was found significant, though low, between Sensex and gold prices as per VEC model results. The relationship has been inferred positive in the long run.
- Impulse response function run between gold prices and Sensex shows that gold prices give a slightly positive response to shocks in Sensex and Sensex reacts very much positively to shocks in gold prices.

- Variance decomposition analysis unleashes that variance in gold is explained by itself leaving only a negligible fraction for sensex returns to explain over a period of time. However, variance in Sensex seems to be explained by gold prices at increasing trend over a period of time.

- Granger causality test results confirm a unilateral causality flowing from Sensex to gold with significant chi-square value. Toda-Yamamoto causality test has been run to validate the results obtained through traditional Granger causality test which may not be free from specification bias in a two-variable model.

- Nifty also has been found positively influencing gold over a long run according to Johansen cointegration results. VECM results show that the error correction term is statistically significant indicating long run causality though the rate of speed of restoration of equilibrium seems low.

- Impulse response function and variance decomposition results have been observed indifferent to those between Sensex and gold prices.

- Toda-Yamamoto causality test confirms the results of Engle-Granger causality test that Nifty granger causes gold prices with a significant chi-square value and the causality from gold to Nifty is insignificant.

Contrary to existing literature, the relationship between gold prices and stock market returns has been found positive. The gold prices have been found attributable to shocks in stock market returns to an extent. In the short run, stock market return influences gold prices though the influence of gold over stock market returns does not seem significant. This further indicated that the safe haven property of gold is limited to the short run and the yellow metal is consistent to stock market returns in terms of performance in the long run.

8.1.2 Trend & Performance analysis of gold prices in India

- The overall trend of spot gold prices has been upward since the introduction of gold futures in 2003. Analyzing the trend of gold prices since last 20 years, it is evident that significant fall in prices has occurred only during 2013-15. Even at

times of economic turbulence, gold prices have been observed either moving upward or a negligible downward trend.

- The forecast of gold prices for two years- 2024 and 2025 using ARIMA method expects a linear growth of gold prices in India. The gold price per troy ounce is expected to cross Rs.2,00,000/- by the year 2025.

8.1.3 Efficiency of gold futures in price discovery of gold in India.

- The results of the Johansen cointegration test indicate the long run association between spot prices and futures prices of gold. Cointegrating vector has been found statistically significant with positive relationship between both markets with spot market imbibing strong influence on futures market. ECT indicates moderate speed of restoration of equilibrium.

- It is observed from results of impulse response function that reaction of spot prices is more volatile than that of futures prices. Futures prices react positively to the shock in spot prices. Spot prices will ingest the effect of shock of futures price after an immediate surge.

- Variance decomposition analysis shows variance of futures prices are largely explained by futures price itself whereas variance in spot price is largely attributable to futures price over a period.

- Causality test validates that there is unidirectional causality from futures market to spot market and not the other way around. This means that the futures market of gold dominates the lead-lag relationship of prices.

The findings imply the efficiency of futures market of gold in which futures price leads and spot price follows and ingests the trend of futures prices. Hence, the role of futures in price discovery of gold plays a key factor in spot market price movements. The relationship between futures price and spot price is very positive i.e., when futures price increases, spot price increases and vice versa.

8.1.4 Descriptive statistics of the investors

- The descriptive statistics of the sample investors indicate that out of 150 sample investors, 119 investors (79.3%) are males and only 31 investors (20.7%) are females. Kerala is the state with highest sex ratio of 1084 in all Indian states. Even though females outnumber males in Kerala, female participation in gold futures market investments appears to be very low.

- The age wise distribution of sample investors shows that 12 (8%) of the investors belong to the age group '20-30 years', 38 (25.3%) belong to '30 – 40 years' category, 36 (24%) belong to '40-50 years' category and 50 (33.3%) belong to '50-60 years' category. Only 14 investors (9.3%) belong to 'above 60 years' age category. Subsequently, it can be inferred that most of the investors involved in the gold futures investment in Kerala are middle aged people.

- The study revealed that 65 (43.3%) of the sample investors are graduates, 70 (46.7%) are postgraduates and 10 (6.7%) are technically or professionally qualified. Only 5 (3.3%) of the sample investors were intermediate qualified. This shows that the majority of the sample investors are academically well qualified.

- The study implies that 107 (71.3%) of the sample investors are married and 19 (12.7%) of sample investors are unmarried. The remaining 16% of sample investors were widowed.

- It can be observed from the study that 47 (31.3%) of the respondents are employed on a salaried basis, 68 (45.3%) are self-employed, and 35 (23.3%) are retired from their respective regular occupations. Therefore, self-employed investors tend to invest more in gold futures.

- It can be inferred that 58 (38.7%) of sample investors earn an average monthly income between Rs. 50000 and Rs.100000 and equal number of investors earn between Rs.100000 and Rs. 150000 per month on average. Out of 150 sample investors, only 7 (4.7%) sample investors earn below Rs.50000 per month whereas 27 (18%) sample investors earn more than Rs.150000 per month on average. This indicates that the majority of investors have a cushion of reasonable income from

their respective occupations.

- The number of earning members in a household has been classified into four- one, two, three and more than three. It has been found that 41 (27.3%) of the sample investors have only themselves as earning member in the family, 71 (47.3%) of the sample investors have two earning members and 31 (20.7%) of the sample investors have three earning members and 7 (4.7%) of the sample investors have four or more earning members in their respective households.

