jamk.fi

Financial Analysis of High-Value Commodities Portfolio: Gold and Silver

Author: Dmitrii Matiushin

Bachelor's Thesis
February 2019
International Business
Degree Programme in International Business

Jyväskylän ammattikorkeakoulu
JAMK University of Applied Sciences

jamk.fi

Description

Author(s)	Type of publication	Date
Matiushin, Dmitrii	Bachelor's thesis	February 2019
		Language of publication:
	Number of pages 71	Permission for web publication: x

Title of publication
Financial Analysis of Portfolio of High-Value Commodities: Gold and Silver

Degree programme
Degree Programme in International Business

Supervisor(s)
Hundal, Shabnamjit

Assigned by

Abstract

Throughout centuries the financial world generated numerous opportunities for profitable investments and capital allocation. Long-term financial decisions were made from the perspective of future gains. However, owing to its complexities and uncertainties, the financial world cannot be explained with a few *ex-ante* theoretical concepts. In times of economic crises, investors not only started searching for the new financial assets but also re-considered investing in relatively *traditional assets*.

The key objective of the thesis was to analyze the performance of gold and silver, which are considered as high-value commodities, in terms of portfolio risks and returns. Several global indexes were chosen as a benchmark comparison. The market indicators were: DIJA, S&P500, and FTSE. The monetary history of the metals was one of the research pillars. Market performance of gold and silver was examined via the most fundamental factors that affect the price volatility and trend development.

A quantitative approach was adopted in order to collect the financial data from several stock market databases. It was used for calculating beta, standard deviation and annualized returns within several timeframes. The results were compared and analyzed.

The results underlined the importance of high value commodities in times of uncertainty and financial instabilities in terms of risk and return performance. Within the correction cycle in the financial world, gold and silver stocks were favored by investors and successfully generated positive returns regardless of high volatility.

Keywords/tags (subjects)
Gold, Silver, Hedge, Safe Haven Assets, Indexes, Beta, Risk, Returns, Investments

Miscellaneous (Confidential information)
-

Contents

Figures

Tables

1 Introduction

Financial world generates thousands of investment opportunities that align with an ever rising risks and market complexities. For several people, in their daily lives, numbers without any real narrative may cause unbearable stress, however, for some individuals they help to reduce daily uncertainty and get a sense of the world's "big picture". The world of finance can be simplified and summarized in certain forms of empirical guidance that covers most of the scenarios that relate to capital allocation. Thousands of portfolio managers are trying to achieve optimal portfolio allocation in order to meet investors expectations regarding risks and returns on the daily basis. In other words, they intend to predict the future that remains unpredictable and unknown (Richards 2012).

The financial crisis of 2008 happened to be an event with an unprecedented scale of long-tail events. The world economy was affected severely: developed countries experienced a tremendous (7.5%) decrease in the real GDP; national currencies of emerging markets were severely losing their value on a monthly basis (Wang 2012). Period of expansion that lasted for almost six years came to the end causing an overall market correction. For example, the SP500 index took 48 months in order to achieve a value benchmark of 2008. However, there were few assets that reacted differently: at the end of 2008 gold fully regained its position after a short-term loss of 25% in October while took only 12 months in order to compensate it's 50% loss and reach its historical peak in April 2011 (Drkmaat 2018). Gold and silver reached their peaks in 2011 – 2012 while the markets were at the first stage of recovery. The following period of overall equity growth triggered the deep correction cycle for metals.

The future remains unpredictable – as it has always been: in 2007 there were only a few people who were pointing out the fragility of U.S. economy and the mortgage bubble that was ready to burst (Cooper 2015). No one could guess that the consequences would be so massive that the Federal Reserve of United States was compelled to start quantitive easing programs in order to fight recession while depreciating the value of the dollar and leaving the whole world in the position of extreme uncertainty (Yglesias 2015).

We cannot predict unpredictable, we can only adjust our behavior. Empirical evidence can provide much more insights rather than bold statements and forecasts. For example, during the crisis of 2007-2008 commodities such as Gold and Silver and their performance have created a financial precedent that can and should be analyzed further. Previous mistakes are a great source of knowledge especially when it comes to investment decisions in an uncertain environment.

The aim of this thesis is to conduct research regarding gold and silver as financial assets from investing point of view. The research has several time frames: 1*) Pre-crisis period* (01/01/2002 - 01/01/2008), 2) *The crisis* (01/01/2008 - 01/01/2012), 3) *Post-crisis period* (01/01/2012 - 01/01/2018). An extra period of *the peak of the crisis* of 2008 (01/01/2008 - 30/09/2010) was taken in order to analyze the financial performance of the metals that are considered as safe haven assets in the times of crises and instabilities. Numeric data were collected from several databases such as yahoo.finance.com and investing.com on a weekly basis.

The research logic consists of two parts. First of all, the correlation between gold and silver was examined. Secondly, beta coefficient, annualized returns, and standard deviation were calculated and compared with certain market benchmarks such as SP500, Dow Jones Industrial Average 30, Financial Times-Stock Exchange 100. The dissertation aims to answer the following research questions:

1) What are the factors that affect the price changes of gold and silver?
2) What is the relationship between the gold and silver prices and their returns during different economic cycles?
3) What are the risks and returns of gold and silver before, during and after the economic crisis of 2008?

The monetary history of the metals was covered and comprehensively explained in the first part of the literature review chapter. Methodology chapter explains the essence of the research and its logic as well as data collection and calculations. Chapter 4 is dedicated to the results and preliminary summary that is widely explained in the conclusion part.

2 Investing in Gold and Silver

Following parts cover the very essence of gold and silver from both consuming good and financial assets perspective as well as their monetary history and cultural value throughout centuries.

2.1 Precious Metals

Precious metals can be defined as rare, naturally occurring chemical elements that have been highly prized by mankind for many centuries. In fact, there are some reasons that make metals such as gold and silver precious. According to Grimwad (2009, xi), the aforementioned metals are naturally occurring solid mineral elements that were widely allocated globally with a limited supply. Secondly, the inherent aesthetic beauty of gold and silver were associated with a great value and therefore considered as symbols of wealth (ibid., xii).

Gold and silver have affected civilizations by inspiring artists and craftsperson's throughout the decades. For example, the Aztecs and the Mohica civilizations were experts in working with gold. The Romans silver legacy can be seen in the British Museum in terms of Mildenhall and Water Newton hoards. (ibid., xiii). Cultures all over the world have created an abundance of beautiful works of art using precious metals of all kind that can be spotted nowadays.

Apart from that, the aforementioned metals are widely used for industrial and technological improvements, medicine and science (Venable & Shannon 2011, 17). Silver plays a significant role in the industry of photography and solar panels (Grimwad 2009, xii). It has become an irreplaceable element for medical purposes and production of hygiene products. Gold due to its physical features such as resistance to corrosion, high conductivity and excellent conduction of electricity is essential for electronics and various high-technology applications (Darst & Morgan 2013, 16). Gold also contributes to the development of pharmacology of modern medicine. It is an extremely valuable element for diagnostic procedures and medical treatments. Gold compounds are used as a part of cancer treatment, HIV/AIDS detection, rheumatoid arthritis treatment and rapid diagnostic tests (RDT).

Since ancient times gold and silver were associated with wealth, beauty and heritage carrying purposes. Through the ages, the metals were considered as a store of value and a medium of exchange due to their durability and rarity (Darst & Morgan 2013, 1-2). Monetary role of gold and silver is impossible to measure objectively. Nowadays, aforementioned precious metals are essential players in the world of finance considered as a safe haven instruments in periods of high uncertainty including: likelihood of wars and local conflicts, extreme inflation and deflation, potential crises in the world of finance or as a long-term investment with purposes of saving current capital value (ibid., 1).

2.2 Relevance of Gold

Gold is one of the precious metals that has been existing in its native form, excluding any other minerals or elements, since time immemorial. Besides its shiny gold color, the metal has a list of physical features that have made it exceptionally valuable throughout history. According to Shannon & Venable (2011, 18), gold has high resistance to corrosion, regardless of its pliability and softness the metal is extremely durable with high levels of conductivity. Apart from its matchless attributes, gold has a relative scarcity in comparison to attainable amounts of other metals. All these factors strengthen the historical value of gold as both a commodity and a form of money (ibid., 18).

The history of gold is unequaled by that of any other metal due to its perceived value from earliest times. Gold is, in fact, one of the first metals known. Its origin dates back to 5000 BC. Ever since then the metal has been considered as a symbol of abundance and power due to its appealing physical features and dazzling beauty (Venable & Shannon 2011, 17). The metal has affected the course of human history itself while influencing developments in science, politics, culture and economics. The pursuit of gold was one of the fundamentals reasons for land discovery and aggressive imperial expansions (ibid., 17). The metal was used as an instrument for segmentation by forming certain groups and castes with concentrated power all over the world. Perceived uniqueness of gold as an aesthetic beauty influenced the development of art and architecture (ibid., 18).

2.2.1 Gold as Money

The history of gold is synonymous with the story of wealth and money. Throughout the history of civilizations, there are numerous historical appearances of gold perceived and being used as money or an attribute of welfare and power. In fact, the studies of ancient societies consider the quality and level of gold crafts as certain benchmark being used for overall estimation of social complexity and technology development (Venable & Shannon 2011, 18). For example, in the Varna Necropolis in Bulgaria gold treasures have been found dating from as far back at the 5th millennium BC. One of the most archaic world collections of gold artifacts in human history that had a significant influence on the perception of advancement of European societies. The burials helped to identify the existence and of stratified society and certain male social dominance (ibid., 19). Monetary exchange in a form of gold was only a matter of time and progress of international trade and communication.

According to Venable & Shannon (2011), the first official declaration of gold as money came around 600 BC, where King of Lydia Croesus oversaw the first official gold coinage or mint. He was the first king who has established the first imperial currency in the history that has been widely accepted and demanded (Bernstein 2012, 34). Created as a need of medium of exchange for international trade, the case created a precedent with historical consequences. The formation of a rational, standardized and widely approved form of money that was perceived as a base for monetary system excluding other forms such as copper, shells or beads. Such a focus has converted gold and silver into the ultimate standards of money and wealth. (ibid., 34). In fact, it was the Croesus who introduced the bimetallic coinage system that has been used in the Western world until the 20th century (Conzett 4). The system was changed by the international adaptation of the gold standard in the 1870s.

The example was followed by the Persian king Darius I who saw the mining of coin as a royal prerogative and another source to gain and enlarge the power of his empire. His government was the first one in the world history that was collecting taxes in coin rather than in kind (Bernstein 2012, 40). The history of money has been changed drastically. In fact, it was suggested that the type of money that states have been

willing to accept as taxes has been the factor of preliminary influence defining what forms of money are the most appropriate to society and state at large (ibid,. 48).

According to Welker & von Hagen (2014), the establishment of coins was not a breakthrough innovation, but rather, a consequent step to the monetary system from pre-monetary exchange system with a global and widely acceptable scale in terms of the form of payment. Bernstein (2018, 39-40) suggests that due to physical features that made gold so appropriate for objects of worship combined with factors such as infinite demand and limit supply made it such a convenient material for producing coins with an extremely low level of resistance throughout the social groups. In fact, according to Darst (2012, 19) throughout its 1100-year history, the Byzantine Empire maintained an economy based on gold. The coin, known as bezant (also solidus or nomisma) circulated freely within and outside the Empire for almost seven centuries. The notions of power, wealth and admiration thus blended into one.

The evolution of gold combined with its exclusive features such as a standard of value and a medium of exchange led to the development of an ideal monetary system in both domestic and international scale (Schwartz 1984, 3). However, since the 16th century, Europe was actively adapting paper money as a medium of payment while gold coins and bullion continued to dominate the European monetary system. Within two centuries, paper money changed the status quo. Wagner (2015) suggests that paper money has certain advantages as a form of payment and exchange such as ease of use and relative cheapness of production. The factors became exceptionally important due to the growing amount of market transactions among buyers and sellers in an expanding area of trade (Ebeling 2015). By the mid-1800s, countries actively involved in trade decided to systematized payments. The solution was to adopt the gold standard that guaranteed that paper currency had a certain value tied to something real – gold (Amadeo 2018). The very essence of the gold standard was the principle that national money has a fixed price in terms of gold, linking the price levels of all countries (Schwartz 1984, 24).

2.2.2 Classical Gold Standard (1880 – 1914)

'The most remarkable aspect of the classical gold standard, therefore, is not the willingness of countries at different levels of industrialization to observe the very strict rules but, rather, the developments which made it possible for these economies to adhere to the rules over such a long period.' (Dr. Milivoje Panic 1992, 117)

Gold monumentalism was a gradual process that reached its apogee in the last third of the 19th century (Giulio & Gallarotti 1995, 19). Thus, the gold standard is a system that gives central monetary status to gold (ibid., 21). In other words, it means that country ties the value of national money to the amount of gold that circulates within the state (Amadeo 2018). At the state level, an idea of the gold standard is a concept of a system for regulating transactions. Considering from an international perspective, the standard was developed and deliberately implemented by advanced-industrial nations such as England, France, and Germany that legitimized gold as a form of international payment including: international medium of exchange, measure and store of value (Giulio & Gallarotti 1995, 5-6). As a result, such practice created a practical precedent of a fairly opened international monetary regime that merged various systems into a greater international system (ibid., 6-7).

According to Amadeo (2018), the principal benefit of the gold standard is that the value of money is backed by a real asset and cannot be artificially inflated. From the position of economic theory, the system itself provides a self-regulating mechanism that discourages inflation, government budget shortages and debt due to the limited amount of gold in bank reserves that is directly linked with the money supply. Amadeo (2018) suggests that the gold standard system creates a healthy environment for international trade and nation productivity: the growth of exported goods brings gold to the state treasury as a form of payment, therefore launching money printing that, in turn, provides positive investment environment for producers. Gullio & Gallarotti (1995, 18-19) provides a description of the monetary regime from 1880 – 1914 under the gold standard concluding that abnormal capital movements were uncommon, artificial manipulation of exchange rates was rare, international trade was rapidly growing while meeting the needs of both suppliers and demanders, high mobility of factors of production and human capital combined

with public and private confidence in the international monetary system and low unemployment.

Classical gold standard has lasted for almost 25 years. Regardless of its exceptional influence on the development of international trade and overall globalization of nations, the system in its essence had some significant disadvantages. Parikh (2012) suggests that initial supply of gold creates a precedent of competitive advantage or disadvantage for the state's economy. In other words, the economy is not reliant on the resourcefulness of its people and business but rather than on the gold supply (Amadeo 2018). According to Parikh (2012), the standard reduces the scale of measures for central bank activities in terms of economic intervention or any sort of unpredictable events with a long tail of consequences. Under such circumstances, the world exchange system can lead to a complete collapse.

