HEDGING EFFECTIVENESS AND SAFE HAVEN PROPERTIES OF GOLD: AN EMPIRICAL EVIDENCE FROM GOLD CONSUMING, GOLD PRODUCING AND KEY CURRENCY COUNTRIES

A THESIS SUBMITTED IN PARTIAL FULFILLMENT FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY

IN

Commerce, Goa Business School

GOA UNIVERSITY



By

MRUNALI M. JAMBOTKAR

Goa University
Goa

February 2024

DECLARATION

I, Mrunali M. Jambotkar, hereby declare that this thesis represents work which has been carried out by me and that it has not been submitted, either in part or full, to any other University or Institution for the award of any research degree.

Place: Taleigao Plateau
Date:

Mrunali M. Jambotkar
Research Scholar
Goa Business School
Goa University

CERTIFICATE

I hereby certify that the above Declaration of the candidate, Mrunali M. Jambotkar is true and the work was carried out under my supervision.

Prof. (Dr.) Guntur Anjana Raju
Research Guide, Professor,
Goa Business School, Goa University,
Taleigao-Goa, 403 406

ACKNOWLEDGEMENT

Throughout the journey of my research, I am blessed with the intellectual contribution and timely guidance from several academicians and researchers as well as moral support from my beloved family and friends.

First and foremost, I am thankful to Almighty God for the countless blessings showered on me during my entire research journey. I offer my sincere gratitude to my Guide Prof. Dr. Guntur Anjana Raju, Goa Business School, Goa University. I gratefully acknowledge her support, patience, motivation, and inspiration during my PhD. I am grateful for all the meetings and discussions we have had together whilst building the research.

I am also deeply grateful to my DRC experts, Dr. Sriram Padyala and Dr. Harip Khanapuri, for their kind guidance and valuable suggestions. Their academic excellence inspired and motivated my research by providing invaluable support and encouragement over difficult moments.

My gratitude especially goes to Dr. Dhaval Mehta, Professor, Veer Narmad South Gujarat University, Surat and Dr. Prashant Sharma, Associate Professor, IIHMR University and Dr. Javed Iqbal, Professor at Institute of Business Administration, Karachi for their generous and valuable impact on my research. Their enthusiasm for research and academic life is both admirable and contagious. They inspired and intellectually stimulated me through their strong econometric and mathematical skills. They are great researchers and mentors and I am fortunate to have research affiliation with them.

I would like to extend my sincere gratitude to the Dean, Vice-Dean (Research), Vice-Dean (Academic), of Goa Business School, Goa University for providing a platform to carry out research. I am also expressing my sincere gratitude to Dr. Gopakumar V., Former Librarian and Mr. Nandkishor K. Bandekar, Assistant librarian at Goa University for all possible help during my research work. Thanks to the library staff of Goa University for extending me their help and support.

My sincere thanks to all of the non-teaching staff members of Goa Business School and the employees of Goa University's AR PG division for their kind assistance. The successful culmination of this study owes much to the co-operation of the staff of NICMAR Centre, Ponda-Goa. A deep debt of gratitude also goes to late Dr. Anil Kumar, Librarian IIM Ahmedabad, Gujarat and library staff for providing access to databases and other enriching resources relevant to the conduct of this research.

No words will ever be adequate to express my enduring indebtedness to my current Institution, Sant Sohirobanath Ambiye, Government College of Arts and Commerce, Pernem, Goa and also my former Institution, GVM'S Gopal Govind Poy Raiturcar College of Commerce and Economics, Ponda, Goa for providing me an opportunity and a conducive environment to carry out the research work. Thanks are due to my colleagues Dr. Meera Mayekar, Dr. Raina Pinto, Dr. Vinaya Gad, Ms. Sarvesha Dhaimodkar, Dr. Keshav Dhuri, Ms. Salony Bhangue and Ms. Harsha Naik for their support, encouragement, and motivation during this Journey.

During my PhD studies, I received fantastic support from my family and friends. Very special thanks to my parents Mr. Manohar Jambotkar and Mrs. Meghana Jambotkar. I will never be able to thank you enough for all you have done for me throughout my life. Without your limitless support, encouragement, patience and unconditional love, this Ph.D. would not have been possible. Last but not least, I am eternally obliged to my friend Dr. Suraj Velip, Assistant Professor and Program Director (MBA), Goa Business School, Goa University for understanding and supporting me and my dreams. Your unceasing support motivated me to succeed and grow. Finally, deep gratitude to my beloved Sister, Dr. Vidhya Jambotkar and my brother, Mr. Mandar Jambotkar, your patience and love have rescued me from peril more times than I can recall.

Mrunali Jambotkar

TABLE OF CONTENTS

Declaration i

Certificate i

Acknowledgement ii

Table of Contents iv

List of Tables ix

List of Figures xiii

List of Tables in Appendix xiv

List of Figures in Appendix xvi

List of Abbreviation xvii

Abstract of the Thesis xviii

1. OVERVIEW OF GOLD MARKET AND ITS ROLE AS A HEDGE AND SAFE HAVEN 1

1.1 Golden Thread through history and its role in a Monetary System 2

1.2 Background and Motivation of the Study 3

1.3 Distinguishing feature of Gold as a Financial Assets 5

1.4 Gold as a Diversifier, Hedge and Safe Haven against Stock, Equity Sectors and Exchange Rate. 6

1.5 Classification of Countries as per WGC 8

1.6 Review of the Gold Market 9

1.7 Chapter Plan of the Thesis 18

2. THEORETICAL BACKGROUND AND LITERATURE REVIEW 20

2.1 Theoretical Background 21

2.2 Literature Review 23

2.2.1 Hedging Effectiveness and Safe Haven Ability of Gold against Stock 23

2.2.2 Hedge and Safe Haven Potential of Gold against Equity Sector Indices of Major Gold Consuming, Major Gold Producing and Key Currency Countries 29

2.2.3 Gold as Hedge and Safe Haven for Currency Markets 32

2.3 Major Observation derived from Literature and Concluding Remarks 36

3. RESEARCH DESIGN AND METHODOLOGY 39

3.1 Statement of the Problem 40

3.2 Research Gap 41

3.3 Significance of the Study 42

3.4 Research Questions 44

3.5 Research Objectives 45

3.6 Research Hypothesis 45

3.7 Research Methodology 46

3.7.1 Hedge and Safe haven ability of Gold against aggregate Equity Indices of Major Gold Consuming, Major Gold Producing and Key Currency Countries 46

3.7.2 Hedge and Safe haven potential of Gold against Equity Sector Indices of Major Gold Consuming, Major Gold Producing and Key Currency Countries 48

3.7.3 Gold to act as a Hedge and Safe haven against Exchange rate fluctuations of Major Gold Consuming, Major Gold Producing and Key Currency Countries 50

3.8 Statistical and Econometrics Estimation Models.....52

4. HEDGE AND SAFE HAVEN ABILITY OF GOLD AGAINST STOCK MARKETS OF MAJOR GOLD CONSUMING, MAJOR GOLD PRODUCING AND KEY CURRENCY COUNTRIES.....59

4.1 Introduction.....60

4.2 Summary Statistics.....60

4.3 Correlation between Gold and Stocks.....61

4.4 Stationary Test Results.....64

4.5 Quantile Model and Gold as a Hedge and Safe Haven.....66

4.6 Gold as a Hedge and Safe Haven in times of Crisis 69

4.7 Residual Diagnosis Test.....71

4.8 Wavelet Coherence Analysis across Time and Investment Horizons.....71

5. HEDGE AND SAFE HAVEN POTENTIAL OF GOLD AGAINST EQUITY SECTOR INDICES OF MAJOR GOLD CONSUMING, MAJOR GOLD PRODUCING AND KEY CURRENCY COUNTRIES.....82

5.1 Introduction.....83

5.2 Summary Statistics.....83

5.3 Correlation Results.....95

5.3.1 Rolling Correlation Results....98

5.4 Stationarity Test Results....99

5.5 Quantile Model and Gold as a Hedge and Safe Haven....100

5.6 Gold as a Hedge and Safe Haven in times of Crisis....111

5.7 Residual Diagnosis Test....124

5.8 Wavelet Coherence analysis across time and investment horizons....125

6. GOLD TO ACT AS A HEDGE AND SAFE HAVEN AGAINST EXCHANGE RATE FLUCTUATIONS OF MAJOR GOLD CONSUMING, MAJOR GOLD PRODUCING AND KEY CURRENCY COUNTRIES....129

6.1 Introduction....130

6.2 Summary Statistics....131

6.3 Correlation Results....131

6.3.1 Rolling Correlation Estimates....133

6.4 Stationarity Test Results....135

6.5 Gold as a Hedge and Safe Haven against Exchange Rate....135

6.6 Gold as a hedge and safe haven against exchange rate in times of crises....138

6.7 Residual Diagnostic....140

7. FINDINGS, CONCLUSION AND SUGGESTIONS....141

7.1 Introduction....142

7.2 Summary of Findings....143

7.2.1 Hedge and Safe haven ability of Gold against aggregate Equity Indices of Major Gold Consuming, Major Gold Producing and Key Currency Countries 143

7.2.2 Hedge and Safe haven potential of Gold against Equity Sector Indices of Major Gold Consuming, Major Gold Producing and Key Currency Countries 145

7.2.3 Gold to act as a Hedge and Safe haven against Exchange rate fluctuations of Major Gold Consuming, Major Gold Producing and Key Currency Countries 148

7.3 Conclusion 150

7.4 Implications and Suggestions 152

7.5 Limitations of the Study.....153

7.6 Future Research Direction 154

BIBLIOGRAPHY 155

PUBLICATIONS 168

APPENDIX - I 169

LIST OF TABLES

Table 1.1 World Gold Council Classification....8

Table 1.2 Total Reserves (US$ Million)....10

Table 1.3 Gold Reserves and Holdings....11

Table 1.4 Gold Import Value Growth (IVG)....12

Table 1.5 Gold Export Value Growth (EVG)....13

Table 1.6 Gold Export and Import Value (%)....13

Table 1.7 Top Performer's Gold and Major Assets Return-Risk Trade Off....15

Table 1.8 Gold Demand and Supply Trend (2010-2020)....16

Table 1.9 Jewellery demand in selected countries (Tonnes)....17

Table 1.10 Total bar and coin demand in selected countries (Tonnes)....17

Table 3.1 Classification of Countries and their Stock Market Index....48

Table 3.2 Selection Criteria for Sample Countries and its Sector Indices....50

Table 3.3 Sample Countries and its Currency Codes....51

Table 4.1 Summary Statistics and Correlation of Gold Returns and Stock Returns....62

Table 4.2a Rolling Correlation estimates....64

Table 4.2b Rolling Correlation estimates....65

Table 4.3 Testing for Stationarity....66

Table 4.4a Estimation output for the Hedge and Safe Haven asset....68

Table 4.4b Residual Diagnostic Test 68

Table 4.5a Estimation output for the Hedge and Safe Haven asset in times of crisis 70

Table 4.5b Residual Diagnostic Test 70

Table 5.1.1 to 5.1.18 Summary Statistics and Correlation of Gold Returns and Sector Indices Returns of GCC, GPC and KCC.....84

Table 5.4.1a Hedge and Safe haven asset of India during Quantile 100

Table 5.4.2a Hedge and Safe haven asset of China during Quantile.....100

Table 5.4.3a Hedge and Safe haven asset of UAE during Quantile 101

Table 5.4.4a Hedge and Safe haven asset of Egypt during Quantile.....102

Table 5.4.5a Hedge and Safe haven asset of Indonesia during Quantile.....102

Table 5.4.6a Hedge and Safe haven asset of South Korea during Quantile 103

Table 5.4.7a Hedge and Safe haven asset of Turkey during Quantile.....103

Table 5.4.8a Hedge and Safe haven asset of Russia during Quantile.....104

Table 5.4.9a Hedge and Safe haven asset of Saudi Arabia during Quantile 105

Table 5.4.10a Hedge and Safe haven asset of Thailand during Quantile 105

Table 5.4.11a Hedge and Safe haven asset of Vietnam during Quantile.....106

Table 5.4.12a Hedge and Safe haven asset of USA during Quantile 106

Table 5.4.13a Hedge and Safe haven asset of Australia during Quantile.....107

Table 5.4.14a Hedge and Safe haven asset of Canada during Quantile 108

Table 5.4.15a Hedge and Safe haven asset of South Africa during Quantile.....108

Table 5.4.16a Hedge and Safe haven asset of Switzerland during Quantile 109

Table 5.4.17a Hedge and Safe haven asset of UK during Quantile.....110

Table 5.4.18a Hedge and Safe haven asset of Japan during Quantile 110

Table 5.5.1a Hedge and Safe Haven asset in times of crisis (India).....112

Table 5.5.2a Hedge and Safe Haven asset in times of crisis (China) 112

Table 5.5.3a Hedge and Safe Haven asset in times of crisis (UAE).....113

Table 5.5.4a Hedge and Safe Haven asset in times of crisis (Egypt) 114

Table 5.5.5a Hedge and Safe Haven asset in times of crisis (Indonesia) 114

Table 5.5.6a Hedge and Safe Haven asset in times of crisis (South Korea).....115

Table 5.5.7a Hedge and Safe Haven asset in times of crisis (Turkey) 116

Table 5.5.8a Hedge and Safe Haven asset in times of crisis (Russia) 116

Table 5.5.9a Hedge and Safe Haven asset in times of crisis (Saudi Arabia).....117

Table 5.5.10a Hedge and Safe Haven asset in times of crisis (Thailand).....118

Table 5.5.11a Hedge and Safe Haven asset in times of crisis (Vietnam) 119

Table 5.5.12a Hedge and Safe Haven asset in times of crisis (US).....119

Table 5.5.13a Hedge and Safe Haven asset in times of crisis (Australia) 120

Table 5.5.14a Hedge and Safe Haven asset in times of crisis (Canada).....121

Table 5.5.15a Hedge and Safe Haven asset in times of crisis (South Africa) 122

Table 5.5.16a Hedge and Safe Haven asset in times of crisis (Switzerland).....122

Table 5.5.17a Hedge and Safe Haven asset in times of crisis (UK) 123

Table 5.5.18a Hedge and Safe Haven asset in times of crisis (Japan).....124

Table 6.1 Summary Statistics and Correlation of Gold Returns and Exchange rate 132

Table 6.2a Rolling Correlation estimates.....133

Table 6.2b Rolling Correlation estimates 134

Table 6.3 Stationarity Test.....135

Table 6.4a Estimation of Hedge and Safe Haven asset under Quantile.....137

Table 6.4b Residual Diagnostic Test 137

Table 6.5a Estimation of Hedge and Safe Haven asset in Times of Crises 139

Table 6.5b Residual Diagnostic Test 139

LIST OF FIGURES

Figure 4.1 Wavelet Squared Coherence (India) 72

Figure 4.2 Wavelet Squared Coherence (China) 72

Figure 4.3 Wavelet Squared Coherence (UAE) 73

Figure 4.4 Wavelet Squared Coherence (Egypt) 73

Figure 4.5 Wavelet Squared Coherence (Indonesia) 73

Figure 4.6 Wavelet Squared Coherence (South Korea) 73

Figure 4.7 Wavelet Squared Coherence (Turkey) 74

Figure 4.8 Wavelet Squared Coherence (Russia) 74

Figure 4.9 Wavelet Squared Coherence (Saudi Arabia) 76

Figure 4.10 Wavelet Squared Coherence (Thailand) 76

Figure 4.11 Wavelet Squared Coherence (Vietnam) 77

Figure 4.12 Wavelet Squared Coherence (USA) 77

Figure 4.13 Wavelet Squared Coherence (Australia) 79

Figure 4.14 Wavelet Squared Coherence (Canada) 79

Figure 4.15 Wavelet Squared Coherence (South Africa) 79

Figure 4.16 Wavelet Squared Coherence (Switzerland) 80

Figure 4.17 Wavelet Squared Coherence (UK) 80

Figure 4.18 Wavelet Squared Coherence (Japan) 81

LIST OF TABLES IN APPENDIX

Appendix – I

Table 5.2.1 Rolling Correlation between Gold and Equity Sector Indices of India 170

Table 5.2.2 Rolling Correlation between Gold and Equity Sector Indices of China.....171

Table 5.2.3 Rolling Correlation between Gold and Equity Sector Indices of UAE 171

Table 5.2.4 Rolling Correlation between Gold and Equity Sector Indices of Egypt.....172

Table 5.2.5 Rolling Correlation between Gold and Equity Sector Indices of Indonesia.....173

Table 5.2.6 Rolling Correlation between Gold and Equity Sector Indices of South Korea 174

Table 5.2.7 Rolling Correlation between Gold and Equity Sector Indices of Turkey.....174

Table 5.2.8 Rolling Correlation between Gold and Equity Sector Indices of Russia.....175

Table 5.2.9 Rolling Correlation between Gold and Equity Sector Indices of Saudi Arabia 176

Table 5.2.10 Rolling Correlation between Gold and Equity Sector Indices of Thailand 177

Table 5.2.11 Rolling Correlation between Gold and Equity Sector Indices of Vietnam.....177

Table 5.2.12 Rolling Correlation between Gold and Equity Sector Indices of USA 178

Table 5.2.13 Rolling Correlation between Gold and Equity Sector Indices of Australia.....179

Table 5.2.14 Rolling Correlation between Gold and Equity Sector Indices of Canada 180

Table 5.2.15 Rolling Correlation between Gold and Equity Sector Indices of South Africa.....180

Table 5.2.16 Rolling Correlation between Gold and Equity Sector Indices of Switzerland 181

Table 5.2.17 Rolling Correlation between Gold and Equity Sector Indices of UK.....182

Table 5.2.18 Rolling Correlation between Gold and Equity Sector Indices of Japan 183

Table 5.3.1 Testing for Stationarity (India) 183

Table 5.3.2 Testing for Stationarity (China).....184

Table 5.3.3 Testing for Stationarity (UAE) 184

Table 5.3.4 Testing for Stationarity (Egypt) 184

Table 5.3.5 Testing for Stationarity (Indonesia) 185

Table 5.3.6 Testing for Stationarity (South Korea) 185

Table 5.3.7 Testing for Stationarity (Turkey) 186

Table 5.3.8 Testing for Stationarity (Russia) 186

Table 5.3.9 Testing for Stationarity (Saudi Arabia) 186

Table 5.3.10 Testing for Stationarity (Thailand) 187

Table 5.3.11 Testing for Stationarity (Vietnam) 187

Table 5.3.12 Testing for Stationarity (USA) 187

Table 5.3.13 Testing for Stationarity (Australia) 188

Table 5.3.14 Testing for Stationarity (Canada) 188

Table 5.3.15 Testing for Stationarity (South Africa) 188

Table 5.3.16 Testing for Stationarity (Switzerland) 189

Table 5.3.17 Testing for Stationarity (UK) 189

Table 5.3.18 Testing for Stationarity (Japan) 190

Table 5.4.1b -5.4.18b Residual Diagnostic Test for a Quantile Model 190

Table 5.5.1b -5.5.18b Residual Diagnostic Test for a Crises Model 196

LIST OF FIGURES IN APPENDIX

Appendix – I

Figure 5.1a to 5.1j Wavelet Coherence (WTC) of India sector indices.....202

Figure 5.2a to 5.2j Wavelet Coherence (WTC) of China sector indices 204

Figure 5.3a to 5.3j Wavelet Coherence (WTC) of South Korea sector indices.....206

Figure 5.4a to 5.4j Wavelet Coherence (WTC) of Turkey sector indices 207

Figure 5.5a to 5.5j Wavelet Coherence (WTC) of Thailand sector indices.....209

Figure 5.6a to 5.6j Wavelet Coherence (WTC) of USA sector indices.....209

Figure 5.7a to 5.7j Wavelet Coherence (WTC) of Switzerland sector indices.....211

Figure 5.8a to 5.8j Wavelet Coherence (WTC) of UK sector indices 212

Figure 5.9a to 5.9j Wavelet Coherence (WTC) of Japan sector indices.....214

LIST OF ABBREVIATIONS

ADF	Augmented Dickey Fuller
ARCH LM	Autoregressive Conditional Heteroscedasticity Lagrange Multiplier
BM	Basic Materials
BRICS	Brazil, Russia, India, China and South Africa
CD	Consumer Discretionary
CS	Consumer Staples
DCBB	Dot Com Bubble Burst
EDC	European Debt Crisis
EN	Energy
FIN	Financials
GARCH	Generalised Autoregressive Conditional Heteroscedasticity
GCC	Gold Consuming Countries
GFC	Global Financial Crisis
GPC	Gold Producing Countries
HC	Health Care
IND	Industrials
KCC	Key Currencies Countries
LB	Ljung Box Test
TECH	Information Technology
TEL	Telecommunication
UT	Utilities

ABSTRACT

Purpose - In the era of massive globalization, co-movement among various financial assets has increased drastically. The greatest difficulty exists in the context of portfolio management in analyzing the behaviour of financial instruments that don't depend on the behavior of other instruments and follow a completely different path. With the rising turbulence in financial markets, a need for hedge/safe-haven assets emerged a decade ago and is gaining relevance and popularity. In particular, while gold is often referred to as safe lending, the study gives attention to: (1) testing the ability of gold to delineate the superiority of hedges and safe havens against traditional assets such as stocks during normal and extreme market conditions; (2) the work has been extended to test the hypothesis of hedge and safe haven potential of gold against specific sector indices that are part of the country's aggregate stock exchange; and in the spirit of the theoretical model, this study exemplifies; (3) the hedge and a safe haven attribute of gold against exchange rates in gold consuming, gold producing, and key currency countries.

Design/Methodology/Approach – The World Gold Council Classification of countries as major gold consuming, major gold producing and international key currencies countries are the central focus of this study. To investigate the objectives, the study uses the sample span ranging from 1st January 2000 to 31st March 2020. Further, to estimate a precise result of hedge and safe haven role of gold, the whole analysis is carried out in and around the four major crises such as the Dot-com bubble burst, the global financial crisis, the European debt crisis and Covid-19. The distinct analysis for the gold-stocks, gold-equity sectors and gold-exchange rate dependency and hedge/safe haven attribute at a specific quantile and in times of crisis was performed employing model adopted by (Baur & McDermott, 2010). Further, a proper understanding of the interconnection between gold and financial assets (stocks, equity sectors and exchange rate) has become a fundamental concern for market participants. Thus, a study takes a step forward to use the novel framework, a Wavelet Coherence, to capture a coherency and hedge/safe haven property of gold in a time-frequency space.

Findings – In times of very extreme equity market falls at 10% quantile (Australia and Canada), at 5% quantile (South Africa) and at 1% quantile (South Africa) countries equity returns are negatively correlated with gold returns. Amongst, the gold of South Africa reveals a strong safe

haven property at 1% quantile. On a similar note, from GCC, at 10% quantile (Turkey and Vietnam), at 5% quantile (China, Egypt, Indonesia, Turkey, Russia, Saudi Arabia, Thailand and USA) and at 1% quantile (India, China, UAE, Egypt, Indonesia, South Korea, Russia and Vietnam) countries' equity returns are negatively associated with gold returns which exhibits weak/strong safe haven property. The gold of all KCCs shows a negative correlation with equity at 5% and 1% quantile, which presents the weak safe-haven appeal. But notably, the UK at 5% and Switzerland at 1% exhibit a strong safe haven property. The estimated coefficients are negative but statistically insignificant for most of the countries during all four crises, which is indicative of the weak safe haven attribute of gold. Nevertheless, the dynamic strong safe have effect is more viable during Covid-19, followed by GFC. Analysing the wavelet coherence for all GCC, GPC and KCC on a time-frequency scale, it can be inferred that the results are consistent with the Quantile methodology adopted.

The estimation results depict a strong hedge property of gold against all sectorial indices of gold consuming countries such as India, South Korea, Indonesia, Turkey, Russia, and Thailand during average market conditions. Even for gold producing countries, gold serves as a strong hedge for all sectors except basic material, information technology and utility for Australia, South Africa and Canada, respectively. Moreover, in key currency countries, namely Switzerland and Japan, gold no longer hedges sector-specific risk. The estimation results at specific quantiles reveal that as the severity of shock increases at extreme negative quantiles given by 1%, gold serves as a haven asset only for health care sector of South Korea, health care and telecom sector of China, basic material sector of South Africa, energy, industrial and utility sector of Canada, consumer staples, financial, industrial and telecom sector of USA.

Indeed, gold efficacy as a hedge and safe haven against fluctuations in foreign exchange rate has turn out to be more pronounced in gold consuming countries, particularly Indonesia, South Korea, Russia and key currencies countries such as Japan.

Practical Implications – The findings of the study point out significant implications for investors and market traders seeing higher risk-returns trade-offs by diversifying equity portfolios with gold. Across GCC, GPC and KCC, when the equity market offered a negative return with higher volatility, particularly during crisis periods, the gold outshined with

favourable returns-risk performance. The study has also noticed a substantial hedge behaviour of gold against the stock of GCC (China, India, Thailand and Vietnam); GPC (USA, Canada, Australia). Additionally, as the severity of shock rises at the extreme quantiles, the demand for safe-haven assets increases in majority of the countries in all three groups. This result signifies the implications for equity portfolio investors to minimize the losses by including gold. Moreover, our hedge and safe haven results suggest that the investment risk in GCC, GPC and KCC sectors (financials, energy, information technology and industrial) can be handled at a relatively low cost by spreading investment in gold in times of financial crises. However, in some GCC (China, UAE, Saudi Arabia and Vietnam); and KCC (Switzerland and Japan), the gold sectors are either less related or not linked to each other during idyllic and even crisis periods, indicating a weak hedge and safe haven property of gold for sectors. These results are robust and useful for investors who are operating at a multi-horizon trading platform.

The contribution of GCC, GPC and KCC gold hedge and safe haven results for stock, sectors and exchange rates during crisis and non-crises periods could be one of the potential sources the investors and market traders can make use of at the time of evaluation of investment, asset allocation and implementing trading strategies. Overall, gold is the most dominant in terms of safe haven capability against stock, sector and exchange rates. But it may be noted that the safe haven behaviour of gold might shift according to the market severity in the future.

Originality/Value- This is one of the first research to study gold's hedge and safe haven role, considering the longer sample period (1st January 2000 to 31st March 2020). Perceiving the frequent occurrence of financial and economic episodes, the author's major contribution is specific to the clarification of the hedge and safe haven appeal of gold against financial assets such as stocks, equity sectors and exchange rates. This study is also unique from past literature in terms of using a group of countries that are highly related to gold trade. Further, testing the hedge and safe haven performance in each of these countries is curious and this has investigated estimating a Quantile model and novel approach such as Wavelet Coherence.

Keywords – GCC; GPC; KCC; stocks; equity sectors; exchange rate; hedge; safe haven; risk diversification; DCBB; GFC; EDC; Covid-19; Quantile model; Wavelet Coherence

CHAPTER - 1

Overview of Gold Market and its Role as a Hedge and Safe Haven

Investing in Gold Today could Protect You against Tomorrow's Surprises.

--- World Gold Council

CHAPTER ONE

Overview of Gold Market and its Role as a Hedge and Safe Haven

The research issue of whether gold appeals as a hedge and a safe haven gained wide consideration from both researchers and practitioners. This thesis unveils such distinguishing attributes with a specific focus on Major Gold Producing, Major Gold Consuming and Key Currencies Countries.

This chapter begins with the golden thread and the role of gold in the monetary system. The subsequent sections provide the background and motivation for focusing on this research. Next sections follow with the distinguishing features of gold as a financial asset, gold as a diversifier, hedge and a safe haven, the classification of countries as per World Gold Council (WGC) and illustrate a complete review of the gold market.

1.1 Golden Thread through history and its role in a Monetary system

The Gold a financial asset has a long-rooted history. Picking up the decade's information, the gold has been labeled with many names across the world. The Incas said gold is the sweat of the sun. For Greek philosopher Homer, it is the glory of the immortal and the Egyptian people consider it as a blessed-after the life (Cnijf, 2019). Open up the historical records, gold has always been regarded with the highest value in the world. In ancient times, metal had a strong usage and value to our ancestors. But before embarking into 560 B.C. the Greeks identified a separate value for gold and silver among the metals. And then people started using these metals extensively for the trade. Further, civilization has brought out the gold as a means of barter trade and it comes as an inseparable metal from the global monetary economy. Since then, until the end of Second World War, it played a crucial role in the world as an Exchange standard. In the 19^{th} century, most of the monetary system also started linking this standard to their domestic currencies to determine the currency value against the specific amount of gold. This system in fact, has advent with the agreement of pegging the world currencies to the US dollar.

For instance, the convertibility value of a dollar into gold is fixed at a standard rate of US $ 35 per troy ounce[1].

1.2 Background and Motivation of the Study

After the Bretton Woods fixed regime system's debacle, gold no longer served as a basis of the International Monetary System. This evolution has led to the emergence of gold being treated at par with other commodities and its assessment as to whether it acts as an internal or external hedge. Furthermore, the financial markets are subject to turbulence. The recent global financial crisis (2007-2008) intensified with the collapse of Lehman brothers has caused uncertainty and shattered the investor's faith in the financial system. Significantly, the beginning of the global financial crisis was marked by an impressive increase in gold prices while other assets (in particular stock prices) exhibited losses. The dawn of numerous black swan events, such as the Dot Com bubble burst, Global financial crisis, European debt crisis and the ongoing Covid-19 crisis, has severely hampered the prices and caused instability in the global financial system.

Owing to these increased financial uncertainties and risks within the financial system, there has been a quest to find a safe haven and hedge asset. The financial media often refers to gold as a safe-haven asset for portfolio investors. Eventually (Kaul & Sapp, 2006), defined a safe haven as "an ideal venue to park money during periods of uncertainty" while the first operational definitions to 'Hedge and Safe Haven' were propounded by (Baur & Lucey, 2010). Accordingly, "a hedge (safe haven) is an asset that is uncorrelated (negatively correlated) with another asset or portfolio on average (only in times of market stress or turmoil)".

In the era of globalization, co-movement among various instruments has increased drastically. The greatest difficulty exists in the context of portfolio management in analysing the behaviour of instruments that don't depend on the behavior of other instruments and follow a completely different path. With the rising turbulence in financial markets, a need for hedge/safe-haven assets emerged a decade ago and is gaining relevance and popularity.

---

[1]*Troy ounce is a measurement tool used for the precious metal. The major purpose of the Bretton Wood agreement was to decide on a new international exchange system to execute the transaction in place of the Gold Exchange Standard.*

The beginning of the global financial crisis in 2008 has been marked by a renewed interest in understanding the properties of gold as an investment tool on account of its ability to limit losses in times of market turbulence. Furthermore, gold often exhibits a lack of correlation with other assets (Baur & Lucey, 2010) and is considered a zero-beta asset (McCown & Zimmerman, 2006). In this vein, gold seems to be an appropriate asset to be considered as a hedge or a safe haven for financial portfolios. The reason is that, in contrast to many other commodities, gold is well-known to be durable, easily recognizable, storable, portable, divisible, and easily standardized.

In addition, the study has been extended to test the hypothesis of hedge and safe haven potential of gold against specific sector indices that are part of the country's aggregate stock exchange. Under the assumption that these industries are coming under government regulations and exposed to all kinds of uncertainties in the market, one can expect an evolving relationship between the gold and equity sectors. Again, testing the hedge and safe haven hypothesis under market aggregation might not portray the real picture of gold potential. So, the investors who are looking well beyond this may be interested to know information on whether gold could be able to protect the investment against industry volatility and seeking to know the potentiality of gold to serve as a tool of hedge and safe haven against sector-wise volatility.

Due to the complex market situation, particularly during the financial crisis, the ultimate concern for investors is to diversify their portfolios and prefer relatively safe assets. The globalisation and growing importance of international trade increased the risk of exchange rate and, in turn, concerns the investors to deal with this risk. Thus, from an investor's perspective, the question triggers how to manage such risk. This question is put forward to address by testing whether holding gold helps mitigate currency risk. Some research insights say that in the past, gold, being a part of the monetary system, served as a hedge to investors. It was also suggested to be a safe haven asset to offset the currency risk. There exist several theoretical reasons to explain the informational dependencies between gold and currency rates. Firstly, the relationship between gold and the exchange rate can be linked to the uncovered interest rate parity. Secondly, as per the 'flow models' of currency rate determination, the fluctuations in currency value directly cause the international competitiveness and trade balance of a country to change. These changes, in turn, impact the output, cash flows, and stock prices of a firm. In the spirit of the theoretical

model, this study exemplifies the hedge and a safe haven attribute of gold against exchange rates in gold-consuming, gold-producing, and key currency countries.

1.3 Distinguishing feature of Gold as a Financial Asset

In 1934, according to the Gold Reserves Act, private ownership of gold was considered to be illegal. But subsequently, the United States lifted those restrictions and allowed citizens to have an investment in non jewellery gold in 1975. For several decades, gold has been always viewed as a universally accepted metal, a store of value and embedded with high liquidity (Michis, 2014). While gold has been regarded as a wealth at all times and in all places, an inflationary hedge and safe haven, it is subject to some distinguishing features from that of other financial assets and commodities. First unlike the other assets, it neither pays a dividend (Equity) nor a coupon (Bond), nor a return (Cryptocurrencies) and, nor a rent (Property) (Ghazali, et al., 2013). But still, it is heaven for the investors because when all the aforementioned assets weigh down due to worries about economic growth and financial crisis, this asset shines. Although gold does not generate a consistent income, but it is an investment strategy that the investors devise, having a set of self-confirming beliefs and with a hope that its value will either rise or at least be maintained. The fundamental price and value of gold is determined by supply and demand forces. Thus, unlike financial assets, which deliver the benefit of portfolio diversification, gold is not subject to counter-party risk (Cnijf, 2019). Rationally, an individual buys gold or gold-backed financial products to protect their wealth and absorb risk-adjusted returns, aiming to achieve their small saving for future or long-term investment goals. In addition, gold is being demanded by the government, fund managers and individuals for portfolio investment(Ghosh, Levin, Macmillan, & Wright, 2004). Industries such as health, electronics and chemicals use it for a productive purpose and the central bank holds it as a weapon for storing reserves. Lastly, what sets gold apart is it does not rely on future earnings or debt. Holding an investment in gold carries no risk of default.

1.4 Gold as a Diversifier, Hedge and Safe Haven against Stock, Equity Sectors and Exchange rate

The ability of gold as a diversifier, hedge and safe haven against the other assets rests on several theoretical underpinnings. The succeeding section describes the definitions;

Gold as a Diversifier

According to (Baur & Lucey, 2010), on average, an asset that is positively but not perfectly correlated with another asset shall be considered a diversifier. Moreover, the diversifier asset is not necessarily required to have the specific property of minimizing losses during market uncertainty. The (Hoang, 2011) stated that due to the differences in the gold price and other financial asset price determinants, gold has always been viewed as a portfolio diversifier. Therefore, this study tested whether the gold of Gold Consuming Countries (GCC), Gold Producing Countries (GPC) and Key Currency Countries (KCC) reveals such behaviour against their stock, equity sectors and exchange rate market.

Gold as a hedge

For a number of decades, gold was considered to be a hedging tool because it was the base of the monetary system. And this was mostly used by developed countries (Capie, Mills, & Wood, 2005), predominantly as an inflation hedge. As per (Baur & Lucey, 2010) and (Baur & McDermott, 2010), an asset that is negatively (uncorrelated) with another asset shall be marked as a hedge. However, the specific property of a hedge asset is not necessarily meant to reduce the losses during normal times and extremely declining market conditions. Before setting out the approach for a result, it is worth understanding why any investors might be interested in considering gold as a hedge against stock, equity sectors and exchange rates. There are many empirical works and theoretical models to explain the relationship between the aforementioned variables (Baur & Lucey, 2010), (Baur & McDermott, 2010), (Bhanja & Dar, 2015), (Capie, Mills, & Wood, 2005), (Joy, 2011), (Reboredo, 2013), (Baumöhl & Lyócsa, 2017), (Elie, Naji, Dutta, & Uddin, 2019), (Beckmann, Berger, Czudaj, & Hoang, 2019).

For instance, the sole existing explanation for why gold served as a stock, equity sectors and exchange rate hedge lies in currency fluctuations in dollar-denominated financial assets. Gold hedging against the stock and currency refers to when these variables move in the opposite direction at a given time. In other words, when there is a decrease in the proportion of the stock and exchange rate in the domestic currency, it induces increasing proportions of the gold prices in the domestic currency. This pattern exhibits hedge property. The fact that when there is a tail dependence, investors can use the gold as a hedging instrument since the gain in this asset offsets the loss in the stock, equity sectors and currency during normal and market turbulent scenarios. Thus, it is important to understand the role of gold as a hedge varies on a timeline during different market situations (Burdekin & Tao, 2021).

Gold as a Safe haven

A distinguishing feature of safe haven assets with hedges is the duration of the effect (Ghazali, Lean, & Bahari, 2013). According to (Baur & Lucey, 2010) and (Baur & McDermott, 2010), an asset that is negatively (uncorrelated) with another asset during a falling market condition is a safe haven for investors to protect their investment value. A safe asset property is consistent with its ability to protect value during market adversity and aid investors in compensating the losses as the safe haven asset (Gold) prices will increase when other financial asset (stock, equity sectors and exchange rate) prices dip down.

But why is gold a popular safe haven asset? Along with long-rooted history, a plethora of research debate revolves around this question. The safe haven property of gold can be recalled with the assertion stated by (Bhanja & Dar, 2015) that the beauty of gold is it loves bad news. The dramatic occurrence of frequent turmoil's that have been witnessed in the last few decades captured the investors' attention towards this asset as a haven, particularly during the turmoil period. This is due to its unique characteristics of co-moving by providing a higher immunity to inflation and financial turmoil. Therefore, during such uncertainty, investors are induced with a strong belief to purchase this asset, which works as a safe haven for their portfolio investment. To this end, the study examines how the safe haven attributes of gold have been impacted by rising undesirable stock, equity sectors and exchange rate volatility over a 2001-2020 sample period that includes four major crises.

1.5 Classification of Countries as per WGC and Economic Rationale supporting the selection of Countries

The World Gold Council (WGC) is the market development organisation meant for the gold industry. Its workings are undertaken across all parts of industry i.e., from mining to investment and thereby stimulate and sustain demand for gold. The Global leading mining companies are members of WGC, thus it supports them in developing Conflict Free Gold Standard. WGC have their headquarters situated in UK and offices spread across the globe namely in India, China, Singapore, Japan and United States.

Table 1.1: World Gold Council Classification

Sr. No	Major consumer countries of gold (currency)	Code	Sr. No	Major producer countries of gold (currency)	Code	Sr. No	Key Currencies of gold Country (currency)	Code
1	United Arab Emirates (Dirham)	AED	1	Australian (Dollar)	AUD	1	Canadian (Dollar)	CAD
2	Chinese Yuan (Renminbi)	CNY	2	Canadian (Dollar)	CAD	2	Swiss (Franc)	CHF
3	Egyptian (pounds)	EGP	3	Chinese Yuan (Renminbi)	CNY	3	British (Pound)	GBP
4	Indonesian (Rupiah)	IDR	4	South African (Rand)	ZAR	4	Japanese (Yen)	JPY
5	Indian (Rupee)	INR	5	U.S. (dollar)	USD	5	U.S. (dollar)	USD
6	South Korean (Won)	KRW						
7	Russian (Ruble)	RUB						
8	Saudi Arabian (Riyal)	SAR						
9	Turkish (Lira)	TRY						
10	Thailand (Thai Baht)	THB						
11	Vietnamese (Dong)	VND						
12	U.S. (dollar)	USD						

Source: https://www.gold.org/goldhub/data/gold-prices

Methodology/Criteria for Classification of Countries based on World Gold Council

The World Gold Council classifies the gold market into three categories, i.e., G5 Countries (Key Currency Countries), Major Gold Consuming Countries, and Major Gold Producing Countries. The above three categories are derived by WGC according to the statistics of gold mining and

sustainable development, supply and demand, jewelry, investment, technology, and reserve asset management. The following are the indexes as per World Gold Council (WGC)[2].

Consumer Index

This Index consists of the 5 largest gold consuming country currencies (India, China, USA, Turkey and Germany), ranked and weighted according to 3 years average demand for gold. (jewelry plus total bar and coin).

Producer Index

This Index comprises of 5 largest gold producing country (China, USA, Russia, Australia and South Africa) currencies ranked and weighted according to 3 years average mine production. (jwellery plus total bar and coin).

G5 Currency Index

This Index includes G5 Currencies (US dollar, euro, yen, pound sterling and the Canadian dollar) weighted by 3 years Gross Domestic Product (GDP) in US dollars.

The Consumer demand (tonnes) is highest among the selected major gold countries countries[3]. The Gold mine Production (tonnes) is also highest among the selected gold producing countries[4]. Countries such as US, Russia, China, Switzerland, Japan, India, Turkey, Saudi Arabia, UK, Thailand, Egypt, South Africa are among the top 40 in terms of world official gold reserves[5].

1.6 Review of the Gold Market

The yellow metal that comes from digging up is one of the significant components of the central government Treasury. The amount of gold reserves that is held by the Central Govt. are typically for four major investment objectives. As a tool to maintain stability in the economy, it is reserved for safety, liquidity, and generating a return. Indeed, the central banks account for one-fifth of all the gold mined at all times.

[2]https://www.gold.org/goldhub/data/gold-prices

[3]https://www.fundresearch.de/fundresearch-wAssets/img/GDT_Q219_Tables_EN_Short.pdf

[4]https://www.metalsfocus.com/

[5]https://www.gold.org/goldhub/data/gold-reserves-by-country

Table 1.2 represents the total gold reserves of each producing, consuming and key currencies countries, showing reserves holding for Q1 2001, Q1 2011 and Q1 2020. As indicated in Table 1.2, among the GCC, China, followed by the US, India and South Korea, holds the largest value of international reserves. More specifically, if we compare the date of Q1 2001 with Q1 2020, there is almost 17, 4, 11 and 4 times increase in total reserves of each of the aforementioned countries. Similarly, Canada from GPC and Japan from KCC show a higher amount of international reserves.

Moving ahead to Table 1.3, which exhibits the gold reserves statistics in the total reserves for Q1 2001, Q1 2011 and Q1 2020. Having perceived gold's precious property and indestructible nature, the gold reserves make up the remarkable shares in the country's total reserves. For instance, during the quoted period, the GCC's central banks of the USA, Russia, Turkey and Egypt reported the largest amount of gold reserves holding (in US $ million tonnes and %). On a similar note, for Q1 2020, about 7.02%, 3.51%, 3.41%, 3.36% and 3.17% of gold reserves contribute towards total reserves in India, Thailand, Saudi Arabia, Indonesia and China. From GPC and KCC, South Africa and Switzerland also own huge tonnes of gold reserves in their international reserve portfolio. It can be also observed that there is at least 3% to 5% hike in gold reserves in majority of countries between a compared date. The rise in gold's contributions to central bank reserves could be due to its unique fundamental value.

Table 1.2: Total Gold Reserves (US$ Million)

Country	Q1 2001	Q1 2011	Q1 2020
Panel A: Major Consumer Countries of Gold			
India	43,136.43	308,321.55	481,306.91
China	182,163.40	3,115,938.53	3,180,506.84
UAE	14,007.20	40,922.41	107,257.86
Egypt	13,498.89	31,173.75	39,266.84
Indonesia	28,887.90	105,756.14	120,938.84
South Korea	94,492.76	299,223.84	400,441.35
Turkey	19,523.18	92,173.88	83,358.10
Russia	29,177.85	502,974.06	562,559.36
Saudi Arabia	18,088.65	480,316.71	489,655.03
Thailand	32,294.67	181,575.40	226,652.47
USA	120,594.03	504,570.43	537,607.69

Panel B: Major Producer Countries of Gold			
Australia	17,260.45	36,953.91	56,888.97
Canada	33,514.42	60,599.49	86,100.43
South Africa	7,666.96	49,293.63	52,459.18
Panel C: Key Currencies of Gold			
Switzerland	49,610.17	280,135.08	850,659.80
UK	46,706.22	107,429.55	170,217.53
Japan	361,471.92	1,116,018.81	1,364,836.32

Note: Compiled using data retrieved from WGC.
Source: https://www.gold.org/goldhub/data/gold-reserves-by-country

Table 1.3: Gold Reserves and Holdings

Country	Gold Reserves (Tonnes)			Gold Reserves (US$ Million)			Gold Holdings (%)		
	Q1 2001	Q1 2011	Q1 2020	Q1 2001	Q1 2011	Q1 2020	Q1 2001	Q1 2011	Q1 2020
Panel A: Major Consumer Countries of Gold									
India	357.76	557.75	653	2,964.14	25,804.29	33,779.47	6.87	8.37	7.02
China	395.01	1,054.09	1,948.31	3,272.79	48,767.71	100,784.63	1.8	1.57	3.17
UAE	12.35	0	31.33	102.31	0	1,620.51	0.73	0	1.51
Egypt	75.65	75.61	79.54	626.78	3,498.21	4,114.61	4.64	11.22	10.48
Indonesia	96.45	73.09	78.57	799.13	3,381.65	4,064.18	2.77	3.2	3.36
South Korea	13.67	14.44	104.45	113.29	667.93	5,403.05	0.12	0.22	1.35
Turkey	116.21	116.1	438.35	962.88	5,371.53	22,675.59	4.93	5.83	27.2
Russia	390.53	811.11	2,299.15	3,235.68	37,526.24	118,933.58	11.09	7.46	21.14
Saudi Arabia	142.95	322.9	323.07	1,184.39	14,939.27	16,712.07	6.55	3.11	3.41
Thailand	73.62	108.86	153.96	609.98	5,036.50	7,964.30	1.89	2.77	3.51
USA	8,137.13	8,133.46	8,133.46	67,418.70	376,296.92	420,738.70	55.91	74.58	78.26
Panel B: Major Producer Countries of Gold									
Australia	79.72	79.85	79.85	660.49	3,694.49	4,130.79	3.83	10	7.26
Canada	36.2	3.39	0	299.96	156.85	0	0.9	0.26	0
South Africa	182.58	124.97	125.31	1,512.70	5,781.90	6,482.46	19.73	11.73	12.36
Panel C: Key Currencies of Gold									
Switzerland	2,368.48	1,040.08	1,040.00	19,623.59	48,119.42	53,798.46	39.56	17.18	6.32
UK	437.07	310.25	310.29	3,621.26	14,354.03	16,050.95	7.75	13.36	9.43
Japan	763.5	765.22	765.22	6,325.86	35,402.91	39,584.10	1.75	3.17	2.9

Note: Compiled using data retrieved from WGC.
Source: https://www.gold.org/goldhub/data/gold-reserves-by-country

Gold, a precious metal, is one of the top-ranked traded products in 2020. Tables 1.4 and 1.5 give a snapshot of gold imports and exports held for the period 2001-05, 2006-10, 2011-15 and 2016-20. Amongst the GCC countries that traded the highest value of imports than exports between 2001-10 are India, China and Thailand. However, on average, the annual gold import bill of

these countries slides down between 2011-20. But the other GCC countries such as UAE, Turkey, USA and Saudi Arabia have grown in that period. For example, between 2011-15 and 2016-20, the UAE showed about 527.38% and 30.03% import growth. The comparative visualization in Tables 1.4 and 1.5 exhibits that the export of major GPCs such as Australia and South Africa, remained strong between 2001-2020. The gold exporter, Canada, could able to depict the trade value in export as higher than import only between 2001-05 (net $ 295.74 million) and in 2006-10 (net $ 3712.29 million). Together, comparing the trade bill, on average, the export value of KCC is marked to be higher than the import value. Switzerland was the main engine to cater to the gold demand between 2001-05 ($ 4588. 83 million), 2006-10 ($ 26769. 7 million) and 2011-15 ($ 11842.08 million).

Table 1.4: Gold Import Value Growth (IVG)

Country	2001-05		2006-10		2011-15		2016-20	
	IVG (US$ Million)	IVG (%)	IVG (US$ Million)	IVG (%)	IVG (US$ Million)	IVG (%)	IVG (US$ Million)	IVG (%)
Panel A: Major Consumer Countries of Gold								
India	4858.53	107.5	29242.43	251.36	-17304	-32.87	-777.42	-3.41
China	238.21	67.1	4038.44	361.82	26752.58	111.52	-39925.5	-83.11
UAE	4000.83	785.7	2243.72	201.32	20994.98	527.38	8840.87	30.03
Egypt	43.27	170.5	54.89	1320.68	151.29	404.96	87.26	126.45
Indonesia	346.07	38128.8	-2.02	-0.87	187.49	24.60	862.38	96.72
South Korea	-842.69	-48.0	782.3	104.84	-448.06	-23.24	-188.05	-16.00
Turkey	2774.86	301.6	-1560.38	-38.31	-2577.67	-42.17	17216.1	263.98
Russia	2.21	2114.6	-4.53	-50.97	261.11	7426.30	498.43	1313.27
Saudi Arabia	-330.13	-28.6	349.65	60.76	3398.65	187.39	-823.83	-40.58
Thailand	1942.06	233.0	4695.88	200.90	-11059	-68.89	1501.85	42.63
Vietnam	869.84	5112.1	-915.36	-46.04	-2351.38	-94.77	71.11	55.62
USA	2618.83	120.1	7439.08	130.86	-4449.66	-29.31	33133.24	220.29
Panel B: Major Producer Countries of Gold								
Australia	1135.58	89.8	3527.15	76.67	-3937.69	-58.39	1862.54	39.51
Canada	1406.97	469.5	5062.91	234.45	-2935.51	-30.20	3283.58	57.54
South Africa	1470.36	432.2	4041.71	164.73	-6188.81	-68.51	-2236.02	-44.73
Panel C: Key Currencies of Gold								
Switzerland	1700.38	30.6	18874.3	167.87	1621.8	35.06	5710.01	7.03
UK	-664.56	-18.6	15666.16	201.62	-1821.43	-7.31	12697.64	17.86
Japan	765.46	135.7	-64.74	-7.87	56.36	10.45	-306.47	-43.90

Source: https://oec.world/en/profile/hs/gold?yearSelector1=2001

Table 1.5: Gold Export Value Growth (EVG)

Country	2001-05		2006-10		2011-15		2016-20	
	EVG (US$ Million)	EVG (%)	EVG (US$ Million)	EVG (%)	EVG (US$ Million)	EVG (%)	EVG (US$ Million)	EVG (%)
Panel A: Major Consumer Countries of Gold								
India	940.58	3846.72	102.25	8.25	6678.32	14.69	-5731.44	-0.93
China	94.23	1.18	-31.84	-0.09	-2009.68	-0.50	2374.36	1.57
UAE	2088.38	4.23	7865.04	3.22	67.78	0.00	1506.3	0.06
Egypt	18.22	360.07	827.65	3.22	-1389.55	-0.67	272.04	0.09
Indonesia	-216.28	-0.41	843.79	0.72	-117.88	-0.04	3909.58	1.62
South Korea	-807.56	-0.73	2111.59	2.34	-2431.1	-0.72	685.34	0.59
Turkey	106.85	4.02	1368.73	1.92	7573.2	5.30	-7592.72	-0.65
Russia	593.47	2.44	-264.07	-0.48	1247.59	2.86	17382.59	13.08
Saudi Arabia	241.89	3.07	-299.75	-0.59	50.55	0.17	1190.36	1.43
Thailand	293.1	14.52	7049.86	10.17	-2141.35	-0.35	6370.97	0.80
Vietnam	3.79	10.16	41.25	1.32	-87.83	-0.84	52.91	8.92
USA	193.41	0.04	8820.57	1.34	-5876.68	-0.21	-2847.22	-0.15
Panel B: Major Producer Countries of Gold								
Australia	3238.09	0.88	5194.54	0.57	4326.93	0.26	-3471.04	-0.16
Canada	1702.71	1.14	8775.2	1.84	-1817.09	-0.12	509.1	0.04
South Africa	1567.57	0.65	2434.16	0.68	13505.53	1.13	-7629.65	-0.37
Panel C: Key Currencies of Gold								
Switzerland	4588.83	0.62	26769.7	2.39	11842.08	0.20	-13878.2	-0.17
UK	-1161.9	-0.35	120.3	0.11	20434.57	13.00	5576.89	0.49
Japan	732.18	1.17	2883	0.95	-3035.2	-0.36	166.51	0.02

Source: https://oec.world/en/profile/hs/gold?yearSelector1=2001

Table 1.6: Gold Export and Import Value (%)

Country	Trade share in Total Export (%)					Trade share in Total Import (%)				
	2001	2005	2010	2015	2020	2001	2005	2010	2015	2020
Panel A: Major Consumer Countries of Gold										
India	0.001	1.6	0.06	2.24	0.09	12.7	15.9	20.9	11.1	5.19
China	0.22	0.3	0.17	0.63	0.92	1	1.01	2.64	15.9	1.91
UAE	1.39	4.39	5.27	4.8	6.73	1.43	7.66	1.72	7.83	9.01
Egypt	0.0001	0.03	0.55	0.22	0.77	0.07	0.12	0.03	0.06	0.04
Indonesia	1.48	0.53	1.03	0.79	1.49	0.003	0.59	0.12	0.3	0.41
South Korea	3.1	0.50	1.54	0.29	0.44	4.95	1.55	0.78	0.46	0.23
Turkey	0.08	0.23	1.06	2.82	0.95	2.59	6.27	1.28	1.11	5.59
Russia	0.69	1.42	0.15	0.53	4.4	0.0003	0.004	0.002	0.08	0.13
Saudi Arabia	0.22	0.54	0.11	0.11	0.48	3.26	1.4	0.47	1.63	0.28
Thailand	0.06	0.53	3.96	1.22	3.37	2.35	4.71	3.6	1.56	1.18
Vietnam	0.001	0.007	0.04	0.005	0.02	0.05	1.51	0.55	0.04	0.05
USA	12.4	7.78	7.86	6.77	3.86	6.14	8.15	6.71	3.36	11.3
Panel B: Major Producer Countries of Gold										
Australia	10.3	11.7	7.34	6.65	4.18	3.56	4.08	4.16	0.88	1.55
Canada	4.2	5.42	6.92	4.2	3.4	0.84	2.9	3.69	2.13	2.12
South Africa	6.75	6.73	3.09	7.98	3.08	0.96	3.07	3.32	0.89	0.65
Panel C: Key Currencies of Gold										

Switzerland	21	20.4	19.4	22.5	16.1	15.6	12.3	15.4	19.6	20.5
UK	9.44	3.71	0.6	6.9	4.01	10.1	4.94	12	7.23	19.7
Japan	1.76	2.31	3.03	1.69	2.17	1.59	2.26	0.39	0.19	0.09

Source: https://oec.world/en/profile/hs/gold?yearSelector1=2001

The percentage of import and export share of each GCC, GPC, and KCC in the total trade are shown in Table 1.6. For a selected period (2001, 2005, 2010, 2015 and 2020), the table statistics show that in 2010 and 2015, the GCC bought the highest percentage of gold. For example, in 2010, India (20.9%), the USA (6.71%), Thailand (3.6%) and China (2.64%) economy demanded the highest gold import to meet the needs of the industries and investors. However, in 2001, 2005, and 2020, these countries showed less participation in gold import transactions.

As expected, on that side, the export share of GPC is higher except in 2020, which inched to lower. More interestingly, the KCC export share is higher than that of GPC. For example, Switzerland alone shipped about 21%, 20.4%, 19.4%, 22.5%, and 16.15% of gold to other countries in 2001, 2005, 2010, 2015, and 2020, respectively.

Historically, gold has always been considered a superior asset over others and yields a positive long-term return to investors in times of uncertainty and favourable market scenario. These duality benefits throw back the manifold demand for gold and manifest its distinct characteristics from other assets. Moreover, the volatility or uncertainty also largely reflects the current and future expectations of investors on the returns of gold. Thus, Table 1.7 presents the performance metrics (Returns-Risk) for gold and other financial assets (fixed income assets and equities) of top performers from GCC, GPC and KCC over various periods and during major financial crises. The statistics highlighted in Table 1.7 allow investors to differentiate gold returns risk and compare it with other assets. As evidenced in the table, on average, the long-term rate of returns on gold is much higher than the other financial assets for all the top countries. It is imperative to draw attention to that in many cases, when the equity and the Govt. Bonds in some countries provided a negative return, the gold potentially led the financial market with favorable returns to the investors. For instance, during the GFC, EDC and Covid-19 crises, when equity index prices in each country fell down enormously, the gold offered at least above 10% returns to the investors. As compared to GPC and KCC, the maximum gold returns are attributed to GCC

(India, China, and US). For instance, between 2001-10, the US (29.36%), followed by China (25.09%) and India (24.03%) recorded the highest annual rate of returns.

On the flip side, the annualised volatility exhibited on gold is marginally higher than that of fixed-income assets and also, in some cases, equities, which indicates high propensity of gold markets to precipitate higher returns with elevated volatility.

Table 1.7: Top Performer's Gold and Major Assets Return-Risk Trade-Off

Country	Gold and Major Assets	DCBB		GFC		EDC		Covid-19		2000-10		2011-20	
		ROR (%)	ADRV (%)	ROR (%)	ADRV (%)	ROR (%)	ADRV (%)	ROR (%)	ADRV (%)	ROR (%)	ADRV (%)	ROR (%)	ADRV (%)
Panel A: Major Consumer Countries of Gold													
India	LMBA Gold	4.40	16.02	10.31	29.88	28.78	19.66	12.32	24.83	24.03	15.49	27.92	19.55
	BSE Govt. Bonds	*	*	-5.39	11.05	6.11	2.32	3.60	3.54	6.31	1.96	11.89	2.57
	MSCI India	-23.5	34.10	4.17	38.55	-20.2	20.87	-26.1	47.10	18.00	15.93	9.13	30.93
China	LMBA Gold	25.09	15.8	5.35	29.85	4.28	20.65	7.67	23.4	25.09	15.79	16.35	18.87
	China Bonds Agg.	6.41	*	0.71	1.27	9.20	2.23	1.35	5.18	6.41	3.06	9.77	4.33
	MSCI China	4.83	41.26	1.33	43.50	-18.2	29.29	-10.2	31.93	4.83	20.91	29.67	24.71
US	LMBA Gold	1.58	15.79	5.38	29.88	8.96	20.97	6.23	24.33	29.36	16.06	24.62	20.02
	US Bond Agg.	10.67	4.01	0.12	5.05	7.84	3.85	3.15	8.22	6.54	3.71	7.51	4.71
	MSCI US	-14.6	22.51	-10.5	41.43	1.99	23.43	-19.7	57.04	15.45	18.02	21.37	34.70
Panel B: Major Producer Countries of Gold													
Australia	LMBA Gold	13.90	18.08	8.02	36.75	11.39	25.38	21.28	25.21	12.10	18.33	13.36	19.79
	ASX Govt. Bond	*	*	-0.19	6.58	13.41	4.84	3.86	8.13	5.83	3.50	4.82	4.95
	MSCI Australia	0.34	15.01	-2.98	26.09	-14.9	19.63	-24.3	48.97	-3.50	16.03	-3.72	30.80
Panel C: Key Currencies of Gold													
Switzerland	LMBA Gold	0.88	15.85	14.02	30.62	9.49	24.04	5.98	25.08	16.83	15.60	9.49	19.20
	Swiss Bond Agg.	6.39	2.10	-0.42	3.19	4.68	2.63	-2.35	6.60	3.56	1.71	4.68	3.91
	MSCI Switzerland	-24.0	23.58	-9.61	28.46	-6.47	20.68	-11.6	37.10	0.80	14.74	-6.47	23.08
UK	LMBA Gold	4.17	*	6.89	*	9.17	*	12.52	*	33.26	11.17	20.38	11.7
	UK Bond Agg.	7.51	*	1.88	*	16.40	*	-0.82	*	11.84	10.11	2.58	9.96
	MSCI UK	-6.33		-10.4	*	-1.79	*	-23.9	*	12.22	11.79	-13.2	11.53
Japan	LMBA Gold	8.44	16.30	15.91	30.03	3.59	21.57	5.14	28.19	14.43	18.35	18.16	20.28
	BPI Bond	3.45	2.27	-0.70	1.95	1.87	1.66	-0.43	3.16	2.44	2.13	-0.75	1.95
	MSCI Japan	-22.5	23.65	-9.09	33.95	-18.6	22.43	-17.2	31.27	0.71	17.65	9.17	22.08

Source: https://www.gold.org/goldhub/data/gold-price-volatility. The * indicates the statistics for those assets are not available.

Table 1.8 reports the global gold demand and supply trends for the recent ten years (2010-20). On the demand side, the gold usage has been displayed for jewelry, technology, investment, central banks, and other institutions. All years, jewelry followed by investment demand is steady, but gold investment demand increased by 504 tonnes from 2019-20. The demand for technology remained weak, but central banks added a lot of gold to their official reserves between 2010-20.

The global supply remained between 4000-4800 tonnes between 2010-20. This was sufficient to cater to the global demand, except in 2011, 2012, and 2013, the demand was recorded to be higher than the supply.

Table 1.8: Global Gold Demand and Supply Trend (2010-2020)

Particulars	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Jewellery	2057.1	2104.2	2157.3	2726.2	2533.2	2459.8	2103.9	2241.0	2248.4	2122.7	1411.6
Technology	460.7	429.1	382.3	355.8	348.4	331.7	323.0	332.6	334.8	326.0	301.9
Electronics	326.7	316.6	289.1	279.2	277.5	262.1	255.6	265.6	268.4	262.3	248.1
Other Industrial	88.3	76.4	64.7	53.7	51.2	51.0	49.8	50.7	51.2	49.8	42.0
Dentistry	45.6	36.2	28.4	22.8	19.6	18.6	17.6	16.3	15.3	13.9	11.9
Investment	1593.1	1763.4	1572.8	843.5	917.1	962.1	1614.1	1315.4	1160.4	1269.2	1773.2
Total bar and coin demand	1204.3	1502.3	1321.9	1730.6	1066.5	1091.4	1073.1	1043.9	1090.3	870.9	896.1
Physical Bar demand	921.2	1189.8	1022.8	1358.1	780.4	790.2	797.2	779.7	775.4	580.5	529.5
Official Coin	195.9	228.3	187.4	271.0	205.5	225.2	208.2	188.1	241.9	224.0	297.6
Medals/Imitation Coin	87.2	84.2	111.6	101.5	80.6	76.0	67.6	76.1	73.0	66.4	69.1
ETFs & similar products*	388.9	261.1	250.9	-887.1	-149.3	-129.3	541.1	271.6	70.1	398.3	877.1
Central banks & other inst.	79.2	480.8	569.2	629.5	601.1	579.6	394.9	378.6	656.6	668.5	272.9
Gold demand	4190.0	4777.5	4681.5	4554.9	4399.8	4333.2	4435.9	4267.6	4400.2	4386.4	3759.6
Total supply	4315.9	4523.0	4542.2	4314.4	4496.2	4435.3	4745.8	4594.3	4688.8	4819.9	4633.1
LBMA Gold Price, US$/oz	1224.5	1571.5	1669.0	1411.2	1266.4	1160.1	1250.8	1257.2	1268.5	1392.6	1769.6

Source: Metals Focus, Refinitiv GFMS, ICE Benchmark Administration, World Gold Council

Table 1.9 shows the jewelry demand specific to each GCC, GPC, and KCC. The outlook is more positive for GCC such as India, China, and the US, as their demand for jewelry was marked to be higher amongst all between 2010-20. This demand is mostly concentrated on wedding sets and engagement rings, particularly in India. In the case of Thailand, followed by Vietnam, Korea, and Canada, their spending on jewelry over the years was weaker in comparison. For instance, Thailand's demand for jewelry was 7.1 tonnes in 2010, 12.2 tonnes in 2015, and 5.8 tonnes in 2020.

Similar to the earlier Table 1.9 statistics, India, China, and US are amongst the few countries spending a high amount on gold bars and coins investment (Table 1.10). In addition, Turkey, Thailand, Vietnam, and Switzerland report the huge tonnes of gold bars and coins demanded over the period. However, the gold market of Japan exhibited relatively weak and negative demand for gold bars and coins (3.9 to -52.3 tonnes) in the mentioned period.

Table 1.9: Jewellery demand in selected countries (Tonnes)

Country	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Panel A: Major Consumer Countries of Gold											
India	661.7	619.3	595.2	617.4	627.5	662.3	504.5	601.9	598.0	544.6	315.9
China	492.7	606.6	654.2	1031.3	875.3	825.9	692.9	715.7	743.0	681.8	435.1
UAE	66.9	56.3	49.4	64.4	56.0	51.4	45.2	46.7	36.2	34.0	21.5
Egypt	53.0	34.1	42.1	45.6	45.1	38.3	25.5	22.0	24.6	26.5	19.8
Indonesia	33.4	33.4	35.2	41.2	36.5	38.9	38.4	38.6	41.9	40.4	20.9
Korea	17.8	18.6	16.6	22.9	22.9	25.6	24.1	22.7	21.7	19.5	16.4
Turkey	67.9	73.6	65.9	79.9	68.1	49.0	40.8	41.2	36.4	36.7	26.0
Russia	60.3	64.4	67.7	79.7	67.6	43.1	38.3	39.8	43.0	44.5	33.3
Saudi Arabia	69.9	54.7	49.0	66.4	68.4	69.5	49.4	44.4	39.4	37.9	25.3
Thailand	7.1	6.9	9.1	14.9	12.4	12.2	11.8	11.4	12.1	11.1	5.8
Vietnam	14.2	12.8	10.5	11.8	12.5	15.6	15.4	16.5	18.2	17.3	10.7
United States	122.3	115.9	107.1	112.5	116.6	119.5	118.8	123.7	128.4	131.1	118.2
Panel B: Major Producer Countries of Gold											
Canada	16.7	14.6	13.2	13.2	14.0	14.2	13.8	14.1	14.3	14.4	12.8
Panel C: Key Currencies of Gold											
United Kingdom	26.0	21.4	20.0	21.2	25.7	25.9	25.2	23.1	22.5	21.8	15.7
Japan	20.8	15.9	16.1	17.0	16.4	16.5	16.9	16.6	16.5	17.0	13.8

Source: Metals Focus, Refinitiv GFMS, ICE Benchmark Administration, World Gold Council

Table 1.10: Total bar and coin demand in selected countries (Tonnes)

Country	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Panel A: Major Consumer Countries of Gold											
India	340.1	354.7	319.0	341.2	206.0	194.9	161.6	169.3	162.4	145.8	130.4
China	183.6	266.5	264.1	418.5	208.4	236.3	292.2	314.0	315.4	217.7	208.2
UAE	10.0	11.9	10.7	14.1	9.9	8.7	6.0	5.5	5.8	5.0	5.2
Egypt	2.3	2.3	2.1	7.1	6.0	4.9	2.7	2.5	2.6	2.5	2.2
Indonesia	17.2	27.4	26.4	46.9	26.9	20.1	21.1	20.2	22.2	14.2	16.8
Korea	1.3	7.9	11.4	17.9	16.7	19.9	15.1	18.5	19.3	19.5	19.0
Turkey	40.9	71.9	48.1	104.2	48.6	23.1	29.4	52.4	37.8	52.9	121.0
Russia	0.0	0.0	0.0	0.0	7.9	4.8	3.7	2.5	2.6	3.7	5.0
Saudi Arabia	14.5	17.7	16.9	18.3	15.6	14.9	10.8	9.9	10.2	8.8	8.4
Thailand	64.2	106.6	100.9	138.9	96.4	78.0	69.7	64.0	68.5	35.4	-87.3
Vietnam	68.2	90.6	73.8	87.9	54.2	47.8	42.9	37.4	41.3	39.1	29.1
United States	104.4	82.6	53.1	75.3	48.2	71.1	91.3	35.2	26.1	19.7	66.4
Panel B: Major Producer Countries of Gold											
Canada	3.7	5.9	4.4	6.4	4.4	3.4	4.1	2.9	2.2	3.0	7.6
Panel C: Key Currencies of Gold											
Switzerland	86.9	96.8	62.2	61.7	47.7	50.3	45.6	42.5	36.6	29.8	42.9
United Kingdom	14.8	17.4	15.0	11.5	7.6	8.5	11.9	10.5	12.1	10.5	14.3
Japan	-39.8	-52.3	-11.0	3.9	-2.7	16.2	17.1	-3.3	12.5	-20.1	-9.3

Source: Metals Focus, Refinitiv GFMS, ICE Benchmark Administration, World Gold Council

1.7 Chapter Plan of the Thesis

Chapter 1: Overview of Gold Market and its Role as a Hedge and Safe Haven

This chapter includes the Motivation behind carrying out the study, the Role of the Gold in Monetary system, Demand and Supply patterns of gold, Performance and characteristics of gold as a financial asset, the Classification of countries as per the World Gold Council, and the economic rationale supporting the selection of countries, Gold as a diversifier, hedge and haven against stock and exchange rate.

Chapter 2: Theoretical Background and Literature Review

The chapter deals with the theoretical background underlying the hedge and haven asset, Baur and Lucey hypothetical assumptions, a Review of literature on Gold as a Diversifier asset, Gold as a hedge and safe haven against Stock market-wide indices, Gold as a hedge and safe haven against Sector Indices and Gold as a hedge and safe haven against Currencies.

Chapter 3: Research Design and Methodology

The chapter covers the Problem statement, Research Gap, Research Questions, Objectives, Significance of the Study, Data description, Sample variables, Sample Period, and the Methodology implemented for the study.

Chapter 4: Hedge and Safe haven ability of Gold against Stock Markets of Major gold consuming, Major gold producing, and Key Currency Countries

With the backdrop of theories and definitions, the fourth chapter will give details of empirical results on the performance of gold as a hedge and safe haven against the stock. Data analysis of Gold Consuming Countries, Gold Producing Countries, and Key Currencies countries using quantile and wavelet framework is enumerated in this chapter.

Chapter 5: Hedge and Safe Haven Potential of Gold against Equity Sector Indices of Major Gold Consuming, Major gold producing, and Key Currency Countries

This chapter summarises the estimation results of regression analysis across quantiles and also at specific crisis periods of gold as a hedge and safe haven against sectoral equity indices. Further, wavelet coherency analysis shows hedge and safe haven potential for sectors across time and investment horizons.

Chapter 6: Gold to act as a hedge and safe haven against exchange rate fluctuations of major gold consuming, major gold producing and key currency countries

The sixth chapter of the thesis sets out the hedge and safe haven behaviour of gold against exchange rate fluctuations across quantiles and crisis periods. A discussion has been made on the analytical results of all the proposed methods.

Chapter 7: Findings, Conclusion and Recommendations

Finally, the results discussed in standalone chapters 4, 5, and 6 are precisely compressed into major findings, conclusions, and possible implications and are reported in chapter 7. The future research ideas that are not explored in this study are also highlighted in this chapter as scope for future research.

CHAPTER - 2

Theoretical Background and Literature Review

CHAPTER TWO

Theoretical Background and Literature Review

The outbreak of various crises and increasing heightened risk in financial markets, has posed a serious challenge to investors to search for alternative safe haven assets for safeguarding wealth and risk management in times of market distress. Therefore, the chapter depicts the theoretical strands and reviews of empirical evidence conducted over years through the application of varied quantitative methods on hedge and safe haven potential of Gold. At the initial stage, the chapter discusses the various theories underpinning this work. Subsequently, empirical research conducted so far on hedge and haven aspects of gold against aggregate stock market index, equity sectoral indices and currency fluctuations is summarised.

2.1 Theoretical Background

While the central controversy of this study is to examine the hedging potentiality and a safe haven property of gold against the stock, equity sector index and exchange rates, the premises of this research are linked to the following theoretical underpinning.

2.1.1 Modern Portfolio Theory (MPT)

A whole lot of empirical analysis on portfolio diversification and hedging evolved in the literature are closely linked to the MPT introduced by (Markowitz, 1952). The underlying assumption of MPT is interdependency between assets which leads towards a diversification issues. MPT is based on a quadratic optimisation which implies generating maximum expected returns by diversifying a portfolio risk. The model points out that the risk reduction mechanisms rest on the magnitude and sign of coherence between assets that comprise in a portfolio. The model also holds that the benefits of risk diversification stem only when there is a weak or a negative correlation between assets (gold with stock, equity index and exchange rate). This is typical because under weak or negatively correlated scenarios, the assets are driven by different market factors.

2.1.2 Capital Asset Pricing Model (CAPM)

The estimate of the hedge attributes of gold can also be tested in a CAPM setting given that the gold's beta value is zero as specified by (Baur & McDermott, 2010) and (Reboredo, 2013). The CAPM model is commonly attributed to the asset's correlation or market sensitivity (Sharpe, 1964), (Lintner, 1969). The basic theoretical argument of the CAPM model states the linear relationship between expected returns on assets and associated risk. Further, it assumes that the sum of the expected returns on assets is uncorrelated with the market and a premium for the risk (Adewuyi & Awodumi, 2019). Therefore, under the basic CAPM model, the study examines the gold's interdependency (during normal and turmoil periods) with the investor's diversified portfolio holding assets such as stock, equity index and exchange rate.

2.1.3 Prospect Theory (PT)

The analysis of this study particularly the gold's linkages with the stock, equity index and exchange rate under crisis periods are also grounded in behavioural finance theory such as Prospect theory. The PT of (Kahneman & Tversky, 1979), is attributed to the uncertainty aversion. It describes that the investors give greater emphasis when there is a worst market scenario to rebuild their portfolio by abruptly switching between the assets. As gold is noncontingent to the various factors, the investors view it as a best alternative asset in worst market scenarios (Ghazali , Lean , & Bahari, 2015). This theory purely states how investors evaluate and react differently to gains versus losses during varied market conditions.

In a similar vein, the haven analysis is also reflected in the investors '***Disposition Effect***' that denotes why gold is a short-lived safe haven asset and why it disappears quickly. This is because during the financial episodes if investors thinking is not to realise the losses or fewer gains then they will prefer to sell the asset in the long run that has offered positive returns in the short-run (i.e., at the commencement of the crisis or during a rise in market distress). Thus, the study presumes the extreme price movement in assets during the crisis periods is informative and a motivational base to carry out the analysis.

The novel approach of clearly distinguishing the hedge and a haven property of gold against the stock, equity index and exchange rate during extreme market uncertainty is also related to the applications of '***Extreme Value Theory'*** (Haan & Ferreira, 2006). The Extreme Value Theory (EVT) tool models and measures the risk associated with extreme events. Thus, under the applications of EVT theory, this study approach aims to identify the extreme behaviour of assets during the four major crises and gauge the superiority of gold under such scenarios. Past studies also stated that during such stormy market conditions, investors tend to switch their investments from risk assets to haven assets. This phenomenon is also related to the application of '***flight to safety theory'***.

Lastly, the whole analysis of the empirical research is based on the definition provided by (Baur & Lucey, 2010), (Baur & McDermott, 2010). A detailed discussion about these definitions is outlined in the prior sections.

Against the preceding theoretical background, exploring the possibility of a hedge and safe haven of gold is imperative for market players to devise the appropriate investment decision strategy during varied market conditions.