8.1.5 Perception and Attitude of investors towards gold futures

Together with various macroeconomic factors, investor psychology plays a crucial role in determining the placing of an investment avenue in the market. It is inevitable to analyse the perception and attitude of the investors so that the commodity market can be understood, and future trends can be forecasted.

- The perception of investors towards gold futures before investment in it can be observed as slightly positive with a mean value of 38.47 and a standard deviation of 9.25. Promising returns has the highest mean value of 4.36 and applicability of margin has the lowest mean value of 2.41 with regard to pre-investment perception.

- The overall perception of investors post investment has been observed slightly positive with a mean value of 39.65 and standard deviation of 7.97. Short selling has the highest mean value of 4.53 and promising return has the lowest mean value of 2.17 with regard to post- investment perception.

- It has been found that pre-investment perception and post investment differ significantly as per the results of paired t-test. Accumulation of gold, elimination of issues theft and lack of storage, transparent prices, portfolio diversification, applicability of margins, short selling, track of market indices, promising returns and hedge against currency fluctuations differ significantly pre investment and post investment for which t-values significant at 5% level.

- The attitude of the investors is prima-facie positive attitude towards gold futures with a mean value of 49.86 and standard deviation of 7.165. Strict adherence to SEBI guidelines has the maximum mean score 4.27 with standard deviation of

0.882 and risk has next highest mean score of 4.25 with a standard deviation of 1.118. Marketing strategy has a minimum mean score of 2.28 with standard deviation of 1.075.

- The sample investors have been classified on the basis of nature of attitude towards gold futures- 48.7% of investors have been found neutral in attitude, 26% of investors have been found negative in attitude and the rest of 25.3% are positive in attitude towards gold futures.

- The chi-square test of independence gives a value of 11.767 with p-value of 0.003 which is a clear indication of strong association between the gender of investors and their attitude towards gold futures. In post hoc residual analysis, it has been found that actual males who represent neutral attitude is significantly higher than expected with a residual of 3.62 and their female counterparts underrepresent neutral attitude with a corresponding residual (-3.62). Female investors were found overrepresenting positive attitude with a residual of 4.64 which resulted in underrepresentation of males with positive attitude correspondingly.

- The strong association between the age of investors and their attitude towards gold futures have been validated by the chi-square test results at 5% level of significance. The young investors within 20-30 years age category are found overrepresenting attitude of all nature – negative, neutral and positive by residual of 5.13, 2.74, and 3.50 respectively. The investors belonging to 40-50 years age category overrepresent positive attitude with a residual of 3.38 underrepresenting negative and neutral attitudes with residuals -2.39 and -2.04 respectively.

- Since the association between the educational qualification of investors and their attitude towards gold futures has been found statistically significant at 5% level with chi-square test results, a post hoc residual analysis is run to yield the results that graduate investors largely overrepresent neutral attitude with a residual of 15.12 and underrepresent positive attitude with a residual of -15.74 whereas post graduate investors overrepresent positive attitude with a residual of 13.91 underrepresenting neutral attitude with a residual of -12.57.

- The occupation category of investor is inferred to have a strong association

with their attitude towards gold futures since p-value is less than 0.05 as per the chi-square test results. Residual analysis indicates that both self-employed and retired investors upheld positive attitude beyond expected proportion with residual of 4.67 against both. It can be seen that the salaried investors largely underrepresented a positive attitude with a residual of -9.33.

- With average income, the attitude of investors has validated an inevitable influence with statistically significant chi-square statistic. Residual analysis puts forth that the investors earning Rs. 12-18 lakhs per year exerts a strong negative attitude towards gold futures underrepresenting neutral and positive attitudes. The neutral attitude is highly overrepresented by the investors who earn Rs. 50000-100000 per month on average.

- Both marital status of the investor and the number of earning adults in the household of investor have been found failed to establish any association with the attitude of investors towards gold futures.

8.1.6 Determinants of investment and investor satisfaction

- The most prominent investment determinant opined by investors is 'extremely liquid' with the highest mean value of 4.27 and the lowest standard deviation of 0.882. The second highest mean score of 4.24 has been secured by the variable 'portfolio diversification' with a standard deviation of 1.028. The variable 'electronic form' has recorded lowest mean value of 2.29 with a standard deviation of 1.083.

- While analysing the impact of investment determinants of gold futures on attitude of investors, all three investment determinants are significant at the 1% significant level with a positive co-efficient – investment format (2.261), portfolio image (1.419) and trading benefits (0.472). All these factors are found statistically significant to the model with significant F-value.

The satisfaction of the investor is crucial in building an investor base. The satisfaction of investor found depending on certain parameters- affordability,

transaction ease, manageable risk, liquidity, transparency in price and return potential.

- The mean score of overall investment satisfaction is 16.40 which means investors' satisfaction towards gold futures is almost neutral with 55%. Transparency in price has secured the highest mean score of 3.63 (SD 1.138) which indicates that approximately 72% or more investors are satisfied with transparency of price in gold futures investment. The management risk aspect has the lowest mean score of 1.73 (SD 1.105).

- The Mann-Whitney U test result indicates that the satisfaction of investors has no significant association with their gender as p-value is greater than 0.05.