Bordo (1981, 7) concludes that the gold standard broke down during World War I in 1914 followed by the system based on currency exchange where a value of a currency is pegged to a stronger, internationally recognized currency. Scammel (1965) arrives at the conclusion that the international gold standard as it has been developed and implemented in the 19th century has provided the growing industrial world with the most efficient system of adjustments for balances of payments that has ever existed before, either by lucky miracle or sensible planning. Cohen (1977, 78) suggest that the international regime was the "Golden Age" in the history of monetary relations. Cleveland (1976, 5) associates the classical gold standard with the period of unmatched consensus in monetary relations. In fact, the precedent of gold standard has significantly changed the course of the global monetary system and its further development.

2.2.3. The Bretton Woods System: 1946 – 1971

In 1944, representatives from forty-four countries gathered at the Mount Washington Hotel in Bretton Woods, New Hampshire, United States, in order to negotiate fundamentals of the international monetary system or "new world order" including pegged exchange rates, borrowing and international trade (Bordo & Eichengreen 1993, xi). "Bretton Woods years", under retrospective distortion, are considered as a golden age of exchange rates and the times of steadily growing

economy (ibid., xii). Bordo (1981, 7) suggests that the Bretton Woods system was an attempt to recover and modify classical gold standard using U.S. dollar as the world's reserve currency. Each member country other than the United States approved a dollar exchange rate parity, while the United States would redeem its Treasury bonds for foreign states for gold at $35 per ounce (Ronald & Mckinnon 1979, xi). In other words, the United States fixed the price of gold at $35 per ounce. Within its own history, the U.S. has been gradually collecting and maintaining gold reserves. By the end of Second World War, the state has accumulated a significant amount of the world's gold. The precedent created a stable financial environment for foreign governments that could hold U.S. Treasuries in their official reserves that were more convenient and liquid rather than physical possession of gold (Ronald & Mckinnon 1979, xiI). Besides that, the United States was the only major country with profound financial markets without restrictions on currency trading. The rest of the world was suffering from destructive consequences of the war sinking in debt and despair. Bordo (1981, 7-8) underlines such circumstances as one of the motivational triggers for comprehensive cooperation and unconditional confidence in the stability of the dollar. Thus, the dollar was considered as "international money" used by states, banks and private corporations (Ronald & Mckinnon 1979, xii-xiii).

The creators of the Bretton Woods system wanted to achieve certain synergy by combining the advantages of the classical gold standard (i.e., long-term exchange rate stability) with advantages of floating rates. At the same time, they aimed to avoid and fully eliminate defects of floating rates (i.e., competitive devaluations and destabilizing speculations) and complexity of the fixed exchange rate gold standard (surplus/ deficit of reserves with consequential impact on trade). The solution was to develop an adjustable peg system of fixed parities that would reform the existing monetary system (Bordo & Eichengreen 1993, 5-6; 28). One of the anchors of the process of creation was the belief that the mistakes of interwar period have to be avoided. Thus, system's errors such as extensively fluctuating exchange rates after First World War, the international transmission of deflation, trade and exchange restrictions and bilateralism were considered at the planning stages. The final goal was to negotiate international policy based on stable exchange rates, national full employment policies and global cooperation (ibid., 28-29). The system that emerged

was a system in which conditions defined in terms of gold and the dollar that could be altered in the event of a fundamental instability of the global order (ibid., 81).

The performance of the system can be seen through analysis of macro-economic conditions such as the rate of inflation, money growth, nominal and real exchange rates while being compared with the performance within classical gold standard (1880 – 1914) and period of floating rates (since 1971). Several countries will be used as a benchmark: U.S., U.K., Germany and Canada.

According to Bordo & Eichengreen (1993, 12), the rate of inflation within Bretton Woods system was relatively low, although it includes two periods of rapid inflation in the 1950s and at the very end of the existence of the system. Overall rate of inflation provided remarkable price stability. Classical gold standard had the lowest rate of inflation (ibid., 12).

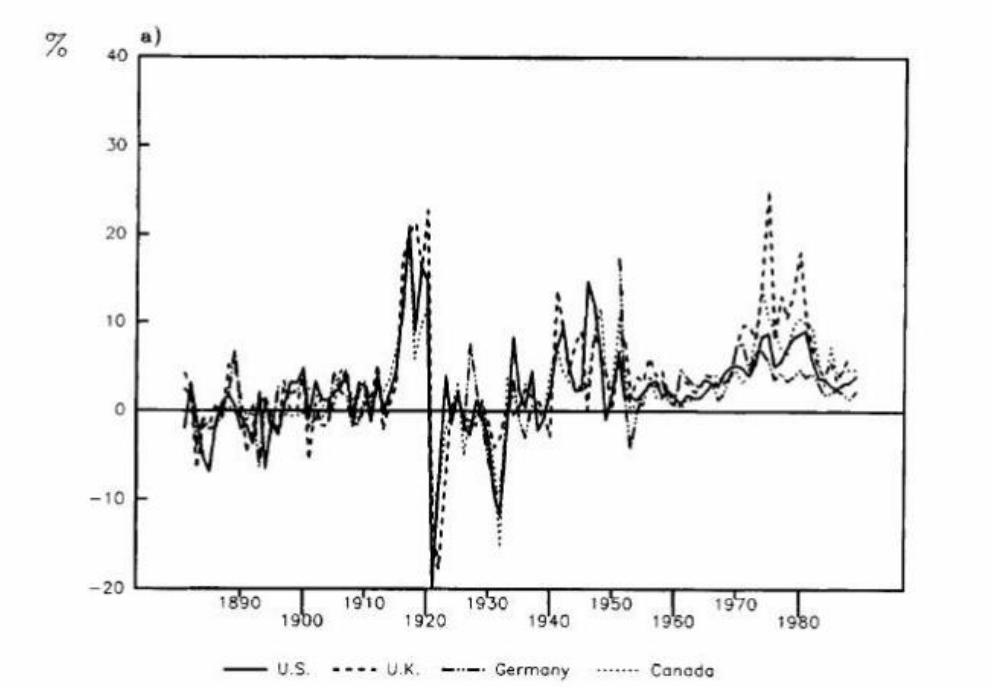


Figure 1. Rate of Inflation (Adapted from Bordo & Eichengreen 1993)

Money growth has a stable upward trend without significant fluctuations. There is not much difference between Bretton Woods and the subsequent floating regime. In its turn, classical gold standard system has a moderate level of volatility with a significant short-term spike. Global gradual growth can be explained by the path of money growth of the United States, the center of the system, that was considerably

lower than other nations mentioned above, excluding Germany (1945 - 1971) (ibid., 15-16).

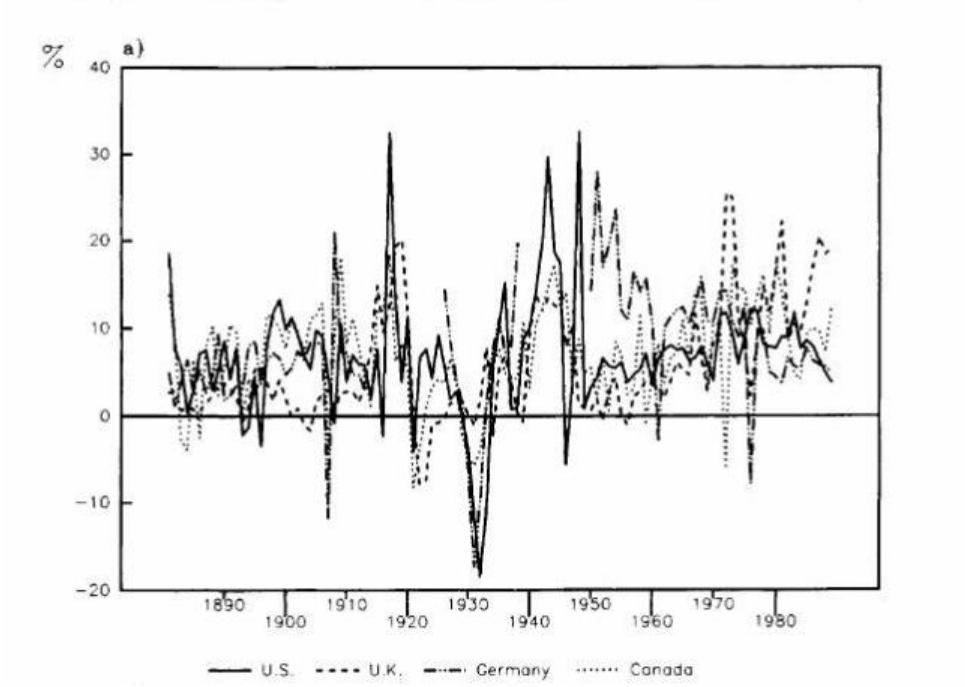


Figure 2. Money Growth (Adapted from Bordo & Eichengreem 1993)

When it comes to nominal and real exchange rates, Bordo & Eichengreen (1993, 19-20) underlines a remarkable stability since the beginning of 1950s in comparison to the sequent period of floating rates and classical gold standard of 1880 – 1914.

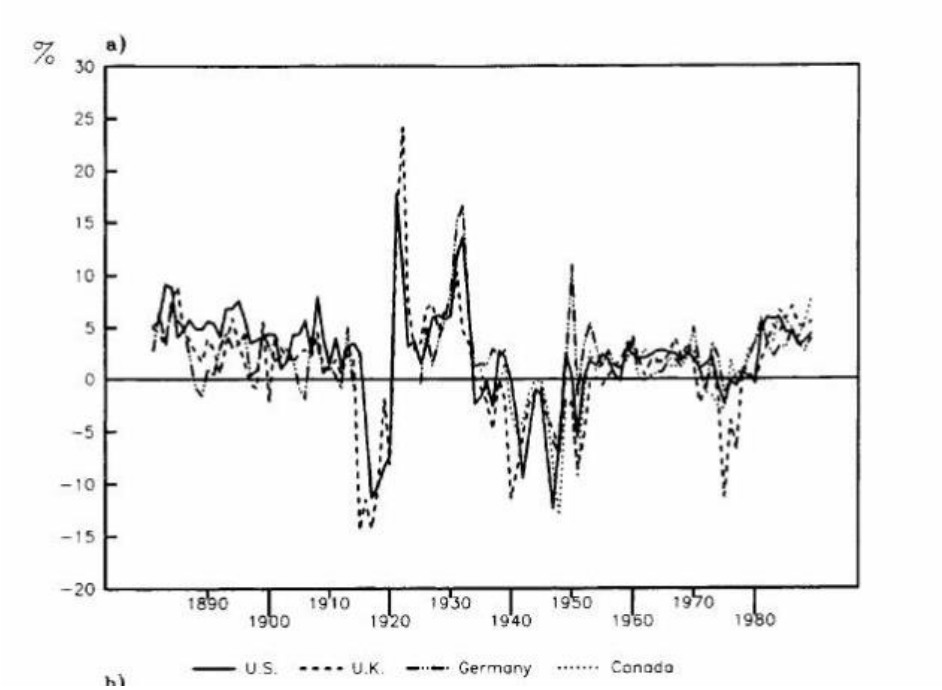


Figure 3. Exchange rates (Adapted from Bordo & Eichengreen 1993)

To sum up, the Bretton Woods regime demonstrated the best overall macro performance of any regime. Bordo & Eichengreen (1993, 27) highlight the convertible period (1959 – 1970). At the same time, the data doesn't let to conclude whether it was the result of stable monetary policy, an absence of fundamental shocks or set of favorable circumstances (ibid., 27-28).

The Bretton Woods system, even though it was originally designed as an adjustable exchange rate regime, de facto was implemented as the fixed rate regime. According to Bordo & Eichengreen (1993, 82), the heyday period of Bretton Woods system (1959 – 1967), when the system reached its apogee in terms of global stability and dollar dominance, also underlined the fundamental problem such adjustment of capital controls; exchange rates and domestic policy autonomy; currency liquidity; lack of confidence. None of the measures that were developed and implemented within the decade including Gold Pool, swaps, Roosa bonds, didn't work as a permanent solution (ibid., 83).

Bordo (1981, 7-8) suggests that the most significant reason of the ultimate breakdown of the system was that steady growth in the use of U.S. dollars as a reserve currency combined with a constant balance deficit of the United States gradually reduced U.S. gold reserves. Furthermore, such a situation has provoked reducing public and international confidence in the ultimate ability of the U.S. to redeem its currency in gold. Since 1965, the escalation of the confidence problem has also coupled with an aversion to paying seignorage and an inflation tax to the U.S. moving towards the irrevocable abandonment of the system (ibid., 8-9).

On August 15th, 1971, President Richard Nixon closed the "gold window" facing growing public debt, negative balance of payment and an overvalued dollar. (Ronald & Mckinnon 1979, 3-4). The breakdown of Bretton Woods marked the end of U.S. financial dominance leading to floating rates and a centrifugal monetary system (Bordo & Eichengreen 1993, 83).

2.2.3 Gold as a financial asset

As it has been discussed above, gold is a precious metal that has been treasured for thousands of years due to its perceived value and natural rarity. According to Darst (2013, 16), the metal is considered as:

- A symbol of wealth
- A medium of international exchange
- A store of value
- A unit of account during certain periods of time

After the breakdown of the Bretton Woods system in 1971, gold regained its role as a financial asset and investment instrument. World Gold Council (2018, 3) states that the price of gold has increased by an average 10% per year since 1971. The following chart highlights the return of the metal comparing to stocks and bonds.

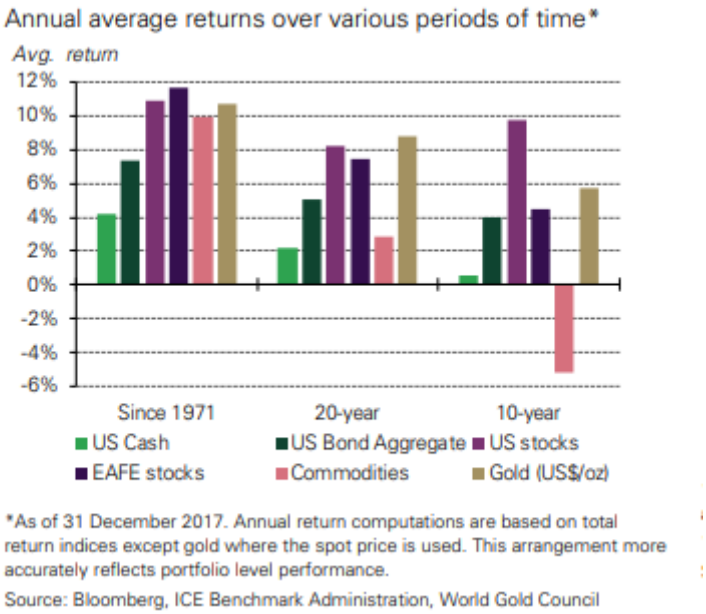


Figure 4. Annual average returns (Adapted from World Gold Council 2018)

When it comes to an investment decision, gold, as a financial asset, mostly considered as a tool for portfolio diversification. In fact, gold can make a significant difference change in terms of risk and return under a period of economic uncertainty or in an environment exposed to a potential crisis and global instability (Darst 2013, 1-2). Broadly speaking, the higher the risk in the portfolio – whether in terms of volatility, liquidity or concentration of assets – the larger the required allocation to offset the risk ratio (World Gold Council 2018, 6).