2.2 Literature Review

A systematic review and a comprehensive analysis of an existing strand of the empirical literature on Gold as a hedge and safe haven asset against fluctuations in aggregate equity indexes, equity sector indexes and foreign exchange rate are depicted in this section.

2.2.1 Hedging effectiveness and Safe Haven ability of Gold against Stock

The concept of hedge and safe haven assets was first coined in the academic literature by (Baur & Lucey, 2010). Accordingly, "a hedge (safe haven) is an asset that is uncorrelated (negatively correlated) with another asset or portfolio on average (only in times of market stress or turmoil)". To ensure the safety of wealth and certainty of investment, there has been a quest to seek safe haven assets in times of turbulent periods. Naturally, gold often provides a shield against heightened downside risk on account of its special characteristics. Gold is well known to be easily standardised, highly durable, universally acceptable, portable, easily divisible (Baur D. G.,

2013) and an asset with zero-beta (McCown & Zimmerman, 2006). Some of the most prominent research articles which have highlighted the value diversifying and hedging ability of gold against various risks are (Capie, Mills, & Wood, 2005), (Baur & Lucey, 2010), (Baur & McDermott, 2010), (Joy, 2011), (Ciner, Gurdgiev, & Lucey, 2012), (Hood & Malik, 2013), (Gurgun & Unalmıs, 2014), (Li & Lucey, 2017), (Iqbal, 2017), (Shakil, Muhammad, Tasnia, & Saiti, 2018), (Ghazali, Lean, & Bahari, 2018), (Bouoiyour, Selmi, & Wohar, 2019), (Beckmann, Berger, & Czudaj, 2019), (Reboredo, 2013), (Kuan-Min Wanga, 2016), (Kuan-Min Wang, Lee, & Nguyen Thi, 2011), (Joscha Beckmann & Czudaj, 2013), (Georgios Bampinas & Panagiotidis, 2015), (C, Ayea, Carcelb, & Gil-Alanab, 2017).

Gold can also offer protection against extreme oil movements. Accordingly, (Reboredo, 2013) carried out a study by applying the copula approach and exhibited the inability of gold to hedge extreme risks in oil prices. While tail independence enumerated the effective safe haven status of gold against severe changes in oil prices. Through a comparative analysis of safe haven assets, (Selmi, Mensi, Hammoud, & Bouoiyour, 2018) tested a hedge, a safe haven and a diversifier property against extreme oil price fluctuations. (Das, Roux, Jana, & Dutta, 2019), indicated that Bitcoin is not the superior asset over other assets to hedge oil-related uncertainties. (Salisu & Adediran, 2020) considered disaggregated dataset developed by (Baumeister & Hamilton, 2019) and alternative empirical techniques for robustness analysis. They found that irrespective of the nature of the oil shock and techniques adopted gold does not act as a hedge against oil shock risks.

Numerous existing studies have documented hedge and safe haven properties of gold for stocks. For instance, (Baur & Lucey, 2010) provided the first operational definition of hedge and safe haven. In their paper, they examined the static and time-varying relations between US, UK and German stock return and gold return and reported that gold is a safe haven for equities in the US, the UK and Germany on average, but not for bonds in any of the markets. According to their findings, gold acts as a safe haven for a limited time, around 15 trading days, suggesting that investors hold gold during extreme equity market conditions.

The definitional approach was further extended to define a strong hedge/safe haven and weak hedge/safe haven (Baur & McDermott, 2010) for the seven largest developed countries (G7), the

largest emerging economies (BRIC) and Switzerland and Australia. The findings evidenced the major role of safe-haven assets in developed markets of Europe and the US but not in emerging BRIC markets, Japan, Canada, and Australia. They also show that during the peak of the recent financial crisis, gold demonstrated safe haven properties in most developed markets, but this is not the case for the Asian crisis. Likewise, (Hillier, et al., 2006) also supported that low correlations strongly offer portfolio diversification and hedging capability of precious metals against abnormal stock market volatility. An application of DCC-GARCH (Engle, 2002) and Quantile Regression, (Ciner, Gurdgiev, & Lucey, 2012) reported traditional hedge properties among bond and equity markets, similarly hedge as well as safe haven status of gold during currency fluctuations, further confirming its monetary asset role. A similar methodological framework (Creti, Joëts, & Mignon, 2013), also reported that dependence among stock and commodity markets evolves over time and is highly volatile during periods of financial turmoil thereby emphasizing on financialization of commodity markets. Meanwhile, the haven property of gold and speculation phenomenon among a few commodities was also evidenced.

Additionally, (Hood & Malik, 2013), tested the ability of precious metals as well as volatility index in offering hedge and safe haven instruments against the stock market in the US. The findings imply that, unlike other precious metals, gold acts as a better hedge and weak safe haven instrument against the stock market in the US. In a nutshell, VIX offers comparatively better hedge and safe haven ability than gold, especially during turbulent times. Similarly, (Lucey & Li, 2015) supported the prominent role of precious metals in risk management during crisis periods. By following the methodological framework by (Baur & McDermott, 2010), (Gurgun & Unalmıs, 2014) extended a study in emerging and developing countries by considering both domestic and international perspectives. From the domestic investor perspective, gold acts as a hedge and haven asset. The findings also hold in the post-global crisis period. Also, using a broad set inclusive of eighteen individual markets and five regional indices (Beckmann, Berger, & Czudaj, Does gold act as a hedge or a safe haven for stocks? A smooth transition approach, 2015), confirmed the market-specific ability of gold as a hedge and safe haven against stocks during two extreme regimes. (Lucey & Li, 2015), also adopted the approach by (Baur & Lucey, 2010) and DCC-GARCH (Engle, 2002) and further confirmed the prominent role of other precious metals in risk management during the crisis periods.

While, (Thomas, Morleya, & Panopou, 2014) by the application of different methodology mainly the Markov regime-switching framework of (Flavin, Panopoulou, & Unalmis, 2008), reported that Gold and longer-dated bond are a potential safe haven asset in times of stock market plunge while 1-year bonds are more sensitive to idiosyncratic shocks and a good hedge against common risk factors. (Choudhry, Hassanb, & Shabi, 2015), reported a significant decline in the safe haven characteristic of gold from the pre-crisis to crisis period in the US, UK and Japan. Hedge property was exhibited against equity portfolio exposure both in its return and volatility. Even (Mensi W. , Hammoudeh, Reboredo, & Nguyen, 2015), used GJR-GARCH (Glosten, Jagannathan, & Runkle, 1993) and the Copula Model and revealed that the Islamic equity index is a dominant hedge and haven asset compared to gold. Moreover, GCC and global equity investors can realise risk reductions by including such vital refuge assets rather than T-Bills in their portfolios. A noteworthy cross-return and volatility effects from gold to Chinese stock markets are exhibited by (Arouri, Lahiani, & Nguyen, 2015). Also, a gold-stock portfolio improves risk-adjusted return, effectively hedges stock market exposure and offers a safe haven advantage in times of crises

The application of the copula approach to capture dependencies by (Nguyen, Bhatti, & Kom, 2016) portrays the safe haven status of gold against a stock market crashes in Malaysia, Singapore, UK, US, Thailand but not for Japan, Indonesia and Philippines. Another study by (Baur & McDermott, 2016), indicated that both Gold and US government bonds offer distinct forms of safety but gold is a riskier alternative asset. Black swan events also exemplify the strong haven effect of gold, also US currencies as a safe haven currency mask safe haven effect of gold. (Basher & Sadorsky, 2016), explained that Oil, VIX or bonds hedge ratios estimated from ADCC is most effective while gold hedge ratios projected from GO-GARCH are best fit to hedge emerging stock market risk. (Chkili, 2016), showed that dynamic correlations shift from positive to negative values with extremely low values during crises implying safe haven characteristics of gold during financial downturn. (Liu, Chang, Wu, & Chui, 2016) findings suggest instantaneous modelling of both safe haven assets namely gold and USD to formulate a joint hedge strategy on account of heavy tail dependence during the stock market crash.

Comparative studies between gold and other precious metals were also carried out. For instance, (Low, Yao, & Faff, 2016), demonstrated that precious metals prove to be an effective hedge and safe haven in Europe, America and Australia while rhodium is considered to be a minor viable alternative. Overall, precious metals offer a better option to shield asset risk in higher volatile scenarios compared to gold. The safe haven nature of precious metals against stock and bonds was revealed by (Li & Lucey, 2017) across developed and emerging countries clustered during certain periods. These periods were characterised based on political, economic and financial uncertainty and findings demonstrated that political uncertainty act as a robust determinant when precious metals are more likely to become safe haven. Additionally, (Bouoiyour, Selmi, & Wohar, 2019), suggested that precious metals namely gold and silver act as diverse haven asset against US stocks both in the medium and long run while bitcoin serves as a weak safe haven only in short run. In contrast, (Klein, 2017) reveals that characteristics of gold and silver as haven seems dissipating after 2013 while platinum act as a surrogate safe haven during market stress.

The robust evidence of the safe haven nature of gold was exhibited against currency risk in India and Pakistan by (Iqbal, 2017). Also hedging potential was seen against inflation in US only during bearish market trends however pieces of evidence on hedging stock market risk were not fairly strong across countries in varying conditions.

A separate strand of studies by (Bhanja & Dar, 2015), (Bredin, Conlon, & Potì, 2015), (Dar & Maitra, 2017), (Bekiros, Boubaker, Uddin, & Nguyen, 2017) employed wavelet coherency to study hedge and safe haven potential at different time and investment horizons. (Bredin, Conlon, & Potì, 2015), gold serves as a hedge and safe haven against traditional investment assets up to the horizon of one year. Diverse results across crises suggested safe haven ability during the Black Money crash in 1987 and global financial crises. But during economic contradictions of 1980 positive coherence exists among assets. Additionally, (Bhanja & Dar, 2015) examined the hedge and haven property of gold for multi-horizon stock market investors of three major gold-consuming countries. The methodological approach of wavelet power and wavelet coherence was applied to test the hedge and safe haven property properties for investors whereas the wavelet coherence and cross wavelet phase angle were applied to assess the relationship between

stock returns and returns in the gold market for both calm as well as turbulent periods. The results indicate that the two assets are not correlated on average and mostly independent for both the calm as well as turbulent periods. Interestingly, (Stelios Bekiros, Boubake, Nguyen, & Gazi, 2017) consider the hedging and diversification role of gold by analysing its interaction with the stock markets of the leading emerging economies, the BRICS. Using a multi-scale wavelet approach and a GARCH-based copula methodology, the results revealed the time-scale co-evolvement patterns and a strong time-varying asymmetric dependence structure between the BRICS stock markets and the gold market. The findings are essential for risk diversification and portfolio hedging strategies among the investigated markets. (Mensi, Hammoudeh, & K, 2016), found a slight dependence structure across short investment horizons while robust asymmetric dependence across both medium and long-run horizons. Besides, gold offers better hedging and safe haven capability across all investment horizons and all GCC markets. The robust methodological approach by (Dar & Maitra, 2017), shows that the two assets are not correlated on average and are independent for both calm and turbulent periods, indicating a weak hedge/safe haven role of gold for multihorizon stock market investors of India, China and US. (Maghyereha, Abdoha, & Awar, 2019), highlighted the potential of gold in diversification and hedging Islamic equities at various investment horizons. Also, gold hedges sukuk risk in both short and medium terms.

Specifically in the Asian context, (Aftab, Shah, & Ismail, 2019) reported the monetary role of gold and substantial evidence of hedge and safe haven against exchange rate risk in the majority of Asian economies except Hong Kong and China. While the diversifier role was exhibited against Asian stock markets except for Korea, Singapore and Thailand. (Shahzad, Bouri, Roubaud, Kristoufek, & Lucey, 2019), used a bivariate cross-quantilogram approach that accounts for heterogeneity across quantiles and exhibits a weak haven status of bitcoin, gold and commodity index, which varies across time and stock indices.

Safe haven assets are particularly pertinent during the episodes of market crashes or crises. The profusion of some studies by (Baur & McDermott, 2010), (Bhanja & Dar, 2015), (Lucey & Li, 2015), (Bredin, Conlon, & Potì, 2015), (Baur & McDermott, 2016), (Aftab, Shah, & Ismail, 2019) has considered string of crises such as Stock market crash in 1987, Asian Crisis in 1997,

Dotcom bubble crises, Global financial crises in 2007-08, European Sovereign debt crises and so on to test the haven property. The haven assets behave quite differently under different crisis periods. Moreover, the outbreak of COVID-19, a current health crisis may have different implications and is further worthy of exploration. A few Studies by (Ji, Zhang, & Zhaoc, 2020) re-evaluated the effectiveness of traditional haven assets against the equity index during an outbreak of COVID-19 distress. The findings of sequential surveillance test and robustness analysis through cross-quantilogram implied weak safe haven ability of bitcoin, forex currencies and crude oil futures. Moreover, gold and soybean commodity futures are validated as a strong safe haven asset during the COVID-19 pandemic. Additionally, (Conlon & McGee, 2020) conducted a timely test on the safe haven potential of bitcoin against S&P 500 during the Covid-19 bear market situation. The empirical results doubt the safe haven property of bitcoin in times of market turmoil as a slight allocation to bitcoin increases the downside risk of a portfolio. The findings are in line with (Conlon, Corbet, & McGee, 2020), who find that Bitcoin and Ethereum will not provide shelter against downside risk in international equity indices during the COVID-19 turmoil.

2.2.2 Hedge and Safe Haven Potential of Gold against Equity Sector Indices of Major Gold Consuming, Major Gold Producing and Key Currency Countries

The majority of previous studies focused on the hedge and safe haven ability of gold against equity market-wide indices. While, equity sector indices might have different inferences on account of a heterogeneous nexus with varied hedge and safe haven assets namely crude oil and other commodities (Arouri, 2012). Accordingly, (Arouri, 2012) specified that “equity sector indices are more beneficial as market aggregations may conceal the characteristics of various sectors”.

Further, there exist a few strands of literature on safe haven assets against equity sector indices. For instance, (Baumöhl & Lyócsa, 2017) analysed the dependence in quantiles from gold to US stock market sector indices. The directional predictability is tested during pre-financial crisis and post-financial crisis. The findings confirmed that safe haven property is largely challenged for most of the sectors except industrials during both periods on account of restricted quantile dependence. While, analysis of the full sample indicates an effective safe haven behaviour of

gold for only three sectors namely IT, Healthcare and Telecommunication. Additionally, (Junttila, et al., 2018) reported that crude oil futures act as an expensive hedging instrument on average whereas in line with previous literature cross hedging and safe haven hypothesis of gold futures was documented against US aggregate and US energy sector equities during stock market crises. In other words, robust time-variation in return correlation between gold and US Stocks appears to be advanced during the crash subsequent to the dot-com bubble burst compared to the crash subsequent to the US housing bubble. Likewise, (Kumar, 2014) found substantial evidence of return spillover rather than volatility spillover from gold to sector stocks in India. The time-varying conditional correlations vary markedly from positive to negative values over time and are observed mainly negative in times of crisis and recession (Dot-com bubble burst, Sub-prime crisis, European debt crisis), signifying broader avenues for portfolio diversification during crisis.

Specifically, focusing on two clean energy stock indices over a data period ranging from 2003 to 2018 (Elie, Naji, Dutta, & Uddin, 2019), investigated the ability of safe haven assets namely gold and crude oil during severe market downturns. It proposed the blended copula approach to model dependence amongst assets. Finally, the results exhibited a prominent haven role of crude oil for extreme movements in the WilderHill Clean Energy Index. While the superiority of gold is exemplified by the S&P Global Clean Energy Index. Similarly, using different Copulas (Beckmann, Berger, Czudaj, & Hoang, 2019) found weak and significant tail dependence between gold and sector-specific stocks of China which enumerated gold's ability to reduce risk in dip times. The robustness checks further confirmed the superior efficiency of gold rather than oil in diversifying a stock portfolio. (Hung, 2020), identified interconnectedness between commodity and financial sector, which provides ready opportunities for risk minimisation through a discretionary portfolio.

Following Cross-quantilogram, (Bouri, et al., 2020) conducted a tail analysis to examine the hedge and haven potential of Cryptocurrencies against US-Market wide and sectoral equity indices. The multifaceted findings support that Stellar, Bitcoin, Ripple and to a minor level Monero and Litecoin show comparatively similar safe haven ability against Equity Indices. Moreover, Ethereum, Dash and Nem act as a hedge only for selected sectors. From the

comparative perspective of gold and bitcoin, (Naeem, Hasan, Arif, & Shahzad, 2020) show that gold exhibits weak hedge for the style and industry portfolio in US. Overall, the findings evidenced superior hedge, safe haven and stable diversifier property of gold over bitcoin for style and industry portfolio.

Moreover, the outbreak of COVID-19, a current health crisis may have different implications and is further worthy of exploration. In the class of conventional safe haven assets, particularly considering COVID-19 crises (Jambotkar & Guntur, 2020) re-evaluated the haven potential against extreme downturns in the stock market energy sector indices. The results confirm the inability of gold to showcase its pronounced hedge and safe haven role before the COVID-19 crises. Specifically, Countries such as Saudi Arabia, Russia and Canada show significant negative predictability from energy sector indices to gold thereby indicating its safe haven role during COVID-19 crises. In similar lines (Salisu, Vo, & Lucey, 2021), studied hedging effectiveness between gold and US sectoral stocks amidst Covid-19 pandemic. The empirical results suggest that inclusion of gold in the stock portfolio maximize the risk-adjusted returns in pandemic times. Concerning the massive scale of upheavals triggered by the enormous outbreak of Covid-19 pandemic, the travel and tourism sector around the world plummeted to its lowest. Accordingly, (Sikiru & Salisu, 2023) found that investors alleviated their investment risk even in travel and tourism sector stocks by investing in the yellow metal. The findings are akin with earlier studies which considered gold to safeguard the event-related risks (9/11 attacks in the US and GFC of 2008) in the travel and tourism sector.

Conversely, given the recent tremendous growth in clean energy stock investments and increased uncertainty (Gustafsson, Dutta, & Bouri, 2022) examined hedge and haven potential of energy metals against clean energy stock returns. The results revealed significant positive associations between energy metals and clean energy stock indices even in periods of high volatility. While results support previous inferences on the hedge and haven ability of gold and silver against certain clean energy stock indices. In similar vein, (Ghabri, Huynh, & Nasir, 2020) also agree that gold can still be trusted as the most promising hedge and robust haven asset as it has shown superiority over bitcoin and tether during recent pandemic times. Consequently, the studies by (Ghorbel & Jeribi, 2021) also concluded that gold serves as a safe haven for all energy and

financial assets during Covid-19 pandemic. The results of portfolio hedging by (Kang, Hernandez, Rehman, Shahzad, & Yoon, 2023) disclosed that gold, oil and US Islamic stocks provide coverage against risk reduction in the real estate equity sector. Additionally, gold is also an immune risk in the financial sector.

A recent study by (Mujtaba, Siddique, Naifar, & Shahzad, 2023) have shown the effectiveness of commodity classes namely (precious metals, energy, agriculture and livestock) against both aggregate and sectoral stock indices of China and United States using quantile regression and cross-quantilogram approach. The findings support the weak safe haven potential of precious metals and agriculture commodities to all sectoral stocks of China and USA. In contrast, other commodities are validated as a weak safe haven only for the health care and Information technology sector. Similarly, a recent study by (Li, Wang, Aizhan, & Karimzade, 2023) has emphasized on the dynamic interplay of gold prices, financial markets, and stock exchange hedging against sector and industry-level market risk. Results revealed that gold safe haven status for stock strengthens as the epidemic worsens and only gold can safeguard against such market volatility.

The pioneering study by (Chopra & Mehta, 2023), adopted a Dynamic conditional correlation approach and demonstrated a strong potential of green bonds, a new asset class to act as a safe haven against high carbon emission sectors across the sample period and against all sectors with the exception of the financial sector in times of Covid-19 period.

2.2.3 Gold as Hedge and Safe Haven for Currency Markets

A considerable amount of economic and financial literature on significant aspects of gold in the economy has been largely tackled in previous studies. Firstly, the majority of studies by (Fortune, 1987), (Sjaastad & Scacciavillani, 1996), (Lucey & Tully, 2006), (Wang & Lee, 2011) examined the effect of and relationship between gold prices and economic variables such as interest rate, foreign exchange rate, income etc.

The second issue deals with the benefits of portfolio diversification, by focusing on the correlation between gold and major asset classes. The results of earlier studies by (Sherman,

1986), (Jaffe, 1989), (Ciner, 2001), (Michaud, Michaud, & Pulv, 2006) suggest a low or negative correlation and benefit of adding gold in asset portfolio.

Thirdly, some studies centered on assessing the hedging effectiveness and safe haven potential of gold concerning stock market fluctuations (Baur & Lucey, 2010), (Baur & McDermott, 2010), (Gurgun & Unalmıs, 2014), (Li & Lucey, 2017), inflation (Taylor, 1998), (Worthington & Pahlavani, 2007), (Wang, Lee, & Thi, 2011), (Beckmann & Czudaj, 2013), (Wang, Lee, & Thi, 2011), (Bampinas & Panagiotidis, 2015), (Shahbaz, Tahir, Ali, & Rehman, 2014), (Aye, Carcel, Gil-Alana, & Gupta, 2017), (Conlon, Lucey, & Uddin, 2018), (Salisu, Ndako, & Oloko, 2019), (Shahzad, Mensi, Hammoudeh, & Sohail, 2019), and as well as against oil price movements (Reboredo, 2013), (Selmi, Mensi, Hammoud, & Bouoiyour, 2018), (Das, Roux, Jana, & Dutta, 2019), (Salisu & Adediran, 2020).

Fourthly, several studies have shown the linkages and volatility spillovers among commodity and currency markets. For instance, an initial work by (Sjaastad & Scacciavillani, 1996) documented that theoretically as well as empirically there exists a link between gold prices and currencies, specifically European currencies which possess high market power and inflations, to bring fluctuations in gold prices. (Antonakakis & Kizys, 2015), investigated return and volatility connection between commodity and currency markets and showed that information contents in precious metals (platinum, silver, gold) and currency pairs (CHF/USD and GBP/USD) can forecast return and volatility in crude oil, palladium, and GBP/USD ad EUR/CHF. Recently, (Mensi, Hernandez, Yoon, & Vo, 2021), revealed asymmetric spillovers among currency-precious metals in the short run, especially in times of increased uncertainty. In similar veins, (Nekhili, Mensi, & Vo, 2021), confirmed a time-varying, asymmetric and crisis-sensitive spillover amongst commodity and currency markets, with more pronounced effect in the short run compared to the long run.

Another strand of literature emphasises on hedge and safe haven ability of gold against currency depreciation. The idea of gold as a potential hedge against currency fluctuations is not new and is addressed in a few studies. Globalisation and increased trade beyond national boundaries have posed a severe Forex risk exposure and increased devaluation of currency value. Thereby,

shifting the attention of the investors to deal with these risks. As indicated by (Santis & Gérard, 1998) and (Hau & Rey, 2005) forex risk is substantial enough to quest for safe-haven assets.

The potential of gold to hedge against exchange rate fluctuations can be done in two ways; explicitly against the internal and external purchasing power of that currency (Nguyen, Bedoui, Majdoub, Guesmi, & Chevallier, 2020). Gold acts as an internal currency hedge, when appreciation in its value offsets the losses owing to the inflation of that country. Several studies adopted this way namely (McCown & Zimmerman, 2006), (Blose, 2010), (Wang & Lee, 2011) (Beckmann, Belke, & Dobnik, 2012). The second aspect deals with gold as an external hedge i.e., the ability of the gold to resist against the deprecation in the forex rate of that specific country. Hedging ability of gold against the external purchasing power of currency is rarely explored in previous literature (Sjaastad, 2008), (Capie, Mills, & Wood, 2005) with robust evidence on relationship between the price of gold and USD depreciation and some by (Joy, 2011) and (Reboredo, 2013) also confirming hedge or safe haven status of gold against US dollar depreciation.

Some of the earlier studies by (Capie, Mills, & Wood, 2005), assessed the extent to which gold act as a hedge against exchange rate risk by considering gold price and sterling–dollar and yen-dollar exchange rates over a period ranging from 1971 to 2004. Using the Autoregressive Distributed Lag Model (ARDL) and Exponential GARCH process (EGARCH), the study confirmed an inverse relationship between exchange rate and gold prices with a variation over time. Further, it concluded that gold had been a hedge against the dollar, though the extent varies over time. Such interplay of gold and currency dynamics is possible as, gold acts as an inflation hedge and thereby offers safety against dollar devaluations, as further supported by (Hammoudeh, Sari, & Ewing, 2009). Considering dynamic correlation among multiple asset classes, (Ciner, Gurdgiev, & Lucey, 2013) reported hedge properties of gold against bond and equity markets. Similarly, consistent hedge and safe-haven status of gold was observed during currency fluctuations in both US and UK markets which thereby confirmed its monetary asset role. In contrast, (Wang, 2013) considered a range of major currencies (Australian Dollar, Canadian Dollar, Euro, Indian rupee, Japanese yen, South African rand, and British pound) and suggested weak value preserving ability of gold in times of dollar devaluations. Along similar

lines, (Sari, Hammoudeh, & Soytas, 2010) suggested the potential for diversification on account of no long-run but short-run association between precious metals and foreign exchange rates. (Erb & Harvey, 2013) critically studied the ability of gold in asset allocations including adversity protection in stock, exchange rate hedging and inflation hedging, found meagre evidence as an inflation hedge and currency hedge argument is merely supported by the data.

Moreover, (Wang & Lee, 2011) examined the hedging potential of gold against exchange rate risk in Japan and concluded that the hedging effectiveness of gold for yen depends upon the extent of yen depreciation. (Joy, 2011), investigated the role of gold as an investment hedge or haven against the dollar using data for 16 major dollar-paired exchange rates. Through the application of the multivariate GARCH model of dynamic conditional correlations (DCC-GARCH Model) on a sample period covering 1986 to 2008, the analyses reported that gold served as an effective hedge but a poor safe haven against exchange rate risk in terms of the US dollar. Likewise, (Pukthuanthong & Roll, 2011) indicated that the gold price is also linked to the depreciation of the currency in all countries.

Applying the Standard Copula techniques (Reboredo, 2013), examined whether gold acts as a hedge or haven by considering a wide set of currencies (Australian dollar, Canadian dollar, euro, British pound sterling, Japanese yen, Norwegian krona, and Swiss franc) against the dollar. The empirical evidence revealed a positive and significant average and symmetric tail dependence implying that gold acts as an effective hedge and safe haven. The analyses of portfolio risk management through gold-currency portfolios provide benefits of diversification and downside risk reduction. The follow up study was carried out by (C, Reboredo, & Rivera-Castro, 2014), through the same data set and sample period to provide deeper insights. The results of Likelihood ratio test indicate that gold acts as a hedge but a weak safe haven against extreme dollar fluctuations.

More recently (Wang & Lee, 2016), studied the ability of gold to hedge against exchange rate fluctuations risks in the major gold producing, gold consuming, and key currency countries. The analyses over the time span from January 1999 to March 2015 through the dynamic panel threshold model reveal that currency fluctuations cause threshold effects and impact the hedging ability of gold. To estimate the time horizon hedging properties of gold, analyses were conducted

on different frequency data and the results evidence that except quarterly data, the weekly and monthly data results shows that the hedge effect is more pronounced in the major gold-consuming countries compared to the major gold-producing countries.

Recent contributions in this domain embrace citing among a few, (Nguyen, Bedoui, Majdoub, Guesmi, & Chevallier, 2020), (Wang & Lee, 2020)**,** (Chemkhaa, BenSaïda, Ghorbel, & Tayachi, 2021) and (Mensi, Ali, Vo, & Kang, 2022). With an application of copula theory, (Nguyen, Bedoui, Majdoub, Guesmi, & Chevallier, 2020) extend the hedge and haven potential of gold against the depreciating value of EUR and JPY besides USD. The results document an effective hedge against currency devaluation and the robust value preserving capacity of gold in times of high uncertainty periods. Unlike previous studies by (Joy, 2011), (Reboredo, 2013), (Qureshi, Rehman , & Qureshi , 2018), (Wang & Lee, 2020) introduce the time-varying parameter VAR approach (TVP-VAR) framework with stochastic volatility to assess the ability of gold to eliminate the currency risk in the short run as well as in country specific shocks at specific times. They reported that gold can act as hedge against exchange rate risk and a safe haven against dynamic risk for the euro, dollar and pound only in the short run. While, the Japanese yen being safe haven currency appreciates as international risks escalate; masking the safe haven effect of gold. Additionally, (Chemkhaa, BenSaïda, Ghorbel, & Tayachi, 2021) used asymmetric dynamic conditional correlation model and showed evidence in favour of gold over bitcoin in preserving its role as weak safe haven asset against world major stock indices (S & P 500, Euro Stoxx 50, FTSE 100) and major currencies quoted in US Dollar (Euro, JPY, and GBP) during COVID-19 crisis. Research by (Mensi, Ali, Vo, & Kang, 2022), found low and negative dependence in extreme quantiles and thereby indicated that all precious metals are good candidates to hedge against all major currencies.

2.3 Major Observations derived from literature and concluding remarks

Gold's potential as a hedge and safe haven is asset-specific, market specific and event specific. The role of gold as a hedge or safe haven asset is not universal. It varies across different markets, asset classes, sectors as well as across varied crisis periods.

Several researchers have tested the ability of gold as a refuge asset to offset the losses of investors and have provided inconclusive evidence. For Instance; (Ji, Zhang, & Zhao, 2020) have highlighted that gold and soybeans serve as trusted robust safe haven assets compared to crude oil, commodity, currency and bitcoin. Studies by (Akhtaruzzaman, Boubaker, Lucey, & Sensoy, 2021), (Boubaker, Cunado, Gil-Alana, & Gupta, 2020), (Jana & Das, 2020) (Salisu, Vo, & Lucey, 2021) supports long-standing safe haven potential of gold. While, counter-evidence by (Cheema, Faff, & Szulczyk, 2020) challenged haven characteristics of gold. Furthermore, many preceding studies documented widespread attention received by gold as leading haven asset (Baur & McDermott, 2010), (Baur & Lucey, 2010), (Ciner, Gurdgiev, & Lucey, 2013), (Lucey & Li, 2015), (Beckmann, Berger, & Czudaj, 2015). While, (Raza, 2017) claim that gold potential as safe haven in short lived and has eroded during GFC and EDC which was quite surprising and disappointing from analyst perspective (Bredin, Conlon, & Potì, 2015). The above shreds or pieces of evidence provides inconclusive evidence and therefore needs reassessment.

The Profusion of studies conducted a decade ago (Baur & McDermott, 2010), (Gurgun & Unalmıs, 2014), (Bredin, Conlon, & Potì, 2015), (Beckmann, Berger, & Czudaj, 2015), (Li & Lucey, 2017), (Wen & Cheng, 2018), (Aftab, Shah, & Ismail, 2019), (Beckmann, Berger, & Czudaj, 2015) concentrated on hedging and safe haven possibilities of gold considering different markets or regions (developed, emerging or standalone markets or by considering trade blocks or specific countries). So, the study contributes to the hedge and safe haven ability of gold by considering countries which are strategically linked to gold can provide additional insights.

A range of methodological frameworks has been adopted in previous literature. While Market participants have heterogeneous expectations due to their heterogeneous nature, diverse risk profile and diverse objectives. For instance, institutional investors and policymakers are more inclined to long-term situations while speculators and market makers are interested in short-term situations. Adopting a multiscale perspective across time and investment horizons through wavelet coherence can provide interesting results.

Safe haven assets are particularly pertinent during the episodes of market crashes or crises. The profusion of some studies by (Baur & McDermott, 2010), (Bhanja & Dar, 2015), (Lucey & Li, 2015), (Bredin, Conlon, & Potì, 2015), (Baur & McDermott, 2016), (Aftab, Shah, & Ismail,

2019) has considered string of crises such as Stock market crash in 1987, Asian Crisis in 1997, Dotcom bubble crises, Global financial crises in 2007-08, European Sovereign debt crises and so on to test the haven property. The haven assets behave quite differently under different crisis periods. Moreover, the outbreak of COVID-19, a current health crisis may have different implications and is further worthy of exploration.

There is limited evidence about the hedging potential of gold at the sector level than at the aggregate level. Even studies at the sector level are confined to specific countries mostly US (Bouri, Shahzad, & Roubaud, 2020), (Baumöhl & Lyócsa, 2017), (Elie, Naji, Dutta, & Uddin, 2019), (Junttila, Pesonen, & Raatikainen, 2018), China (Beckmann, Berger, Czudaj, & Hoang, 2019), (Salisu, Vo, & Lucey, 2021), India (Kumar, 2014). Precisely, the majority of studies focused were sector specific mostly considering the energy sector (Elie, Naji, Dutta, & Uddin, 2019), (Junttila, Pesonen, & Raatikainen, 2018), (Jambotkar & Guntur, 2020) and hospitality (Sikiru & Salisu, 2023) while the rest of the sectors were rarely explored.

With an increased financial integration on account of free global financial flows, it will be difficult to reduce and minimise risk even at the sector level. Further, given the severity caused by substantial turmoil and the increased economic uncertainty in financial markets, there is a quest to reassess the potential of traditional assets as hedge and haven assets.

Considering the extant literature, the study makes an attempt to evaluate the hedge and haven potential of gold across different crisis, time and investment horizons and also different countries which are strategically linked to gold.

CHAPTER - 3

Research Design and Methodology

CHAPTER THREE

Research Design and Methodology

The chapter covers the Problem statement, Research Gap, Research Questions, Objectives, Significance of the Study, Data description, Sample variables, Sample Period and the Methodology implemented for the study.

3.1 Statement of the Problem

The financial markets are often prone to unprecedented risk and uncertainties on account of worldwide turmoil. This frequent economic and financial crisis has led to a large swing in financial asset prices, exchange rates and economic activities, which left to the investors the control of financial risk optimisation is more challenging. Furthermore, massive advancement in technological and information channels has given a rise to transmission of cross-border uncertainty in the financial assets (stocks and sectors in domestic market). Similarly, growing up of cross-market trades led by rapid globalization hit a huge exposure to exchange rate risk, which is a great worry for investors and regulators. Therefore, the shattered investor's faith and disastrous losses in global financial markets stimulate the quest among investors to explore alternative refuge assets to mitigate risk and shelter their investment during such a crisis. Safe haven assets are therefore pertinent during episodes of market crashes or crises.

Theoretical underpinning points out that offsetting downside risk and optimising portfolio diversification depends upon the strength of coherency and sign of the correlation between the assets. Accordingly, investors design an investment portfolio. For a decade, investors have often seen commodities as a remedy for protecting equity portfolios under challenging circumstances. The profusion of some studies by (Baur & McDermott, 2010), (Bhanja & Dar, 2015), (Lucey & Li, 2015), (Bredin, Conlon, & Potì, 2015), (Baur & McDermott, 2016), (Aftab, Shah, & Ismail, 2019) has considered a string of crises such as a Stock market crash in 1987, Asian Crisis in 1997, Dot com bubble crises, Global financial crises in 2007-08, European Sovereign debt crises and so on to assess the hedge and haven property. However, the value of an alternative safe

haven asset may not be universal. Hence, the safe haven potential is dynamic and may change over time or may depend upon fundamental characteristics of the market or the nature of turmoil. The safe haven assets behave quite differently under distinct crisis periods. Moreover, the outbreak of COVID-19, a recent health crisis, is diverse from all other preceding crises and may have different inferences. Therefore, considering the COVID-19 crisis may provide additional insight and is further worthy of exploration. More specifically and historically, many argued that gold remained to be a central cornerstone for investors and a safe haven asset. This is reasoned out by stating that, unlike other conventional assets, gold is verified to be a potential value asset. This phenomenon has given rise to the question of how differently gold appealed as a hedge and a safe haven against other financial assets in response to the financial episodes and normal market conditions across the gold trade-involved countries.

3.2 Research Gap

From the empirical research, there exists comprehensive evidence that points out the superiority of gold as a store of value or an alternative asset to safeguard wealth in periods of market turbulences. The safe haven and hedging ability of conventional assets, namely gold, has been documented mostly in the context of developed, emerging and developing financial markets. Even studies were conducted by considering Asian countries, BRICS countries and G7 countries. However, against this brief background, this study contributes to the preceding literature by modelling the hedge and safe haven role of traditional yellow metal against the aggregate stock indices, sectoral indices and exchange rates of countries being strategically linked to gold (major gold consuming countries, major gold producing countries and key currency countries) which is viewed to be relatively scarce in the literature. More specifically, we looked at the research theme from a domestic perspective and tested the hedge and safe haven behaviour of gold over a time frame from January 2000 to March 2020.

Majority of past literature concentrated on the hedge and safe haven ability of gold against aggregate equity indices, which are representative of major market participants. However, due to the frequent upheaval in the rise, the switching of investment from aggregate domestic stocks to disaggregated sector level has been quite prominent over the last decades. While, equity sector-wide indices might have diverse implications on account of heterogeneous links with varied

refuge assets, namely crude oil and other commodities (Arouri, 2012). Moreover, analysis using equity sector indices is crucial to find out diversification benefits on account of information transmission and dispersal of policy decisions across diverse asset classes and markets. Similarly, market aggregations undermine the heterogeneous profiling of equity market fundamentals. While equity sector analysis shows that diverse sectors respond differently to the hedging ability of gold. In line with the previous literature, the study attempts to understand the potential of gold as a hedge and haven asset against the salient attributes of numerous sectors. The outcome of the study will be therefore valuable for investors in portfolio construction and diversification of risk across different sectors. An understanding of hedging effectiveness and safe haven abilities of refuge assets is therefore significant to draw inferences to design portfolio management strategies.

Furthermore, over the years, the fusion of the rising value of gold and large fluctuations in the currency values on account of the expansion of boundaries for worldwide trade fascinated risk managers and financial analysts to trace the links amongst these assets. This approach also allowed to test the hypotheses of the hedge and safe haven attributes of gold against exchange rates during normal and extreme market severity.

The financial market participants have different purposes, heterogeneous preferences and diverse risk profiles. Thus, their behaviour differs across short, medium and long-run horizons, which can be captured by time-frequency techniques. To trace such hidden changes between alternate assets and stocks across various frequency components and investment horizons a novel wavelet approach has been used. The robustness test through wavelet analysis is needed to simultaneously confirm the richer characterisation of hedge and safe haven ability in both calendar time and frequency horizons.

3.3 Significance of the Study

Over the last few decades, the global financial market has sworn to a string of many crises. Mapping the impact of these crises, a conjecture set up in mind is of the excessive spread of volatility in the financial market, mainly stock and quest for alternative investment assets. Historical experience shows that gold always portrays a positive and upward trend when a

country's financial market assets spike large volatility. This research focuses on the analysis of four major crises, such as DCBB, GFC, EDC and Covid-19, during which the world experienced high turmoil and uncertainty in the financial system rose to an unprecedented level. Thus, this interest is well-placed to evaluate gold's function as a hedge and a safe haven on a multi-time scale. Therefore, this research contribution is significant to various market participants in understanding gold hedging and safe haven perspectives in major gold-producing, consuming and key currencies countries against financial assets such as stock, equity sectors and exchange rates in different market scenarios.

1. Given that the financial market is closely connected to the unpredictability and volatility factors, the investors and the portfolio managers are highly concerned with uncertainty while making their investment decisions. In that sense, this study offers several implications to traders, portfolio managers, financial analysts and institutional investors for asset allocation decisions and portfolio risk management. For example, times of negative correlation between gold and financial assets such as stocks, equity sectors and Forex in each country provide an opportunity for optimizing hedging strategies. More specifically, the evidence of the hedging potential of gold could help investors reduce losses caused by inflation. On a similar note, while articulating portfolio strategies, investors in each country may earn better return premiums by keeping investments in low or negatively correlated assets during both normal and turbulent market scenarios. On the other front, the appeal of gold as a safe haven coincides with the financial crises, will assist investors to a greater extent for value protection and keep the portfolio investment less volatile. Moreover, the precise knowledge about equity sectors exposed to price volatility and the intriguingly high efficiency of gold as a hedge and a safe haven will immune the portfolio investment ranging from aggregate country-level stocks to disaggregated equity sector risk.
2. The above view is also significant to even the government to increase the gold reserves and accumulate the gold at a lower price variation, which can lead to strengthening the public finance in the country.
3. This study is also expected to be of interest to monetary authorities in major gold-producing, consuming and key currencies countries. The large chunk of the fund invested in gold due to inflationary pressure or during market adversity could be mobilized by introducing

alternative safe assets in the economy. Although gold is an instrument used for hedging against inflation, simultaneously, a large hoarding of gold may also lead to a decline in the volume of financial resources for a country's economic growth and development.

4. Lastly, globalization has also expanded the boundaries for international trade, which is inevitable and exposed to exchange rate risk. Given the higher volatility in financial assets (stocks, equity sectors and forex) of the progressing economy and the relatively higher yield on fixed-income securities of developing countries than that of advanced countries, portfolio investors are holding assets in these growing markets, which makes them exposed to cross-border transaction risk factors predominantly exchange rate risk (Wang & Lee, 2022). Therefore, worry about minimizing such exposure during different market conditions and determining whether gold could be treated as a hedge and a safe haven against the country's exchange rate risk is a critical concern for investors and national govt.

3.4 Research Questions

With the frequent occurrence of different natures of the crisis and with the rapid expansion of globalization and integration on the other side, the risk posed to financial assets has increased. Thus, it is vital to uncover the landscape of financial asset exposure to risk and the safe haven attributes of gold. Furthermore, the different series of financial episodes have given rise to the common perception that gold's appeal as a hedge and a safe haven may differ according to the intensity of the shock. Therefore, in line with these assumptions, the premises of this research are based on the aforementioned research questions;

1. First, the key question is, how do the major gold-producing, consuming and key currencies countries gold behave in conjunction with the stock, equity sectors and exchange rate on its normal and worst performing days?
2. Is gold investment a better tactical play with regard to the stock of major gold-producing, consuming and key currencies countries? Furthermore, while the quest for a safe haven asset is appealing during the market uncertainty, another question arises whether the gold attributes of a safe haven differ from one crisis to another?

3. In each major gold-producing, consuming and key currencies country, for which equity sector fluctuations gold is a suitable hedge and a safe haven? Further, we seek to investigate whether this ability of gold varies in different periods of stock market fluctuations.
4. As the ultimate step for the analysis, the study also explored the research question of whether and to what extent gold is a safe haven and is effective as an exchange rate hedge?
5. Concerning the complete discussion, the last question at hand is to what extent gold benefits as a hedge and a safe haven to the portfolio managers and investors during varying market conditions?

3.5 Research Objectives

1. To examine the hedge and safe haven ability of Gold against aggregate Equity Indices of Major Gold Consuming, Major Gold producing and Key Currency Countries.

2. To investigate the hedge and safe haven potential of Gold against Equity Sector Indices of Major Gold Consuming, Major Gold producing and Key Currency Countries.

3. To study the ability of Gold to act as a hedge and safe haven against Exchange rate fluctuations of Major Gold Consuming, Major Gold producing and Key Currency Countries.

3.6 Research Hypothesis

3.6.1. To examine the hedge and safe haven ability of Gold against aggregate Equity Indices of Major Gold Consuming, Major Gold producing and Key Currency Countries.

H_0: Gold has a positive co-movement with equity market-wide indices on average (no hedge) and during market stress (no safe haven).

H_1: Gold has a negative co-movement with equity market-wide indices on average and is termed as a hedge.

H_2: Gold has a negative co-movement with equity market-wide indices in the episodes of financial downturns and is treated as a safe haven asset.

3.6.2. To investigate the hedge and safe haven potential of Gold against Equity Sector Indices of Major Gold Consuming, Major Gold producing and Key Currency Countries.

H_0: Gold has a positive co-movement with equity sector indices (no hedge) and during market stress (no safe haven).
H_1: Gold has a negative co-movement on average with equity sectoral indices and can serve as a hedging tool.
H_2: Gold has a negative co-movement with equity sectoral indices in times of market stress and can be bestowed as a safe haven asset.

3.6.3. To study the ability of Gold to act as a hedge and safe haven against Exchange rate fluctuations of Major Gold Consuming, Major Gold producing and Key Currency Countries.

H_0: Gold is not a hedge and a safe haven asset against currency fluctuations.
H_1: Gold is a hedge and safe haven asset against currency fluctuations.

3.7 Research Methodology

3.7.1. Hedge and Safe haven Ability of Gold against aggregate Equity Indices of Major Gold Consuming, Major Gold Producing and Key Currency Countries

Data Sources

The study relies on a dataset that comprises daily observations of gold prices and Stock market indices. The data for gold spot prices were obtained from the World Gold Council (WGC) and is expressed in the respective local currency of each country. Daily closing prices of Stock market indices of respective countries are all denominated in their local currency and are collected from Bloomberg. Although there are multiple aggregate stock market indices concerning some of these countries. Only major stock indexes which are widely used in previous literature were selected and the information about the same is presented in Table 3.1.

Sample Period and Sample Variables

The Sample countries are classified into three main panels based on the World Gold Council Classification. Panel A comprises of Twelve Major Gold Consuming Countries such as India, China, United Arab Emirates, Egypt, Indonesia, South Korea, Turkey, Russia, Saudi Arabia, Thailand, Vietnam and the United States. Panel B includes five major Gold Producing countries namely Australia, Canada, China, South Africa and the United States and Panel C consists of five International Key Currency Countries such as Canada, Switzerland, the United Kingdom, Japan and the United States.

The sample period covers from 1st January 2000 to 31st March 2020 and therefore encompasses four major turmoil's namely the Dot com bubble burst, the Global Financial Crisis, the European debt crisis and COVID-19 crisis. The choice of crisis is based on two motivations. Firstly, some previous research reveals that these tensions significantly influenced stock markets and consequently, the dynamic relationship between commodity and stock prices. (Hood & Malik, 2013) (Creti, Joëts, & Mignon, 2013). Secondly, these crises are also employed in previous literature to determine the hedge and safe haven property of various asset classes. As indicated by the contagion literature, it is not straightforward to determine the outburst and the end of a crisis (Dungey, Fry, Martin, & Gonzalez-Hermosillo, 2004). So, it is vital to select the crisis periods and define its start date and the length. We define 1st March 2000 to 31st October 2001 (Bhanja & Dar, 2015) (Dar & Maitra, 2017), 1st August 2007 to 31st March 2009 (Baumöhl & Lyócsa, 2017), 1st January 2010 to 31st December 2011 (Chkili, 2016), 31st December 2019 to 31st March 2020 (Jambotkar & Guntur, 2020) as a start date and end date for Dot com bubble burst, Global Financial Crisis (GFC), European debt crisis and Covid-19 crisis respectively. Further, the data period is consistent across all countries except for the United Arab Emirates and Vietnam. The data for these countries in the sample starts from 30th September 2001 and 28th July 2000 respectively and ends on 31st March 2020. The returns for the stock prices and gold prices are estimated as $r(t) = \ln(P(t) / P(t-1))$, wherein r(t) stands for returns at the time t and P(t) and P(t-1) stands for prices at the time t and t-1 respectively.

Table 3.1 Classification of Countries and their Stock Market Index

Countries	Equity Index
Panel A: Major Gold Consuming Countries	
India	NSE NIFTY Fifty Index
China*	SHCOM Index
United Arab Emirates	ADSMI Index
Egypt	EGX 30 Index
Indonesia	JKSE Composite Index
South Korea	KOSPI Index
Turkey	BIST 100 Index
Russia	MICEX
Saudi Arabia	SASIDX
Thailand	STI Index
Vietnam	VN-Index
United States*	S&P 500 Index
Panel B: Major Gold Producing Countries	
Australia	S&P ASX 200 Index
Canada*	SPTSE Index
China*	SHCOM Index
South Africa	JALSH Index
United States*	S&P 500 Index
Panel C: Key international currency Countries	
Canada*	TSX Composite Index
Switzerland	SMI Index
United Kingdom	FTSE 100 Index
Japan	Nikkei 225 Index
United States*	S&P 500 Index

Note: ******* indicates that the United States (US) is a part of all three Panels, China is included in two groups (Major Gold producing as well as Major Gold Producing), and Canada is also part of two panels (Major Gold Producing and Key currency countries). For the sake of brevity, they are shown in only one group for analysis.

3.7.2. Hedge and Safe Haven Potential of Gold against Equity Sector Indices of Major Gold Consuming, Major Gold Producing and Key Currency Countries

Data Sources:

To address the widely mooted hedge and safe haven property of gold against extreme downturns in the stock market sector indices, the secondary data source is considered. This study relies on a dataset that comprises daily observations of gold prices and sector stock indices of twenty-two countries being strategically linked to gold (Major gold consuming countries, Major gold producing countries and Key Currency countries). The data for gold spot prices were obtained

from the World Gold Council (WGC) and daily closing prices of equity sector indices of respective countries all denominated in their local currency were extracted from Thomson Reuters DataStream.

Sample Period and Sample Variables

The sample constitutes the equity sector indices of Twenty-two countries which include Twelve Major gold consuming countries (India, China, United Arab Emirates, Egypt, Indonesia, South Korea, Turkey, Russia, Saudi Arabia, Thailand, Vietnam and the United States), Five major gold producing countries (Australia, Canada, China, South Africa and United States) and Five Key Currency countries (Canada, Switzerland, United Kingdom, Japan and United States). Furthermore, ten equity sector indices were used namely Consumer Discretionary (CD), Consumer Staples (CS), Energy (EN), Financials (FIN), Health Care (HC), Industrial (IND), Information Technology (TECH), Telecommunication (TEL), Basic Materials (BM) and Utility (UT) classified on basis of Datastream report 2020.

In order to get a consistent sample across all countries and sectors, a data span from 1st January 2000 to 31st March 2020 is considered. The inception date for UAE, Saudi Arabia and Vietnam sectoral indices data differs resulting in different data frames. The data for UAE sector indices are available from 31st December 2003, data about Saudi Arabia sector indices are available from 3rd October 2005, while data on Vietnam sector indices start from 2nd April 2007. In consequence, for the above-mentioned countries, the data period begins from the date of inception and ends on 31st March 2020. More information on selected sample countries and their sector indices are presented in Table 3.2.

For each data series, returns were calculated by taking natural logarithms of the proportion of two consecutive daily prices.

Table 3.2 Selection Criteria for Sample Countries and their Sector Indices

Country	Sector									
	CD	CS	EN	FIN	HC	IND	TECH	TEL	BM	UT
Panel A: Major Consumer Countries of Gold										
India	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
China*	✓	✓	✓	✓	✓	✓	✓	×	✓	✓
UAE	✓	×	×	✓	✓	✓	×	✓	×	×
Egypt	✓	✓	×	✓	✓	✓	×	✓	✓	✓
Indonesia	✓	✓	✓	✓	✓	✓	×	✓	✓	×
South Korea	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Turkey	✓	✓	✓	✓	×	✓	×	✓	×	✓
Russia	✓	×	✓	✓	×	×	×	✓	×	✓
Saudi Arabia	✓	✓	×	✓	×	✓	×	✓	✓	✓
Thailand	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Vietnam	×	✓	×	✓	✓	✓	×	×	×	✓
USA*	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Panel B: Major Producer Countries of Gold										
Australia	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Canada*	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
South Africa	✓	✓	✓	✓	✓	✓	✓	✓	✓	×
Panel C: Key Currencies Countries of Gold										
Switzerland	✓	✓	×	✓	✓	✓	✓	✓	✓	✓
UK	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Japan	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Note: The symbol ✓ represents the sector Index considered for examining hedge and safe haven roles and × indicates the sector index of the respective countries dropped from analysis owing to either improper or limited availability of data. ***** indicates that the United States (US) is a part of all three Panels, China is included in two groups (Major Gold producing as well as Major Gold Producing), and Canada is also part of two panels (Major Gold Producing and Key currency countries). For the sake of brevity, they are shown in only one group for analysis.

3.7.3 Gold to act as a Hedge and Safe haven against Exchange rate fluctuations of Major Gold Consuming, Major Gold Producing and Key Currency Countries

Data Sources

To investigate the hedging potential of gold against currency risk, the study considered the daily prices of gold denominated in terms of the local currency of each country retrieved from the World Gold Council Value Research & Statistics Database. While, exchange rate data relative to USD are sourced from the Bloomberg database. An exchange rate increase indicates the appreciation of USD and depreciation of local currency and vice versa.

Sample Period and Sample Variables

The sample period spans from 1st January 2000 to 31st March 2020, comprising 5283 daily observations. The period is marked with major global economic and financial turmoil. In order to capture the effect of crisis, the data is split into subsamples. Moreover, four subsamples were adopted by creating dummies. The first subsample is the span of the internet bubble burst that ranges from 1st March 2000 to 31st October 2001, second subsample is marked with Global financial crisis that spans from 1st August 2007 to 31st March 2009, the third sample period is concerning European debt crisis that ranges from 1st January 2010 to 31st December 2011. The cluster of COVID-19 cases was first stated in December 2019, so the fourth sub-sample is the COVID-19 period that spans from 31st December 2019 to 31st March 2020. The dating of subsamples resembles the dating applied in section 3.1.

A detailed description of Sample Countries and their Currency Codes is exhibited in Table 3.2. The United States is excluded from the analysis as the local currency of each country is denominated interms of U.S. dollars. So, apparently, there are a total seventeen sample countries which includes eleven major gold consuming countries, four major gold producing countries and four key currency countries. The exchange rate data and gold prices are analysed by considering the natural logarithm of each series.

Table 3.3 Sample Countries and its Currency Codes

Major Gold Consuming Country (Currency)	Currency Code	Major Gold Producing Country (Currency)	Currency Code	Key Currency Country (Currency)	Currency Code
India (Indian Rupee)	INR	Australia (Australian Dollar)	AUD	Canada* (Canadian Dollar)	CAD
China* (Chinese Yuan -Renminbi)	CNY	Canada* (Canadian Dollar)	CAD	Switzerland (Swiss Franc)	CHF
United Arab Emirates (Dirham)	AED	China* (Chinese Yuan - Renminbi)	CNY	United Kingdom (British Pound)	GBP
Egypt (Egyptian Pound)	EGP	South Africa (South African Rand)	ZAR	Japan (Japanese Yen)	JPY
Indonesia (Indonesian Rupiah)	IDR	United States* (US Dollar)	USD	United States* (US Dollar)	USD
South Korea (South Korean Won)	KRW				

Turkey (Turkish Lira)	TRY				
Russia (Russian Ruble)	RUB				
Saudi Arabia (Saudi Arabian Riyal)	SAR				
Thailand (Thai Baht)	THB				
Vietnam (Vietnamese Dong)	VND				
United States* (US Dollar)	USD				

Note: ******* indicates that the United States (US) is a part of all three Panels, China is included in two groups (Major Gold producing as well as Major Gold Producing), and Canada is also part of two panels (Major Gold Producing and Key currency countries). For the sake of brevity, they are shown in only one group for analysis.

3.8 Statistical and Econometrics Estimation Models

3.8.1 Summary Statistics

Summary statistics comprises a series of statistical tools used to identify the characteristics of data. The behavioural specifications of data are estimated using five statistical properties as Mean, Standard deviation, Skewness, Kurtosis and Jarque-Bera Test. The mean and standard deviation indicators measure the returns performance with the associated volatility or variability for all the variables. The kurtosis and skewness value illustrates the tail and symmetric/asymmetric distribution of data. The Jarque-Bera test (JB) demonstrates the normality in the data series. This test statistics takes the following equations;

$$JB = n [S^2/6 + (K-3)^2/24]$$

Where, n = number of observations, S stands for Skewness (S=0) and K denotes Kurtosis (K=3)

3.8.2 Correlation Test

Further at a ground stage, the correlation test allows capturing the preliminary insight on the co-movement of gold with stock, equity sectors and exchange rate. The correlation approach determines the strength of association established within a range of 0 to +/- 1 (Koop, 2006). If

the 'r' coefficient value in the equation is zero, then it illustrates no correlation between the assets. If it is positive and near to 1, it indicates a strong positive co-movement, and a negative coefficient near 1 denotes a perfect negative correlation. The simple correlation test shows the following equation;

$$r = \frac{COV\ (GR,OFAR)}{\sigma GR\ \sigma OFAR}$$

The COV (GR, OFAR) represents the covariance between gold returns and other financial asset returns (stocks, equity sectors and exchange rate). The σGR σOFAR highlights the standard deviation of gold returns and other financial asset returns. The correlation results are closely attached to the postulations of modern portfolio theory and (Baur & Lucey, 2010)definitional assumptions.

3.8.3 Rolling Correlation

To add on and more specifically to measure the evolution of the correlation of gold with other select financial assets, the rolling correlation approach has been used. Pertaining to the data period from 1st January 2000 to 31st March 2020, the 24 rolling correlation windows (rolling two years data for each window) have formed to determine the changes in correlation to a specific window width falls in and around the four major crises. This framework will assist in gauging a hedge and a safe haven appeal of gold at an initial stage.

3.8.4 Unit Root Test

Most of the time series data are characterised as having a non-stationary behavior (Gujarati & Porter, 2011).

According to (Brooks, 2002), before carrying out the analysis checking for stationarity and non-stationary is essential due to the following reasons;

(i) "Stationary can strongly influence the data series behaviour and its properties".

(ii) "Non-stationary series can lead to the spurious regression".

(iii) "Assumption for asymptotic analysis will not be valid if the regression model variables are non-stationary".

To test the stationarity property of data under the unit root test, widely used ADF test statistics (Said & Dickey, 1984) have been estimated. Formally, the ADF test estimations are expressed as follows;

$\Delta y_t = \alpha_0 + \alpha y_{t-1} + \sum_{j=1}^{p} y_j \Delta y_{t-j} + \varepsilon_t$

The null hypothesis of the ADF test is H_0= y_t is not integrated or the series is non-stationary. If the calculated test statistics value is less than 1% and 5% significant level, the null hypothesis is rejected, which indicates that the data is stationary.

3.8.5 Modelling Framework (Objective 1 and Objective 2)

The section presents the modelling framework adopted by (Baur & McDermott, 2010), to examine the hedge and haven property of gold against the stock market. We assume the dynamics between gold and aggregate stock indices/ stock sector indices are non-linear especially during extreme market conditions. Specifically, the following model is estimated:

$$r_{\text{Gold,t}} = \alpha + b_t r_{\text{Stock,t}} + e_t \quad (1a)$$

$$b_t = c_0 + c_1 D(r_{\text{Stock}} q_{10}) + c_2 D(r_{\text{Stock}} q_5) + c_3 D(r_{\text{Stock}} q_1) \quad (1b)$$

$$h_t = \pi + \alpha e_{t-1}^2 + \beta h_{t-1} \quad (1c)$$

Equation 1a. depicts the relationship between the returns of gold and aggregate stock indices/ stock sector indices. In equation 1b. $b_t$is exhibited as a dynamic process by including dummies D(….) that captures the outcome of stress or extreme equity market movements. The time dummies D(….) assumes the value equal to one if the aggregate stock indices/ stock sector indices returns are in the predetermined lowest quantiles of return distribution, i.e., 10%, 5% and 1% respectively and zero otherwise. If the parameters (c_1, c_2 andc_3) specified in equation 1b. are negative, then gold serves as a weak safe haven. If the parameters are negative and statistically

significant then gold serves as a strong safe haven. If the parameter c_0 is zero (negative) then gold acts as a weak (strong) hedge. To capture the heteroscedasticity problem in the data series GARCH (1,1) Model is used and all equations are estimated through the Maximum Likelihood Method.

Finally, a less statistical and arbitrary approach would be to consider certain periods such as major economic and financial crises explicitly (rather than creation of thresholds) and to create time dummies equal to 1 if the returns overlap within the predefined phase of crises and zero otherwise. The following model is specified to check the ability of gold as a safe haven specifically during the crisis periods:

$$r_{\text{Gold,t}} = \alpha + b_t r_{\text{Stock,t}} + e_t \quad (2a)$$

$$b_t = c_0 + c_1 D(Dot\ Com\ bubble\ burst) + \ldots\ldots + c_n D(Covid - 19\ crisis) \quad (2b)$$

$$h_t = \pi + \alpha e_{t-1}^2 + \beta h_{t-1} \quad (2c)$$

If the estimated coefficients of the equation (c_1, c_2, c_3 and c_4) are zero/negative and statistically significant, gold acts as a safe haven in the respective stress/crisis periods. However, if the parameters are positive gold is not a safe haven as it co-moves with the stock. (Baur & McDermott, 2010), (Gurgun & Unalmıs, 2014), (Chkili, 2016).

3.8.6 Wavelet Coherency

To analyse the localised correlation between two time series a bivariate framework is essential. This can be measured through Cross Wavelet Spectrum between two time series i.e., p(t) and q(t). The Cross Wavelet Spectrum is the product of its wavelet coefficients and is expressed as:

$$W_{\lambda,\text{T}}(p, q) = W_{\lambda,\text{T}}(p)\, W_{\lambda,\text{T}}{}^*(q)$$

Wherein, * indicates complex conjugate. The limitation of Cross Wavelet Spectrum is that its extend is determined by the variance of each time series. To deal with this most of the previous

studies have applied Wavelet Coherency. With 'O' being a Smoothing operator, Wavelet Coherency is calculated as:

$$R^2_{\lambda,T}(p,q) = \frac{|o\left(\lambda^{-1}W_{\lambda,T}(p,q)\right)|^2}{o\left(|\left(\lambda^{-1}W_{\lambda,T}(p)\right)|^2\right)o\left(|\left(\lambda^{-1}W_{\lambda,T}(q)\right)|^2\right)}$$

Wavelet Coherency corresponds to squared correlation as it measures covariance between two time series divided by its variance at different times and scales. The $R^2_{\lambda,T}(p,q)$ implies Wavelet Coherency whose value lies between zero to one. The higher value indicates higher co-movement while the lower value indicates lower co-movement. Further, the Monte Carlo Simulation method is applied to determine statistical significance (Torrence & Compo, 1998). The phased difference information is revealed through the arrows on the coherency plot. The phased difference between two time series is defined as:

$$\emptyset_{\lambda,T}(p,q) = tan^{-1}\left(\frac{I\left\{o\left(\lambda^{-1}W_{\lambda,T}(p,q)\right)\right\}}{R\left\{o\left(\lambda^{-1}W_{\lambda,T}(p,q)\right)\right\}}\right)$$

The I and R symbolise imaginary and real parts of wavelet coefficients. The phase is indicated by arrows, wherein the direction of arrows signifies positive and negative correlation among the time series. This, confirms whether gold serves as a hedge or a safe haven at different time and frequency domains.

According, to (Bredin, Conlon, & Potì, 2015) and (Raza, 2017), the GARCH model doesn't measure the nexus across time and varied investment horizons. This conveys the benefit of identifying breaks and estimating the relationship at varied investment horizons. (Baruník, Evžen, & Vacha, 2014). Further, (Anoruo, 2011) is of the opinion that the basic limitation of linear modelling is that the time series are linear.

While in real times it's not the case, on account of asymmetry and structural breaks (heterogeneous economic agents, major credit events, black swan events, crisis, business cycles, trends and so on.). These no linearities have an impact on market dynamics, when study period is marked by major economic and financial downturns. To overcome this drawback, the study employs the GARCH model along with the Wavelet coherency (i.e., time-frequency) technique

which accounts for different order of relation among the time series (Shin, Yu, & Greenwood-N, 2014).

So, in order to analyse the cyclical patterns, trends, and lead lag relationship in the time frequency horizon domain and further cover up difficulties including non-stationarity and no linearity, the Wavelet coherence measure is adopted which is attributed to investors varied expectations across short and long-run horizons. Even the time-varying linear and nonlinear phase-dependent nexus can be captured through the Wavelet Coherence method, which is not possible through the linear correlation method (Bekiros, Boubaker, Uddin, & Nguyen, 2017).

3.8.7 Modelling Framework (Objective 3)

From the perspective of investors, an extreme movement in the exchange rate takes place when the percentage changes in its value reaches the highest level. This is captured by the highest quantiles namely 90%, 95% and 99%. The methodological approach specified to test the hedge and safe haven potential against deteriorating local currency broadly follows the work of (Baur & Lucey, 2010), (Baur & McDermott, 2010), and (Iqbal, 2017).

The econometric model adopted here is as follows:

$$r_{\text{Gold,t}} = \alpha + b_t r_{\text{Exchange rate,t}} + e_t \quad (3a)$$

$$b_t = c_0 + c_1 D(r_{Exchange\ rate} q_{90}) + c_2 D(r_{Exchange\ rate} q_{95}) + c_3 D(r_{Exchange\ ratetock} q_{99}) \quad (3b)$$

$$h_t = \pi + \alpha e_{t-1}^2 + \beta h_{t-1} \quad (3c)$$

Equation (3a) models the relationship between the returns of gold and the exchange rate. The e_t stands for error term. Further, the parameter b_t in equation (3b) is exhibited as a dynamic process by including dummies D(….) that captures the asymmetries of adverse shocks in the Forex market. The time dummies D(….) assumes the value equal to one if the exchange rate returns lie in or exceeds the predetermined highest quantiles of return distribution i.e., 90%, 95% and 99% respectively and zero otherwise.

If the parameters (c_1, c_2 and c_3) specified in equation (3b) are greater than or equal to zero, then gold serves as a safe haven in periods of stress or extreme exchange rate movements. If the parameter c_0 is positive and significant, then gold serves as a hedge against exchange rate movements.

Finally, a less statistical and arbitrary approach would be to consider periods of crisis and create time dummies equal to 1 if the returns overlap within the predefined phase of crises and zero otherwise. The following model is estimated:

$$r_{\text{Gold,t}} = \alpha + b_t r_{\text{Exchange rate,t}} + e_t \quad (4a)$$

$$b_t = c_0 + c_1 D(Dot\ Com\ bubble\ burst) + \ldots + c_n D(Covid-19\ crisis) \quad (4b)$$

$$h_t = \pi + \alpha e_{t-1}^2 + \beta h_{t-1} \quad (4c)$$

If the estimated coefficients of the equation (c_1, $c_2$and c_3) are zero/negative then gold acts as a safe haven in the respective stress/crisis periods. However, if the parameters are positive gold is not a safe haven.

CHAPTER - 4

HEDGE AND SAFE HAVEN ABILITY OF GOLD AGAINST STOCK MARKETS OF MAJOR GOLD CONSUMING, MAJOR GOLD PRODUCING AND KEY CURRENCY COUNTRIES

CHAPTER FOUR

Hedge and safe haven ability of gold against stock markets of major gold consuming, major gold producing and key currency countries

4.1 Introduction

Over a decade, the financial markets, instruments and financial product trade value have grown tremendously in a global economy (GCC, GPC and KKC). On a similar note, there takes place massive financial deregulations and thus, financial assets have become more sensitive to various factors. Furthermore, the series of frequent economic and financial episodes was no exception to inducing investors to hedge or flight toward a safe haven asset (gold), when the uncertainty in the financial asset (stocks) is rising.

While gold is often referred to as safe lending, in this chapter, the study concentrates on testing the ability of gold to delineate the superiority of hedges and safe havens against traditional assets such as stocks during normal and extreme market conditions. In detail, the study addresses the verbalized research questions of Chapter 3, section 3.4, by documenting a comprehensive empirical analysis and discussion.

4.2 Summary Statistics

The statistical performance was observed for the daily gold and stock returns across gold-consuming, gold-producing, and key currency countries over the whole sample period (01/01/2000 to 31/03/2020). In particular, for the sample period, the mean daily returns, standard deviation, skewness, kurtosis, Jarque-Bera test statistics, ARCH-LM test and Ljung Box Q statistics are reported in Table 4.1. Several points emerged from the preliminary analysis of summary statistics in Panels A, B and C. At first glance, generally, the mean daily returns of gold and stock are positive (except for stock returns of the UK and Japan). In terms of performance, the higher positive returns of gold range between 0.0039% to 0.0798%, with a lesser amount of risk ranging from 1.0012% to 1.4690% over the stock market, indicating

benefits of risk-return trade-off to the investors. This performance contradicts the findings of (Ghazali, et al., 2013), who claimed the highest daily returns of stock over gold. When we look at the major gold-consuming countries (Panel A), Turkey, followed by Egypt, provides the highest returns of 0.0798% and 0.0613% at a volatility of 1.4690% and 1.3161%, respectively. While in major gold-producing countries, South Africa has the highest daily returns of 0.5271%, associated with higher risk behaviour of 1.2812%. Surprisingly, on domestic gold, all key currency countries displayed the lowest returns as compared to other markets in the table. Amongst the stock markets, Russia (0.0531%) has depicted the greater returns, followed by Egypt (0.0392%), while Switzerland (0.0039%) and Canada (0.0088%) show the lowest returns for unconditional volatility ranges from 1.1166% to 1.9603%.

Altogether, the countries that consume the highest proportion of gold and their gold and stock returns outperform the gold-producing and key currency countries. Nevertheless, investment in this country's gold and stock is prone to higher variation in returns. The return distributions for the stock indices and gold are negatively skewed except for the gold returns of Egypt, Turkey, South Africa and the UK and stock returns of Turkey and Vietnam, which are positively skewed. The kurtosis coefficient is above three, and Jarque-Bera test statistics show that the return series are not normally distributed. The null hypothesis of normality is rejected at the significance level of 1%. Further, the ARCH LM test upto 20 lags underline the presence of the ARCH effect in the return series. The significant values of Ljung-Box statistics upto 20th order lag reveal the non-linear temporal dependency in the gold and stock market returns for all cases. This has been carefully considered while estimating a Quantile GARCH Model.

4.3 Correlation Analysis

Correlation analysis is a qualitative approach to evaluate the degree of association between the variables. The results of the test are documented in Table 4.1. The correlation coefficient between gold and stock indices of all countries with the exception of China, UAE, Egypt, Switzerland and Japan, is noted to be negative. Further, there is a low degree of association between gold and stock indices of all the selected countries.

Table 4.1: Summary Statistics and Correlation of Gold Returns and Stock Returns

Country	Series	Mean	SD	Skewness	Kurtosis	JB test	ARCH LM test	LB Q Statistics	Correlation
Panel A: Major Consumer Countries of Gold									
India	Gold	0.0428	1.0703	-0.1338	8.9298	7779.31 ***	381.1611***	27.398***	-0.0685
	Stock	0.0318	1.4213	-0.5098	14.1814	27833.67 ***	630.2630***	84.482***	
China	Gold	0.0295	1.0686	-0.2489	9.1013	8245.71 ***	358.5516***	26.736***	0.0122
	Stock	0.0132	2.8959	-0.0235	1406.3690	4.33E+08 ***	1753.477***	689.50***	
UAE	Gold	0.0353	1.0839	-0.3687	8.5495	6303.46 ***	376.5426***	27.871***	0.0054
	Stock	0.0253	1.1452	-0.2216	14.9890	28948.62 ***	938.2539***	146.12***	
Egypt	Gold	0.0613	1.3161	7.1502	226.2960	1101652 ***	57.08025***	77.027***	0.0480
	Stock	0.0392	1.6243	-0.4401	12.5641	20298.14 ***	453.9205***	172.49***	
Indonesia	Gold	0.0483	1.1714	-0.1196	9.3578	9024.30 ***	365.8362***	34.683***	-0.0972
	Stock	0.0360	1.2954	-0.6390	10.8808	14025.55 ***	173.9366***	55.592***	
South Korea	Gold	0.0339	1.1905	-0.4375	15.6852	35576.07 ***	833.2226***	80.754***	-0.1640
	Stock	0.0101	1.4570	-0.5775	10.6965	13327.81 ***	779.2123***	43.912***	
Turkey	Gold	0.0798	1.4690	3.6994	99.6802	2068787 ***	392.7844***	31.271***	-0.0613
	Stock	0.0336	9.1745	0.2716	2386.2560	1.25E+09 ***	2394.671***	1198.5***	
Russia	Gold	0.0523	1.2268	-0.0244	16.0223	37315.17 ***	947.4341***	26.788***	-0.0056
	Stock	0.0531	1.9603	-0.2057	19.8905	62812.59 ***	1145.996***	76.888***	
Saudi Arabia	Gold	0.0325	1.0742	-0.2559	9.0850	8205.07 ***	378.0331***	27.201***	-0.0099
	Stock	0.0221	19.6610	-0.1593	2613.0400	1.50E+09***	2498.544***	1303.9***	
Thailand	Gold	0.0302	1.0579	-0.1837	9.9845	10764.10 ***	325.6675***	43.993***	-0.0310
	Stock	0.0161	1.2789	-0.9531	15.6898	36233.33 ***	625.2023***	95.640***	
Vietnam	Gold	0.0443	1.0825	-0.1800	9.0184	7772.94 ***	335.8760***	26.992***	-0.0108
	Stock	0.0368	3.3358	0.4306	1703.0860	6.18E+08***	2235.626***	805.85**	
USA	Gold	0.0324	1.0731	-0.2548	9.0351	8071.61 ***	370.3623***	27.026***	-0.0128
	Stock	0.0109	1.2492	-0.3644	17.5861	46931.44 ***	707.1854***	87.113***	
Panel B: Major Producer Countries of Gold									
Australia	Gold	0.0092	1.0012	-0.7852	12.3847	19922.30 ***	606.9994***	16.303***	-0.1231
	Stock	0.0339	1.0974	0.4725	17.1797	44439.13 ***	1338.411***	73.899***	
Canada	Gold	0.0322	1.0568	-0.1569	10.1372	11230.63 ***	458.6951***	61.086***	-0.0127
	Stock	0.0088	1.1166	-0.9809	20.9916	72074.23***	1398.057***	64.198***	
South Africa	Gold	0.5271	1.2812	0.1934	7.9509	5426.47 ***	683.5184***	25.559***	-0.0022
	Stock	0.0316	1.1934	-0.3776	8.6690	7197.04 ***	1238.083***	42.815***	
Panel C: Key Currencies of Gold									
Switzerland	Gold	0.0231	1.0229	-0.2970	11.3624	15464.90 ***	384.5853***	39.299***	0.0713
	Stock	0.0039	1.1488	-0.3025	11.3277	15340.40 ***	1029.114***	59.100***	
UK	Gold	0.0375	1.0760	0.0836	12.7026	20720.77 ***	304.4446***	45.234***	-0.0407
	Stock	-0.0038	1.1716	-0.3518	11.6728	16659.86 ***	1017.308***	67.852***	
Japan	Gold	0.0336	1.0885	-0.3843	9.3578	9024.30 ***	527.1030***	45.232***	0.1647
	Stock	-1.73E0	1.4506	-0.3918	10.0145	10961.78 ***	181.0183***	2.5888***	

Note: ***, **, and * denote significance at 1%, 5%, and 10% levels of significance, respectively. Where SD represents the Standard Deviation of returns, the JB test indicates Jarque-bera statistics, the ARCH-LM test indicates the Lag-range Multiplier test for conditional heteroskedasticity upto 20 lags and Ljung-Box Q-Statistic is the test for serial correlation upto 20 lags.