- With age-wise analysis, the result of Kruskal-Wallis H test implies that the association between investor satisfaction towards gold futures and their age is statistically insignificant.

- The educational qualification of the investor shares a strong association with the investor satisfaction with significant H-value at 5% level of significance. Dunn-Bonferroni post hoc pairwise comparison indicates that post graduate investors differ significantly in terms of their investment satisfaction from investors having other qualification- diploma or professional courses since adjusted p-value of the pair is less than 0.05. All other pairs were having insignificant difference in between.

- The respective association demographic variables like marital status, occupation category and average monthly income share with the satisfaction of investors towards gold futures has been found statistically insignificant.

- There exists a significant association between investor satisfaction towards gold futures and the number of earning adults in household of investors. Dunn-Bonferroni post hoc test has been employed to do pairwise comparison and to yield the result that all the pairwise comparison except comparison between one earning adult and two earning adults as statistically significant. On a general note, it can be inferred that satisfaction from investment in gold futures increases with increasing number of earning adults in the household to investors.

- The effort to identify the satisfaction variables on which attitude of investors towards gold futures have significant impact on yielded the result that satisfaction with regard to affordability, transaction ease, transparency in price and return potential changes with investor attitude since p-value is significant at 5% ($p<0.05$). However, attitude of investors does not have any impact on satisfaction with regard to of risk manageability and liquidity of gold futures being statistically insignificant.

- It is evident that the post investment perception of investors towards gold futures have significant impact on overall satisfaction of investors at 5% level of statistical significance. The overall satisfaction means all parameters individually and hence jointly.

- While analyzing the influence of investment determinants of gold futures on investor satisfaction, the results show that the coefficients of investment format, portfolio image and trading benefits are significant at a 5% significance level, and the coefficients are positive. This indicates that the determinants have a positive relationship with the satisfaction investors derive from their investment in gold futures.

9.3 Conclusion

Gold is an investment avenue which has a significant influence over the market with its price volatility and sensitivity to various market indicators and gold futures are no exception. The study has probed into the community view and perceptual view of the futures market of gold. The analysis of relationship of stock market returns with gold spot in India indicates that the former represented by- Sensex and Nifty- are positively related to gold spot market in long term. In the long run, gold prices seem to be the product of itself whereas it plays a not-so-negligible role in explaining the stock market. The causality direction has been proven unilateral from stock market to gold prices which implies that the stock market shocks are absorbed by gold prices though it fails to work other way around which further explains why the yellow metal qualifies to be a safe haven asset in a short run.

Gold prices have been found to have a predominant bullish trend in its movements. The price of gold is forecasted to have a strong and linear growth at a uniform rate in India in upcoming years. This indicates the growth in return on gold investments in the future due to the expected rise in the price of underlying.

The predominant function of a futures market is to reach efficient prices to be followed by the gold futures market. The futures market of gold has been affecting the spot prices of gold in the long term. The spot market could be seen as a product of futures market movements over a period of time and the former reacts to the shocks in futures in a volatile manner. The unilateral causality to spot prices itself implies the domination of gold futures market in the price discovery. Hence, the significance of gold futures market in forming efficient price trend drives the significance of its very existence.

Though the perception of investors in Kerala towards gold futures seems to differ pre and post investment, the overall perception seems to be free of extremes. The attitude of investors in Kerala towards gold futures tends to remain neither too positive nor too negative. Structured market adhering to SEBI guidelines, amount of risk involved and less volatile prices in global markets tend to affect investor attitude more.

Investment determinants have a significant role in shaping investor attitude towards gold futures. The relationship between determinants of investment taken into consideration by investors in Kerala leads to the belief the investor may upkeep towards the investment in gold futures and ultimately market is not free from investor irrationality.

Investment, if one time, would not serve its purpose and the satisfaction derived out of it is the motivating factor for repeated investment. The investors in Kerala have recorded a satisfaction of 55% in their investment in gold futures. The satisfaction of investors in Kerala while partially consonant with investor attitude has proven fully consonant with post investment perception. This makes it clear that investor

satisfaction, apart from investment determinants, plays a role in forming perception and shaping attitude of investors in Kerala towards gold futures.

Investor attitude is hence a product of multiple dimensions of gold futures market and its characteristics as well as how the same is perceived by investors.

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Chapter 10

RECOMMENDATIONS

Contents

10.1 Introduction

Gold futures is not only an appropriate hedger but also an excellent portfolio diversifier which acts a savior in times of turbulence in the financial system. However, it is yet to penetrate into the investment market in a way it is expected to. The present study discusses the relationship between stock market and gold prices in India, efficiency of gold futures in price discovery, perception and attitude of investors towards gold futures and the identification of determinants of investment for investors in gold futures. The recommendations, implications of the study and scope for further research are discussed in the present chapter.

10.2 Recommendations of the study

Based on the findings of the study, the researcher put forward the followingrecommendations on the basis of investment perception & attitude among investors in Kerala.

10.2.1 To the Investors

The findings of the study would be useful for the investors as it examines the relationship between stock market and gold prices and efficiency of gold futures in price discovery thereby facilitating them to adjust their portfolio of gold futures analysing the movement of stock market and spot gold prices.

Based on the findings, the researcher proposes the following recommendations to

the investors:

1. There exists co-integration between stock market and gold prices in India and causality runs from stock market to gold prices indicating that movements in stock market causes similar variation in gold prices. Hence, the investors could employ gold futures in the portfolio as they will yield increased returns with increasing stock market returns thereby diversifying the portfolio. Further, they could predict the movements in gold market analyzing the stock market movements.