Considering gold from a theoretical point of view, it is usually linked to the financial concepts such as hedging, diversifier, and safe haven asset, which, in turn, establish the theoretical argument in favor of gold as a portfolio asset.

According to Baur and Lucey (2010, 219-220), hedge is defined as an asset that has zero or negative correlation with another type of asset or portfolio on average. The purpose of hedging is to minimize the significant loss of the portfolio value in case of severe scenarios such as market correction or global financial turmoil (Amadeo 2018).

A diversifier, in turn, is defined as an asset that is positively correlated with another type of asset or portfolio on average (Baur & Lucey 2010, 219-220). Its main purpose is to reduce the overall risk in a portfolio. In other words, a diversifier helps to increase risk-adjusted returns.

A safe haven asset is defined as an asset that is uncorrelated or negatively correlated with another asset or portfolio in times of high market volatility (ibid., 220) The underlying idea is that an asset has a non-responsive correlation with a portfolio return in extreme market conditions. According to Ghazali, Lean and Bahari (2013, 428-429) a safe haven asset must, therefore, be some asset that holds its value in an adverse market disorder. Such an asset serves like insurance for investors to protect their wealth in the event of negative market conditions as well as at to compensate the loss of portfolio value. In other words, a safe haven asset provides certain value stability of the capital by reducing the severity and duration of negative market scenarios.

Following part about factors with a high level of influence on the prices of precious metals will provide a deeper analysis of factors that determine the investment decision when it comes to gold and silver and overall portfolio performance.

2.3 Relevance of Silver

Silver is a soft ductile metal with atomic number 47 denoted by the chemical symbol (Ag). In its appearance, the metal has a shiny whitish color that was associated with the moon by early civilizations (Grimwade 2009, xi). The original Latin name for silver was luna meaning “moon”, although it was changed later to Argentum (Ag) meaning

"white and shining" (ibid., xi). Silver has the highest electrical conductivity of any element and the highest thermal conductivity of any metal (Darst 2012, 43). In fact, it has a wide range of uses including industrial production, medicine, food, and automotive industry, photographic film and solar panels (Darst 2012, 41; Grimwade 2009, xii).

Silver, as gold, for centuries, has been attracting human interest all over the world. Due to its physical inherent aesthetic beauty and relative scarcity, the metal has been appreciated throughout millenniums as a symbol of wealth and a mean of legacy. Moreover, the metal's indestructibility and rarity made it suitable for monetary purposes such as trading and accumulation of wealth (Grimwade 2009, xii-xiii). The remains of several civilizations include a plentiful amount of silver jewelry, sacred religious items and other artifacts shaped from the metal (Darst 2012, 41). For centuries silver was used for artistic purposes all over the globe. One of the most significant historical relics is dated in between 1st and 4th centuries AD when the Romans occupied Britain. Mildenhall and Water Newtoon hoards are considered as an exceptional work of the Romans silversmiths. The artifacts can be seen in the British Museum (Grimwade 2009, xiii).

2.3.1 Silver as money (Monetary History of Silver: 3,400 B.C – 1880)

According to Turgot (1898, 38), money is a medium of exchange and a unit that is used as a price expression. Silver, as a mean of exchange and measurement of value, has a long history of use and development. Equally, with gold, silver was considered as money within centuries. Morgan & Marhese (2015, 7-8) underlines that the very word for silver is money in many languages: Italian, French, and Spanish are only a few examples of the list. In Hebrew, the word *kesephh* means both silver and money. In fact, among more than 250 million people in over 50 countries, the word for money is identical with the word for silver (ibid., 8).

Silver's value has been appreciated for a long time. Morgan & Marhese (2015, 9) suggest that silver was being used as money since 3400 BC in Mesopotamia. While the monetary system was at its very development stages, societies used silver as a form of payment for local trade as well as a storage of value (ibid., 10).

Lydians significantly contributed to the development of the monetary system by utilizing coinage (both gold and silver) for monetary purposes around 700 BC. Historians suggest that King Gyges (690 – 657 BC) was the first ruler who established coinage and system of coins that was an admixture of gold and silver (ibid., 11-12). Within a century King Croesus originated the first bimetallic system of coins with a stable exchange rate between the two metals (ibid., 12):

- 1 gold stater = 8.17 grams of gold
- 1 silver stater = 10.89 grams of silver
- 1 gold stater = 10 silver staters
- (8.17) x (1) = (10.89) x (10) OR
- Gold-to-silver ratio = (108.90/8.17) = 13.33

He was the first king who has established the primary imperial currency in the history that has been widely accepted and demanded (Bernstein 2012, 34). In fact, it was the Croesus who introduced the bimetallic coinage system that has been used in the Western world until the 20th century (Conzett 4). The system was changed by the international adaptation of the gold standard in the 1870s.

The system has spread through the East, Greece and Mediterranean Europe (Morgan & Marchese 2015, 10-14). Greeks favored silver and minted their coins exclusively in silver. Financial leadership of Athens has contributed to the development of the Attic silver standard that was widespread over the Mediterranean and beyond. At the same time, Davies (2005, 74) argues that there were a large number of rival coinage systems and quite a few complicated standards. For many societies silver was considered as a subsidiary of gold coinage. The choice of which metal to use as a political and economic tool depended on a mixture of changing factors such as availability of raw materials, social acceptance of the certain type of metal, labor, and transport as well as mining abilities. As a result, the changing relationships between gold and silver has twisted monetary policy from the beginning until the bimetallist controversies in USA and Europe at the end of 19th century (ibid., 64-69).

The medieval period (5th – 15th century) has significantly contributed to the silver global expansion in terms of the form of payment for daily operations and trade. Charlemagne, the king of Gaul and Germany, decided to replace the previous

worthless currencies with a new one, taking silver as a foundation in 771 (Morgan & Marchese 2015, 14-15). Although the monetary units were nearly the same with the basic unit being called the Roman denarius, it was the first time in the history of money when the system was on a monometallic standard, such as silver. British silversmiths have significantly contributed to the adaption of silver via minting pennies and using them as a currency for international trade (Davies 2005, 127-130). The Charlemagne's precedent has created a long tail of consequences for the monetary history that has affected the monetary course of development of Europe for many decades (Morgan & Marchese 2015, 14-15). The monometallic system lasted for several centuries until first "sequins" made of gold were minted in the 13th century. Due to its high value and merchants' use in foreign trade, gold coinage regained its power over silver in the Middle ages (Davies 2005, 148).

The consequences of the bimetallism shift were terrible. After the commercial revolution in the 13th century that facilitated the development of the taxation systems and coinage minting, lack of unified currency system, as well as numerous gold-to-silver manipulations, caused financial meltdowns and systematic crashes in Europe reaching its peak in 1345 (Davies 2005, 159-160). The catastrophe resulted in extreme poverty and famine among the masses known as the Black Plague. The crisis, along with the Hundred Years' War, resulted in a shortage of silver and economic stagnation that slowed down the economic progress for more than a century (Morgan & Marchese 2015, 14-16; Hunt 1994).

The new era started at the end of the 15th century is commonly associated with three inventions such as the compass, gunpowder, and printing. Every single one of them had its own heyday moments, however, printing was about to change the course of monetary system worldwide. The idea of paper money was first developed and implemented in China by the Chinese Emperor Wu-ti as a financial need due to a series of wars (Morgan & Marchese 2015, 16). The experience was not very successful: Chinese people lost their faith in the paper money and became even more convinced with the virtues of silver that have lasted until up to the early part of the twentieth century. Such a reaction was caused by high banknote inflation that led to a significant loss of value among citizens (Davies 2005, 180). The Mongol

empire also adopted the paper money experience of China and repeated its financial history on an even grander scale (Goodrich 1957, 174).

Davies (2005, 181) suggest that the Marco Polo has already described the paper money circulation in China in his well-known "Travels" that was written during 1275 – 1292. In Europe, however, the knowledge that printing money could be a direct substitute of coins took almost two centuries to discover. Since the 16th century, Europe was actively adapting paper money as a medium of payment until the total corruption of printing press that led to an inflationary flood (ibid., 181). Even at that point, silver and gold coins and bullion continued to dominate the European monetary system contributing to the fundamentals of the bimetallism system.

Discovery of the New World (Bolivia, Peru, and Mexico) in 1492 led to a large increase in silver production (Darst 2012, 41). Growth in silver production during the 16th century was closely connected with the developments in foreign trade (Kobata 1964, 245). Morgan and Marchese (2015, 16-18) also suggest that developing the international trade between European countries and China & Japan strengthened the global role of silver as an international form of payment. Gold had relatively low value in China, thus a significant amount of trade with the Chinese merchants was done using silver as the primary monetary unit (ibid., 17). In other words, Europeans used silver as a form of payment for Chinese goods such as gunpowder, silk, tea and ceramics which were carried over the fabled "Silk Road". The growing interconnectedness of the international trade between East and West combined with the silver discovery and mining in Latin America have predetermined the key monetary role of silver since the 15th century. Adoption of the gold standard in 1880 changed the very essence of international monetary in favor of gold. Ever since then silver was taken out of the official monetary system (Popescu 2016).

Throughout the monetary history of 5th-18th century's silver was a chief metal for local and domestic as well as retail trade. The metal was considered a legal form of payment – money. It was widely used as a form of payments for wages and salaries. In other words, silver played an essential role in daily operations whereas gold was the preferred medium for international trade and high-value transactions. Such conditions were essentials principles of bimetallism (Morgan & Marchese 2015, 30). Friedman (1990) defines bimetallism as a system in which a currency unit is

exchangeable for a certain amount of gold or silver. The system promotes a fixed rate between the metals. Morgan & Marchese (2015, 29) argue that such an approach had a fundamental problem: it has been assumed that markets are static, but markets are incredibly dynamic. Various factors affect supply and demand that inevitably lead to the price volatility of the metals causing inflation and deflation cycles that cannot be controlled. The system has prevailed for almost two and a half millenniums from the origins of coinage in antiquity until the global acceptance of classical gold standard in 1880.

2.3.2 Silver as a financial asset

Silver is sought as a practical and valuable industrial commodity with a wide range of applications in jewelry, electronics and photography industries (Darst 2013, 41-42). From a financial point of view, the metal is usually considered as an instrument for diversification of portfolio investment. In fact, silver, as an asset, is very similar to gold when it comes to uncertainty and high market volatility – both of the metals are used as hedging instruments, diversifiers, and safe haven assets during global instabilities and financial turmoil.

According to Gold & Shah (2016) silver's price performance has historically been 80% correlated with the price performance of gold. In other words, when investors turn positive towards gold, optimism to silver usually follows. At the same time, gold and silver priced in US Dollars have positive correlation when it comes to trade-weighted USD exchange rate. Popescu (2014) suggest that silver never moves independently from gold, despite its fundamentals. Silver investors are much the same as gold investors in a way that they focus mostly on the monetary aspect rather than industrial especially in the times of economic crisis. Other factors that influence the price of the metals will be covered later.

2.4 Investing in Gold and Silver

There are many aspects that have to be considered before answering this question. From an investor point of view, such things as preferences for owning paper or physical gold & silver combined with motivation, concerns, temperament, amount of available capital, goals and personal circumstances can significantly affect

the decision making process. Darst (2012, 19-20; 44) suggest that the metals can be purchased in a variety of forms, including:

- Recently minted legal tender and commemorative coins
- Previously issued coins
- Bars and bullion
- Shares of mining companies
- Futures and option
- Gold-backed bonds
- Exchange traded funds (ETF)
- Gold and silver jewelry and objects of art

2.5 Gold and Silver Psychology

Investors buy precious metals, such as gold and silver, for two primary reasons. First of all, as in any investment, they hope that price will continue to grow and generate positive returns in a foreseeable future. Secondly, investors believe that other types of assets will decrease in value due to some instability or negative market circumstances. Investors' motivation can be divided into two basic groups: greed or desire to earn money; fear or desire to maintain existing value. According to Richards (2012), every investment decision is significantly affected by emotions. Greed and fear are not the same: they lead to different behavioral patterns and, in turn, controversy investment strategies. When it comes to fear, investor's confidence is more affected by the losses rather than by profits. In such case, a conservative approach is the optimal solution when it comes to the allocation of personal capital. On the other hand, a prevailing feeling of material losses while the market is experiencing uptrend leads to more aggressive investing decisions based on greed. An emotional balance based on both strengths and weaknesses is a crucial factor of a sensible investment strategy.

Gold and silver are historically considered as safe haven assets. In terms of high volatility or financial turmoil, investors intend to purchase assets that will more likely behave as a protection of their capital. In a situation when U.S. dollar is not strong on the market and its value is decreasing due to some reasons, investors are willing to

buy gold and silver. McGuire (2010) suggest that U.S. dollar and gold can be seen as substitutes in an investment portfolio. For example, if an investor wants to hold more U.S. dollars, he will decrease the hold of gold and silver and vice versa.

Regardless of the fact, that gold and silver are considered as distinct types of commodities with a significant difference in terms of industrial use, the correlation between the two monetary metals has remained high (Popescu 2016). The chard below underlies the trend moving of gold and silver since 1990: the correlation reached its apogee during crises of 1993 in Russia and the recession of 2008. Since 2012 the average correlation is around 90%. Furthermore, according to the report of Shah & Gold (2016), silver's price performance has historically been 80% correlated with the price performance of gold.

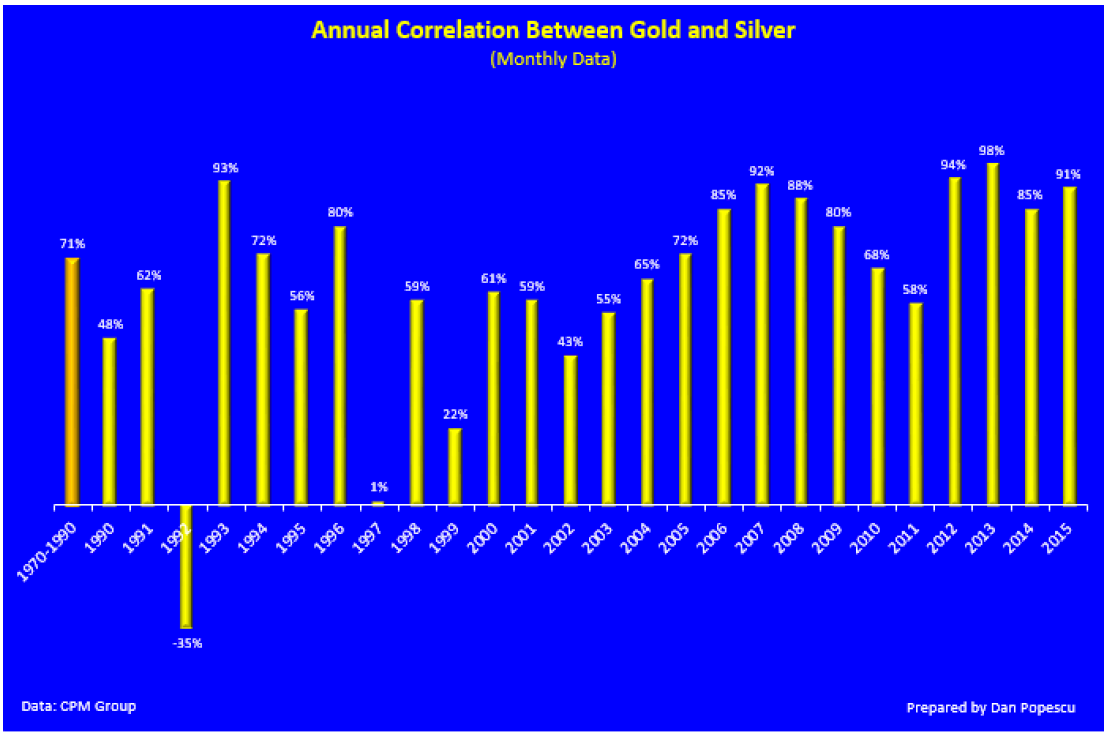


Figure 5. Gold & Silver Correlation (Adapted from Propescu 2016)

Propescu (2016) suggests that during global crises, monetary aspect are preliminary concerns for investors rather than industrial importance. The global financial crisis of 2007-2008 has favored the role of silver as a safe haven asset in a similar way it has favored gold. In other words, silver's value is deeply ingrained in the world of finance. As a result, Propescu (2014) claims that silver doesn't move independently from gold, despite differences in fundamental factors.