4.3.1 Rolling Correlation Analysis

The correlation between the variables does not remain static, but it certainly evolves over time. Thus, we investigate the behaviour of equity and gold on a rolling correlation window in and around the four major crises (DCBB, GFC, EDC and Covid-19 crisis) that cropped out between January 2000 to March 2020. The results are shown in Tables 4.2a and 4.2b.

The correlation coefficients produced from the test confirm that the correlation varies on 24 windows. Looking at Panel A, B and C with the exception of China, Japan and Switzerland, all countries equity-gold pairing reveals negative correlation behaviour during the crisis period. The high negative and significant correlation between the equity-gold pair is noted for Turkey, followed by Indonesia, Thailand, India, the US, Canada, South Africa and Australia. On that side, during the crisis, Russia, Egypt, the UK and Vietnam's gold-equity negative connectedness is substantially low. It can also be argued that the domestic gold of South Korea, Turkey, Russia, South Africa and China performed well during the Covid-19 pandemic to provide a safe net to the investors. On the flip side, India, Indonesia, Thailand, Australia, Canada, and US and UK gold proved to be potential safe haven candidates against stock uncertainty during the GFC followed by DCBB. However, in the aftermath of the crisis, we noticed two remarkable findings. First, in some cases, there is a drop in the negative correlation, and second, the correlation turns out to be positive, corresponding to normal periods. In addition to China, Japan and Switzerland, we filtered the positive relationship of gold with equity for some of the developed countries such as Canada, the US, the UK, South Africa, the United Arab Emirates, Egypt and Russia during the normal market conditions. This phenomenon is often attributed to the diversification role of gold to the investors during the absence of large volatility in the stock market. Nevertheless, the rolling correlation between equity and gold remains negative during all four crises for most of the countries from Panel A, B and C, pointing out the fear of stock market uncertainty and the rush of investors towards safe-haven assets. Interestingly, understanding these findings seeks to be a useful tool for investors to shelter their investment during the crisis in the future.

Table 4. 2a: Rolling Correlation estimates

Window Width	Panel A: Major Gold Consumer Countries											
	IN	CH	UAE	EY	ID	SK	TK	RS	SUA	TH	VN	US
W1	-0.13***	0.04	--	0.06	-0.22***	-0.16***	-0.17***	-0.04	-0.13***	-0.14***	-0.01	-0.19***
W2	-0.10**	0.06	0.03	0.07	-0.18***	-0.13***	-0.47***	-0.03	-0.01	-0.11***	0.01	-0.20***
W3	-0.11***	0.08	0.03	0.06	-0.15***	-0.08	-0.43***	0.05	-0.01	-0.04	-0.04	-0.12***
W4	-0.11***	0.06	0.02	0.03	-0.14***	-0.04	-0.26***	0.11***	0.04	-0.01	-0.05	0.04
W5	-0.05	0.09*	0.06	0.03	-0.15***	-0.02	-0.21***	0.21***	0.05	-0.01	-0.06	0.05
W6	0.23***	-0.02	0.04	0.06	0.05	0.07	-0.15***	0.25***	0.02	0.09*	0.02	-0.06
W7	0.26***	-0.02	-0.03	0.09*	0.07	0.12***	-0.11***	0.29***	-0.04	0.09*	-0.02	-0.03
W8	0.15***	0.02	-0.01	0.02	0.08	0.05	-0.30***	0.25***	-0.07	0.08	-0.05	-0.02
W9	-0.11***	0.04	-0.05	0.03	-0.08	-0.24***	-0.35***	0.08	-0.12***	-0.09*	-0.01	-0.07
W10	-0.16***	0.05	-0.06	-0.01	-0.14***	-0.33***	-0.34***	-0.01	-0.10**	-0.08	-0.01	-0.07
W11	-0.17***	0.04	-0.05	0.03	-0.17***	-0.38***	-0.29***	-0.02	-0.02	-0.10**	-0.01	-0.02
W12	-0.09*	0.17***	0.01	0.02	-0.10**	-0.32***	-0.19***	-0.01	-0.02	0.06	0.01	0.16***
W13	-0.02	0.09*	0.07	-0.01	0.07	-0.22***	-0.17***	-0.11***	-0.02	0.06	0.10**	0.05
W14	0.04	0.17***	0.07	-0.02	0.15***	-0.14***	-0.07	-0.07	0.03	0.15***	0.08	0.05
W15	0.01	0.17***	0.09*	0.03	0.15***	-0.07	-0.04	-0.06	0.01	0.11***	0.09*	0.06
W16	-0.19***	0.12***	0.02	-0.03	0.01	-0.06	-0.05	-0.07	-0.04	-0.03	0.07	0.08
W17	-0.24***	0.05	0.01	-0.04	-0.09*	-0.04	-0.08	-0.02	-0.02	-0.07	0.05	0.01
W18	-0.23***	-0.02	-0.03	-0.08	-0.18***	-0.13***	-0.30***	-0.10**	-0.07	-0.11***	-0.07	-0.14***
W19	-0.31***	-0.05	-0.01	-0.01	-0.23***	-0.28***	-0.39***	-0.15***	-0.09	-0.21***	-0.10**	-0.15***
W20	-0.30***	-0.04	0.01	0.16***	-0.19***	-0.36***	-0.43***	-0.30***	-0.15***	-0.21***	-0.07	-0.15***
W21	-0.34***	-0.06	0.01	0.21***	-0.07	-0.41***	-0.40***	-0.28***	-0.11***	-0.18***	0.01	-0.24***
W22	-0.18***	0.02	0.05	0.22***	-0.02	-0.30***	-0.25***	-0.18***	-0.05	-0.06	-0.02	-0.04
W23	-0.22***	-0.12***	-0.01	-0.06	-0.13***	-0.36***	-0.27***	-0.19***	-0.07	-0.07	-0.05	-0.01
W24	-0.04	-0.06	0.07	0.03	-0.19***	-0.20***	-0.25***	-0.13***	0.02	0.07	-0.04	0.25***

Note: ***, **, and * denote significance at 1%, 5%, and 10% levels of significance, respectively. Where W1 to W24 indicates a window width for a period from 1st January 2000 to 31st March 2020.

4.4 Stationary Test Results

The stationarity of variables is a preliminary requisite in a time series analysis. Assuming this phenomenon, under unit root test, we have estimated Augmented Dickey-Fuller (ADF) statistics to examine stability in data series. Table 4.3 summarises the results of the ADF Unit root test. The results of the ADF test indicate that the null hypothesis is rejected at a 5% significant level.

Therefore, gold and stock returns of all the sample countries are stationary, which fulfills the first requisite to compute the GARCH models.

Table 4. 2b: Rolling Correlation estimates

Window Width	Panel B: Major Gold Producer Countries			Panel C: Key Currencies Countries		
	AU	CN	SA	SW	UK	JP
W1	-0.14***	-0.20***	0.24***	-0.01	-0.08	-0.01
W2	-0.14***	-0.19***	0.41***	0.05	-0.07	0.03
W3	-0.09*	-0.09*	0.33***	0.09*	-0.05	0.01
W4	-0.02	0.12***	0.48***	0.18***	0.05	-0.06
W5	-0.02	0.10**	0.34***	0.13***	0.10**	0.01
W6	0.15***	0.13***	0.22***	0.10**	0.14***	0.14***
W7	0.22***	0.14***	0.19***	0.17***	0.19***	0.24***
W8	0.03	0.10**	0.06	0.20***	0.09*	0.26***
W9	-0.24***	-0.01	-0.16***	0.01	-0.17***	0.35***
W10	-0.29***	-0.07	-0.18***	-0.06	-0.20***	0.26***
W11	-0.32***	-0.09*	-0.24***	-0.08	-0.19***	0.27***
W12	-0.27***	-0.04	-0.11***	0.10**	-0.01	0.21***
W13	-0.27***	-0.08	-0.22***	0.12***	-0.04	0.10**
W14	-0.16***	-0.02	-0.13***	0.11***	0.03	0.20***
W15	-0.09*	0.06	-0.05	0.09*	0.07	0.22***
W16	0.03	0.23***	0.15***	0.08	0.17***	0.21***
W17	0.01	0.15***	0.18***	0.07	0.08	0.18***
W18	-0.12***	-0.10**	-0.04	0.31***	-0.10**	0.09*
W19	-0.19***	-0.23***	-0.28***	0.16***	-0.27***	0.11***
W20	-0.22***	-0.21***	-0.24***	-0.08	-0.21***	0.16***
W21	-0.23***	-0.27***	-0.22***	-0.23***	-0.22***	0.15***
W22	-0.19***	-0.06	-0.11***	0.01	0.14***	0.12***
W23	-0.14***	-0.06	-0.22***	0.05	0.05	0.09*
W24	0.18***	0.24***	-0.09*	0.23***	0.15***	0.19***

Note: ***, **, and * denote significance at 1%, 5%, and 10% levels of significance, respectively.

Table 4.3: Testing for Stationarity

Country	With Intercept		With Intercept and Trend	
	Gold	Stock	Gold	Stock
Panel A: Major Consumer Countries of Gold				
India	-74.4167***	-69.6141***	-74.4113***	-69.6082***
China	-73.9502***	-25.8563***	-73.9462***	-25.8572***
UAE	-69.1886***	-59.7926***	-69.2016***	-59.8322***
Egypt	-67.4094***	-60.9624***	-67.4052***	-60.9613***
Indonesia	-74.6770***	-65.5518***	-74.6749***	-65.5499***
South Korea	-45.3574***	-71.8801***	-45.3578***	-71.8735***
Turkey	-54.5900***	-36.1919***	-54.5894***	-36.1889***
Russia	-72.4479***	-70.1785***	-72.4423***	-70.1922***
Saudi Arabia	-73.3901***	-31.7258***	-73.3913***	-31.7458***
Thailand	-75.9676***	-48.2153***	-75.9708***	-48.2155***
Vietnam	-71.4957***	-30.8487***	-71.5031***	-30.8758***
USA	-73.3424***	-82.5537***	-73.3438***	-82.5615***
Panel B: Major Producer Countries of Gold				
Australia	-76.7806***	-76.5009***	-76.7808***	-76.4937***
Canada	-76.3463***	-27.6566***	-76.3390***	-27.6578***
South Africa	-73.9873***	-70.5133***	-73.9804***	-70.5226***
Panel C: Key Currencies of Gold				
Switzerland	-75.3696***	-34.8176***	-75.3647***	-34.8214***
UK	-74.8415***	-28.1673***	-74.8360***	-28.1655***
Japan	-73.4992***	-74.2740***	-73.5006***	-74.2838***

Note: The ADF unit root test is the empirical statistic to determine stationary. ***, **, * denotes rejection of the null hypothesis of unit root.

4.5 Quantile Model and Gold as a Hedge and Safe Haven

The section depicts the estimation results of regression analysis shown by equations 1(a), 1(b) and 1(c). The negative coefficients in the hedge column (c_0) denote that gold is a hedge against stocks. The zero/negative coefficients in adverse market conditions given by quantiles (10% (c_1), 5% (c_2) and 1% (c_3) show (weak) strong safe haven ability of gold. The Hedge property is consistent across major gold producing countries with the exception of South Africa. Gold is a strong hedge for the stock markets of Australia and a weak hedge in Canada. Although, the stock markets of South Africa co-move with gold on average but shows negative coefficient estimates only in the extreme market conditions, i.e., in the 5% and 1% quantiles of the return distributions. At very extreme equity market falls (at the 1% quantile) gold is a strong safe haven for equity market investment in South Africa. The pattern is quite similar at 5% quantiles but

lends support for a weak safe haven. Further, the severity of the shock, which brings a decline in stock prices, rarely matters to capture the demand for safe haven assets. Gold shows safe haven property in Australia and Canada as the decline in stock prices deepens at 10% quantile. For Instance, at 10% quantile two, at 5% quantile one and at 1% quantile one country equity returns are negatively correlated with gold returns.

The Hedge property is consistent across major gold consuming countries with the exception of China, UAE and Saudi Arabia. Gold is a strong hedge for the stock markets of India, Indonesia, South Korea, Turkey, Russia, Thailand, Vietnam, USA and a weak hedge in Egypt and Saudi Arabia. Although the stock markets of UAE and China co-move with gold on average but shows negative coefficient estimates only in the extreme market conditions i.e., in the 5% and 1% quantiles of the return distributions. At very extreme equity market falls (at the 1% quantile) gold is a strong safe haven for equity market investment in South Korea and a weak safe haven in India, China, UAE, Egypt, Indonesia, Russia, Vietnam and South Africa. The pattern is quite similar at 5% quantiles, wherein only the case of USA gold exhibits strong safe haven property. Further, the severity of the shock, which brings a decline in stock prices, does matter to capture the demand for the safe haven assets. Gold shows safe haven property in more countries as the decline in stock prices deepens. For Instance, at 10% quantile two, at 5% quantile eight and at 1% quantile eight countries' equity returns are negatively correlated with gold returns. This confirms that faced with heavy losses or high levels of uncertainty, investors sell stocks and buy gold i.e., seeks the shelter of a haven asset. Most of the Key Currency countries exhibit positive and statistically significant coefficient estimates for the average relation, excluding the possibility of hedge. The gold of all KCC shows a negative correlation with equity at 5% and 1% quantile, which presents the weak safe-haven appeal. But notably, the UK at 5% and Switzerland at 1% exhibit strong safe haven properties.

Table 4.4a: Estimation output for the Hedge and Safe Haven asset

Estimation Results								
Country	Hedge		0.10		0.05		0.01	
	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value
Panel A: Major Consumer Countries of Gold								
India	-0.0730	0.0000***	0.0094	0.7698	0.0688	0.0591*	-0.0322	0.3192
China	0.0059	0.3429	0.0104	0.7100	-0.0059	0.8577	-0.0153	0.5568
UAE	0.0047	0.7527	0.0032	0.9413	0.0286	0.5544	-0.0455	0.2046
Egypt	-0.0076	0.4405	0.0673	0.0178**	-0.0198	0.5334	-0.0145	0.6369
Indonesia	-0.0838	0.0000***	0.1133	0.0014***	-0.0631	0.1306	-0.0564	0.1558
South Korea	-0.1094	0.0000***	0.0223	0.5079	0.0604	0.1181	-0.0577	0.0881*
Turkey	-0.0880	0.0000***	-0.0153	0.5259	-0.0314	0.2572	0.1343	0.0000***
Russia	-0.0178	0.0312**	0.0460	0.0696*	-0.0025	0.9299	-0.0311	0.2577
Saudi Arabia	0.0001	0.9695	0.0361	0.2793	-0.0382	0.3412	0.0009	0.9791
Thailand	-0.0555	0.0000***	0.0473	0.1664	-0.0179	0.6430	0.0352	0.3448
Vietnam	-0.0093	0.3095	-0.0002	0.9947	0.0357	0.2740	-0.0265	0.4178
USA	-0.0415	0.0007***	0.1050	0.0072***	-0.1316	0.0026***	0.0078	0.8295
Panel B: Major Producer Countries of Gold								
Australia	-0.0357	0.0058***	-0.0336	0.3381	0.0022	0.9549	0.0159	0.6488
Canada	-0.0026	0.8505	-0.0620	0.1780	0.0044	0.9329	0.0261	0.5845
South Africa	0.0003	0.9856	0.1400	0.0020***	-0.0533	0.3142	-0.0946	0.0760*
Panel C: Key Currencies of Gold								
Switzerland	0.0677	0.0000***	0.0216	0.5840	-0.0383	0.3899	-0.0782	0.0418**
UK	0.0259	0.0411**	0.0568	0.1469	-0.1227	0.0059**	-0.0512	0.2488
Japan	0.0449	0.0000***	0.0434	0.1576	-0.0124	0.7284	-0.0061	0.8557

Notes: ***, ** and *, denote the statistical significance at 1%, 5% and 10% levels, respectively.

Table 4.4b: Residual Diagnostic Test

Country	ARCH LM Test	Prob.	LB Q Statistics	Prob.	Lag
Panel A: Major Consumer Countries of Gold					
India	11.6882	0.3875	9.4091	0.584	11
China	10.2469	0.6736	9.7586	0.714	13
UAE	7.6380	0.8664	13.887	0.382	13
Egypt	8.2468	0.5095	7.9472	0.539	9
Indonesia	9.5761	0.7925	17.820	0.215	14
South Korea	8.6653	0.7977	19.037	0.122	13
Turkey	0.0051	0.9975	0.2454	0.885	2
Russia	7.8618	0.5481	6.4501	0.694	9
Saudi Arabia	8.8660	0.7830	10.224	0.676	13
Thailand	11.8264	0.6202	14.474	0.415	14
Vietnam	0.7305	0.3927	0.0181	0.893	1
USA	8.0721	0.8389	11.315	0.584	13
Panel B: Major Producer Countries of Gold					
Australia	15.8299	0.1991	7.0506	0.854	12
Canada	9.6725	0.8832	19.616	0.238	16
South Africa	12.2972	0.1971	6.0817	0.732	9
Panel C: Key Currencies of Gold					

Switzerland	10.1259	0.8600	14.061	0.594	16
UK	10.0233	0.9026	18.308	0.370	17
Japan	24.5361	0.0565	16.777	0.332	15

Note: ARCH-LM test indicates lagrange Multiplier test for conditional heteroskedasticity upto 20 lags (H_0 = no heteroskedasticity) and Ljung-Box Q-Statistic has tested for serial correlation upto 20 lags (H_0 = no autocorrelation). The hypothesis has been inferred at 1%, 5% and 10% levels of significance, respectively.

4.6 Gold as a Hedge and Safe Haven in times of crisis

The Table 4.5a presents the safe haven properties of gold during periods of financial distress **(**Dot com bubble burst, Global Financial Crisis, European debt crisis and Covid-19 crisis). The negative coefficients in the hedge column (c_0) signify that the gold is a hedge against the stock market. Negative coefficients in the subsequent columns show that it was a safe haven during Dot com bubble burst (c_1), Global Financial Crisis (c_2), the European debt crisis (c_3) and the Covid-19 crisis (c_4). The coefficient estimates for DCBB is negative and statistically significant, which implies that gold is a strong safe haven only for the stock markets of GCC (Indonesia, Russia, Saudi Arabia and Thailand); GPC (South Africa); and KCC (Japan). Whereas it is a weak safe haven in the case of GCC (UAE and USA); and GPC (Australia and Canada). The results during GFC are more heterogeneous and exhibit larger effect in comparison with other selected crises. A substantial influence of gold as a safe haven asset was seen for almost all countries, with the exception of Indonesia and Russia (GCC); Canada (GPC); and Switzerland and Japan (KCC) during GFC. Among the eighteen countries, UAE, Turkey, Thailand, Australia, South Africa and UK's gold appeal as a strong safe haven.

During EDC, the correlation among the assets decreased significantly. The estimated coefficients are positive and statistically significant for most of the countries. Moreover, the coefficients are negative and statistically significant only in four countries, i.e., Egypt, South Korea, Australia and South Africa. This gives clear evidence of the strong, safe haven role of gold only in these four countries. The positive values for the remaining countries are not surprising, given that these countries have not considered gold as haven asset in this crisis. Finally, the analysis of the recent Covid-19 crisis period shows that investors preferred gold as a safe haven asset to protect their wealth for most of the countries' stock price movement except UAE, Thailand, USA, Australia, Canada, Switzerland and UK countries. The dynamic safe haven effect is more viable during Covid-19 followed by GFC.

Table 4.5a: Estimation output for the Hedge and Safe Haven asset in times of crisis

Estimation Results										
Country	Hedge		Dot Com Bubble Burst		Global Financial Crises		European Debt Crises		Covid-19 Crises	
	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value
Panel A: Major Consumer Countries of Gold										
India	-0.0657	0.0000***	0.0312	0.1520	-0.0021	0.9350	0.0337	0.3211	-0.0465	0.3434
China	0.0010	0.8669	0.0309	0.3773	0.0230	0.3159	0.0626	0.0290**	-0.0810	0.2773
UAE	0.0082	0.6187	-0.3204	0.6269	-0.0633	0.0710*	0.1252	0.1137	0.0611	0.2088
Egypt	0.0132	0.1693	0.0106	0.6464	-0.0206	0.5005	-0.0517	0.0362**	-0.0238	0.6102
Indonesia	-0.0684	0.0000***	-0.1409	0.0002***	0.0248	0.3851	0.1277	0.0001***	-0.1290	0.0093***
South Korea	-0.0822	0.0000***	0.0058	0.7607	-0.0209	0.5323	-0.1497	0.0000***	-0.2057	0.0006***
Turkey	-0.1348	0.0000***	0.1188	0.0000***	-0.1619	0.0000***	0.0215	0.4175	-0.0923	0.0885*
Russia	0.0040	0.6372	-0.0344	0.0470**	0.0176	0.3998	0.0129	0.6467	-0.1804	0.0102**
Saudi Arabia	-0.0122	0.2229	-0.0930	0.0954*	-0.0439	0.1486	0.0118	0.2387	-0.1321	0.0078***
Thailand	-0.0131	0.4050	-0.0695	0.0395**	-0.0953	0.0024***	0.0685	0.0908*	0.1191	0.0119**
Vietnam	-0.0054	0.0255**	0.0329	0.2785	-0.0295	0.3246	0.0839	0.0077***	-0.0307	0.5841
USA	-0.0420	0.0011***	-0.0127	0.6549	-0.0357	0.2714	0.1071	0.0006***	0.0477	0.2153
Panel B: Major Producer Countries of Gold										
Australia	-0.0222	0.0518*	-0.0015	0.9668	-0.1844	0.0000***	-0.1888	0.0000***	0.1371	0.1658
Canada	-0.0158	0.3360	-0.0310	0.2507	0.0277	0.4458	0.0058	0.8972	0.1018	0.0054***
South Africa	0.0794	0.0000***	-0.0799	0.0547*	-0.2008	0.0000***	-0.2108	0.0000***	-0.0348	0.4653
Panel C: Key Currencies of Gold										
Switzerland	0.0482	0.0000***	0.0024	0.9447	0.0200	0.5177	0.1182	0.0004***	0.1742	0.0000***
UK	0.0158	0.2339	0.0084	0.8151	-0.1273	0.0000***	0.0211	0.5482	0.1491	0.0024***
Japan	0.0506	0.0000***	-0.0438	0.0862*	0.1048	0.0004***	0.0963	0.0002***	-0.0170	0.7644

Notes: ***, ** and *, denote the statistical significance at 1%, 5% and 10% levels, respectively.

Table 4.5b: Residual Diagnostic Test

Country	ARCH LM Test	Prob.	LB Q Statistics	Prob.	Lag
Panel A: Major Consumer Countries of Gold					
India	11.2060	0.4262	9.6386	0.5630	11
China	8.9457	0.7770	9.7515	0.7140	13
UAE	8.7095	0.7945	14.0070	0.3730	13
Egypt	0.0176	1.0000	6.7258	0.4580	7
Indonesia	9.0971	0.8248	19.3640	0.1510	14
South Korea	6.8542	0.9095	19.6300	0.1050	13
Turkey	0.0028	0.9986	1.3027	0.5210	2
Russia	7.9517	0.5390	6.4585	0.6930	9
Saudi Arabia	9.5875	0.7273	10.4030	0.6610	13
Thailand	12.5386	0.5631	14.2880	0.4290	14
Vietnam	6.6206	0.9206	16.0990	0.2440	13
USA	8.7114	0.7944	10.0480	0.6900	13
Panel B: Major Producer Countries of Gold					
Australia	2.5084	0.1132	0.7664	0.3810	1
Canada	10.1002	0.8613	20.0260	0.2190	16
South Africa	12.3701	0.1932	5.6927	0.7700	9

Panel C: Key Currencies of Gold					
Switzerland	10.1508	0.8586	15.7180	0.4730	16
UK	9.7816	0.7117	9.9502	0.6980	13
Japan	24.3267	0.0597	17.7270	0.2770	15

Note: ARCH-LM test indicates lagrange Multiplier test for conditional heteroskedasticity upto 20 lags (H_0 = no heteroskedasticity) and Ljung-Box Q-Statistic has tested for serial correlation upto 20 lags (H_0 = no autocorrelation). The hypothesis has been inferred at 1%, 5% and 10% levels of significance, respectively.

4.7 Residual Diagnostic

The results of the residual diagnostic test, i.e., the ARCH LM test and the Ljung-Box Statistic in Table 4.4b and 4.5b, fail to reject the null hypothesis, which clarifies that the estimated model is free from heteroskedasticity and serial correlation problem.

4.8 Wavelet Coherence analysis across time and investment horizons

To verify the robustness of previous analysis outcome, Wavelet Coherence approach was employed. The Wavelet Coherency measures varying dependence for a bivariate series over time and across investment horizons and the results of the same are conveyed in Figure 1 to Figure 18.

Panel A: Gold Consumer Countries

Little co-dependency between gold and stock over time and period, represented by the predominance of blue colouring for upto 8 days (Figure 4.1). This suggests that gold acts as a short-horizon investment hedge for equity. From 2004-2007 and 2009-2012, at periods of approximately 128 days, red colour bounds with south-west facing arrows represent a pocket of negative dependency with gold leading equities. This signifies that gold acts as a safe haven at these horizons. Finally, an extended period of positive coherency exists for Indian stocks at periods of 256 days during 2000-2002 and between 128 to 500 days for 2018-2020. Northeast and east-facing arrows signify that gold and stocks have a long-horizon positive relationship at this time.

Figure 4.2 reports the Wavelet coherence between the gold and China stock index. Overall, the predominance of blue colour shows very low co-dependency between gold and the stock over time as well as period. In the case of Chinese stock, low coherency dominates at short horizons as well as long horizons on average. This suggests that gold acts as both short and long-horizon

hedge up to a period of 32 days, very little evidence of coherency exists, with left-facing arrows indicating a weak safe haven property of gold during the year 2001, which is marked by DCBB. Beyond this horizon, distinct pockets of coherency are found. In the case of equities, north-east facing arrows from the year 2010 to 2016 at a higher frequency horizon (greater than 256 days) indicate that the series is in phase with gold leading equities.

Figure 4.1: Wavelet Squared Coherence (India)

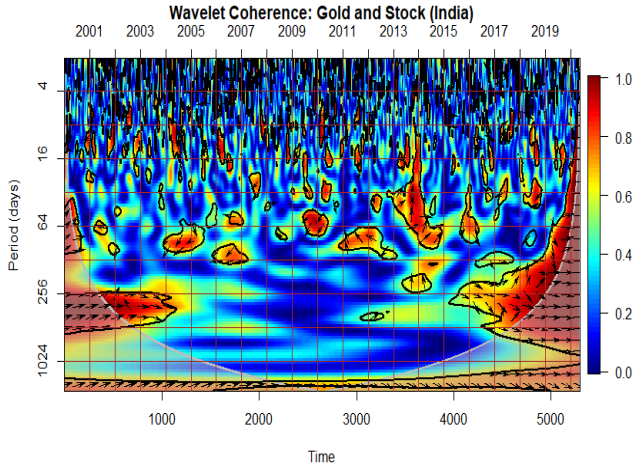
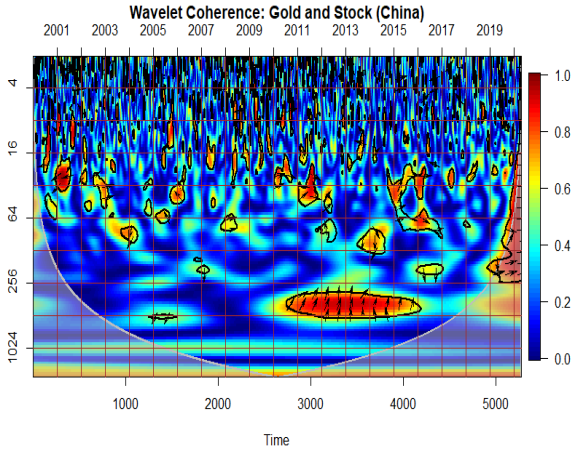


Figure 4.2: Wavelet Squared Coherence (China)



Note: Wavelet coherency is shown between gold and stock markets for a time span ranging from January 2000 to March 2020. The horizontal axis shows calendar time, while the vertical axis shows the time period in days. The area within the grey contours indicates coherency significance at a 5% level of significance, which is estimated with Monte-Carlo simulations. The COI indicates the region affected by edge effects and is represented by the area outside the cone in light shade. Coherency takes values between 0 and 1 and warmer colours (deep red) are indicative of higher high coherence/perfect correlation, while colder colours (deep blue) are indicative of low coherence/no correlation. The phase difference between the two series is indicated by arrows. East (west) facing arrows represent in- (out-of-) phase, while north (south) facing arrows indicate that gold leads (lags) the traditional asset. A north-east (south-east) facing arrow symbolises that the series are in-phase, but that gold (another asset) leads the other asset. A north-west (south-west) facing arrow symbolises that the series are out-of-phase but that the other asset (gold) leads gold (another asset). In phase, the variables have a positive correlation, and out-of-phase or anti-phase shows a negative correlation.

The dimmed coherency with a huge blue colouring region between UAE gold and stock over a time period and frequency horizon states that gold might be served as a potential hedging tool for equity investment (Figure 4.3). However, a small red coherency pocket with left-facing arrows in 2007 (GFC) and 2015 between 16 and 64 days is indicative of a weak safe haven. In between, on a time-frequency scale, one can also capture a significant positive coherence with east-facing arrows.

For Egypt, figure 4.4 indicates less coherence between gold and equity for a short horizon. This blue region at this horizon signifies the hedging role of gold. Moreover, beyond this horizon, a huge band of high coherence is displayed between gold and stock. Meanwhile, coherency pockets with right-facing arrows in 2003-04 and 2012-13 demonstrate a positive relationship at a long horizon. In contrast, the left-facing arrows between 64 and 128 days in 2010 remind the appeal of gold as a safe haven for stock during the EDC.

Figure 4.3: Wavelet Squared Coherence (UAE)

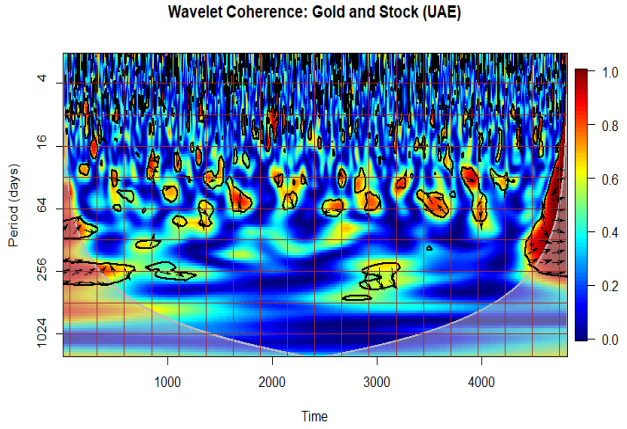


Figure 4.4: Wavelet Squared Coherence (Egypt)

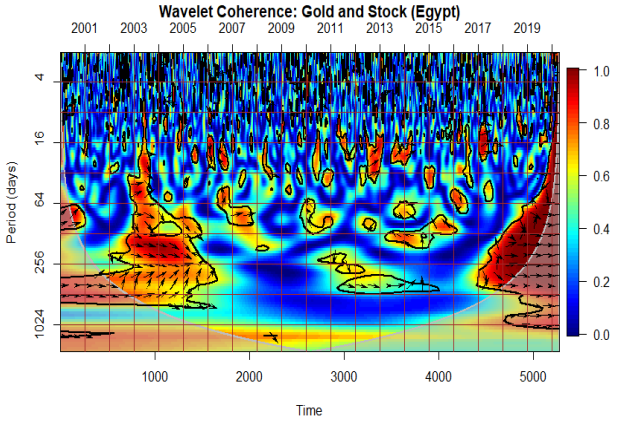


Figure 4.5: Wavelet Squared Coherence (Indonesia)

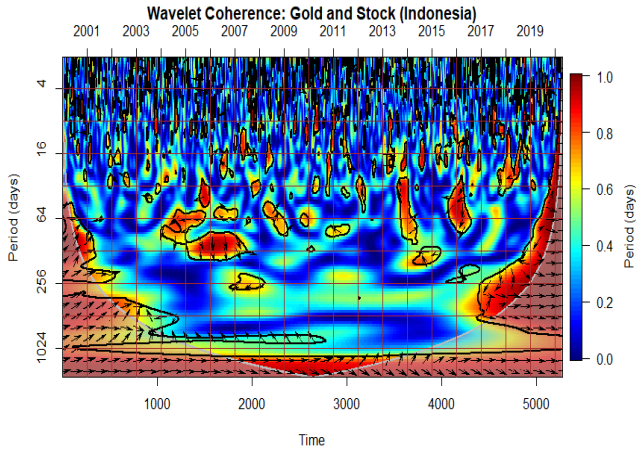
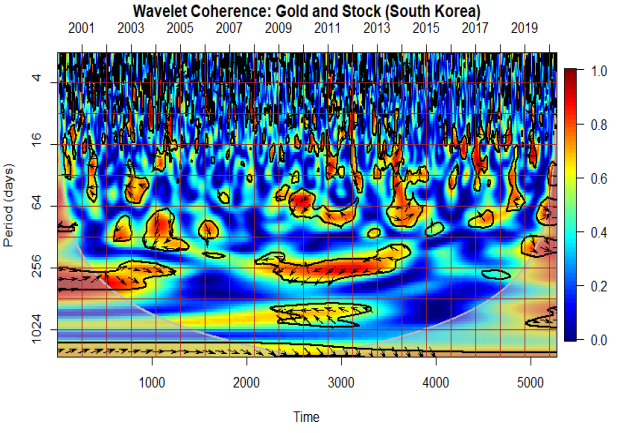


Figure 4.6: Wavelet Squared Coherence (South Korea)



The measurement of Wavelet coherency between the gold and equity markets of Indonesia is conveyed in Figure 4.5. The figure clearly indicates regions with warmer colours outside the white line, representing areas with no statistical significance. Over the frequency band of 0-16 days (i.e., short investment horizons), there was no existence of dependency among gold and the stock market. Furthermore, small red zones at medium and longer horizons with arrows either

facing the right direction and turned down show positive bidirectional lead-lag dependency among the gold and stocks. Eventually, another huge warm red area with arrows facing south-west was observed at the end of the sample period. This can be on account of investors reallocating their asset portfolio based on extreme negative shocks inherent to the outbreak of the Covid-19 pandemic.

Interesting results about coherency patterns between gold and stock are observed in the case of South Korea. As presented in Figure 4.6 at first glance, our results confirm the findings drawn from previous analysis. Across time and frequency, a predominance of blue colour with some small patches of red colour and left direction phase arrows suggests strong hedge property of gold against equities. Moreover, one negative coherence area is found at the frequency band of around 16-64 days in the year 2001-2002, signifying the weak safe haven role of gold during the internet bubble burst. More evidence related to negative coherency was also found during and after the outbreak of GFC. Surprisingly, a dominance of significant negative correlation across short, medium and long horizons was exhibited during the period of EDC. This signifies that gold might have a strong safe haven role to play against equity price movements. When we compare with the beginning phase of Covid-19 crisis, very small significant areas of dependence were exhibited, indicating an evolving relationship between gold and equities.

Figure 4.7: Wavelet Squared Coherence (Turkey)

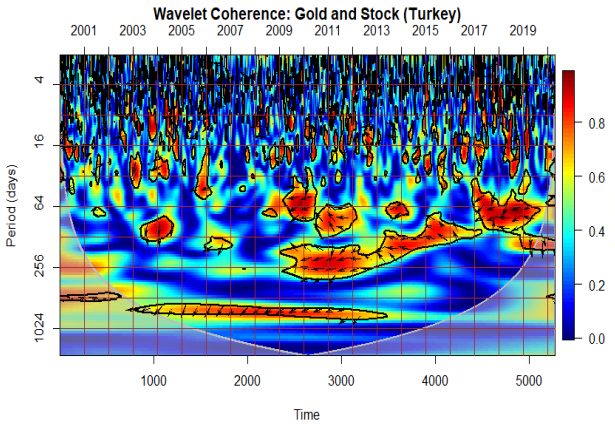
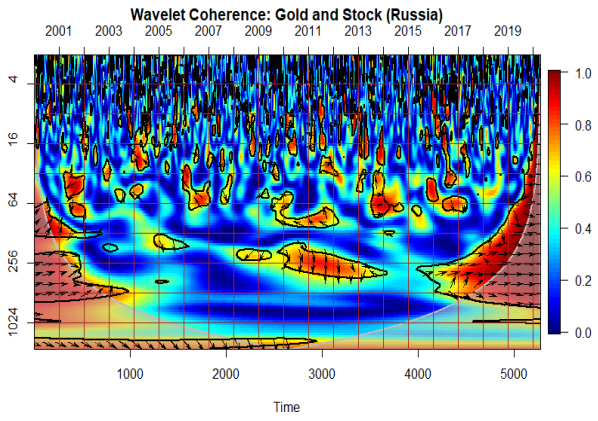


Figure 4.8: Wavelet Squared Coherence (Russia)



Based upon the large blue areas, Figure 4.7 reported little coherence between gold and the stock market of Turkey upto the period of 8 days scale. Overall, on aggregate, the high dominance of red colour islands with westward-facing arrows throughout the sample period indicates strong

hedge properties on average. Moreover, two red patches at medium and long horizons are found during GFC with left-direction phase arrows. This signifies that gold and stock prices moved in the opposite direction, indicating the strong safe haven power of gold against stock price movements. Similarly, high negative coherence in times of EDC at medium and long horizons indicates the ability of gold to compensate participants for losses due to fluctuations in stock prices. Even, evolving strong coherency at medium horizons is visible at the onset of a novel corona virus from the end of December 2019 onwards. For one thing, due to a drastic hike in infected counts and, thereby fall in stock prices, investors moved to gold to safeguard their wealth.

Figure 4.8 depicts the wavelet coherency plot during both turmoil and tranquil periods. In the long run we indeed find high co-movements with gold leading equities. It appears to correspond with the increased tendency of gold prices after 2002 and the increased attention of investors as gold as a diversifier asset in the aftermath of sequential uninterrupted crises and turmoil (e.g., Russian economic crises from 2000-2001, dot com bubble burst 2000-2001, Global financial crisis 2008-09). It is evident that gold performs its role as a strong haven asset during economic downturns created by DCBB in the short run. Coherency also shows one minor yellow droplet with west-facing arrows at around 256 days, indicating the weak safe haven role of gold in GFC. Small orange droplets are also seen at both the short-term frequency band (8 -16 days) and long-term frequency band (64-128 days) with left-facing out-of-phase arrows during EDC. This shows a weak negative correlation significantly flowing in times of the above crisis.

The wavelet coherence between Saudi Arabia gold and equity is shown in Figure 4.9. First, as seen in the plot, statistically less significant denoted by more blue regions, point out that gold dominates as a short-term investment hedge for investors. To add on, the coherency between gold and stock with a few black line pouches was detected only on 8- and 128-day frequencies. Moreover, the phase angles falling towards the west confirm the safe haven results of gold, which is consistent with the results shown in Table 4.7 during the Covid-19 crisis.

The wavelet coherence results signify that for Thailand, the gold and equity are closely cohorts from short to medium investment horizons (Figure 4.10). The wavelet phase angles towards the west across a short horizon particularly some arrows pertaining to the DCBB and GFC crisis,

state that gold might reveal the weak safe haven against the equity price movement. At a medium horizon, the arrows face south within a warmer colour big black outline, illustrating gold leads the Thailand stock market.

As observed there arefewer patches of coherence in Figure 4.11 for the Vietnam market. The deep blue across the surface of the plot lends support to the hedging appeal of gold against equity. Specifically, looking at a selected crisis period, it seems that the safe haven ability of gold remained negligible against stock. However, some east fronting arrowing on a time-frequency horizon extend a positive coherence between gold and equity.

Figure 4.9: Wavelet Squared Coherence (Saudi Arabia)

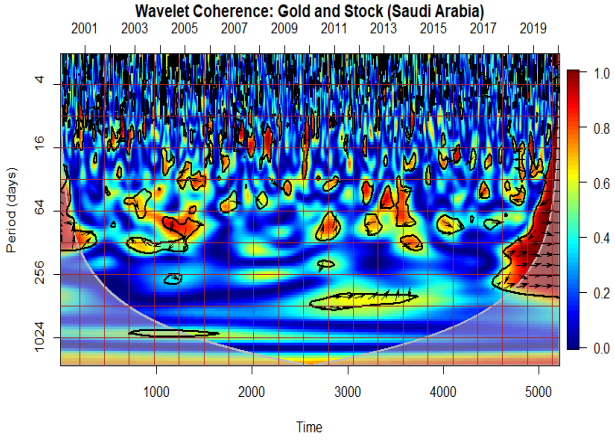
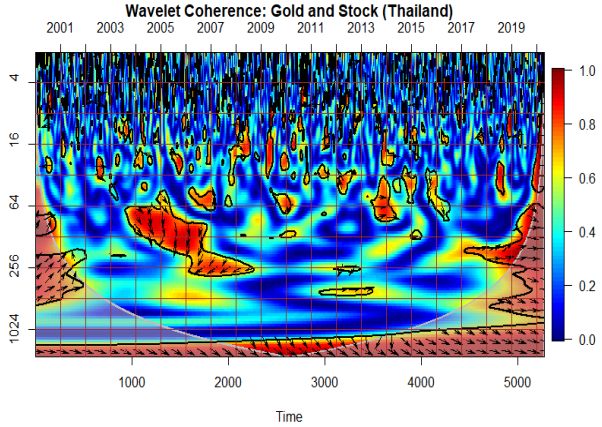


Figure 4.10: Wavelet Squared Coherence (Thailand)



In the case of Wavelet coherency plot Figure 4.12 between gold and US equities, at shorter horizons of around 8 days, there were very limited bands of high coherency (red colour) visible between gold and equities. The predominance of blue colour indicates the role of gold as a short-term investment hedge for equities. However, throughout the sample period, at longer horizons beyond 64 days, small patches of distinct bands of positive coherency between gold and stock are evident. During the time span from 2001-2002, at periods of approximately 64 days, a small red colour patch with westward facing arrows corresponds to elevated negative co-dependency between gold and US stocks. This signifies a weak safe haven ability of gold in times of DCBB. Moreover, at longer horizons of beyond 64- and 256-day frequency bands, a higher coherency with east-facing arrows signifies positive co-dependence between gold and stocks. Further increased negative coherency was experienced over 1024 days (longer horizons) in 2007-2008 with north-west facing arrows, corresponding to the phase of GFC. From 2010-2012, at periods

of approximately 256 days, a pocket of negative coherency was also exhibited with south-west facing arrows with gold leading equities depicting safe haven property of gold. Finally, a substantial coherence with a small island of dependency was evidenced at the end of the sample period, i.e., around 128 to 256 days frequency band. The period was marked by the beginning of COVID-19 crisis. This can be on account of the combined effect of some of the factors, such as the reaction of US stock markets towards bad news coming from Wuhan city, an announcement of the first death on 31st December 2019 by an unknown deadly virus, High-level warning alerts by US authorities on account of unprecedented increase in global cases, global pandemic announcement by WHO on 11th March 2020 and further extensive measures of lockdown, shutting of cross borders and suspension of economic activities and so on. The Covid-19 fears triggered the positive co-movement between gold and stock during this phase. These are represented by north-east facing arrows, indicating gold leading US equities.

Figure 4.11: Wavelet Squared Coherence (Vietnam)

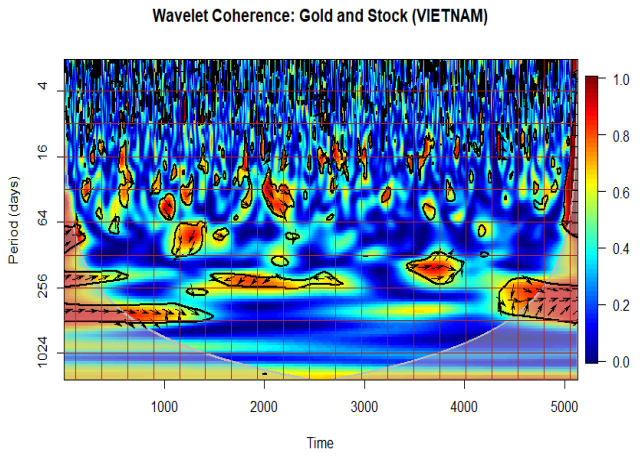
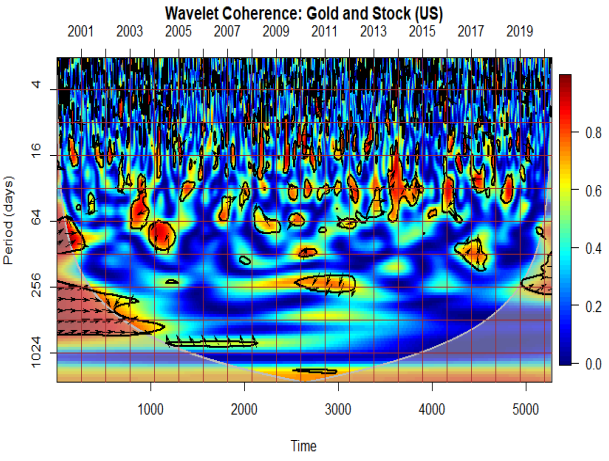


Figure 4.12: Wavelet Squared Coherence (USA)



Panel B: Gold Producer Countries

Figure 4.13 exhibits the Wavelet coherence between gold and Australian equity markets. Initially, during DCBB negligible short horizon coherence with arrows in the left direction demonstrates weak safe haven property of gold. Moreover, at longer horizons, there is strong evidence of positive coherence among the assets. The analysis of GFC has shown negative long-horizon coherence, usually linked with a safe haven. An extended band of high coherency both at medium and long-term horizons was exhibited during EDC. This suggests that including the yellow asset in a portfolio would have aided in decreasing the portfolio risk during this turmoil.

Surprisingly, the safe haven status of gold was not displayed during the recent Covid crisis. Gold exhibits a comparatively strongest hedge property and safe haven property across all crises except the Covid-19 crisis in Australian stock markets, with a more pronounced effect during EDC across all investment horizons. This implies that gold does not glitter for all types of crises.

In the case of Figure 4.14, evidence of hedge was exhibited upto a short horizon of 8 days throughout the sample period. During later phases, a large number of red droplets were found with arrows in the phase facing east direction. A high positive co-dependence amongst markets was seen wherein the gold market was leading stock markets. However, during the internet bubble burst in 2001, a small red patch with westward-facing arrows gives conclusive evidence of the weak safe haven ability of gold. In periods of EDC, the arrows are mostly turned to the left, implying stock is leading gold and the sharp decline in the equity market has strikingly raised gold prices in Canada. Other coherencies at medium horizons were also observed with arrows turned up in the right direction, suggesting a cyclic relationship between gold and stock during the Covid-19 phase.

Figure 4.15 depicts the coherency chart between gold and South African equities. A close look at the plot reveals a high degree of co-movement and synchronization with highly concentrated red regions at the various medium and long frequency bands over a time span from 2001 to 2020. In most of the frequency and time intervals, gold and stock move together positively and significantly. This high co-movement between gold and stocks is particularly associated with the high dependence of the South African economy on its natural resources, namely gold. The safe haven property is also displayed across all the crisis periods in the short and medium horizon. Specifically, during such turmoil, an equity investor would have alleviated a huge loss by holding a portfolio in combination with gold.

Figure 4.13: Wavelet Squared Coherence (Australia)

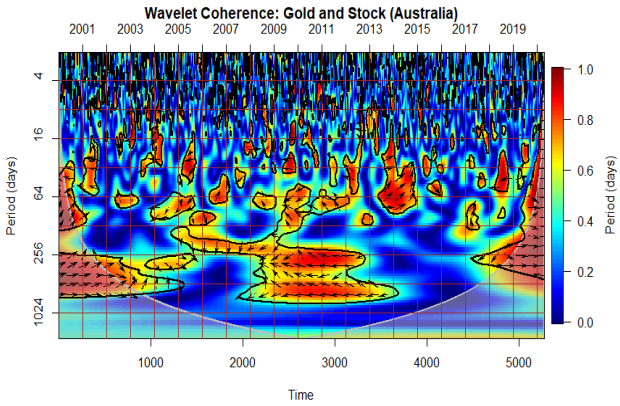


Figure 4.14: Wavelet Squared Coherence (Canada)

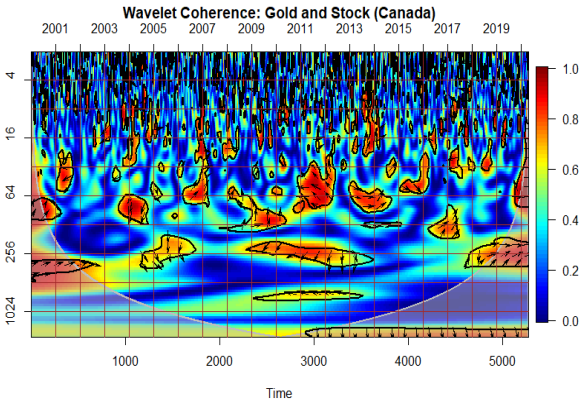
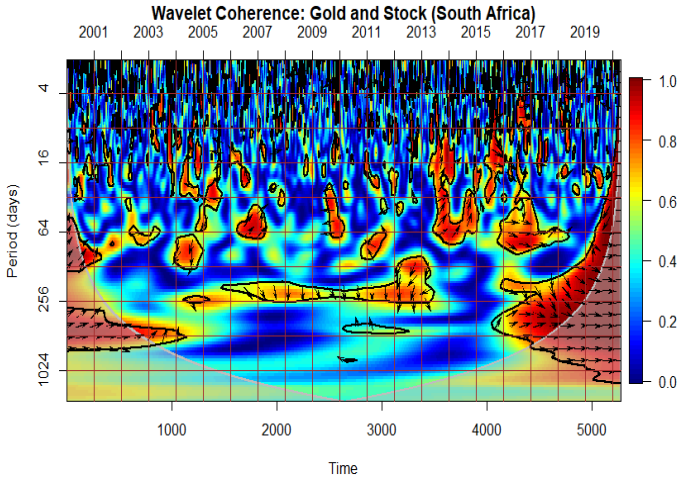


Figure 4.15: Wavelet Squared Coherence (South Africa)



Panel C: Key Currencies Countries

Figure 4.16 reports that investors are losing faith in gold as a traditional safe haven asset. Referring to the recent Covid-19 crisis, the performance of gold is very disappointing in serving as a haven asset for Switzerland's stock markets. Even wavelet coherence plots hardly show negative red droplets during DCBB and GFC, implying a diminishing safe haven status of gold. However, only in medium horizons during a period of EDC, gold outperforms in exhibiting a strong negative coherency, indicating westward-facing arrows with stocks.

Figure 4.17 displays the coherency between UK gold and equity. For this market, the study finds a band of red colouring visible at a period between 4 and 96 days across the time horizon. However, the areas with blue colour at a medium and longer horizon specify the gold existence

of hedge against UK equity. Arrows facing west in between 16 – 64 days frequency at the end of 2007 suggest a safe haven appeal of gold at the beginning of GFC. At the end of 2018 and 2019 year, at a frequency of about 8-32 days, left-facing arrows also signify the safe haven attribute of gold. Besides, some arrows within red colour patches pointing towards the east indicate a positive coherency. And the phase angles facing south-east (2005-06) suggest gold is shown to lead equity at a longer horizon.

Figure 4.18 plots the connectedness between gold and the stock market during both calm and crisis periods within a time-frequency domain. Overall, the lead-lag interplay between the gold and equity markets of Japan suggests a low correlation, which is also indicated by the predominance of blue colour. A significant positive relationship was exemplified throughout the time and frequency domain, which shows the inability of gold to serve as a financial protector against severe negative shocks during a crisis. Nevertheless, a small red patch around 64 to 128 days (medium horizon) indicates a pocket of negative coherency flowing from gold to stock during DCBB and also during the recent Covid-19 crisis. Thereby indicating weak safe haven potential during these crises.

Figure 4.16: Wavelet Squared Coherence (Switzerland)

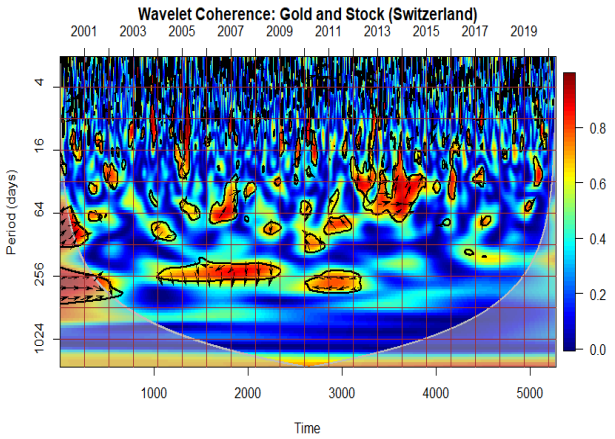


Figure 4.17: Wavelet Squared Coherence (UK)

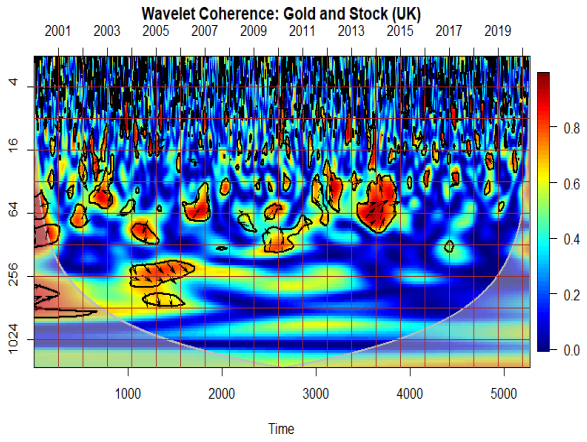
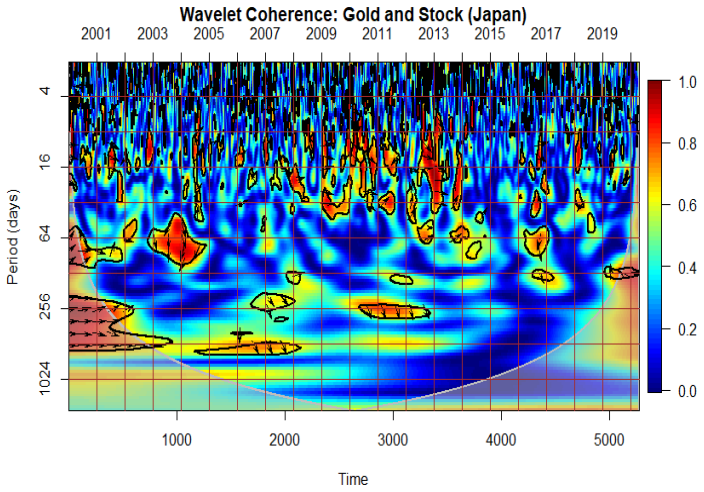


Figure 4.18: Wavelet Squared Coherence (Japan)



In conclusion, the results of wavelet analysis are supportive of the results drawn by (Bredin, Conlon, & Potì, 2015), indicating low co-dependency between gold and stock markets of US, UK and Germany and hedge for traditional asset in short horizons. Even findings by (Bredin, Conlon, & Potì, 2015) are consistent with weak safe haven potential of gold during the global financial crisis. Incase of Saudi Arabia and UAE, a positive dependence across indicates strong hedge potential of gold. These results are line with (Mensi, Hammoudeh, & K, 2016) for GCC markets (inclusive of UAE and Saudi Arabia), making this shiny metal a good hedge for short and long run horizons.

(Mensi, Hammoudeh, & K, 2016) also suggested significance of diversification for short term (traders and speculators) and long term investors (institutional investors and central bank). In similar veins with (Dar & Maitra, 2017), the results of gold stock nexus confirmed weak safe haven role of gold against major gold consuming countries (US, India and China) during DCBB and GFC at multiple horizons.

The phenomenon of remarkably high degree of synchronization was also observed between gold and stocks markets in longer horizons for India, Russia, China and Saudi Arabia, which is similar to results of (Bekiros, Boubaker, Uddin, & Nguyen, 2017) with respect to BRICS Countries.

CHAPTER - 5

HEDGE AND SAFE HAVEN POTENTIAL OF GOLD AGAINST EQUITY SECTOR INDICES OF MAJOR GOLD CONSUMING, MAJOR GOLD PRODUCING AND KEY CURRENCY COUNTRIES

CHAPTER FIVE

Hedge and safe haven potential of gold against equity sector indices of major gold consuming, major gold producing and key currency countries

5.1 Introduction

In recent years, investors have been shifting a large influx of investment in disaggregated sector levels due to the aggregate level stocks are at the peak of adversity. However, given the equity sectors are a part of the aggregate stock market, the equity sectors are also presumed to be associated with risk under challenging circumstances. Thus, the question to answer is how to manage this risk. Many argue that the choice of investment in a different avenue should be based on the asset's interdependency. From the market trader's perspective, it is about how far the equity sectors and gold market are interconnected.

In line with the above, in this chapter, the importance of gold is assessed as a hedge and a safe haven against equity sectors of GCC, GPC and KCC during normal periods, downturns and downside risks. Further, the study presents a broader overview of empirical analysis and a detail discussion.

5.2 Summary Statistics

Table 5.1.1 to 5.1.18 illustrates the summary statistics between gold and sectoral indices of Panel A - Major Gold Consuming Countries (India, China, UAE, Egypt, Indonesia, South Korea, Turkey, Russia, Saudi Arabia, Thailand, Vietnam and USA), Panel B - Major Gold Producing Countries (Australia, Canada and South Arica) and Panel C - Key Currency Countries (Japan, UK and Switzerland). The results of these tables are explained as follows;

Panel A: Major Gold Consuming Countries

For India (Table 5.1.1), for the entirety of the sample period, we noticed positive returns on equity sectors. The average daily returns of this country's sectors range from 0.0821% to 0.2788%. In terms of risk, it is in the range of 1.0078% to 1.8716%. Telecommunication (0.2788%), financials (0.2762%), utilities (0.2614%) and basic materials (0.2534%) provide the highest daily returns in comparison to other sectors. However, comparatively, the information technology (1.8716%), telecommunication (1.8062%) and industrials (1.8050%) sectors seem to be more volatile. A higher telecommunication sector risk-return performance indicates a greater trade-off opportunity in this sector for investors.

Table 5.1.1: Summary Statistics and Correlation of Gold Returns and Sector Indices Returns of India

Series	Mean	SD	Skewness	Kurtosis	JB test	Correlation
Gold	0.0403	1.0296	0.1621	8.9798	7496.772***	-
Sector Indices						
Consumer Discretionary	0.0821	1.1505	0.4251	6.4725	2784.133***	-0.0653
Consumer Staples	0.1071	1.2188	0.6405	6.6634	3280.864***	-0.0438
Energy	0.1051	1.5669	0.7917	8.5599	7279.772***	-0.0484
Financials	0.2762	1.4446	1.5144	11.6989	17735.84***	-0.0999
Health Care	0.1901	1.0078	0.9254	6.0325	2638.399***	-0.0255
Industrial	0.0944	1.8050	0.6951	7.4679	4769.549***	-0.0157
Information Technology	0.1141	1.8716	0.7061	7.5420	4928.203***	-0.0343
Telecommunication	0.2788	1.8062	1.1548	6.7092	3991.055***	-0.0503
Basic Materials	0.2534	1.4235	1.2416	8.7094	8103.239***	-0.0343
Utilities	0.2614	1.4349	2.0705	18.6757	54951.95***	-0.0492

Note:***, **, and * denote significance at 1%, 5% and 10% levels of significance, respectively. Where SD represents the Standard Deviation of returns, the JB test indicates Jarque-Bera statistics.

The descriptive statistics of China's equity sector returns are reported in Table 5.1.2. Except for the industrial sector, all sectors offered positive returns to the investors. The percentage ranges between 0.0001% to 0.0280%, which is proportionately lower in each sector. Among the sectors, we see that the telecommunication sector (2.2900%) has the highest volatility, while the energy sector (0.0179%) has the lowest on a daily basis.

Table 5.1.2: Summary Statistics and Correlation of Gold Returns and Sector Indices Returns of China

Series	Mean	SD	Skewness	Kurtosis	J-B test	Correlation
Gold	0.0295	1.0686	-0.2489	9.1013	8245.72***	-
Sector Indices						
Consumer Discretionary	0.0160	1.7169	-0.4993	7.4234	4524.76***	0.0203
Consumer Staples	0.0280	1.6609	-0.3593	7.2196	4030.63***	0.0307
Energy	4.73E-05	0.0179	-0.1371	12.7386	20885.26***	0.0428
Financials	0.0079	1.6799	0.0514	7.7720	5013.19***	0.0184
Health Care	0.0258	1.6074	-0.2398	7.0232	3612.23***	0.0267
Industrial	-0.0149	1.7077	-0.3895	7.5799	4749.17***	0.0271
Information Technology	0.0158	1.9960	-0.3062	6.0115	2078.13***	0.0282
Telecommunication	0.0160	2.2900	0.1211	7.7945	4377.73***	0.0429
Basic Materials	0.0012	1.8240	-0.3580	7.0125	3655.48***	0.0680
Utilities	0.0054	1.6128	-0.4056	8.4251	6620.89***	0.0178

Note:***, **, and * denote significance at 1%, 5% and 10% levels of significance, respectively. Where SD represents the Standard Deviation of returns, the JB test indicates Jarque-Bera statistics.

Table 5.1.3: Summary Statistics and Correlation of Gold Returns and Sector Indices Returns of UAE

Series	Mean	SD	Skewness	Kurtosis	J-B test	Correlation
Gold	0.0319	1.1111	-0.3682	8.6017	5638.09***	-
Sector Indices						
Consumer Discretionary	-0.0106	1.7690	0.0578	10.3233	9474.890.***	-0.0315
Consumer Staples	0.0198	2.0491	0.3437	8.11675	4199.061.***	-0.0073
Financials	0.0229	1.3279	-0.2350	10.5290	10051.09***	0.0177
Health Care	-0.0143	2.1484	1.6187	41.0611	257718.9***	-0.0133
Industrial	-0.0038	1.8962	-0.1622	7.9665	4375.24***	0.0238
Telecommunication	0.0222	1.4924	0.9126	20.9105	57247.24***	-0.0141
Utility	-0.0515	2.3207	0.1794	7.5626	3299.887***	-0.0298

Note: ***, **, and * denote significance at 1%, 5% and 10% levels of significance, respectively. Where SD represents the Standard Deviation of returns, the JB test indicates Jarque-Bera statistics.

The statistical performance of UAE sector returns is presented in Table 5.1.3. At first glance, the consumer staples, financials and telecommunication sectors show positive mean returns and other sectors are measured with negative returns. At the same time, the sectors such as utilities and health care sector, which have shown a negative return, are also associated with higher standard deviations of 2.3707% and 2.1484%. This indicates that investments in these sectors are subject to higher risk.

Table 5.1.4: Summary Statistics and Correlation of Gold Returns and Sector Indices Returns of Egypt

Series	Mean	SD	Skewness	Kurtosis	J-B test	Correlation
Gold	0.0613	1.3253	6.9951	220.5416	10456394***	-
Sector Indices						
Consumer Discretionary	0.0291	1.5970	-4.4241	128.9022	3505185.***	0.0215
Consumer Staples	0.0242	1.3846	-3.8148	112.9603	2673389.***	0.0248
Energy	-0.0253	1.8940	-0.1762	14.0907	19407.89***	-0.0188
Financials	0.0328	1.5220	-0.6779	11.6315	16798.01***	0.0510
Health Care	0.0449	1.9649	-0.2245	15.5509	34706.43***	0.0169
Industrial	0.0357	1.7369	0.4190	28.0290	138000.1***	0.0448
Information Technology	-0.0167	2.7422	-3.6430	92.2295	1296090.***	0.0082
Telecommunication	0.0029	2.0534	0.3338	10.5456	12626.27***	0.0334
Basic Materials	0.0168	1.5854	-1.2681	21.6714	78126.17***	0.0129

Note: ***, **, and * denote significance at 1%, 5% and 10% levels of significance, respectively. Where SD represents the Standard Deviation of returns, the JB test indicates Jarque-Bera statistics.

Table 5.1.4 provides the summary statistics for each of the sector returns of Egypt. Energy and information technology are the only equity sectors that recorded negative average returns during the sample period. All other sectors have positive returns between a range of 0.0029% to 0.0449% for a volatility range from 1.3846% to 2.7422%. Interestingly, the healthcare and industrial sectors outperformed the others in the Egyptian market.

Table 5.1.5: Summary Statistics and Correlation of Gold Returns and Sector Indices Returns of Indonesia

Series	Mean	SD	Skewness	Kurtosis	J-B test	Correlation
Gold	0.0483	1.1714	-0.1196	9.6380	9708.35***	-
Sector Indices						
Consumer Discretionary	0.0436	2.4251	0.0618	9.4747	9227.85***	-0.1087
Consumer Staples	0.0463	1.7552	-0.0599	9.7735	10098.79***	-0.0988
Energy	0.0185	3.8179	0.5639	23.2474	90487.42***	-0.0206
Financials	0.0164	1.9499	0.1195	10.7605	13264.49***	-0.0877
Health Care	0.0385	1.9585	0.6122	14.6145	30012.92***	-0.0616
Industrial	0.0350	1.8322	0.0974	21.3832	74370.02***	-0.0690
Information Technology	0.1664	2.3461	1.1641	17.0091	23545.61***	-0.0158
Telecommunication	0.0315	1.8807	-0.1036	9.0466	8054.49***	-0.0824
Basic Materials	0.0052	2.0494	-0.7498	16.5975	41178.94***	-0.0589
Utilities	0.0183	2.8093	0.0981	12.1045	14689.18***	-0.0258

Note:***, **, and * denote significance at 1%, 5% and 10% levels of significance, respectively. Where SD represents the Standard Deviation of returns, the JB test indicates Jarque-Bera statistics.

For Indonesia, descriptive statistics show that all sector returns are positive (Table 5.1.5). Among the sectors, the information technology (0.1664) sector outperforms other sector returns over the sample period. The coefficient of variation ranges from 1.7552% to 3.8179%, saying that the

favourable returns on Indonesian equity sectors are associated with significant trade-offs. The sectors such as energy (3.8179%), utilities (2.8093%), consumer discretionary (2.4251%), information technology (2.3461%) and basic materials (2.0494%) have shown higher volatility than other sector returns.

Table 5.1.6: Summary Statistics and Correlation of Gold Returns and Sector Indices Returns of South Korea

Series	Mean	SD	Skewness	Kurtosis	J-B test	Correlation
Gold	0.0339	1.1905	-0.4375	15.6852	35576.07***	-
Sector Indices						
Consumer Discretionary	0.0258	1.5141	-0.3438	7.5869	4733.65***	-0.1322
Consumer Staples	0.0306	1.7505	-0.2493	8.7945	7442.83***	-0.1118
Energy	0.0146	2.1897	-0.1096	7.3015	4082.01***	-0.1134
Financials	-0.0019	1.9512	-0.0171	10.2480	11559.76***	-0.1646
Health Care	0.0769	2.4062	0.1206	10.0422	10925.33***	-0.0533
Industrial	0.0094	1.9971	-0.3050	9.7978	10250.09***	-0.1376
Information Technology	-0.0122	2.3499	-0.2537	9.3166	8836.16***	-0.1112
Telecommunication	-0.0267	1.6415	-0.1732	11.0452	14268.62***	-0.0775
Basic Materials	0.0205	1.8976	-0.2361	8.4769	6649.47***	-0.1245
Utilities	-0.0111	1.8037	-0.0582	7.9798	5459.66***	-0.1038

Note:***, **, and * denote significance at 1%, 5% and 10% levels of significance, respectively. Where SD represents the Standard Deviation of returns, the JB test indicates Jarque-Bera statistics.

Except for financials, information technology, telecommunication and utilities, all other sectors of South Korea have shown a positive return (Table 5.1.6). The average highest daily returns on the health care sector are 0.0769% and on consumer staples is 0.0306%, indicating an interesting investment avenue in the sector market. The returns variation measured by standard deviation ranges from 1.5141% to 2.4062% on sector returns of South Korea.

For Turkey (Table 5.1.7), it can be seen that all the sector indices display positive returns, with information technology (0.0825%) exhibiting the highest returns and the energy sector (0.0104%) showing the lowest returns. The volatility of sector returns is significantly higher, varying between 1.9863% and 2.9034%.

Table 5.1.7: Summary Statistics and Correlation of Gold Returns and Sector Indices Returns of Turkey

Series	Mean	SD	Skewness	Kurtosis	J-B test	Correlation
Gold	0.0798	1.4690	3.6994	99.6802	2068787.***	-
Sector Indices						
Consumer Discretionary	0.0393	2.0757	-0.0814	11.4574	15744.94***	-0.2070
Consumer Staples	0.0466	1.9863	-0.1511	13.6925	25177.47***	-0.1905
Energy	0.0104	2.2078	0.0792	9.97074	10697.62***	-0.1536
Financials	0.0424	2.4084	0.0428	8.54886	6776.67***	-0.2324
Industrial	0.0328	2.1050	-0.0133	11.4350	15656.08***	-0.1709
Information Technology	0.0825	2.9034	0.1877	10.8115	13457.71***	-0.1638
Telecommunication	0.0308	2.5887	0.1986	10.7590	13281.83***	-0.1459
Utilities	0.0381	2.1738	-0.0355	10.4618	12252.59***	-0.1478

Note:***, **, and * denote significance at 1%, 5% and 10% levels of significance, respectively. Where SD represents the Standard Deviation of returns, the JB test indicates Jarque-Bera statistics.

Table 5.1.8: Summary Statistics and Correlation of Gold Returns and Sector Indices Returns of Russia

Series	Mean	SD	Skewness	Kurtosis	J-B test	Correlation
Gold	0.0523	1.2269	-0.0024	16.0223	37315.17***	-
Sector Indices						
Consumer Discretionary	0.0608	2.3014	0.7914	21.15539	73080.99***	-0.0366
Consumer Staples	0.0618	12.4774	-10.5583	1916.76	6.83E+08***	-0.0036
Energy	0.0467	2.1284	0.0174	19.4603	59618.64***	-0.0105
Financials	0.0841	2.3767	0.0954	16.2872	38856.12***	-0.1003
Health Care	-0.0120	2.3604	-0.4032	37.2541	160739.7***	0.0044
Industrial	-0.0224	3.4204	-8.8712	251.018	8287458.***	-0.0503
Information Technology	0.0587	4.4161	9.6613	1082.72	1.79E+08***	-0.0070
Telecommunication	0.0297	1.9112	2.2507	95.7949	1899214***	-0.0367
Basic Materials	0.0656	2.0091	-0.8311	16.1186	35001.21***	-0.0080
Utilities	0.0168	2.5562	-1.6428	96.4007	1921949.***	-0.0532

Note:***, **, and * denote significance at 1%, 5% and 10% levels of significance, respectively. Where SD represents the Standard Deviation of returns, the JB test indicates Jarque-Bera statistics.

For Russia, the risk-adjusted return ratio of the health care and industrial sectors shows that high risk does not always compensate by greater returns (Table 5.1.8). Rest all sectors offer positive returns to the investors for a higher level of risk. More clearly, the consumer staple sector reveals 0.0618% returns for the highest risk of 12.4774%.

For Saudi Arabia (Table 5.1.9), consumer discretionary, consumer staples and health care sectors have a positive average daily return, while all other sectors have shown a negative return. The health care sector has much higher returns of 0.0451%. However,the energy sector is more volatile than others, with a 2.4435% standard deviation value.

Table 5.1.9: Summary Statistics and Correlation of Gold Returns and Sector Indices Returns of Saudi Arabia

Series	Mean	SD	Skewness	Kurtosis	J-B test	Correlation
Gold	0.0328	1.1451	-0.3640	8.5427	4923.34***	-
Sector Indices						
Consumer Discretionary	0.0105	1.8766	-0.3945	14.4810	20864.22***	-0.0070
Consumer Staples	0.0025	1.9880	-0.8542	14.0170	19581.42***	-0.0031
Energy	-0.0498	2.4435	-0.3859	7.9761	3356.62***	-0.0037
Financials	-0.0173	1.4886	-0.6348	12.1095	13327.18***	-0.0015
Health Care	0.0451	1.6136	0.1345	8.6258	3646.67***	-0.0311
Industrial	-0.0178	1.6283	-1.0682	17.5014	33848.63***	-0.0003
Telecommunication	-0.0146	1.6791	-0.4626	13.1851	16477.54***	-0.0054
Basic Materials	-0.0275	1.9579	-0.7334	10.6416	9538.35***	0.0334
Utilities	-0.0153	2.0194	-0.3103	12.0968	13097.63***	-0.0174

Note:***, **, and * denote significance at 1%, 5% and 10% levels of significance, respectively. Where SD represents the Standard Deviation of returns, the JB test indicates Jarque-Bera statistics.

Table 5.1.10: Summary Statistics and Correlation of Gold Returns and Sector Indices Returns of Thailand

Series	Mean	SD	Skewness	Kurtosis	J-B test	Correlation
Gold	0.0302	1.0579	-0.1837	9.9845	10764.10***	-
Sector Indices						
Consumer Discretionary	0.0289	1.6031	-0.0494	13.2765	23240.16***	-0.0284
Consumer Staples	0.0234	1.6823	-0.2834	7.1371	3836.76***	-0.0121
Energy	0.0318	1.9401	-0.7932	20.4661	167.8603***	-0.0103
Financials	0.0013	1.6760	-0.5267	14.1295	27499.52***	-0.0413
Health Care	0.0407	1.4994	-0.2334	8.8789	7652.838***	0.0009
Industrial	0.0240	1.9825	-0.0632	14.3134	28167.47***	-0.0320
Information Technology	-0.0014	2.2485	-0.0829	8.8751	7601.2808***	-0.0373
Telecommunication	0.0080	1.9421	-0.5938	13.8829	26371.33***	-0.0381
Basic Materials	-0.0009	1.9375	-0.9703	16.2780	39623.14***	-0.0148
Utilities	0.0378	1.4283	-0.1451	15.0618	32031.59***	0.0058

Note: ***, **, and * denote significance at 1%, 5% and 10% levels of significance, respectively. Where SD represents the Standard Deviation of returns, the JB test indicates Jarque-Bera statistics.

Table 5.1.10 documents the summary statistics of each sector for Thailand. The health care sector is the high performer among the sectors with the highest positive returns and lowest risk. On that side, during the sample period, information technology and basic materials are the inefficient assets that have given negative returns to the investors with the highest variation.

In the case of Vietnam, except for consumer staples and health care, all other sectors furnished negative returns during a whole sample period (Table 5.1.11). Although this is a frontier economy and there is a lot of potential to grow but, investors should note that the returns provided by Vietnam in the equity sector are subject to higher volatility. In particular, consumer

discretionary (2.6207%), telecommunication (2.3780%) and energy sector (2.1623%) are the most volatile among others.