2. Compared to spot market prices of gold, futures prices are less volatile and hence investing in gold futures decreases the risk of investment compared to much popular investment of physical gold. Further, the movements in futures prices will help to forecast spot prices thereby ensuring better returns.

3. Investors are advised to clearly understand the concept of the futures instrument before investing in it and strengthening their awareness is expected to increase their returns and the safety of the portfolio.

4. Investors are suggested to consult financial advisors before making an investment to make better investment decisions.

10.2.2 To the Brokers/ Commodity exchanges

1. Investors in Kerala are highly prone to various psychological factors behind their irrational investment decisions. The futures broker firms should try to educate individuals by conducting more awareness programmes which would lead to popularization of gold futures.

2. The present study suggests that perception as well as attitude vary among investors based on investors' gender, age, education, occupation, marital status, income etc. Hence, it is imperative for the exchanges to assess the needs of investors and include market customization to formulation of instrument.

3. Commodity exchanges should increase the credibility of gold futures so as to boost its penetration as an investment avenue and develop a sense of trust among investors.

4. Future brokers shall be given proper training as they are the main source of influence for the people. By gaining proper knowledge, one could exploit the hedging as well as profitability aspect of gold futures.

10.3 Research Implications

Gold can be an excellent avenue of investment wherein the price trend may be much predictable since stock and gold follows a causal effect with the stock market in long run. Gold futures is comparatively less popular still par effective investment tool. Gold futures could be an amazing diversifier of any portfolio opening up hedging opportunity with its price efficiency function. Despite its tremendous role in determining price of gold in spot market, the appropriate penetration of the instrument seems lacking in individual portfolios though the case may be different with institutional portfolios.

The majority of investors in Kerala maintain either an indifferent or negative attitude towards gold futures. This fact sits contradictory with hedging as well as speculating advantages of gold futures due to various characteristics of the investment instrument. It is not out of the context to state that the satisfaction of the investors depends upon how the investor perceives the instruments and believes its role in his portfolio to be. Hence, the investor base needs to be enhanced by attracting more probable investors along with providing adequate awareness about the instrument and popularizing its benefits. The market has to be made more approachable, affordable, and customized catering to various socio-demographic strata of investors.

The reach of gold futures among individual investors is meagre, which again points towards the dominance of institutional investors in the base. This has to be prevented henceforth to avoid the abuse of dominant position. The benefit of including these in portfolio for hedging, price discovery and such will thus be spread among mass population strengthening the investment of the economy. A further step to popularize the presence of gold futures in the portfolio is expected to minimize the risk and maximize the returns on every pie of money invested by the prospective portfolio managers.

10.4 Scope for Further Research

The results and limitations of the present study observed several worthy topics. These topics would foster further research, expanding the findings of the present study.

1. The future research could be extended to incorporate more types of gold derivative instruments as the present study has confined its scope to futures only.

2. The researcher further recommends that studies could be conducted to analyse the effect of various macro-economic variables such as exchange rate, gold price, crude oil price, money supply, interest rate and foreign exchange reserves on the gold prices. Further, it is also recommended to undertake a comparative analysis among various metal markets.

3. An awareness perspective is recommended which may unveil different dimension to the existing literature.

4. Empirical analysis on the investment performance has not been done in the present research; hence, this area remains to be further investigated.

5. Only selected variables have been considered in the study. Inclusion of different variables or a greater number of variables may lead to deeper insights.

6. Satisfaction perspective of gold futures as an investment avenue may be analyzed in detail with investment performance of gold futures.

7. The present study is confined to the state of Kerala and further studies can be extended to the whole of India with a wider perspective.

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Appendix A

An Analysis of Perception & Attitude of investors towards and Investment determinants of Gold Futures

STRUCTURED SCHEDULE

I. PROFILE OF RESPONDENT

1. Age (in years):

2. Sex:

a) Male b) Female

3. Educational Qualification:

a) Postgraduate b) Graduate c) Intermediate

d) Diploma/Professional courses

4. Marital Status:

a) Unmarried b) Married c) Widow/ Widower

5. Employment Category:

a) Salaried b) Self-employed c) Retired

6. Average Income per month (in rupees):

a) Up to 50000 b) 50000-100000

b) 100000-150000 d) Above 150000

7. Number of earning adults in household:

a) One b) Two c) Three d) More than three

II. **PERCEPTION OF MARKET PARTICIPANTS**

(Mark level of agreement before and after investing in Gold Futures)

(HA- Highly agree, A- Agree, N- neutral, DA- Disagree, HD- Highly Disagree)

Sl. No.	Statement	BEFORE INVESTING					AFTER INVESTING				
		HA	A	N	DA	HD	HA	A	N	DA	HD
1.	Gold futures help to accumulate gold over a period of time.										
2.	Gold futures eliminate issues like theft and lack of storage space.										
3.	Gold futures can be traded at transparent prices.										
4.	Gold futures are exempt from wealth tax, VAT, sales tax etc.										
5.	Gold futures diversify the investment portfolio.										
6.	Gold futures can be traded at different exchange floors.										
7.	Margin is applicable to gold futures trading.										
8.	Gold futures can be sold at short.										
9.	Gold futures track market indices.										
10.	Gold futures have promising returns.										
11.	It hedges against currency fluctuations.										
12.	Gold futures are tradable at any brokerage firm.										