For the purposes of my work, I will define and analyze common factors that have the most significant influence on price and trend development of gold and, hence, silver. The idea behind is that the gold stimulates the market performance of commodity market as a whole and silver in particular. At the same time, I intend to identify unique factors that affect the price of silver.

2.6 Factors that affect gold and silver prices

It has been considered that gold and silver are good hedge against booming inflation (McGuire 2010). According to Darst (2013, 27), key price factors also include changes in supply and demand, geopolitical tension and central bank activity. Jagerson and Hansen (2011) conclude that threat of war and stock performance should be taken into account as fundamental factors when it comes to the price volatility of gold and silver. Zhang & Wei (2010) suggest that crude's oil price has a significant positive correlation with gold's price, therefore affecting the market of commodities. In fact, every single factor has a significant influence on the market performance of the metals, however, they also impose a bigger thread or potential reward due to high fragility of the global financial system.

2.6.1 Inflation

During the Gold Standard and The Bretton Woods system, U.S. dollar was pegged to the price of gold thus creating a close link between gold and U.S. inflation. After the collapse of the system in 1971 inflation became one of the key price drivers of gold.

The experience of the last 50 years suggested that gold is a good hedge against inflation shocks – vivid examples are the spikes of in the late 1970s and early 1980s due to the surging oil prices (Harvey 2018). In other words, gold has protected investors against extreme inflation driving up prices of gold by more than 10% in years when inflation has been higher than 3% (World Gold Council 2016).

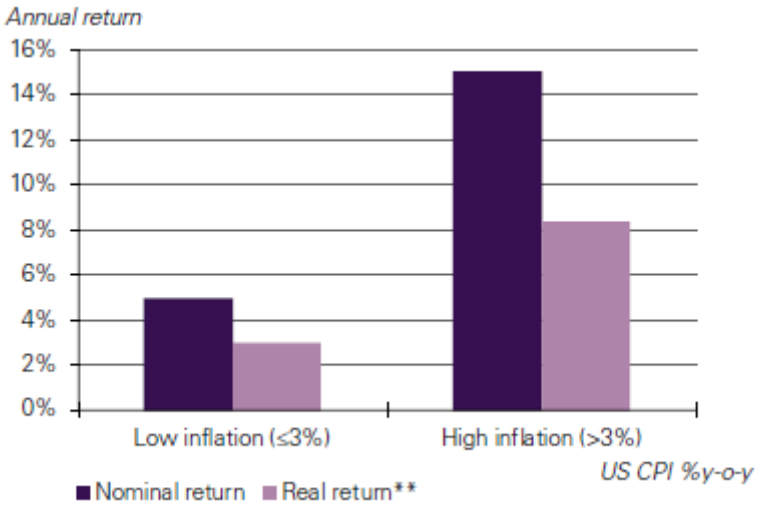


Figure 6. Annual Return of Gold (Adapted from World Gold Council 2016)

In its very essence, any type of inflationary system supposes that the money supply will grow and hence the currency will have a trend of gradual depreciation. If monetary inflation exceeds real growth in products and services then there will be price inflation, which is measured via the Consumer Price Index (CPI) and Product Price Index (PPI). An empirical study conducted by Wang (2012) confirms that gold has a strong positive correlation with rising inflation rates. One of the reasons for positive correlation is that the volume of investments in gold is increasing as a result of the accumulation of the metal caused by inflationary fears and diminishing power of U.S. dollar. Authorities cannot produce gold the same way they produce currencies, and therefore they cannot debase the value of gold. The existence of gold certificates and ETFs allow investors to easily trade gold and also own it without having to actually store it.

Jagerson & Hansen (2011) explore that the gold price reaction between 2008 and 2011 is a direct consequence of the aggressive monetary policy of the U.S. The similarities to the deficit in 1958 made investors and central banks to fear the decline in dollar‘s purchasing power, and therefore increasing the holding of gold as a safe haven. The precedent was explained by Gulati & Mody (1982) leading to the conclusion that inflationary expectation has an impact on gold‘s price.

However, McGuire (2010, 32-33) argues that with inflation under control, the economy begins to expanding and assets classes such as stocks and bonds become financially attractive. Such a scenario makes gold and silver less attractive for

investors. Furthermore, Shafiree and Topal (2010) state that they didn't find a significant positive correlation between gold price and inflation in the U.S. According to the empirical study of Lawrence (2003) there is no substantial correlation of gold and macro-economic variables such as GDP, interest rate and inflation rate.

2.6.2 Central Bank Activity

After the break of the Bretton Wood's System in 1971, both gold and U.S. dollar are happened to be in a free market. Regardless of the fact that gold is no longer a global monetary standard, governments and central banks all over the world are still holding gold as a portfolio in their reserves to back the fiat currencies.

According to Darst (2013, 16-19), central banks have a clear vision of why they hold gold as a part of their reserves. Even though different central banks may emphasize different factors at different times the prevailing reasons are:

- *Diversification*: gold provides good diversification potential within a currency portfolio. The idea behind is that the price of gold is determined by world supply and demand, whereas a currency unit depends on a central bank monetary policy and government promises. In other words, gold behaves in an almost completely different way from the currencies and exchange rates due to its global role and overall interconnectedness.
- *Economic security*: within centuries gold has maintained its real purchasing power value and thus provides economic security for central banks in the long run.
- *Physical security*: reserves held in the form of another country's securities are extremely vulnerable. With appropriate location, gold tends to be safe in case of an emergency. Total and inconvertible liquidity is, therefore, essential – gold is perceived to provide this.
- *Unexpected needs*: gold is the best existing financial instrument for uncertain events. It provides a form of insurance against highly unsettling and/or damaging events.
- *Social confidence*: the public tends to be more confident from knowing that its government holds gold. In other words, gold presence in the bank reserves has a strong psychological influence on the crowd

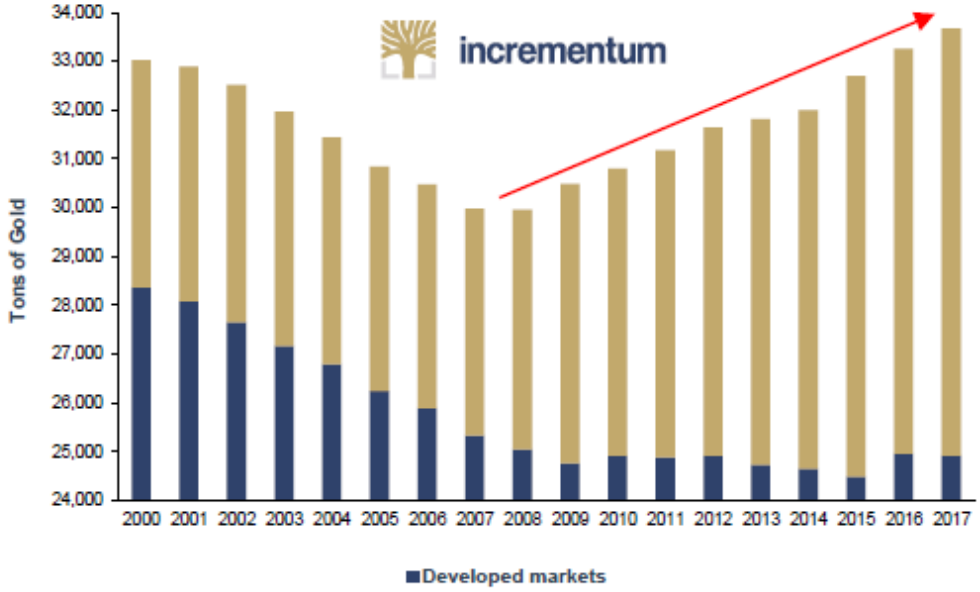
- *Insurance*: the opportunity cost of holding gold may be viewed as comparable to an insurance premium.

From the theoretical point of view, central banks and governments have to back up their liabilities. In most of the cases, bank reserves include foreign currencies, gold and other kinds of assets with the low-risk rate. Such combination helps to lower the overall risk for the government and reduce the chance of default. The preliminary role of gold is to diversify the portfolio and control risks (Wang 2012). According to Jagerson & Hansen (2011), central banks should hold gold as a large position in its asset, so they can rely on a more safe position towards the reserves.

Gold is rediscovered as a supranational reserve asset by various central banks (China, Russia, Turkey, Iran). A failure of monetary policy normalization or an escalation of geopolitical tensions may lead to a significant erosion of confidence in the U.S. dollar-centric currency regime (In Gold We Trust Report 2018, 4).

Economic Crisis of 2008

The global recession of 2008 marked a turning point: while the gold reserves of central banks steadily declined until 2008, they have been rising ever since. The remarkable point of such is that the entire increase is due to gold accumulation by emerging-market central banks. The pattern should be seen as strong evidence of growing distrust to the existing monetary and credit systems (In Gold We Trust Report 2018, 82). In fact, the governments of countries such as China, Russia, and Iran have frequently and more or less openly questioned the global economic order dominated by the U.S. The doubt is reflected in the steady expansion of their gold reserves.



Sources: IMF-IFS, World Gold Council, Incrementum AG

Figure 7. Consolidation of Gold (Adapted from In Gold We Trust Report 2018)

Example of Russia shows the degree of the gold cover of the monetary basis is by no means carved in stone. The country experienced fall of the communist regime in 1991 that led to default and high financial instability that lasted for a decade. Ever since the crisis of 2007 – 2008 the accumulation of gold reserves formed an uptrend that was strengthened since the Ukraine crisis in 2014 and massive financial and economic sanctions that Western countries imposed. Since 2007 Russia has boosted its central bank holding of gold by four times (408%).

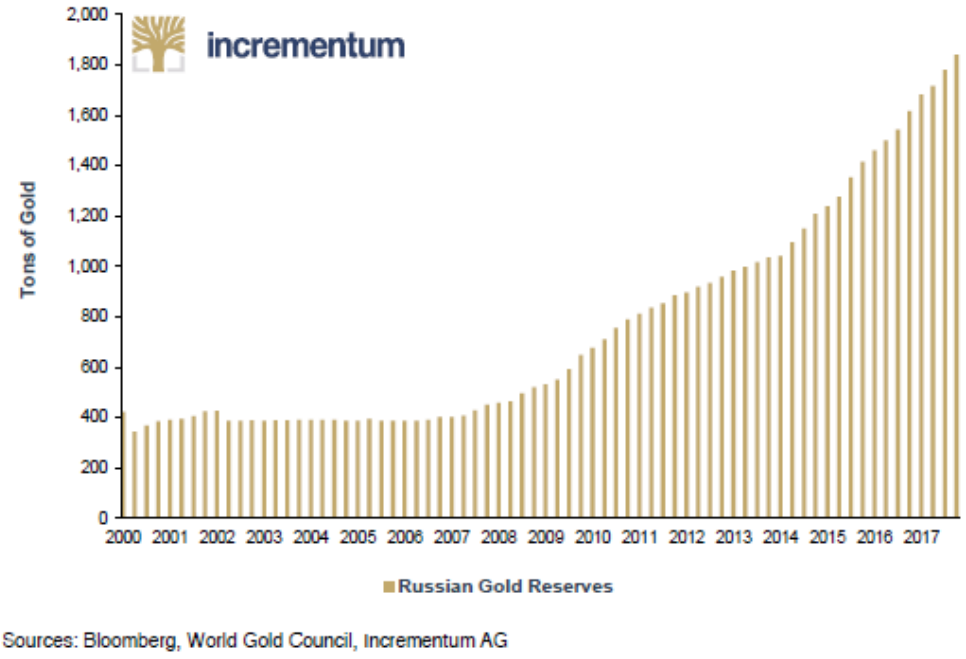


Figure 8. Russian Gold Reserves (Adapted from In Gold We Trust Report 2018)

In a global scale, starting in 2008 central banks have continuously added gold to their reserves turning from being net sellers of gold to net buyers. The research notes that central banks have remained solid buyers of the metal despite soft demand from investors and high levels of bets for a price decline in the futures market (Forbes 2018). Ever since the financial crisis countries all over the globe started to consider the metal as one of the crucial instruments for diversification and hedging against market instabilities. As global debt continues to skyrocket, central banks and some individual investors alike might want to possess some gold, the chart below suggest that it is happening already.

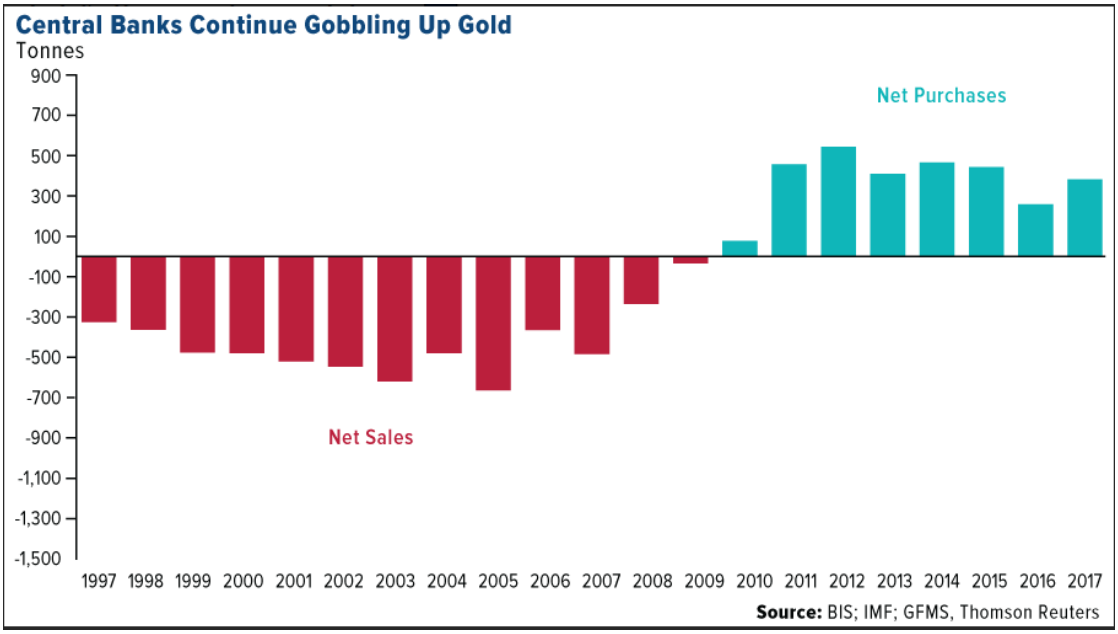


Figure 9. Central bank gold purchases (Adapted from World Gold Council 2018)

The past seemed to be catching up with the future following the financial crisis when savers once again began to see their savings disappear. Regardless of desirable macro-economic outcomes, gold was and is the insurance against negative financial scenarios for both central banks and individual investors.