Table 5.1.11: Summary Statistics and Correlation of Gold Returns and Sector Indices Returns of Vietnam

Series	Mean	SD	Skewness	Kurtosis	J-B test	Correlation
Gold	0.0378	1.1295	-0.1694	9.3111	5643.773***	-
Sector Indices						
Consumer Discretionary	-0.0742	2.6207	-1.0262	427.3792	23698408***	-0.0218
Consumer Staples	0.0105	1.5171	-0.1156	17.8221	31048.730***	0.0074
Energy	-0.0246	2.1623	-0.1058	3.9430	129.882***	0.0065
Financials	-0.0075	1.5663	-0.1802	4.9814	573.064***	0.0044
Health Care	0.0191	1.5644	0.1002	4.6945	411.352***	0.0294
Industrial	-0.0180	1.6190	-0.2617	4.5957	398.453***	0.0062
Telecommunication	-0.0191	2.3780	0.1715	168.9005	3848647***	-0.0231
Basic Materials	-0.0381	1.6768	-0.0734	5.3929	765.403***	0.0054
Utilities	-0.0457	1.6409	-0.2163	4.4987	343.805***	0.0014

Note:***, **, and * denote significance at 1%, 5% and 10% levels of significance, respectively. Where SD represents the Standard Deviation of returns, the JB test indicates Jarque-Bera statistics.

Table 5.1.12: Summary Statistics and Correlation of Gold Returns and Sector Indices Returns of USA

Series	Mean	SD	Skewness	Kurtosis	J-B test	Correlation
Gold	0.0324	1.0731	-0.2548	9.0351	8071.61***	-
Sector Indices						
Consumer Discretionary	0.0172	1.1557	-0.5185	13.2551	23377.72***	-0.0410
Consumer Staples	0.0211	0.9441	-0.3100	16.9399	42842.96***	-0.0011
Energy	0.0017	1.6900	-1.0136	21.7846	78548.05***	0.0732
Financials	0.0071	1.6709	-0.2772	18.1168	50350.79***	-0.0353
Health Care	0.0250	1.0781	-0.2422	13.1183	22579.37***	-0.0201
Industrial	0.0152	1.3935	-0.4481	11.9143	17662.07***	-0.0064
Information Technology	0.0093	1.7213	0.0900	10.3695	11957.42***	-0.0242
Telecommunication	-0.0141	1.3913	-0.0009	11.5229	15983.58***	-0.0284
Basic Materials	0.0123	1.6780	-0.4365	11.9771	17900.62***	0.0713
Utilities	0.0155	1.2020	-0.1438	18.0631	49944.94***	0.0445

Note: ***, **, and * denote significance at 1%, 5% and 10% levels of significance, respectively. Where SD represents the Standard Deviation of returns, the JB test indicates Jarque-Bera statistics.

According to the descriptive statistics results, although the US equity sector (except the telecommunication sector) offered daily positive returns but the return percentage is proportionately lower (Table 5.1.12). However, these returns are found to be less risky than equity sector returns of other markets. The sector market takes values from 0.0017% to 0.0250% for volatility, which varies from 0.9441% to 1.7213%.

Panel B: Major Gold Producing Countries

Table 5.1.13 presents the summary statistics of the Australian equity sectors. It shows that the consumer discretionary and telecommunication sector has negative mean returns and all other sectors depicted a less but positive return. Amidst sectors, health care (0.0441%), followed by information technology (0.0475%), found more potential investment avenues for investors with higher returns. The standard deviation on equity sectors starts at 1.0939% and stretches upto 1.7993%.

Table 5.1.13: Summary Statistics and Correlation of Gold Returns and Sector Indices Returns of Australia

Series	Mean	SD	Skewness	Kurtosis	J-B test	Correlation
Gold	0.0339	1.0974	0.4725	17.1797	44439.13***	-
Sector Indices						
Consumer Discretionary	-0.0009	1.2336	-0.5927	18.3695	52287.87***	-0.1180
Consumer Staples	0.0021	1.3241	-2.3790	54.6321	591584.7***	-0.0540
Energy	0.0104	1.4662	-0.8556	13.4026	24455.65***	-0.0647
Financials	0.0066	1.1231	-0.5162	14.7273	30496.64***	-0.1531
Health Care	0.0441	1.1067	-0.2350	12.5988	20322.55***	-0.0684
Industrial	0.0061	1.0993	-0.8622	13.5417	25107.12***	-0.1035
Information Technology	0.0475	1.7993	-0.0011	6.5037	2589.27***	-0.0526
Telecommunication	-0.0173	1.2910	-0.7005	9.8557	10774.02***	-0.0603
Basic Materials	0.0256	1.4864	-0.4208	9.2113	8645.04***	-0.0334
Utilities	0.0087	1.0939	-0.4981	8.2434	6268.13***	-0.0856

Note:***, **, and * denote significance at 1%, 5% and 10% levels of significance, respectively. Where SD represents the Standard Deviation of returns, the JB test indicates Jarque-Bera statistics.

Table 5.1.14: Summary Statistics and Correlation of Gold Returns and Sector Indices Returns of Canada

Series	Mean	SD	Skewness	Kurtosis	J-B test	Correlation
Gold	0.0322	1.0568	-0.1569	10.1372	11230.63***	-
Sector Indices						
Consumer Discretionary	0.0096	0.9499	-1.5260	39.6359	297386.7***	-0.0764
Consumer Staples	0.0153	1.3256	-0.3003	8.4926	6717.74***	-0.0592
Energy	0.0080	1.5780	-1.2656	25.4986	112792.2***	-0.0062
Financials	0.0002	0.0112	-0.3477	29.5302	154982.6***	-0.1150
Health Care	-0.0011	2.2850	-3.3913	90.2551	1685401.***	-0.0393
Industrial	0.0077	1.4056	-0.5423	10.5067	12658.39***	-0.0864
Information Technology	-0.0214	2.4458	-1.1912	21.4552	76193.56***	-0.0743
Telecommunication	0.0118	1.1667	-0.8641	27.0430	127855.9***	-0.0343
Basic Materials	0.0048	1.7111	-0.3372	12.9645	21948.17***	0.1850
Utilities	0.0275	0.8715	-0.9779	28.2335	140948.7***	-0.0151

Note:***, **, and * denote significance at 1%, 5% and 10% levels of significance, respectively. Where SD represents the Standard Deviation of returns, the JB test indicates Jarque-Bera statistics.

Canadian health care and information technology provide negative daily returns of -0.0011% and -0.0214%, respectively, while others advanced a positive return, but it is substantially lower for the portfolio investors (Table 5.1.14). The lowest returns were marked on the financials (0.0002%) sector, followed by basic materials (0.0048%). The volatility of all sectors ranges from 0.0112% to 2.4458%. Among the sectors, information technology, followed by the health care sector, shows a greater variation in returns.

Table 5.1.15: Summary Statistics and Correlation of Gold Returns and Sector Indices Returns of South Africa

Series	Mean	SD	Skewness	Kurtosis	J-B test	Correlation
Gold	0.0527	1.2812	0.1934	7.9509	5426.47***	-
Sector Indices						
Consumer Discretionary	0.0229	1.2986	-0.8996	12.6550	21224.25***	-0.1754
Consumer Staples	0.0038	1.6061	-2.4003	64.3718	833857.9***	-0.0781
Energy	0.0116	2.1435	-1.7896	38.1689	274978.3***	0.0101
Financials	0.0197	1.3984	-0.4834	10.9668	14171.84***	-0.2420
Health Care	0.0341	1.3063	-0.6896	11.0264	14594.39***	-0.1202
Industrial	0.0163	1.3289	-1.6935	34.3714	219080.9***	-0.1772
Information Technology	0.0801	2.2799	-0.1516	7.1403	3792.17***	-0.1139
Telecommunication	0.0229	2.0231	0.0911	9.7948	10166.36***	-0.1546
Basic Materials	0.0194	1.7984	-0.5988	12.3079	19379.23***	0.1371

Note:***, **, and * denote significance at 1%, 5% and 10% levels of significance, respectively. Where SD represents the Standard Deviation of returns, the JB test indicates Jarque-Bera statistics.

Looking at the summary statistics, all the sector returns of South Africa appear to have positive average returns (Table 5.1.15). If the emphasis points to the returns column, the two sectors (health care = 0.0341% and information technology = 0.0801%) lead in terms of highest performance. However, the standard deviation results say that these equity sector returns are not far from higher volatility. We can see that the information technology (2.2799%), energy (2.1435%), and telecommunication (2.0231%) sectors dominate the returns with higher risk.

Panel C: Key Currency Countries

The results of summary statistics for sector returns of Switzerland reveal that energy (-0.1056%), information technology (-0.0047%) and telecommunication (-0.0027%) have negatively performed during a sample period (Table 5.1.16). Among other sectors that have given positive returns are consumer staples (0.0206%), followed by basic materials (0.0183%), which have

shown a higher return. Moreover, the standard deviation values in these sectors range between 0.9943% to 2.3814%.

Table 5.1.16: Summary Statistics and Correlation of Gold Returns and Sector Indices Returns of Switzerland

Series	Mean	SD	Skewness	Kurtosis	J-B test	Correlation
Gold	0.0231	1.0229	-0.2970	11.3624	15464.90***	-
Sector Indices						
Consumer Discretionary	0.0101	1.6303	-0.2601	9.4581	9236.74***	0.0686
Consumer Staples	0.0206	1.3448	-0.0248	9.3467	8863.90***	0.0730
Energy	-0.1056	2.3814	-5.9687	145.4688	2962079. ***	0.0184
Financials	-0.0116	1.5319	-0.1459	12.8508	21371.32***	0.0400
Health Care	0.0119	1.0849	-0.2597	10.2279	11554.79***	0.0580
Industrial	0.0014	1.4800	-0.6325	11.8425	17557.11***	0.0855
Information Technology	-0.0047	1.0229	-0.2970	11.3624	15464.90***	0.0347
Telecommunication	-0.0027	1.1976	0.2506	13.3386	23574.97***	0.0308
Basic Materials	0.0183	1.2102	-0.4751	10.0928	11268.60***	0.1074
Utilities	0.0125	0.9943	-0.0785	11.898	17422.22***	0.0140

Note:***, **, and * denote significance at 1%, 5% and 10% levels of significance, respectively. Where SD represents the Standard Deviation of returns, the JB test indicates Jarque-Bera statistics.

Table 5.1.17: Summary Statistics and Correlation of Gold Returns and Sector Indices Returns of UK

Series	Mean	SD	Skewness	Kurtosis	J-B test	Correlation
Gold	0.0375	1.0760	0.0836	12.7026	20720.77***	-
Sector Indices						
Consumer Discretionary	0.0067	1.0648	-0.5995	13.3563	20720.77***	-0.0792
Consumer Staples	0.0175	1.1787	-0.1833	10.9105	13798.91***	-0.0331
Energy	-0.0025	1.5632	-0.3793	17.8941	48939.63***	0.0659
Financials	-0.0098	1.4794	-0.1736	13.0723	22350.04***	-0.1324
Health Care	0.0148	1.1476	-0.1661	7.9005	5308.655***	-0.0385
Industrial	0.0089	1.1863	-0.64045	9.5409	9775.158***	-0.0675
Information Technology	-0.0150	1.7895	-0.2588	12.4029	19513.80***	-0.0281
Telecommunication	-0.0281	1.7274	-0.0443	7.4928	4443.364***	-0.0762
Basic Materials	0.0124	2.0197	-0.1933	12.4495	19681.08***	0.0787
Utilities	0.0123	1.0805	-0.2708	11.5330	16086.14***	-0.0554

Note:***, **, and * denote significance at 1%, 5% and 10% levels of significance, respectively. Where SD represents the Standard Deviation of returns, the JB test indicates Jarque-Bera statistics.

Table 5.1.17 illustrates the statistical performance of UK sector returns. It can be verified that the investments made in the energy, financials, information technology and telecommunication sectors yield a negative return to the investors. All other sectors offered lower but positive returns on investment. The UK sector indices have recommended its lowest returns volatility between 1.0648% to 2.0197%.

Table 5.1.18: Summary Statistics and Correlation of Gold Returns and Sector Indices Returns of Japan

Series	Mean	SD	Skewness	Kurtosis	J-B test	Correlation
Gold	0.0336	1.0886	-0.3843	9.3578	9024.30***	-
Sector Indices						
Consumer Discretionary	0.0004	1.2706	-0.2925	9.4999	9371.89***	0.1619
Consumer Staples	0.0066	1.3960	-0.2609	8.9552	7863.48***	0.1587
Energy	-0.0001	1.8199	-0.1981	6.9624	3489.29***	0.1608
Financials	-0.0155	1.6396	-0.1288	8.6469	7031.19***	0.1327
Health Care	0.0171	1.1606	-0.5033	11.8589	17491.74***	0.1214
Industrial	0.0058	1.5239	-0.3050	9.0231	8064.54***	0.1698
Information Technology	-0.0210	1.6645	-0.2759	7.0020	3591.29***	0.1296
Telecommunication	-0.0114	1.6703	-0.3093	8.7519	7364.24***	0.0851
Basic Materials	0.0052	1.5558	-0.3094	10.5765	12715.48***	0.1770
Utilities	-0.0065	1.3208	-0.3581	12.5140	20030.01***	0.0663

Note:***, **, and * denote significance at 1%, 5% and 10% levels of significance, respectively. Where SD represents the Standard Deviation of returns, the JB test indicates Jarque-Bera statistics.

For the Japan market (Table 5.1.18), sector indices have given either negative returns or the least positive returns for the investors. The energy (-0.0001%), financials (-0.0155%), information technology (-0.0210%), telecommunication (-0.0114%) and utilities (-0.0065%) headed with negative returns while consumer discretionary (0.0004%), consumer staples (0.0066%), health care (0.0171%), industrials (0.0058%) and basic materials sectors (0.0052%) are associated with positive returns. However, all sector indices of Japan are less volatile, with less than a 1.90% standard deviation.

All-inclusive, significant observations have been made. First, out of 18 countries' sector indices under consideration, all the sector indices of India, Indonesia, Turkey and South Africa persistently offered positive and higher returns on sector investment. However, investors should note that although investment in these emerging countries sectors will yield higher returns but, essentially, they need to take a proportionately higher level of risk. When seeing these statistics, the aforementioned results are contrary to those of developed countries (Australia, US, UK, and Canada) sector indices. More specifically, the growing economies sector indices such as health care, information technology, energy and telecommunication offer a massive yield to the investors while the same has been pictured out negative for developed countries sector indices, particularly of Switzerland, UK and Japan. Another remarkable observation is that investors can look at India's and Indonesia's sector indices as bright investment spots due to their highest risk-return trade-off opportunities.

Table 5.1.1 to 5.1.18 also presents the skewness, kurtosis and Jarque-Bera test statistics for all the country's sector indices. Across the sector series, we have captured skewness value is either positive or negative and the kurtosis value is above 3. This reflects asymmetric behaviour and fatter tails of returns distribution. Using the Jarque- Bera test, we checked the normality of the return series and the results suggest the normality of the series can be rejected at a 5% level in all cases.

5.3 Correlation Results

To identify the position of gold as a hedge and safe haven against specific sectors of each country, we conducted the analysis with a preliminary test. Table 5.1.1 to 5.1.18 in the last column of each country gives a correlation result emanating from the test. The major observations derived from the test can be explained as follows;

For India (Table 5.1.1), all sector returns and gold are negatively correlated with values of -0.0157 to -0.0999. This crucial examination at the preliminary stage indicates the role of gold as a hedge/safe haven against sector indices in India. Although the negative correlation between gold and the sector meets the criteria of the theoretical framework but, we do not find any evidence of a higher correlation.

For China, Table 5.1.2 reports that all sectors and gold share a positive correlation during the whole sample period. But, the magnitude of the correlation is substantially lower, less than 0.0680. Thus, we infer this is a diversifier attribute of gold for equity sectors.

For UAE with correlation result, we noticed that the gold capability to serve as a hedge and a safe haven against sector returns (except the financial sector) appears to be weak due to its low correlation (Table 5.1.3).

The computed correlation coefficients for Egypt gold-sector pairs (except the gold-energy pair) show a positive sign of dependency that neglects gold's hedge and safe haven properties to the risk associated with sectors (Table 5.1.4).

There is also a low negative correlation between gold and all sector returns of Indonesia, ranging from -0.0258 to -0.1087 (Table 5.1.5). This evidence seems to be consistent with the argument that gold can be attributed as a hedge and safe haven when there is a decline in the equity sector.

For the South Korea market (Table 5.1.6), the corresponding relationship between gold and all sector returns seems negative, and the strength of the correlation varies between -0.0533 and -0.1646. Thus, we infer the possibility of minimizing the risk of sector markets if investors hold investments in gold in South Korea.

For Turkey (Table 5.1.7), it is evident that gold demonstrates a strong negative dependency with all sector returns during the sample period. If we consider consumer discretionary (-0.2070) and financial sector (-0.2324), they hold the highest negative and significant correlation with sector returns. This can be supported by the fact that gold may be widely used in the consumer discretionary and financial sectors.

With respect to the analysis for Russia (Table 5.1.8), we also reported a fairly low and negative correlation between the gold and sector (except gold and the health care sector). The correlation coefficient is lowest for the consumer staples and gold pair (-0.0036), followed by the information technology-gold pair (-0.0070).

For Saudi Arabia, the correlation results stated in Table 5.1.9 imply that gold could be a hedge and safe haven against all sector indices uncertainty (except basic materials) as it uncovered a negative correlation. However, the strength of the correlation is substantially low and remains below -0.0311. Among the sector markets, the industrial sector has the lowest correlation of -0.0003 with gold.

As for the unconditional correlation between the gold sectors of Thailand (Table 5.1.10), it is evident that there is a negative correlation between the variables (except gold-health care and gold-utilities sector, which indicates gold could act as a diversifier to these sectors).

Moving to the correlation outcome of Vietnam (Table 5.1.11), we observe that gold could provide diversification for the sample period since it exhibits a positive correlation with sectors such as consumer staples, energy, financials, health care, industrials, basic materials and utilities.

Moreover, gold is found to have a negative correlation with consumer discretionary (-0.0218) and telecommunication (-0.0231) sectors.

For the USA, the negative connectedness between the gold and equity sectors is very minute, ranging from -0.0011 to -0.0410 (Table 5.1.12). Sectors such as consumer staples (-0.0011) followed by industrials (-0.0064) exhibited the lowest correlation with domestic gold. The underlying results also display a positive relationship of gold with energy, basic materials and the utility sector. Thus, gold can be regarded as a diversifier for these sectors.

The correlation results presented in the last column of Table 5.1.13 unveil that the domestic gold returns of gold producing country (Australia) are negatively associated with all sector returns. The negative coefficient takes values from -0.0334 to -0.1531. This inverse relationship appreciates the possibility of a weak hedge and the safe haven role of gold.

Not surprisingly, Canada's gold returns (Table 5.1.14) also displayed a consistent negative relation with sector returns (except basic materials). Specifically, the coefficient value of -0.1150 dominates the higher negative correlation of gold with the financial sector. In the case of the basic materials sector, uncertainty depicts a positive correlation with gold (0.1850).

The pairwise unconditional correlation between gold and sector returns of South Africa is also negative (Table 5.1.15). However, the magnitude of the correlation between assets is low. It is around -0.0781 to -0.2420. Empirical results also show the gold-financial sector pair has the highest negative correlation of -0.2420, followed by gold-industrial (-0.1772) and gold-consumer staples (-0.1754). Besides, gold is unable to detect the negative correlation with the basic material sector.

In the last column of Table 5.1.16, we can see that there is a positive dependency between gold and all sector returns of Switzerland. This suggests gold seems to be not a hedge and safe haven for equity sectors.

For the UK (Table 5.1.17), the gold dependency is negative for most of the sectors except the energy and basic materials sector, which shows a positive relation. This negative association

occurs within a range of -0.0281 to -0.1324, which shows that gold could be regarded as a weak hedge and safe haven.

For Japan (Table 5.1.18), the results indicate that all the correlation coefficients are positive, which suggests that in this country, gold seems to be much more attractive for risk diversification in a sector portfolio.

Overall, we find a more negative correlation of gold-sector pairs across gold consuming, gold producing and key currencies countries. However, the strength of correlation is substantially low, taking values not more than -0.20. In addition, the gold returns of Turkey and South Africa showed a slightly larger negative correlation with the sector returns. The negative dependence on gold signals the weak hedge and safe haven attribute against sector investment volatility. We also captured the positive relationship of China, Switzerland, Egypt, Vietnam and Japan's gold returns with equity sectors. Interestingly, among developed countries (USA, Saudi Arabia, Canada and UK), there is a positive association of gold and the basic materials sector.

5.3.1 Rolling Correlation Results

In addition to the first objective, the study has been extended to test the hypothesis of hedge and safe haven potential of gold against specific sector indices that are part of the country's aggregate stock exchange. The results are displayed in Appendix 1, Table 5.2.1 to Table 5.2.18 with respect to Panel A - Major Gold Consuming Countries (India, China, UAE, Egypt, Indonesia, South Korea, Turkey, Russia, Saudi Arabia, Thailand, Vietnam and USA), Panel B - Major Gold Producing Countries (Australia, Canada and South Arica) and Panel C - Key Currency Countries (Japan, UK and Switzerland). Under the assumption that these industries are coming under government regulations and exposed to all kinds of uncertainties in the market, one can expect an evolving relationship between the gold and equity sectors. Again, testing the hedge and safe haven hypothesis under market aggregation might not portray the real picture of gold potential. So, the investors who are looking well beyond this may be interested to know information on whether gold could be able to protect the investment against industry volatility and seeking to know the potentiality of gold to serve as a tool of hedge and safe haven against

sector-wise volatility. So accordingly, under this assumption and at a formative stage of the hypothesis, we figured out using a preliminary test known as rolling correlations.

The correlation that is claimed in the above section can be visualised in detail by seeing the 24 rolling correlation windows pertaining to in and around the crises. On average, most of the sector indices of India, Turkey, South Korea, Indonesia, Thailand and the US (GCC); Australia, Canada and South Africa (GPC); and the UK (KCC) depicted a negative correlation with the local gold during crisis periods particularly GFC and EDC. However, the magnitude of the correlation coefficient remains below -0.50. Over the estimated rolling correlation windows, specifically on W1, W2, W9, W10, W13, W14 and W24 (falling into the crisis periods), the highest negative correlation holds between gold with financial, consumer discretionary, energy and industrial sectors. This dependency reminds gold appears to act as a hedge and safe haven for these sectors, particularly in times of market turmoil. At the same time, gold returns of China, Egypt, Vietnam (GCC); Switzerland and Japan (GPC) showed a positive correlation for most of the sectors. These results might appear contradictory, but gold highlights its wide scope of diversification against these countries' sectors. Moreover, the correlation between gold and sector indices of UAE, Russia and Saudi Arabia is low, around 0.15. Thus, it may be reasoned out by the fact that gold may be consumed less in these countries' sectors.

5.4 Stationary Test Results

In Appendix I, Table 5.3.1 to Table 5.3.18 shows the results of ADF, a unit root test that was used to capture stationarity in all equity sector data of GCC, GPC and KCC. The ADF test statistics offer a notable observation that the hypothesis of having non-stationarity characteristics in data is rejected at a 5% significant level. Thus, the results are regarded as stationary for all the sector data across the group of countries. This enables the use of a further estimation strategy.

5.5 Quantile Model and Gold as a Hedge and Safe Haven

Panel A: Major Gold Consuming Countries

Table 5.4.1a. Hedge and safe haven asset of India during Quantile

Sector Indices	Hedge		Safe Haven Quantiles					
			0.10		0.05		0.01	
	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value
Consumer Discretionary	-0.0522	0.0000***	0.0213	0.4994	0.0330	0.3954	-0.0005	0.9900
Consumer Staples	-0.0251	0.0341**	0.0546	0.1101	0.0331	0.3581	-0.0326	0.3195
Energy	-0.0257	0.0044***	-0.0152	0.5354	0.0929	0.0012***	-0.0835	0.0015***
Financials	-0.0520	0.0000***	-0.0233	0.3692	0.0281	0.3205	-0.0011	0.9632
Health Care	-0.0313	0.0098***	-0.0314	0.3459	0.0153	0.6775	-0.0021	0.9501
Industrial	-0.0023	0.7597	0.0426	0.0233**	0.0086	0.7154	-0.0358	0.1003
Information Technology	-0.0133	0.0725*	0.0045	0.8031	0.0363	0.1315	-0.0466	0.0369**
Telecommunication	-0.0154	0.0240**	-0.0213	0.2691	0.0501	0.0282**	-0.0303	0.1436
Basic Materials	-0.0237	0.0097***	-0.0268	0.2785	0.0347	0.2054	0.0208	0.3799
Utilities	-0.0245	0.0056***	-0.0277	0.2457	0.0233	0.4113	-0.0134	0.6001

Note: ***, ** and *indicate the significance levels at 1%, 5% and 10% levels, respectively.

The estimation results depict the significant potential of gold as a hedge for all the sector indices in India (Table 5.4.1a). Gold has a negative relationship with energy, financials, health care, telecommunication, basic materials and utility sectors during less than 10% quantile market shock, which turns out to be positive with all the sector indices during less than 5% quantile market shock. However, the safe haven potential of gold was more pronounced for all the sectors except basic materials at the extreme market shocks captured by 1% quantiles.

Table 5.4.2a. Hedge and safe haven asset of China during Quantile

Sector Indices	Hedge		Safe Haven Quantiles					
			0.10		0.05		0.01	
	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value
Consumer Discretionary	0.0058	0.5720	-0.0020	0.9288	-0.0170	0.5536	0.0261	0.3641
Consumer Staples	0.0111	0.2736	-0.0091	0.7066	0.0176	0.5686	-0.0032	0.9114
Energy	2.1098	0.0215**	-3.5538	0.1157	-2.5242	0.3481	3.7504	0.1035
Financials	0.0006	0.9535	0.0601	0.0220	-0.0267	0.3417	-0.0429	0.0557*
Health Care	-0.0041	0.7097	-0.0056	0.8461	0.0585	0.0540**	-0.0592	0.0130**
Industrial	0.0129	0.2272	-0.0107	0.6671	0.0147	0.5597	-0.0091	0.6885
Information Technology	0.0029	0.7272	0.0308	0.1360	-0.0243	0.3081	-0.0169	0.3894
Telecommunication	-0.0005	0.9449	0.0476	0.0318**	-0.0409	0.0869*	-0.0322	0.0759*
Basic Materials	0.0259	0.0063***	-0.0211	0.2923	-0.0641	0.0172**	0.0711	0.0051***
Utilities	0.0100	0.3704	-0.0001	0.9965	-0.0082	0.7920	0.0093	0.6946

Note: ***, ** and *indicate the significance levels at 1%, 5% and 10% levels, respectively.

According to Table 5.4.2a, the hedging coefficient is positive and insignificant, which reported that gold is no longer a hedge asset against all the Chinese stock market sector indices except health care sector. In all extreme market shocks, gold has weak safe haven properties against most of the sector indices. For instance, gold doesn't exhibit a safe haven role for only the financials and information technology sector at 10% quantile, consumer staples, health care and industrial sector at 5% quantile and energy, basic material and utility sector at 1% quantile. Herein, it's observed that gold exhibits weak safe haven potential irrespective of the degree of market shocks.

Table 5.4.3a. Hedge and safe haven asset of UAE during Quantile

Sector Indices	Hedge		Safe Haven Quantiles					
			0.10		0.05		0.01	
	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value
Consumer Discretionary	-0.0068	0.5201	0.0386	0.2049	-0.0559	0.0954*	0.0032	0.9136
Consumer Staples	0.0016	0.8510	-0.0093	0.7041	-0.0212	0.4322	0.0352	0.1284
Financials	0.0279	0.0456**	-0.0033	0.9361	-0.0449	0.3122	0.0212	0.5500
Health Care	0.0069	0.4289	-0.0093	0.6884	-0.0098	0.6917	0.0242	0.3000
Industrial	0.0051	0.5836	-0.0076	0.7714	0.0354	0.2147	-0.0519	0.0536*
Telecommunication	0.0135	0.2145	0.0081	0.8490	-0.0497	0.2877	0.0276	0.4077
Utilities	-0.0080	0.2777	0.0170	0.4180	-0.0206	0.3810	-0.0289	0.1879

Note: ***, ** and *indicate the significance levels at 1%, 5% and 10% levels, respectively.

The estimation results for hedge and safe haven property of gold against UAE Sectoral equity indexes are presented in Table 5.4.3a. The correlations are negative only for consumer discretionary and utility sectors, indicating the hedging ability of gold against only these sectors. The results during the specific quantiles are also mixed. The correlation coefficient is negative and quite insignificant only for consumer staples, financial, health care and industrial sectors at 10% quantile and for industrial and utility sectors at 1% quantile. Surprisingly, at 5% quantile with the exception of the industrial sector, all other sectors show negative connectivity towards gold, which indicates the ability of gold to provide shelter to investments in most of these UAE Sectoral indexes.

As shown in Table 5.4.4a, we found a positive dependence between gold and Egypt sectoral indexes. More precisely, a negative dependence on gold was found only in the case of health care sector at normal intervals, making this yellow metal a good hedge. Even at extreme returns captured by lower quantiles, we found only selected sectors, namely consumer discretionary,

consumer staples, energy, information technology, telecommunication and basic materials (at 10% quantiles), consumer staples, health care, Industrial, telecommunication (at 5% quantile), consumer discretionary, consumer staples, energy, financials, telecommunication and basic materials (at 1% quantile) exhibiting insignificant negative relation with gold, signifying its weak safe haven ability.

Table 5.4.4a. Hedge and safe haven asset of Egypt during Quantile

Sector Indices	Hedge		Safe Haven Quantiles					
			0.10		0.05		0.01	
	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value
Consumer Discretionary	0.0145	0.1607	-0.0175	0.5732	0.0084	0.8063	-0.0221	0.4410
Consumer Staples	0.0143	0.2318	-0.0109	0.7632	-0.0202	0.6093	-0.0005	0.9882
Energy	0.0109	0.3246	-0.0446	0.1518	0.0351	0.3000	-0.0401	0.1097
Financials	0.0122	0.2766	0.0164	0.5829	0.0071	0.8304	-0.0745	0.0201**
Health Care	-0.0021	0.8057	0.0019	0.9370	-0.0152	0.5681	0.0089	0.6717
Industrial	0.0083	0.3134	0.0071	0.7963	-0.0198	0.5157	0.0228	0.3451
Information Technology	2.90E-05	0.9970	-0.0246	0.2633	0.0180	0.4489	0.0087	0.6277
Telecommunication	0.0176	0.0166**	-0.0098	0.6537	-0.0092	0.6996	-0.0299	0.1349
Basic Materials	0.0064	0.5327	-0.0348	0.2302	0.0399	0.2157	-0.0216	0.4306

Note: ***, ** and *indicate the significance levels at 1%, 5% and 10% levels, respectively.

Table 5.4.5a. Hedge and safe haven asset of Indonesia during Quantile

Sector Indices	Hedge		Safe Haven Quantiles					
			0.10		0.05		0.01	
	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value
Consumer Discretionary	-0.0385	0.0000***	-0.0317	0.1175	0.0515	0.0161**	-0.0775	0.0000***
Consumer Staples	-0.0399	0.0001***	0.0037	0.8992	-0.0284	0.3568	-0.0331	0.1082
Energy	-0.0028	0.6007	-0.0120	0.4729	0.0084	0.6318	-0.0048	0.6562
Financials	-0.0313	0.0013***	-0.0213	0.4460	0.0004	0.9881	-0.0426	0.0167**
Health Care	-0.0279	0.0035***	0.0072	0.7942	-0.0188	0.5087	-0.0383	0.0281**
Industrial	-0.0271	0.0045***	-0.0228	0.4317	0.0080	0.7950	-0.0064	0.7459
Information Technology	-0.0037	0.6525	-0.0762	0.0164**	0.0809	0.0196**	-0.0024	0.9305
Telecommunication	-0.0382	0.0000***	0.0275	0.3104	0.0021	0.9386	-0.0657	0.0002***
Basic Materials	-0.0138	0.1181	-0.0152	0.5398	-0.0169	0.5223	-0.0193	0.2646
Utilities	0.0046	0.4639	0.0014	0.9418	-0.0372	0.0778*	0.0262	0.1083

Note: ***, ** and *indicate the significance levels at 1%, 5% and 10% levels, respectively.

Table 5.4.5a illustrates the hedge and safe haven dynamics between Indonesia's gold and stock market sector indices. The results suggest that gold does provide effective hedging features for all sectors except the utilities sector. However, safe haven coefficients at 10% quantile reveal that gold is a weak safe haven for all sectors except consumer staples, healthcare, and

telecommunications. As the severity of shock increases (5 % quantile), gold reveals its safe haven characteristics for three sectors, namely consumer staples, health care, and basic materials. Following a period of economic downfall at extreme quantiles (1% quantile), gold does provide a sufficient safe cushion against investment in all equity sectors except the utility sector.

Table 5.4.6a. Hedge and safe haven asset of South Korea during Quantile

Sector Indices	Hedge		Safe Haven Quantiles					
			0.10		0.05		0.01	
	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value
Consumer Discretionary	-0.0494	0.0000***	-0.0349	0.2591	-0.0231	0.4607	0.0034	0.9022
Consumer Staples	-0.0347	0.0001***	-0.0319	0.2183	-0.0041	0.8794	0.0026	0.9009
Energy	-0.0349	0.0000***	-0.0400	0.0507**	-0.0380	0.1153	0.0711	0.0007***
Financials	-0.0513	0.0000***	-0.0380	0.1153	-0.0146	0.5709	0.0711	0.0007***
Health Care	-0.0264	0.0004***	0.0217	0.3496	-0.0446	0.0705*	-0.0016	0.9312
Industrial	-0.0433	0.0000***	-0.0564	0.0051***	0.0006	0.9800	0.0597	0.0029***
Information Technology	-0.0411	0.0000***	-0.0007	0.9747	-0.0071	0.7253	0.0158	0.2866
Telecommunication	-0.0437	0.0000***	0.0071	0.7243	-0.0189	0.3494	0.0249	0.0538*
Basic Materials	-0.0488	0.0000***	-0.0240	0.3581	0.0066	0.8069	0.0064	0.7963
Utilities	-0.0110	0.1169	-0.0524	0.0066***	0.0419	0.0521*	0.0033	0.8149

Note: ***, ** and *indicate the significance levels at 1%, 5% and 10% levels, respectively.

It is noteworthy that gold has a significant negative relationship with all sectoral indices of South Korea, on average, signifying that gold serves as a hedge for all sectors (Table 5.4.6a). Further, the results revealed that gold is the safe haven for all sector indices except health care sector and telecommunication sector at 10% quantile and the industrial, basic material and utility sector at 5% quantile. Meanwhile, gold shows insignificant negative comovement with shocks to only the health care sector during the most extreme, 1% quantile, indicating its safe haven potential.

Table 5.4.7a. Hedge and safe haven asset of Turkey during Quantile

Sector Indices	Hedge		Safe Haven Quantiles					
			0.10		0.05		0.01	
	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value
Consumer Discretionary	-0.1329	0.0000***	0.0005	0.9834	-0.0313	0.2438	-0.1998	0.0000***
Consumer Staples	-0.1368	0.0000***	-0.0275	0.2721	0.0037	0.8960	-0.1895	0.0000***
Energy	-0.0846	0.0000***	-0.0596	0.0033***	0.0193	0.3705	-0.2165	0.0000***
Financials	-0.1057	0.0000***	-0.0219	0.2839	-0.0389	0.0834*	-0.1676	0.0000***
Industrial	-0.0981	0.0000***	-0.0690	0.0030***	0.0782	0.0023***	-0.2620	0.0000***
Information Technology	-0.0348	0.0000***	-0.0259	0.1818	-0.0118	0.5809	-0.2078	0.0000***
Telecommunication	-0.0739	0.0000***	-0.0428	0.0443**	0.0422	0.0597*	-0.2048	0.0000***
Utilities	-0.0693	0.0000***	-0.0431	0.0325**	-0.0342	0.0000***	-0.1903	0.0000***

Note: ***, ** and *indicate the significance levels at 1%, 5% and 10% levels, respectively.

The hedge and safe haven properties of gold for Turkey's equity sector indices are reported in Table 5.4.7a. The findings reveal significant negative values for all sectors except the industrial sector, indicating that gold serves as a robust hedge during the full sample periods. While weak hedge features for the industrial sector were also evidenced during regular market situations. In similar veins, during extremely negative market conditions, safe haven features of gold were exhibited for Turkey's sector indices. For all sectoral indices with the exception of the consumer discrepancy sector (at 10% quantile), consumer staples, energy, industrial, telecommunication (at 5% quantile) and Utility sector (at 1% quantile), a negative comovement indicated a safe haven status of gold for investors.

Table 5.4.8a. Hedge and safe haven asset of Russia during Quantile

Sector Indices	Hedge		Safe Haven Quantiles					
			0.10		0.05		0.01	
	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value
Consumer Discretionary	-0.0226	0.0003***	-0.0194	0.3993	0.0259	0.2959	-0.0136	0.4379
Energy	-0.0104	0.2851	0.0108	0.6578	0.0050	0.8327	-0.0213	0.2153
Financials	-0.0251	0.0014***	-0.0542	0.0043***	0.0706	0.0003***	-0.0568	0.0000***
Industrial	-0.0082	0.3406	-0.0056	0.8484	0.0060	0.8456	0.0013	0.9511
Telecommunication	-0.0045	0.5616	0.0099	0.7403	-0.0008	0.9780	-0.0294	0.0830*
Basic Materials	-0.0138	0.1181	-0.0152	0.5398	-0.0169	0.5223	-0.0193	0.2646
Utilities	-0.0110	0.1169	-0.0524	0.0066***	0.0419	0.0521*	0.0033	0.8149

Note: ***, ** and *indicate the significance levels at 1%, 5% and 10% levels, respectively.

Looking at the hedge column, the results evidence that gold serves as a hedge because they have a statistically negative correction with all the sector indices (Table 5.4.8a). However, looking at the corresponding coefficients at safe haven quantiles, the results imply that gold is a haven asset to protect investment in consumer discretionary, financials, basic materials and utilities sector at 10% quantile, and telecommunication and basic material sector at 5% quantile. While in the worst periods captured by 1% quantiles, gold correlates negatively with all sector indices except the utility sector index and thereby portrays its safe haven feature.

The estimated parameters for hedge and safe haven quantiles for gold and Saudi sectoral equity indices are reported in Table 5.4.9a. The findings indicate the hedging potential of gold against selected sectors, mainly consumer discrepancy, energy, health care, industrial, telecommunication and utilities. Results are mixed across different quantiles. At 10% quantiles, only a few sectors, such as consumer discrepancy, consumer staples, financial and basic materials, show a negative correlation with gold. While at 5% quantile, negative correlations

between gold and all Saudi sectoral indices except consumer staples support the safe haven capability of gold to safeguard investments in Saudi sectoral indexes. At extreme quantile gold shield returns in consumer staples, energy, health care and industrial sectors.

Table 5.4.9a. Hedge and safe haven asset of Saudi Arabia during Quantile

Sector Indices	Hedge		Safe Haven Quantiles					
			0.10		0.05		0.01	
	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value
Consumer Discretionary	-0.0083	0.4653	-0.0388	0.2354	-0.0142	0.6843	0.0554	0.0373**
Consumer Staples	0.0078	0.4716	-0.0228	0.4614	0.0093	0.7764	-0.0360	0.1506
Energy	-0.0052	0.5283	0.0083	0.7486	-0.0116	0.6657	-0.0256	0.1807
Financials	0.0059	0.6786	-0.0283	0.5006	-0.0558	0.2061	0.0373	0.2460
Health Care	-0.0256	0.0337**	0.0137	0.7099	-0.0292	0.4747	-0.0173	0.5905
Industrial	-0.0006	0.9664	0.0005	0.9905	-0.0250	0.5480	-0.0120	0.6871
Telecommunication	-0.0069	0.5793	0.0395	0.2532	-0.0690	0.0581*	0.0012	0.9678
Basic Materials	0.0338	0.0037***	-0.0715	0.0237	-0.0051	0.8760	0.0215	0.4069
Utilities	-0.0040	0.6924	0.0325	0.2803	-0.0522	0.0954	0.0024	0.9334

Note: ***, ** and *indicate the significance levels at 1%, 5% and 10% levels, respectively.

Table 5.4.10a. Hedge and safe haven asset of Thailand during Quantile

Sector Indices	Hedge		Safe Haven Quantiles					
			0.10		0.05		0.01	
	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value
Consumer Discretionary	-0.0170	0.0644*	-0.0153	0.6044	-0.0278	0.3819	0.0371	0.1504
Consumer Staples	-0.0106	0.2177	-0.0048	0.8477	0.0008	0.9762	-0.0376	0.1559
Energy	-0.0037	0.6419	-0.0134	0.5198	-0.0099	0.6935	-0.0058	0.7966
Financials	-0.0196	0.0294**	-0.0057	0.8348	0.0220	0.4422	-0.0387	0.1332
Health Care	-0.0082	0.4095	-0.0079	0.7796	0.0052	0.8772	-0.0239	0.4318
Industrial	-0.0158	0.0392**	-0.0003	0.9890	-0.0228	0.3697	0.0078	0.7413
Information Technology	-0.0216	0.0012***	-0.0201	0.2940	0.0369	0.0733*	-0.0077	0.6693
Telecommunication	-0.0147	0.0577*	-0.0287	0.1697	0.0194	0.4110	-0.0052	0.8033
Basic Materials	-0.0106	0.1912	-0.0244	0.2767	-0.0005	0.9854	-0.0089	0.6809
Utilities	-0.0059	0.5816	0.0249	0.3824	-0.0204	0.5623	-0.0323	0.3062

Note: ***, ** and *indicate the significance levels at 1%, 5% and 10% levels, respectively.

Table 5.4.10a shows the results for gold and all sector pairs and supports negative dependence during average market conditions. Incase of extreme downturns specifically, this precious metal offers greater compensation for sector-specific risk (except for utilities at 10% quantile and consumer discrepancy at 1% quantile). While at an extreme 5% quantile, only consumer discrepancy, energy, industrial, basic material, and utility sector losses can be compensated by investing in gold. It highlights the ability of shiny metal to provide refuge to this sector investor in times of extreme market severity.

Table 5.4.11a. Hedge and safe haven asset of Vietnam during Quantile

Sector Indices	Hedge		Safe Haven Quantiles					
			0.10		0.05		0.01	
	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value
Consumer Discretionary	-0.0140	0.2074	0.0378	0.1575	-0.0405	0.1822	0.0002	0.9964
Consumer Staples	0.0086	0.5359	-0.0344	0.3273	0.0149	0.7013	-0.0567	0.1616
Energy	0.0036	0.6725	-0.0211	0.3412	0.0062	0.8160	0.0075	0.7728
Financials	0.0066	0.6020	-0.0618	0.0697*	0.0304	0.4117	-0.0275	0.4398
Health Care	0.0143	0.2263	-0.0628	0.0680*	0.0297	0.4360	0.0227	0.5595
Industrial	1.06E-05	0.9993	-0.0135	0.6679	0.0067	0.8468	-0.0415	0.2012
Telecommunication	-0.0036	0.6859	-0.0200	0.4154	0.0175	0.5523	-0.0276	0.3278
Basic Materials	0.0102	0.4151	0.0082	0.8010	-0.0314	0.3938	0.0306	0.3811
Utilities	-0.0120	0.3305	0.0238	0.4472	-0.0333	0.3458	0.0173	0.6240

Note: ***, ** and *indicate the significance levels at 1%, 5% and 10% levels, respectively.

As shown in Table 5.4.11a for Vietnam, the outcomes for most of the sector indices show positive values of the hedge coefficient, indicating a co-movement in the same sense during normal market conditions. Gold acts as a weak hedge only against consumer discretionary, telecommunication and utilities sectors. At extreme quantiles of 10%, gold does not serve as a safe haven for consumer discretionary, basic materials and utility sectors. Contradictory at 5% quantile gold protects investments in consumer discretionary, basic materials and utility sectors. While at extreme quantiles of 1%, gold safeguards against downside risk in consumer staples, financials, industrial and telecommunication sectors.

Table 5.4.12a. Hedge and safe haven asset of USA during Quantile

Sector Indices	Hedge		Safe Haven Quantiles					
			0.10		0.05		0.01	
	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value
Consumer Discretionary	-0.0439	0.0017***	-0.0644	0.0711*	0.0238	0.5437	0.0319	0.3752
Consumer Staples	-0.0152	0.3773	-0.0143	0.7762	0.0285	0.5922	-0.0009	0.9828
Energy	0.0341	0.0008***	0.0091	0.7214	-0.0339	0.2214	0.0205	0.4226
Financials	-0.0507	0.0000***	-0.0037	0.8995	0.0024	0.9389	-0.0053	0.8489
Health Care	-0.0309	0.0398**	0.0754	0.0591*	-0.0949	0.0270**	0.0640	0.0872*
Industrial	-0.0319	0.0065***	-0.0006	0.9848	-0.0061	0.8506	-0.0336	0.2379
Information Technology	-0.0379	0.0000***	0.0057	0.7969	0.0108	0.6501	0.0470	0.0194*
Telecommunication	-0.0334	0.0028***	0.0705	0.0166**	-0.0780	0.0127**	-0.0044	0.8630
Basic Materials	0.0307	0.0015***	-0.0497	0.0485**	0.0146	0.5956	0.0385	0.1577
Utilities	0.0290	0.0373**	0.0570	0.1080	-0.0771	0.0409**	0.0374	0.2344

Note: ***, ** and *indicate the significance levels at 1%, 5% and 10% levels, respectively.

The estimation results in Table 5.4.12a show that hedging coefficients are negative and statistically significant for all sector indices except energy, basic materials and utilities. This indicates that gold offers strong hedging properties against consumer discrepancy, consumer staples, financials, health care, industrial, information technology and telecommunication sectors, while gold does not act as a hedge against energy, basic material and utility sector. The findings also corroborate with (Naeem, Hasan, Arif, & Shahzad, 2020), who reported similar results for US industry sector indices. Moreover, gold shows strong (weak) safe haven potential for the consumer discretionary sector and basic material sector (financials, consumer staples and information technology sector) at 10% quantiles. Interestingly, at 5% quantiles of the return distribution, telecommunication, health care and utility sector exhibit strong hedge properties while the energy and industrial sector shows weak safe haven potential. At extreme quantiles hardly, there are few sectors (consumer staples, financials, industrial and telecommunication sector) which discloses negative and non-significant comovement with gold

Panel B: Major Gold Producing Countries

In the case of Australia, gold shows hedge potential for all industry portfolios, excluding basic materials (Table 5.4.13a). Inaddition, results also reported the safe haven nature of gold against consumer staples, energy, financials, information technology and telecommunication sector at 10% quantile. As the severity of shock increases further at 5% quantile and 1% quantile, a more pronounced safe haven effect was exhibited as more gold-sector pairs showed a negative relationship.

Table 5.4.13a. Hedge and safe haven asset of Australia during Quantile

Sector Indices	Hedge		Safe Haven Quantiles					
			0.10		0.05		0.01	
	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value
Consumer Discretionary	-0.0268	0.0728*	-0.0176	0.3809	-0.1537	0.0000****	-0.0180	0.6549
Consumer Staples	-0.0279	0.0318**	0.0465	0.1040	0.0180	0.5980	-0.0454	0.1688
Energy	-0.0030	0.7924	0.0152	0.5811	-0.0493	0.1258	-0.0109	0.7115
Financials	-0.1018	0.0000***	0.0083	0.7951	-0.0042	0.9119	-0.0318	0.4338
Health Care	-0.0410	0.0063***	-0.0246	0.4559	-0.0109	0.8076	-0.0307	0.4455
Industrial	-0.0343	0.0347**	-0.0478	0.1833	-0.077	0.0574*	0.1127	0.0007***
Information Technology	-0.0074	0.4345	0.0261	0.2187	-0.0176	0.4191	0.0117	0.5829
Telecommunication	-0.0101	0.3523	0.9962	0.2793	0.0146	0.9970	-0.0023	0.9996
Basic Materials	0.0105	0.3419	-0.0319	0.2679	0.0299	0.3398	-0.0742	0.0126**
Utilities	-0.0128	0.3697	-0.0696	0.0799*	0.0345	0.4225	-0.1006	0.0027

Note: ***, ** and *indicate the significance levels at 1%, 5% and 10% levels, respectively.

Table 5.4.14a. Hedge and safe haven asset of Canada during Quantile

Sector Indices	Hedge		Safe Haven Quantiles					
			0.10		0.05		0.01	
	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value
Consumer Discretionary	-0.0690	0.0001***	-0.0007	0.9874	-0.0434	0.3999	0.0018	0.9700
Consumer Staples	-0.0364	0.0017***	-0.0101	0.7700**	-0.0504	0.1600	0.0566	0.0194**
Energy	0.0103	0.3676	0.0092	0.7464	-0.0145	0.6426	-0.0122	0.6722
Financials	-10.7318	0.0000***	4.1031	0.3489	-4.6671	0.3281	0.0282	0.9949
Health Care	-0.0059	0.4117	-0.0352	0.1049	0.0197	0.3956	0.0211	0.2028
Industrial	-0.0519	0.0000***	0.0801	0.0042***	-0.0209	0.5358	-0.0243	0.4361
Information Technology	-0.0300	0.0000***	-0.0346	0.0532*	0.0473	0.0158**	0.0182	0.2153
Telecommunication	-0.0445	0.0029***	-0.0388	0.3663	0.0796	0.0921**	0.0062	0.8630
Basic Materials	0.1108	0.0000***	-0.0098	0.6891	0.0111	0.6792	0.0438	0.0784*
Utilities	0.0147	0.4629	0.0025	0.9607	-0.0419	0.5018	-0.0281	0.6170

Note: ***, ** and *indicate the significance levels at 1%, 5% and 10% levels, respectively.

Turning now to the results shown by Table 5.4.14a, a significant negative dependence for the gold and specific sector pair is obtained in case of consumer discrepancy, consumer staples financials, industrial, information technology and telecommunication sector for normal market conditions, negative the strong role of asset as a protector against sector risk. Although the severity of shock increases at extreme quantiles but conversely, findings reveal that at 10% quantile, six sectors explicitly consumer discretionary, consumer staples, health care, information technology, telecommunication and basic materials and at 5% quantile five sectors, namely consumer discretionary, consumer staples, energy, financials, industrial and utilities and at 1% quantile only three sectors including energy, industrial and utilities sector exhibited the safe haven property of gold.

Table 5.4.15a. Hedge and safe haven asset of South Africa during Quantile

Sector Indices	Hedge		Safe Haven Quantiles					
			0.10		0.05		0.01	
	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value
Consumer Discretionary	-0.1279	0.0000***	-0.0195	0.6097	-0.0292	0.4908	0.0775	0.0246**
Consumer Staples	-0.0658	0.0000***	0.0138	0.6983	0.0234	0.5423	0.0213	0.4655
Energy	0.0349	0.0002***	-0.0199	0.4257	-0.0392	0.1637	0.0122	0.6151
Financials	-0.1673	0.0000***	-0.0601	0.0994*	-0.0146	0.7204	0.0016	0.9637
Health Care	-0.0670	0.0000***	-0.0316	0.4271	0.0027	0.9504	0.0155	0.6768
Industrial	-0.1318	0.0000***	-0.0174	0.6573	-0.0440	0.3031	0.0472	0.1970
Information Technology	-0.0381	0.0000***	0.0214	0.3350	-0.0283	0.2571	0.0086	0.6933
Telecommunication	-0.0692	0.0000***	-0.0317	0.2306	0.0192	0.5078	0.0545	0.0255**
Basic Materials	0.0995	0.0000***	-0.0012	0.9672	-0.0352	0.2888	-0.0199	0.5437

Note: ***, ** and *indicate the significance levels at 1%, 5% and 10% levels, respectively.

Table 5.4.15a exhibits the estimated parameters for the South African sectoral indices against gold. The hedge parameters are mostly negative and significant for all the sectoral indices with the exception of basic materials and the energy sector. This implies that gold is the most effective hedge against the downside risks of most of the South African sectors. Notably, gold is also a safe haven for all sectors except consumer staples and information technology at 10% quantile and consumer staples, health care and telecommunication at 5% quantile. Surprisingly, at extreme market downturns covered by 1% quantile gold safe haven characteristic was only seen in the case of the basic material sector.

Panel C: Key Currency Countries

Table 5.4.16a. Hedge and safe haven asset of Switzerland during Quantile

Sector Indices	Hedge		Safe Haven Quantiles					
			0.10		0.05		0.01	
	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value
Consumer Discretionary	0.0251	0.0058***	0.0522	0.0346	-0.0426	0.1085	0.0333	0.0508**
Consumer Staples	0.0232	0.0267**	0.0781	0.0087***	-0.0145	0.6402	-0.0331	0.0648
Energy	0.0481	0.0002***	-0.0367	0.2409	0.0008	0.9817	-0.0126	0.5194
Financials	0.0318	0.0028***	-0.0382	0.1525	0.0736	0.0078***	-0.1081	0.0000***
Health Care	0.0235	0.0902**	-0.0248	0.5636	0.0809	0.0693*	-0.0003	0.9905
Industrial	0.0506	0.0000***	0.0024	0.9300	-0.0244	0.4006	0.0346	0.0567*
Information Technology	0.0091	0.2250	0.0124	0.5477	-0.0193	0.3658	0.0139	0.2690
Telecommunication	0.0345	0.0149**	0.0399	0.2986	-0.0282	0.4658	-0.0685	0.0077***
Basic Materials	0.0719	0.0000***	-0.0128	0.7121	0.0426	0.2248	-0.0114	0.6177
Utilities	0.0289	0.0430**	-0.0493	0.2367	0.0130	0.7709	0.1519	0.0000***

Note: ***, ** and *indicate the significance levels at 1%, 5% and 10% levels, respectively.

Table 5.4.16a shows the coefficient estimates of hedge for average market conditions and safe haven for extreme market conditions (10% quantile, 5% quantile and 1% quantile). The results exhibit that the dependence structure between gold and equity sector indices is time-varying, i.e., hedging potential during average market conditions widely varies as compared to extreme market conditions. In fact, gold is mostly positively related to all the sector indices in normal conditions. Moreover, gold is a weak safe haven asset for the financial, health care, basic material and utility sectors at 10 % quantile. On the other hand, as the market worsens further (5% quantile), weak safe haven characteristics of gold were observed in consumer discretionary, consumer staples, industrial, telecommunication and informational technology sectors. In

extremely negative market conditions (1% quantile), gold is a safe haven only for consumer staples, financial, health care, and basic materials sectors.

Table 5.4.17a. Hedge and safe haven asset of the UK during Quantile

Sector Indices	Hedge		Safe Haven Quantiles					
			0.10		0.05		0.01	
	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value
Consumer Discretionary	-0.0365	0.0160**	0.0969	0.0114**	-0.1214	0.0022**	-0.0981	0.0002***
Consumer Staples	0.0328	0.0189	-0.0641	0.0104**	0.0605	0.1183	-0.0912	0.0127**
Energy	0.0803	0.0000***	-0.0220	0.4079	-0.0341	0.2300	0.0061	0.8031
Financials	-0.0482	0.0000***	-0.0223	0.4592	0.0494	0.1086	-0.1866	0.0000***
Health Care	0.0075	0.5753	-0.1327	0.0000***	-0.0873	0.0340**	0.0545	0.1577
Industrial	-0.0050	0.7236	-0.0117	0.6666	0.0330	0.3196	-0.0632	0.0652*
Information Technology	-0.0074	0.4345	0.0261	0.2187	-0.0176	0.4191	0.0117	0.5829
Telecommunication	-0.0208	0.0240**	-0.0371	0.0504**	0.0576	0.0242**	-0.0389	0.0941*
Basic Materials	0.0686	0.0000***	0.0305	0.2079	-0.0314	0.1774	-0.0594	0.0005***
Utilities	-0.0154	0.2902	-0.1365	0.0000***	-0.0328	0.4538	0.0533	0.2052

Note: ***, ** and *indicate the significance levels at 1%, 5% and 10% levels, respectively.

Table 5.4.18a. Hedge and safe haven asset of Japan during Quantile

Sector Indices	Hedge		Safe Haven Quantiles					
			0.10		0.05		0.01	
	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value
Consumer Discretionary	0.0808	0.0000***	-0.0283	0.4176	0.0312	0.3910	0.0153	0.5723
Consumer Staples	0.0746	0.0000***	-0.0126	0.6816	0.0096	0.7642	0.0165	0.5472
Energy	0.0497	0.0000***	-0.0094	0.6633	0.0035	0.8827	0.0056	0.7955
Financials	0.0392	0.0000***	-0.0074	0.7905	0.0217	0.5070	0.0402	0.1154
Health Care	0.0343	0.0138**	0.0111	0.7714	0.0081	0.8371	0.0203	0.4875
Industrial	0.0685	0.0000***	-0.0266	0.3547	0.0368	0.2285	-0.0014	0.9525
Information Technology	0.0550	0.0000***	-0.0051	0.8412	-0.0201	0.4604	0.0007	0.9756
Telecommunication	0.0440	0.0000***	-0.0618	0.0145**	0.0604	0.0141**	-0.0542	0.0033***
Basic Materials	0.0724	0.0000***	-0.0040	0.8806	0.0120	0.6863	0.0191	0.4352
Utilities	0.0442	0.0002***	0.0250	0.3844	0.0250	0.4915	-0.0145	0.6632

Note: ***, ** and *indicate the significance levels at 1%, 5% and 10% levels, respectively.

In the case of the UK (Table 5.4.17a), sector indices, on average, show negative coefficients with the exception of consumer staples, energy, health care and basic materials. The coefficients are higher and significant for consumer discretionary, financials and telecommunication sectors, which gives conclusive evidence of the safe haven property of gold against these sector indices. At 10% quantile with the exception of consumer discretionary, information technology and basic materials, at 5% quantile with the exception of consumer staples, financials, industrial and telecommunication and 1% quantile with the exception of energy, health care, information

technology and utility, all other sectors displayed negative association with gold. Thus, gold serves as a safe haven for these UK equity sector indices.

Japan's sectoral indices yield similar results to Switzerland's sectoral indices, as the hedge coefficients are positive, statistically significant and albeit higher on average (Table 5.4.18a). This indicates a strong positive relationship between gold and sectoral indices of Japan. Accordingly, it is reasonable to conclude that yellow metal can be a deleterious way out to offset the decline in Japan's equity sector returns during average market conditions. At extreme shocks captured extreme quantiles, gold acts as a safe haven for consumer discretionary, consumer staples, energy, financials, industrial, information technology, telecommunication and basic materials sectors at 10% quantiles, only the information technology sector at 5% quantiles and industrial, telecommunication and utilities sector at 1% quantiles.

5.6 Gold as a Hedge and Safe Haven in times of Crisis

Table 5.5.1a displays the estimates for gold and Indian sectoral indices. The results reveal that the correlations between gold and Indian equity sectoral indices remained negative, signifying inverse co-movement between gold and sectors during normal economic conditions. In this way, gold offers hedging opportunities for sector-specific risk. However, the internet bubble burst provides sufficient insights for investors where gold served as a safe haven tool only for industrial and information technology stocks. It was quite obvious that the industrial and information technology sectors were catastrophically impacted by the adverse effects of this crisis and preferred gold as a protective investment asset. Correspondingly, the GFC also impacted the markets significantly. As indicated in the above table, negative values referring to the GFC suggest strong (weak) safe haven potential of gold against the information technology and telecommunication sectors (consumer discretionary, consumer staples, financials and health care sector). Even during periods of EDC, gold displayed weak (strong) safe haven characteristics for health care, industrial, telecommunication and utility sectors (except for the information technology sector). While, even the magnitude of the shock is not that rigorous during the early phases of the outbreak of Covid-19, pointing to the weak safe haven role of gold against certain sectors (telecommunication, financials and basic material sector).

Table 5.5.1a: Hedge and Safe Haven Asset in times of crisis (India)

Sector Indices	Hedge		Dot Com Bubble Burst		Global Financial Crises		European Debt Crises		Covid-19 Crises	
	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value
Consumer Discretionary	-0.0527	0.0000***	0.0445	0.0235*	-0.0307	0.4074	0.0671	0.1573	0.0649	0.1657
Consumer Staples	-0.0362	0.0009***	0.0520	0.0244*	-0.0388	0.2744	0.0597	0.1797	0.0218	0.6888
Energy	-0.0410	0.0000***	0.0282	0.1692	0.0132	0.5480	0.0595	0.0687**	0.0206	0.5813
Financials	-0.0483	0.0000***	0.0228	0.2664	-0.0255	0.2069	0.0177	0.5274	-0.0538	0.1792
Health Care	-0.0436	0.0001***	0.0154	0.5304	-0.0126	0.7223	-0.0172	0.6666	0.4274	0.0000***
Industrial	-0.0050	0.5246	-0.0054	0.6534	0.0072	0.7195	-0.0063	0.7938	0.0248	0.5595
Information Technology	-0.0112	0.1456	-0.0099	0.3888	-0.0694	0.0047***	-0.0558	0.0392**	0.1788	0.0000***
Telecommunication	-0.0102	0.1249	0.0031	0.7983	-0.0425	0.0602**	-0.0327	0.1737	-0.0123	0.7387
Basic Materials	-0.0247	0.0037***	0.0070	0.6946	0.0039	0.8604	0.0119	0.6631	-0.0423	0.3133
Utilities	-0.0321	0.0002***	0.0178	0.2874	0.0037	0.8514	-0.0121	0.7167	0.0766	0.0940**

Note: ***, ** and *indicate the significance levels at 1%, 5% and 10% levels, respectively.

Table 5.5.2a: Hedge and Safe Haven asset in times of crisis (China)

Sector Indices	Hedge		Dot Com Bubble Burst		Global Financial Crises		European Debt Crises		Covid-19 Crises	
	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value
Consumer Discretionary	0.0048	0.5779	0.0555	0.0086***	0.0213	0.3065	0.0143	0.5752	-0.0361	0.3969
Consumer Staples	0.0118	0.1730	0.0091	0.7382	0.0334	0.1194	-0.0106	0.7217	-0.0606	0.2191
Energy	1.5866	0.0496**	-0.6562	0.7807	2.4600	0.1585	7.5259	0.0108**	6.3859	0.0700*
Financials	0.0022	0.8015	0.0463	0.0910	0.0147	0.4980	0.0527	0.0729*	-0.0210	0.6860
Health Care	-0.0048	0.5984	0.0635	0.0127**	0.0311	0.1922	0.0158	0.5595	-0.0675	0.2240
Industrial	0.0052	0.5508	0.0117	0.7528	0.0331	0.1140	0.0499	0.0733*	-0.0198	0.6898
Information Technology	0.0001	0.9868	0.0166	0.3492	0.0191	0.3625	0.0389	0.0780*	0.0373	0.1885
Telecommunication	-0.0030	0.6029	-	-	0.0383	0.0113**	0.0259	0.2528	-0.0636	0.0631*
Basic Materials	0.0241	0.0021***	0.0303	0.2371	0.0209	0.2593	0.0442	0.0564*	0.0113	0.7545
Utilities	0.0023	0.8027	0.0207	0.5453	0.0293	0.1608	0.0362	0.2619	-0.0634	0.4598

Note: ***, ** and *indicate the significance levels at 1%, 5% and 10% levels, respectively.

Table 5.5.2a reports the estimation of the output of gold against Chinese sectoral indices during turmoil periods. As expected, the correlation between different sectors is relatively positive except for health care and telecommunication sectors (similar findings reported for hedge coefficient during specific quantiles). The highest and most significant value is observed for the material sector and lowest for the utility, financial, health care, and information sectors. The findings collaborate with the results and rationale suggested by (Beckmann, et al., 2019), indicating the highest dependence between gold and the material sector of China, explained by the fact that gold may be used by firms relating to the material sector, which is not the case for

other sectors. Even the energy sector's higher value implies a close link between gold and energy firms involved in oil and gas activities. The higher dependence is observed across all sectors during DCBB, GFC, and EDC, indicating returns of gold and sectorial stocks co-move during extreme events. Gold neither shows a safe haven facility for Chinese sector indices. On the onset of the pandemic stroke to the global economy, the safe haven coefficients turned out to be negative for the consumer discretionary, consumer staples, financials, health care, industrial, telecommunication and utilities sectors of China. These negative coefficients, predominantly during the Covid-19 pandemic suggest that gold is a safe haven investment for investors in times of economic downfalls.

Table 5.5.3a: Hedge and Safe Haven Asset in times of crisis (UAE)

Sector Indices	Hedge		Dot Com Bubble Burst		Global Financial Crises		European Debt Crises		Covid-19 Crises	
	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value
Consumer Discretionary	-0.0094	0.2967	-	-	0.0072	0.7772	0.0358	0.2879	-0.1410	0.0048***
Consumer Staples	-0.0071	0.3165	-	-	0.0225	0.4628	0.0516	0.0349**	0.0183	0.4931
Financials	0.0131	0.2605	-	-	0.0253	0.4682	0.0943	0.0234**	-0.2072	0.0003***
Health Care	-0.0001	0.9873	-	-	0.0181	0.4190	0.0151	0.5314	0.1247	0.3928
Industrial	0.0002	0.9748	-	-	0.0980	0.0001***	0.0535	0.0392**	-0.1442	0.0026***
Telecommunication	0.0055	0.5633	-	-	0.0117	0.7055	0.0582	0.2168	-0.0740	0.0668
Utilities	-0.0069	0.3049	-	-	0.0001	0.9949	0.0629	0.0141**	-0.0475	0.0048**

Note: ***, ** and *indicate the significance levels at 1%, 5% and 10% levels, respectively.

The estimated parameters for UAE sectoral indices against gold are presented in Table. 5.5.3a. The findings report an insignificant negative coefficient for consumer discretionary, consumer staples, health care and utility sectors, indicating hedging ability of gold against these sectors. Conversely, the parameters are positive and insignificant for all other combinations of gold and UAE sectoral indices. The correlations between gold and all UAE sectoral indices are positive and significant for only the industrial sector (in the case of GFC) and consumer staples, financials, industrial and utilities sectors (in the case of EDC). Hence, gold failed to provide a safe cushion to investments for all UAE sectoral indices during this crisis. In times of pandemic, the results of gold against UAE sectoral indices vary. Gold co-moves with consumer staples and health care sector while showing negative and significant dependency on the rest of the sectors.

Consistent with (Shah, Bhanja, & Dar, 2023), gold reveals varying safe haven features for the financials, industrial and consumer staples sectors of UAE during COVID-19.

Table 5.5.4a: Hedge and Safe Haven asset in times of crisis (Egypt)

Sector Indices	Hedge		Dot Com Bubble Burst		Global Financial Crises		European Debt Crises		Covid-19 Crises	
	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value
Consumer Discretionary	0.0014	0.8565	0.0358	0.1496	-0.0147	0.6702	-0.0532	0.0696*	-0.0279	0.5846
Consumer Staples	0.0023	0.7949	0.0454	0.2817	-0.0254	0.4857	-0.0682	0.0331**	0.0757	0.2475
Energy	-0.0083	0.3751	-	-	0.0264	0.4575	0.0075	0.7403	-0.0152	0.5614
Financials	0.0148	0.1385	0.0090	0.7309	-0.0526	0.1402	-0.0356	0.1892	-0.0258	0.6802
Health Care	-0.0052	0.4645	0.0013	0.9518	0.0369	0.1037	-0.0380	0.1671	-0.0449	0.3502
Industrial	0.0149	0.0975*	-0.0048	0.7507	-0.0107	0.6897	-0.0693	0.0103**	-0.0417	0.2221
Information Technology	0.0007	0.9129	-	-	-0.0044	0.8480	-0.0030	0.8584	-0.0121	0.7287
Telecommunication	0.0080	0.2479	0.0126	0.4004	0.0096	0.7308	-0.0611	0.0180**	-0.0119	0.6539
Basic Materials	-0.0010	0.9120	0.0177	0.6030	0.0352	0.2007	-0.0239	0.3135	0.0417	0.2403

Note: ***, ** and *indicate the significance levels at 1%, 5% and 10% levels, respectively.

Table 5.5.4a provides results for hedge and safe haven dynamics of gold against stock sector indices in Egypt. The results show the hedging potential of gold against energy, health care and the material sector, albeit the coefficient values are negative. The likelihood of gold being a refuge asset against a fall in equity sector returns is evidenced for all sector indices except energy, health care, telecommunication and material sector in the case of GFC, except the energy sector, even for EDC and except consumer staples and basic material sector during covid-19 crisis. While the weak safe haven status of gold was evidenced only for the industrial sector during DCBB.

Table 5.5.5a: Hedge and Safe Haven asset in times of crisis of (Indonesia)

Sector Indices	Hedge		Dot Com Bubble Burst		Global Financial Crises		European Debt Crises		Covid-19 Crises	
	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value
Consumer Discretionary	-0.0408	0.0000***	-0.1253	0.0000***	0.0399	0.0199*	0.0343	0.0753*	-0.1276	0.0001***
Consumer Staples	-0.0451	0.0000***	-0.1595	0.0000***	0.0347	0.2303	0.0639	0.0164**	-0.0403	0.2423
Energy	-0.0090	0.0494**	-0.0019	0.8426	0.0184	0.1124	0.0490	0.0207**	-0.0625	0.0434**
Financials	-0.0408	0.0000***	-0.0407	0.0037***	-0.0083	0.7500	0.0588	0.0138**	-0.0911	0.0014***
Health Care	-0.0410	0.0000***	-0.1287	0.0000***	-0.0069	0.7705	0.0758	0.0000***	-0.0051	0.8493
Industrial	-0.0376	0.0000***	-0.3534	0.1219	0.0145	0.4833	0.0371	0.1181	-0.0438	0.0285**
Information Technology	-0.0011	0.8964	-	-	-	-	-0.0111	0.4240	-0.0739	0.2510
Telecommunication	-0.0345	0.0000***	-0.0614	0.0021***	-0.0088	0.7442	0.0676	0.0149**	-0.0517	0.1399
Basic Materials	-0.0320	0.0000***	-0.0896	0.0004***	0.0319	0.0218*	0.0693	0.0016***	-0.0169	0.4354
Utilities	-0.0009	0.8654	-	-	-0.0048	0.7659	0.0133	0.4789	-0.0251	0.2711

Note: ***, ** and *indicate the significance levels at 1%, 5% and 10% levels, respectively.

Table 5.5.5a shows the estimation output for hedge and safe haven assets in times of crisis for Indonesia. There exists a negative correlation (significant in most cases), which supports the hedging role of gold. Additionally, negative coefficients for all sector indices in Indonesia during the DCBB and Covid-19 crisis further signify the ability of gold to safeguard investments in equity sectors. The noteworthy findings also reveal that gold acts as a safe haven for downturns in returns of the financial, health care, telecommunication and utilities sectors during GFC and the information technology sector during EDC.

Table 5.5.6a: Hedge and Safe Haven asset in times of crisis (South Korea)

Sector Indices	Hedge		Dot Com Bubble Burst		Global Financial Crises		European Debt Crises		Covid-19 Crises	
	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value
Consumer Discretionary	-0.0676	0.0000***	0.0125	0.4865	-0.0247	0.4904	-0.0698	0.0371**	-0.0438	0.3532
Consumer Staples	-0.0471	0.0000***	0.0236	0.0605	-0.0457	0.1792	-0.0562	0.0629*	-0.0530	0.2861
Energy	-0.0349	0.0000***	-0.0109	0.6076	0.0035	0.8692	-0.0237	0.2251	-0.0161	0.6433
Financials	-0.0573	0.0000***	0.0246	0.0741*	-0.1089	0.0001***	-0.1099	0.0000***	-0.0750	0.1233
Health Care	-0.0280	0.0000***	-0.0193	0.1843	0.0273	0.3757	-0.0088	0.6660	-0.1078	0.0233**
Industrial	-0.0519	0.0000***	0.0007	0.9591	0.0074	0.7391	-0.0920	0.0005***	-0.0932	0.0179**
Information Technology	-0.0249	0.0003***	-0.0297	0.0012***	-0.0824	0.0022***	-0.1085	0.0000***	-0.0939	0.0179**
Telecommunication	-0.0416	0.0000***	-0.0228	0.1569	0.0017	0.9665	-0.1067	0.0012***	-0.1197	0.1272
Basic Materials	-0.0479	0.0000***	-0.0220	0.1785	0.0013	0.9524	-0.0363	0.1546	-0.0502	0.2349
Utilities	-0.0129	0.0142**	-0.0156	0.2049	0.0048	0.7994	-0.0443	0.0353**	-0.0842	0.0846*

Note: ***, ** and *indicate the significance levels at 1%, 5% and 10% levels, respectively.

The primary results from Table 5.5.6a indicate that gold exhibits its traditional role as an effective hedge against all sector indices of South Korea. The attributes of gold as a safe haven are confined to energy, health care, information technology, telecommunication, basic material and utility sector during DCBB (turmoil on account of collapse in technology stocks), and consumer discretionary, consumer staples, financials and information technology sectors during GFC. Consistently during both EDC and Covid-19 crises, a negative correlation between gold and all sectoral indices thereby gives conclusive evidence that gold proved to be protective shield during such turmoil.

Table 5.5.7a shows the results of the hedge and safe haven status of gold against the sectoral indices of Turkey. Overall, results for all equity sectors of Turkey provide conclusive evidence of gold as a suitable hedge. Besides, gold acts as a safe haven against declining stock performance across all sectors during GFC and, except the energy and utility sector during

DCBB. Conversely, gold offers a protective shield against falling returns in the information technology sector only during EDC. Even the magnitude and unprecedented nature of the recent pandemic showcase the diminishing role of gold as a safe haven against consumer discretionary, consumer staples, energy, financials and industrial sectors.

Table 5.5.7a: Hedge and Safe Haven asset in times of crisis of (Turkey**)**

Sector Indices	Hedge		Dot Com Bubble Burst		Global Financial Crises		European Debt Crises		Covid-19 Crises	
	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value
Consumer Discretionary	-0.1603	0.0000***	-0.1502	0.0000***	-0.1540	0.0000***	0.0343	0.2513	0.1313	0.0001***
Consumer Staples	-0.1640	0.0000***	-0.1416	0.0000***	-0.1225	0.0001***	0.0793	0.0106**	0.2780	0.0000***
Energy	-0.1194	0.0000***	0.3406	0.0000***	-0.1118	0.0000***	0.0491	0.0563*	0.1005	0.0086***
Financials	-0.1384	0.0000***	-0.1501	0.0000***	-0.0885	0.0000***	0.0300	0.2313	0.1262	0.0000***
Industrial	-0.1342	0.0000***	-0.1593	0.0000***	-0.0681	0.0080***	0.0429	0.0617*	0.1424	0.0071***
Information Technology	-0.0640	0.0000***	-0.0259	0.1192	-0.1758	0.0000***	-0.0067	0.829	-0.0468	0.0150**
Telecommunication	-0.0345	0.0000***	-0.0614	0.0021***	-0.0088	0.7442	0.0676	0.0149**	-0.0517	0.1399
Utilities	-0.1005	0.0000***	0.3468	0.0000***	-0.0417	0.0215**	0.0493	0.0436**	-0.0212	0.6691

Note: ***, ** and *indicate the significance levels at 1%, 5% and 10% levels, respectively.