III. **ATTITUDE OF MARKET PARTICIPANTS**

(Mark level of influence against the attitude factors towards gold futures)

(HI- highly influential, I- influential, N-Neutral, LI- less influential, NI- not influential)

Sl. No.	Factors	HI	I	N	LI	NI
1.	**Past satisfactory performance of gold instruments.**					
2.	**Comparatively less-volatile prices at international arena.**					
3.	**Image of gold.**					
4.	**Performance during volatility.**					
5.	**Services from Brokers.**					
6.	**Marketing Strategy.**					

7.	**Transparency.**					
8.	**Strict adherence to SEBI guidelines.**					
9.	**Strong possibility for capital appreciation.**					
10.	**Returns**					
11.	**Administrative expenses**					
12.	**Risk**					
13.	**Liquidity**					
14.	**Guarantee**					

IV. INVESTMENT DETERMINANTS:

(Mark level of influence against the factors influencing investment towards gold futures) (HI- highly influential, I- influential, N-Neutral, LI- less influential, NI- not influential)

Sl. No	Factors	HA	A	N	D	HD
1.	**There is no worry on adulteration.**					
2.	**Gold provides diversification in the portfolio.**					
3.	**Gold is considered as Global Asset Class.**					
4.	**Gold is used as hedge against inflation.**					
5.	**It is considered to be less volatile with equities.**					
6.	**It helps to keep in paperless form.**					
7.	**It is safety method of storing the gold.**					
8.	**Extremely liquid investment.**					
9.	**The portfolio disclosure is on daily/real time.**					
10.	**The intraday trading is done at possible low cost.**					
11.	**The spot at expiration matches the expected return.**					

V. LEVEL OF SATISFACTION

(Mark level of satisfaction towards gold futures) (HS- highly satisfied, S- satisfied, N-Neutral, DS- dissatisfied, HDS- highly dissatisfied)

Sl. No.	Factors	HS	S	N	DS	HDS
1	Affordability					
2	Ease of transaction					
3	Manageable Risk					
4	Liquidity					
5	Transparency in price					
6	Return Potential					

XXXXXXX

Appendix B

DATA USED FOR GROWTH TREND OF GOLD PRICES

Year	Growth
2003	12.34356
2004	9.670749
2005	5.79574
2006	39.55185
2007	4.801797
2008	31.62847
2009	24.47969
2010	19.07902
2011	31.25484
2012	21.21863
2013	-7.65339
2014	-6.09401
2015	-3.77673
2016	13.04463
2017	-2.56322
2018	5.860388
2019	13.20542
2020	33.75342
2021	1.358933
2022	6.242309

Source: Yearly average gold prices per troy ounce in INR published by World Gold Council

Appendix C

TOOLS USED IN TIME SERIES DATA ANALYSIS

A. Augmented Dickey Fuller Test

A stationary time series is one whose statistical properties such as mean, variance, autocorrelation, etc. are all constant over time. Such statistics are useful as descriptors of future behaviour only if the series is stationary. In statistics, a unit root test tests whether a time series variable is non-stationary and possesses a unit root. In this study, ADF tests have been conducted to examine the stationarity properties of the variables. Before understanding ADF Test, one must know the basics of a Dickey Fuller test. Dickey and Fuller (1979) consider three different regression equations that can be used to test the presence of a unit root:

$$\Delta Y_t = \gamma Y_{t-1} + \varepsilon t \quad \text{(C.1)}$$

$$\Delta Y_t = \alpha 0 + \gamma Y_{t-1} + \varepsilon t \quad \text{(C.2)}$$

$$\Delta Y_t = \alpha 0 + \gamma Y_{t-1} + \alpha 2t + \varepsilon t \quad \text{(C.3)}$$

In the above equations, the difference between the three regressions concerns the presence of the deterministic elements a0, a2t. While the first equation represents a pure random walk model, the second equation adds an intercept or drift term intothe model and the third equation includes both an intercept and linear time trend. The test is used to identify the value of γ. If γ = 0, it implies that the Yt sequence contains a unit root. The test estimates the value of γ and associated standard errorof the equations using OLS method. By analysing the value of t-statistic along with the probability value helps to determine whether to accept or reject the null hypothesis of γ = 0. Dickey Fuller test assumes that the error term εt is uncorrelated. In case when no such assumption regarding εt is taken into consideration, Dickey and Fuller have developed another unit root test which is known as the ADF test. In this test, the lagged difference terms of the variable are included in the model to make the error term serially independent. This test is conducted by 'augmenting' the preceding three equations such as Equation (C.1,

A. and C.3) by adding the lagged values of the independent variable ΔYt. The ADF test can handle more complex models than the Dickey-Fuller test, and it is also more powerful. The ADF test may be specified as follows:

$$\Delta Yt = \alpha 0 + \alpha It + \gamma Yt-1 + X\, k\, i=1\, \beta i Yt-i + \varepsilon t \qquad \text{(C.4)}$$

Where εt represents a pure white noise error term Δ represents the difference operator γ and β represents the parameters.