2.6.3 Supply and Demand for Commodities

In fact, the market forces such as demand and supply determine the price of any financial asset. In fact, commodity prices are heavily influenced by the long-term dynamics of demand and supply, which are usually referred to as “fundamental drivers”. They can also be subject to short-term shocks from events such as geopolitical crises, weather, and catastrophes (World Gold Council 2011).

Gold

The balance between gold demand and supply has effects on price in the long-term. Although, if the demand for the metal changes from time to time, the supply, in the long run, is relatively inelastic (Investment 2011). In other words, the supply of gold does not change drastically, regardless of the volatile demand. Gold is considered a commodity unlike others because it is not consumed. Popescu (2014) concludes that the traditional economic models and theories of supply and demand influence simply don’t apply when analyzing monetary metal such as gold. In the case of gold, the relevant supply is the total supply. It is the total supply that exists. Demand, in turn,

is the total demand, not the new demand (mining) coming to the market during a year. The vast majority of all gold mined throughout human history still exists and is held either in bars, coins, or jewelry. Wang (2012) suggest that gold mining is slightly adjusted according to demand and, thus, the forces of demand and supply don't have a great impact on gold's price. In fact, contrary to other commodities, gold can be recycled. According to Darst (2013, 26-27), 40% of overall gold production since 2008 is recycled gold, whereas mine production is responsible for only 60%.

Demand Sources

Gold demand sources can be divided into four categories:

- Jewelry
- Investment
- Central Bank activity
- Technology

Gold jewelry represents the largest source of annual demand per sector. Despite the downtrend over recent decades, gold demand for jewelry still accounts for around 60% of total demand. The largest market players are China and India, in volume terms, together accounting for over 50% of current gold demand (Word Gold Council 2016; Darst 2013, 30-31).

Gold has unique properties as an asset class. As it has been mentioned above, a certain allocation of gold is proven to protect and enhance the performance of an investment portfolio. Investment demand is considered as the factor that really drives the price of gold. According to the World Gold Council (2017), investors of all sorts are coming to accept gold as a reliable long-term of value that has a strong hedging power that has zero or negative correlation with other assets. The annual volume of gold bought by investors has increased by at least 200% over the last three decades.

Central bank activities, as it has been covered above, have a significant influence on gold in terms of price definition and formation of potential trends. In fact, since 2008 central banks have continuously added gold to their reserves turning from being net sellers of gold to net buyers. Emerging market central banks have increased their official gold purchasing, while European banks have ceased selling, and the sector

now represents a significant source of annual demand for gold (World Gold Council 2017).

Within history, gold's primary industrial use has been in electronics due to its unique physical properties. New development in technologies is driving new forms of uses in medicine, engineering and environmental management (World Gold Council 2016). Although most technological applications use low volumes of gold, their impacts lead to the first technology increase of gold used for the first time in seven years.

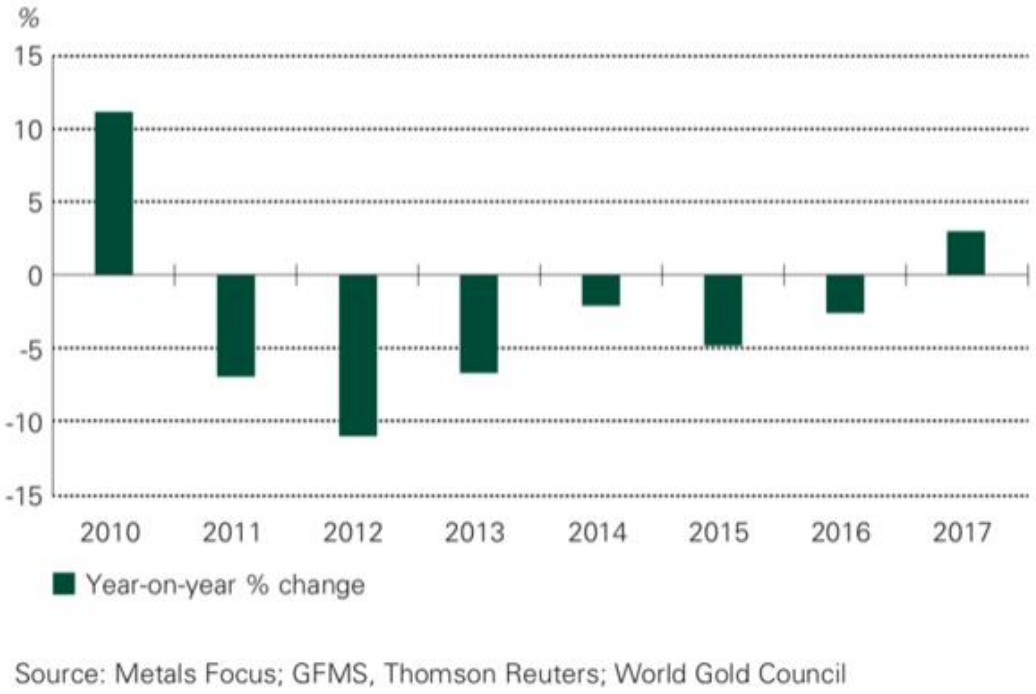


Figure 10. The use of gold (Adapted from World Gold Council 2018)

The uniqueness of gold and the leading role in the monetary history set the metal apart from other commodities. Gold is less exposed to swings in business cycles due to the minor industrial demand. The asset usually exhibits low volatility and tends to be more robust at times of financial and global turmoil. In turn, the correlation of gold to other commodities is insignificant. Moreover, gold is nearly indestructible: all the gold that has been mined still exists in one form or another. Recycled gold comprises a larger share of supply allowing the market to reduce production shocks and shortage. The metal is also well diversified, with no single region accounting for more than 20% of production that, in turn, contributes to lower volatility relative to other commodities (World Gold Council 2012, 1-7). Darst (2013, 26) concludes that

gold's supply is relatively inelastic and unable to react quickly to changes in the price outlook.

Silver

Silver, in contrast, has a significant positive correlation with supply and demand. According to Shah (2016), more than 50% of silver's demand comes from industrial fabrication, whereas less than 10% of gold demand comes from the sector.

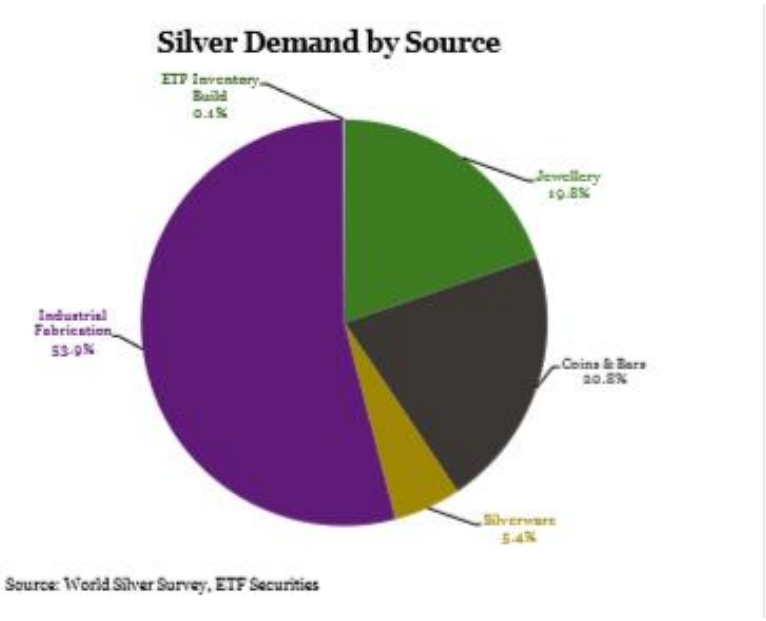


Figure 11. Silver demand by source (Adapted from Investment Insight: gold and silver, similar but different 2016)

Such a fundamental difference has a significant influence on the price of silver. Mine supply of gold represents only a tiny fraction of the above ground stock of gold, however, a large amount of mined silver goes into industrial applications and therefore is "consumed" until the goods using silver, for example photovoltaic panels, are recycled (Shah 2016). The biggest demand factor for silver is an industrial fabrication that accounts for 60% of total supply (World Silver Survey 2018). In fact, silver becomes more dependent on business cycles and overall conditions of the global market rather than gold. Economic turmoil that leads to industrial slowdown imposes an imminent threat to silver demand that, in turn, increase the price volatility causing short-term price shocks.

Investment demand, which consists of physical bar investment, coins, and medals, is accounted for 15% in 2017 reaching its lowest level since 2008. Drastic investment decrease by 35% in comparison to 2016, was driven by risk-lover investors and

rallying equity markets (World Silver Survey 2018). Since the beginning of 2018, the price of silver falls by more than 10%.

Silver is best known as a material for jewelry and ornaments (Grimwad 2009). The demand trend has positive dynamics since the beginning of 2000 accounting for around 20% of total supply. India and China attribute is considered as the main players on both gold and silver markets (Darst 2013).

To sum up, silver differs from gold when it comes to supply and demand. Gold's supply is relatively inelastic and unable to react quickly to changes in the price outlook (Darst 2013). Silver, on the other hand, is considered as an industrial metal with a high correlation of supply and demand outcomes that has a direct influence on the price of the metal (Gold & Shah 2016). Thus, in times of global and financial turmoil gold tends to be a more stable asset rather than silver in the short-term. However, from the long-term perspective, gold and silver have a very strong correlation of annual performance ever since 1990 (Propescu 2016).

2.6.4 Crises and Global Uncertainty

Gold is traditionally perceived as the store of value to which investors turn during actual or expected periods of uncontrolled inflation, deflation, geopolitical instability or severe turbulence in capital markets. Well-established wisdom is that gold has the ability to serve as a hedge or safe haven against other assets (Baur & Lucey 2010).

Since the end of the gold standard in the early 1970s, gold's role in the world economy has closely tracked periods of economic and political turmoil, expanding when confidence declines and retreating when confidence returns. Following chart emphasizes some global events that led to the increased volatility of gold's price.

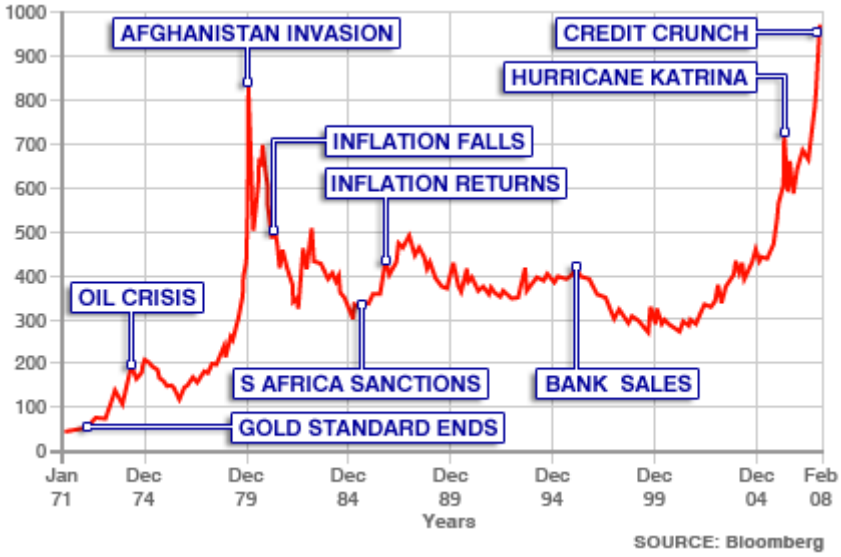


Figure 12. Gold price 1971 – 2008 (Adapted from BBC News 2008)

The recent peaks and troughs of the gold price occurred at some of the key moments in the world history. The significance of the chart is that it underlines how the price of gold reflects the risk and instability. Jagerson & Hansen (2011) suggest that the threat of war is a significant market manipulator. After the Soviet invasion in Afghanistan in 1980, the price of gold peaked around $800 per ounce followed by the downtrend within two decades. However, in 2001 U.S. invaded Afghanistan, the price of gold raised after a long period of downturn. Again in 2003, U.S. invaded Iraq, which triggered the price of gold to rise again. Wang (2012) argues that during the war the development of an economy becomes very fragile possessing the threat of hyperinflation and financial turmoil.

One of the greatest triggers for gold price dynamics is the conditions of the economic policy. Balcilar (2016) tested the role of economic, macroeconomic and financial uncertainty in determining gold returns and volatility, and found that macroeconomic and financial uncertainties play a vital role in explaining gold price dynamics. Jones and Sackley (2016) investigated the dependence between gold price dynamics and the economic policy uncertainty and found that great uncertainty leads to an increase in gold prices.

However, despite the fact, that gold has been perceived as a hedge and effective safe haven instrument used to store value, its ability to serve mentioned functions

depend on various market circumstances and the scale of uncertainty (Bouoiyour & Selmi 2018).

2.6.5 Interest Rates

As a widely held opinion, interest rates and gold have inverse dependence: rising rates cause a decline in gold prices and vice versa. To put it simply, declining rates signal an expansive monetary policy leading to the devaluation of U.S. dollar. Investors tend to buy gold and silver due to the fear that value of U.S. dollars they hold will decrease. In contrast, rising interest rates increase the opportunity cost of having gold instead of the dollar. As monetary policy becomes loose, the gold price should strengthen, and it should weaken in periods of tightening monetary policy (In Gold We Trust Report 2015).

The relationship between gold and interest rates is usually linked to U.S. investment markets. According to the World Gold Council (2013), the basis for the assumption that U.S. interest rates form a benchmark for global interest rates is based on the following reasons:

- Gold is primarily traded in U.S. dollars
- U.S. dollar is the world's reserve currency
- U.S. assets have the biggest share in the global investment portfolio

Several types of research support the perspective that interest rates have a strong correlation with the gold's price. Gulati & Mody (1982) examined the gold's price from 1972 to 1982 and concluded that one of the fundamental factors of high gold volatility within the decade were changes in interest rates. Jagerson and Hansen (2011) supported the argument of Gulati and Mody.