Table 5.5.8a: Hedge and Safe Haven asset in times of crisis of (Russia)

Sector Indices	Hedge		Dot Com Bubble Burst		Global Financial Crises		European Debt Crises		Covid-19 Crises	
	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value
Consumer Discretionary	-0.0345	0.0000***	0.0259	0.0073***	0.0328	0.1942	0.0109	0.6224	-0.0566	0.4061
Energy	-0.0026	0.7509	-0.0215	0.2328	0.0228	0.1388	0.0026	0.9253	-0.1175	0.0338**
Financials	-0.0308	0.0000***	-0.0065	0.6535	0.0071	0.6487	-0.0091	0.6831	-0.1627	0.0022***
Industrial	-0.0158	0.0671*	-	-	0.0123	0.4119	0.0309	0.0887*	0.0258	0.7248
Telecommunication	-0.0018	0.7941	-0.0164	0.2039	0.0565	0.0980*	-0.0590	0.0513*	-0.1095	0.0550*
Basic Materials	-0.0320	0.0000***	-0.0896	0.0004***	0.0319	0.0218**	0.0693	0.0016***	-0.0169	0.4354
Utilities	-0.0129	0.0142**	-0.0156	0.2049	0.0048	0.7994	-0.0443	0.0353**	-0.0842	0.0846*

Note: ***, ** and *indicate the significance levels at 1%, 5% and 10% levels, respectively.

Table 5.5.8a reports the estimation output for hedge and safe haven features of gold in the case of Russia. The negative coefficient values in the hedge column show that gold provides opportunities for hedging the sector-specific risk in Russian stock markets. In particular, gold acts as a safe haven for all sector indices except the energy sector around the period that coincides with the collapse of technology stocks. Even during the "Credit crunch," positive values across all Russian stock sectors indicate no safe haven role of gold. While during EDC, gold plays its haven role in the financial, telecommunication and utility sectors. In the recent

pandemic phase, traditional assets often serve as refuge assets for investment in all sectors except the industrial sector.

Table 5.5.9a: Hedge and Safe Haven asset in times of crisis (Saudi Arabia)

Sector Indices	Hedge		Dot Com Bubble Burst		Global Financial Crises		European Debt Crises		Covid-19 Crises	
	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value
Consumer Discretionary	-0.0148	0.1001	-	-	0.0180	0.5783	-0.0747	0.0292**	-0.0680	0.0983*
Consumer Staples	-0.0076	0.3818	-	-	0.0474	0.0911*	-0.0179	0.5540	-0.0901	0.0606*
Energy	-0.0030	0.6646	-	-	0.0239	0.2285	-0.0349	0.0631*	-0.0737	0.0065***
Financials	-0.0144	0.2320	-	-	0.0401	0.2198	-0.0552	0.1035	-0.1270	0.0037***
Health Care	-0.0273	0.4609	-	-	-	-	-0.0105	0.8902	0.1429	0.0599*
Industrial	-0.0118	0.2819	-	-	0.0511	0.1332	-0.0293	0.4750	-0.1334	0.0063***
Telecommunication	-0.0087	0.3761	-	-	0.0226	0.4424	-0.0387	0.3219	-0.0657	0.1458
Basic Materials	0.0027	0.7872	-	-	0.0439	0.0734*	-0.0057	0.8109	-0.0057	0.8109
Utilities	-0.0039	0.6436	-	-	-0.0040	0.8686	-0.0640	0.0353**	-0.1149	0.0064***

Note: ***, ** and *indicate the significance levels at 1%, 5% and 10% levels, respectively.

Table 5.5.9a depicts the estimation results of Hedge and Safe Haven coefficients, specifically in times of crisis for Saudi Arabia. The negative coefficients during average market conditions signify the hedging ability of gold for all sector returns except basic materials, which is also consistent with previous findings indicated in (Shah, Bhanja, & Dar, 2023). As the data is available at later periods for all Saudi Arabia sectoral indices, DCBB is not considered in the study. Similarly, for the health care sector, data is available for later periods, DCBB and GFC are not included in study. As indicated by (Shah, Bhanja, & Dar, 2023), Saudi sectoral indexes are exposed to severe susceptibility to crashes in times of financial uncertainty and volatility in global markets and thus, certainty needs safe havens to balance their negative returns. Consistently, correlations of gold with all Saudi sectoral indices except the utility sector are positive throughout the period during GFC, indicating that gold works as a risky asset rather than a refuge asset to safeguard investment in Saudi sectors in times of GFC. Interestingly, in the case of EDC, the negative correlation across all sectors indicates that gold served as a sanctuary to invest against sector-specific risk. Being Covid-19 pandemic, a great health crisis, a positive and significant comovement was expected between the gold and health care sectors. While, the rest of the Saudi Arab sector indexes show almost significant negative comovement with gold, which gives conclusive evidence that gold shines out with its robust, safe haven potential during the

Covid-19 pandemic. In similar lines, (Shah, Bhanja, & Dar, 2023) also reported that correlations during the global financial crisis were less volatile compared to the Covid-19 crisis.

Table 5.5.10a: Hedge and Safe Haven asset in times of crisis (Thailand)

Sector Indices	Hedge		Dot Com Bubble Burst		Global Financial Crises		European Debt Crises		Covid-19 Crises	
	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value
Consumer Discretionary	-0.0266	0.0028***	-0.0028	0.8800	-0.0074	0.8571	0.0287	0.2761	-0.0891	0.0106**
Consumer Staples	-0.0087	0.2838	-0.0397	0.0603*	-0.0034	0.9090	-0.0181	0.4052	-0.0047	0.9061
Energy	-0.0087	0.2550	-0.0303	0.0635*	0.0389	0.0688*	0.0149	0.5174	0.0353	0.2288
Financials	-0.0268	0.0026***	-0.0005	0.9770	-0.0302	0.3393	0.0022	0.9349	0.0173	0.6315
Health Care	-0.0172	0.0642*	-0.0287	0.3238	0.0178	0.5755	0.0194	0.4003	0.0248	0.5283
Industrial	-0.0175	0.0162**	-0.0008	0.9526	-0.0493	0.1568	-0.0134	0.5873	-0.0591	0.1120
Information Technology	-0.0159	0.0092***	-0.0250	0.0619*	0.0095	0.7493	0.0276	0.1401	-0.0376	0.1190
Telecommunication	-0.0184	0.0065***	-0.0229	0.1878	-0.0009	0.9725	0.0152	0.4823	-0.0306	0.5333
Basic Materials	-0.0203	0.0066***	-0.0367	0.1088	0.0112	0.6572	0.0311	0.1266	0.0198	0.3932
Utilities	-0.0133	0.1963	-0.0451	0.0242*	0.0570	0.1233	0.0292	0.4173	-0.0246	0.4557

Note: ***, ** and *indicate the significance levels at 1%, 5% and 10% levels, respectively.

Table 5.5.10a depicts the results of hedge and safe haven estimates in times of crisis for Thailand Sector indices. All sector indices of Thailand exhibit negative (mostly significant) coefficient estimates during normal market conditions. This thereby indicates the hedging potential of gold against all sector indices of Thailand. Along similar lines, gold served as a safe haven for DCBB crisis for all sectors and during EDC only for the industrial and consumer staples sector. The remaining crisis, particularly GFC, gold is a preferred haven asset for consumer discretionary, consumer staples, financials, industrial and telecommunication sectors. Even small negative coefficients for consumer discretionary, consumer staples, information technology, industrial, telecommunication and utility sectors signify the weak safe haven role of gold during pandemic times.

Concerning the analysis of the hedge and haven status of gold for Vietnam, this is also reported in Table. 5.5.11a, the dynamic evolution of negative comovement across all sectors except the basic material sector suggests the hedging role of gold. The observed positive coefficients between gold and all sector indices during the EDC imply that gold is no longer a haven for sector stocks in this crisis. The positive correlation was also seen for consumer discretionary, consumer staples, energy and health care sectors, while it switched to negative for financials, industrial, telecommunication, basic material and utility sectors during the financial crisis (the

"credit crunch"). Moreover, during the recent health crisis, negative correlation values for the financial and telecommunication sectors imply weak safe haven role of gold.

Table 5.5.11a: Hedge and Safe Haven asset in times of crisis (Vietnam)

Sector Indices	Hedge		Dot Com Bubble Burst		Global Financial Crises		European Debt Crises		Covid-19 Crises	
	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value
Consumer Discretionary	-0.0169	0.0888	-	-	0.0154	0.5951	0.0412	0.0876*	0.0093	0.8364
Consumer Staples	-0.0135	0.3084	-	-	0.0097	0.6948	0.0580	0.1082	0.0332	0.5187
Energy	-0.0097	0.2013	-	-	0.0167	0.4785	0.0629	0.0035***	0.0342	0.4047
Financials	-0.0165	0.1373	-	-	-0.0125	0.6797	0.0728	0.0170**	-0.0435	0.3167
Health Care	-0.0069	0.5474	-	-	0.0246	0.2865	0.0559	0.1515	0.0446	0.2876
Industrial	-0.0106	0.3342	-	-	-0.0301	0.2916	0.0635	0.0257**	0.0371	0.3754
Telecommunication	-0.0111	0.1820	-	-	-0.0269	0.2005	0.0340	0.1275	-0.0487	0.1415
Basic Materials	0.0039	0.7348	-	-	-0.0472	0.1177	0.0570	0.0403**	0.0554	0.1455
Utilities	-0.0201	0.0844*	-	-	-0.0070	0.7872	0.0593	0.0301***	0.1141	0.0035***

Note: ***, ** and *indicate the significance levels at 1%, 5% and 10% levels, respectively.

Table 5.5.12a: Hedge and Safe Haven asset in times of crisis (USA)

Sector Indices	Hedge		Dot Com Bubble Burst		Global Financial Crises		European Debt Crises		Covid-19 Crises	
	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value
Consumer Discretionary	-0.0625	0.0000***	0.0024	0.9314	-0.0696	0.0591*	0.0987	0.0029***	0.0741	0.0686*
Consumer Staples	-0.0172	0.3015	0.0094	0.7874	-0.1024	0.0390**	0.0992	0.0280***	0.0925	0.0275**
Energy	0.0293	0.0022***	-0.0186	0.4607	0.0255	0.2743	0.0796	0.0016***	-0.0204	0.4339
Financials	-0.0561	0.0000***	0.0005	0.9844	-0.0198	0.3666	0.0789	0.0024***	0.1068	0.0002***
Health Care	-0.0388	0.0050***	0.0575	0.0760*	-0.0577	0.1715	0.1176	0.0012***	0.0396	0.3582
Industrial	-0.0441	0.0002***	0.0041	0.8488	-0.0241	0.4394	0.0993	0.0002***	0.0805	0.0190**
Information Technology	-0.0315	0.0004***	0.0078	0.5431	-0.0542	0.0657*	0.0740	0.0080***	-0.0179	0.5886
Telecommunication	-0.0313	0.0020***	0.0070	0.7201	-0.0499	0.0966*	0.0552	0.1128	0.0672	0.1238
Basic Materials	0.0176	0.0778*	-0.0386	0.0653*	0.0344	0.1212	0.0849	0.0001***	-0.0460	0.1782
Utilities	0.0320	0.0116**	-0.0041	0.8862	-0.0596	0.0817*	0.0701	0.0638*	0.2022	0.0000***

Note: ***, ** and *indicate the significance levels at 1%, 5% and 10% levels, respectively.

Table 5.5.12a. shows hedge and safe haven status of gold against sector indices of USA in times of crisis. The significant negative coefficient for all sectors except energy basic material and utility indicate substantial hedge effect of yellow metal. The results corroborate with the findings by (Kang, Hernandez, Rehman, Shahzad, & Yoon, 2023) in terms of gold as an effective hedge against risk in financial and real estate sector of US. Similarly, for USA during internet bubble burst gold served as safe haven for Energy, Basic material and Utility sector but surprisingly not for Information technology sector. In contrast, except for energy and basic material sector, safe

haven characteristics of gold was observed for rest of the stock market sector indices. A significant negative dependency was also observed for almost all sectors of US in and around GFC indicating safe haven behaviour of gold which was also supported by (Salisu, Vo, & Lucey, 2021).

While during European debt crisis almost all sectors showed positive and significant comovement with gold, but surprisingly Covid-19 crisis has disastrously impacted some of the sector, particularly energy, basic material and information technology sector and safe haven potential of traditional asset still observed during this crisis. Consistent with results of (Ghorbel & Jeribi, 2021) which reported contagion and safe haven effect of gold against energy assets in times of Covid-19 crisis. Similarly, even (Junttila, Pesonen, & Raatikainen, 2018) supported cross hedging benefits of gold futures against equity sector of US in periods of market crash. In constrast, (Sikiru & Salisu, 2023) reported safe haven attributes of gold for travel and tourism stock in pandemic.

Table 5.5.13a: Hedge and Safe Haven asset in times of crisis (Australia)

Sector Indices	Hedge		Dot Com Bubble Burst		Global Financial Crises		European Debt Crises		Covid-19 Crises	
	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value
Consumer Discretionary	-0.0886	0.0000***	0.0789	0.0001***	-0.1048	0.0018***	-0.2005	0.0003***	0.1348	0.0000***
Consumer Staples	-0.0190	0.0706**	-0.0285	0.2416	-0.1300	0.0012***	-0.1853	0.0000***	0.1813	0.0007***
Energy	-0.0069	0.5042	-0.0834	0.0271**	-0.0421	0.0633*	-0.0949	0.0018***	0.1442	0.0000***
Financials	-0.1032	0.0000***	0.0785	0.0755*	-0.0687	0.0130**	-0.1802	0.0000***	0.2402	0.0000***
Health Care	-0.0556	0.0002***	-0.0022	0.9538	-0.0617	0.0785*	-0.0496	0.2665	0.2071	0.0000***
Industrial	-0.0498	0.0007***	0.0232	0.5024	-0.1514	0.0000***	-0.1429	0.0009***	0.1469	0.0000***
Information Technology	0.0010	0.9152	0.0125	0.3235	-0.1284	0.0000***	-0.0263	0.3319	-0.0092	0.7592
Telecommunication	-0.0243	0.0356**	0.0073	0.8100	-0.0139	0.6458	-0.0541	0.1247	0.1432	0.0255**
Basic Materials	0.0040	0.7117	-0.0657	0.0538*	-0.0286	0.1650	-0.0671	0.0263**	0.2415	0.0000***
Utilities	-0.0250	0.0573*	0.0023	0.9400	-0.1482	0.0000***	-0.1623	0.0000***	0.1754	0.0000***

Note: ***, ** and *indicate the significance levels at 1%, 5% and 10% levels, respectively.

Table 5.5.13a reflects the hedge and safe haven characteristics of gold across varied turmoil's. Accordingly, the negative signs of the coefficients for all sector indices (except Information technology and basic materials) indicate the effective hedging ability of gold in normalized market conditions. While during DCBB, only four sectors considered gold as a refuse asset to safeguard their investment, namely consumer staples, energy, healthcare and basic materials.

While, EDC and GFC had a significant impact on Australian equity sectoral indices. The negative values for all sectors and statistical significance observed for most of the sectors thereby reported sufficient, safe haven attributes of gold for Australian sector stocks. Considering the pandemic, a high dependence structure was revealed between gold and all sector indices except the weak safe haven status of gold, which is shown only against the information technology sector.

Table 5.5.14a: Hedge and Safe Haven asset in times of crisis (Canada)

Sector Indices	Hedge		Dot Com Bubble Burst		Global Financial Crises		European Debt Crises		Covid-19 Crises	
	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value
Consumer Discretionary	-0.0848	0.0000***	0.0411	0.2579	-0.1008	0.0379**	-0.1111	0.0427**	0.1324	0.0004***
Consumer Staples	-0.0541	0.0000***	-0.0018	0.9211	0.0360	0.4084	0.0437	0.2685	0.2851	0.0000***
Energy	-0.0054	0.5941	0.0459	0.1548	0.0561	0.0264**	-0.0529	0.0990*	0.0242	0.3751
Financials	-12.8673	0.0000***	4.5002	0.2193	-0.9266	0.7872	-7.5825	0.0919	19.3522	0.0000
Health Care	-0.0034	0.5498	-0.0346	0.2072	-0.0905	0.0086***	-0.0317	0.0805*	-0.0485	0.0811*
Industrial	-0.0656	0.0000***	0.0292	0.1360	-0.0165	0.6134	-0.0904	0.0189**	0.1335	0.0006***
Information Technology	-0.0258	0.0001***	0.0126	0.1741	-0.0426	0.0196**	-0.0112	0.6084	0.1217	0.0003***
Telecommunication	-0.0118	0.5089	-0.0375	0.2898	-0.1317	0.0001***	-0.1761	0.0061***	0.1771	0.0000***
Basic Materials	0.1227	0.0000***	-0.1672	-7.5825	0.0919	0.3494	0.0218	0.4241	0.0299	0.3640
Utilities	-0.0014	0.9401	-0.0248	0.6048	-0.0098	0.8579	-0.1380	0.0096***	0.1475	0.0000***

Note: ***, ** and *indicate the significance levels at 1%, 5% and 10% levels, respectively.

Table 5.5.14a shows the results of the hedge and safe haven status of gold in times of crisis for Canadian sectoral indices. The results are more heterogeneous across varied crises and sectors. The estimates are negative for all sectors except basic materials in the case of Canada, implying the hedging ability of gold. During the internet bubble burst, only consumer staples, health care and telecommunication, basic material and utility sectors have shown insignificant negative estimates, indicating the weak safe haven role of gold. In times of GFC with the exception of consumer staples, energy and basic materials sector, all other sectors considered gold as a refuge asset. Subsequently, during EDC, more sectors, except consumer staples and basic materials, have preferred gold as a haven asset. Moreover, the coefficients are positive and statistically significant for all sectors except the health care sector of Canada during COVID-19. This gives clear evidence of the diminishing safe haven property of gold during COVID-19 with respect to Canadian sectoral indices.

Table 5.5.15a: Hedge and Safe Haven asset in times of crisis (South Africa)

Sector Indices	Hedge		Dot Com Bubble Burst		Global Financial Crises		European Debt Crises		Covid-19 Crises	
	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value
Consumer Discretionary	-0.1550	0.0000***	0.1229	0.0004***	-0.1510	0.0004***	0.0298	0.4856	-0.0007	0.9881
Consumer Staples	-0.0288	0.0030***	-0.0169	0.4839	-0.1882	0.0000***	-0.1508	0.0024***	-0.3119	0.0000***
Energy	0.0401	0.0000***	-0.0471	0.0404**	-0.0585	0.0116**	-0.0840	0.0043***	-0.0828	0.0010***
Financials	-0.2021	0.0000***	0.1551	0.0000***	-0.0863	0.0080***	-0.0421	0.2956	0.0671	0.1242
Health Care	-0.0712	0.0000***	0.0058	0.8747	-0.1136	0.0066***	-0.0054	0.9077	-0.0193	0.6973
Industrial	-0.1552	0.0000***	0.1068	0.0012***	-0.0593	0.0886*	-0.0731	0.0971*	-0.0424	0.4296
Information Technology	-0.0276	0.0008***	-0.0031	0.8306	-0.1286	0.0000***	-0.0578	0.0176**	0.1134	0.0147**
Telecommunication	-0.0870	0.0000***	0.0779	0.0000***	-0.0863	0.0006***	-0.0893	0.0048***	3.77E-05	0.9994
Basic Materials	0.1239	0.0000***	-0.1224	0.0000***	-0.0523	0.0597*	-0.0865	0.0125**	-0.0272	0.4219

Note: ***, ** and *indicate the significance levels at 1%, 5% and 10% levels, respectively.

Table 5.5.15a shows estimation results for gold as a hedge and haven asset in times of crisis for South African equity sector indices. Apart from the basic materials sector, all other sectors exhibit negative and significant coefficient estimates for average relation with gold, indicating the possibility of an effective hedge. With respect to South Africa equity sector indices, gold exhibited haven properties for all sectors during the GFC. The strong, safe haven effect of gold was confined to all sectoral indices except the consumer discretionary sector during EDC. Even during DCBB with the exception of a few sectors, namely consumer discrepancy, financial, health care, industrial and telecommunication, gold played its safe haven role. The results of the Covid-19 pandemic are more heterogeneous, showing safe haven potential for all sectors except Financials, information technology and telecommunication.

Table 5.5.16a: Hedge and Safe Haven asset in times of crisis (Switzerland)

Sector Indices	Hedge		Dot Com Bubble Burst		Global Financial Crises		European Debt Crises		Covid-19 Crises	
	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value
Consumer Discretionary	0.0343	0.0000***	-0.0205	0.1233	-0.0228	0.3798	0.0663	0.0009***	0.0502	0.0619*
Consumer Staples	0.0423	0.0000***	-0.0286	0.0459*	-0.0246	0.4309	0.1488	0.0000***	0.0715	0.0300**
Energy	0.0400	0.0053***	-	-	-0.0053	0.7916	-0.0386	0.0247**	0.2070	0.7246
Financials	0.0241	0.0048***	-0.0167	0.1798	-0.0409	0.0424*	0.0631	0.0087***	0.2004	0.0000***
Health Care	0.0417	0.0001***	-0.1139	0.0000***	-0.0427	0.2418	0.1190	0.0002***	0.0205	0.4043
Industrial	0.0471	0.0000***	-0.0339	0.0102**	0.0146	0.5745	0.0998	0.0001***	0.0624	0.0405**
Information Technology	0.0056	0.3405	0.0083	0.5424	0.0194	0.3543	0.0811	0.0003***	0.0509	0.0406**
Telecommunication	0.0289	0.0236**	-0.0290	0.2237	0.0378	0.3475	0.1280	0.0041***	0.1219	0.0000***
Basic Materials	0.0793	0.0000***	-0.1375	0.0000***	0.0512	0.0884*	0.0492	0.0654*	0.0650	0.0822*
Utilities	0.0227	0.0873*	0.0282	0.2756	-0.0150	0.6509	0.0714	0.0689*	0.0853	0.0521*

Note: ***, ** and *indicate the significance levels at 1%, 5% and 10% levels, respectively.

Table 5.5.16a exhibits the hedge and safe haven properties of gold against Switzerland sector stocks. Following the definition of (Baur & McDermott, 2010)**,** gold is positively and significantly correlated with all the sectoral indices of Australia, demonstrating its non-hedge characteristics during normal market situations. Similarly, particularly during EDC and the Covid-19 crisis, significant positive associations reveal a non-safe haven status of traditional shiny metal. While during the internet bubble burst with the exception of utilities and information technology sectors, all other sectors have considered yellow metal as a protective investment tool. Gold also provides shelter during the financial crisis to some of the sector-specific risks, mainly consumer discretionary, consumer staples, energy, financials, health care and utility sectors.

Table 5.5.17a: Hedge and Safe Haven asset in times of crisis (UK)

Sector Indices	Hedge		Dot Com Bubble Burst		Global Financial Crises		European Debt Crises		Covid-19 Crises	
	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value
Consumer Discretionary	-0.0268	0.0728**	-0.0176	0.3809	-0.1537	0.0000***	-0.0180	0.6549	0.0356	0.1576
Consumer Staples	0.0251	0.0506**	-0.0362	0.0494**	-0.1874	0.0000***	-0.0037	0.9266	0.0939	0.0384**
Energy	0.0401	0.0000**	-0.0471	0.0404**	-0.0585	0.0116**	-0.0037	0.0043***	-0.0828	0.0010***
Financials	-0.0514	0.0000**	-0.0146	0.3595	-0.0921	0.0000***	0.0005	0.9850	0.0844	0.0078***
Health Care	0.0051	0.6640	-0.0612	0.0012***	-0.1441	0.0001***	-0.0081	0.8370	0.0913	0.0267**
Industrial	-0.0195	0.1087	0.0085	0.7413	-0.1052	0.0011***	0.0238	0.4880	0.0369	0.2057
Information Technology	0.0010	0.9152	0.0125	0.3235	-0.1284	0.0000***	-0.0263	0.3319	-0.0092	0.7592
Telecommunication	-0.0278	0.0030***	0.0224	0.0995*	-0.0672	0.0048***	-0.0259	0.4543	0.2057	0.0000***
Basic Materials	0.0778	0.0000***	-0.1810	0.0000***	-0.0270	0.1157	-0.0115	0.5776	-0.0595	0.0079***
Utilities	0.0051	0.6914	-0.1573	0.0000***	-0.1260	0.0004***	-0.0579	0.1562	0.0942	0.0024***

Note: ***, ** and *indicate the significance levels at 1%, 5% and 10% levels, respectively.

Table 5.5.17a reports the estimation results in the case of the UK for the role of gold as a hedge and haven against equity sectoral indices. The results show that gold appears as a hedge against consumer discretionary, financials, industrial, and telecommunication sectors as the hedge coefficient is significantly negative. Further, gold serves as a haven asset for all equity sectoral indices in times of GFC, for only specific sectors, namely consumer discretionary, consumer staples, energy, financials and health care sector during DCBB, for only energy, information technology and basic material sector during Covid-19 crisis. Also, the safe haven role of gold was evidenced for all sectors except the industrial and financial sectors during periods of EDC.

Table 5.5.18a: Hedge and Safe Haven asset in times of crisis (Japan)

Sector Indices	Hedge		Dot Com Bubble Burst		Global Financial Crises		European Debt Crises		Covid-19 Crises	
	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value
Consumer Discretionary	0.0684	0.0000***	-0.0540	0.0498**	0.1189	0.0001***	0.1147	0.0000***	0.2047	0.0000***
Consumer Staples	0.0650	0.0000***	-0.0537	0.0437**	0.1044	0.0003***	0.1053	0.0000***	0.1440	0.0028***
Energy	0.0388	0.0000***	-0.0324	0.1568	0.1005	0.0000***	0.0610	0.0027***	0.3036	0.0000***
Financials	0.0375	0.0000***	-0.0306	0.2556	0.0560	0.0177**	0.0795	0.0007***	0.1998	0.0000***
Health Care	0.0287	0.0088***	-0.0472	0.1572	0.1505	0.0000***	0.2234	0.0000***	0.1796	0.0000***
Industrial	0.0569	0.0000***	-0.0473	0.0313**	0.0960	0.0005***	0.1027	0.0000***	0.2199	0.0000***
Information Technology	0.0437	0.0000***	-0.0453	0.0010***	0.1100	0.0001***	0.1258	0.0000***	0.2266	0.0000***
Telecommunication	0.0263	0.0005***	-0.0305	0.0207**	0.1271	0.0000***	0.1423	0.0000***	0.2099	0.0000***
Basic Materials	0.0617	0.0000***	-0.0257	0.2903	0.0869	0.0007***	0.0917	0.0000***	0.1745	0.0000***
Utilities	0.0497	0.0000***	-0.0635	0.1011	0.0153	0.6828	0.0189	0.4171	0.1180	0.0102***

Note: ***, ** and *indicate the significance levels at 1%, 5% and 10% levels, respectively.

Table 5.5.18a shows the estimation results during periods of normal market conditions and specific turmoil in the case of Japan. A positive significant correlation pattern was portrayed between gold and Japan sectoral indexes during average market conditions. Surprisingly, a similar pattern with significant positive values was also observed during GFC. Apart from the DCBB crisis gold couldn't exhibit its refuge characteristics across all tranquil and turmoil periods. Unlike other crises that never resulted in negative correlations, gold exhibited its sanctuary capabilities to investors holding Japanese sectoral indexes during DCBB crisis periods.

5.7 Residual Diagnosis Test

The results of the Residual diagnostics test are presented in Appendix I, Table 5.4.1b to Table 5.4.18b with respect to Panel A - Major Gold Consuming Countries (India, China, UAE, Egypt, Indonesia, South Korea, Turkey, Russia, Saudi Arabia, Thailand, Vietnam and USA), Panel B - Major Gold Producing Countries (Australia, Canada and South Arica) and Panel C - Key Currency Countries (Japan, UK and Switzerland).. The estimated Quantile models for specific quantiles and in times of crises were revealed to be appropriate as the ARCH LM and LB Q statistics results are insignificant. That is, both the tests suggest the models' results are devoid of serial correlation and heteroscedasticity problems.

5.8 Wavelet Coherence analysis across time and investment horizons

Wavelet Coherency denotes a localized measure of asset dependence in time and frequency horizon. Again, the definition of (Baur & Lucey, 2010) is followed to define hedge and safe haven. In order to determine the hedge and safe haven potential of gold at each point in time and across multiple investment horizons, wavelet coherency is used. The X-axis denotes the time frame studied in terms of a number of observations measured in thousands and also the years are estimated at the top of the Wavelet coherence plot. While, the Y-axis denotes the time horizon. Wavelet coherency is shown between gold and sector markets for a time span ranging from January 2000 to March 2020.

The dynamics hedge and safe haven role of gold through coherency and phase angles are presented in Appendix I, Figures 5.1 to 5.9. The wavelet coherency between the gold and equity sector indices of India is presented in Figures 5.1a to 5.1j. In the case of all sectoral indices, low coherency dominates on throughout the sample period, indicating the hedging ability of gold. The findings also collaborate with (Bekiros, Boubaker, Uddin, & Nguyen, 2017) who also mentioned that gold serves as a hedge against the stock. The visual demonstration also reports the safe haven attribute of gold during DCBB. As small patches with red color at around 32 days investment implies haven potential of gold for the industrial, utility and energy sectors. For a holding period of around 32 days to 256 days, arrows in the westward direction indicate that gold performed safe haven role for consumer discretionary, telecommunication, information technology, heath care, financial and consumer staples sectors at the beginning of the GFC. Thus, safe haven attributes are very much apparent for most of the sectors during the GFC. At the onset of EDC, a pocket of negative coherency was also observed beyond the 32-day investment horizon from gold to telecom, information technology, utility, health care and industrial sectors. While the safe haven status of gold for most of the sector indices dissipated with the emergence of the Covid-19 crisis.

As indicated in previous literature, China markets are immune to foreign shocks (Figure 5.2a to 5.2i). Similar results were exhibited during the GFC, the Internet bubble burst and the EDC, as positive coefficient values for all sectors are not surprising given that all these sectors have not considered gold as a safe haven asset during this crisis. But during the initial phases of the

Covid-19 period, negative coherence with westward-facing arrows also evidenced safe haven dynamics of gold against most of the sectors.

In the case of South Korea (Figure 5.3a to 5.3j) low coherency dominates on average for all equity sector indices, indicating that gold can be a potential hedge for all investment horizons. The negative movement with arrows facing in the left direction is less apparent for the financial and utility sectors during the internet bubble burst. For investors with a holding period of around 16 to 32 days and around 128 to 256 days, the negative coherency pattern between the gold and information technology sector and the gold and financial sector, respectively, seems more apparent throughout the GFC. Beyond the short horizons, an extended phase of negative co-movement was seen during EDC for almost all the sectors, signifying the safe haven status of gold. As the pandemic approached, an inverse relation was observed between the majority of the equity sector index and gold, with equity sector prices leading to gold prices. Overall, the results show the predominance of the role of gold as a safe haven for stock sector indices, specifically during EDC and the Covid-19 pandemic.

Figures 5.4a to 5.4h show the coherency between the gold and sectoral indices of Turkey. The predominance of blue color indicates low coherency across all investment horizons. Thus, gold plays its role as an effective hedge, especially in times of tranquil period. In comparison to all other crises, a heightened co-movement between gold and all equity sectors was exhibited during the GFC, thus exemplifying the safe haven status of gold. With the outbreak of the pandemic, a positive relationship is also detected beyond short horizons.

Figures 5.5a to 5.5b show the results of wavelet coherency between the gold and finance sector and the gold and utility sector of Thailand. The predominance of blue color indicates the hedging ability of gold against both sectors. The red patches with east-facing arrows indicate positive coherency beyond 16 day horizon between the gold and, finance and utility sectors. During EDC safe haven ability of gold was not pronounced. While in times of COVID-19 pandemic, a positive movement was observed in gold with the utility sector at longer horizons and a negative coherency of gold was observed between 16 days to 64 days horizon for the finance sector.

Figures 5.6a to 5.6i show the wavelet coherency plots between gold and US sectoral indices. The safe haven potential of gold is detailed in times of four severe market turmoils. The results of wavelet coherency showed a long-horizon safe haven potential of gold against the information technology and telecom sector during the internet bubble burst. While all other sectors exhibited positive co-movement with gold in longer horizons. However, during GFC, out-of-phase southwest direction arrows indicate that gold prices are lagging sector indices prices. Gold has not shown any coherence with the equity sector during EDC, thus not serving as a safe haven. Additionally, during the period surrounding the Covid-19 pandemic, gold has shown robust negative dependence on the energy sector of the US.

Figures 5.7a to 5.7i depict the coherency pattern between the gold and equity sector indices of Switzerland. During the tranquil periods, the existence of high positive coherency indicates that gold doesn't hedge sector-specific risk. In the case of Switzerland, positive coherency was exhibited at longer horizons for all sectors, with the exception of information technology, financial, telecommunication and industrial sectors during the DCBB. While a small red droplet with respect to the health care sector at the short horizon of 64 days and financials, industrial and telecommunication sector at longer horizons, thereby indicating the safe haven potential of gold. While beyond the 32-day investment horizon, red patches with westward direction arrows indicated safe haven dynamics of gold for the utility, financial and consumer discretionary sector during the Covid-19 phases.

The wavelet coherency plots between gold and equity sector indices of the UK are demonstrated in figures 5.8a to 5.8j. The hedge property of gold is predominant in the consumer discretionary, financials, industrial and telecommunication sectors. While, the red islands are larger and predominant for the telecommunication sector at longer horizons with west-direction arrows, indicating a negative correlation with gold during DCBB. The period marked by GFC, shows the dominant role of gold as a haven asset against financial, health care (at 256 days frequency horizon) and telecom sector (at 64 days frequency horizon). During the Covid-19 crisis, many arrows were pointing towards the west, suggesting a co-movement in opposite directions from sector indices, mainly energy, basic material, telecommunication and financial, to gold at

horizons beyond 16 days. While, the utility sector has not shown any co-movement during pandemic time.

The connection between equity sectoral indices and yellow assets, namely gold, is exhibited in Figures 5.9a to 5.9j. The information on phases represented by arrows facing the right direction indicates that gold leads sectoral indices during average market conditions. In addition, wavelet results show negative coherency from 64 days to 1024 days for the telecom sector during the Covid-19 crisis. Even distinct pockets of high coherency indicating positive coherency at longer horizons were revealed during Covid-19 for the energy sector. Similarly, the information technology sector shows negative co-movement with gold from 64 to 1024 days and around 256 days in the time frame of 2006 to 2015 for the utility sector. This implies the safe haven status of gold, while the co-movement between oil and the Islamic index becomes strong during the pandemic phase. For the rest of the sectors, higher positive co-movement across all horizons during the global financial crisis and European debt crisis shows the diminishing role of traditional assets in safeguarding investment across time and investment horizons.

CHAPTER - 6

GOLD ACTS AS A HEDGE AND SAFE HAVEN AGAINST EXCHANGE RATE FLUCTUATIONS OF MAJOR GOLD CONSUMING, MAJOR GOLD PRODUCING AND KEY CURRENCY COUNTRIES

CHAPTER SIX

Gold acts as a hedge and safe haven against exchange rate fluctuations of major gold consuming, major gold producing and key currency countries

6.1 Introduction

Due to the complex market situation, particularly during the financial crisis, the ultimate concern for investors is to diversify their portfolios and prefer relatively safe assets. The globalization and growing importance of international trade increased the risk of exchange rate and in turn concerns the investors to deal with this risk (Nguyen, Bedoui, Majdoub, Guesmi, & Chevallier, 2020). Thus, from an investor's perspective, the question triggers how to manage such risk. This question is put forward to address by testing whether holding gold helps mitigate currency risk. Some research insights say that in the past, gold, being a part of the monetary system, served as a hedge to the investors (Capie, Mills, & Wood, 2005). It was also suggested to be a safe haven asset to offset the currency risk (Hau & Rey, 2005).

There are several theoretical reasons to explain the informational dependencies between gold and currency rates. Firstly, the relationship between gold and the exchange rate can be linked to the uncovered interest rate parity. Secondly, as per the 'flow models' of currency rate determination, the fluctuations in currency value directly cause the international competitiveness and trade balance of a country to change. These changes, in turn, impact the output, cash flows, and stock prices of a firm (Ciner, Gurdgiev, & Lucey, 2013).

In the spirit of the theoretical model, this chapter exemplifies the hedge and a safe haven attribute of gold against exchange rates in gold-consuming, gold producing and key currencies countries.

6.2 Summary Statistics

Table 6.1 reports the gold and exchange rate returns statistical performance for the entire sample period. The results of gold returns are explained in Chapter 4, section 4.2. As shown, the average yield provided by China (0.1408%), Switzerland (0.0093) and Thailand's (0.0023%) exchange rate is positive, indicating the average appreciation and less swings in the currency value. On that side, the rest all countries' exchange rate mean value of returns is negative, indicating the currency rates of India, UAE, Egypt, Indonesia, South Korea, Turkey, Russia, Saudi Arabia, Vietnam, Australia, South Africa, UK and Japan are depreciatory. The mean return of Turkey's exchange rate, followed by Egypt, reveals a greater fall in currency value, while Saudi Arabia and UAE have low negative average returns. The exchange rate yield variability ranges from 0.0207% to 27.2221%. The volatility is more pronounced in India (27.2221%) followed by Turkey (1.9282%) exchange rate market. The China exchange rate (0.0207%) followed by UAE (0.0301%) and Saudi Arabia (0.0325%) taking the less variance on the mean returns. As to the skewness, the values are negative and positive for the sample variables, indicating the left-skewed and right-skewed behaviour of returns distribution. In addition, the kurtosis value more than 3 shows the leptokurtic distribution. Looking at the Jarque-Bera test statistics, the normality in exchange rate returns distribution can be rejected at a 1% significant level.

6.3 Correlation Results

According to the theoretical argument, the gold and exchange rate share an inverse relation. In line with that, in this research, the value of gold is hypothesized to negatively depend on the exchange rate. In the last column of Table 6.1 illustrates the unconditional correlation between gold and the exchange rate of all 18 countries in the panels. At a preliminary stage, this test has featured out the negative correlation between gold and currency rates of all countries except UAE and Thailand. In other words, a rise in gold returns is associated with a depreciation in the exchange rate value. More specifically, the gold and exchange rate of Egypt (-0.5262), followed by Turkey (-0.5960) and South Africa (-0.4843), shares a greater strength of negative correlation.

Besides, it can be seen that the gold-exchange rate pair of China (-0.0075) followed by Saudi Arabia (-0.0105) and India (-0.0204) exhibits a lower negative correlation. Moreover, the sign of positive correlation suggests the gold returns go up when the currencies of UAE and Thailand country appreciate against the dollar. This also means that investors can use positive correlation outcomes to predict diversification opportunities in the underlying asset. The degree of negative correlation between gold and exchange rate across all countries signals the sign of hedge and safe haven prospects in the gold market.

Table 6.1: Summary Statistics and Correlation of Gold Returns and Exchange Rate

Country	Series	Mean	SD	Skewness	Kurtosis	J-B test	Correlation
Panel A: Major Consumer Countries of Gold							
India	**Gold**	0.0428	1.0703	-0.1338	8.9298	7779.31 ***	-0.0204
	Exchange rate	-0.0104	27.2221	0.0036	2639.266	1.53E+09***	
China	**Gold**	0.0295	1.0686	-0.2489	9.1013	8245.71 ***	-0.0075
	Exchange rate	0.1408	0.0207	20.3971	971.6838	2.05E+08***	
UAE	**Gold**	0.0353	1.0839	-0.3687	8.5495	6303.46 ***	0.0007
	Exchange rate	-3.12E-06	0.0301	0.0946	809.9464	1.43E+08***	
Egypt	**Gold**	0.0613	1.3161	7.1502	226.2960	1101652 ***	-0.5262
	Exchange rate	-0.0289	0.8284	-30.9640	1543.069	5.23E+08***	
Indonesia	**Gold**	0.0483	1.1714	-0.1196	9.3578	9024.30 ***	-0.3144
	Exchange rate	-0.0159	0.6763	0.0767	22.43381	83108.98***	
South Korea	**Gold**	0.0339	1.1905	-0.4375	15.6852	35576.07 ***	-0.2720
	Exchange rate	-0.0015	0.6683	0.0496	26.6528	123105.5 ***	
Turkey	**Gold**	0.0798	1.4690	3.6994	99.6802	2068787 ***	-0.5960
	Exchange rate	-0.0474	1.1282	-5.2776	133.7944	3788806.***	
Russia	**Gold**	0.0523	1.2268	-0.0244	16.0223	37315.17 ***	-0.4101
	Exchange rate	-0.0200	0.7867	-0.7038	36.4042	245967.8***	
Saudi Arabia	**Gold**	0.0325	1.0742	-0.2559	9.0850	8205.07 ***	-0.0105
	Exchange rate	-7.12E-05	0.0325	-0.7235	77.3967	1218362***	
Thailand	**Gold**	0.0302	1.0579	-0.1837	9.9845	10764.10 ***	0.0051
	Exchange rate	0.0023	0.4045	-1.5112	37.8020	268519.2 ***	
Vietnam	**Gold**	0.0443	1.0825	-0.1800	9.0184	7772.94 ***	-0.1083
	Exchange rate	-0.0099	0.1642	-15.4627	522.7993	59663791***	
Panel B: Major Producer Countries of Gold							
Australia	**Gold**	0.0092	1.0012	-0.7852	12.3847	19922.30 ***	-0.3433
	Exchange rate	-0.0014	0.7869	-0.3691	12.6186	20477.69***	
South Africa	**Gold**	0.5271	1.2812	0.1934	7.9509	5426.47 ***	-0.4843
	Exchange rate	-0.0202	1.1066	-0.6900	15.7202	36022.44***	
Panel C: Key Currencies of Gold							
Switzerland	**Gold**	0.0231	1.0229	-0.2970	11.3624	15464.90 ***	-0.2264
	Exchange rate	0.0093	0.7029	3.7283	121.3324	3093379.***	
UK	**Gold**	0.0375	1.0760	0.0836	12.7026	20720.77 ***	-0.2506
	Exchange rate	-0.0052	0.5806	-0.7688	13.5479	25001.84***	
Japan	**Gold**	0.0336	1.0885	-0.3843	9.3578	9024.30 ***	-0.2732
	Exchange rate	-0.0011	0.6226	0.0303	7.2630	3999.694***	

Note: ***, **, and * denote significance at 1%, 5%, and 10% levels of significance, respectively. Where SD represents the Standard Deviation of returns, the JB test indicates Jarque-bera statistics.

6.3.1 Rolling Correlation Estimates

Tables 6.2a and 6.2b present the rolling correlation between the local gold returns and exchange rate of GCC, GPC and KCC. The test is applied to the 24 distinct rolling correlation windows that fall into and around the four crises. At first glance, it has been observed that gold-exchange rate is negatively correlated in GCC such as Egypt, Indonesia, South Korea, Turkey, Russia and Thailand; GPC (Australia, Canada and South Africa); and KCC (Switzerland, UK and Japan) during all four crises periods. The further results illustrate that among GCC, Indonesia, South Korea, Turkey and Russia, the gold market depicted a substantially higher negative correlation against the exchange rate. However, this relationship does not remain static rather, it gradually evaporates after the hit of crisis. And this can be encapsulated by seeing the rolling correlation windows falling into non-crisis periods.

Table 6.2a:Rolling Correlation estimates

Panel A: Major Gold Consumer Countries											
Window Width	**IN**	**CH**	**UAE**	**EY**	**ID**	**SK**	**TK**	**RS**	**SUA**	**TH**	**VN**
W1	-0.17***	-0.02	-0.03	-0.30***	-0.74***	-0.34***	-0.81***	-0.02	-0.01	-0.21***	-0.01
W2	0.04	-0.01	-0.06	-0.58***	-0.51***	-0.23***	-0.69***	-0.04	-0.06	0.01	-0.07
W3	-0.02	-0.05	-0.05	-0.52***	-0.30***	-0.17***	-0.57***	0.02	0.02	0.04	-0.06
W4	-0.08*	-0.04	-0.04	-0.14***	-0.28***	-0.14***	-0.48***	0.04	0.06	0.06	-0.06
W5	-0.09*	-0.06	-0.01	-0.12***	-0.35***	-0.14***	-0.45***	0.08*	0.04	-0.01	-0.05
W6	0.04	-0.04	0.05	-0.03	-0.21***	-0.15***	-0.43***	0.14***	0.04	-0.03	-0.01
W7	-0.05	-0.04	0.07	0.07	-0.19***	-0.12***	-0.37***	0.17***	0.04	-0.14***	-0.01
W8	-0.05	0.05	0.09*	0.04	-0.02	-0.12***	-0.41***	0.28***	-0.01	-0.10**	-0.05
W9	-0.15***	0.12***	0..02	-0.01	-0.26***	-0.46***	-0.39***	0.13***	-0.08*	-0.08*	-0.12***
W10	-0.16***	0.14***	0.01	-0.03	-0.28***	-0.48***	-0.41***	-0.11***	-0.08*	0.04	-0.12***
W11	-0.14***	0.17***	0.01	-0.04	-0.29***	-0.47***	-0.38***	-0.20***	-0.08*	0.05	-0.12***
W12	-0.10**	0.10**	0.03	-0.09*	-0.12***	-0.23***	-0.31***	-0.29***	0.06	0.12***	-0.31***
W13	-0.08*	0.09*	0.05	-0.10**	0.07	-0.19***	-0.34***	-0.29***	0.06	0.24***	-0.27***
W14	0.02	0.11***	0.01	-0.10**	0.12***	-0.11***	-0.29***	-0.25***	0.05	0.37***	-0.26***
W15	-0.01	0.06	0.01	-0.14***	0.05	-0.08*	-0.17***	-0.19***	0.07	0.32***	-0.01
W16	-0.12***	0.01	0.02	-0.11***	-0.09*	-0.04	-0.26***	-0.16***	0.11***	0.16***	0.08*
W17	-0.17***	-0.04	-0.03	-0.08*	-0.16***	-0.08*	-0.34***	-0.64***	0.09*	0.05	0.09*
W18	-0.10**	-0.15***	-0.01	-0.08*	-0.07	0.01	-0.47***	-0.74***	0.02	0.13***	-0.14***
W19	-0.12***	-0.13***	-0.07	-0.45***	-0.16***	-0.06	-0.46***	-0.74***	-0.03	0.15***	-0.11***

W20	-0.10**	-0.04	-0.04	-0.89***	-0.11***	-0.14***	-0.47***	-0.63***	-0.03	0.15***	-0.06
W21	-0.11**	0.08*	-0.03	-0.90***	-0.13***	-0.20***	-0.48***	-0.58***	0.01	0.12***	0.09*
W22	-0.04	0.21***	0.03	-0.92***	0.12***	-0.07	-0.78***	-0.50***	0.03	0.20***	0.03
W23	-0.17***	0.13***	-0.02	-0.04	-0.05	-0.09*	-0.80***	-0.52***	-0.02	0.13***	0.01
W24	-0.18***	-0.01	-0.03	-0.02	-0.05	-0.07	-0.73***	-0.56***	-0.05	0.05	-0.09*

Table 6.2b:Rolling Correlation estimates

Panel B: Major Gold Producers and Key Currencies Countries						
Window Width	**AU**	**CN**	**SA**	**SW**	**UK**	**JP**
W1	-0.40***	-0.23***	-0.61***	-0.30***	-0.23***	-0.40***
W2	-0.38***	-0.25***	-0.70***	-0.26***	-0.19***	-0.36***
W3	-0.30***	-0.22***	-0.60***	-0.24***	-0.13***	-0.23***
W4	-0.32***	-0.24***	-0.64***	-0.28***	-0.17***	-0.24***
W5	-0.30***	-0.24***	-0.56***	-0.27***	-0.20***	-0.28***
W6	-0.08*	-0.11***	-0.45***	-0.14***	-0.10**	-0.24***
W7	-0.04	-0.06	-0.35***	-0.08*	-0.04	-0.24***
W8	-0.14***	-0.12***	-0.39***	0.01	0.02	-0.23***
W9	-0.48***	-0.23***	-0.37***	0.04	-0.07	-0.20***
W10	-0.48***	-0.26***	-0.43***	-0.06	-0.20***	-0.21***
W11	-0.50***	-0.28***	-0.40***	-0.09*	-0.26***	-0.28***
W12	-0.34***	-0.27***	-0.39***	-0.26***	-0.31***	-0.44***
W13	-0.37***	-0.24***	-0.40***	-0.42***	-0.24***	-0.35***
W14	-0.30***	-0.17***	-0.41***	-0.38***	-0.15***	-0.28***
W15	-0.20***	-0.10**	-0.38***	-0.34***	-0.09*	-0.32***
W16	-0.14***	-0.05	-0.34***	-0.08*	-0.09*	-0.33***
W17	-0.15***	-0.05	-0.31***	-0.15***	-0.15***	-0.29***
W18	-0.32***	-0.22***	-0.41***	-0.45***	-0.18***	-0.09*
W19	-0.40***	-0.30***	-0.58***	-0.45***	-0.51***	-0.15***
W20	-0.41***	-0.30***	-0.61***	-0.18***	-0.56***	-0.22***
W21	-0.42***	-0.34***	-0.63***	-0.12***	-0.62***	-0.23***
W22	-0.28***	-0.24***	-0.61***	-0.15***	-0.43***	-0.20***
W23	-0.29***	-0.22***	-0.61***	-0.12***	-0.40***	-0.18***
W24	-0.20***	-0.13***	-0.52***	-0.07	-0.35***	-0.27***

6.4 Stationary Test Results

The (Majumder, 2022), stated that most of the macroeconomic variables, including exchange rate are having a non-stationary characteristic. Using such variables tends to violate the assumptions of the Quantile regression model and as a result, it can produce a spurious regression problem. Therefore, the unit root of the series is tested using the ADF test. In Table 6.3, the null hypothesis is rejected at a 1% level, and it is concluded that the data series is stationary.

Table 6.3. Stationarity Test

Country	With Intercept		With Intercept and Trend	
	Gold	Exchange rate	Gold	Exchange rate
Panel A: Major Consumer Countries of Gold				
India	-74.4167***	-26.41152***	-74.4113***	-26.41051***
China	-73.9502***	-25.8563***	-73.9462***	-25.8572***
UAE	-69.1886***	-26.9122***	-69.2016***	-26.9099***
Egypt	-67.4094***	-21.6340***	-67.4052***	-21.6338***
Indonesia	-74.6770***	-30.2291***	-74.6749***	-30.2274***
South Korea	-45.3574***	-77.1710***	-45.3578***	-77.1650***
Turkey	-54.5900***	-45.0944***	-54.5894***	-45.0901***
Russia	-72.4479***	-73.3821***	-72.4423***	-73.4089***
Saudi Arabia	-73.3901***	-22.9968***	-73.3913***	-23.0012***
Thailand	-75.9676***	-80.7639***	-75.9708***	-80.7564***
Vietnam	-71.4957***	-76.4269***	-71.5031***	-76.4225***
Panel B: Major Producer Countries of Gold				
Australia	-76.7806***	-76.5009***	-76.7808***	-76.4937***
South Africa	-73.9873***	-75.0869***	-73.9804***	-75.0848***
Panel C: Key Currencies of Gold				
Switzerland	-75.3696***	-75.7229***	-75.3647***	-75.7207***
UK	-74.8415***	-70.0949***	-74.8360***	-70.0964***
Japan	-73.4992***	-75.6908***	-73.5006***	-75.6836***

Note: The ADF unit root test is the empirical statistic to determine stationary. ***, **, * denotes rejection of the null hypothesis of unit root.

6.5 Gold as a Hedge and Safe Haven against Exchange Rate

The supporting evidence of gold as a hedge for the exchange rate is highlighted in the second column in Table 6.4a. The fourth, sixth and eighth columns in Table 6.4a show the estimation results for safe haven during the period of market stress for the 90%, 95% and 99% quantile of most negative exchange rate returns. The quantile correlation effect exemplifies the extent to which gold could be regarded as a safe haven from exchange rate volatility. Keeping at the background the definition of hedge and safe haven, if, for a given quantile, the coefficient value

of the exchange rate is negative (uncorrelated), then the corresponding result is gold serves as an effective safe haven. Similarly, if the quantile regression constant coefficient is negative or uncorrelated, then gold acts as a hedge.

The estimation result depicts that the hedging coefficients are statistically significant and negative for Egypt, Indonesia, South Korea, Turkey, Russia, Vietnam, Australia, South Africa, Switzerland, the UK and Japan against exchange rate. For instance, in Panel A, the Vietnam and Egypt gold hedging against the US dollar appreciation showed a higher effect (constant coefficient is -0.8312 and -0.7128) than does that in South Korea (-0.2996). In Panel B, the more currency value fluctuations, the larger the hedge effect of South African gold (-0.5610). In Panel C, the larger coefficient value of -0.4018 also determines that UK gold provides a strong hedging role against exchange rate volatility. However, the positive constant term coefficient for India, China, UAE, Saudi Arabia and Thailand suggests that gold is not a hedge for exchange rate risk. In fact, the significant and positive coefficient value of 0.1078 for Thailand reminds us that gold offers risk-hedging benefits to traders. Next, we observe the safe haven status of gold for 90%, 95%, and 99% tail quantiles. For the 90% quantile, we have captured a negative but insignificant coefficient for Russia (-0.0274), Saudi Arabia (-5.6192), Switzerland (-0.0240) and Japan (-0.0384). The insignificant negative effect indicates that gold is a weak safe haven asset for exchange rate volatility. The significant and negative coefficient value for the Indian market out of 18 countries under 90% quantile directed to non-reject the hypothesis. Hence, Indian domestic gold acts as a strong, safe haven asset for the exchange rate. For a quantile 95%, except for a significant and negative coefficient for Egypt (-0.4721) and Indonesia (-0.3478), for the rest of all countries, gold's role as a strong safe haven from exchange rate movement is negligible. The estimation results for the 99% quantile denote that the coefficient is negative and significant for Indonesia (-0.1631), South Korea (-0.1832), Turkey (-0.1181), Russia (-0.1603), Thailand (-0.1457) and so gold is a strong safe haven asset against exchange rate risk. In Panel B, we can also observe a negative and significant coefficient for Australia (-0.2414) and South Africa (-0.0936), which shows that gold exhibits a strong safe haven attribute when a degree of foreign exchange rate shock increases. For Panel C countries, under the 99% quantile, the negative but insignificant coefficient value shows the weak safe haven role of gold in the key currency countries.

Table 6.4a: Estimation of Hedge and Safe Haven assets under Quantile

Country	Hedge		0.90		0.95		0.99	
	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value
Panel A: Major Consumer Countries of Gold								
India	-0.0006	0.9364	-0.2898	0.0059***	0.0500	0.6905	0.2396	0.0065***
China	-0.0017	0.7815	0.1224	0.6741	0.0544	0.8683	-0.1781	0.3309
UAE	-0.3178	0.4161	0.3780	0.7984	8.3012	0.2807	-8.3214	0.2768
Egypt	-0.7128	0.0000***	0.6854	0.0000***	-0.4721	0.0096***	0.1636	0.0894*
Indonesia	-0.4792	0.0000***	0.1516	0.0599*	-0.3478	0.0001***	-0.1631	0.0028***
South Korea	-0.2996	0.0000***	0.0614	0.4674	-0.0601	0.5436	-0.1832	0.0268**
Turkey	-0.6399	0.0000***	0.0027	0.9588	0.0027***	0.9588	-0.1181	0.0222**
Russia	-0.4878	0.0000***	-0.0274	0.7017	0.0078	0.9265	-0.1603	0.0065***
Saudi Arabia	-0.0351	0.9392	-5.6192	0.2585	-0.0382	0.3412	0.0009	0.9791
Thailand	0.1078	0.0080***	0.0278	0.7855	-0.1274	0.2683	-0.1457	0.0815*
Vietnam	-0.8312	0.0000***	0.8873	0.0928*	0.1063	0.7597	-0.0717	0.9028
Panel B: Major Producer Countries of Gold								
Australia	-0.3906	0.0000***	0.0586	0.2826	0.0085	0.8878	-0.2414	0.003***
South Africa	-0.5610	0.0000***	0.0368	0.4269	0.0040	0.9431	-0.0936	0.0551*
Panel C: Key Currencies of Gold								
Switzerland	-0.2517	0.0000***	-0.0240	0.6832	-0.0593	0.3631	-0.0206	0.6330
UK	-0.4018	0.0000***	0.0433	0.5235	-0.1209	0.1107	-0.0246	0.7648
Japan	-0.3702	0.0000***	-0.0389	0.5097	-0.0564	0.4201	-0.0750	0.1731

Notes: ***, ** and *denotes the statistical significance at 1%, 5% and 10% levels, respectively. Dark shade represents a strong hedge/safe haven. Light color shades represent a weak hedge/safe haven. Unshaded regions represent no hedge/safe haven cases.

Table 6.4b: Residual Diagnostic Test

Country	ARCH LM Test	Prob.	LB Q Statistics	Prob.	Lag
Panel A: Major Consumer Countries of Gold					
India	9.7664	0.5515	9.2639	0.598	11
China	10.1363	0.6828	9.9093	0.701	13
UAE	8.9249	0.7786	10.599	0.644	13
Egypt	4.1639	0.9649	10.281	0.505	11
Indonesia	10.4750	0.8825	15.659	0.548	17
South Korea	1.7172	0.7876	1.7233	0.786	4
Turkey	2.3478	0.9969	15.666	0.154	11
Russia	8.9681	0.9605	13.309	0.773	18
Saudi Arabia	8.9906	0.7736	10.366	0.664	13
Thailand	7.9423	0.5400	7.0800	0.629	9
Vietnam	14.6680	0.3285	12.296	0.504	13
Panel B: Major Producer Countries of Gold					
Australia	10.2997	0.8505	17.233	0.371	16
South Africa	8.4074	0.7525	8.5206	0.743	12
Panel C: Key Currencies of Gold					
Switzerland	2.3093	0.3152	1.0518	0.591	2
UK	7.7570	0.8591	13.103	0.440	13
Japan	7.9194	0.3398	6.4614	0.487	7

Note: ARCH-LM test indicates lagrange Multiplier test for conditional heteroskedasticity upto 20 lags (H_0 = no heteroskedasticity) and Ljung-Box Q-Statistic has tested for serial correlation upto 20 lags (H_0 = no autocorrelation). The hypothesis has been inferred at 1%, 5% and 10% levels of significance, respectively.

6.6 Gold as a hedge and safe haven against exchange rate in times of crises

Recalling the assumption of literature on exchange rates that it shows a high fluctuation during a financial episode, we put forward the hypothesis of whether gold has the capability to hedge this risk and provide a safe shelter to investors. The hedge and safe haven picture of gold during Dot-com bubble burst, global financial crisis, European debt crisis and Covid-19 are reported in Table 6.5a. The hedging coefficients show, except for Thailand, all are negative, indicating gold is a strong (weak) hedge against the exchange rate. More specifically, the results of Indonesia (-0.3880), South Korea (-0.1942), Turkey (-0.6589), Russia (-0.5503), Switzerland (-0.2740) and Japan (-0.3510) are negative and significant and are consistent with the hypothesis. For the rest of the countries, gold can be regarded as a weak hedge. In comparison, the larger and more significant coefficient value indicates gold is a more effective hedge in the gold consuming countries. Turning to the investigation of gold, strong safe haven behaviour, during a Dot-com bubble burst, was identified with a negative and significant coefficient for Indonesia, South Korea, Turkey, Thailand (Panel A), Switzerland and Japan (Panel C). For other countries such as India, China, Egypt, Saudi Arabia (gold consuming countries), Australia and South Africa (gold producing countries), we have assessed gold's weak safe haven role against depreciation in the local currency. Panel A (UAE = 0.5480 and Russia = 0.9537) and Panel C (UK = 0.0068) point out gold is neither a weak nor strong safe haven but may be treated as a diversifier.

During the GFC, only South Korea, out of 18 countries, exhibited its strong safe haven against currency risk. The results obtained for other countries such as India and Saudi Arabia, Thailand (gold consuming), Australia (gold producing)and Japan (key currency country) gold can be used as a weak safe haven. The study also noticed that the information on exchange rate volatility during a GFC has a positive effect on the China, UAE, Egypt, Turkey, Russia, South Africa, Switzerland and UK domestic gold behaviour.

Testing the hypothesis during an EDC, we find evidence that only two countries' gold (Panel C= Switzerland and Japan) provides a strong safe net for investors against currency market uncertainty. The negative but insignificant coefficient of India, Egypt, South Korea, Australia and the UK determines the weak safe haven property of gold. Interestingly, the safe haven coefficient during COVID-19 remains high for most of the countries. As far as a strong safe

haven against exchange rate, the gold market of China (-0.7077), South Korea (-0.4084), Russia (-0.2670), Thailand (-0.7125) and Japan (-0.4218) provided strong evidence to prove it. India, UAE, Egypt, Saudi Arabia, Australia, South Africa, and Switzerland's domestic gold provided a weak safe haven during the COVID-19 episode.

Overall, the results of Tables 6.4a and 6.5a indicate that for the smaller number of countries, we reject the hypothesis (gold is not a strong hedge and safe haven), while for the majority of the countries, the gold is a weak hedge and safe haven is accepted during a quantile period and financial crisis. Indeed, gold efficacy as a hedge and safe haven against exchange rate fluctuations has become more pronounced in gold consuming countries, particularly Indonesia, South Korea, Russia and key currency countries such as Japan. We have also noticed the gold's effectiveness as a strong hedge and safe haven against currency depreciation for a 99% upper quantile and predominantly during the COVID-19 and DCBB periods. A consistent positive effect was also registered in some countries, indicating gold is not a hedge and a safe haven for exchange rate volatility. And this is valid for developed countries such as the UAE, the UK and Russia.

Table 6.5a: Estimation of Hedge and Safe Haven asset in Times of Crises

Country	Hedge		Dot Com Bubble Burst		Global Financial Crises		European Debt Crises		Covid-19 Crises	
	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value	Coeff	P-value
Panel A: Major Consumer Countries of Gold										
India	-0.0008	0.7170	-0.7831	0.0000	-0.6173	0.0000	-0.1663	0.0423	-0.9031	0.0000
China	-0.0025	0.4893	-2.5778	0.6845	1.2364	0.0035***	0.5535	0.0559**	-0.7077	0.0072***
UAE	-0.5285	0.2906	0.5480	0.7934	6.2326	0.0199	8.6265	0.2654	-86.849	0.1305
Egypt	-0.5000	0.0000	-0.2880	0.0000	0.2355	0.4010	-0.0240	0.9226	-0.1601	0.7559
Indonesia	-0.3880	0.0000***	-0.5988	0.0000***	0.0767	0.3246	0.4277	0.0000***	0.2393	0.0005***
South Korea	-0.1942	0.0000***	-0.7359	0.0000***	-0.4681	0.0000***	-0.0748	0.1970	-0.4084	0.0001***
Turkey	-0.6589	0.0000***	-0.0094	0.0000***	0.1163	0.0137**	0.1139	0.0182**	0.1551	0.4481
Russia	-0.5503	0.0000***	0.9537	0.0000***	0.7953	0.0000***	0.0768	0.1492	-0.2670	0.0044***
Saudi Arabia	-0.0351	0.9392	-5.6192	0.2585	-0.4986	0.5322	2.3020	0.1895	-0.1665	0.9490
Thailand	0.1243	0.0000***	-0.6733	0.0000***	-0.0766	0.4298	0.5782	0.0000***	-0.7125	0.0000***
Panel B: Major Producer Countries of Gold										
Australia	-0.354	0.0000	-0.0906	0.0091	-0.1031	0.0043	-0.0485	0.2535	-0.2157	0.0034
South Africa	-0.5647	0.0000	-0.1456	0.0037	0.1502	0.0001	0.1208	0.0022	-0.1759	0.0882
Panel C: Key Currencies of Gold										
Switzerland	-0.2740	0.0000***	-0.0721	0.0133**	0.2586	0.0001***	-0.2111	0.0000***	-0.1996	0.2674
UK	-0.4217	0.0000	0.0068	0.9140	0.2293	0.0031	-0.0774	0.2245	0.0154	0.9085
Japan	-0.3510	0.0000***	-0.1633	0.0017***	-0.0603	0.3865	-0.3721	0.0000***	-0.4218	0.0000***

Notes: ***, ** and *denotes the statistical significance at 1%, 5% and 10% levels, respectively. Dark shade represents a strong hedge/safe haven. Light color shades represent a weak hedge/safe haven. Unshaded regions represent no hedge/safe haven cases.

6.7 Residual Diagnostic test

In Tables 6.4b and 6.5b, the null hypothesis failed to be rejected. Therefore, it is also clear that the residual fit requirement of no autocorrelation and ARCH effect signifies the specification of the GARCH model is appropriate.

Table 6.5b: Residual Diagnostic Test

Country	ARCH LM Test	Prob.	LB Q Statistics	Prob.	Lag
Panel A: Major Consumer Countries of Gold					
India	10.2831	0.5051	9.3511	0.590	11
China	2.7713	0.2502	0.5967	0.742	2
UAE	8.8048	0.7875	10.471	0.655	13
Egypt	0.4463	1.0000	8.7601	0.644	11
Indonesia	3.0352	0.6946	3.0204	0.697	5
South Korea	1.5485	0.9562	1.5513	0.956	6
Turkey	3.5360	0.9977	16.287	0.296	14
Russia	4.3422	0.2268	2.0825	0.555	3
Saudi Arabia	8.9906	0.7736	10.366	0.664	13
Thailand	4.4995	0.1054	4.4224	0.110	2
Panel B: Major Producer Countries of Gold					
Australia	6.4432	0.7768	6.3923	0.781	10
South Africa	2.8404	0.4169	2.8259	0.419	3
Panel C: Key Currencies of Gold					
Switzerland	10.1309	0.8679	11.277	0.792	16
UK	7.7417	0.8600	13.239	0.430	13
Japan	8.2291	0.8350	0.7733	0.942	4

Note: ARCH-LM test indicates lagrange Multiplier test for conditional heteroskedasticity upto 20 lags (H_0 = no heteroskedasticity) and Ljung-Box Q-Statistic has tested for serial correlation upto 20 lags (H_0 = no autocorrelation). The hypothesis has been inferred at 1%, 5% and 10% levels of significance, respectively.

CHAPTER - 7

FINDINGS, CONCLUSION AND SUGGESTIONS

CHAPTER SEVEN

Findings, Conclusion and Suggestions

7.1 Introduction

Given the analogy that the supply of gold is restricted due to its physical nature and it is sought to be a store of wealth, it becomes widely accepted by investors to manage portfolio risk. Sometimes traders use it as a diversifier, hedge against other financial assets and many a time, due to a frequent occurrence of financial episodes, they climb onto the gold as a haven to protect their investment value. Furthermore, in a fast-moving world with a lot of advancement in information channels and expanding the boundaries of globalization, massive exposure to financial assets risks is inevitable. And in recent years, this is one of the great concerns to the market players. This study closely addresses this issue and contributes to the importance of the gold in providing the role of hedge and a safe haven against stocks, equity sectors and exchange rate risk during normal and turmoil periods for the gold consuming, gold producing and key currencies countries.

The general review of the research undertaken ends with the summary of findings for the all three-panel countries. This chapter also outlines the conclusion and the major implications of the findings discussed. And finally, the study gives the direction for future research to witness the depth of importance of gold in comparison with other traditional assets.

FINDINGS

7.2 Summary of Findings

7.2.1 To examine the hedge and safe haven ability of gold against aggregate equity indices of major gold consuming, major gold producing and key currency countries.

1. The countries that consume the highest proportion of gold and their gold and stock returns outperform the gold-producing and key currency countries. Nevertheless, investment in this country's gold and stock is prone to higher variation in returns.
2. The rolling correlation between equity and gold remains negative during all four crises for most of the countries from Panel A, B and C, pointing out the fear of stock market uncertainty and the rush of investors towards safe-haven assets. The high negative and significant correlation between the equity-gold pair is noted for Turkey, followed by Indonesia, Thailand, India, the US, Canada, South Africa and Australia. On that side, during the crisis, Russia, Egypt, the UK and Vietnam's gold-equity negative connectedness is substantially low.
3. The Hedge property of gold is consistent across major gold consuming countries with the exception of China, UAE and Saudi Arabia. Similarly, across major gold producing countries with the exception of South Africa. However, most of the key currency countries exhibit positive and statistically significant coefficient estimates for the average relation, excluding the possibility of hedge.
4. In times of very extreme equity market falls at 10% quantile (Australia and Canada), at 5% quantile (South Africa) and at 1% quantile (South Africa) countries equity returns are negatively correlated with gold returns. Amongst, gold of South Africa reveals a strong safe haven property at 1% quantile. On a similar note, from GCC, at 10% quantile (Turkey and Vietnam), at 5% quantile (China, Egypt, Indonesia, Turkey, Russia, Saudi Arabia, Thailand and USA) and at 1% quantile (India, China, UAE, Egypt, Indonesia, South Korea, Russia and Vietnam) countries' equity returns are negatively associated with gold returns which exhibits weak/strong safe haven property. The gold of all KCCs shows a negative correlation with

equity at 5% and 1% quantile, which presents the weak safe-haven appeal. But notably, the UK at 5% and Switzerland at 1% exhibit a strong safe haven property.

5. The coefficient estimates for DCBB is negative and statistically significant which implies that gold is a strong safe haven only for stock markets of GCC (Indonesia, Russia, Saudi Arabia and Thailand); GPC (South Africa); and KCC (Japan). Whereas it is a weak safe haven incase of GCC (UAE and USA); and GPC (Australia and Canada). Among the eighteen countries, UAE, Turkey, Thailand, Australia, South Africa and the UK's gold appeal as a strong safe haven during GFC. During EDC, the correlation among the assets decreased significantly. The estimated coefficients are positive and statistically significant for most of the countries. The analysis of the recent COVID-19 crisis period shows that investors preferred gold as a safe haven asset to protect their wealth for most of the countries' stock price movements except UAE, Thailand, USA, Australia, Canada, Switzerland, and the UK.
6. The estimated coefficients are negative but statistically insignificant for most countries during all four crises, which indicates the weak safe haven attribute of gold. Nevertheless, the dynamic, strong safe haven effect is more viable during Covid-19, followed by GFC.
7. Analyzing the wavelet coherence for all GCC, GPC and KCC on a time-frequency scale, it can be inferred that the results are consistent with the Baur and Lucey methodology adopted. The behaviour of gold against stock exhibits several similarities in terms of safe haven. More specifically, towards the end of the wavelet coherence results for all countries, it can be portrayed that gold and equity are close cohorts from short to medium investment horizons. To add on, the deep blue across the surface of figures 1 to 18 also lends support to the hedge appeal of gold against equity.
8. The findings of wavelet analysis are supportive of the results drawn by (Bredin, Conlon, & Potì, 2015), indicating low co-dependency between gold and stock markets of US, UK and Germany and hedge for traditional asset in short horizons. Even findings of by (Bredin, Conlon, & Potì, 2015) are consistent with weak safe haven potential of gold during the global financial crisis. Incase of Saudi Arabia and UAE, a positive dependence across indicates strong hedge potential of gold. These results are line with (Mensi, Hammoudeh, & K, 2016) for GCC markets (inclusive of UAE and Saudi Arabia), making this shiny metal a good hedge for short and long run horizons. (Mensi, Hammoudeh, & K, 2016) also suggested

significance of diversification for short term (traders and speculators) and long term investors (institutional investors and central bank). In similar veins with (Dar & Maitra, 2017), the results of gold stock nexus confirmed weak safe haven role of gold against major gold consuming countries (US, India and China) during DCBB and GFC at multiple horizons. The phenomenon of remarkably high degree of synchronization was also observed between gold and stocks markets in longer horizons for India, Russia, China and Saudi Arabia, which is similar to results of (Bekiros, Boubaker, Uddin, & Nguyen, 2017) with respect to BRICS Countries.

7.2.2 To investigate the hedge and safe haven potential of gold against equity sector indices of major gold consuming, major gold producing and key currency countries.

1. Out of 18 countries sector indices under consideration, all the sector indices of India, Indonesia, Turkey and South Africa persistently offered positive and higher returns on sector investment. However, investors should note that although investment in these emerging countries sectors will yield a higher return but, essentially, they need to take a proportionately higher level of risk. When seeing these statistics, the aforementioned results are contrary to those of developed countries' (Australia, US, UK, and Canada) sector indices.
2. More specifically, the growing economies sector indices such as health care, information technology, energy and telecommunication offer a massive yield to the investors while the same has been pictured out negative for developed countries sector indices, particularly of Switzerland, UK and Japan. Another remarkable observation is that investors can look at India and Indonesia sector indices as bright investment spots due to their highest risk-return trade-off opportunity.
3. The study finds a more negative correlation of gold-sector pairs across gold consuming, gold producing and key currencies countries. However, the correlation strength is substantially low, taking values not more than -0.20. In addition, the gold returns of Turkey and South Africa showed a slightly larger negative correlation with the sector returns. The negative dependence on gold signals the weak hedge and safe haven attribute against sector investment volatility.

4. The study also captured the positive relationship of China, Switzerland, Egypt, Vietnam and Japan's gold returns with equity sectors. Interestingly, among developed countries (USA, Saudi Arabia, Canada and the UK), the positive association of gold and the basic materials sector also reminds us that gold might offer a diversification.
5. On average, most of the sector indices of India, Turkey, South Korea, Indonesia, Thailand and the US (GCC); Australia, Canada and South Africa (GPC); and UK (KCC) depicted a negative correlation with the local gold during crisis periods particularly GFC and European debt crisis. However, the magnitude of the correlation coefficient remains below -0.50. Also, over the estimated rolling correlation windows, specifically on W1, W2, W9, W10, W13, W14 and W24 (falling into the crisis periods), the highest negative correlation holds between gold with financial, consumer discretionary, energy and industrial sectors.
6. The estimation results depict a strong hedge property of gold against all sectorial indices of gold consuming countries such as India, South Korea, Indonesia, Turkey, Russia, and Thailand during average market conditions. Even for gold producing countries, gold serves as a strong hedge for all sectors except basic material, information technology and utility for Australia, South Africa and Canada, respectively. Moreover, in key currency countries, namely Switzerland and Japan, gold no longer hedges sector-specific risk. The estimation results at specific quantiles reveal that as the severity of shock increases at extreme negative quantiles given by 1%, gold serves as a haven asset only for the health care sector of South Korea, health care and telecom sector of China, basic material sector of South Africa, energy, industrial and utility sector of Canada, consumer staples, financial, industrial and telecom sector of USA. However, contradictory results were found for most of the gold consuming countries such as India, Indonesia, Turkey and Russia. For almost all sectors, the safe haven property of gold was pronounced.
7. The estimation results during periods of specific turmoil show that gold doesn’t exhibit its property as a haven asset in times of all turmoil period and across all equity sectors of Japan. With respect to South Africa equity sector indices, gold exhibited haven properties for all sectors during the GFC. During the EDC and COVID-19 crisis, with the exception of a few sectors, namely consumer discrepancy, financial, information technology, and telecom, gold played its safe haven role. As indicated in previous literature, China markets are immune to

foreign shocks. Similar results were exhibited during the global financial crisis, the internet bubble burst and the EDC as positive coefficient values for all sectors.