ADF test follows the same asymptotic distribution as the DF statistics, i.e whetherγ = 0 so the same critical values can be used. It is important to note that the selection of statistic depends on the deterministic components included in the regression equation. When there is no intercept and trend, τ statistic is used; with only the intercept, τ statistic is used and with both intercept and trend, ττ statistic is used. The statistics labelled τ, τ and ττ are the appropriate statistics to be used in Equations (C.1, C.2 and C.3) respectively. For ADF test, the value of K is determined based on either AIC or SIC.

B. Vector Auto Regression (VAR)

VAR method is widely used in the estimation of appropriate lag length of each variable in the system. It is possible to use different lag length for each variable in the equation. Such type of VAR is called as NEAR VAR and can be estimated through Seemingly Unrelated Regression. But for the sake of simplicity the same lag length is used for all equations. Various lag selection criteria are used to select the optimum lag length of the model. These are Likelihood Ratio, Final Prediction Error, Akaike Information Criteria, Schwarz Information Criteria and Hannan- Quinn information criteria. After setting lag length, the next step is to estimate the model through OLS. However, it is difficult to interpret individual coefficients in estimated VAR models directly. To overcome this problem, advanced techniques like impulse response function and variance decomposition are made use of.

Suppose a multivariate VAR is given as follows:

$$Xt = A0 + A1Xt-1 + A1Xt-2 + \ldots\ldots\ldots + ApXt-p + et \qquad \text{(C.5)}$$

Where, Xt = the (n × 1) vector containing each of the n variables included in the VAR
A0 = an (n × 1) vector of intercept terms.
Ai = an (n × n) matrix of coefficient. et = an (n × 1) vector of error terms.
In the above example, matrix A0 contains n intercept term and each matrix Ai contains n2 coefficients, hence n + pn2 terms need to be estimated. Unquestionably, a VAR will be over parameterized by which many of these coefficient estimates can be properly excluded.

C. Johansen's Co-integration Test

Johansen Co-integration test, named after Søren Johansen, is a procedure for testing cointegration of several, say *k*, I(1) time series. This test permits more than one cointegrating relationship so is more generally applicable than the Engle– Granger test which is based on the Dickey–Fuller (or the augmented) test for unit roots in the residuals from a single (estimated) cointegrating relationship. There are two types of Johansen test, either with trace or with eigenvalue, and the inferences might be a little bit different. The null hypothesis for the trace test isthat the number of cointegration vectors is $r = r^* < k$, vs. the alternative that $r = k$. Testing proceeds sequentially for $r^* = 1,2$, etc. and the first non-rejection of the null is taken as an estimate of *r*. The null hypothesis for the "maximum eigenvalue" test is as for the trace test but the alternative is $r = r^* + 1$ and, again, testing proceeds sequentially for $r^* = 1, 2$ etc., with the first non-rejection used asan estimator for *r*.

The trace test and maximum eigen value test can be shown in equations

$J_{trance} = -T \sum^{N}$

$i=r+1 \ln (1- \lambda\hat{}i)$ (C.6)

$J_{tmax} = -T \ln (1- \lambda\hat{}r+1)$ (C.7)

Where T is the sample size

$\lambda\hat{}i$ is the i^{th} largest canonical correlation.

The trace test tests the null hypothesis of r cointegrating vectors against the alternative hypothesis of n cointegrating vectors. The maximum eigen value test, on the other hand, tests the null hypothesis of r cointegrating vectors against the alternative hypothesis of r +1 cointegrating vectors.

D. Vector Error Correction Model

If a set of variables are found to have one or more cointegrating vectors, then a suitable estimation technique that can be used to adjust both short run changes in variables and deviations from equilibrium a VECM. Granger (1969) argued that VECM is more appropriate to examine the causality between the series at I (1). VECM is the restricted form of unrestricted VAR and restriction is levied on the presence of the long run relationship between the series. The system of ECM makes use of all series endogenously. This system allows the predicted values to explain itself both by its own lags and lags of forcing variables as well as the lagsof the ECT and by residual term.

$$\begin{pmatrix} \Delta x_{1t} \\ \Delta y_{1t} \\ \Delta y_{2t} \\ \Delta y_{3t} \\ \dots \\ \Delta y_{nt} \end{pmatrix} = \begin{pmatrix} C_{1t} \\ C_{2t} \\ C_{3t} \\ C_{4t} \\ \dots \\ C_{nt} \end{pmatrix} + \sum_{i=1}^{p} \begin{bmatrix} \beta_{11i} & \beta_{12i} & \beta_{13i} & \beta_{14i} & \dots & \beta_{1ni} \\ \beta_{21i} & \beta_{22i} & \beta_{23i} & \beta_{24i} & \dots & \beta_{2ni} \\ \beta_{31i} & \beta_{32i} & \beta_{33i} & \beta_{34i} & \dots & \beta_{3ni} \\ \beta_{41i} & \beta_{42i} & \beta_{43i} & \beta_{44i} & \dots & \beta_{4ni} \\ \vdots & \vdots & \vdots & \vdots & \dots & \vdots \\ \beta_{n1i} & \beta_{n2i} & \beta_{n3i} & \beta_{n4i} & \dots & \beta_{nni} \end{bmatrix} \begin{pmatrix} \Delta x_{1_{t-i}} \\ \Delta y_{1_{t-i}} \\ \Delta y_{2_{t-i}} \\ \Delta y_{3_{t-i}} \\ \dots \\ \Delta y_{n_{t-i}} \end{pmatrix} + \begin{pmatrix} \gamma_{1t} \\ \gamma_{2t} \\ \gamma_{3t} \\ \gamma_{4t} \\ \dots \\ \gamma_{nt} \end{pmatrix} ECM_{t-1} + \begin{pmatrix} \varepsilon_{1t} \\ \varepsilon_{1t} \\ \varepsilon_{2t} \\ \varepsilon_{3t} \\ \dots \\ \varepsilon_{nt} \end{pmatrix} \quad \text{(C.8)}$$