Following chart examines the changes in return in gold within monetary tightening phases that have taken place since 1971 by Federal Reserve:

Gold price in monetary tightening cycles:

	Change Fed Funds Effective Rate			Gold
	Start	End	Change	Return
Jan. 1977 - Apr. 1980	4.61	17.61	13.00	318.93%
Feb. 1972 - Aug. 1974	3.30	12.92	9.62	194.97%
Jun. 2004 - Jul. 2007	1.03	5.26	4.23	69.81%
Jan. 1994 - Apr. 1995	3.05	6.05	3.00	1.09%
Feb. 1987 - Mar. 1989	6.10	9.85	3.75	-2.69%
Apr. 1999 - Nov. 2000	4.74	6.51	1.77	-5.88%
Feb. 1983 - Aug. 1984	8.51	11.64	3.13	-29.55%
Jul. 1980 - Jul. 1981	9.03	19.10	10.07	-36.62%

Sources: Federal Reserve St. Louis, Incrementum AG

Figure 13. Gold price in QT cycles (Adapted from Federal Reserve St. Louis 2010)

Although the interest rate and gold prices exhibit a negative correlation, there are some periods during which the correlation collapse. In other words, tightening cycles can also cause growth in gold's prices. From a historical perspective, the correlation could be observed in several interest rate cycles. In fact, three of the largest gold rallies of the post-1971 era occurred in rising nominal rate environments (In Gold We Trust 2015).

Furthermore, Lawrence's empirical study (2003) concluded that changes in interest rate have an insignificant correlation with the price of gold. Empirical research conducted by Wang (2012) suggest that the return of gold doesn't relate to the interest rate. Analyzing the movements in the price of gold since 1975, Bilello (2018) suggests that interest rates are only one part of a complex story. Insignificant correlation between interest rates and gold's prices does not imply anything close to a perfect inverse relationship. In fact, gold is used for consumer purposes, such as jewelry, and therefore can be positively influenced by economic growth – even if real rates are rising. Furthermore, as developing markets continue to expand, interest rates will likely become only one of many factors that affect gold's price.

2.6.6 Oil price dynamics

It has been considered by economists that the correlation between the prices of gold and oil is historically strong. One of the fundamental reasons is that crude oil is seen as the most important commodity in the energy sector whereas gold is taken as the most trusted commodity in the world of finance. Moreover, prices for gold and oil

are determined in U.S. dollar, hence the performance of the assets is impacted by the change in purchasing power of U.S. dollar. When the value of U.S. dollar rises, dollar-denominated assets usually drop in price, as investors of other currencies consider such assets more expensive. Because gold and crude oil are dollar-denominated assets, both assets have an inverse relationship with U.S. dollar (Meesa 2015; Tang 2017).

Inflation performance also contributes to the correlation between oil and gold: growth in oil prices triggers the inflation, which, in turn, leads to the growth of gold's price as an instrument of hedging against uncontrolled volatility. According to Mesa (2015), in over 60% of the precedents, crude oil and gold have a direct interdependence. However, within the periods of booming inflation rates, gold maintains its ability to serve as a hedging instrument whereas oil is seen as a risky asset with high price volatility. Arfaoui & Rejeb (2016) conclude that within such intervals gold and oil have a negative correlation.

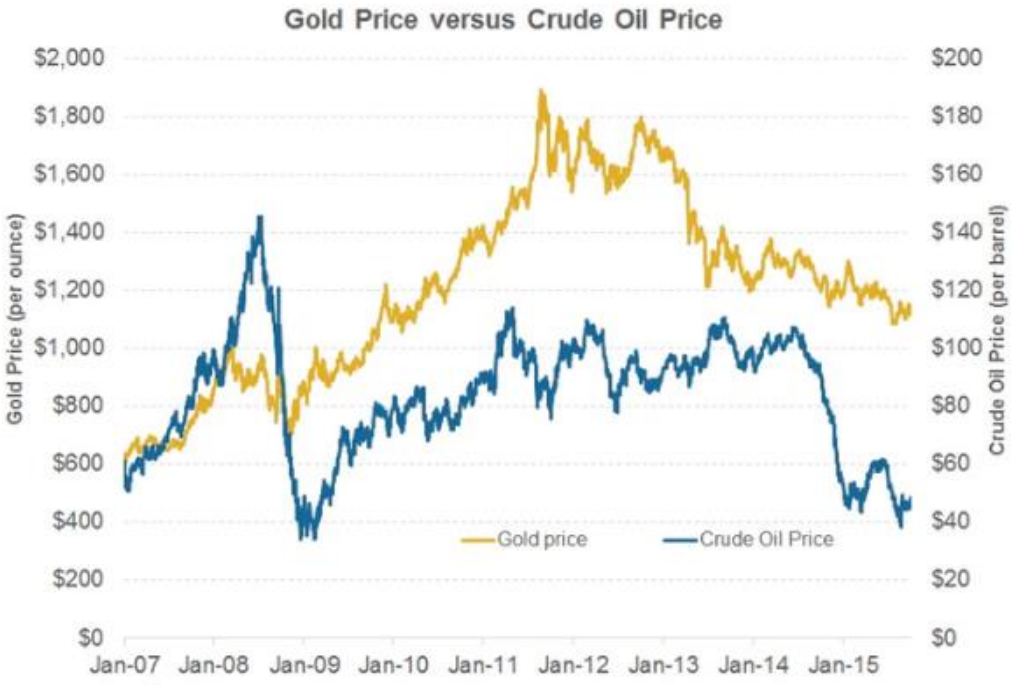


Figure 14. Gold price vs. Crude oil price (Adapted from Market Realist 2015)

The chart above underlines that gold and oil relationship is not perfect. World crises, as the recession of 2008 or Russian annexation of Crimea in 2014, can cause drastic spikes in prices of the assets that cannot be explained via factors such as inflationary relationship and inverse correlation with the performance of U.S. dollar.

Recent studies signify that the market of crude oil and the market of gold have close interaction between each other. As it has been mentioned above, the assets are two main representatives of the commodity market that have a positive mutual correlation: when the return on the oil market increases, the gold market repeats the pattern (Zhang&Wei 2010; Tang 2017).

2.6.7 Gold - Silver Ratio

To put it simply, the ratio shows the amount of silver it takes to purchase one ounce of gold. Long lasting history of precious metals has generated a significant amount of data that can be used as one of the most fundamental indicators of the market conditions. For precious metal investors, the ratio is an important barometer used to determine the most opportunistic times to buy or sell one of the aforementioned assets. In other words, the gold to silver ratio can be a predictive measure determining whether one of the metals is overpriced or undervalued. For example, if the ratio is historically high then silver is considered too cheap in terms of gold. Conversely, a low ratio tends to favor gold and may be a signal that it's a good time to buy the yellow metal and/or sell some silver.

As it has been covered earlier, the price fluctuations of gold and silver have the tendency to move together, although reaching ups and downs at different times. The fundamental reason is that gold is seen as a trustworthy hedge and a safe haven asset in times of uncertainty. Silver, in turn, is mostly used for industrial purposes and hence is highly dependent on economic growth and thus can experience additional volatility caused by changes in supply and demand. According to Religare (2016), in times of economic slowdown, the ratio tends to escalate remarkably, as it happened in 2008, causing a short-term overvaluation of gold in terms or silver's value.

Radomski (2017) studied the gold-silver correlation from various perspective concluding that, on average, silver's price rises in conjunction with the price of gold. First of all, gold makes the move while silver performs a lagging effect. In other words, an increase in the price of silver goes after confirmed uptrend of gold. Under such circumstances, silver forms its own upward tendency. Secondly, within the first stages of the bull market in commodities, gold significantly outperforms silver.

Following stage creates a linear trend line that leads to exponential growth of silver as it happened in 2004, 2006, 2008 and 2011.

The following chart represents the value correlation of gold and silver since 1996.

Figure 15. Gold to Silver Ratio (Adapted from World Gold Council 2018)

Extreme spikes of gold are preliminarily caused by economic instabilities and market corrections because it is generally seen as a safe-haven asset. Silver, on the other hand, catches investor's eyes when the turmoil is at its very end. The ratio underlines different perspectives of investing in precious metals: insurance, speculation, and trading. Each one of them determines the behavior of market players affecting the further development of trends in the commodities market.

Current conditions of the ratio signals that silver is in a downtrend since the beginning of bull market in equities in 2012. Gold, on the other hand, has a stable market performance pushing silver's value even lower. However, according to historical performance, silver inevitably follows the trend of gold – either up or down.

2.7 Risks in investments

As a matter of fact, each investment decision is considered from two main perspectives: risk and return. Return can be identified as a net income generated by an investment of any type that is converted into a percentage (Medina 1988, 70). Definition of risk, in turn, has a long story of the debate starting with Frank Knight in

1921. He defines financial risk as future outcomes that can be quantified and managed via probabilities due to sufficient frequency of relevant empirical data that can be used in various mathematical models (Knight 1921). In other words, risk can be calculated and hence successfully managed. However the complexity of financial words doesn't state on the fact that everything can be forecasted beforehand – the system of global development and interconnectedness also includes such factor as uncertainty. According to Knight (1921), when it comes to uncertainty, future outcomes cannot be managed due to the infrequency of relevant historical events. It only can be hedged by investments of long-term type or specific risk-reducing contracts. Although the full elimination of uncertain risk cannot be achieved due to high unpredictability of future developments factors. Uncertainty is a state of not knowing whether a proposition is true or false (Holton 2004). In the world of finances, it means making a financial decision without precise knowledge whether expected return rate will be successfully realized.

2.7.1 Systematic and Unsystematic risks

As a common knowledge in finance, behavioral patterns of investors can be divided into two groups: 1) value based investor – a long-term investing approach where a person invests in the securities that are below their intrinsic value (undervalued) due to some factors, 2) growth based investor – an approach of buying assets that have a confirmed uptrend and favorable micro and macro-economic conditions in a foreseeable future (Mayo 2016, 206). In fact, regardless of investor's behavioral type, the risk factor effects every player in the market. There are two types of risk in finance: systematic and unsystematic. Any investment decision has to be analyzed via specific risk factors that, in turn, adjust the sense of reality for an investor. Systematic risk is commonly associated with the market returns. Its wide origin covers macroeconomic dynamics such as inflation, volatility of currencies, geopolitical crises and other factors. Such risks influence global markets and cannot be predicted and controlled. Unsystematic risk, in turn, includes internal factors prevailing within an organization or an industry as a whole. Therefore such risks can

be planned by proactive measures by an organization that aims to mitigate the risk (Akrani 2012).

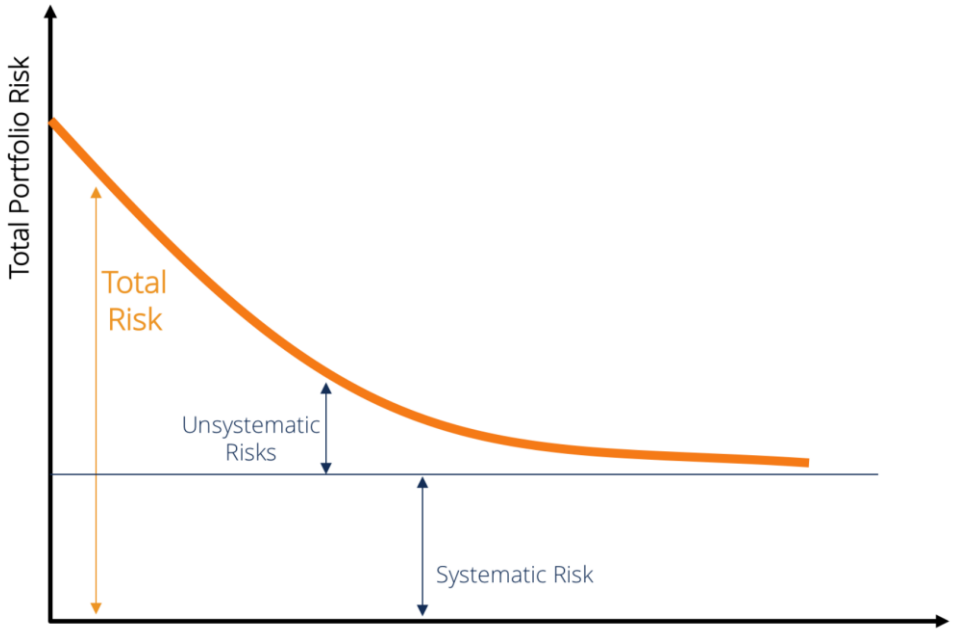


Figure 16. Risk of the portfolio (Adapted from Corporate Finance Institute)

The following chart comprehensively covers various types of risks in finance. For the purposes of the research, I will cover the most fundamental ones.

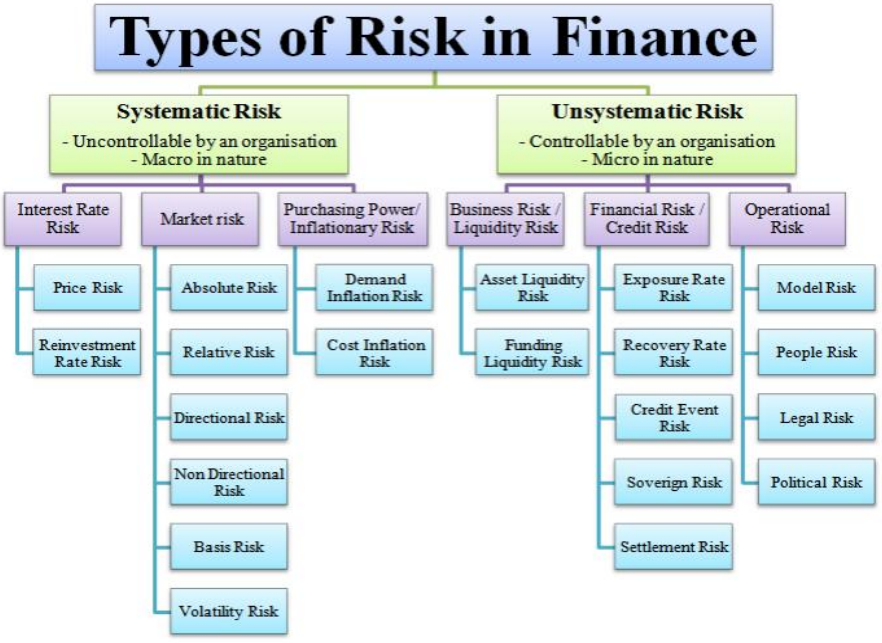


Figure 17. Types of risks in finance (Adapted from Gaurav Akrani 2012)

Systematic Risks:

- *Market risk*: caused by changes in investor's attitudes towards stock performance and hence expectations. The way investors react to tangible and intangible events significantly affect short-term stock volatility. Major triggers are political, social and economic changes that lead to a decline or rise in market price causing fear of loss or undue confidence towards asset performance. As a result, excessive selling or purchasing occur throughout the market.
- *Interest rate risk*: the risk arises due to fluctuations in the interest rates affecting debt securities with a fixed rate of return. As a result, the price of shares, commodities and various types of investment are exposed to a decline in the price causing a cyclical effect.
- *Purchasing power / Inflationary risk*: the risk arises out of a change in the prices of goods and services causing either demand inflation risk where demand outpaces supply due to maximum utility of factors of production or cost inflation risk where the rise in prices of goods and services is sustainable due to higher production costs.