8. A significant negative dependency was also observed for almost all sectors of US in and around GFC indicating safe haven behaviour of gold which was also supported by (Salisu, Vo, & Lucey, 2021). The results corroborate with the findings by (Kang, Hernandez, Rehman, Shahzad, & Yoon, 2023) in terms of gold as an effective hedge against risk in financial and real estate sector of US. Further the results are also in line with the findings by (Jambotkar & Guntur, 2020) as we move from Pre-COVID to COVID crises period significant negative predictability among gold and energy sector indices was revealed for Saudi Arabia and Russia. These Countries are among the major oil exporting countries and a significant contribution to their revenue comes from the energy sector. On account of COVID-19 Pandemic the energy sector of these countries was severely affected and investors opted for the traditional candidates of safe haven asset namely gold. As indicated by (Shah, Bhanja, & Dar, 2023) Saudi sectoral indexes are expose to severe susceptibility to crash in times of financial uncertainty and volatility in global markets and thus certainty need safe havens to balance their negative returns Consistently, correlations of gold with all Saudi sectoral indices except utility sector are positive throughout the period during Global financial crises indicating that gold works as risky asset rather than refuge asset to safeguard investment in Saudi sectors in times of GFC. The negative coefficients during average market conditions signifies hedge ability of gold for all sector returns except basic materials, which is also consistent with previous findings indicated in (Shah, Bhanja, & Dar, 2023). Being Covid-19 pandemic, a great health crisis a positive and significant comovement was expected between gold and health care sector. While, rest all the Saudi Arab sector indexes shows almost significant negative comovement with gold, which gives conclusive evidence that gold shines out with its robust safe haven potential during Covid-19 pandemic. In similar lines, (Shah, Bhanja, & Dar, 2023) also reported that correlations during global financial crisis were less volatile compared to COVID-19 crisis.

7.2.3 To study the ability of gold to act as a hedge and safe haven against exchange rate fluctuations of major gold consuming, major gold producing and key currency countries.

1. The average yield provided by China (0.1408%), Switzerland (0.0093%) and Thailand's (0.0023%) exchange rate is positive, indicating the average appreciation and fewer swings in the currency value. However, the rest all country's exchange rate mean value of returns is negative, indicating the currency rates of India, UAE, Egypt, Indonesia, South Korea, Turkey, Russia, Saudi Arabia, Vietnam, Australia, South Africa, UK and Japan are depreciatory. Similarly, for the GCC, GPC and KCC, exchange rate yield variability ranges from 0.0207% to 27.2221%.
2. Through the preliminary correlation test, the results suggest a negative correlation between gold and currency rates of all countries except UAE and Thailand. In other words, a rise in gold returns is associated with a depreciation in the exchange rate value. More specifically, the gold and exchange rate of Egypt (-0.5262), followed by Turkey (-0.5960) and South Africa (-0.4843), shares a greater strength of negative correlation. Besides, it can be seen that the gold-exchange rate pair of China (-0.0075) followed by Saudi Arabia (-0.0105) and India (-0.0204) exhibits a lower negative correlation.
3. The rolling window width correlation analysis shows that the gold-exchange rate is negatively correlated in GCC such as Egypt, Indonesia, South Korea, Turkey, Russia and Thailand; GPC (Australia, Canada and South Africa); and KCC (Switzerland, UK and Japan) during all four crises periods.
4. The estimation result depicts that the hedging coefficients are statistically significant and negative for Egypt, Indonesia, South Korea, Turkey, Russia, Vietnam, Australia, South Africa, Switzerland, UK and Japan against exchange rate. However, the positive constant term coefficient for India, China, UAE, Saudi Arabia and Thailand suggests that gold is not a hedge for exchange rate risk.
5. The insignificant negative effect indicates that gold is a weak safe haven asset for exchange rate volatility of Russia, Saudi Arabia, Switzerland and Japan for 90% quantile. For a quantile 95%, except for a significant and negative coefficient for Egypt (-0.4721) and Indonesia (-0.3478), for the rest of the countries, gold's role as a strong safe haven from

exchange rate movement is negligible. The estimation results for the 99% quantile denote that the coefficient is negative and significant for Indonesia (-0.1631), South Korea (-0.1832), Turkey (-0.1181), Russia (-0.1603), Thailand (-0.1457) and so gold is a strong safe haven asset against exchange rate risk.

6. The hedging coefficients show, except for Thailand, all are negative, indicating gold is a strong (weak) hedge against exchange rate during a DCBB, GFC, EDC and Covid-19 crisis.
7. For the smaller number of countries, we reject the hypothesis (gold is not a safe haven), while for the majority of the countries, gold is a safe haven accepted during a financial crisis.
8. Indeed, gold efficacy as a hedge and safe haven against exchange rate fluctuations has become more pronounced in gold consuming countries, particularly Indonesia, South Korea, Russia and key currencies countries such as Japan.

CONCLUSION

7.3 Conclusion

The issue of pondering upon the hedge and a safe haven attribute of gold is a popular research theme that has grabbed huge attention from worldwide researchers in the last decades. The hedge and a safe haven benefit stem from the potentiality of a negative or weak correlation between financial assets (gold with stocks, equity sectors and exchange rates). This state-dependent association offers a significant implication in mitigating the risk of stock, equity sectors and exchange rate positions. Many literatures witness that gold is a suitable asset in offsetting the downside risk, and an interesting expression states that "The beauty of gold is that it loves bad news" (Bhanja & Dar, 2015). However, on the flip side, given the frequent occurrence of different natures of events in the global economy intensified the uncontrollability of financial risk and investor's fear by making stocks, sectors and exchange rate prices more unpredictable. Therefore, understanding the significant role of gold becomes vital, particularly in times of various financial events such as DCBB, GFC, EDC, and Covid-19, which induced a large amount of distress in a traditional financial market. In line with this backdrop, this study develops a Baur and Lucey and wavelet model to test the empirical hypothesis. Finally, the study concludes by giving the following highlights;

- The results of the Quantile model for a specific quantile and in times of crises suggest that most of the countries within a group report certain degrees of safe haven features on stocks, equity sectors and exchange rates.
- The estimation results of the Wavelet model are also similar to quantile results, which present different coherency between gold and financial assets on a time-frequency horizon. From the results, it can be inferred that gold and equity are closely cohorts from the short to medium-investment horizon.
- The estimation results for a select crisis period suggest that gold can be a preferable hedge and a safe haven asset for most of the GCC, GPC and KCC, at least during turbulent market periods predominantly during Covid-19 followed by GFC. For the rest of the period and in each country, the hedge and safe haven property of gold significantly differed. Thus, the

nature of the market, as well as the nature of the crisis, influences the choice of safe haven assets.

- The findings also state that adding gold to a portfolio of sector indices of gold consuming countries such as India, South Korea, Indonesia, Turkey, Russia, and Thailand during average market conditions offers a hedging effectiveness, particularly at a medium to long investment horizon. However, during normal market conditions and when the severity of shock increases, gold serves as a haven only for a few volatile sectors of a group of countries.
- The study has also observed that the ability of gold as a hedge and safe haven against exchange rate fluctuations has become more pronounced in gold consuming countries, particularly Indonesia, South Korea, Russia and key currencies countries such as Japan.
- In the journey of risk management and searching for a safe haven asset, market participants can concentrate on GCC gold as it shows a substantial negative association with stocks, equity sectors and exchange rates, particularly during downturns and downside risks.
- Finally, the notion that gold loves bade news can work for investors who want to protect their investment against unprecedented upheaval in stocks, equity sectors and exchange rates in severe financial and economic turmoil in the future.

IMPLICATIONS AND SUGGESTIONS

7.4 Implications and Suggestions

1. The findings of the study point out significant implications for investors and market traders seeing higher risk-returns trade-offs by diversifying equity portfolios with gold. Across GCC, GPC and KCC, when the equity market offered a negative return with higher volatility, particularly during crisis periods, the gold outshined with favourable returns-risk performance.
2. Moreover, our hedge and safe haven results suggest that the investment risk in GCC, GPC and KCC sectors (financials, energy, information technology and industrial) can be handled ata relatively low cost by spreading investment in gold in times of financial crises. However, in some GCC (China, UAE, Saudi Arabia and Vietnam); and KCC (Switzerland and Japan), the gold sectors are either less related or not linked to each other during idyllic as well as crisis periods, indicating a weak hedge and safe haven property of gold for sectors. These results are robust and useful for investors who are operating at a multi-horizon trading platform.
3. A study has also noticed a substantial hedge behaviour of gold against the stock of GCC (China, India, Thailand and Vietnam); GPC (USA, Canada, Australia). Additionally, as the severity of shock rises at the extreme quantiles, the demand for safe-haven assets increases in most of the countries in all three groups. This result signifies the implications for equity portfolio investors to minimize the losses by including gold.
4. It has also been observed that the gold and exchange rates of some of the countries, namely UAE, Thailand and China, are independent across the estimated quantiles as well as in times of crisis. This offers insightful guidance to the CNY, AED and THB investors that gold can be inserted into a portfolio as a weak hedge and safe haven. This is because it will neither bring down the risk nor elevate it, as it tends to co-move insignificantly.
5. The results also indicate that the financial analysts and policymakers using gold to bring stability to the economy are expected to note that gold in some timeframes does not act as a hedge and safe haven, particularly for some sectors.

6. The contribution of GCC, GPC and KCC gold hedge and safe haven results for stock, sectors and exchange rates during crisis and non-crises periods could be one of the potential sources the investors and market traders can make use of at the time of evaluation of investment, asset allocation and implementing trading strategies.
7. Overall, gold is the most dominant in terms of safe haven capability against stock, sector and exchange rates. But it may be noted that the safe haven behaviour of gold might shift according to the market severity in the future.

7.5 Limitations of the study

1. The study made a comprehensive assessment of the hedge and safe haven appeal of gold for the select period and crises. However, it does not concentrate on portfolio construction with hedge ratios and hedging effectiveness. Also, it does not focus on the risk factors that drive the price movement in stocks, equity sectors and exchange rates across all the GCC, GPC and KKC.
2. The study restricted to widely accepted methodologies such as the Quantile and Wavelet coherence approach. Although, putting the entire sample period on a wavelet framework, the study captured the hedge and safe haven attribute through coherency, but difficulty faced in detecting a detailed result on each year period because of length. Moreover, the hedge and safe haven research can also be extended using an advanced methodology.
3. The choice of considering eighteen countries, which can be grouped GCC, GPC and KCC is taken from WGC, which is highly based and involved in gold trade across the world. Historically, gold has been argued as a shining metal all the time and on that side, the portfolio managers assets, such as stocks, equity sectors and exchange rates within a given economy, are prone to more uncertainty. Beyond this, the study has not taken other countries and assets that may have significant information to present to the market participants.
4. The study has tested the hedge and safe haven hypothesis only in and around the four major crises such as DCBB, GFC, EDC and COVID-19. However, there is so much economic and financial turmoil erupts in each economy regularly, the exploration of which can lend meaningful information.

7.6 Future Research Direction

1. The contribution of this study is set up to gold consumers, gold producers and key currency countries. Moreover, in future research lines, we suggest including other countries and exploring the potential role of gold in reducing the equity and sector portfolio risk, particularly in different financial episodes.
2. In addition to the traditional asset gold that we have already studied, in the future, further progress may be made to examine other alternative assets such as VIX, cryptocurrencies and commodities in relation to equity, sector and currency rates to portray an accurate picture of hedge and safe haven asset to the investors.
3. Hedge and safe haven are a potential risk management tool. Thus, within the sphere of this study, results, including gold equity and sector-level portfolio weight, may be computed to lead the portfolio investors to use this asset at an appropriate time in the future.
4. In the literature, it is argued that the macroeconomic variables drive the prices of most of the financial assets. Hence, in addition to the exchange rate, gold hedge and safe haven behaviour may also be tested against the other macroeconomic variables to add more information to the current literature.
5. The curious researchers could expand the analysis by including green financial instruments such as green equity, green bonds and green debts. Since these assets have a different market structure, the study of hedges and safe havens can provide comprehensive information to portfolio investors to make a sound asset allocation decision.

BIBLIOGRAPHY

BIBLIOGRAPHY

Adewuyi, A., & Awodumi, O. B. (2019). Analysing the gold-stock nexus using VARMA-BEKK-AGARCH and Quantile regression models: New evidence from South Africa and Nigeria. *Resources Policy* .

Aftab, M., Shah, S. Z., & Ismail, I. (2019). Does gold act as hedge in the currency and stock markets in Asia? *Global Business Review, 20* (1), 105-118.

Akhtaruzzaman , M., Boubaker , S., Lucey , B., & Sensoy, A. (2021). Is gold a hedge or a safe-haven asset in the COVID–19 crisis? *Economic Modelling, 102*, 105588.

Anoruo, E. (2011). Testing for Linear and Nonlinear Causality between Crude Oil Price Changes and Stock Market Returns. *International Journal of Economic Sciences and Applied Research, IV* (3), 75-92.

Antonakakis , N., & Kizys, R. (2015). Dynamic spillovers between commodity and currency markets. *International Review of Financial Analysis, 41*, 303-319.

Arouri, M. E., Lahiani, A., & Nguyen, D. K. (2015). World gold prices and stock returns in China: Insights for hedging and diversification strategies. *Economic Modelling, 44*, 273–282.

Arouri, M. (2012). Stock Returns And Oil Price Changes In Europe: A Sector Analysis. *Manchester School, University of Manchester, 80* (2), 237-261.

Aye, C. G., Carcel, H., Gil-Alana, L. A., & Gupta, R. (2017). Does gold act as a hedge against inflation in the UK? Evidence from a fractional cointegration approach over 1257 to 2016. *Resources Policy, 54*, 53–57.

Bai, Z., Wong, W. K., & Zhang, B. (2010). Multivariate linear and nonlinear causality tests. *Mathematics and Computers in Simulation, 81* (1), 5-17.

Bampinas, G., & Panagiotidis, T. (2015). Are gold and silver a hedge against inflation? A two century perspective. *International Review of Financial Analysis, 41*, 267–276.

Baruník, J., Evžen, K., & Vacha, L. (2014). Wavelet-Based Correlation Analysis of the Key Traded Assets. *Wavelet Applications in Economics and Finance* , 157-183.

Basher, S. A., & Sadorsky, P. (2016). Hedging emerging market stock prices with oil, gold, VIX, and bonds: A comparison between DCC, ADCC and GO-GARCH. *Energy Economics, 54*, 235–247.

Baumeister, C., & Hamilton, J. D. (2019). Structural Interpretation of Vector Autoregressions with Incomplete Identification: Revisiting the Role of Oil Supply and Demand Shocks. *American Economic Review, 109* (5), 1873-1910.

Baumöhl , E., & Lyócsa, Š. (2017). Directional predictability from stock market sector indices to gold: A cross-quantilogram analysis. *Finance Research Letters, 23*, 152–164.

Baur , D. G., & McDermott, T. K. (2016). Why is gold a safe haven? *Journal of Behavioral and Experimental Finance, 10*, 63–71.

Baur, D. G. (2013). Gold — fundamental drivers and asset allocation.

Baur, D. G., & Lucey, B. M. (2010). Is Gold a Hedge or a Safe Haven? An Analysis of Stocks, Bonds and Gold. *The Financial Review, 45* (2), 217-229.

Baur, D. G., & McDermott, T. K. (2013). Financial Turmoil and Safe Haven Assets. *UTS Discussion paper series* .

Baur, D., & McDermott, T. (2010). Is gold a Safe Haven? International Evidence. *Journal of Banking and Finance* (34), 1886-1898.

Beckmann, J., & Czudaj, R. (2013). Gold as an inflation hedge in a time-varying coefficient framework. *North American Journal of Economics and Finance, 24*, 208– 222.

Beckmann, J., Belke, A., & Dobnik , F. (2012). Cross-section dependence and the monetary exchange rate model–A panel analysis. *The North American Journal of Economics and Finance, 23* (1), 38-53.

Beckmann, J., Berger, T., & Czudaj, R. (2015). Does gold act as a hedge or a safe haven for stocks? A smooth transition approach. *Economic Modelling* , 16-24.

Beckmann, J., Berger, T., & Czudaj, R. (2019). Gold price dynamics and the role of uncertainty. *Quantitative Finance, 19* (4), 663-681.

Beckmann, J., Berger, T., Czudaj, R., & Hoang, T.-H.-V. (2019). Tail dependence between gold and sectorial stocks in China: perspectives for portfolio diversification. *Empirical Economics, 56* (3), 1117–1144.

Bekiros , S., Boubaker , S., Uddin, G. S., & Nguyen, D. K. (2017). Black swan events and safe havens: The role of gold in globally integrated emerging markets. *Journal of International Money and Finance, 73*, 317–334.

Bhanja, N., & Dar, A. (2015). The Beauty of Gold is, it Loves Bad News - Evidence Form Three Major Gold Consumers. *Economic Change and Restructuring, 48* (3), 187–208.

Blose, L. E. (2010). Gold prices, cost of carry, and expected inflation. *Journal of Economics and Business, 62* (1), 35-47.

Boubaker , H., Cunado , J., Gil-Alana, L., & Gupta, R. (2020). Global crises and gold as a safe haven: Evidence from over seven and a half centuries of data. *Physica A: Statistical Mechanics and its Applications, 540*, 123093.

Bouoiyour, J., Selmi, R., & Wohar, M. E. (2019). Safe havens in the face of Presidential election uncertainty: A comparison between Bitcoin, oil and precious metals. *Applied Economics, 51* (58), 6076-6088.

Bouri, E., Shahzad, S. J., & Roubaud, D. (2020). Cryptocurrencies as hedges and safe-havens for US equity sectors. *The Quarterly Review of Economics and Finance, 75*, 294–307.

Bredin, D., Conlon , T., & Potì, V. (2015). Does gold glitter in the long-run? Gold as a hedge and safe haven across time and investment horizon. *International Review of Financial Analysis, 41*, 320-328.

Broock , W. A., Scheinkman, J. A., Dechert, W. D., & LeBaron, B. (1996). A test for independence based on the correlation dimension. *Econometric Reviews, 15* (3), 197-235.

Brooks, C. (2002). *Introductory Econometrics for Finance.* United Kingdom: Cambridge University Press.

Burdekin , R. C., & Tao, R. (2021). The golden hedge: From global financial crisis to global pandemic. *Economic Modelling, 95*, 170-180.

C, J., Reboredo, M. A., & Rivera-Castro. (2014). Can gold hedge and preserve value when the US dollar depreciates? *Economic Modelling, 39*, 168–173.

Capie, F., Mills, T., & Wood, G. (2005). Gold as a hedge against the dollar. *Journal of International Financial Markets, Institutions and Money, 15*, 343–352.

Cappiello, L., Engle, R. F., & Sheppard, K. (2006). Asymmetric dynamics in the correlations of Global Equity and Bond Returns. *Journal of Financial Econometrics, 4* (4), 537-572.

Cheema, M., Faff, R., & Szulczyk, K. (2020). The 2008 Global Financial Crisis and COVID-19 Pandemic: How Safe are the Safe Haven Assets? *Covid Economics, Vetted and Real-Time Papers, 34*, 88-115.

Chemkhaa, R., BenSaïda, A., Ghorbel, A., & Tayachi, T. (2021). Hedge and safe haven properties during COVID-19: Evidence fromBitcoin and gold. *The Quarterly Review of Economics and Finance* (82), 71–85.

Chen , K., & Wang, M. (2017). Does Gold Act as a Hedge and a Safe Haven for China's Stock Market? *International Journal of Financial Studies, 5* (3), 1-18.

Chen, J., Huang, C., Wang, M. L., & Cheng, J. C. (2010). Information Effects During the U. S. Subprime Crisis. *Emerging Markets Finance and Trade, 46* (1), 75-87.

Chkili, W. (2016). Dynamic correlations and hedging effectiveness between gold and stock markets: Evidence for BRICS countries. *Research in International Business and Finance, 38*, 22–34.

Chkili, W. (2017). Is gold a hedge or safe haven for Islamic stock marketmovements? A Markov switching approach. *Journal of Multinational Financial Management, 42-43*, 152-163.

Chopra, M., & Mehta, C. (2023). Going green: Do green bonds act as a hedge and safe haven for stock sector risk? *Finance Research Letters, 51*.

Choudhry , T., Hassanb, S. S., & Shabi, S. (2015). Relationship between gold and stock markets during the global financial crisis: Evidence from nonlinear causality tests. *International Review of Financial Analysis, 41*, 247–256.

Ciner , C., Gurdgiev , C., & Lucey, B. M. (2013). Hedges and safe havens: An examination of stocks, bonds, gold, oil and exchange rates. *International Review of Financial Analysis, 29*, 202–211.

Ciner, C. (2001). On the long run relationship between gold and silver prices A note. *Global Finance Journal, 12* (2), 299–303.

Cnijf, C. D. (2019). Is Gold still a Safe Haven? Assessed at: https://libstore. ugent.be/fulltxt/RUG01/002/784/019/RUG01-002784019_2019_0001_AC.pdf

Conlon, T., & McGee, R. (2020). Safe haven or risky hazard? Bitcoin during the Covid-19 bear market. *Finance Research Letters, 35*, 101607.

Conlon, T., Corbet, S., & McGee, R. J. (2020). Are cryptocurrencies a safe haven for equity markets? An international perspective from the COVID-19 pandemic. *Research in International Business and Finance, 54*, 101248.

Conlon, T., Lucey, M. B., & Uddin, G. S. (2018). Is gold a hedge against inflation? A wavelet time-scale perspective. *Review of Quantitative Finance and Accounting, 51* (2), 317–345.

Coudert , V., & Raymond-Feingold, H. (2011). Gold and financial assets: Are there any safe havens in bear markets? *Economics Bulletin, 31* (2), 1613-1622.

Creti , A., Joëts , M., & Mignon , V. (2013). On the links between stock and commodity markets' volatility. *Energy Economics, 37*, 16-28.

Dar , A. B., & Maitra, D. (2017). Is gold a weak or strong hedge and safe haven against stocks? Robust evidences from three major gold-consuming countries. *Applied Economics, 49* (53), 5491-5503.

Das, D., Roux, C. L., Jana, R. K., & Dutta, A. (2019). Does Bitcoin hedge crude oil implied volatility and structural shocks? A comparison with gold, commodity and the US Dollar. *Finance Research Letters* , 101335.

Dee, J., Li, L., & Zheng, Z. (2013). Is gold a hedge or a safe haven? Evidence from inflation and stock market. *International Journal of Development and Sustainability, 2* (1), 12-27.

Dungey, M., Fry, R., Martin, V. L., & Gonzalez-Hermosillo, , B. (2004). Empirical modeling of contagion: a review of methodologies. *IMF Working Papers 04/78, International Monetary Fund.*

Eichengreen, B. (2003). *Capital Flows and Crises.* Cambridge, Massachusetts London, England: The MIT Press.

Elie , B., Naji , J., Dutta , A., & Uddin, G. S. (2019). Gold and crude oil as safe-haven assets for clean energy stock indices: Blended copulas approach. *Energy, 178*, 544-553.

Engle, R. (2002). Dynamic conditional correlation: a simple class of multivariate generalized autoregressive conditional heteroskedasticity models. *Journal of Business & Economic Statistics, 20*, 339–350.

Erb, C. B., & Harvey, C. R. (2013). The Golden Dilemma. *Financial Analysts Journal, 69* (4), 10-42.

Flavin, T. J., Panopoulou, E., & Unalmis, D. (2008). On the stability of domestic financial market linkages in the presence of time-varying volatility. *Emerging Markets Review, 9* (4), 280-301.

Fortune, N. J. (1987). The inflation rate of the price of gold, expected prices and interest rates. *Journal of Macroeconomics, 9* (1), 71-82.

Gencer, G., & Musoğlu, Z. (2014). The Safe Haven Property of Gold in Turkish Financial Markets: An Investigation of the Global Financial Crisis. *Bogazici Journal: Review of Social, Economic & Administrative Studies, 28* (2), 75-89.

Ghabri, Y., Huynh, L. D., & Nasir, M. A. (2020). Volatility spillovers, hedging and safe-havens under pandemics: All that glitters is not gold! *International Journal of Finance & Economics* , 1-27.

Ghazali , M. F., Lean , H. H., & Bahari, Z. (2015). Sharia compliant gold investment in Malaysia: Hedge or safe haven? *Pacific-Basin Finance Journal, 34*, 192–204.

Ghazali, M. F., Lean, H. H., & Bahari, Z. (2018). Gold Investment in Malaysia: Refuge from Stock Market Turmoil or Inflation Protector? *The Journal of Social Sciences Research* (2), 214-224.

Ghazali, M. F., Lean, H. H., & Bahari, Z. (2013). Is Gold a Hedge or a Safe Haven? An Empirical Evidence of Gold and Stocks in Malaysia. *International Journal of Business and Society, 14* (3), 428 - 443.

Ghazali, M. F., Lean, H. H., & Baharia, Z. (2016). Gold Investments in Malaysia. *The 2016 International Congress on Banking, Economics,Finance, and Business.* (pp. 24-27). Sapporo, Japan.: BEFB 2016.

Ghorbel, A., & Jeribi, A. (2021). Volatility spillovers and contagion between energy sector and financial assets during COVID-19 crisis period. *Eurasian Economic Review* , 449–467.

Ghosh, D., Levin, E. J., Macmillan, P., & Wright, R. E. (2004). Gold as an Inflation Hedge? *Studies in Economics and Finance, 22* (1), 1-25.

Gibbons, M. R. (1982). Multivariate tests of financial models: A new approach. *Journal of Financial Economics, 10* (1), 3-27.

Glosten, L. R., Jagannathan, R., & Runkle, D. E. (1993). On the Relation between the Expected Value and the Volatility of the Nominal Excess Return on Stocks. *The Journal of Finance, 48* (5), 1779-1801.

Gujarati, D., & Porter, D. (2011). *Basic Econometrics. 5th Edition,* (Fifth Edition ed.). New Delhi: Mc Grow Hill Education.

Gurgun , G., & Unalmıs, I. (2014). Is gold a safe haven against equity market investment in emerging and developing countries? *Finance Research Letters, 11*, 341-348.

Gustafsson, R., Dutta, A., & Bouri, E. (2022). Are energy metals hedges or safe havens for clean energy stock returns? *Energy, 244*, 122708.

Haan, L., & Ferreira, A. (2006). Extreme value theory: an introduction. (Vol. 3). New York: *Springer*.

Hamilton, J. D. (1989). A New Approach to the Economic Analysis of Nonstationary Time Series and the Business Cycle. *Econometrica, 57* (2), 357-384.

Hammoudeh, S., Sari, R., & Ewing, B. (2009). Relationships among strategic commodities and with financial variables: A new look. *Contemporary Economic Policy, 27*, 251–264.

Han, H., Linton, O., Oka, T., & Whang, Y.-J. (2016). The cross-quantilogram: Measuring quantile dependence and testing directional predictability between time series. *Journal of Econometrics, 193* (1), 251-270.

Hau, H., & Rey, H. (2005). Exchange rates, equity prices, and capital flows. *The Review of Financial Studies, 19* (1), 273-317.

He, Z., O'Connor, F. A., & Thijssen, J. J. (2018). Is gold a Sometime Safe Haven or an Always Hedge for equity investors? A Markov-Switching CAPM approach for US and UK stock indices. *International Review of Financial Analysis* , 30-37.

Hiemstra, c., & Jones, J. D. (1994). Testing for linear and nonlinear Granger causality in the stock price–volume relation. *The Journal of Finance, 49* (5), 1639–1664.

Hillier, D., Draper , P., & Faff, R. (2006). Do Precious Metals Shine? An Investment Perspective. *Financial Analysts Journal, 62* (2), 98-106.

Hoang, T. V. (2011). Gold Quoted at Paris and the Diversification of French Portfolios from 2004 to 2009.

Hood , M., & Malik, F. (2013). Is gold the best hedge and a safe haven under changing stock market volatility? *Review of Financial Economics, 22* (2), 47–52.

Hung, N. T. (2020). Analysis of the Time-frequency Connectedness between Gold Prices, Oil Prices and Hungarian Financial Markets. *International Journal of Energy Economics and Policy, 10* (4), 51-59.

Inclan, C., & Tiao, G. C. (1994). Use of Cumulative Sums of Squares for Retrospective Detection of Changes of Variance. *Journal of the American Statistical Association, 89* (427), 913-923.

Iqbal, J. (2017). Does gold hedge stock market, inflation and exchange rate risks? An econometric investigation. *International Review of Economics and Finance, 48*, 1-17.

Jaffe, J. F. (1989). Gold and Gold Stocks as Investments for Institutional Portfolios. *Financial Analysts Journal, 45* (2), 53-59.

Jambotkar, M. M., & Guntur, A. R. (2020). Does Gold Retain its Hedge and Safe Haven Role for Energy Sector Indices During COVID-19 Pandemic? A Crossquantilogram Approach. *International Journal of Energy Economics and Policy, 11* (1), 233–240.

Jana, R., & Das, D. (2020). Did Bitcoin act as an antidote to the Chinese equity market and booster to Altcoins during the Novel Coronavirus outbreak? 28.

Jeon, N. B., & Chiang, T. C. (1991). A system of stock prices in world stock exchanges: Common stochastic trends for 1975–1990. *Journal of Economics and Business, 43* (4), 329-338.

Ji , Q., Zhang , D., & Zhao, Y. (2020). Searching for safe-haven assets during the COVID-19 pandemic. *International Review of Financial Analysis, 71*, 101526.

Joscha Beckmanna, R., & Czudaj. (2013). Gold as an inflation hedge in a time-varying coefficient framework. *North American Journal of Economics and Finance, 24*, 208– 222.

Joy, M. (2011). Gold and the US dollar: Hedge or haven? *Finance Research Letters, 8*, 120–131.

Junttila, J., Pesonen, J., & Raatikainen, J. (2018). Commodity market based hedging against stock market risk in times of financial crisis: The case of crude oil and gold. *Journal of International Financial Markets, Institutions and Money, 56*, 255-280.

Kahneman, D., & Tversky, A. (1979). Prospect theory: an analysis of decision under risk. *Econometrica, 47* (2), 263–291.

Kang, S. H., Hernandez, J. A., Rehman, M. U., Shahzad, S. J., & Yoon, S.-M. (2023). Spillovers and hedging between US equity sectors and gold, oil, islamic stocks and implied volatilities. *Resources Policy, 81*, 103286.

Kaul, A., & Sapp, S. (2006). Y2K fears and safe haven trading of the U.S. dollar. *Journal of International Money and Finance, 25* (5), 760-779.

Klein, T. (2017). Dynamic correlation of precious metals and flight-to-quality in developed markets. *Finance Research Letters, 23*, 283–290.

Koenker, R., & Bassett, G. (1978). Regression Quantiles. *Econometrica, 46* (1), 33-50.

Koop, G. (2006). *Analysis of Financial Data.* John Wiley & Sons, England.

Kuan-Min Wang, Y.-M., Lee, T.-B., & Nguyen Thi. (2011). Time and place where gold acts as an inflation hedge: An application of long-run and short-run threshold model. *Economic Modelling, 28*, 806–819.

Kuan-Min Wanga, Y.-M. L. (2016). Hedging exchange rate risk in the gold market: A panel dataanalysis. *Journal of Multinational Financial Managemnet, 35*, 1–23.

Kumar, D. (2014). Return and volatility transmission between gold and stock sectors: Application of portfolio management and hedging effectiveness. *IIMB Management Review, 26* (1), 5-16.

Lee, J., & Strazicich, M. (2003). Minimum Lagrange multiplier unit root test with two Structural Breaks. *Review of Economics and Statistics, 85* (4), 1082–1089.

Li, J., Wang, R., Aizhan, D., & Karimzade, M. (2023). Assessing the impacts of Covid-19 on stock exchange, gold prices, and financial markets: Fresh evidences from econometric analysis. *Resources Policy, 83*, 103617.

Li, S., & Lucey, M. B. (2017). Reassessing the role of precious metals as safe havens–What colour is your haven and why? *Journal of Commodity Markets, 7*, 1-14.

Lintner, J. (1969). The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets: A Reply. *The Review of Economics and Statistics, 51* (2), 222-224.

Liu, C.-S., Chang,, M.-S., Wu, X., & Chui, C. M. (2016). Hedges or safe havens—revisit the role of gold and USD against stock: a multivariate extended skew-t copula approach. *Quantitative Finance* , 1469-7696.

Low, R. K., Yao, Y., & Faff, R. (2016). Diamonds vs. precious metals: What shines brightest in your investment portfolio? *International Review of Financial Analysis, 43*, 1-14.

Lucey , B. M., & Li, S. (2015). What precious metals act as safe havens, and when? Some US evidence. *Applied Economics Letters, 22* (1), 35-45.

Lucey, B., & Tully, E. (2006). International Portfolio Formation, Skewness and the Role of Gold. *Frontiers in Finance and Economics, SKEMA Business School, 3* (1), 49-68.

Maghyereh , A. I., Awartani , B., & Tziogkidis, P. (2017). Volatility spillovers and cross-hedging between gold, oil and equities:Evidence from the Gulf Cooperation Council countries. *Energy Economics, 68*, 440–453.

Maghyereha, A. I., Abdoha,, H., & Awar, B. (2019). Connectedness and hedging between gold and Islamic securities: A new evidence from time-frequency domain approaches. *Pacific-Basin Finance Journal, 54*, 13-28.

Majumder, S. B. (2022). Searching for hedging and safe haven assets for Indian equity market – a comparison between gold, cryptocurrency and commodities. *Indian Growth and Development Review* , 60-84.

Markowitz, H. (1952). Portfolio Selection. *The Journal of Finance, 7* (1), 77-91.

McCown, J., & Zimmerman, J. R. (2006). Is gold a zero-beta asset? Analysis of the investment potential of precious metals. *SSRN Electronic Journal* .

Mensi , W., Hammoudeh , S., & Aviral K. (2016). New evidence on hedges and safe havens for Gulf stock markets using the wavelet-based quantile. *Emerging Markets Review, 28*, 155-183.

Mensi , W., Hammoudeh , S., Reboredo, J. C., & Nguyen, D. K. (2015). Are Sharia stocks, gold and U.S. Treasury hedges and/or safe havens for the oil-based GCC markets? *Emerging Markets Review, 24*, 101-121.

Mensi, W., Ali, S. R., Vo, X. V., & Kang, S. H. (2022). Multiscale dependence, spillovers, and connectedness between precious metals and currency markets: A hedge and safe-haven analysis. *Resources Policy, 77*, 102752.

Mensi, W., Hammoudeh, S., & Reboredo, J. C. (2014). Do global factors impact BRICS stock markets? A quantile regression approach. *Emerging Markets Review, 19*, 1-17.

Mensi, W., Hernandez, J. A., Yoon, S.-M., & Vo, X. V. (2021). Spillovers and connectedness between major precious metals and major currency markets: The role of frequency factor. *International Review of Financial Analysis, 74*, 101672.

Michaud, R., Michaud, R., & Pulv, K. (2006). *Gold as a Strategic Asset.*World Gold Council, 10 Old Bailey, London EC4M 7NG, UK, 2006, Available at SSRN: https://ssrn.com/abstract=2402862.

Michis, A. A. (2014). Investing in gold: Individual asset risk in the long run. *Finance Research Letters, 11* (4), 369-374.

Miyazaki, T., Toyoshima, Y., & Hamori, S. (2012). Exploring the dynamic interdependence between gold and other financial markets. *Economics Bulletin, 32* (1), 37-50.

Mujtaba, G., Siddique, A., Naifar, N., & Shahzad, S. J. (2023). Hedge and safe haven role of commodities for the US and Chinese equity markets. *nternational Journal of Finance & Economics* .

Naeem, M. A., Hasan, M., Arif, M., & Shahzad, S. J. (2020). Can Bitcoin Glitter More Than Gold for Investment Styles? *SAGE Open, 10* (2), 1-17.

Narayan, P. K., & Liu, R. (2015). A unit root model for trending time-series energy variables. *Energy Economics, 50*, 391-402.

Nekhili, R., Mensi, W., & Vo, X. V. (2021). Multiscale spillovers and connectedness between gold, copper, oil, wheat and currency markets. *Resources Policy, 74*, 102263.

Nguyen , C., Bhatti , M. I., & Kom, M. (2016). Gold price and stock markets nexus under mixed-copulas. *Economic Modelling, 58*, 283–292.

Nguyen, N. Q., Bedoui, R., Majdoub, N., Guesmi, K., & Chevallier, J. (2020). Hedging and safe-haven characteristics of Gold against currencies: An investigation based on multivariate dynamic copula theory. *Resources Policy, 68*, 101766.

Oliveira, M. A., & Santos, C. (2016). A volatility-based approach to gold as a safe haven: can it explain the abnormalities in gold returns during periods of extreme financial adversity? *Investment Management and Financial, 13* (3), 203-214.

Perron, P. (2006). Dealing with Structural Breaks. *Palgrave Handbook of Econometrics*, 278-352.

Pukthuanthong, K., & Roll, R. (2011). Gold and the Dollar (and the Euro, Pound, and Yen). *Journal of Banking & Finance, 35* (8), 2070-2083.

Qureshi, S., Rehman , I. U., & Qureshi , F. (2018). Does gold act as a safe haven against exchange rate fluctuations? The case of Pakistan rupee. *Journal of Policy Modeling, 40* (4), 685-708.

Raza, N. (2017). *Modeling the asymmetric dynamics of financial assets: insights into hedging, safe haven and portfolio diversification strategies.* Ph.D. Thesis, Universiti Malaysia Terengganu.

Reboredo, J. C. (2013). Is gold a hedge or safe haven against oil price movements? *Resources Policy, 38*, 130–137.

Reboredo, J. C. (2013). Is gold a safe haven or a hedge for the US dollar? Implications for risk management. *Journal of Banking & Finance, 37*, 2665–2676.

Said , S., & Dickey, D. (1984). Testing for Unit Roots in Autoregressive-Moving Average Models of Unknown Order. (5.-6. . 71 (3), Ed.) *Biometrika, 71* (3), 599-607.

Salisu , A. A., & Adediran, I. (2020). Gold as a hedge against oil shocks: Evidence from new datasets for oil shocks. *Resources Policy, 66*, 101606.

Salisu, A. A., & Oloko, T. F. (2015). Modeling oil price–US stock nexus: A VARMA–BEKK–AGARCH approach. *Energy Economics, 50*, 1-12.

Salisu, A. A., Ndako, U. B., & Oloko, T. F. (2019). Assessing the inflation hedging of gold and palladium in OECD countries. *Resources Policy, 62*, 357–377.

Salisu, A. A., Vo, X. V., & Lucey, B. (2021). Gold and US sectoral stocks during COVID-19 pandemic. *Research in International Business and Finance, 57*.

Santis, G. D., & Gérard, B. (1998). How big is the premium for currency risk? *Journal of Financial Economics, 49* (3), 375-412.

Sari, R., Hammoudeh, S., & Soytas, U. (2010). Dynamics of oil price, precious metal prices, and exchange rate. *Energy Economics, 32* (2), 351-362.

Selmi , R., Mensi , W., Hammoud, S., & Bouoiyour, J. (2018). Is Bitcoin a hedge, a safe haven or a diversifier for oil price movements? A comparison with gold. *Energy Economics, 787–801*, 74.

shah, A. A., Bhanja, N., & Dar, A. B. (2023). Do gold and the US dollar diversify global sectoral risk? Evidence from connectedness and dynamic conditional correlation measures. *The Journal of Economic Asymmetries, 28*, e00304.

Shahbaz, M., Tahir, M. I., Ali, I., & Rehman, I. U. (2014). Is gold investment a hedge against inflation in Pakistan? A co-integration and causality analysis in the presence of structural breaks. *The North American Journal of Economics and Finance, 28*, 190-205.

Shahzad, H. S., Mensi, W., Hammoudeh, S., & Sohail, A. (2019). Does gold act as a hedge against different nuances of inflation? Evidence from Quantile-on-Quantile and causality-in-quantiles approaches. *Resources Policy, 62*, 602–615.

Shahzad, S. J., Bouri, E., Roubaud, D., Kristoufek, L., & Lucey, B. (2019). Is Bitcoin a better safe-haven investment than gold and commodities? *International Review of Financial analysis, 63*, 322-330.

Shahzad, S. J., Raza, N., Shahbaz, M., & Ali, A. (2017). Dependence of stock markets with gold and bonds under bullish and bearish market states. *Resources Policy, 52*, 308-319.

Shakil, M. H., Muhammad , I. M., Tasnia, M., & Saiti, B. (2018). Is gold a hedge or a safe haven? An application of ARDL approach. *Journal of Economics, Finance and Administrative Science, 22* (44), 60-76.

Sharpe, W. F. (1964). Capital asset prices: a theory of market equilibrium under conditions of risk. *19* (3), 425-442.

Sherman, E. J. (1986). *Gold Investment: Theory and Application.* India: Prentice Hall.

Shin, Y., Yu, B., & Greenwood-N, M. (2014). Modelling Asymmetric Cointegration and Dynamic Multipliers in a Nonlinear ARDL Framework. *Festschrift in Honor of Peter Schmidt* , 281–314.

Sikiru, A. A., & Salisu, A. A. (2023). Hedging against risks associated with travel and tourism stocks during COVID-19 pandemic: The role of gold. *International Journal of Finance and Economics, 28* (2), 1872-1882.

Sim, N., & Zhou, H. (2015). Oil prices, US stock return, and the dependence between their their quantiles. *Journal of Banking & Finance, 55*, 1-8.

Sjaastad, L. A. (2008). The price of gold and the exchange rates: Once again. *Resources Policy, 33* (2), 118-124.

Sjaastad, L. A., & Scacciavillani, F. (1996). The price of gold and the exchange rate. *Journal of International Money and Finance, 15* (6), 879-897.

Smiech, S., & Papiez, M. (2017). In search of hedges and safe havens: Revisiting the relations between gold and oil in the rolling regression framework. *Finance Research Letters* , 238–244.

Stelios Bekiros, S., Boubake, D., Nguyen, S., & Gazi. (2017). Black swan events and safe havens: The role of gold in globally integrated emerging markets. *Journal of International Money and Finance, 73*, 317–334.

Taylor, N. J. (1998). Precious metals and inflation. *Applied Financial Economics, 8* (2), 201-210.

Thomas, F. J., Morleya, C. E., & Panopou, E. (2014). Identifying safe haven assets for equity investors through ananalysis of the stability of shock transmission. *Journal of International Financial Markets, Institutions & Money, 33*, 137-154.

Tiwari, A. K., Adewuyi, A. O., & Roubaud, D. (2019). Dependence between the global gold market and emerging stock markets (E7+1): Evidence from Granger causality using quantile and quantile-on-quantile regression methods. *The World Economy, 42* (7), 2172-2214.

Torrence , C., & Compo, G. P. (1998). A Practical Guide to Wavelet Analysis. *Bulletin of the American Meteorological Society, 79* (1), 61-78.

Wang, K.-M. (2013). Can gold effectively hedge risks of exchange rate? *Journal of Business Economics and Management, 14* (5), 833-851.

Wang, K.-M., & Lee, Y.-M. (2016). Hedging exchange rate risk in the gold market: A panel dataanalysis. *Journal of Multinational Financial Managemnet, 35*, 1–23.

Wang, K.-M., & Lee, Y.-M. (2020). Is gold a safe haven for exchange rate risks? An empirical study of major currency countries. *Journal of Multinational Financial Management, 63*, 100705.

Wang, K.-M., & Lee, Y.-M. (2011). The yen for gold. *Resources Policy, 36*, 39–48.

Wang, K.-M., Lee, Y.-M., & Thi, T.-B. N. (2011). Time and place where gold acts as an inflation hedge: An application of long-run and short-run threshold model. *Economic Modelling, 28*, 806–819.

Weide, R. V. (2002). GO-GARCH: a multivariate generalized orthogonal GARCH model. *Journal of Applied Econometrics, 17* (5), 549-564.

Wen , X., & Cheng, H. (2018). Which is the safe haven for emerging stock markets, gold or the US dollar? *Emerging Markets Review, 35*, 69-90.

Worthington , A. C., & Pahlavani, M. (2007). Gold investment as an inflationary hedge: cointegration evidence with allowance for endogenous structural breaks. *Applied Financial Economics Letters, 3* (4), 259-262.

Wu, Z., & Huang, N. E. (2009). "Ensemble Empirical Mode Decomposition: A Noise-assisted Data Analysis Method". *Advances in Adaptive Data Analysis, 1* (1), 1-41.

Papers Publications

1. **Jambotkar , M. M., & Guntur , A. R. (2021)** "Does Gold Retain its Hedge and Safe Haven Role for Energy Sector Indices During COVID-19 Pandemic? A Crossquantilogram Approach", *International Journal of Energy Economics and Policy*, 11(1), 233-240. ***(Scopus Q1)***

2. **Jambotkar , M. M., & Guntur , A. R. (2021)** "An Assessment of Gold as a Hedge or Safe Haven: Evidence from Major Gold Producing Countries", *Asian Economic and Financial Review*, 11(7), 524-533. ***(Scopus-Q2)***

APPENDIX

APPENDIX – I

Panel A: Major Consumer Countries of Gold

Table 5.2.1: Rolling Correlation between Gold and Equity Sector Indices of India

Window Width	BM	CD	CS	EN	FIN	HC	IND	TECH	TEL	UT
W1	-0.02	-0.05	0.01	0.03	-0.06	-0.06	-0.02	-0.06	0.01	-0.01
W2	-0.03	-0.04	-0.05	0.05	-0.04	-0.07	-0.06	-0.13***	-0.01	0.03
W3	-0.08*	-0.07	-0.06	-0.02	-0.09*	-0.08*	-0.01	-0.12***	-0.05	-0.11***
W4	-0.10**	-0.10**	-0.11***	-0.05	-0.11***	-0.10**	0.03	-0.09*	-0.05	-0.14***
W5	-0.04	-0.05	-0.02	-0.01	-0.07	-0.06	0.06	-0.03	-0.03	-0.11***
W6	0.26***	0.21***	0.21***	0.21***	0.15***	0.22***	0.10**	0.21***	0.10**	0.18***
W7	0.28***	0.24***	0.25***	0.20***	0.20***	0.25***	0.13***	0.26***	0.15***	0.21***
W8	0.18***	0.17***	0.18***	0.09*	0.11***	0.18***	0.07	0.14***	0.08*	0.13***
W9	-0.05	-0.14***	-0.12***	-0.07	-0.18***	-0.07	0.01	-0.11***	-0.11***	-0.09*
W10	-0.10**	-0.17***	-0.15***	-0.12***	-0.20***	-0.11***	-0.04	-0.17***	-0.15***	-0.11***
W11	-0.11***	-0.18***	-0.16***	-0.13***	-0.21***	-0.12***	-0.05	-0.18***	-0.17***	-0.16***
W12	-0.04	-0.01	0.01	-0.10**	-0.07	-0.04	-0.04	-0.10**	-0.14***	-0.10**
W13	-0.01	0.04	0.04	0.03	-0.03	-0.03	0.04	-0.07	-0.06	-0.05
W14	0.07	0.09*	0.11***	0.05	0.01	-0.01	0.08*	0.03	0.01	-0.01
W15	0.06	0.07	0.08*	-0.06	-0.02	-0.03	0.10**	0.04	0.01	-0.03
W16	-0.08*	-0.11***	-0.11***	-0.20***	-0.21***	-0.08*	0.04	0.03	-0.10**	-0.15***
W17	-0.09*	-0.17***	-0.17***	-0.22***	-0.24***	-0.10**	0.04	-0.03	-0.12***	-0.16***
W18	-0.18***	-0.17***	-0.17***	-0.20***	-0.23***	-0.09*	-0.09*	-0.05	-0.16***	-0.19***
W19	-0.24***	-0.28***	-0.27***	-0.26***	-0.28***	-0.18***	-0.14***	-0.18***	-0.15***	-0.24***
W20	-0.22***	-0.27***	-0.26***	-0.26***	-0.30***	-0.18***	-0.17***	-0.12***	-0.11***	-0.22***
W21	-0.20***	-0.30***	-0.28***	-0.27***	-0.32***	-0.20***	-0.17***	-0.12***	-0.09*	-0.21***
W22	-0.08*	-0.19***	-0.18***	-0.18***	-0.18***	-0.10**	-0.11***	0.02	-0.07	-0.08*
W23	-0.12***	-0.20***	-0.20***	-0.19***	-0.19***	-0.14***	-0.08*	-0.04	-0.09*	-0.11***
W24	-0.06	-0.04	0.01	-0.05	-0.08*	0.05	0.01	0.14***	-0.02	0.03

Note: ***, **, and * denote significance at 1%, 5%, and 10% levels of significance, respectively. The BM, CD, CS, EN, FIN, HC, IND, TECH, TEL and UT are abbreviations of equity sector indices such as Consumer Discretionary, Consumer Staples, Energy, Financials, Health Care, Industrial, Information Technology, Telecommunication, Basic Materials and Utility.

Table 5.2.2: Rolling Correlation between Gold and Equity Sector Indices of China

Window Width	BM	CD	CS	EN	FIN	HC	IND	TECH	TEL	UT
W1	0.01	0.02	0.01	-0.02	0.01	0.03	-0.02	-0.01	0.09*	-0.01
W2	0.06	0.07	0.06	0.09*	0.02	0.05	0.04	0.05	0.01	0.05
W3	0.09*	0.08*	0.07	0.10**	0.04	0.06	0.13	0.08*	0.03	0.06
W4	0.08*	0.06	0.05	0.08*	0.02	0.03	0.10**	0.08*	0.06	0.02
W5	0.10**	0.09*	0.10**	0.07	0.07	0.07	0.12***	0.09*	0.08*	0.07
W6	0.06	0.01	-0.01	0.03	-0.01	-0.01	0.03	0.02	0.11***	-0.01
W7	0.03	-0.02	-0.03	-0.01	0.03	-0.02	0.01	-0.02	0.05	-0.03
W8	0.05	-0.02	-0.01	0.01	0.03	-0.03	0.01	-0.03	0.09*	-0.03
W9	0.04	-0.01	0.03	0.06	0.01	0.03	0.03	0.03	0.06	0.02
W10	0.07	0.02	0.05	0.08*	0.01	0.03	0.04	0.05	0.07	0.05
W11	0.21***	0.13***	0.12***	0.16***	0.11***	0.07	0.15***	0.04	0.10**	0.14***
W12	0.21***	0.13***	0.12***	0.16***	0.11***	0.07	0.15***	0.16***	0.10**	0.14***
W13	0.12***	0.03	0.02	0.08*	0.08*	0.03	0.07	0.06	0.05	0.03
W14	0.17***	0.11***	0.10**	0.15***	0.16***	0.11***	0.14***	0.11***	0.10**	0.08*
W15	0.19***	0.14***	0.15***	0.13***	0.15***	0.15***	0.14***	0.13***	0.14***	0.09**
W16	0.14***	0.09*	0.12***	0.11***	0.08*	0.11***	0.10**	0.10**	0.12***	0.07
W17	0.11***	0.06	0.07	0.02	-0.01	0.08*	0.07	0.13***	0.06	0.03
W18	0.05	0.01	0.01	-0.01	-0.06	0.01	0.01	0.03	0.05	-0.01
W19	0.01	-0.05	-0.03	-0.01	-0.10**	-0.04	-0.04	-0.04	0.01	-0.03
W20	0.01	-0.05	-0.04	-0.02	-0.08*	-0.04	-0.05	-0.05	0.01	-0.03
W21	-0.03	-0.08*	-0.03	-0.04	-0.08*	-0.07	-0.07	-0.07	-0.09*	-0.03
W22	-0.01	0.01	0.01	0.08*	0.03	0.03	-0.02	0.01	-0.10**	0.02
W23	-0.11***	-0.11***	-0.10**	-0.03	-0.08*	-0.11***	-0.12***	-0.05	-0.13***	-0.13***
W24	-0.01	-0.07	-0.05	-0.03	-0.06	-0.04	-0.09*	-0.05	-0.07	-0.07

Note: ***, **, and * denote significance at 1%, 5%, and 10% levels of significance, respectively.

Table 5.2.3: Rolling Correlation between Gold and Equity Sector Indices of UAE

Window Width	CD	CS	FIN	HC	IND	TEL	UT
W1	-	-	-	-	-	-	-
W2	-	-	-	-	-	-	-
W3	0.17*	-	-0.02	0.04	-0.10	-0.01	-
W4	0.09	-	-0.01	0.02	-0.08	0.04	-
W5	0.02	-	0.02	0.04	-0.02	0.06	-
W6	0.02	0.07	0.03	0.01	-0.02	0.02	0.02

W7	-0.03	0.04	0.03	0.01	-0.01	-0.03	-0.01
W8	-0.03	0.03	0.01	0.01	-0.02	-0.02	-0.04
W9	-0.13***	-0.04	-0.05	-0.03	0.07	-0.05	-0.06
W10	-0.09**	-0.07	-0.04	-0.05	0.08*	-0.08*	-0.03
W11	-0.10**	-0.05	-0.02	-0.14***	0.08*	-0.10**	-0.01
W12	0.03	-0.01	0.09**	-0.04	0.11**	0.01	0.07
W13	0.03	0.08	0.11**	0.01	0.05	0.06	0.04
W14	-0.04	0.03	0.13**	0.02	0.06	0.04	0.06
W15	-0.04	0.05	0.13**	0.02	0.06	0.04	0.04
W16	-0.06	0.02	0.05	0.01	-0.01	-0.02	-0.02
W17	-0.06	-0.01	0.01	0.01	-0.01	-0.01	-0.07*
W18	-0.10**	-0.02	-0.01	-0.04	-0.04	-0.06	-0.11**
W19	-0.09*	-0.03	-0.02	-0.02	-0.01	-0.09**	-0.10**
W20	-0.05	-0.04	0.01	-0.11**	-0.02	-0.08*	-0.05
W21	-0.01	-0.02	0.02	-0.03	-0.01	-0.04	-0.04
W22	0.01	-0.06	0.07	-0.04	0.02	0.07	0.01
W23	0.01	-0.03	-0.01	0.03	-0.01	0.02	0.02
W24	0.03	-0.01	0.07	0.08*	0.05	0.08*	-0.07

Note: ***, **, and * denote significance at 1%, 5%, and 10% levels of significance, respectively.

Table 5.2.4: Rolling Correlation between Gold and Equity Sector Indices of Egypt

Window Width	BM	CD	CS	EN	FIN	HC	IND	TECH	TEL
W1	0.01	0.08**	0.06*	-	0.07*	-0.01	0.05	-	0.05
W2	0.04	0.01	0.01	-	0.09**	-0.04	0.17***	-	0.05
W3	0.01	-0.01	-0.01	-	0.08*	-0.06	0.12***	-	0.04
W4	0.03	-0.03	-0.02	-	0.04	-0.05	0.02	-	0.02
W5	0.03	0.07	0.06	-	0.05	0.03	0.01	-	0.03
W6	0.04	0.04	0.02	0.10*	0.04	-0.01	0.09**	0.01	1.00
W7	0.04	0.01	0.01	0.08*	0.04	-0.02	0.10**	0.03	0.12***
W8	0.02	-0.03	-0.02	-0.01	-0.02	-0.05	0.04	-0.01	0.06
W9	-0.01	-0.02	-0.03	-0.03	-0.03	0.02	0.03	0.02	0.06
W10	-0.01	-0.05	-0.05	-0.05	-0.05	0.03	0.01	-0.01	-0.01
W11	0.01	-0.02	-0.03	-0.04	0.01	0.02	0.04	0.03	0.02
W12	0.03	0.01	-0.02	-0.04	0.08*	0.03	0.01	-0.01	-0.04
W13	0.02	-0.02	-0.04	0.01	0.03	-0.06	-0.02	0.04	-0.03
W14	-0.01	-0.06	-0.05	0.01	0.01	-0.11**	-0.05	0.03	-0.05
W15	0.03	0.01	0.03	0.06	0.04	-0.04	0.01	0.04	0.04
W16	-0.03	-0.08*	-0.03	-0.03	-0.02	-0.01	-0.02	-0.02	-0.01

W17	-0.07	-0.08*	-0.02	-0.01	-0.03	0.01	0.01	-0.05	-0.02
W18	-0.07	-0.08*	-0.06	-0.01	-0.07	-0.07	0.00	-0.08*	-0.10**
W19	-0.04	0.02	0.03	-0.03	-0.01	-0.01	-0.01	-0.07	-0.05
W20	0.04	0.13***	0.16***	-0.09*	0.18***	0.12***	0.13***	0.02	0.08*
W21	0.02	0.13***	0.17***	-0.10**	0.24***	0.13***	0.13***	0.03	0.09*
W22	0.02	0.11***	0.17***	-0.10**	0.26***	0.12***	0.10**	0.04	0.09*
W23	-0.10**	-0.06	-0.05	-0.02	-0.03	-0.07	-0.01	0.05	-0.03
W24	0.04	0.02	0.06	0.03	0.04	0.03	0.05	-0.01	0.01

Note: ***, **, and * denote significance at 1%, 5%, and 10% levels of significance, respectively.

Table 5.2.5: Rolling Correlation between Gold and Equity Sector Indices of Indonesia

Window Width	**BM**	**CD**	**CS**	**EN**	**FIN**	**HC**	**IND**	**TEL**
W1	-0.13***	-0.22***	-0.21***	-0.01	-0.15***	-0.19***	-0.02	-0.14***
W2	-0.09*	-0.12***	-0.12***	-0.05	-0.12***	-0.15***	-0.04	-0.17***
W3	-0.14***	-0.10**	-0.10**	0.01	-0.16***	-0.12***	-0.05	-0.12***
W4	-0.13***	-0.17***	-0.17***	-0.05	-0.14***	-0.08*	-0.05	-0.09*
W5	-0.16***	-0.15***	-0.15***	-0.10**	-0.12***	-0.08*	-0.11***	-0.11***
W6	0.01	0.02	-0.01	-0.01	0.10**	0.03	-0.01	0.03
W7	0.02	0.02	0.04	0.02	0.11***	0.01	0.01	0.07
W8	0.06	0.07	0.10**	0.05	0.09*	-0.05	0.08*	0.05
W9	-0.05	-0.06	-0.05	-0.04	-0.07	-0.05	-0.09*	-0.11***
W10	-0.10**	-0.10**	-0.11***	-0.08*	-0.14***	-0.07	-0.15***	-0.15***
W11	-0.12***	-0.13***	-0.14***	-0.12***	-0.15***	-0.06	-0.18***	-0.15***
W12	-0.04	-0.10**	-0.06	-0.03	-0.11***	-0.01	-0.13***	-0.11***
W13	0.09*	0.03	0.08*	0.09*	0.06	0.11***	0.04	0.02
W14	0.16***	0.09*	0.16***	0.15***	0.11***	0.15***	0.10**	0.07
W15	0.15***	0.09*	0.15***	0.13***	0.13***	0.10**	0.09*	0.03
W16	0.08*	-0.04	-0.03	0.07	0.02	-0.07	-0.01	-0.03
W17	0.03	-0.14***	-0.12***	0.03	-0.05	-0.10**	-0.11***	-0.09*
W18	-0.09*	-0.15***	-0.15***	-0.07	-0.16***	-0.06	-0.19***	-0.12***
W19	-0.10**	-0.19***	-0.16***	-0.09*	-0.21***	-0.11***	-0.19***	-0.15***
W20	-0.11***	-0.17***	-0.13***	-0.11***	-0.18***	-0.08*	-0.14***	-0.10**
W21	-0.10**	-0.07	-0.07	-0.05	-0.06	-0.01	-0.02	-0.03
W22	-0.07	-0.03	-0.04	-0.05	0.01	-0.01	-0.03	0.01
W23	-0.13***	-0.15***	-0.12***	-0.08*	-0.08*	-0.07	-0.14***	-0.08*
W24	-0.15***	-0.26***	-0.14***	-0.09*	-0.17***	-0.13***	-0.20***	-0.12***

Note: ***, **, and * denote significance at 1%, 5%, and 10% levels of significance, respectively.

Table 5.2.6: Rolling Correlation between Gold and Equity Sector Indices of South Korea

Window Width	BM	CD	CS	EN	FIN	HC	IND	TECH	TEL	UT
W1	-0.13***	-0.11***	-0.10**	-0.08*	-0.12***	-0.05	-0.14***	-0.09*	-0.08*	-0.08*
W2	-0.13***	-0.13***	-0.13***	-0.13***	-0.11***	-0.08*	-0.09*	-0.05	-0.15***	-0.08*
W3	-0.02	-0.07	-0.07	-0.06	-0.09*	-0.11***	-0.05	-0.05	-0.09*	-0.09*
W4	0.01	-0.01	-0.01	-0.04	-0.07	-0.05	-0.01	-0.03	-0.07	-0.08*
W5	0.02	-0.01	-0.01	0.02	-0.03	-0.04	0.01	-0.05	-0.03	-0.05
W6	0.07	0.03	0.04	0.09*	0.06	0.03	0.06	0.06	0.01	0.05
W7	0.13***	0.06	0.06	0.13***	0.10**	0.04	0.09*	0.10**	0.01	0.07
W8	0.06	0.02	0.04	0.07	0.04	0.07	0.03	0.03	0.05	0.04
W9	-0.18***	-0.19***	-0.16***	-0.18***	-0.25***	0.03	-0.20***	-0.19***	-0.11***	-0.17***
W10	-0.26***	-0.26***	-0.22***	-0.25***	-0.36***	0.03	-0.27***	-0.25***	-0.14***	-0.28***
W11	-0.31***	-0.30***	-0.26***	-0.36***	-0.39***	0.01	-0.32***	-0.29***	-0.22***	-0.32***
W12	-0.20***	-0.22***	-0.18***	-0.27***	-0.31***	-0.09*	-0.26***	-0.22***	-0.17***	-0.29***
W13	-0.13***	-0.18***	-0.17***	-0.14***	-0.20***	-0.12	-0.16***	-0.24***	-0.15***	-0.14***
W14	-0.08*	-0.16***	-0.15***	-0.04	-0.10**	-0.09*	-0.09*	-0.16***	-0.07	-0.02
W15	-0.02	-0.07	-0.07	-0.02	-0.04	-0.10**	-0.03	-0.14***	-0.08*	-0.05
W16	0.01	-0.03	-0.02	0.02	-0.07	-0.06	-0.01	-0.07	-0.11***	-0.09*
W17	0.01	-0.02	-0.02	0.01	-0.07	-0.07	0.01	-0.03	-0.11***	-0.03
W18	-0.09*	-0.11***	-0.10**	-0.09*	-0.07	-0.09*	-0.10**	0.01	-0.05	0.01
W19	-0.16***	-0.23***	-0.22***	-0.17***	-0.18***	-0.16***	-0.23***	-0.12***	-0.06	0.02
W20	-0.25***	-0.24***	-0.24***	-0.20***	-0.24***	-0.15***	-0.31***	-0.21***	-0.11***	-0.06
W21	-0.26***	-0.28***	-0.28***	-0.17***	-0.33***	-0.16***	-0.34***	-0.26***	-0.13***	-0.07
W22	-0.21***	-0.20***	-0.20***	-0.14***	-0.22***	-0.06	-0.26***	-0.22***	-0.09*	-0.08*
W23	-0.22***	-0.29***	-0.29***	-0.19***	-0.25***	-0.10**	-0.29***	-0.29***	-0.12***	-0.14***
W24	-0.19***	-0.19***	-0.21***	-0.19***	-0.28***	-0.13***	-0.23***	-0.21***	-0.07	-0.03

Note: ***, **, and * denote significance at 1%, 5%, and 10% levels of significance, respectively.

Table 5.2.7: Rolling Correlation between Gold and Equity Sector Indices of Turkey

Window Width	CD	CS	EN	FIN	IND	TECH	TEL	UT
W1	-0.15***	-0.14***	-0.09***	-0.18***	-0.14***	-0.16***	-0.11***	-0.08**
W2	-0.43***	-0.43***	-0.43***	-0.46***	-0.43***	-0.23***	-0.29***	-0.42***
W3	-0.41***	-0.41***	-0.38***	-0.42***	-0.40***	-0.22***	-0.30***	-0.39***
W4	-0.26***	-0.25***	-0.16***	-0.25***	-0.26***	-0.13***	-0.17***	-0.19***
W5	-0.21***	-0.21***	-0.09**	-0.20***	-0.18***	-0.06	-0.12**	-0.09**
W6	-0.15***	-0.14***	-0.11**	-0.15***	-0.10**	-0.11**	-0.07	-0.12***
W7	-0.10**	-0.11**	-0.10**	-0.11**	-0.07	-0.10**	-0.04	-0.09**

W8	-0.27***	-0.28***	-0.25***	-0.29***	-0.23***	-0.15***	-0.17***	-0.18***
W9	-0.32***	-0.30***	-0.29***	-0.33***	-0.30***	-0.27***	-0.25***	-0.23***
W10	-0.31***	-0.28***	-0.26***	-0.34***	-0.30***	-0.30***	-0.23***	-0.23***
W11	-0.18***	-0.14***	-0.13***	-0.19***	-0.24***	-0.13***	-0.09***	-0.11***
W12	-0.18***	-0.14***	-0.13***	-0.19***	-0.24***	-0.13***	-0.09***	-0.11***
W13	-0.17***	-0.12***	-0.12***	-0.17***	-0.20***	-0.12***	-0.05	-0.14***
W14	-0.10**	-0.09**	-0.04	-0.07	-0.11**	-0.09**	0.02	-0.10**
W15	-0.04	-0.05	-0.05	-0.02	-0.05	0.02	0.03	-0.07
W16	-0.18***	-0.19***	-0.13***	-0.12**	-0.05	-0.03	-0.11**	-0.09**
W17	-0.24***	-0.23***	-0.15***	-0.18***	-0.08*	-0.07	-0.20***	-0.09**
W18	-0.34***	-0.29***	-0.20	-0.30	-0.17***	-0.14***	-0.22***	-0.13***
W19	-0.40***	-0.35***	-0.33***	-0.36***	-0.32***	-0.18***	-0.30***	-0.16***
W20	-0.40***	-0.36***	-0.38***	-0.40***	-0.34***	-0.18***	-0.32***	-0.19***
W21	-0.36***	-0.34***	-0.34***	-0.39***	-0.28***	-0.11**	-0.27***	-0.14***
W22	-0.22***	-0.18***	-0.04	-0.38***	0.08**	-0.12***	-0.12**	-0.19***
W23	-0.20***	-0.18***	-0.06	-0.36***	0.06	-0.17***	-0.18***	-0.24***
W24	-0.12***	-0.08*	-0.06	-0.25***	0.07	-0.22***	-0.14***	-0.24***

Note: ***, **, and * denote significance at 1%, 5%, and 10% levels of significance, respectively.

Table 5.2.8: Rolling Correlation between Gold and Equity Sector Indices of Russia

Window Width	**CD**	**EN**	**FIN**	**TEL**	**UT**
W1	-0.04	-0.09*	-0.11***	-0.07	-0.09*
W2	-0.02	-0.09*	-0.07	-0.04	-0.07
W3	0.03	0.01	0.03	0.03	0.02
W4	-0.03	0.09*	0.07	0.11***	0.09*
W5	-0.03	0.20***	0.15***	0.18***	0.08*
W6	-0.02	0.25***	0.18***	0.15***	0.05
W7	0.05	0.28***	0.19***	0.18***	0.08*
W8	0.14***	0.25***	0.15***	0.16***	0.13***
W9	0.05	0.10**	0.01	0.03	0.04
W10	-0.03	0.01	-0.08*	0.07	-0.04
W11	-0.03	0.01	-0.08*	0.07	-0.04
W12	-0.01	-0.01	-0.04	0.10**	-0.06
W13	-0.06	-0.11	-0.11***	-0.13***	-0.12***
W14	-0.02	-0.09*	-0.09*	-0.11***	-0.07
W15	-0.04	-0.10**	-0.06	-0.07	-0.01
W16	-0.10**	-0.05	-0.11***	-0.09*	-0.04
W17	-0.05	0.01	-0.27***	-0.18***	-0.18***

W18	-0.06	-0.08*	-0.40***	-0.22***	-0.34***
W19	-0.06	-0.15***	-0.46***	-0.24***	-0.35***
W20	-0.13***	-0.29***	-0.45***	-0.22***	-0.21***
W21	-0.13***	-0.27***	-0.36***	-0.14***	-0.16***
W22	-0.13***	-0.10**	-0.32***	-0.06	-0.22***
W23	-0.13***	-0.09*	-0.33***	-0.10**	-0.24***
W24	-0.10**	-0.09*	-0.30***	-0.07	-0.13***

Note: ***, **, and * denote significance at 1%, 5%, and 10% levels of significance, respectively.

Table 5.2.9: Rolling Correlation between Gold and Equity Sector Indices of Saudi Arabia

Window Width	**BM**	**CD**	**CS**	**EN**	**FIN**	**HC**	**IND**	**TEL**	**UT**
W1	-	-	-	-	-	-	-	-	-
W2	-	-	-	-	-	-	-	-	-
W3	-	-	-	-	-	-	-	-	-
W4	-	-	-	-	-	-	-	-	-
W5	-	-	-	-	-	-	-	-	-
W6	0.06	0.08	0.01	-	0.03	-	0.05	0.08	-0.02
W7	0.03	0.04	-0.03	-	0.01	-	0.02	0.06	-0.03
W8	0.01	-0.01	-0.05	-	-0.01	-	0.02	0.06	-0.02
W9	0.11**	-0.02	0.04	0.07	0.04	-	0.02	0.01	-0.03
W10	0.09*	0.01	0.04	0.07	0.04	-	0.01	0.01	-0.03
W11	0.10**	0.04	0.05	0.09*	0.04	-	0.01	0.01	-0.06
W12	0.10**	0.04	0.05	0.09*	0.04	-0.01	0.01	0.01	-0.06
W13	0.01	-0.15***	-0.02	-0.07	-0.05	-0.06	-0.02	-0.02	-0.05
W14	-0.01	-0.13***	0.01	-0.04	-0.02	-0.03	-0.04	-0.01	-0.04
W15	0.02	-0.10**	0.02	-0.01	0.01	-0.05	0.01	-0.02	-0.02
W16	0.03	0.02	-0.01	0.02	0.01	-0.09*	0.01	-0.06	0.01
W17	0.04	0.02	-0.03	-0.01	0.02	-0.07	0.02	-0.03	0.01
W18	-0.03	-0.04	-0.12***	-0.07	-0.06	-0.12***	-0.06	-0.05	-0.04
W19	-0.07	-0.10	-0.08*	-0.10**	-0.09*	-0.07	-0.07	-0.03	0.01
W20	-0.14***	-0.13***	-0.08*	-0.15***	-0.16***	-0.08*	-0.11***	-0.09*	-0.02
W21	-0.13***	-0.11***	0.02	-0.16***	-0.11***	-0.02	-0.08*	-0.06	-0.02
W22	-0.03	-0.10*	-0.02	0.02	-0.08*	-0.06	-0.06	-0.06	0.01
W23	-0.03	-0.10*	-0.02	0.02	-0.08*	-0.06	-0.06	-0.06	0.01
W24	0.05	0.05	0.02	0.04	0.02	0.04	0.01	-0.08*	0.08*

Note: ***, **, and * denote significance at 1%, 5%, and 10% levels of significance, respectively.

Table 5.2.10: Rolling Correlation between Gold and Equity Sector Indices of Thailand

Window Width	BM	CD	CS	EN	FIN	HC	IND	TECH	TEL	UT
W1	-0.09*	-0.09*	-0.08*	-0.08*	-0.09*	-0.03	-0.07	-0.11***	-0.09*	-0.09*
W2	-0.08*	-0.08**	-0.09*	0.04	-0.12***	-0.06	-0.08*	-0.09*	-0.11***	-0.05
W3	-0.08*	-0.08*	-0.09*	0.04	-0.12***	-0.06	-0.08*	-0.09*	-0.11***	-0.05
W4	-0.02	-0.08*	-0.03	0.01	-0.02	-0.07	-0.07	-0.03	-0.01	0.04
W5	-0.05	-0.07	0.01	0.01	0.03	-0.06	-0.01	-0.04	0.01	-0.01
W6	0.04	0.05	0.10**	0.09*	0.07	0.10**	0.09*	0.09*	0.06	0.09*
W7	0.06	0.07	0.10**	0.11***	0.05	0.07	0.09*	0.08*	0.05	0.09*
W8	0.08*	0.07	0.10**	0.14***	0.03	0.05	0.03	0.07	0.05	0.08*
W9	-0.11***	-0.05	-0.04	-0.05	-0.11***	0.03	-0.13***	-0.09*	-0.09*	0.04
W10	-0.09*	-0.06	-0.04	-0.05	-0.11***	0.05	-0.10**	-0.04	-0.07	0.03
W11	-0.09*	-0.07	-0.05	-0.08*	-0.13***	0.01	-0.10**	-0.06	-0.09*	0.01
W12	0.10**	0.05	0.01	0.07	0.01	-0.01	0.05	0.08*	0.06	0.02
W13	0.10**	0.06	0.01	0.05	0.04	0.06	0.03	0.01	0.01	0.07
W14	0.17***	0.08*	0.08*	0.14***	0.12***	0.09*	0.15***	0.02	0.02	0.11***
W15	0.14***	0.06	0.08*	0.10**	0.11***	0.06	0.10**	-0.04	-0.03	0.08*
W16	0.01	-0.03	0.02	0.01	-0.01	-0.05	-0.02	-0.09*	-0.03	-0.01
W17	-0.04	-0.04	0.01	-0.06	-0.05	-0.09*	-0.06	-0.09*	-0.05	-0.04
W18	-0.13***	-0.07	-0.04	-0.10**	-0.10**	-0.04	-0.11***	-0.05	-0.05	-0.07
W19	-0.13***	-0.12***	-0.13***	-0.17***	-0.18***	-0.08*	-0.16***	-0.10**	-0.17***	-0.09*
W20	-0.13***	-0.11***	-0.11***	-0.19***	-0.21***	-0.11***	-0.16***	-0.12	-0.16***	-0.08*
W21	-0.09*	-0.08*	-0.09*	-0.17***	-0.18***	-0.14***	-0.12***	-0.09*	-0.11***	-0.06
W22	-0.02	-0.01	-0.01	-0.04	-0.07	-0.04	-0.01	-0.02	0.00	-0.03
W23	-0.10**	-0.02	-0.06	-0.06	-0.05	0.02	-0.01	-0.03	0.01	-0.07
W24	0.06	0.05	0.05	0.10**	0.02	0.05	0.08*	0.04	0.03	0.07

Note: ***, **, and * denote significance at 1%, 5%, and 10% levels of significance, respectively.