Where C's, β's and γ's are the parameters to be estimated

ECM t−1 represents the one period lagged error-term derived from the co-integration vector ε's are serially independent with mean zero and finite covariance matrix

All variables in the model are treated as endogenous variables. F test is applied to examine the direction of causal relationship between the variables. The coefficients on the ECM represent how fast deviations from the long-run equilibrium become stable.

E. Granger Causality Test

Causality refers to the ability of one variable containing useful information to predict and therefore influence the value of another variable based on linear least squares (Diebold 2007). To explain the causality test, the Granger (1969) definition of the proof of causality is that if variable X_t can be predicted with greater accuracy by using past values of the variable Y_t when all other terms or factors remain unchanged, it simply says Y_t that causes X_t. Therefore, the variables Y_t and X_t can affect each other with distributed lags (past period). Causality test reveals which variable is exogenous and which variables are endogenous.

Engle and Granger (1987), find that a causal relationship exists in at least one direction if two individual variables are cointegrated. The VAR model can beconstructed in terms of time series at level form, (I(0)). It also can be constructed in terms of the first difference of the variable, (I(1)), with the addition of an ECT to capture the dynamic short-run response. However, if the data are not cointegrated (I(1)), the causality test can be derived from transforming the data into stationarity.

F. Variance Decomposition Analysis

Short run variations occurring in a variable are mostly due to its own shocks. However, there are chances of other variables to have an impact on the variable. Forecast Error Variance Decomposition (FEVD) helps to measure the impact of external variables on the selected variable. While Impulse Response Function (IMF) analyses the dynamic behaviour of the target variables due to unanticipated shocks within a VAR model, variance decomposition analysis determines the relative importance of each innovation on the variables in the system. Variance decompositions analysis can be considered as similar to R2 values associated with the dependent variables in different horizons of shocks. To calculate n-period forecast error Xt+n considering the vector moving average representation of VAR, the following equation is used.

$$X_t+n\text{-}EtX_{t+n} = \mu + \Sigma n{-}1\ \theta i{=}0\ i\varepsilon t+n{-}1 \qquad (C.9)$$

Considering Yt, the first element of the Xt+n matrix in Equation (C.9), the variance of the n-step-ahead forecast error can be calculated as:

$$Y_t + n\text{-}EtX_{t+n} = \theta^{11}(0)\varepsilon_{yt+n} + \theta_{11}(1)\ \varepsilon_{yt+n-1}+....+\ \theta11(n-1)\varepsilon_{yt+1}+\theta12(0)\varepsilon_{zt+n} +\theta12(1)\varepsilon_{zt+n-1} + ... + \theta12(n-1)\ \varepsilon zt+1 \qquad (C.10)$$

or

$$\sigma y(n)^2 = \sigma^2 y\ [\theta11(0)^2 + \theta11(1)^2 +....+\theta11(n-1)^2] + \sigma 2z\ [\theta12(0)^2 + \theta12(1)^2 + \ + \theta12(n-1)^2] \qquad (C.11)$$

Where $\sigma y(n)^2$ and $\sigma z(n)^2$ denote the n-step-ahead forecast error variance of Y_{t+n} and Z_{t+n}, respectively. While the first part of the Equation (C.10) shows the proportion of variance due to the variables own shock i.e., Y_t, the second part of the Equation (C.11) shows the proportion of variance due to the other variables shock i.e., Z_t.

Theoretically, the first part decreases over time and the second part of the variance increases. However, it is typical for a variable to explain almost all of its forecast error variance at a short horizon and smaller proportions at longer horizons. From this standpoint, variance decomposition analysis is useful to assess how one variable explains a considerable portion of forecast error variance of another variable. That is, when a shock εz explains none of the forecast error variance ofthe sequence Y_t at all forecast horizons, i.e., $\delta\sigma^2 y/\sigma^2 z \approx 0$, we may say that Y_t evolves indecently of the Z_t shocks i.e, εz. In addition to that, when a shock given to the Z_t sequence i.e.,εz explains the entire forecast error variance of the sequence Y_t at all forecast horizons, i.e., δσ2 y/σ2z≈ 100%, may say that Y_t sequence is totally endogenous.