Unsystematic Risks:

- *Business or liquidity Risk:* the risk arises when a certain benchmark of operating income or gross profit is out of control. For example, if the operating income of the organization for the upcoming year is calculated as 14%, the business risk will be considered low if it varies from 13 - 15%. If the results are significantly higher or lower the business risk will be considered high. Under such circumstances, an organization might have problems with liability payments. In fact, it affects the stock price of an organization.
- *Financial Risk or credit risk:* the risk arises due to a fundamental change in the capital structure that includes: 1) Owned capital, 2) Borrowed funds, 3) Retained earnings. In the case of unstable earnings, a company might have problems with interest payments due to excessive leverage that leads to a bubble and financial failure.

- *Operational risk:* the risk occurs in case of human errors via failures in the internal operations, labor, changes in policies and systems. Severe mistakes can lead to a complete shutdown of the company.

To sum up, when it comes to an investment decision of any type an investor has to have a piece of comprehensive knowledge about micro and macro factors that affect the specific industry, dynamics of global development and changes in business cycles. Such knowledge provides a more complete perspective of the performance of the chosen asset and hence can help to adjust risks by including hedging instruments and diversification tools in the investment portfolio.

2.7.2 Risky assets and the risk-free asset

Optimal portfolio usually consists of a combination of risky assets that, in turn, increase potential returns and risk-free assets that adjust the overall risk rate. From a theoretical point of view, the return of a risky asset is highly uncertain within the future developments of the markets and global volatility. In other words, the return for such an asset cannot be predicted. For example, assume that an investor buys the stock of Lidl today with an intention to hold it for at least a year. At the very time of purchase, a stockholder does not know what return will be realized. The overall return will be dependent on the price of Lidl stock one year from the moment of purchase. Stocks of all companies follow the pattern and hence are considered as risky assets (Fabozzi & Grant 2011, 13-14)

On the other hand, an investor can buy an asset with a certain future return. Such assets are referred to as risk-free or riskless assets. As a common knowledge, short-term obligations of the U.S. government are commonly considered as the risk-free asset. For example, if an investor purchases security that expires in a year and intends to hold it for that period of time, then the overall return is certain. In other words, an investor knows that in one year after, when the maturity date of the security is due, the government will pay a specific interest (Ibid., 13-14).

2.7.3 Modern Portfolio Theory

Modern portfolio theory is one of the most important tools of investment analysis when it comes to calculations of potential risks and returns created by Markowitz in 1952. The theory suggests that a portfolio of investments consisted of 2 or more

assets can lower the risks and increase the potential returns. The fundamental idea of the MPT is that an investor can apply diversification principles for portfolios that will maximize expected returns meeting acceptable levels of risks. In other words, by applying quantitative models and historical data modern portfolio theory defines expected portfolio returns and acceptable level of portfolio risks constructing most optimal portfolio (Fabozzi & Grant 2011, 11). In fact, it is one of the most important and influential economic theories dealing with finance and investments that have significantly influenced the development of portfolio management (Levendis & Dicle 2017).

While constructing an investment portfolio investors seek to achieve an efficient portfolio where the expected returns meet the equilibrium with potential risks. In fact, risk tolerance has a significant influence on an investment decision process. Assuming that investor A has a lower tolerance towards potential risk he will prefer the less risky portfolio. On the other hand, investor B with high-risk tolerance is willing to accept higher risks and hence greater potential returns. MPT implies that an investor can reduce overall portfolio risk by principles of diversification: possession of several assets that are not perfectly correlated with each other. Such a portfolio can lower the total risk of the portfolio while maintaining the desired level of returns. However, even if assets have a positive correlation, diversification can still lower risks (Elton et al. 2007). Muller (1988, 10) claims that due to the overall correlation between the returns of financial assets, diversification helps to reduce risks but not to fully eliminate them.

2.7.4 Bull and Bear markets

Stock markets are perceived to have a cyclical pattern of development: cycles of growths (bull markets) are followed by a correction (bear markets) and vice versa. They both form a complete business cycle. The cycle itself consists of four phases: expansion, peak, contraction, and trough.

In fact, the bull market is the market when an asset prices rise over time. Investors buy assets because they believe the market has an uptrend and will continue to go up. Such periods are characterized by overall optimism and high investor confidence when greed is prevailing over the fear of loss (Richards 2012).

Bear markets, in turn, are characterized by negative price development and typically shrouded pessimism. Markets become highly unstable. According to Amadeo (2018), the irrational behavior of investors and speculators can affect micro and macro indexes throughout the globe. Richards (2012) states that fear and uncertainty is highly unpredictable. In fact, such conditions have a positive influence on gold and silver that are considered safe-haven assets.

2.8 Financial Assets

As a common knowledge, a financial asset is an asset that has its value from a contractual claim. Such assets are intangible and can be easily converted into cash. For example, bank deposits, bonds, and stocks. For the purposes of the dissertation, it is critically important to provide a description of chosen assets that will be analyzed via their stock market performance.

2.8.1 Gold

Ever since the breakdown of After the Bretton Woods system in 1971, gold regained its role as a financial asset and investment instrument. The asset is mostly considered as a tool for portfolio diversification and, thus, is favored by investments in terms of economic uncertainty and global crises that refer to the metal as a hedging instrument and trustworthy safe haven asset with intrinsic value. Gold Futures are traded on the Commodity Exchange (COMEX), based in New York City.

2.8.2 Silver

The metal, regardless of its high industrial dependence, has tight dependence on the performance of gold and its trend changes. Silver has been historically correlated with gold: both of the metals are used as hedging instruments, diversifiers, and safe haven assets during global instabilities and financial turmoil. In other words, silver investors are preliminary concerned with the monetary aspect of the asset that performs well during turmoil and instability, following the pattern of gold. Silver Futures, same as gold futures, are listed on the COMEX, New York City.

2.8.3 S&P 500 Index

The S&P500 Index is a basket of 500 largest U.S. publicly traded companies measured in terms of their market value. Due to its depth and breadth, the index is considered as one of the most reliable and favorable investing choices for both institutional and private investors all over the world. Due to the fact that the index covers around 80% of all U.S. market capitalization, it is commonly taken as a credible indicator of the U.S. and global markets as a whole. The index futures are listed on the New York Stock Exchange (NYSE) as well as on the NASDAQ.

2.8.4 Dow Jones Industrial Average

The Dow Jones Industrial Average (DJIA) or "the Dow" is the price-weighted average of the stock of 30 companies on the NYSE with large capitalizations and stable earning history. So-called "blue chip" companies refer to Apple, IBM, Microsoft, Nike, and other global players. The index is also considered as an indicator of economic growth and activity due to its industrial coverage. In other words, the performance of 30 stocks in the DJIA affects the performance of the entire stock market and represents conditions of several industries on a global scale. "The Dow" is traded on the NYSE and the NASDAQ.

2.8.5 Financial Times-Stock Exchange

The FTSE is a basket of 100 companies with the highest market capitalization that are listed on the London Stock Exchange. In other words, the index consists of "blue-chip" companies that are publicly listed in the United Kingdom. The index is considered as one of the indicators that represent the conditions of the U.K. business environment as well as it helps to examine trend changes in the European economy as a whole. The index is listed on the London Stock Exchange.

Futures

A future contract is a standardized contract between two parties with an intermediary involved that allows one of the party to purchase or sell a financial asset or commodity in the future. Some basic characteristics of the future contract are: 1. Known date; 2. Specified conditions; 3. Effective price contraction. In other words, future contract is a customized contract that helps buyers and sellers to serve their specific needs and goals. Most commonly, future contracts are used by producers and consumers of

goods that want to reduce potential risks due to the price volatility. For example, producers are willing to use future contracts against a probable fall in the prices while consumers want to hedge themselves against rising prices. In fact, some traders and mutual fund managers use futures in order to have speculative gains (Evans 2013).

Type of futures contracts are:

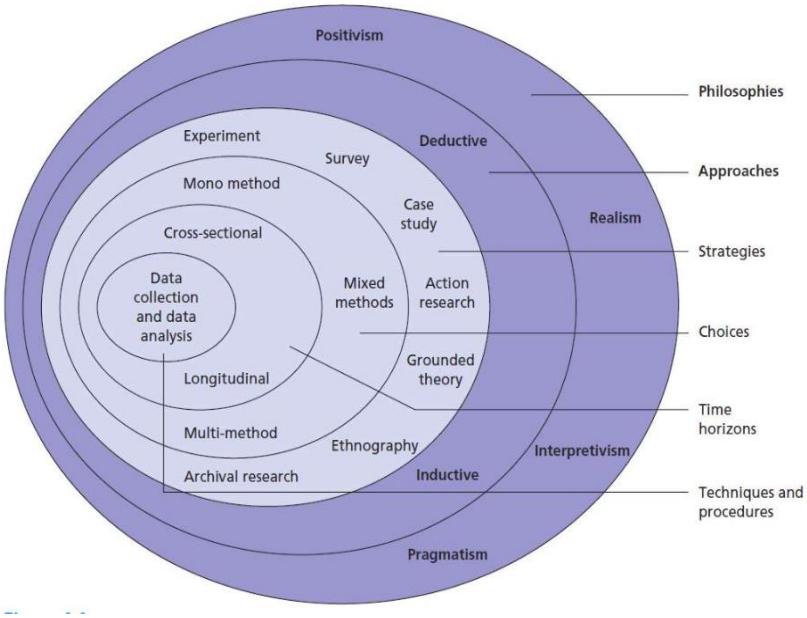
- *Energies*: oil, natural gas, diesel and other.
- *Currencies*: Euro, Pound, Dollar, Yen and other.
- *Financials*: interest rates futures.
- *Indices*: global and local indices all over the world.
- *Metals*: gold, silver, copper, platinum and other.
- *Agricultural commodities*: corn, wheat, rice, coffee and other.

Future contracts are traded on future exchanges around the world, including the Chicago Mercantile Exchange (CME) and the Intercontinental Exchange (ICE).

3 Methodology

Research methodology is one of the most crucial aspects of any research paper. It is a fundamental purpose is to describe and explain a broad range of choice including research method, data collection, and methods of analysis. The research “onion” by Saunders, Lewis, and Thornhill (2009) helps to provide a comprehensive understanding of data collection and its reasons. Thus, it will be used as the methodological pillar for the research.

Figure 18. Research "onion" (Adapted from Saunders et al. 2009)



3.1 Research Approach

The first layer of the research "onion" refers to the research philosophies: 1) Positivism, 2) Realism, 3) Interpretivism, 4) Pragmatism. The best suitable philosophy is positivism due to the perspective that observations can lead to the combination of unbiased credible data and certain outcomes leaving the possibility that existing theoretical background can be revised and linked to deductive logic. Data collection and application of existing theories (Beta, Standard Deviation, and Covariance) will comprehend chosen research philosophy and hypothesis development.

The second layer of the "onion" is research approaches: 1) Deductive (quantitative), 2) Inductive (qualitative). Due to the nature of this research, the deductive approach is a suitable one. It allows to search and explain various types of relationships between examining variables and hence develop a proper hypothesis based on developed theory. In order to ensure the reliability of the dissertation, the research will apply the principles of structured methodology. Other important characteristics of deduction such as operationalize, reductionism and generalization complete the collection and analysis of research data (Saunder et al. 2009, 124 - 125). Massive amounts of numerical data dictate the choice of quantitative method of research as a primary one due to the fact that it deals with numbers and anything that can be

measured. In other words, quantitative research explains phenomena by collecting data that is analyzed via mathematically based methods that examine the relationships among variables (Aliaga & Gunderson 2002). In contrast, the qualitative method is used in order to work with non-numerical data including pictures and video clips (Saunder et al. 2009, 151).

The research strategy is predetermined by the research purpose. The fundamental goal of the dissertation is to analyze and compare how gold and silver perform within different times frames including periods of booming global growth and severe correction of the financial markets. Several well-known financial indexes will be taken as the performance benchmark. The comparison of the calculated figures during several time frames makes it an explanatory study that, in the result, will determine certain relationships and patterns between variables. Thus, the research relates to the explanatory type that studies casual links. In other words, the research strategy explains whether a change in one variable causes a change in another variable and at what scale (Hakim 2000).

The choice of research approach is dependent on the sort of date that the research requires: numeric (numbers) or non-numeric (words). Financial information is required for the research purposes, hence, the research approach is mono-method.

Following layer of the “onion” is the definition of time horizon. As a matter of fact, the time horizon of the research is dependent on several factors such as prevailing research strategy and choice of method. Longitudinal research allows studying change and its development within several periods of time. In other words, such choice of studies allows to examine the dynamics of the research hypothesis and to operate with a massive amount of changing data (Saunder et al. 2009, 155). This particular research requires analysis within several time frames since it focuses on past performance trends.

3.2 Financial markets

For the purposes of the thesis five major financial markets were chosen: 1) Gold Futures, 2) Silver Futures, 3) SP500, 4) Dow Jones Industrial Average, 5) Financial Times-Stock Exchange 100. Numeric data is obtained as secondary data from the

stock market. Various calculations were applied to the data including beta, standard deviation and other. The fundamental reason for choosing the following financial markets indicators is to determine certain benchmark in terms of financial risk and return when it comes to investing under different circumstances. Financial indexes such as SP500 and Dow Jones are chosen due to their investing popularity all over the globe. In other words, the indexes are most commonly used as benchmarks in terms of risk and return performance expectations for the stock market.

3.2.1 Gold Futures

COMEX Gold futures (ticker symbol GC) represent the world's leading benchmark futures contract for gold prices. GC futures have different uses: 1) Portfolio diversification, 2) Hedging instrument, 3) Safe haven asset, 4) Currency. The contract size is 100 troy ounces (1 troy ounce is 31,1 grams). Futures are traded on COMEX, located in New York City.

3.2.2 Silver Futures

Similar to gold futures, silver futures are considered a safe haven in times of uncertainty and financial instability. The contract size is 5,000 troy ounces (1 troy ounce is 31,1 grams). Futures are traded on COMEX, located in New York City.

3.2.3 S&P 500

The S&P500 Index is a basket of 500 largest U.S. publicly traded companies measured in terms of their market value. The index covers around 80% of all U.S. market capitalization. S&P 500 is used as an indicator of the U.S. and global markets as a whole. The index stock is listed on the New York Stock Exchange (NYSE) as well as on the NASDAQ, New York City.

3.2.4 Dow Jones Industrial Average

The Dow Jones Industrial Average (DJIA) or "the Dow" is the price-weighted average of the stock of 30 companies on the NYSE with large capitalizations and stable earning history. The index is considered as an indicator of economic growth and activity due to its industrial coverage. "The Dow" is traded on the NYSE and the NASDAQ, located in New York City.