Table 5.2.11: Rolling Correlation between Gold and Equity Sector Indices of Vietnam

Window Width	BM	CD	CS	EN	FIN	HC	IND	TEL	UT
W1	-	-	-	-	-	-	-	-	-
W2	-	-	-	-	-	-	-	-	-
W3	-	-	-	-	-	-	-	-	-
W4	-	-	-	-	-	-	-	-	-
W5	-	-	-	-	-	-	-	-	-
W6	-	-	-	-	-	-	-	-	-
W7	-	-	-	-	-	-	-	-	-

W8	-0.03	-	-0.07	0.01	-0.02	-0.05	-0.03	-0.03	-0.03
W9	0.02	0.04	0.04	0.04	0.02	0.05	0.03	0.02	-0.03
W10	-0.02	0.01	0.02	0.03	-0.01	0.06	-0.01	-0.02	-0.03
W11	-0.01	-0.04	0.03	0.04	-0.02	0.11**	-0.02	-0.03	-0.02
W12	0.01	-0.05	-0.01	0.03	0.01	0.05	-0.01	-0.02	-0.01
W13	0.09**	0.04	0.08*	0.09**	0.09**	0.05	0.07	0.06	0.09**
W14	0.06	0.03	0.06	0.01	0.08*	0.04	0.05	0.04	0.05
W15	0.06	-0.04	0.02	-0.01	0.10**	0.05	0.07	-0.03	0.08*
W16	0.02	-0.04	0.01	0.02	0.07	0.03	0.05	-0.05	0.01
W17	0.01	-0.05	0.00	0.05	0.02	-0.01	0.02	-0.06	-0.01
W18	-0.02	-0.04	-0.07	-0.02	-0.08*	-0.07	-0.07	-0.03	-0.08*
W19	-0.01	-0.06	-0.14***	-0.06	-0.08*	-0.11**	-0.08*	-0.07	0.01
W20	0.02	0.01	-0.07*	-0.07	-0.03	-0.05	-0.04	-0.06	0.07*
W21	0.05	0.02	0.04	-0.05	0.03	-0.02	0.01	-0.01	0.06
W22	-0.01	-0.02	0.07	-0.02	-0.01	0.01	-0.02	-0.01	-0.04
W23	0.06	-0.08*	0.01	-0.05	-0.04	-0.04	-0.05	-0.03	-0.06
W24	-0.01	-0.04	0.04	-0.03	0.01	0.06	0.06	-0.01	0.05

Note: ***, **, and * denote significance at 1%, 5%, and 10% levels of significance, respectively.

Table 5.2.12: Rolling Correlation between Gold and Equity Sector Indices of US

Window Width	**BM**	**CD**	**CS**	**EN**	**FIN**	**HC**	**IND**	**TECH**	**TEL**	**UT**
W1	-0.17***	-0.19***	-0.11***	-0.08*	-0.16***	-0.07	-0.15***	-0.09*	-0.11***	-0.06
W2	-0.24***	-0.23***	-0.14***	-0.08*	-0.17***	-0.14***	-0.20***	-0.17***	-0.13***	-0.06
W3	-0.14***	-0.16***	-0.09*	-0.03	-0.09*	-0.10**	-0.13***	-0.12***	-0.08*	0.01
W4	0.06	0.01	0.03	0.18***	0.08*	0.02	0.01	0.00	0.04	0.16***
W5	0.08*	0.01	0.01	0.19***	0.05	-0.02	0.04	0.03	0.02	0.16***
W6	0.10**	-0.13***	-0.12***	0.16***	-0.07	-0.14***	-0.03	-0.10**	-0.08*	0.03
W7	0.12***	-0.08*	-0.05	0.14***	-0.04	-0.09*	-0.01	-0.07	-0.05	0.05
W8	0.19***	-0.09*	-0.03	0.16***	-0.06	-0.08*	-0.01	-0.05	-0.07	0.03
W9	0.10**	-0.12***	-0.12***	0.06	-0.06	-0.15***	-0.04	-0.10**	-0.11***	-0.07
W10	0.09*	-0.12***	-0.11***	0.06*	-0.08*	-0.12***	-0.05	-0.09*	-0.10**	-0.06
W11	0.09*	-0.05	-0.06	0.06	-0.03	-0.07	0.01	-0.05	-0.06	-0.02
W12	0.25***	0.13***	0.13***	0.21***	0.11***	0.13***	0.16***	0.14***	0.03	0.15***
W13	0.13***	0.03	0.06	0.11***	-0.01	0.04	0.05	0.06	0.04	0.06
W14	0.14***	0.03	0.04	0.11***	-0.01	0.02	0.05	0.06	0.02	0.01
W15	0.17***	0.06	0.08*	0.14***	0.03	0.07	0.08*	0.09*	0.04	0.02
W16	0.22***	0.10**	0.11***	0.19***	0.10**	0.07	0.13***	0.08*	0.02	0.07
W17	0.15***	0.01	0.04	0.09*	-0.03	-0.01	0.03	-0.02	-0.07	0.03

W18	-0.03	-0.15***	-0.06	-0.05	-0.19***	-0.10**	-0.14***	-0.15***	-0.11***	0.02
W19	-0.05	-0.16***	-0.08*	-0.06	-0.21***	-0.13***	-0.14***	-0.13***	-0.07	0.04
W20	-0.05	-0.14***	-0.03	-0.06	-0.23***	-0.12***	-0.15***	-0.12***	-0.01	0.11***
W21	-0.15***	-0.19***	-0.05	-0.10**	-0.33***	-0.19***	-0.24***	-0.18***	-0.04	0.09*
W22	0.01	0.01	0.08*	0.02	-0.16***	-0.01	-0.09*	0.01	0.02	0.08*
W23	0.11***	-0.01	0.04	0.04	-0.05	0.03	-0.01	-0.02	0.04	0.04
W24	0.28***	0.24***	0.27***	0.20***	0.24***	0.25***	0.25***	0.18***	0.23***	0.36***

Note: ***, **, and * denote significance at 1%, 5%, and 10% levels of significance, respectively.

Panel B: Major Producer Countries of Gold

Table 5.2.13: Rolling Correlation between Gold and Equity Sector Indices of Australia

Window Width	BM	CD	CS	EN	FIN	HC	IND	TECH	TEL	UT
W1	-0.07**	-0.09**	-0.04	-0.12***	-0.04	-0.05	-0.03	-0.01	-0.03	-0.03
W2	-0.15***	-0.15***	-0.02	-0.09*	-0.09*	-0.08*	-0.04	-0.01	-0.07	-0.02
W3	-0.12***	-0.13***	-0.01	-0.06	-0.05	-0.11***	-0.04	-0.06	-0.02	-0.01
W4	-0.02	-0.04	-0.01	0.04	-0.06	-0.04	-0.05	-0.05	0.04	-0.02
W5	-0.01	-0.03	-0.01	0.10**	-0.08*	-0.02	-0.01	0.01	-0.02	-0.01
W6	0.23***	-0.01	-0.01	0.22***	0.04	0.10**	0.11***	0.11***	0.02	0.06
W7	0.28***	0.09*	0.07	0.26***	0.15***	0.12***	0.21***	0.15***	0.01	0.11***
W8	0.14***	-0.06	-0.04	0.14***	-0.05	0.04	-0.02	0.01	-0.01	-0.04
W9	-0.11***	-0.27***	-0.16***	-0.15***	-0.28***	-0.19***	-0.25***	-0.13***	-0.14***	-0.27***
W10	-0.15***	-0.30***	-0.15***	-0.20***	-0.31***	-0.19***	-0.30***	-0.13***	-0.12***	-0.24***
W11	-0.18***	-0.34***	-0.17***	-0.23***	-0.35***	-0.21***	-0.32***	-0.16***	-0.14***	-0.28***
W12	-0.15***	-0.29***	-0.15***	-0.18***	-0.30***	-0.13***	-0.26***	-0.18***	-0.14***	-0.23***
W13	-0.16***	-0.29***	-0.20***	-0.19***	-0.32***	-0.18***	-0.24***	-0.13***	-0.19***	-0.22***
W14	-0.05	-0.18***	-0.15***	-0.11***	-0.21***	-0.17***	-0.14***	-0.04	-0.17***	-0.11***
W15	0.05	-0.14***	-0.07	-0.06	-0.15***	-0.13***	-0.06	0.02	-0.16***	-0.04
W16	0.14***	-0.03	-0.02	0.05	-0.05	0.01	0.05	0.07	-0.05	0.05
W17	0.14***	-0.06	0.01	0.03	-0.07	0.01	0.02	0.03	-0.07	0.03
W18	-0.07	-0.13***	-0.05	-0.07	-0.12***	-0.10**	-0.10**	-0.06	-0.06	-0.04
W19	-0.13***	-0.13***	-0.09*	-0.11***	-0.21***	-0.12***	-0.17***	-0.18***	-0.03	-0.10**
W20	-0.14***	-0.15***	-0.09*	-0.13***	-0.25***	-0.14***	-0.17***	-0.19***	-0.06	-0.13***
W21	-0.12***	-0.17***	-0.08*	-0.10**	-0.26***	-0.11***	-0.14***	-0.14***	-0.06	-0.09*
W22	-0.09*	-0.16***	-0.07	-0.10**	-0.18***	-0.18***	-0.14***	-0.03	-0.09*	-0.08*
W23	-0.02	-0.17***	-0.08*	-0.06	-0.16***	-0.12***	-0.11***	-0.07	-0.01	-0.04
W24	0.20***	0.10**	0.08*	0.13***	0.16***	0.14***	0.17***	0.01	0.09*	0.09*

Note: ***, **, and * denote significance at 1%, 5%, and 10% levels of significance, respectively.

Table 5.2.14: Rolling Correlation between Gold and Equity Sector Indices of Canada

Window Width	BM	CD	CS	EN	FIN	HC	IND	TECH	TEL	UT
W1	-0.18***	-0.17***	-0.18***	0.06	-0.21***	-0.17***	-0.18***	-0.12***	-0.06	-0.08*
W2	-0.23***	-0.20***	-0.22***	0.08*	-0.19***	-0.16***	-0.19***	-0.21***	-0.09*	-0.03
W3	-0.08*	-0.13***	-0.14***	0.14***	-0.13***	-0.08*	-0.16***	-0.15***	-0.02	-0.01
W4	0.15***	0.04	0.06	0.21***	0.07	0.05	-0.04	-0.01	0.05	0.01
W5	0.13***	0.01	-0.01	0.13***	0.05	-0.04	-0.01	0.03	0.03	0.03
W6	0.20***	-0.01	-0.05	0.13***	-0.01	-0.04	0.03	0.06	-0.07	0.02
W7	0.22***	0.01	0.03	0.12***	0.02	-0.04	0.03	0.06	-0.09*	0.02
W8	0.16***	-0.16***	-0.02	0.01	-0.12***	-0.16***	-0.08*	-0.16***	-0.12***	-0.07
W9	0.16***	-0.16***	-0.02	0.01	-0.12***	-0.16***	-0.08*	-0.16***	-0.12***	-0.07
W10	0.17***	-0.18***	-0.06	-0.06	-0.20***	-0.15***	-0.15***	-0.18***	-0.14***	-0.11***
W11	0.14***	-0.18***	-0.03	-0.10**	-0.19***	-0.16***	-0.16***	-0.19***	-0.14***	-0.14***
W12	0.22***	-0.09*	-0.02	-0.12***	-0.14***	-0.03	-0.14***	-0.10**	-0.12***	-0.08*
W13	0.17***	-0.16***	-0.10**	-0.15***	-0.21***	-0.12***	-0.18***	-0.11***	-0.12***	-0.13***
W14	0.20***	-0.12***	-0.13***	-0.07	-0.18***	-0.12***	-0.12***	-0.09*	-0.08*	-0.05
W15	0.31***	-0.08*	-0.08*	-0.01	-0.10**	-0.07	-0.06	-0.06	0.04	0.01
W16	0.41***	0.01	0.07	0.14***	0.05	0.03	0.05	0.02	0.09*	0.13***
W17	0.40***	-0.04	0.02	0.03	0.01	0.03	-0.01	-0.01	0.07	0.10**
W18	0.28***	-0.12***	-0.10**	-0.16***	-0.21***	0.01	-0.16***	-0.08*	0.01	-0.07
W19	0.23***	-0.25***	-0.23***	-0.26***	-0.36***	0.01	-0.26***	-0.20***	-0.02	-0.15***
W20	0.25***	-0.26***	-0.24***	-0.25***	-0.35***	0.01	-0.26***	-0.21***	-0.02	-0.12***
W21	0.23***	-0.33***	-0.31***	-0.27***	-0.39***	-0.04	-0.28***	-0.24***	-0.04	-0.10**
W22	0.23***	-0.10**	-0.11***	-0.09*	-0.18***	0.02	-0.10**	-0.04	0.05	0.02
W23	0.24***	-0.09*	-0.12***	-0.08*	-0.14***	-0.07	-0.08*	-0.04	-0.01	0.02
W24	0.35***	0.22***	0.12***	0.13***	0.19***	0.05	0.20***	0.25***	0.22***	0.27***

Note: ***, **, and * denote significance at 1%, 5%, and 10% levels of significance, respectively.

Table 5.2.15: Rolling Correlation between Gold and Equity Sector Indices of South Africa

Window Width	BM	CD	CS	EN	FIN	HC	IND	TECH	TEL
W1	0.07	-0.04	-0.04	0.15***	-0.08*	-0.08*	-0.05	-0.11***	-0.07
W2	0.19***	0.02	0.04	0.27***	-0.07	0.05	-0.01	-0.05	-0.08*
W3	0.15***	0.02	0.10**	0.21***	-0.05	0.01	0.01	0.05	-0.07
W4	0.29***	0.08*	0.16***	0.31***	0.01	0.09*	0.06	0.10**	-0.01
W5	0.14***	-0.02	0.04	0.18***	-0.04	0.01	-0.03	0.05	-0.06
W6	0.27***	-0.05	-0.02	0.17***	-0.07	-0.10**	-0.06	0.02	-0.11***
W7	0.31***	-0.03	-0.01	0.18***	-0.05	-0.09*	-0.02	0.01	-0.10**

W8	0.25***	-0.14***	-0.07	0.13***	-0.17***	-0.12***	-0.10**	-0.09*	-0.17***
W9	0.03	-0.30***	-0.24***	-0.11***	-0.33***	-0.20***	-0.19***	-0.30***	-0.27***
W10	0.07	-0.28***	-0.24***	-0.14***	-0.39***	-0.19***	-0.21***	-0.31***	-0.27***
W11	0.01	-0.28***	-0.28***	-0.21***	-0.42***	-0.22***	-0.24***	-0.33***	-0.29***
W12	0.06	-0.12***	-0.12***	-0.05	-0.26***	-0.12***	-0.20***	-0.15***	-0.20***
W13	-0.04	-0.18***	-0.20***	-0.17***	-0.28***	-0.14***	-0.27***	-0.18***	-0.25***
W14	0.04	-0.15***	-0.15***	-0.12***	-0.22***	-0.10**	-0.20***	-0.14***	-0.15***
W15	0.16***	-0.14***	-0.12***	-0.03	-0.17***	-0.10**	-0.14***	-0.10**	-0.13***
W16	0.29***	-0.11***	-0.02	0.14***	-0.09*	-0.07	-0.05	-0.02	-0.09*
W17	0.35***	-0.10**	0.01	0.14***	-0.05	-0.06	-0.05	-0.01	-0.10**
W18	0.18***	-0.20***	-0.13***	0.01	-0.20***	-0.11***	-0.15***	-0.06	-0.16***
W19	0.14***	-0.47***	-0.37***	-0.07	-0.48***	-0.28***	-0.41***	-0.20***	-0.31***
W20	0.18***	-0.47***	-0.29***	-0.05	-0.51***	-0.24***	-0.46***	-0.16***	-0.29***
W21	0.20***	-0.43***	-0.15***	-0.05	-0.50***	-0.19***	-0.45***	-0.11***	-0.30***
W22	0.20***	-0.31***	-0.07	0.08*	-0.42***	-0.04	-0.35***	-0.08*	-0.25***
W23	0.12***	-0.35***	-0.10**	-0.01	-0.42***	-0.15***	-0.39***	-0.20***	-0.30***
W24	0.20***	-0.24***	-0.13***	-0.10**	-0.30***	-0.17***	-0.30***	-0.14***	-0.21***

Note: ***, **, and * denote significance at 1%, 5%, and 10% levels of significance, respectively.

Panel C: Key Currencies Countries of Gold

Table 5.2.16: Rolling Correlation between Gold and Equity Sector Indices of Switzerland

Window Width	BM	CD	CS	FIN	HC	IND	TECH	TEL	UT
W1	-0.02	0.03	0.04	0.03	-0.02	0.05	0.03	0.03	0.05
W2	0.02	0.02	0.01	0.03	0.07	0.04	-0.04	0.01	-0.01
W3	0.09*	0.02	0.02	0.06	0.10**	0.07	-0.01	0.07	-0.01
W4	0.18***	0.12***	0.12***	0.17***	0.16***	0.16***	0.06	0.16***	0.01
W5	0.20***	0.09*	0.09*	0.14***	0.10**	0.20***	0.08*	0.10**	0.08*
W6	0.18***	0.11***	0.09*	0.08*	0.07	0.22***	0.08*	0.01	0.05
W7	0.20***	0.09*	0.09*	0.14***	0.10**	0.20***	0.08*	0.10**	0.08*
W8	0.24***	0.20***	0.22***	0.15***	0.12***	0.24***	0.20***	0.15***	0.11***
W9	0.19***	0.02	0.03	0.01	-0.05	0.12***	0.09*	0.03	-0.04
W10	0.08*	-0.06	-0.06	-0.07	-0.07	0.03	-0.03	-0.02	-0.08*
W11	0.03	-0.07	-0.08*	-0.07	-0.08*	0.01	-0.05	-0.05	-0.13***
W12	0.12***	0.08*	0.08*	0.06	0.04	0.10**	0.02	0.07	-0.08*
W13	0.09*	0.09*	0.14***	0.01	0.13***	0.08*	0.05	0.04	-0.02
W14	0.10**	0.09*	0.11***	0.01	0.14***	0.10**	0.07	0.06	-0.01
W15	0.06	0.07	0.11***	0.01	0.11***	0.07	0.05	-0.03	-0.03
W16	0.07	0.08*	0.11***	0.06	0.03	0.10**	0.08*	0.01	0.01

W17	0.07	0.09*	0.10**	0.06	0.03	0.09*	0.02	-0.04	0.01
W18	0.30***	0.34***	0.31***	0.26***	0.29***	0.26***	0.18***	-0.05	0.13***
W19	0.19***	0.16***	0.17***	0.07	0.18***	0.07	0.03	-0.13***	0.05
W20	0.02	-0.12***	-0.04	-0.17***	-0.03	-0.16***	-0.17***	-0.10**	-0.04
W21	-0.11***	-0.24***	-0.15***	-0.30***	-0.16***	-0.26***	-0.21***	-0.14***	-0.08*
W22	0.11***	0.03	0.05	-0.07	0.01	0.03	-0.01	0.05	-0.01
W23	0.09*	0.05	0.10**	-0.03	0.06	0.04	-0.02	0.06	0.02
W24	0.19*	0.20***	0.20***	0.28***	0.16***	0.20***	0.12***	0.26***	0.19***

Note: ***, **, and * denote significance at 1%, 5%, and 10% levels of significance, respectively.

Table 5.2.17: Rolling Correlation between Gold and Equity Sector Indices of UK

Window Width	**BM**	**CD**	**CS**	**EN**	**FIN**	**HC**	**IND**	**TECH**	**TEL**	**UT**
W1	-0.07	-0.04	-0.06	0.05	-0.08*	-0.07	-0.05	0.02	-0.06	-0.11***
W2	-0.03	-0.07	-0.04	0.02	-0.08*	-0.06	-0.08*	-0.09*	-0.11	0.01
W3	-0.02	-0.05	-0.04	0.02	-0.06	-0.06	-0.08*	-0.06	-0.09*	0.02
W4	0.01	-0.02	-0.02	0.15***	0.02	0.03	-0.02	-0.01	-0.01	0.04
W5	0.05	-0.01	0.04	0.22***	0.03	0.02	0.01	0.07	0.03	0.05
W6	0.31***	0.05	0.08*	0.27***	0.05	-0.05	0.12***	0.14***	-0.04	0.01
W7	0.35***	0.10**	0.15***	0.30***	0.11***	-0.02	0.17***	0.21***	-0.01	0.08*
W8	0.30***	-0.01	0.03	0.22***	-0.01	-0.08*	0.10**	0.13***	0.02	0.04
W9	0.02	-0.22***	-0.22***	-0.06	-0.21***	-0.21***	-0.15***	-0.19***	-0.20***	-0.15***
W10	-0.04	-0.25***	-0.22***	-0.06	-0.26***	-0.17***	-0.21***	-0.23***	-0.23***	-0.17***
W11	0.08*	-0.07	-0.01	0.06	-0.08*	0.01	-0.02	-0.01	-0.09*	-0.06
W12	0.08*	-0.07	-0.01	0.06	-0.08*	0.01	-0.02	-0.01	-0.09*	-0.06
W13	0.06	-0.07	-0.02	0.03	-0.11***	-0.06	-0.06	-0.05	-0.10**	-0.08*
W14	0.17***	-0.01	0.03	0.06	-0.02	-0.08*	0.01	0.03	-0.04	-0.05
W15	0.23***	0.03	0.07	0.10**	0.01	-0.05	0.04	0.05	-0.03	-0.03
W16	0.34***	0.10**	0.15***	0.21***	0.10**	0.04	0.12***	0.07	0.01	0.04
W17	0.33***	0.02	0.08*	0.11***	0.02	-0.04	0.04	-0.01	-0.06	-0.04
W18	0.06	-0.11***	-0.07	-0.02	-0.18***	-0.08*	-0.13***	-0.10**	-0.10**	-0.09*
W19	-0.02	-0.33***	-0.17	-0.06	-0.47***	-0.09*	-0.37***	-0.22***	-0.31***	-0.18***
W20	0.02	-0.25***	-0.07	-0.01	-0.45***	-0.01	-0.33***	-0.14***	-0.22***	-0.07
W21	0.04	-0.25***	-0.01	0.01	-0.51***	0.02	-0.35***	-0.14***	-0.20***	-0.05
W22	0.18***	0.14***	0.20***	0.12***	-0.06	0.10**	0.01	0.07	0.10**	0.13***
W23	0.16***	0.01	0.09*	0.10**	-0.13***	0.08*	-0.07	0.02	-0.03	0.01
W24	0.15***	0.06	0.15***	0.23***	0.01	0.22***	0.02	-0.01	0.15***	0.08*

Note: ***, **, and * denote significance at 1%, 5%, and 10% levels of significance, respectively.

Table 5.2.18: Rolling Correlation between Gold and Equity Sector Indices of Japan

Window Width	BM	CD	CS	EN	FIN	HC	IND	TECH	TEL	UT
W1	0.03	0.07	0.07	0.01	0.02	0.03	0.02	-0.01	-0.03	-0.01
W2	0.04	0.05	0.06	0.06	0.01	0.05	0.01	0.01	-0.01	0.01
W3	0.06	-0.02	0.02	0.04	-0.01	-0.04	0.04	0.02	0.01	0.07
W4	0.09*	-0.06	-0.06	-0.04	-0.02	-0.10**	-0.02	-0.05	-0.03	0.04
W5	0.01	0.01	0.02	0.05	-0.02	0.01	0.02	0.01	0.05	-0.06
W6	0.16***	0.13***	0.11***	0.19***	0.12***	0.03	0.15***	0.12***	0.08*	0.04
W7	0.25***	0.22***	0.21***	0.25***	0.18***	0.12***	0.25***	0.19***	0.12***	0.11***
W8	0.25***	0.24***	0.24***	0.29***	0.20***	0.19***	0.24***	0.22***	0.17***	0.11***
W9	0.35***	0.33***	0.34***	0.37***	0.27***	0.28***	0.37***	0.34***	0.21***	0.12***
W10	0.25***	0.25***	0.25***	0.29***	0.20***	0.22***	0.27***	0.25***	0.19***	0.10**
W11	0.26***	0.25***	0.25***	0.29***	0.20***	0.23***	0.28***	0.25***	0.18***	0.11***
W12	0.18***	0.18***	0.18***	0.13***	0.16***	0.16***	0.19***	0.18***	0.17***	0.11***
W13	0.18***	0.16***	0.15***	0.13***	0.11***	0.16***	0.18***	0.19***	0.18***	0.08*
W14	0.20***	0.14***	0.15***	0.16***	0.16***	0.13***	0.19***	0.18***	0.16***	0.07
W15	0.22***	0.19***	0.19***	0.19***	0.21***	0.16***	0.22***	0.21***	0.17***	-0.01
W16	0.23***	0.21***	0.21***	0.19***	0.23***	0.17***	0.22***	0.20***	0.14***	0.04
W17	0.21***	0.19***	0.19***	0.18***	0.21***	0.16***	0.20***	0.19***	0.11***	-0.01
W18	0.12***	0.10**	0.11***	0.14***	0.11***	0.04	0.11***	0.10**	0.09*	0.04
W19	0.15***	0.12***	0.13***	0.17***	0.11***	0.05	0.13***	0.09*	0.11***	0.07
W20	0.18***	0.15***	0.16***	0.14***	0.14***	0.08*	0.16***	0.12***	0.14***	0.10**
W21	0.17***	0.15***	0.15***	0.10**	0.11***	0.10**	0.16***	0.12***	0.11***	0.14***
W22	0.13***	0.12***	0.11***	0.05	0.07	0.08*	0.12***	0.13***	0.12***	0.13***
W23	0.14***	0.11***	0.11***	0.08*	0.07	0.03	0.11***	0.10**	-0.02	0.11***
W24	0.19***	0.21***	0.13***	0.15***	0.19***	0.10**	0.16***	0.21***	0.07	0.16***

Note: ***, **, and * denote significance at 1%, 5%, and 10% levels of significance, respectively.

Stationarity Tests

Panel A: Major Gold Consuming Countries

Table 5.3.1: Testing for Stationarity of India

Country	With Intercept	With Intercept and Trend
Gold	-74.4167***	-74.4113***
Sector Indices		
Consumer Discretionary	-79.1225***	-79.1310***
Consumer Staples	-74.9181***	-74.9636***
Energy	-76.0497***	-76.0873***

Financials	-80.7859***	-81.0023***
Health Care	-83.9876***	-84.0966***
Industrial	-77.6536***	-77.8655***
Information Technology	-75.3946***	-75.4869***
Telecommunication	-81.8046***	-82.2592***
Basic Materials	-59.5109***	-59.8767***
Utilities	-67.4298***	-68.1368***

Note: The ADF unit root test is the empirical statistic to determine stationary. ***, **, * denotes rejection of the null hypothesis of unit root.

Table 5.3.2: Testing for Stationarity of China

Country	With Intercept	With Intercept and Trend
Gold	-73.9502***	-73.9462***
Sector Indices		
Consumer Discretionary	-69.7380***	-69.7320***
Consumer Staples	-70.4192***	-70.4156***
Energy	-73.3412***	-73.3659***
Financials	-73.3837***	-73.3777***
Health Care	-68.2770***	-68.2883***
Industrial	-69.0568***	-69.0642***
Information Technology	-70.0668***	-70.0608***
Telecommunication	-68.3848***	-68.3794***
Basic Materials	-69.5223***	-69.5310***
Utilities	-70.5704***	-70.562***

Note: The ADF unit root test is the empirical statistic to determine stationary. ***, **, * denotes rejection of the null hypothesis of unit root.

Table 5.3.3: Testing for Stationarity of UAE

Country	With Intercept	With Intercept and Trend
Gold	-64.8128***	-64.8215***
Sector Indices		
Consumer Discretionary	-49.2668***	-49.2767***
Consumer Staples	-64.2630***	-64.2777***
Financials	-55.2547***	-55.3266***
Health Care	-70.9510***	-70.9838***
Industrial	-59.6769***	-59.7081***
Telecommunication	-45.5471***	-45.5554***
Utility	-59.7119***	-59.7372***

Note: The ADF unit root test is the empirical statistic to determine stationary. ***, **, * denotes rejection of the null hypothesis of unit root.

Table 5.3.4: Testing for Stationarity of Egypt

Country	With Intercept	With Intercept and Trend
Gold	-68.0733***	-68.0690***
Sector Indices		
Consumer Discretionary	-64.4893***	-64.4835***
Consumer Staples	-65.0796***	-65.0737***

Energy	-50.4234***	-50.4207***
Financials	-61.2463***	-61.2406***
Health Care	-56.1505***	-56.1452***
Industrial	-63.4207***	-63.4416***
Information Technology	-44.3107***	-44.3580***
Telecommunication	-61.5400***	-61.5351***
Basic Materials	-60.4187***	-60.4241***

Note: The ADF unit root test is the empirical statistic to determine stationary. ***, **, * denotes rejection of the null hypothesis of unit root.

Table 5.3.5: Testing for Stationarity of Indonesia

Country	With Intercept	With Intercept and Trend
Gold	-74.6770***	-74.6749***
Sector Indices		
Consumer Discretionary	-66.7146***	-66.7214***
Consumer Staples	-67.5502***	-67.5489***
Energy	-39.3617***	-39.3581***
Financials	-72.1322***	-72.1530***
Health Care	-69.8274***	-69.8206***
Industrial	-69.6897***	-69.7003***
Information Technology	-50.8883***	-51.5686***
Telecommunication	-45.6740***	-45.6782***
Basic Materials	-67.5349***	-67.5288***
Utilities	-62.0770***	-62.1925***

Note: The ADF unit root test is the empirical statistic to determine stationary. ***, **, * denotes rejection of the null hypothesis of unit root.

Table 5.3.6: Testing for Stationarity of South Korea

Country	With Intercept	With Intercept and Trend
Gold	-45.3574***	-45.3578***
Sector Indices		
Consumer Discretionary	-71.2509***	-71.2536***
Consumer Staples	-70.8446***	-70.8397***
Energy	-71.1896***	-71.1960***
Financials	-70.3095***	-70.3086***
Health Care	-69.9878***	-69.9830***
Industrial	-69.9009***	-69.9148***
Information Technology	-70.5083***	-70.5806***
Telecommunication	-69.8782***	-69.8889***
Basic Materials	-69.9189***	-69.9233***
Utilities	-53.1177***	-53.1183***

Note: The ADF unit root test is the empirical statistic to determine stationary. ***, **, * denotes rejection of the null hypothesis of unit root.

Table 5.3.7: Testing for Stationarity for Turkey

Country	With Intercept	With Intercept and Trend
Gold	-54.5900***	-54.5894***
Sector Indices		
Consumer Discretionary	-48.8731***	-48.8683***
Consumer Staples	-71.5470***	-71.5421***
Energy	-73.8434***	-73.8437***
Financials	-71.8176***	-71.8108***
Industrial	-71.3662***	-71.3592***
Information Technology	-70.9647***	-70.9617***
Telecommunication	-71.9534***	-71.9473***
Utilities	-71.1815***	-71.1747***

Note: The ADF unit root test is the empirical statistic to determine stationary. ***, **, * denotes rejection of the null hypothesis of unit root.

Table 5.3.8: Testing for Stationarity of Russia

Country	With Intercept	With Intercept and Trend
Gold	-68.5569***	-68.5498***
Sector Indices		
Consumer Discretionary	-73.8152***	-73.8961***
Consumer Staples	-66.1023***	-66.0956***
Energy	-72.2716***	-72.2800***
Financials	-71.3954***	-71.4650***
Health Care	-20.2892***	-20.2871***
Industrial	-17.1046***	-17.1157***
Information Technology	-60.9769***	-60.9686***
Telecommunication	-71.4723***	-71.4883***
Basic Materials	-64.6233***	-64.6104***
Utilities	-37.1241***	-37.1255***

Note: The ADF unit root test is the empirical statistic to determine stationary. ***, **, * denotes rejection of the null hypothesis of unit root.

Table 5.3.9: Testing for Stationarity of Saudi Arabia

Country	With Intercept	With Intercept and Trend
Gold	-61.4405***	-61.4599***
Sector Indices		
Consumer Discretionary	-26.5126***	-26.5090***
Consumer Staples	-26.8223***	-26.8259***
Energy	-51.5206***	-51.5131***
Financials	-33.2666***	-33.2725***
Health Care	-48.8774***	-48.90199***
Industrial	-25.5644***	-25.5737***
Telecommunication	-44.8330***	-44.8667***
Basic Materials	-58.3729***	-58.3693***
Utilities	-45.8632***	-45.8701***

Note: The ADF unit root test is the empirical statistic to determine stationary. ***, **, * denotes rejection of the null hypothesis of unit root.

Table 5.3.10: Testing for Stationarity of Thailand

Country	With Intercept	With Intercept and Trend
Gold	-75.9676***	-75.9708***
Sector Indices		
Consumer Discretionary	-70.9913***	-70.9853***
Consumer Staples	-72.5128***	-72.5100***
Energy	-73.4739***	-73.5062***
Financials	-71.3097***	-71.3030***
Health Care	-73.2868***	-73.2798***
Industrial	-70.8787***	-70.8724***
Information Technology	-72.6800***	-72.6738***
Telecommunication	-75.4628***	-75.4563***
Basic Materials	-47.6340***	-47.6486***
Utilities	-76.5935***	-76.5935***

Note: The ADF unit root test is the empirical statistic to determine stationary. ***, **, * denotes rejection of the null hypothesis of unit root.

Table 5.3.11: Testing for Stationarity of Vietnam

Country	With Intercept	With Intercept and Trend
Gold	-57.8422***	-57.8559***
Sector Indices		
Consumer Discretionary	-66.0448***	-66.1536***
Consumer Staples	-53.2222***	-51.6919***
Energy	-51.6919***	-51.6870***
Financials	-48.3664***	-48.3870***
Health Care	-49.5311***	-49.5240***
Industrial	-47.6654***	-47.6716***
Telecommunication	-61.1911***	-61.224***
Basic Materials	-49.6916***	-49.6941***
Utilities	-50.4973***	-50.5129***

Note: The ADF unit root test is the empirical statistic to determine stationary. ***, **, * denotes rejection of the null hypothesis of unit root.

Table 5.3.12: Testing for Stationarity of USA

Country	With Intercept	With Intercept and Trend
Gold	-73.3424***	-73.3438***
Sector Indices		
Consumer Discretionary	-76.4865***	-76.4928***
Consumer Staples	-78.6364***	-78.6307***
Energy	-77.3328***	-77.3844***
Financials	-82.2364***	-82.2287***
Health Care	-76.7103***	-76.7101***
Industrial	-76.2145***	-76.2115***
Information Technology	-77.0713***	-77.1306***
Telecommunication	-44.7678***	-44.8070***
Basic Materials	-75.3919***	-75.3858***
Utilities	-18.4352***	-18.4367***

Note: The ADF unit root test is the empirical statistic to determine stationary. ***, **, * denotes rejection of the null hypothesis of unit root.

Panel B: Major Gold Producing Countries

Table 5.3.13: Testing for Stationarity of Australia

Country	With Intercept	With Intercept and Trend
Gold	-76.5009***	-76.4937***
Sector Indices		
Consumer Discretionary	-71.4605***	-71.4551***
Consumer Staples	-76.3148***	-76.3089***
Energy	-70.4903***	-70.5166***
Financials	-73.6956***	-73.7093***
Health Care	-80.4257***	-80.4396***
Industrial	-72.8683***	-72.8616***
Information Technology	-73.4648***	-73.4581***
Telecommunication	-53.7968***	-53.7970***
Basic Materials	-72.7040***	-72.7262***
Utilities	-74.0731***	-74.0804***

Note: The ADF unit root test is the empirical statistic to determine stationary. ***, **, * denotes rejection of the null hypothesis of unit root.

Table 5.3.14: Testing for Stationarity of Canada

Country	With Intercept	With Intercept and Trend
Gold	-76.3463***	-76.3390***
Sector Indices		
Consumer Discretionary	-27.9532***	-27.9503***
Consumer Staples	-73.2617***	-73.2549***
Energy	-26.7850***	-26.8891***
Financials	-28.3859***	-28.4282***
Health Care	-70.1832***	-70.1966***
Industrial	-72.9651***	-72.9879***
Information Technology	-71.6211***	-71.6826***
Telecommunication	-74.1752***	-74.1707***
Basic Materials	-73.6232***	-73.6251***
Utilities	-28.3728***	-28.3898***

Note: The ADF unit root test is the empirical statistic to determine stationary. ***, **, * denotes rejection of the null hypothesis of unit root.

Table 5.3.15: Testing for Stationarity of South Africa

Country	With Intercept	With Intercept and Trend
Gold	-75.3696***	-75.3647***
Sector Indices		
Consumer Discretionary	-67.5039***	-67.5218***
Consumer Staples	-68.3281***	-68.3411***
Energy	-67.0164***	-67.1220***
Financials	-53.2139***	-53.2189***

Health Care	-53.0626***	-53.1010***
Industrial	-72.9264***	-72.9437***
Information Technology	-69.2245***	-69.2304***
Telecommunication	-51.8785***	-51.8952***
Basic Materials	-67.6818***	-67.6930***

Note: The ADF unit root test is the empirical statistic to determine stationary. ***, **, * denotes rejection of the null hypothesis of unit root.

Panel C: Key Currency Countries

Table 5.3.16: Testing for Stationarityof Switzerland

Country	With Intercept	With Intercept and Trend
Gold	-75.3696***	-75.3647***
Sector Indices		
Consumer Discretionary	-69.8132***	-69.8130***
Consumer Staples	-72.2043***	-72.1988***
Energy	-49.1031***	-49.1384***
Financials	-66.3559***	-66.3497***
Health Care	-33.6876***	-33.6945***
Industrial	-67.4511***	-67.4513***
Information Technology	-67.2057***	-67.2270***
Telecommunication	-70.8274***	-70.8323***
Basic Materials	-71.4158***	-71.4172***
Utilities	-73.3466***	-73.3877***

Note: The ADF unit root test is the empirical statistic to determine stationary. ***, **, * denotes rejection of the null hypothesis of unit root.

Table 5.3.17: Testing for Stationarity of UK

Country	With Intercept	With Intercept and Trend
Gold	-74.8415***	-74.8360***
Sector Indices		
Consumer Discretionary	-68.0501***	-68.0492***
Consumer Staples	-53.8186***	-53.8154***
Energy	-35.1993***	-35.2077***
Financials	-71.1924***	-71.1863***
Health Care	-73.0874***	-73.0816***
Industrial	-67.1873***	-67.1851***
Information Technology	-67.1750***	-67.2859***
Telecommunication	-47.4568***	-47.4562***
Basic Materials	-72.1758***	-72.1737***
Utilities	-45.8152***	-45.8261***

Note: The ADF unit root test is the empirical statistic to determine stationary. ***, **, * denotes rejection of the null hypothesis of unit root.

Table 5.3.18: Testing for Stationarity of Japan

Country	With Intercept	With Intercept and Trend
Gold	-73.4992***	-73.5006***
Sector Indices		
Consumer Discretionary	-71.6262***	-71.6257***
Consumer Staples	-71.3224***	-71.3205***
Energy	-71.9362***	-71.9449***
Financials	-67.3107***	-67.3051***
Health Care	-75.7331***	-75.7353***
Industrial	-70.2553***	-70.2518***
Information Technology	-66.4632***	-66.5039***
Telecommunication	-72.6502***	-72.7184***
Basic Materials	-71.0298***	-71.0260***
Utilities	-71.4255***	-71.4224***

Note: The ADF unit root test is the empirical statistic to determine stationary. ***, **, * denotes rejection of the null hypothesis of unit root.

Residual Diagnosis Test for Quantile Model

Table 5.4.1b: Residual Diagnostic Test (India)

Sector Indices	ARCH LM Test	Prob.	LB Q Statistics	Prob.	Lag
Consumer Discretionary	10.7416	0.4652	8.0876	0.705	11
Consumer Staples	10.3713	0.4973	8.0774	0.706	11
Energy	10.5848	0.4787	9.3360	0.591	11
Financials	10.5993	0.4774	8.5636	0.662	11
Health Care	10.9160	0.4503	8.1850	0.697	11
Industrial	11.4674	0.4050	8.2933	0.687	11
Information Technology	11.5078	0.4017	7.9428	0.718	11
Telecommunication	10.6396	0.4739	7.8921	0.723	11
Basic Materials	10.4863	0.4872	8.3404	0.683	11
Utilities	10.0271	0.5280	8.5258	0.666	11

Table 5.4.2b: Residual Diagnostic Test (China)

Sector Indices	ARCH LM Test	Prob.	LB Q Statistics	Prob.	Lag
Consumer Discretionary	11.2032	0.7968	13.650	0.625	16
Consumer Staples	5.5087	0.7021	4.2443	0.834	8
Energy	11.0852	0.7465	12.287	0.657	15
Financials	11.1220	0.6764	10.736	0.707	14
Health Care	5.1645	0.6399	3.6979	0.814	7
Industrial	10.8982	0.8157	13.653	0.625	16
Information Technology	5.0947	0.6484	7.2505	0.778	11
Telecommunication	8.9720	0.7751	10.922	0.617	13
Basic Materials	13.4227	0.7659	15.731	0.611	18
Utilities	12.6936	0.8094	15.254	0.644	18

Table 5.4.3b: Residual Diagnostic Test (UAE)

Sector Indices	ARCH LM Test	Prob.	LB Q Statistics	Prob.	Lag
Consumer Discretionary	6.5253	0.9249	14.701	0.326	13
Consumer Staples	6.6057	0.9213	16.736	0.212	13
Financials	6.5048	0.9258	14.452	0.343	13
Health Care	6.4337	0.9289	14.575	0.335	13
Industrial	6.4950	0.9263	14.979	0.309	13
Telecommunication	6.5149	0.9254	14.642	0.330	13
Utilities	6.5387	0.9243	16.937	0.202	13

Table 5.4.4b: Residual Diagnostic Test (Egypt)

Sector Indices	ARCH LM Test	Prob.	LB Q Statistics	Prob.	Lag
Consumer Discretionary	0.0186	0.9606	6.0733	0.531	07
Consumer Staples	0.0186	0.8246	6.0924	0.529	07
Energy	0.0261	0.8002	7.5805	0.817	12
Financials	0.0184	1.0000	6.1400	0.523	07
Health Care	0.0278	0.8567	6.8426	0.654	09
Industrial	0.0187	0.9102	6.0126	0.538	07
Information Technology	0.0262	0.9204	7.5548	0.819	12
Telecommunication	0.0183	1.0000	6.0574	0.533	07
Basic Materials	0.0189	0.7358	6.0928	0.529	07

Table 5.4.5b: Residual Diagnostic Test (Indonesia)

Sector Indices	ARCH LM Test	Prob.	LB Q Statistics	Prob.	Lag
Consumer Discretionary	13.7434	0.7457	19.990	0.333	18
Consumer Staples	10.6393	0.8747	19.794	0.285	17
Energy	19.8511	0.4036	18.523	0.488	19
Financials	12.6771	0.8547	21.078	0.333	19
Health Care	9.2505	0.8147	16.752	0.270	14
Industrial	9.2450	0.8644	17.945	0.266	15
Information Technology	6.0092	0.9989	21.056	0.394	20
Telecommunication	7.5547	0.5796	7.4972	0.585	9
Basic Materials	12.6730	0.8106	19.299	0.374	18
Utilities	7.1151	0.9302	15.238	0.362	14

Table 5.4.6b: Residual Diagnostic Test (South Korea)

Sector Indices	ARCH LM Test	Prob.	LB Q Statistics	Prob.	Lag
Consumer Discretionary	10.0551	0.9301	24.835	0.130	18
Consumer Staples	9.7358	0.9402	24.471	0.140	18
Energy	7.8161	0.9542	21.762	0.151	10
Financials	2.7342	0.8414	12.793	0.046	6
Health Care	2.0117	0.5700	12.340	0.006	3
Industrial	10.0503	0.9303	24.723	0.133	18
Information Technology	9.4934	0.7982	10.004	0.762	14
Telecommunication	2.7342	0.8414	12.793	0.046	6
Basic Materials	8.6099	0.8552	18.677	0.178	14
Utilities	10.2585	0.7430	10.122	0.753	14

Table 5.4.7b: Residual Diagnostic Test (Turkey)

Sector Indices	ARCH LM Test	Prob.	LB Q Statistics	Prob.	Lag
Consumer Discretionary	24.2604	0.0608	11.058	0.748	15
Consumer Staples	17.0010	0.313	2.3732	0.967	8
Energy	14.7461	0.1416	6.3748	0.783	10
Financials	29.4905	0.0056	9.0876	0.766	13
Industrial	45.9170	0.0005	15.032	0.721	19
Information Technology	6.1682	0.8619	7.3668	0.769	11
Telecommunication	29.6249	0.513	8.4345	0.814	13
Utilities	11.3545	0.448	0.8004	0.977	5

Table 5.4.8b: Residual Diagnostic Test (Russia)

Sector Indices	ARCH LM Test	Prob.	LB Q Statistics	Prob.	Lag
Consumer Discretionary	2.7330	0.7411	2.7143	0.744	5
Energy	12.8290	0.8016	17.100	0.516	18
Financials	10.2545	0.8034	8.7119	0.892	15
Industrial	5.6953	0.8402	9.1714	0.516	10
Telecommunication	6.4387	0.7772	7.2802	0.699	10
Basic Materials	12.6730	0.8106	19.299	0.374	18
Utilities	10.2585	0.7430	10.122	0.753	14

Table 5.4.9b: Residual Diagnostic Test (Saudi Arabia)

Sector Indices	ARCH LM Test	Prob.	LB Q Statistics	Prob.	Lag
Consumer Discretionary	6.8037	0.9120	16.603	0.218	13
Consumer Staples	6.5558	0.9236	16.688	0.214	13
Energy	5.9264	0.9488	13.404	0.417	13
Financials	7.1467	0.8944	16.870	0.205	13
Health Care	0.8314	0.3619	1.7352	0.188	01
Industrial	6.6218	0.9206	16.665	0.215	13
Telecommunication	6.7453	0.9148	16.798	0.209	13
Basic Materials	6.6806	0.9179	16.676	0.215	13
Utilities	6.7448	0.9148	17.004	0.199	13

Table 5.4.10b: Residual Diagnostic Test (Thailand)

Sector Indices	ARCH LM Test	Prob.	LB Q Statistics	Prob.	Lag
Consumer Discretionary	12.8307	0.5399	15.399	0.351	14
Consumer Staples	12.4467	0.5705	15.059	0.374	14
Energy	12.5292	0.5639	15.166	0.367	14
Financials	12.6079	0.5576	14.986	0.379	14
Health Care	12.2097	0.5895	14.966	0.381	14
Industrial	12.5885	0.5592	14.724	0.397	14
Information Technology	13.0867	0.5197	13.800	0.465	14
Telecommunication	12.2933	0.5828	14.755	0.395	14
Basic Materials	12.0682	0.6008	15.119	0.370	14
Utilities	12.6597	0.5535	14.840	0.389	14

Table 5.4.11b: Residual Diagnostic Test (Vietnam)

Sector Indices	ARCH LM Test	Prob.	LB Q Statistics	Prob.	Lag
Consumer Discretionary	5.4719	0.9873	19.463	0.194	15
Consumer Staples	5.5346	0.9866	20.286	0.161	15
Energy	8.7548	0.8900	17.893	0.268	15
Financials	5.3728	0.9885	19.220	0.204	15
Health Care	5.7563	0.9836	20.175	0.165	15
Industrial	5.5072	0.9869	19.997	0.172	15
Telecommunication	5.4561	0.9875	19.709	0.183	15
Basic Materials	5.5844	0.9859	19.271	0.202	15
Utilities	5.7214	0.9841	19.865	0.177	15

Table 5.4.12b: Residual Diagnostic Test (US)

Sector Indices	ARCH LM Test	Prob.	LB Q Statistics	Prob.	Lag
Consumer Discretionary	7.3709	0.8820	10.476	0.655	13
Consumer Staples	8.8619	0.7833	10.458	0.656	13
Energy	9.4286	0.7399	8.8647	0.783	13
Financials	7.5604	0.8710	11.206	0.594	13
Health Care	8.6969	0.7954	10.286	0.670	13
Industrial	7.77621	0.8579	11.111	0.602	13
Information Technology	9.0202	0.7714	10.848	0.624	13
Telecommunication	8.2814	0.8248	9.8834	0.703	13
Basic Materials	13.2227	0.9623	25.321	0.389	24
Utilities	9.7220	0.7165	9.4129	0.741	13

Table 5.4.13b: Residual Diagnostic Test (Australia)

Sector Indices	ARCH LM Test	Prob.	LB Q Statistics	Prob.	Lag
Consumer Discretionary	13.9662	0.7857	22.073	0.281	19
Consumer Staples	5.3824	0.3710	0.6240	0.987	5
Energy	10.6773	0.5568	13.794	0.314	12
Financials	5.0468	0.7526	7.9327	0.440	8
Health Care	13.4719	0.7628	22.356	0.217	18
Industrial	15.888	0.255	10.9818	0.612	13
Information Technology	4.4215	0.8816	20.935	0.283	9
Telecommunication	11.3524	0.8788	11.125	0.889	18
Basic Materials	11.1946	0.5945	14.485	0.341	13
Utilities	5.0823	0.7487	6.2806	0.616	8

Table 5.4.14b: Residual Diagnostic Test (Canada)

Sector Indices	ARCH LM Test	Prob.	LB Q Statistics	Prob.	Lag
Consumer Discretionary	10.8098	0.8211	20.977	0.179	16
Consumer Staples	9.5836	0.8875	21.080	0.175	16
Energy	9.6805	0.8828	19.674	0.235	16
Financials	9.4329	0.8945	21.471	0.161	16
Health Care	9.8114	0.8763	20.492	0.199	16
Industrial	9.4861	0.8921	20.579	0.195	16
Information Technology	9.7995	0.8769	21.155	0.173	16
Telecommunication	9.9399	0.8697	18.839	0.277	16
Basic Materials	8.8961	0.9176	31.937	0.010	16
Utilities	9.8639	0.8736	12.543	0.484	16

Table 5.4.15b: Residual Diagnostic Test (South Africa)

Sector Indices	ARCH LM Test	Prob.	LB Q Statistics	Prob.	Lag
Consumer Discretionary	11.6937	0.3871	12.142	0.353	11
Consumer Staples	10.5379	0.3087	5.9224	0.748	9
Energy	14.2311	0.2205	9.7852	0.550	11
Financials	12.7450	0.1745	6.7253	0.666	9
Health Care	14.0474	0.2304	10.536	0.483	11
Industrial	11.2557	0.2586	6.0047	0.739	9
Information Technology	11.4496	0.2461	6.6006	0.679	9
Telecommunication	12.5624	0.3229	9.2126	0.602	11
Basic Materials	11.05118	0.4390	11.897	0.371	11

Table 5.4.16b: Residual Diagnostic Test (Switzerland)

Sector Indices	ARCH LM Test	Prob.	LB Q Statistics	Prob.	Lag
Consumer Discretionary	8.9825	0.8322	10.872	0.696	14
Consumer Staples	10.0124	0.9031	14.095	0.660	17
Energy	10.6777	0.3832	6.4458	0.777	10
Financials	14.1065	0.7774	15.299	0.703	19
Health Care	4.9711	0.8368	8.9323	0.444	9
Industrial	12.7495	0.8062	15.342	0.638	18
Information Technology	10.1481	0.8973	13.629	0.693	17
Telecommunication	8.9198	0.7098	9.7105	0.641	12
Basic Materials	8.7118	0.9248	13.691	0.622	16
Utilities	10.0778	0.8625	12.884	0.681	16

Table 5.4.17b: Residual Diagnostic Test (UK)

Sector Indices	ARCH LM Test	Prob.	LB Q Statistics	Prob.	Lag
Consumer Discretionary	7.1111	0.8963	16.870	0.205	13
Consumer Staples	10.1584	0.8582	17.906	0.329	16
Energy	8.7330	0.8478	17.619	0.225	14
Financials	15.4889	0.6911	21.697	0.300	19
Health Care	8.4844	0.8107	17.461	0.179	13
Industrial	8.5775	0.6608	15.761	0.150	11
Information Technology	4.4215	0.8816	13.872	0.127	9
Telecommunication	15.1365	0.7139	20.201	0.383	19
Basic Materials	8.9389	0.8807	17.168	0.143	15
Utilities	9.9092	0.8713	17.360	0.363	16

Table 5.4.18b: Residual Diagnostic Test (Japan)

Sector Indices	ARCH LM Test	Prob.	LB Q Statistics	Prob.	Lag
Consumer Discretionary	17.4277	0.1342	10.549	0.568	12
Consumer Staples	15.161	0.2970	18.022	0.158	13
Energy	14.5080	0.2061	9.854	0.544	11
Financials	14.9812	0.1834	9.328	0.592	11
Health Care	19.0470	0.2116	16.519	0.348	15
Industrial	18.7111	0.1323	16.513	0.223	13
Information Technology	20.9408	0.2824	18.202	0.442	18
Telecommunication	18.6878	0.2852	16.296	0.433	16
Basic Materials	19.308	0.2530	18.383	0.302	16
Utilities	20.1061	0.0926	14.941	0.311	13

Residual Diagnosis Test for Quantile Model during Crises

Table 5.5.1b: Residual Diagnostic Test (India)

Sector Indices	ARCH LM Test	Prob.	LB Q Statistics	Prob.	Lag
Consumer Discretionary	15.3662	0.1663	8.4746	0.670	11
Consumer Staples	10.3713	0.4973	8.0976	0.705	11
Energy	10.5511	0.4816	9.3002	0.594	11
Financials	10.1633	0.5158	8.9952	0.622	11
Health Care	11.6190	0.3930	7.3852	0.767	11
Industrial	11.1367	0.4319	7.9164	0.721	11
Information Technology	11.7296	0.3843	7.4959	0.758	11
Telecommunication	16.1479	0.1357	8.2544	0.690	11
Basic Materials	10.3122	0.5025	8.4703	0.671	11
Utilities	10.2126	0.5114	8.1605	0.699	11

Table 5.5.2b: Residual Diagnostic Test (China)

Sector Indices	ARCH LM Test	Prob.	LB Q Statistics	Prob.	Lag
Consumer Discretionary	4.7463	0.6909	4.7389	0.692	7
Consumer Staples	12.6566	0.8557	12.772	0.850	19
Energy	5.4232	0.6085	3.5324	0.832	7
Financials	10.8749	0.6958	11.371	0.657	8
Health Care	4.5885	0.7100	4.1523	0.762	15
Industrial	4.9261	0.6690	4.1868	0.758	7
Information Technology	5.1529	0.6413	5.1448	0.642	7
Telecommunication	8.8718	0.7826	11.202	0.594	13
Basic Materials	5.1119	0.6463	4.0494	0.774	7
Utilities	10.1053	0.6853	9.9071	0.702	13

Table 5.5.3b: Residual Diagnostic Test (UAE)

Sector Indices	ARCH LM Test	Prob.	LB Q Statistics	Prob.	Lag
Consumer Discretionary	7.1747	0.8929	14.560	0.336	13
Consumer Staples	6.6268	0.9203	17.686	0.170	13
Financials	7.9289	0.8482	14.775	0.322	13
Health Care	6.3597	0.9321	14.903	0.313	13
Industrial	7.7110	0.8619	15.128	0.299	13
Telecommunication	6.5999	0.9216	14.608	0.332	13
Utilities	6.5491	0.9239	17.718	0.169	13

Table 5.5.4b: Residual Diagnostic Test (Egypt)

Sector Indices	ARCH LM Test	Prob.	LB Q Statistics	Prob.	Lag
Consumer Discretionary	0.0276	1.0000	7.2985	0.606	09
Consumer Staples	0.0275	1.0000	6.9694	0.640	09
Energy	0.0255	1.0000	7.4384	0.827	12
Financials	0.0183	1.0000	6.0831	0.530	07
Health Care	0.0186	1.0000	6.2943	0.506	07
Industrial	0.0188	1.0000	6.3204	0.503	07
Information Technology	0.0262	1.0000	7.4444	0.827	12
Telecommunication	0.0160	1.0000	6.0772	0.531	07
Basic Materials	0.0186	1.0000	5.9315	0.548	07

Table 5.5.5b: Residual Diagnostic Test (Indonesia)

Sector Indices	ARCH LM Test	Prob.	LB Q Statistics	Prob.	Lag
Consumer Discretionary	12.2315	0.8351	19.699	0.350	18
Consumer Staples	9.1176	0.8234	18.670	0.178	14
Energy	13.9897	0.7843	19.741	0.410	19
Financials	3.6183	0.7282	4.6977	0.583	6
Health Care	6.6009	0.4716	3.3411	0.852	7
Industrial	9.1206	0.8711	17.952	0.265	15
Information Technology	5.9261	0.9990	21.128	0.390	20
Telecommunication	5.5520	0.4752	4.2345	0.645	6
Basic Materials	6.2964	0.6141	3.6930	0.884	8
Utilities	7.4226	0.9172	15.152	0.368	14

Table 5.5.6b: Residual Diagnostic Test (South Korea)

Sector Indices	ARCH LM Test	Prob.	LB Q Statistics	Prob.	Lag
Consumer Discretionary	3.0737	0.6886	3.0646	0.690	5
Consumer Staples	8.3884	0.4955	8.5969	0.475	9
Energy	10.5939	0.9367	24.644	0.173	19
Financials	2.9624	0.8885	13.628	0.058	7
Health Care	10.2138	0.9475	25.092	0.158	19
Industrial	11.8663	0.9206	23.932	0.245	20
Information Technology	6.9089	0.6466	7.0604	0.631	9
Telecommunication	2.8262	0.9006	13.136	0.069	7
Basic Materials	8.1221	0.8829	18.501	0.185	14
Utilities	9.4934	0.7982	10.004	0.762	14

Table 5.5.7b: Residual Diagnostic Test (Turkey)

Sector Indices	ARCH LM Test	Prob.	LB Q Statistics	Prob.	Lag
Consumer Discretionary	6.0866	0.7312	6.0842	0.731	9
Consumer Staples	9.7650	0.7792	9.5263	0.796	14
Energy	6.5173	0.9964	6.5274	0.996	19
Financials	11.6346	0.5578	8.2079	0.830	13
Industrial	5.1489	0.6418	0.9639	0.995	7
Information Technology	6.1682	0.8619	7.3668	0.769	11
Telecommunication	5.5520	0.4752	4.2345	0.645	6
Utilities	5.6667	0.3400	5.5851	0.349	5

Table 5.5.8b: Residual Diagnostic Test (Russia)

Sector Indices	ARCH LM Test	Prob.	LB Q Statistics	Prob.	Lag
Consumer Discretionary	4.3013	0.7445	4.1231	0.765	7
Energy	6.9226	0.7327	7.4354	0.684	10
Financials	9.7465	0.7805	9.0829	0.826	14
Industrial	5.5832	0.8490	9.1208	0.521	10
Telecommunication	4.5935	0.7094	4.5570	0.714	7
Basic Materials	6.2964	0.6141	3.6930	0.884	8
Utilities	10.0716	0.8152	10.544	0.784	15

Table 5.5.9b: Residual Diagnostic Test (Saudi Arabia)

Sector Indices	ARCH LM Test	Prob.	LB Q Statistics	Prob.	Lag
Consumer Discretionary	6.9278	0.9058	17.096	0.195	13
Consumer Staples	6.4827	0.9268	16.603	0.218	13
Energy	6.4648	0.9276	13.379	0.419	13
Financials	7.2292	0.8900	17.033	0.198	13
Health Care	0.0009	0.9763	0.0048	0.945	01
Industrial	6.8151	0.9114	17.080	0.196	13
Telecommunication	10.2500	0.6734	24.805	0.209	13
Basic Materials	6.7696	0.9136	16.970	0.201	13
Utilities	7.3112	0.8854	16.900	0.204	13

Table 5.5.10b: Residual Diagnostic Test (Thailand)

Sector Indices	ARCH LM Test	Prob.	LB Q Statistics	Prob.	Lag
Consumer Discretionary	12.2752	0.5842	15.609	0.338	14
Consumer Staples	12.8592	0.5376	15.379	0.353	14
Energy	13.1096	0.5179	14.649	0.403	14
Financials	12.9865	0.5276	14.618	0.405	14
Health Care	12.5153	0.5650	15.012	0.377	14
Industrial	12.1669	0.5929	14.770	0.394	14
Information Technology	13.0788	0.5203	13.605	0.480	14
Telecommunication	12.2696	0.5847	14.611	0.405	14
Basic Materials	12.8233	0.5405	14.564	0.409	14
Utilities	12.5996	0.5583	14.746	0.396	14

Table 5.5.11b: Residual Diagnostic Test (Vietnam)

Sector Indices	ARCH LM Test	Prob.	LB Q Statistics	Prob.	Lag
Consumer Discretionary	5.7876	0.9831	19.898	0.176	15
Consumer Staples	5.8677	0.9819	19.815	0.179	15
Energy	5.6494	0.9851	17.750	0.276	15
Financials	5.7018	0.9843	19.906	0.176	15
Health Care	5.7489	0.9837	20.091	0.168	15
Industrial	5.7835	0.9832	18.974	0.215	15
Telecommunication	5.6188	0.9855	19.493	0.192	15
Basic Materials	5.5906	0.9858	18.807	0.223	15
Utilities	5.6650	0.9848	18.888	0.219	15

Table 5.5.12b: Residual Diagnostic Test (US)

Sector Indices	ARCH LM Test	Prob.	LB Q Statistics	Prob.	Lag
Consumer Discretionary	8.1949	0.8307	9.7374	0.715	13
Consumer Staples	9.4408	0.7389	9.9021	0.702	13
Energy	9.6034	0.7260	8.4989	0.810	13
Financials	14.3031	0.3529	9.7963	0.710	13
Health Care	8.7509	0.7915	9.5886	0.727	13
Industrial	8.9598	0.7760	10.143	0.682	13
Information Technology	8.4107	0.8159	10.539	0.649	13
Telecommunication	8.8620	0.7833	9.4390	0.739	13
Basic Materials	13.7293	0.9525	24.424	0.438	24
Utilities	10.7567	0.6312	9.9076	0.653	13

Table 5.5.13b: Residual Diagnostic Test (Australia)

Sector Indices	ARCH LM Test	Prob.	LB Q Statistics	Prob.	Lag
Consumer Discretionary	13.6221	0.8053	13.590	0.807	19
Consumer Staples	4.8298	0.4370	0.7408	0.981	5
Energy	10.5426	0.5685	10.447	0.577	12
Financials	13.7145	0.8001	24.207	0.188	19
Health Care	11.1731	0.7402	18.920	0.217	15
Industrial	14.5428	0.7512	22.263	0.271	19
Information Technology	14.1891	0.7726	17.689	0.279	15
Telecommunication	11.3682	0.7261	17.689	0.279	15
Basic Materials	6.9284	0.7322	7.4851	0.679	10
Utilities	5.8624	0.6626	5.5052	0.702	8

Table 5.5.14b: Residual Diagnostic Test (Canada)

Sector Indices	ARC H LM Test	Prob.	LB Q Statistics	Prob.	Lag
Consumer Discretionary	10.1786	0.8571	21.773	0.151	16
Consumer Staples	14.4541	0.5649	18.429	0.299	16
Energy	10.3396	0.8483	20.398	0.203	16
Financials	10.3801	0.8460	22.287	0.134	16
Health Care	10.0752	0.8627	21.025	0.178	16
Industrial	9.8598	0.8738	21.257	0.169	16
Information Technology	9.9693	0.8682	20.617	0.194	16
Telecommunication	17.5971	0.3480	17.179	0.374	16
Basic Materials	21.2578	0.1688	33.154	0.107	16
Utilities	10.1595	0.8582	20.326	0.206	16

Table 5.5.15b: Residual Diagnostic Test (South Africa)

Sector Indices	ARCH LM Test	Prob.	LB Q Statistics	Prob.	Lag
Consumer Discretionary	9.4867	0.5771	11.500	0.402	14
Consumer Staples	9.9636	0.3535	4.9072	0.842	9
Energy	11.8951	0.2193	5.5619	0.783	9
Financials	11.0742	0.2707	7.4311	0.592	9
Health Care	13.8399	0.2420	10.461	0.489	11
Industrial	9.8344	0.3641	6.5455	0.684	9
Information Technology	12.1232	0.2065	6.6997	0.668	9
Telecommunication	11.8040	0.3786	9.7084	0.557	9
Basic Materials	12.3976	0.3345	10.565	0.480	11

Table 5.5.16b: Residual Diagnostic Test (Switzerland)

Sector Indices	ARCH LM Test	Prob.	LB Q Statistics	Prob.	Lag
Consumer Discretionary	9.1781	0.6055	10.051	0.526	11
Consumer Staples	9.5869	0.7917	10.801	0.702	14
Energy	10.6717	0.3837	6.5918	0.763	10
Financials	9.1450	0.5184	8.8804	0.543	10
Health Care	13.7587	0.7976	14.773	0.737	19
Industrial	5.3034	0.7247	5.2066	0.735	8
Information Technology	3.9125	0.4180	2.9956	0.559	4
Telecommunication	12.8071	0.8483	14.751	0.738	19
Basic Materials	9.2129	0.8172	10.737	0.707	14
Utilities	10.3849	0.8458	12.896	0.680	16

Table 5.5.17b: Residual Diagnostic Test (UK)

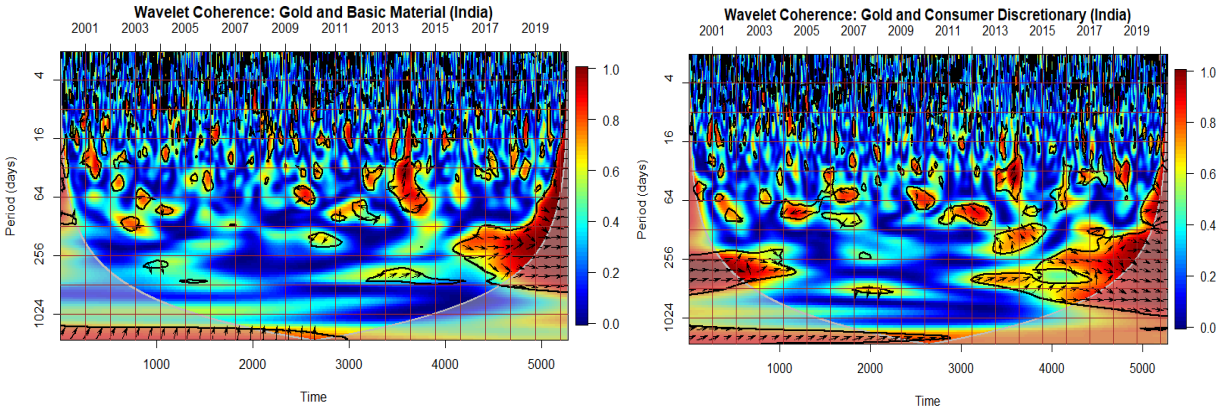
Sector Indices	ARCH LM Test	Prob.	LB Q Statistics	Prob.	Lag
Consumer Discretionary	8.7745	0.6427	14.162	0.224	11
Consumer Staples	9.1924	0.7583	15.763	0.262	12
Energy	14.1202	0.7766	19.272	0.440	19
Financials	10.9545	0.8123	16.582	0.413	16
Health Care	14.3558	0.7056	19.932	0.337	18
Industrial	4.6053	0.8673	4.6144	0.867	9
Information Technology	14.1891	0.7726	19.027	0.455	19
Telecommunication	11.2093	0.7964	16.787	0.400	9
Basic Materials	8.5280	0.7426	16.391	0.174	12
Utilities	4.8018	0.8512	13.646	0.135	9

Table 5.5.18b: Residual Diagnostic Test (Japan)

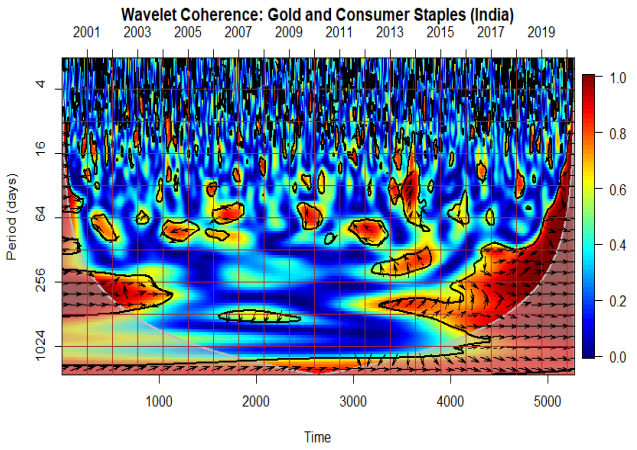
Sector Indices	ARCH LM Test	Prob.	LB Q Statistics	Prob.	Lag
Consumer Discretionary	25.1361	0.1561	19.372	0.433	19
Consumer Staples	24.0855	0.1929	19.092	0.451	19
Energy	22.8974	0.1165	20.439	0.201	16
Financials	21.1175	0.2211	17.591	0.415	17
Health Care	24.4679	0.1788	18.939	0.461	19
Industrial	24.6875	0.1711	20.253	0.379	19
Information Technology	10.5536	0.0144	2.5877	0.460	3
Telecommunication	21.7304	0.2442	20.802	0.290	18
Basic Materials	20.7233	0.1894	19.523	0.242	16
Utilities	30.4696	0.1697	21.385	0.616	24

Note: ARCH-LM test indicates lagrange Multiplier test for conditional heteroskedasticity upto 20 lags (H_0 = no heteroskedasticity) and Ljung-Box Q-Statistic has tested for serial correlation upto 20 lags (H_0 = no autocorrelation). The hypothesis has been inferred at 1%, 5% and 10% levels of significance, respectively.