G. Impulse Response Function

Impulse response function is the reaction of any dynamic system in response to some external change. It is a useful tool in determining the magnitude, direction, and the duration of the variables in the system which are affected by an external variable's shock. Its main purpose is to describe the evolution of a model's variables in reaction to a shock in one or more variables. For estimating impulse response function, VAR model is be transformed into Vector Moving Average (VMA) as it allows to identify the effects of various shocks on variables in the system. In a VAR model which includes two variables, the form of the impulse response function can be written as:

$$\begin{bmatrix} Y_t \\ Z_t \end{bmatrix} = \begin{bmatrix} \bar{Y} \\ \bar{Z} \end{bmatrix} + \sum_{i=0}^{\infty} \frac{A^i}{1 - b_{12}b_{21}} \begin{bmatrix} 1 & -b12 \\ -b_{21} & 1 \end{bmatrix} \begin{bmatrix} \varepsilon_{Y_{t-i}} \\ \varepsilon_{Z_{t-i}} \end{bmatrix} \begin{bmatrix} Y_{t-i} \\ \varepsilon_{Z_{t-i}} \end{bmatrix} \tag{C.12}$$

$$\begin{bmatrix} Y_t \\ Z_t \end{bmatrix} = \begin{bmatrix} \bar{Y} \\ \bar{Z} \end{bmatrix} + \sum_{i=0}^{\infty} \begin{bmatrix} \theta_{11}^i & \theta_{12}^i \\ \theta_{21}^i & \theta_{22}^i \end{bmatrix} \begin{bmatrix} \varepsilon_{Y_{t-i}} \\ \varepsilon_{Z_{t-i}} \end{bmatrix} \tag{C.13}$$

and

$$X_t = \mu + \sum_{i=0}^{\infty} \theta_i \varepsilon_{t-i} \tag{C.14}$$

Where θi is the impulse response function of disturbances.

Therefore, impulse response function is analysed by reading off the coefficients in the moving average representation of the process. If the innovations εtâĹŠi are

contemporaneously uncorrelated, interpretation of the impulse response will be straightforward. For example, the i^{th} innovation of εt is simply a shock to the i^{th} endogenous variable in the system. However, the residuals generated by the VAR models are usually contemporaneously correlated. This is because in a VAR model only lagged endogenous variables are admitted on the right-hand side of each equation (in addition to a constant term), and hence all the contemporaneous shocks which impact on X_t are forced to feed through the residuals u_{it}. While this may not cause a problem in the estimation of the VAR model, the impulse responses and variance decompositions derived from the initial estimates of the VAR model can be affected because any adjustment made in the order of the variables entered in the system could produce different results. Thus, there is a need to impose some restrictions when estimating the VAR model to identify the impulse response function. In this regard, a common approach is the Cholesky decomposition, which was originally applied by Sims in 1980. The Cholesky decomposition overcomes the problem of contemporaneous relationships among the innovations error terms within the estimated VAR model by identifying structural shocks so that the covariance matrix of the estimated residuals is lower triangular. In fact, the Cholesky decomposition suggests that there is no contemporaneous pass-through from Y_t to the other variable, z_t. More formally, in the VAR, the matrix error structure becomes left triangular. In practice, this means that the Cholesky decomposition attributes all the effect to the variable that comes first to the target variable in the VAR system.

H. Auto Regressive Integrated Moving Average (ARIMA)

An Autoregressive Integrated Moving Average (ARIMA) model is a generalization of an autoregressive moving average (ARMA) model. Both of these models are fitted to time series data either to better understand the data or to predict future points in the series (forecasting). ARIMA models are applied in some cases where data show evidence of non-stationarity, where an initial differencing step (corresponding to the "integrated" part of the model) can be applied one or more times to eliminate the non-stationarity. The AR part of ARIMA indicates that the evolving variable of interest is regressed on its own lagged (i.e., prior) values. The equation for the AR model is shown below:

$$Y_t = \beta_1 + \Phi_1 Y_{t-1} + \Phi_2 Y_{t-2} + \ldots + \Phi_p Y_{t-p} \qquad \text{(C.15)}$$

The respective weights (Φ1, Φ2 …Φp) of the corresponding lagged observations are decided by the correlation between that lagged observation and the current observation. If the correlation is more, the weight corresponding to that lagged observation is high (and vice-versa). This (p) is called the lag order. It represents the number of prior lag observations we include in the model i.e., the number of lags which have a significant correlation with the current observation. The MA part indicates that the regression error is actually a linear combination of error terms whose values occurred contemporaneously and at various times in the past.

$$Y_t = \beta_2 + \omega_1 \varepsilon_{t-1} + \omega_2 \varepsilon_{t-2} + \ldots + \omega_q \varepsilon_{t-q} + \varepsilon_t \quad \text{(C.16)}$$

The ε terms represent the errors observed at respective lags and the weights (ω1, ω2

…ωq) are calculated statistically depending on the correlations. (q) represents the size of the moving window i.e., the number of lag observation errors which have a significant impact on the current observation. It's similar to the lag order (p), but it considers errors instead of the observations themselves.

When we combine the AR and MA equations, we get

$$\begin{aligned} Y_t = {} & (\beta_1 + \beta_2) \\ & + (\Phi_1 Y_{t-1} + \ldots + \Phi_p Y_{t-p}) \\ & + (\omega_1 \varepsilon_{t-1} + \ldots + \omega_q \varepsilon_{t-q} + \varepsilon_t) \end{aligned} \quad \text{(C.17)}$$

The I (for "integrated") indicates that the data values have been replaced with the difference between their values and the previous values (and this differencing process may have been performed more than once). This is equivalent to performing a transformation of the form:

$$Z_t = Y_{t+1} - Y_t \quad \text{(C.18)}$$

So to revise, the final ARIMA model will take the following form, ARIMA (*p,d,q*).

Where *p* represents Auto Regressive (AR)

d represents order of differencing (I)

q represents moving average (MA)