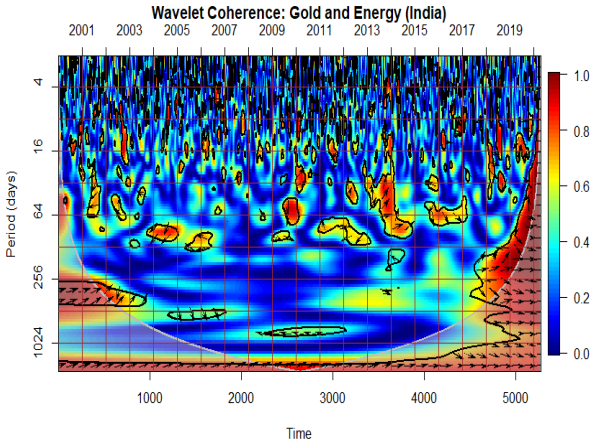
Figure 5.1a to Figure 5.1j: Wavelet Squared Coherence (WTC) Plots of India



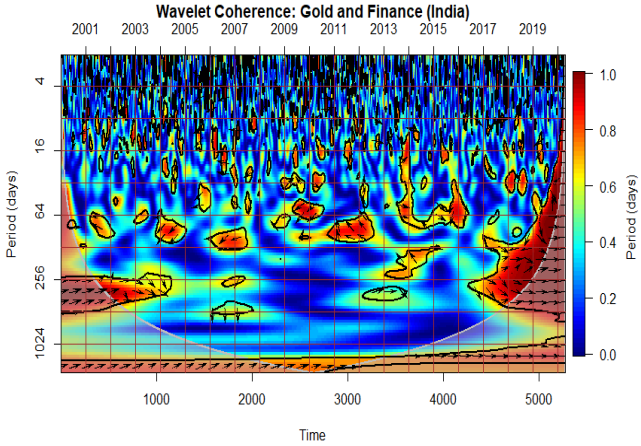
(a) (b)


Wavelet Coherence: Gold and Consumer Staples (India)
2001 2003 2005 2007 2009 2011 2013 2015 2017 2019
Period (days)
4 16 64 256 1024
1000 2000 3000 4000 5000
Time
1.0 0.8 0.6 0.4 0.2 0.0

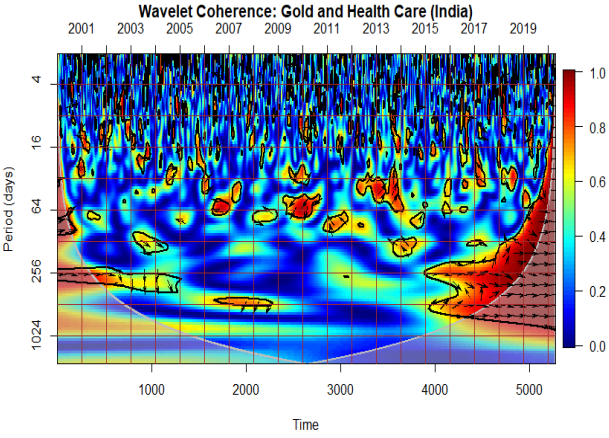
(c)


Wavelet Coherence: Gold and Energy (India)
2001 2003 2005 2007 2009 2011 2013 2015 2017 2019
Period (days)
4 16 64 256 1024
1000 2000 3000 4000 5000
Time
1.0 0.8 0.6 0.4 0.2 0.0

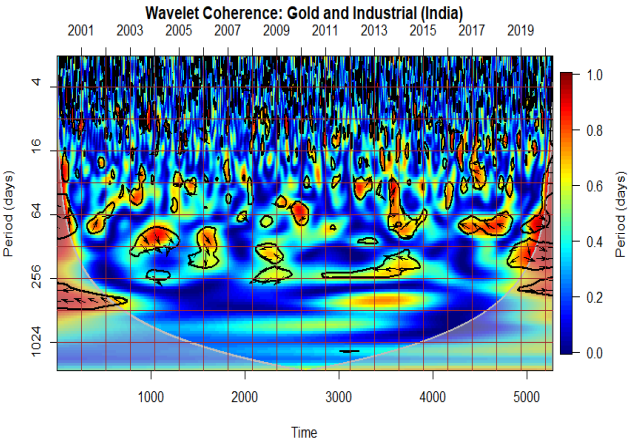
(d)


Wavelet Coherence: Gold and Finance (India)
2001 2003 2005 2007 2009 2011 2013 2015 2017 2019
Period (days)
4 16 64 256 1024
1000 2000 3000 4000 5000
Time
1.0 0.8 0.6 0.4 0.2 0.0

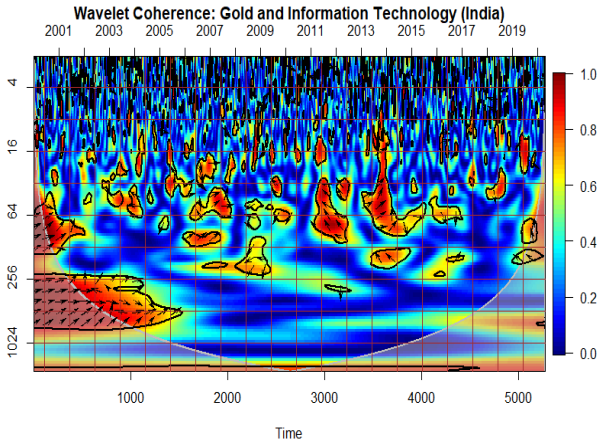
(e)


Wavelet Coherence: Gold and Health Care (India)
2001 2003 2005 2007 2009 2011 2013 2015 2017 2019
Period (days)
4 16 64 256 1024
1000 2000 3000 4000 5000
Time
1.0 0.8 0.6 0.4 0.2 0.0

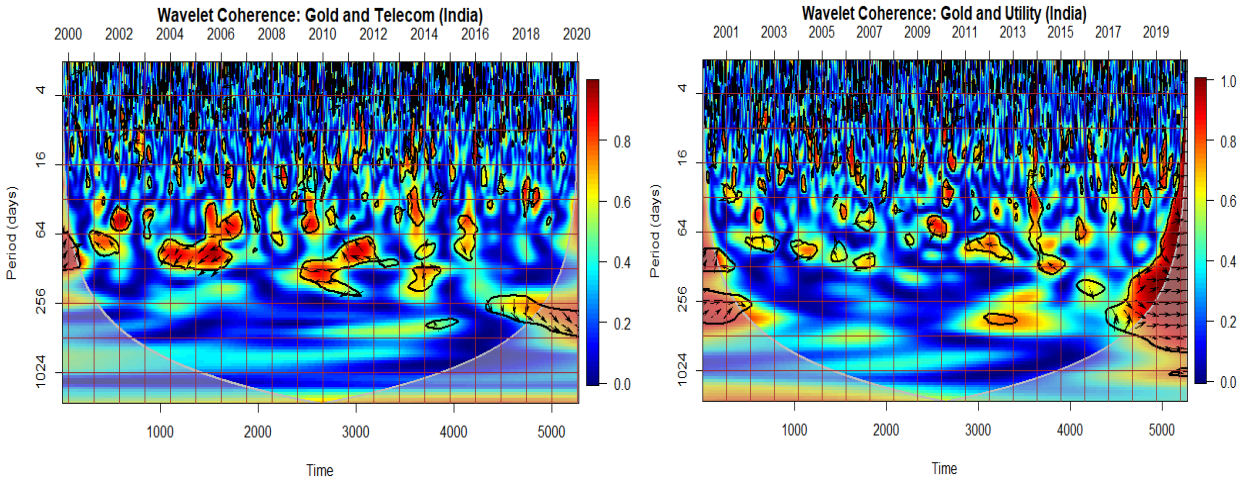
(f)


Wavelet Coherence: Gold and Industrial (India)
2001 2003 2005 2007 2009 2011 2013 2015 2017 2019
Period (days)
4 16 64 256 1024
1000 2000 3000 4000 5000
Time
1.0 0.8 0.6 0.4 0.2 0.0

(g)

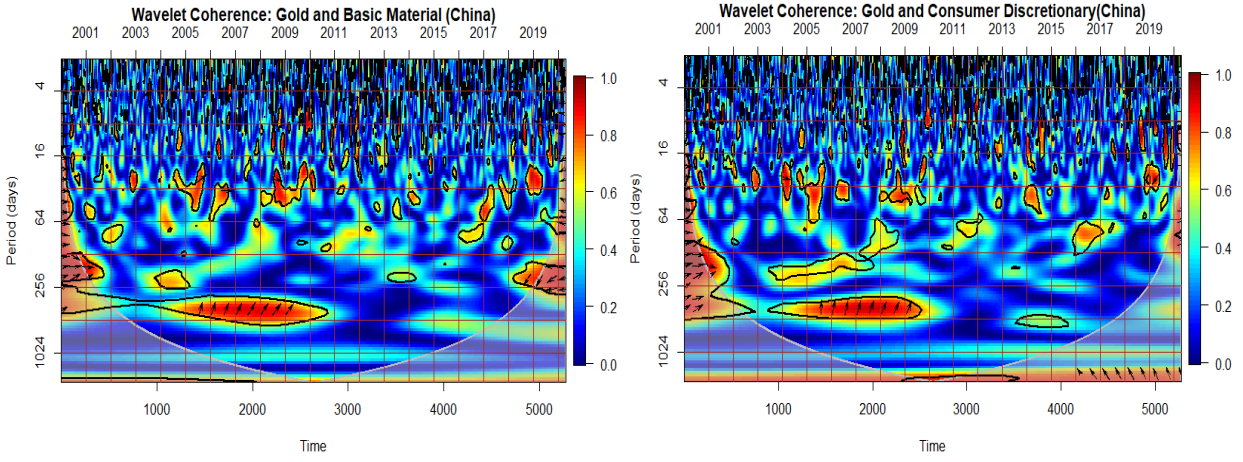

Wavelet Coherence: Gold and Information Technology (India)
2001 2003 2005 2007 2009 2011 2013 2015 2017 2019
Period (days)
4 16 64 256 1024
1000 2000 3000 4000 5000
Time
1.0 0.8 0.6 0.4 0.2 0.0

(h)

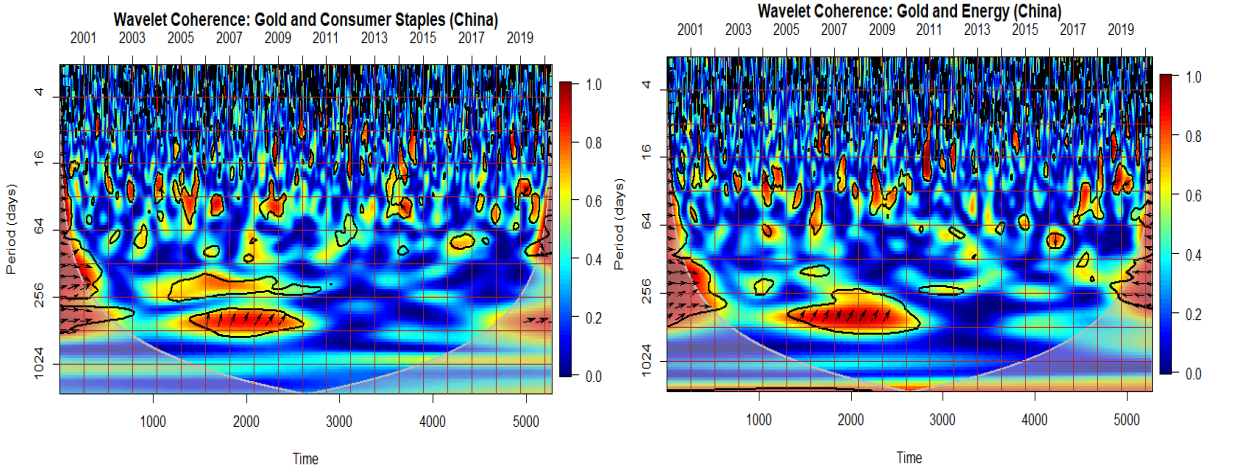


(i) (j)

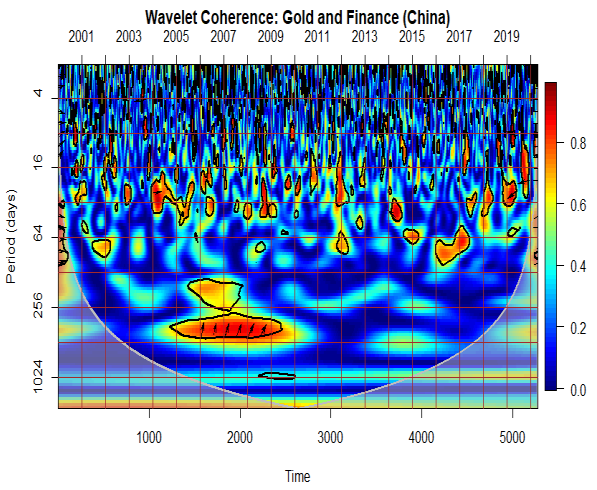
Figure 5.2a to Figure 5.2i: Wavelet Squared Coherence (WTC) Plots of China



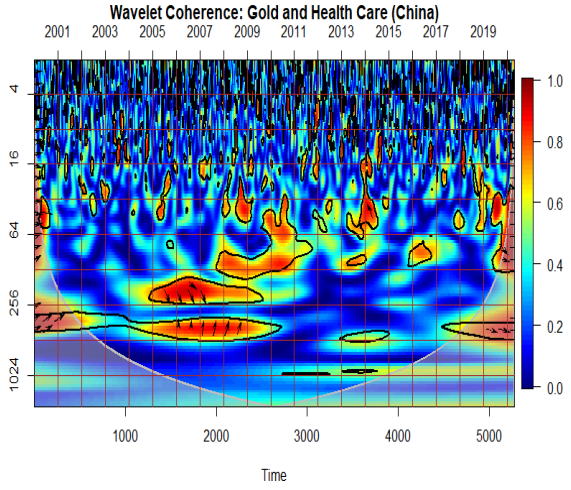
(a) (b)



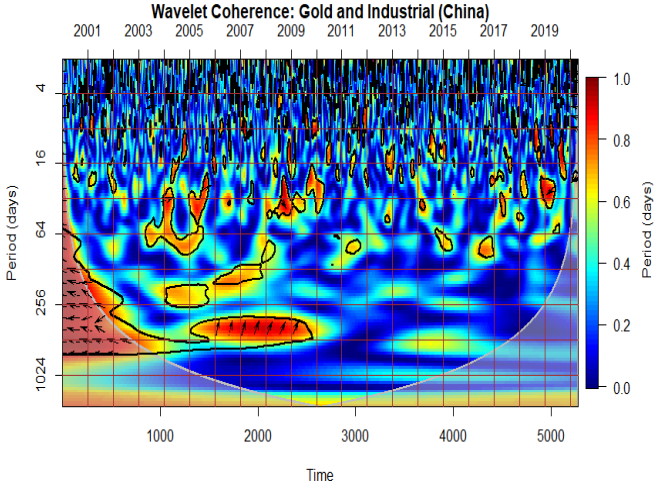
(c) (d)


Wavelet Coherence: Gold and Finance (China)
2001 2003 2005 2007 2009 2011 2013 2015 2017 2019
Period (days)
4 16 64 256 1024
1000 2000 3000 4000 5000
Time
0.0 0.2 0.4 0.6 0.8

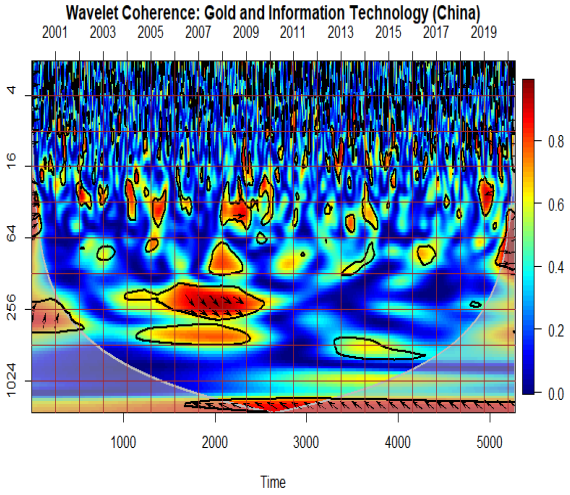
(e)


Wavelet Coherence: Gold and Health Care (China)
2001 2003 2005 2007 2009 2011 2013 2015 2017 2019
Period (days)
4 16 64 256 1024
1000 2000 3000 4000 5000
Time
0.0 0.2 0.4 0.6 0.8 1.0

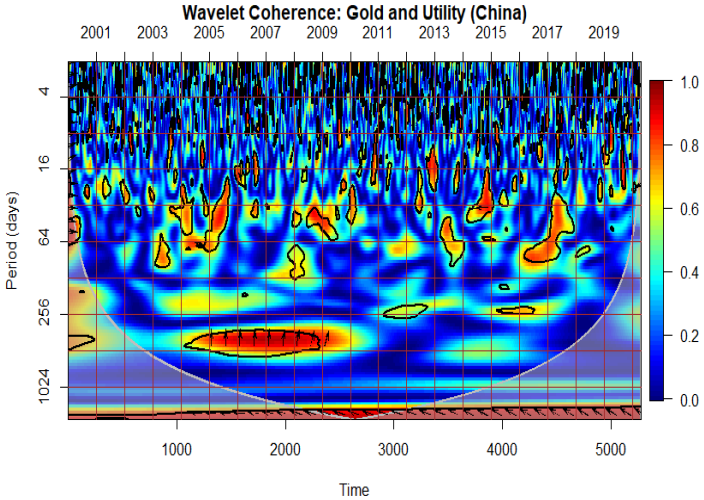
(f)


Wavelet Coherence: Gold and Industrial (China)
2001 2003 2005 2007 2009 2011 2013 2015 2017 2019
Period (days)
4 16 64 256 1024
1000 2000 3000 4000 5000
Time
0.0 0.2 0.4 0.6 0.8 1.0

(g)

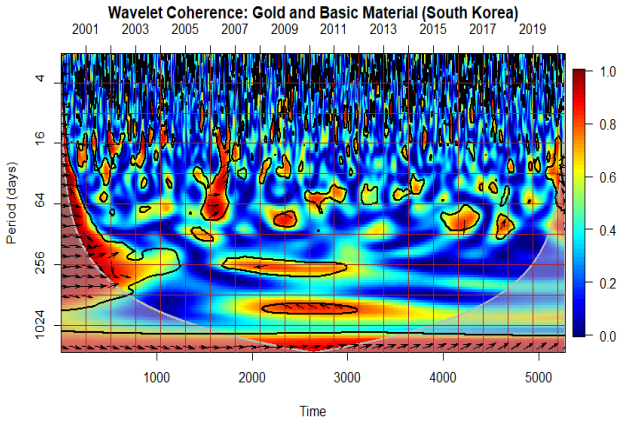

Wavelet Coherence: Gold and Information Technology (China)
2001 2003 2005 2007 2009 2011 2013 2015 2017 2019
Period (days)
4 16 64 256 1024
1000 2000 3000 4000 5000
Time
0.0 0.2 0.4 0.6 0.8

(h)

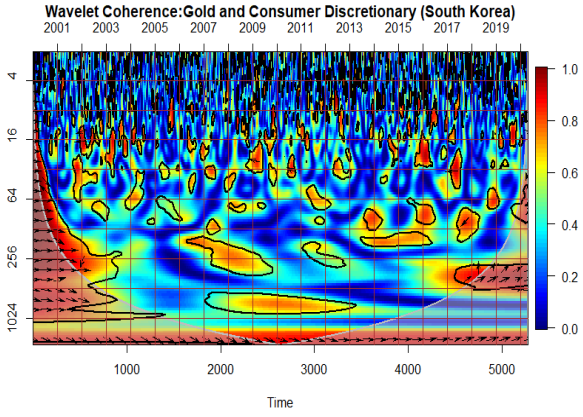

Wavelet Coherence: Gold and Utility (China)
2001 2003 2005 2007 2009 2011 2013 2015 2017 2019
Period (days)
4 16 64 256 1024
1000 2000 3000 4000 5000
Time
0.0 0.2 0.4 0.6 0.8 1.0

(j)

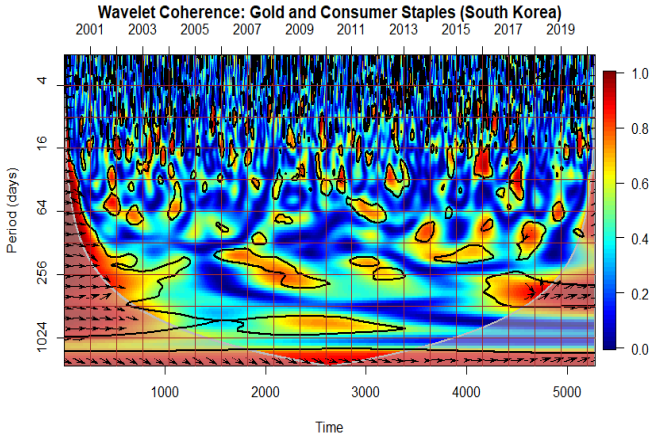
Figure 5.3a to Figure 5.3j: Wavelet Squared Coherence (WTC) Plots of South Korea



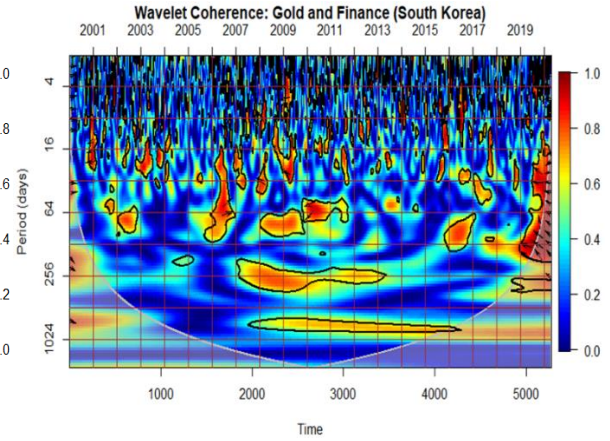
(a)



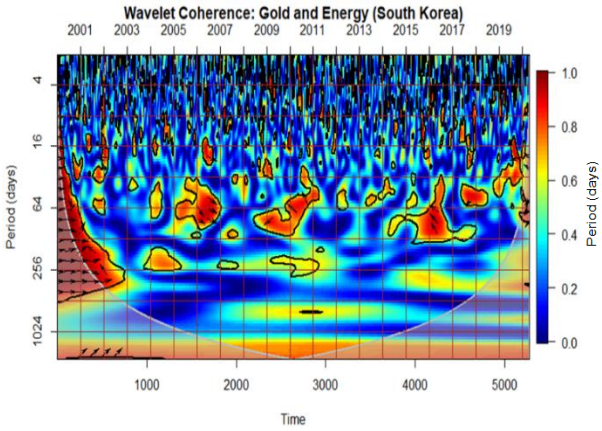
(b)



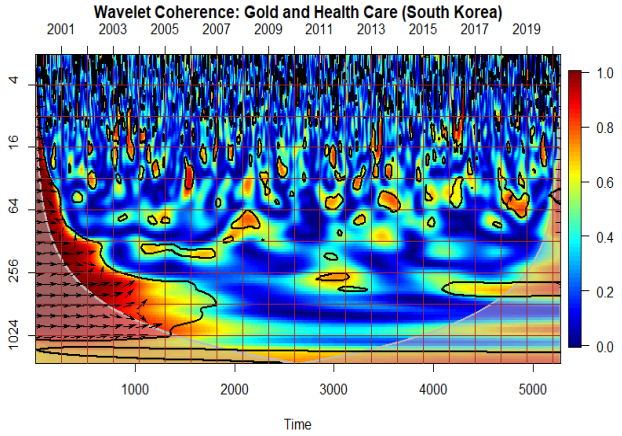
(c)



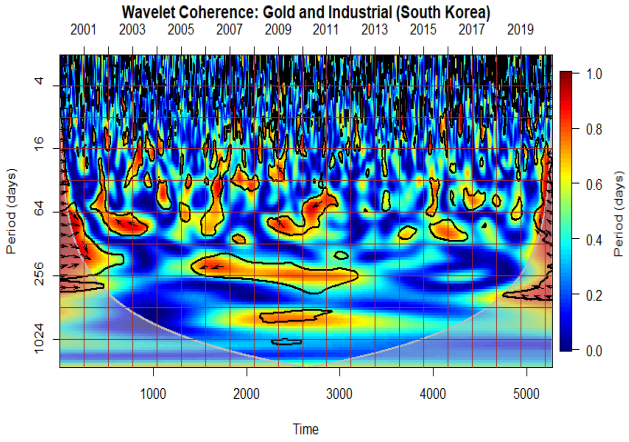
(d)



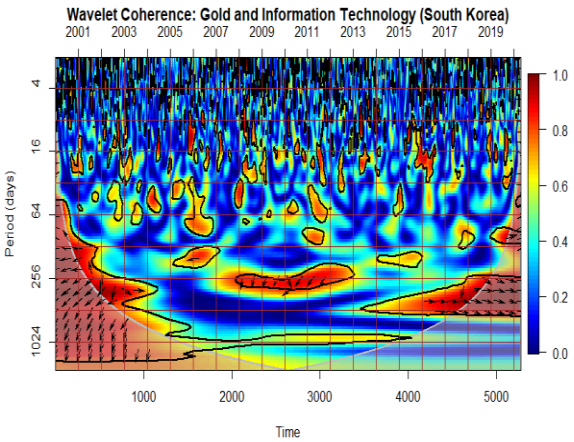
(e)



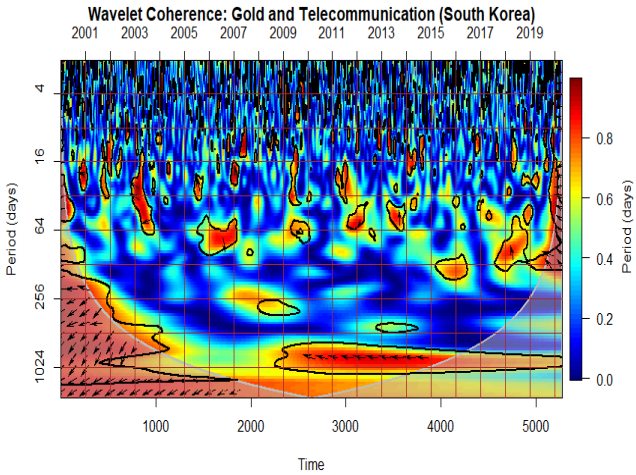
(f)



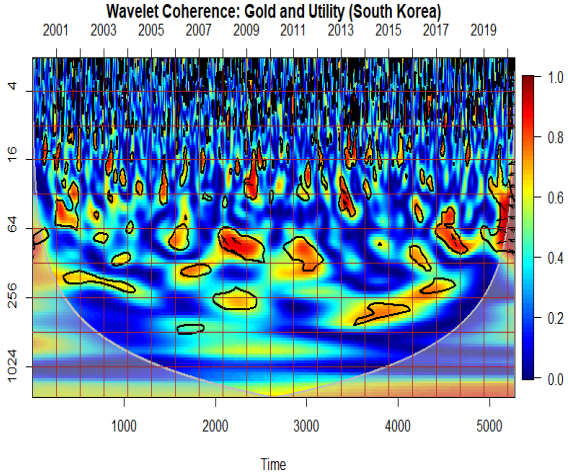
(g)



(h)

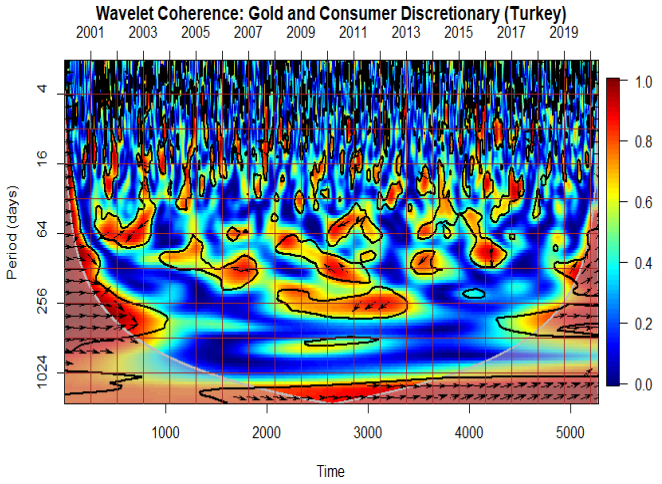


(i)

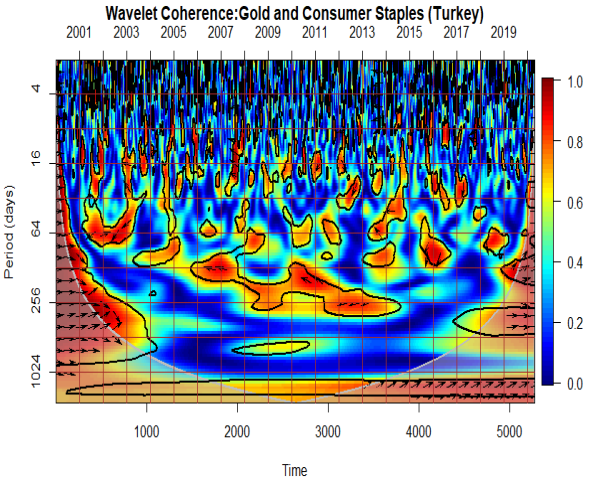


(j)

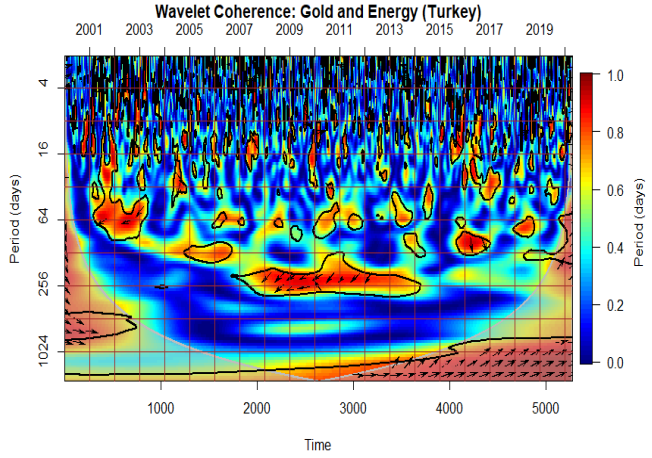
Figure 5.4a to Figure 5.4h: Wavelet Squared Coherence (WTC) Plots of Turkey



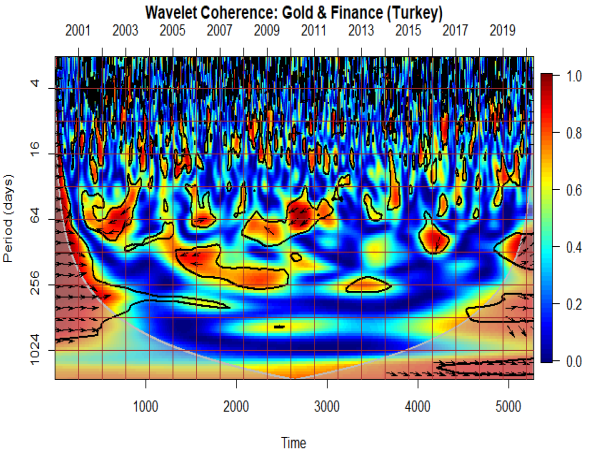
(a)



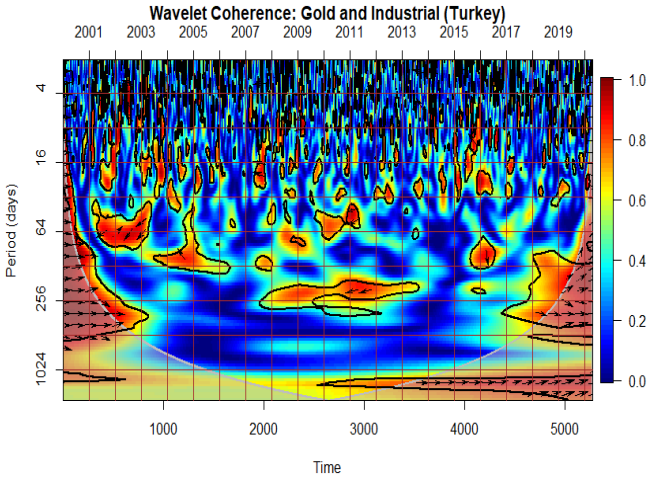
(b)


Wavelet Coherence: Gold and Energy (Turkey)
2001 2003 2005 2007 2009 2011 2013 2015 2017 2019
Period (days)
4 16 64 256 1024
1000 2000 3000 4000 5000
Time
1.0 0.8 0.6 0.4 0.2 0.0

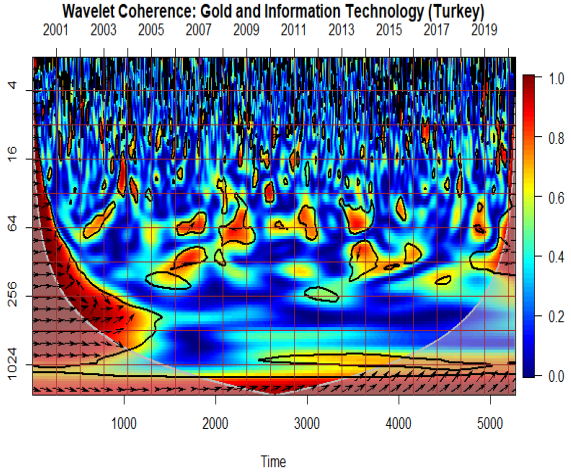
(c)


Wavelet Coherence: Gold & Finance (Turkey)
2001 2003 2005 2007 2009 2011 2013 2015 2017 2019
Period (days)
4 16 64 256 1024
1000 2000 3000 4000 5000
Time
1.0 0.8 0.6 0.4 0.2 0.0

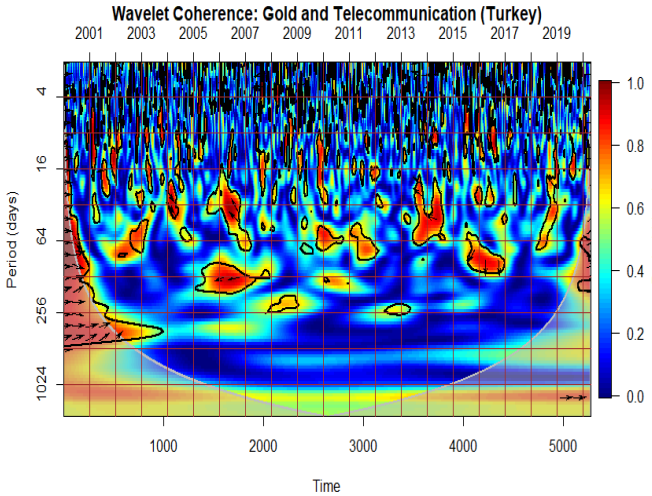
(d)


Wavelet Coherence: Gold and Industrial (Turkey)
2001 2003 2005 2007 2009 2011 2013 2015 2017 2019
Period (days)
4 16 64 256 1024
1000 2000 3000 4000 5000
Time
1.0 0.8 0.6 0.4 0.2 0.0

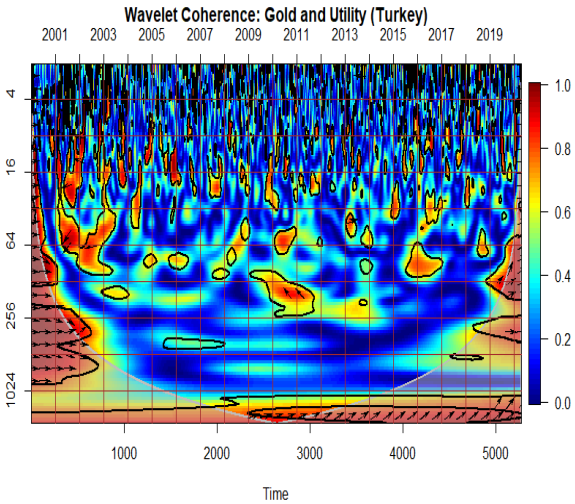
(e)


Wavelet Coherence: Gold and Information Technology (Turkey)
2001 2003 2005 2007 2009 2011 2013 2015 2017 2019
Period (days)
4 16 64 256 1024
1000 2000 3000 4000 5000
Time
1.0 0.8 0.6 0.4 0.2 0.0

(f)

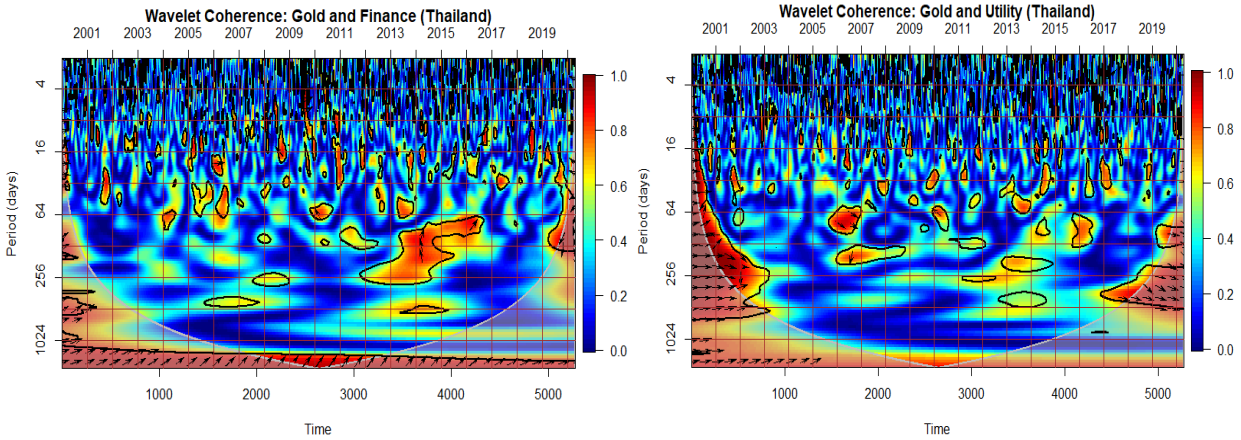

Wavelet Coherence: Gold and Telecommunication (Turkey)
2001 2003 2005 2007 2009 2011 2013 2015 2017 2019
Period (days)
4 16 64 256 1024
1000 2000 3000 4000 5000
Time
1.0 0.8 0.6 0.4 0.2 0.0

(g)


Wavelet Coherence: Gold and Utility (Turkey)
2001 2003 2005 2007 2009 2011 2013 2015 2017 2019
Period (days)
4 16 64 256 1024
1000 2000 3000 4000 5000
Time
1.0 0.8 0.6 0.4 0.2 0.0

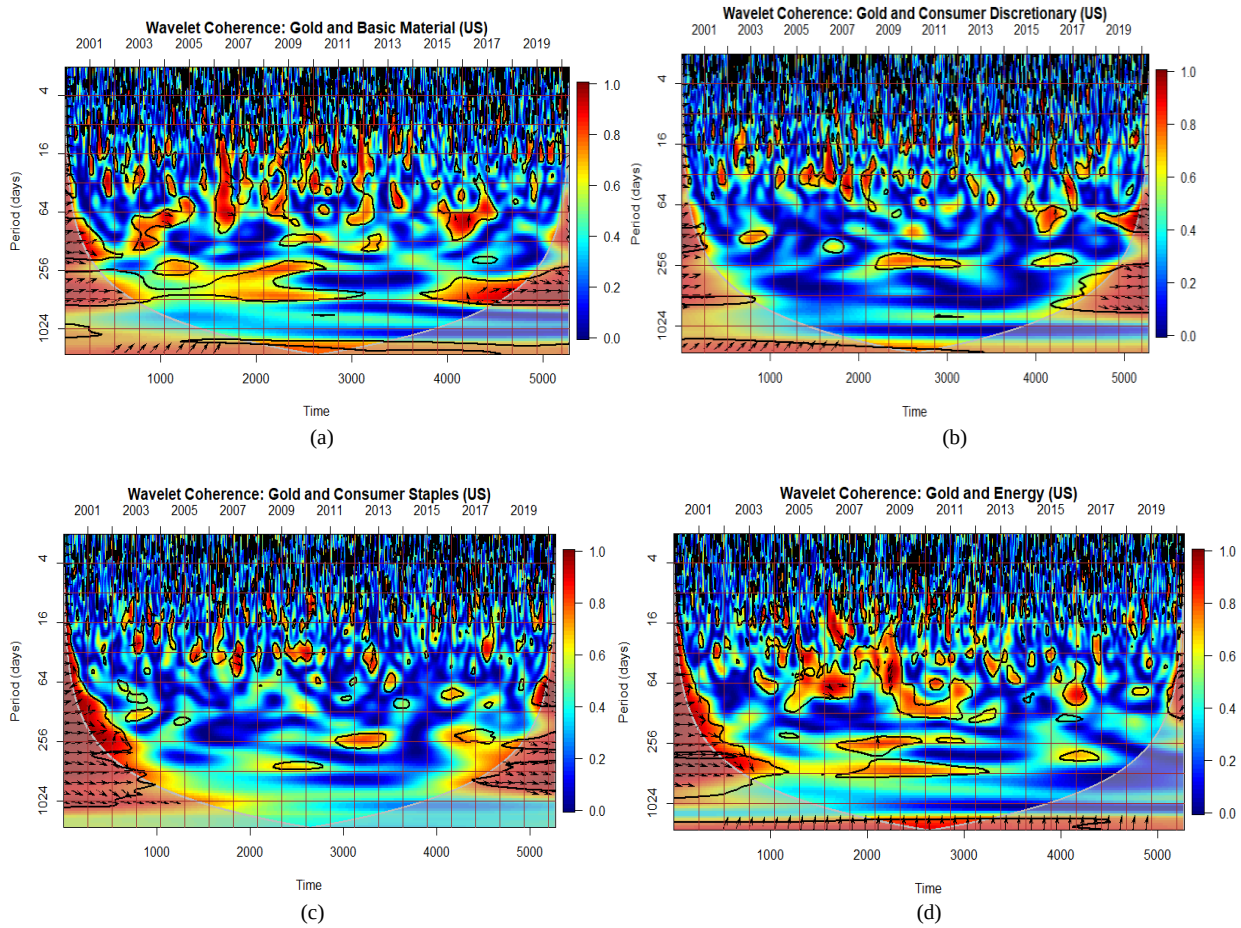
(h)

Figure 5.5a to Figure 5.5b: Wavelet Squared Coherence (WTC) Plots of Thailand



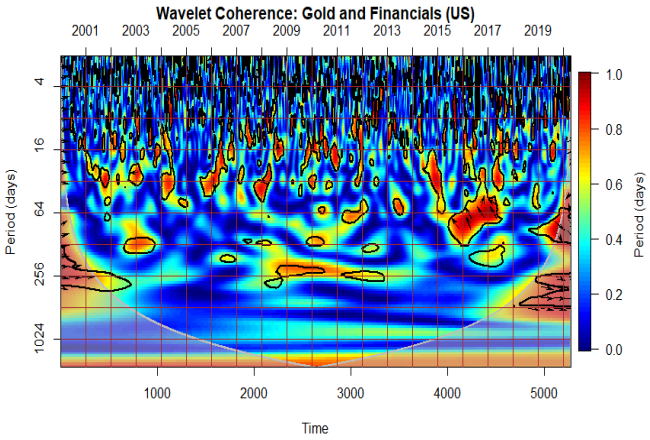
(a) (b)

Figure 5.6a to Figure 5.6i: Wavelet Squared Coherence (WTC) Plots of USA

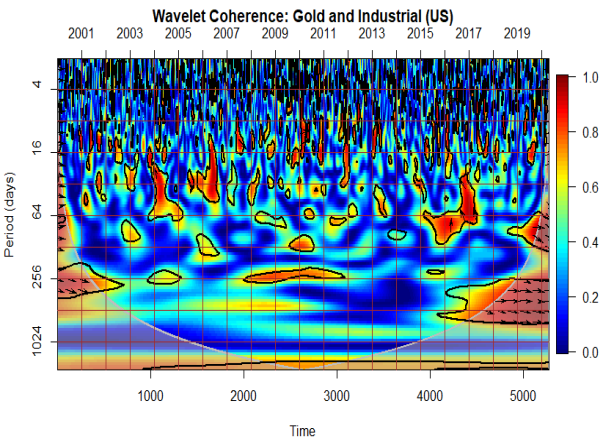


(a) (b)

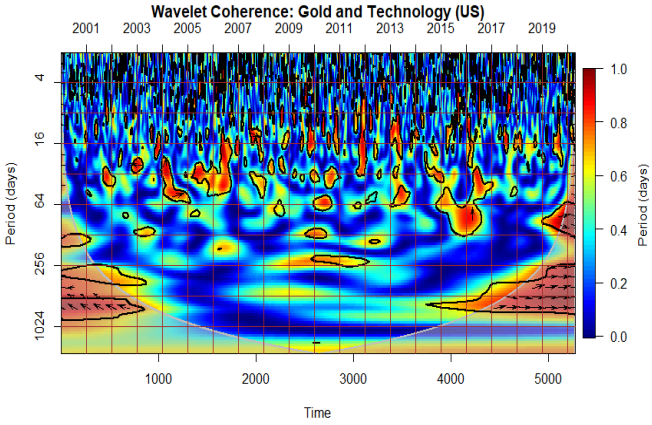
(c) (d)


Wavelet Coherence: Gold and Financials (US)
2001 2003 2005 2007 2009 2011 2013 2015 2017 2019
Period (days)
4 16 64 256 1024
1000 2000 3000 4000 5000
Time
1.0 0.8 0.6 0.4 0.2 0.0

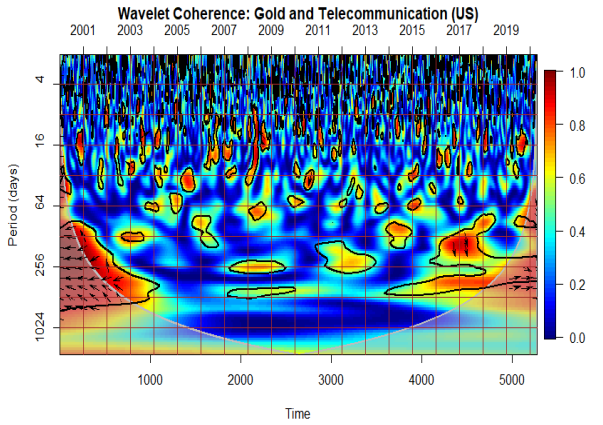
(e)


Wavelet Coherence: Gold and Industrial (US)
2001 2003 2005 2007 2009 2011 2013 2015 2017 2019
Period (days)
4 16 64 256 1024
1000 2000 3000 4000 5000
Time
1.0 0.8 0.6 0.4 0.2 0.0

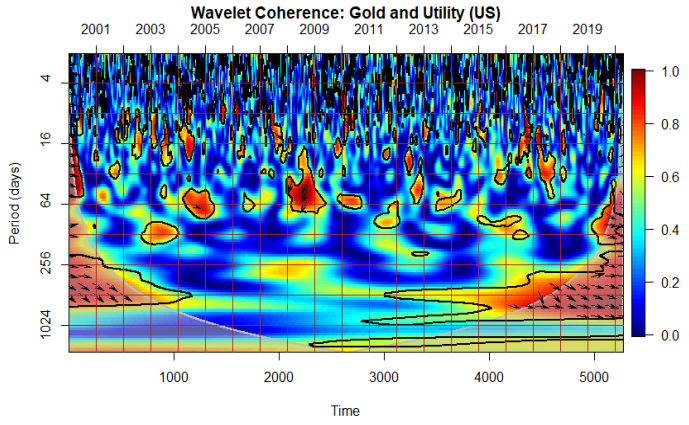
(f)


Wavelet Coherence: Gold and Technology (US)
2001 2003 2005 2007 2009 2011 2013 2015 2017 2019
Period (days)
4 16 64 256 1024
1000 2000 3000 4000 5000
Time
1.0 0.8 0.6 0.4 0.2 0.0

(g)

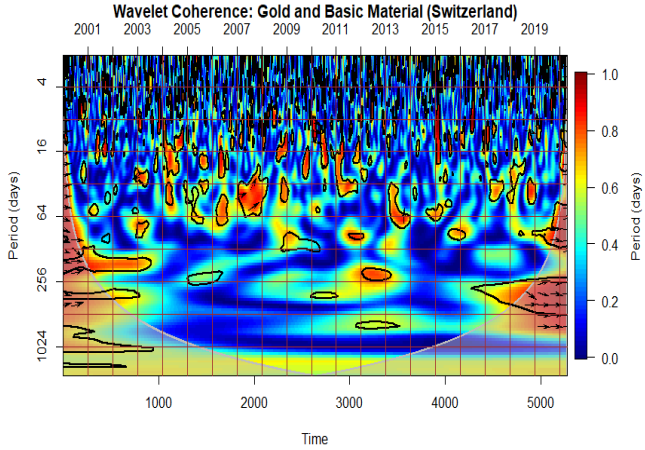

Wavelet Coherence: Gold and Telecommunication (US)
2001 2003 2005 2007 2009 2011 2013 2015 2017 2019
Period (days)
4 16 64 256 1024
1000 2000 3000 4000 5000
Time
1.0 0.8 0.6 0.4 0.2 0.0

(h)

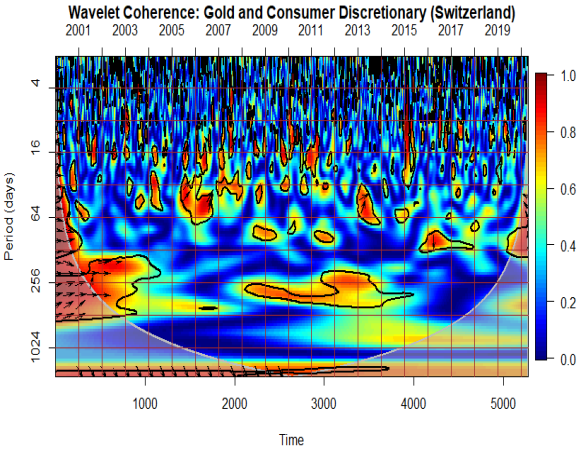

Wavelet Coherence: Gold and Utility (US)
2001 2003 2005 2007 2009 2011 2013 2015 2017 2019
Period (days)
4 16 64 256 1024
1000 2000 3000 4000 5000
Time
1.0 0.8 0.6 0.4 0.2 0.0

(i)

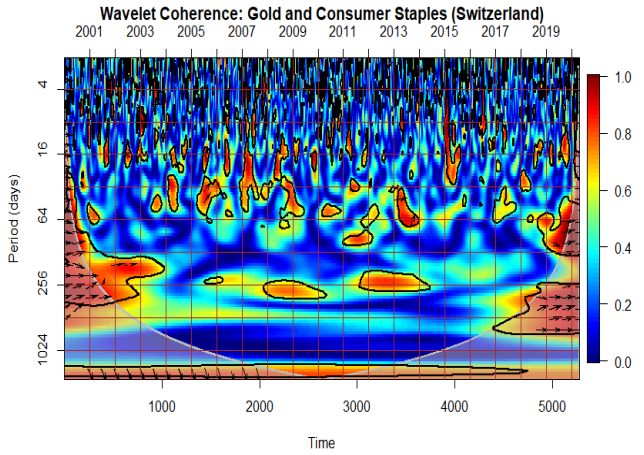
Figure 5.7a to Figure 5.7i: Wavelet Squared Coherence (WTC) Plots of Switzerland



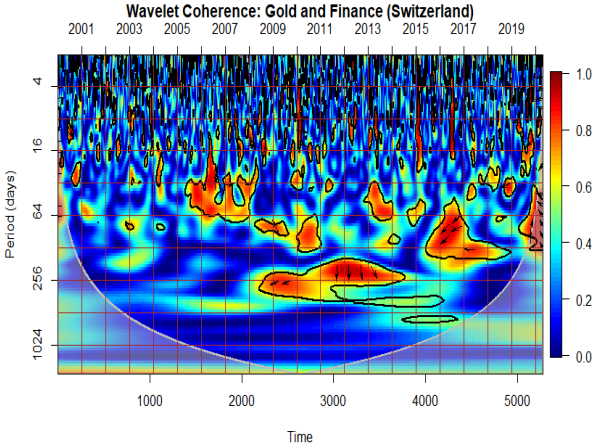
(a)



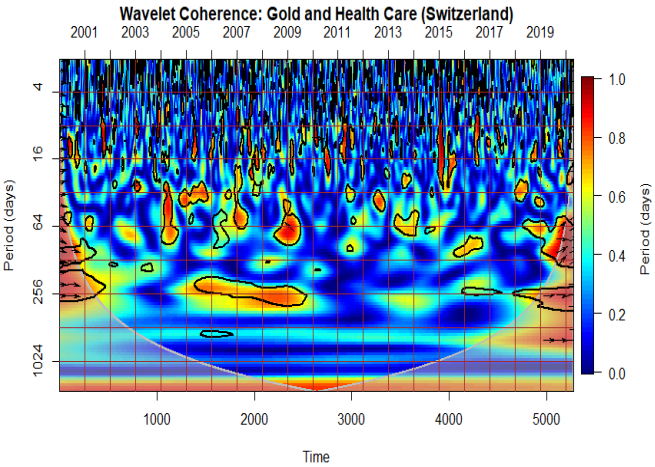
(b)



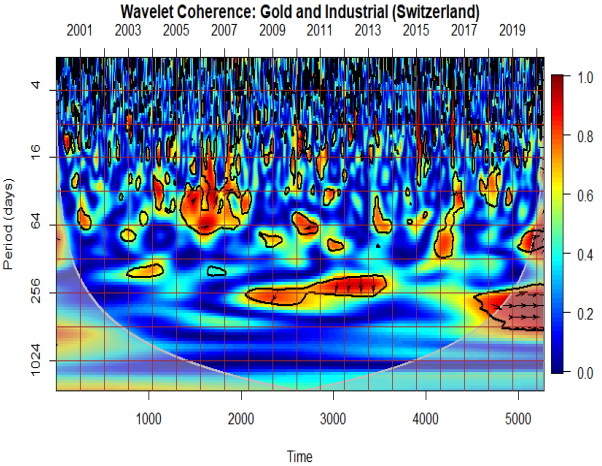
(c)



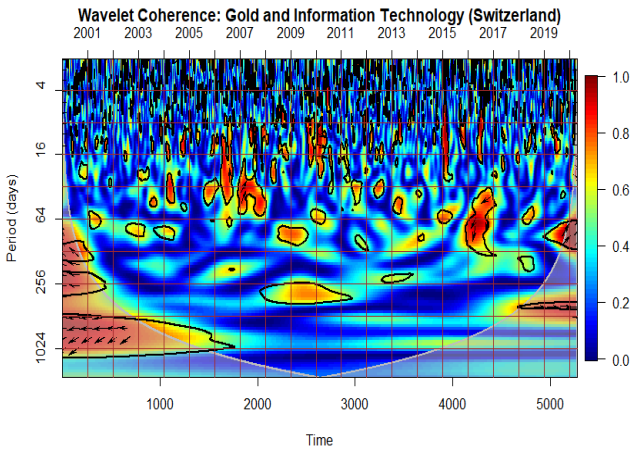
(d)



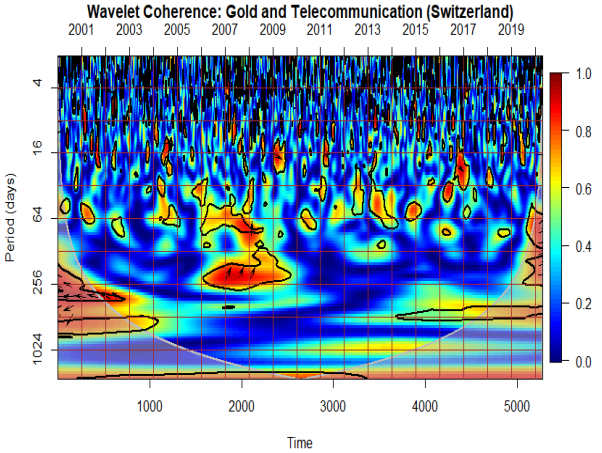
(e)



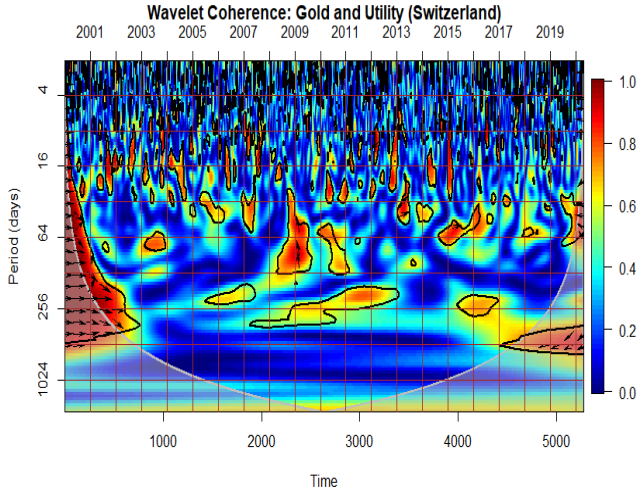
(f)



(g)

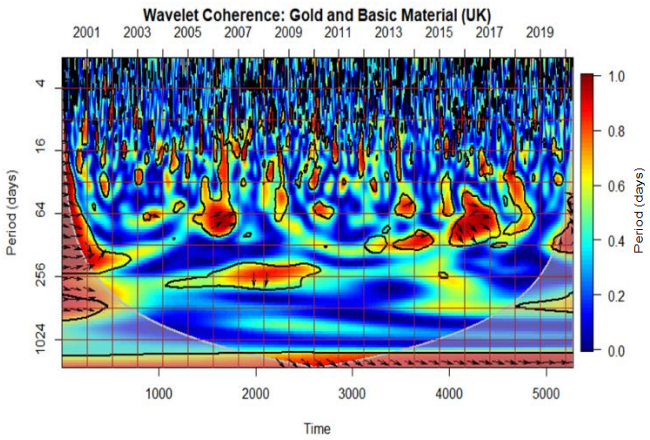


(h)

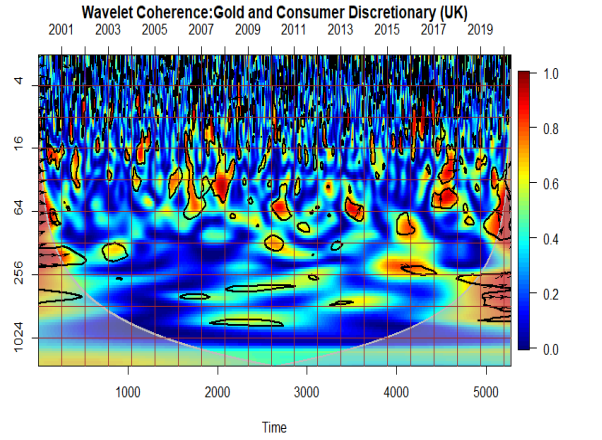


(i)

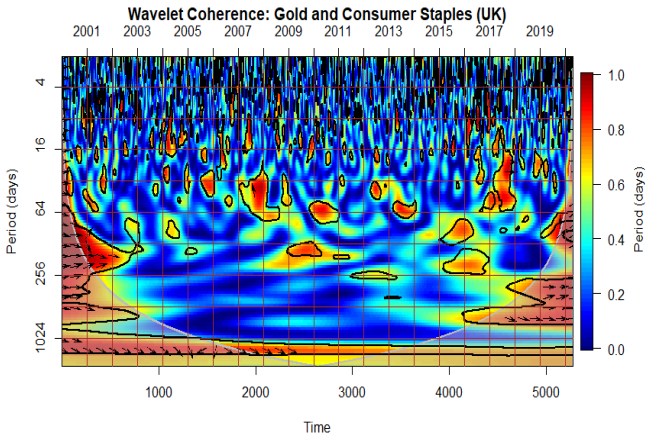
Figure 5.8a to Figure 5.8j: Wavelet Squared Coherence (WTC) Plots of UK



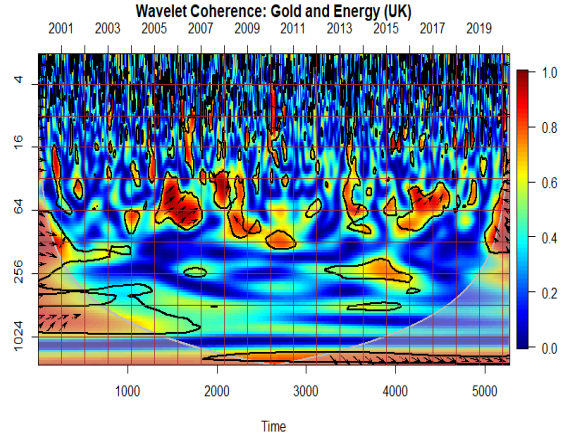
(a)



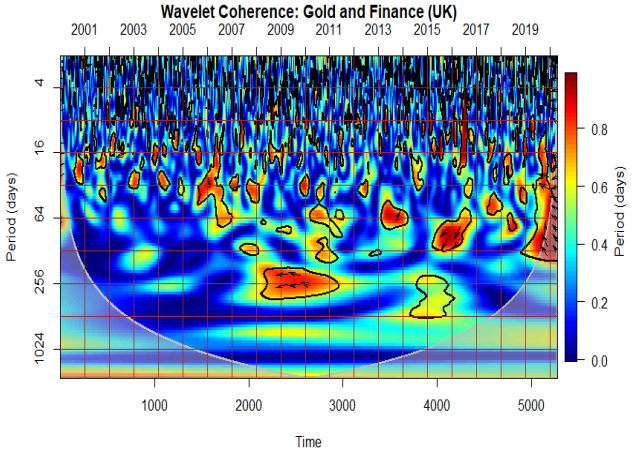
(b)


Wavelet Coherence: Gold and Consumer Staples (UK)
2001 2003 2005 2007 2009 2011 2013 2015 2017 2019
Period (days)
4 16 64 256 1024
1000 2000 3000 4000 5000
Time
1.0 0.8 0.6 0.4 0.2 0.0

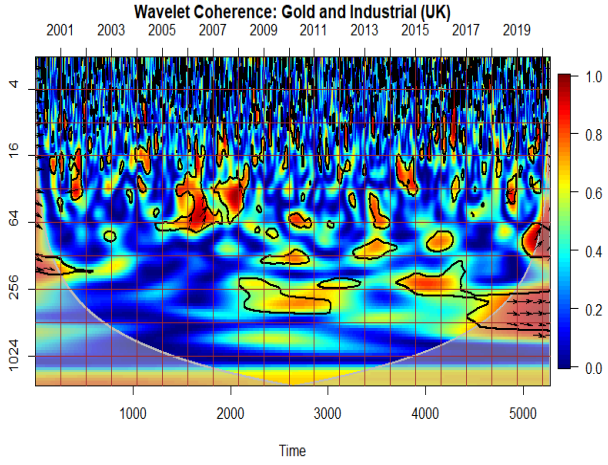
(c)


Wavelet Coherence: Gold and Energy (UK)
2001 2003 2005 2007 2009 2011 2013 2015 2017 2019
Period (days)
4 16 64 256 1024
1000 2000 3000 4000 5000
Time
1.0 0.8 0.6 0.4 0.2 0.0

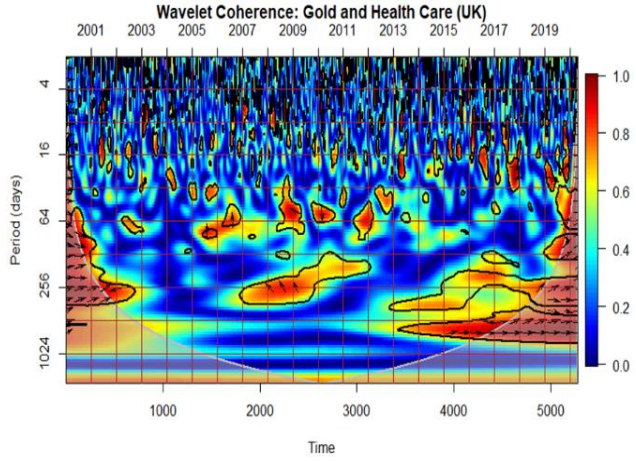
(d)


Wavelet Coherence: Gold and Finance (UK)
2001 2003 2005 2007 2009 2011 2013 2015 2017 2019
Period (days)
4 16 64 256 1024
1000 2000 3000 4000 5000
Time
0.8 0.6 0.4 0.2 0.0

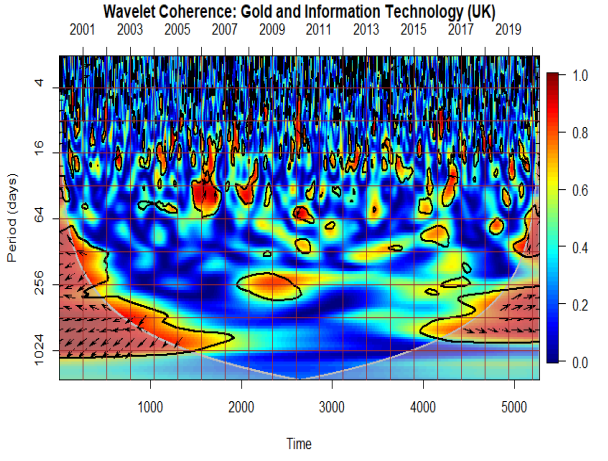
(e)


Wavelet Coherence: Gold and Industrial (UK)
2001 2003 2005 2007 2009 2011 2013 2015 2017 2019
Period (days)
4 16 64 256 1024
1000 2000 3000 4000 5000
Time
1.0 0.8 0.6 0.4 0.2 0.0

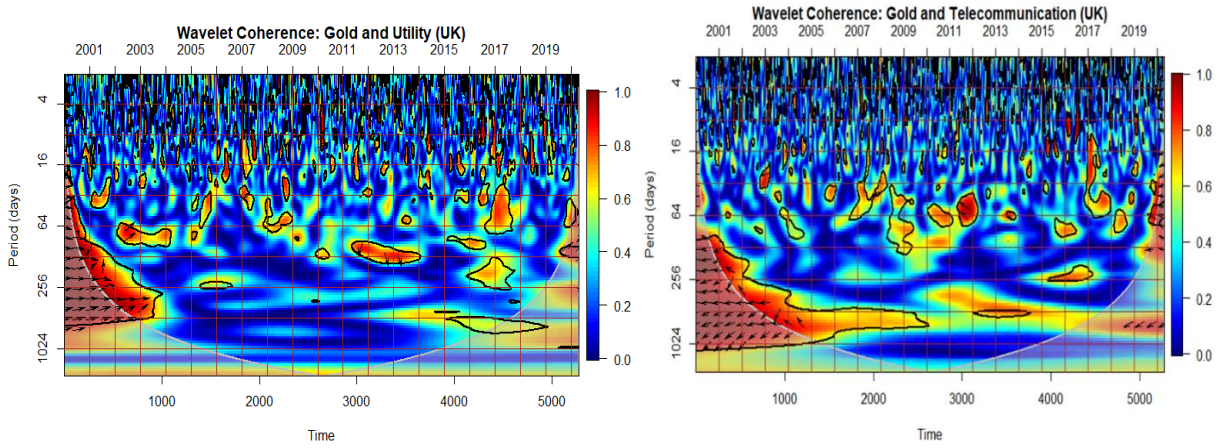
(f)


Wavelet Coherence: Gold and Health Care (UK)
2001 2003 2005 2007 2009 2011 2013 2015 2017 2019
Period (days)
4 16 64 256 1024
1000 2000 3000 4000 5000
Time
1.0 0.8 0.6 0.4 0.2 0.0

(g)

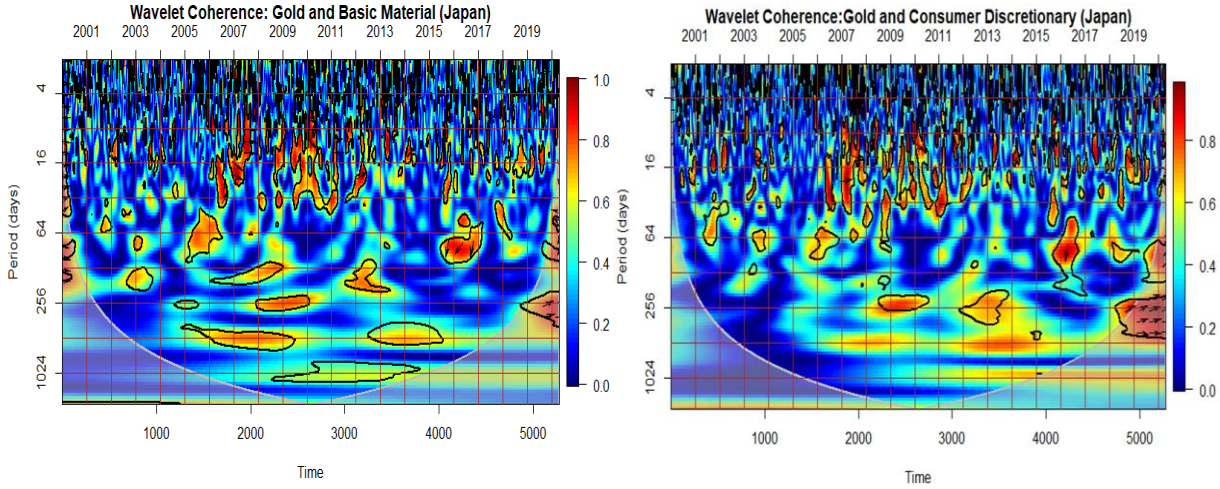

Wavelet Coherence: Gold and Information Technology (UK)
2001 2003 2005 2007 2009 2011 2013 2015 2017 2019
Period (days)
4 16 64 256 1024
1000 2000 3000 4000 5000
Time
1.0 0.8 0.6 0.4 0.2 0.0

(h)

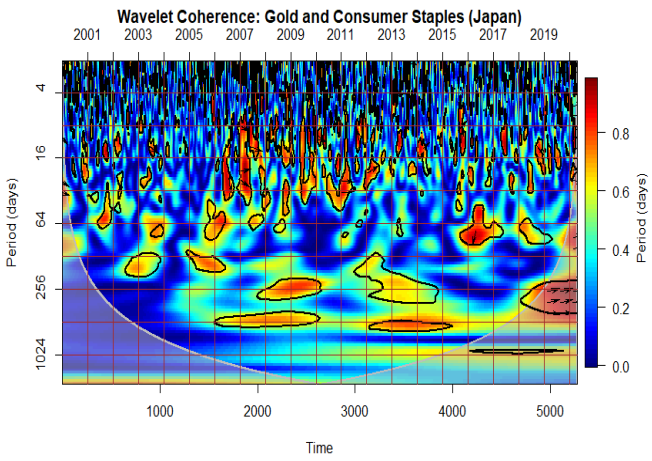


(i) (j)

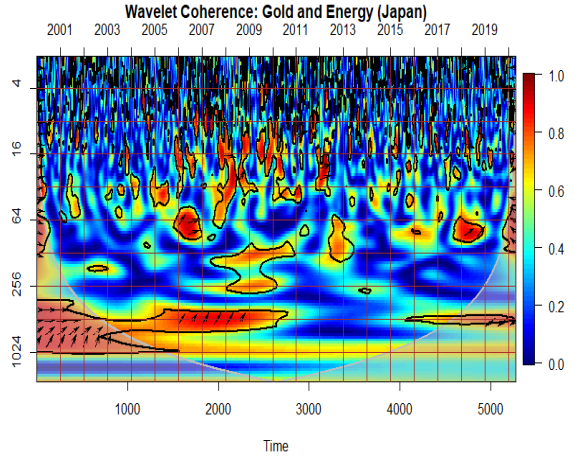
Figure 5.9a to Figure 5.9j: Wavelet Squared Coherence (WTC) Plots of Japan



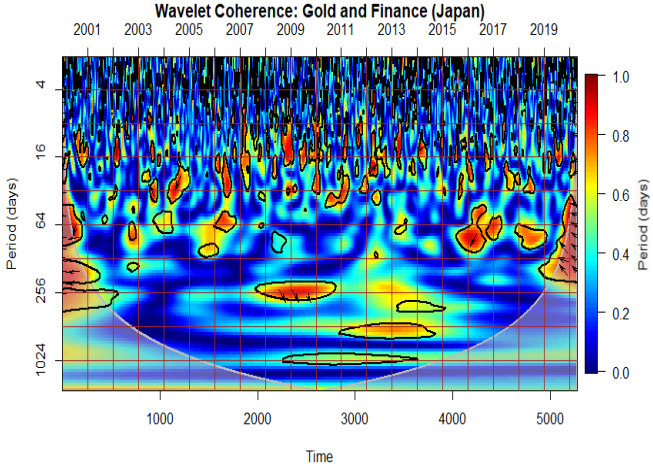
(a) (b)


Wavelet Coherence: Gold and Consumer Staples (Japan)
2001 2003 2005 2007 2009 2011 2013 2015 2017 2019
Period (days)
4 16 64 256 1024
1000 2000 3000 4000 5000
Time
0.0 0.2 0.4 0.6 0.8

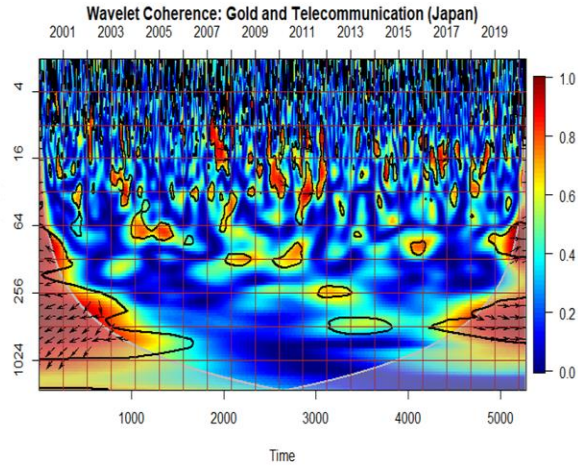
(c)


Wavelet Coherence: Gold and Energy (Japan)
2001 2003 2005 2007 2009 2011 2013 2015 2017 2019
Period (days)
4 16 64 256 1024
1000 2000 3000 4000 5000
Time
0.0 0.2 0.4 0.6 0.8 1.0

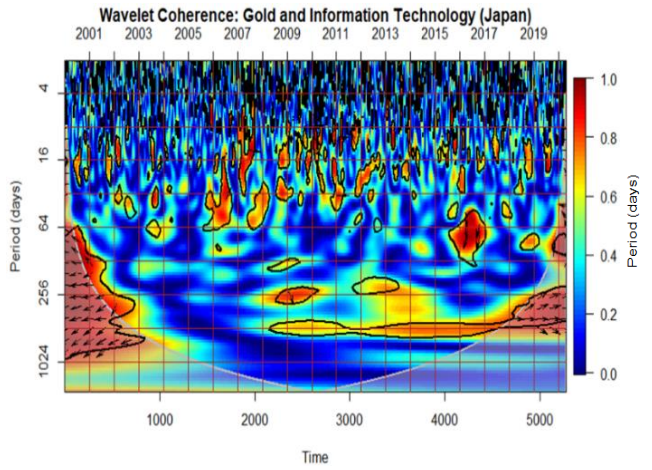
(d)


Wavelet Coherence: Gold and Finance (Japan)
2001 2003 2005 2007 2009 2011 2013 2015 2017 2019
Period (days)
4 16 64 256 1024
1000 2000 3000 4000 5000
Time
0.0 0.2 0.4 0.6 0.8 1.0

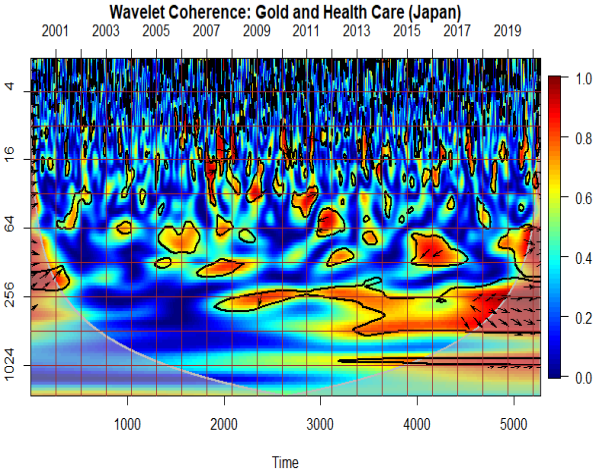
(e)


Wavelet Coherence: Gold and Telecommunication (Japan)
2001 2003 2005 2007 2009 2011 2013 2015 2017 2019
Period (days)
4 16 64 256 1024
1000 2000 3000 4000 5000
Time
0.0 0.2 0.4 0.6 0.8 1.0

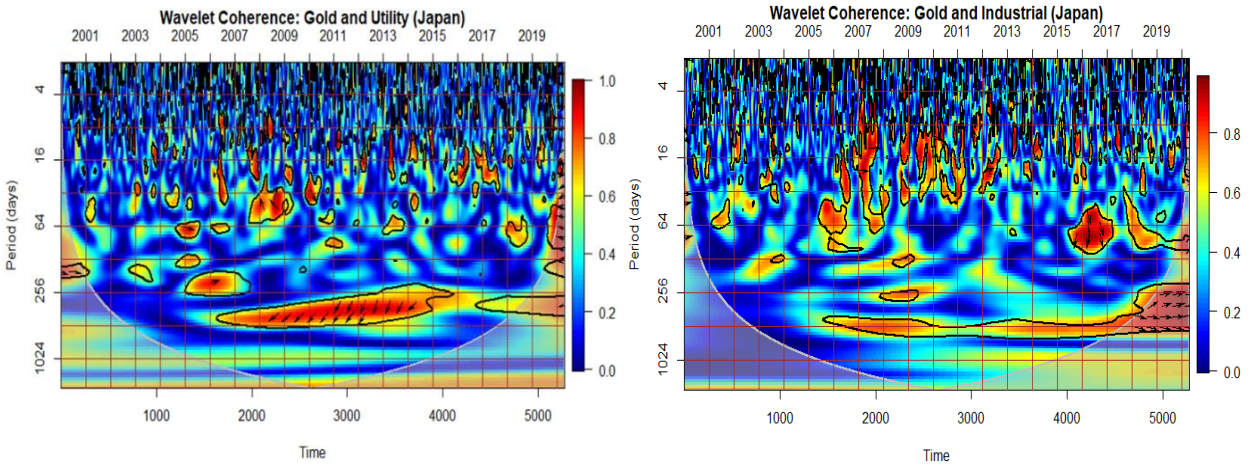
(f)


Wavelet Coherence: Gold and Information Technology (Japan)
2001 2003 2005 2007 2009 2011 2013 2015 2017 2019
Period (days)
4 16 64 256 1024
1000 2000 3000 4000 5000
Time
0.0 0.2 0.4 0.6 0.8 1.0

(g)


Wavelet Coherence: Gold and Health Care (Japan)
2001 2003 2005 2007 2009 2011 2013 2015 2017 2019
Period (days)
4 16 64 256 1024
1000 2000 3000 4000 5000
Time
0.0 0.2 0.4 0.6 0.8 1.0

(h)



(i) (j)

Note: Wavelet coherency is shown between gold and stock markets for a time span ranging from January 2000 to March 2020. The horizontal axis shows calendar time, while the vertical axis shows the time period in days. The area within the grey contours indicates coherency significant at 5% level of significance, which is estimated with Monte-Carlo simulations. The COI indicates the region affected by edge effects and is represented by the area outside the cone in light shade. Coherency takes values between 0 and 1 and warmer colours (deep red) are indicative of higher high coherence/perfect correlation while colder colours (deep blue) are indicative of low coherence/no correlation. The phase difference between the two series is indicated by arrows. East (west) facing arrows represent in- (out-of-) phase, while north (south) facing arrows indicate that gold leads (lags) the traditional asset. A north-east (south-east) facing arrow symbolises that the series are in-phase but that gold (another asset) leads the other asset. A north-west (south-west) facing arrow symbolises that the series are out-of-phase but that the other asset (gold) leads gold (another asset). In phase, the variables have a positive correlation, and out of phase or anti-phase shows a negative correlation. **For other countries, Wavelet Coherency Plots estimation is not reported for some sectoral indices on account of technical errors in analysis.**