3.2.5 Financial Times-Stock Exchange 100 (FTSE 100)

The FTSE is a stock basket of 100 companies with the highest market capitalization that are listed on the London Stock Exchange. The index is considered as one of the indicators that represent the conditions of U.K. business. The index is listed on the London Stock Exchange, London.

3.3 Data Collection

Data collection for the research purposes can be divided into two categories: 1) Primary (new) data, 2) Secondary data (already collected). In fact, the choice for data collection is linked to the research objectives and methods. For example, when it comes to comparisons of any scale secondary data have better off research perspectives. In contrast, when the interviews and surveys are required new data have to be collected. The dissertation falls under secondary data collection category. Secondary data collection has significant advantages such as: 1) Fewer resource requirements lead to time and resource saving, 2) Collection of reliable high-quality data, 3) Implementation of longitudinal studies, 4) Adjust comparative and contextual data, 5) Leaving possibility for unexpected discoveries, 6) The data is permanent and can be rechecked. On the other hand, a collection of secondary data has some significant disadvantages such as costly access to the required data, lack of data control and censor as well as biased segmentation and interpretation of available data (Saunder et al. 2009, 259 – 270).

Required financial information was obtained from three databases that cover the historical performance of stock markets: 1) investing.com, 2) yahoo.finance.com. The data is collected on a weekly basis calculating as *(Ending Value - Beginning Value) / Beginning Value within* 7 days. The overall amount of trading weeks per year is 51 – such approach provides a more precise and profound date coverage. Before the data was extracted to the Excel spreadsheets with the purpose of further investigation, it was required to define several time frames. In total, the observations were segmented into four periods with the begging data of 01/01/2002. The closing date was 01/01/2018. First time frame covers the period from 01/01/2002 to 01/01/2008 that related to the growth period all over the financial markets. The second period relates to the correction period of 2008-2012. The third period covers

the following period of growth since 01/01/2012 until 01/01/2018. Additionally, the peak period of crisis was examined dated from 01/01/2008 to 30/09/2010. The segmentation of time periods that covers in the total of sixteen years provides credible and comprehensive data. Financial terms and definitions were briefly explained using academic publications and articles of financial and investing experts.

3.4 Data Methods and Calculations

The required data were exported from stock databases into the excel spreadsheet where calculations of beta, standard deviation, and correlation coefficient were applied.

3.4.1 Calculating Beta

As it has been mentioned before, the concept of risk is central to the world of finance. It affects the decision-making process since its very beginning. Ever since the wide acceptance of Markowitz's portfolio theory and further introduction of the Capital Asset Pricing Model (CAPM), beta is considered one of the most fundamental pillars of portfolio management. To put it simply, beta shows the correlation between the returns of a financial asset and overall market (Levendis & Dicle 2017). The beta (β) of a stock or portfolio can be seen as the reaction of the stock to the changes in the stock market. In other words, the Beta value is a measure of stock's instability adjusted to the market instability as a whole.

Beta is commonly expressed by the consideration that market volatility equals 1. A stock or an investment asset that has a beta of 0 does not correlate with the market. To put it differently, an asset is not influenced by market volatility. Hence, a positive beta means that an asset follows the market trend at a certain level. A negative beta, in turn, suggests that an asset moves in an opposite way in comparison to the market uptrend or downtrend. Additionally, to that, a beta correlation of 1 indicates that the price of the chosen stock or asset completely follows the market trend. In case of the beta being equal more than 1 the investment is considered a more volatile than the market in general. A beta of less than 1 indicates less volatile investment in terms of market performance. For example, a portfolio's beta being equal 1,6 signifies that the overall volatility of the portfolio is 60% percent more than the market's.

However, if a portfolio's beta is 0,75 than volatility is 25% less than the volatility of the market.

According to Christensen (2017), the formula for Beta Coefficient is:

$$\beta(beta) = \frac{Cov(R_a R_b)}{Var(R_b)}$$

Where covariance of the asset (R_a) and market (R_b) is divided by variance of the market (R_b). The calculations show whether the chosen stock follows the pattern of the market as well as its volatility compared with the markets. The research examines the performance of several benchmarks such as SP500, DJIA, and FTSE in order to find the pattern behavior and casual relationships within taken time frames. In other words, the performance of assets such as gold and silver is compared with the aforementioned indexes.

3.4.2 Calculating Standard Deviation

In its very essence, a standard deviation is a statistical tool that measures the dispersion of some date relative to its mean. When it comes to financing, the measurement is one of the most crucial tools for risk analysis of a stock or an investment portfolio. Standard deviation helps to calculate historical volatility of market and stock that, in turn, adjust future return expiations and trend performance.

Standard deviation, compared with certain benchmark level, helps to get a better of understanding about the risk of an investment in terms of historical volatility and, therefore, predetermine a level of return both negative and positive within a particular range.

According to Taylor (2018), the formula for Standard Deviation:

$$SD = \sqrt{\frac{\sum \left(r_i - r_{avg}\right)^2}{n-1}}$$

3.4.3 Calculating Correlation Coefficient

The correlation coefficient is a measure of how closely two variables move in relation to one another. For example, if one variable goes up by a certain amount the correlation coefficient indicates which way other variable moves and by how much. The coefficient is usually in the range of -1 to 0 to +1. If the two variables have a correlating of -1 then, in case of variable X goes up by one unit, variable Y will go down by one unit and vice versa. If the correlation coefficient equals zero it indicates that the variables don't correlate. In the world of finance, the correlation coefficient is used in order to diversify the portfolio and reduce overall volatility.

According to Wiz (2012), the formula for the Correlation Coefficient:

$$r = \frac{1}{n-1}\sum_{i=1}^{n}\left(\frac{x_i - \bar{x}}{s_x}\right)\left(\frac{y_i - \bar{y}}{s_y}\right)$$

3.4.4 Calculating Annualized Total Returns

The annualized total return is the average return of investment each year over a given time period. Of the most significant advantages of ATR is that it provides a single figure that can be used as a benchmark for investment comparison of different types. The return provides a geometric average that does not reflect volatility and based only the past data, therefore cannot be considered as a guarantee for future gains.

According to Wallace (2011), the formula for Annualized Total Returns:

$$\text{Annualized Return} = (1 + \text{cumulative return})^{(365\,/\,\text{days held})} - 1$$

3.5 Validity and reliability

Ghauri & Gronhaug (2005) state that validity explains how well the collected data covers the actual area of investigation. In other words, it implicates the credibility and accuracy of the study and can be seen as its core. Messick (1989, 9) pointed that validity refers to the degree to which empirical facts and theoretical justifications explain the logic and appropriateness of the results of the study. The very essence of

validity is based on three types of evidence: content, construct and criterion (Moskal & Leydens 2000).

When it comes to quantitative research, it is critically important to have both external and internal validity. External validity applies on which degree the study results can be examined on a wider scale. Internal validity, on the other hand, links the results with the targeted goals (Moskal & Leydens 2000). The nature of this study required the analysis of the previous investigations with the purpose to ensure the empirical credibility and relativeness. Furthermore, internal validity was carefully analyzed in a proactive way that obviates statistical effects and heuristic delusions. The data was collected from the databases such as investing.com and yahoo.finance.com, which collect and segment the financial data. Aforementioned databases are considered as reliable sources in the world of finance.

Reliability refers to the measurement of phenomena and its ability to provide stable and consistent results (Carmines & Zeller 1979). It can also be defined as the ability of the research to produce reliable results using the same data input (Saunder et al. 2009). The reliability of this study is based on the perspective that applied methods have been utilized by other researches in the similar area. In other words, if a researcher will apply similar databases obtained from reliable sources he will get similar outcomes and there will be significant difference. In such case, the dissertation can be considered as valid and reliable.

4 Results

The following sub-chapters represent the calculated results by applying collected data with the aforementioned equations.

4.1 Risk and Return

The first part of the results covers the performance of gold and silver as well as indices in terms of their correlation coefficient, annualized returns, and volatility. The data for gold and silver futures were obtained from stock databases such as investing.com and yahoo.finance.com and then exported to an Excel sheet. The data was divided into 4 categories that represent different time frames: 1) Period before

the Economic crisis of 2008, 2) Period of correction within the crisis, 3) Period after the Economic crisis, 4) Extra period of the peak of the crisis of 2008. In this case, information can be analyzed avoiding over generalization and absenteeism principles by clarifying the influence of different business cycles such as growth and correction. Thus, time intervals allow having obtained significant insights about what happened and how it happened including and excluding influence of the economic crisis of 2008.

In order to present information in a simple and concrete way, several tables were created regarding different time periods and calculated results.

4.1.1 Pre-Crisis period: 01/01/2002 – 01/01/2008

The results indicate that the metals have a positive correlation coefficient of 0,67. Annualized return of gold within the booming economic cycle is 22%. Silver outpaces gold by 5% reaching 27% in terms of average annualized returns in the period of 2002-2008.

The volatility of the metals is significantly higher in comparison to the indexes, however, the annualized returns of gold and silver surpass the benchmark levels in 4-5 times. Such a pattern indicates that the assets with higher volatility generate higher rates of return. Silver, for example, has the highest level of volatility, however, the realized returns are also the highest.

Table 1. Pre-Crisis Period: 01/01/2002 – 01/01/2008

	Gold	Silver	DJIA	S&P500	FTSE100
Standard Deviation	14,9%	27,7%	12,1%	11,9%	12,4%
Annualised Returns	22%	27%	5,5%	4,9%	4,4%
Correlation Coefficient	0,67				

4.1.2 Crisis Period: 01/01/2008 – 01/01/2012

The burst of the mortgage bubble in the U.S. has significantly shaped the status quo of the global financial world. Within the correction period, the correlation coefficient between the metals reached 0,80. Annualized return of gold reached 20% within the period of 01/01/2008 – 01/01/2012. Silver, in turn, reached the value peak in 2011 touching the benchmark of $50 with an annualized return of 27.5% within the same time period.

The period of overall market correction significantly increased the acceptable level of volatility for both the metals and the indexes, however, only gold and silver generated significant returns while the market benchmark in terms of return was close to zero percent.

Table 2. Crisis Period: 01/01/2008 – 01/01/2012

	Gold	Silver	DJIA	S&P500	FTSE100
Standard Deviation	22,6%	43,6%	23,6%	25,1%	18,6%
Annualised Returns	20,0%	27,5%	1,6%	0,3%	-1,9%
Correlation Coefficient	0,80				

4.1.3 The peak of the Crisis: 01/01/2008 – 30/09/2010

For the purposes of the research, it was decided to calculate the performance of gold and silver within the most severe time frame of the crisis when all the market were losing their value on a weekly basis.

Within two and a half years the correlation between gold and silver reached its peak of 0,83. Annualized return of gold was calculated as 19% while silver provided 24% on average return.

Thirty-three months of severe correction can be examined with the help of generated results: indexes reached a higher level of volatility than gold generating negative annualized returns. The metals, in turn, regardless of the market fluctuations, achieved significantly positive returns in comparison to the overall market performance.

Table 3. The peak of the Crisis: 01/01/2008 – 30/09/2010

	Gold	Silver	DJIA	S&P500	FTSE100
Standard Deviation	24,0%	41,0%	25,1%	27,2%	28,4%
Annualised Returns	19,4%	24,0%	-2,8%	-3,6%	-1,4%
Correlation Coefficient	0,83				

4.1.4 Post Crisis Period: 01/01/2012 – 01/01/2018

The period of global market correction lasted for almost 4 years preparing the foundation for next the bull run throughout the world markets indexes.

Regardless of the bear cycle in gold and silver markets the assets reached, mutual correlation of the metals kept certain benchmark by delivering 0,826 as a final

benchmark. However, average annual returns turned to be negative: gold was losing 1.6% per year whereas silver suffered 4.7% loss per year.

Following the bull cycle in the global markets triggered correctional cycle for the metals that led to increased volatility and negative annualized returns. The indexes, in contrast, lowered the overall volatility that was exceeded by total returns.

Table 4. Post Crisis Period: 01/01/2012 – 01/01/2018

	Gold	Silver	DJIA	S&P500	FTSE100
Standard Deviation	15,2%	24,5%	10,9%	11,0%	13,0%
Annualised Returns	-1,6%	-4,7%	13,2%	14,2%	6,3%
Correlation Coefficient	0,82				

4.2 Metals and Global Indexes

The second part of the results covers the performance of gold and silver in a form of comparison with several financial indexes like SP500, DJIA and FTSE 100 which are considered as global market performance indicators. The data was divided into 4 categories that represent different time frames: 1) Period before the Economic crisis of 2008, 2) Period of correction within the crisis, 3) Period after the Economic crisis, 4) Extra period of the peak of the crisis of 2008. Presented information has a clear segmentation in terms of results within different time frames. Excel spreadsheet tables are needed for simple and comprehensive information presenting.

4.2.1 Beta coefficient

Beta coefficient results within different timeframes will be presented in the following parts of the thesis in the logic sequence.

Beta coefficient during 01/01/2002 - 01/01/2008

The results within the period of economic expansion indicate that gold has an insignificant correlation with the indexes such as DJIA, SP500, and FTSE.

In comparison to gold, silver has a broad scale of industrial use and, hence, it is more dependent on the development of business activity and changes in economic cycles. Within the first time interval, silver's beta coefficient indicates a normal positive correlation with the indexes.

Table 5. Beta coefficient during 01/01/2002 - 01/01/2008

Gold		Silver	
DJIA	0,04	DJIA	0,27
S&P500	0,08	S&P500	0,34
FTSE	-0,01	FTSE	0,20

Beta coefficient during 01/01/2008 - 01/01/2012

The second time frame covers the period of overall market correction. Performance of gold has its own trend development regardless of the market changes.

Within the correction cycle, the beta coefficient of silver tends to be even more positive. In other words, the market trend of silver follows the overall pattern of the chosen benchmarks with lower volatility.

Table 6. Beta coefficient during 01/01/2008 - 01/01/2012

Gold		Silver	
DJIA	0,01	DJIA	0,48
S&P500	0,03	S&P500	0,5
FTSE	-0,01	FTSE	0,55

Beta coefficient during 01/01/2008 - 30/09/2010

The peak of a market correction and a significant drop in the markets values result in a slightly negative beta coefficient of gold. In other words, gold was moving in the opposite direction in comparison to the chosen benchmarks.

The period of the peak of the market correction indicates that silver was less correlated with the markers rather than within a four-year period.

Table 7. Beta coefficient during 01/01/2008 - 30/09/2010

Gold		Silver	
DJIA	-0,10	DJIA	0,33
S&P500	-0,01	S&P500	0,38
FTSE	-0,10	FTSE	0,10

Beta coefficient during 01/01/2012 - 01/01/2018

The overall growth of financial markets after the economic crisis triggered the correction cycle for gold. The beta coefficient became negative signaling the opposite market trend for gold.

The coefficient tends to be close to zero within this time frame due to the correction cycle of the metals. In other words, silver did not follow the market pattern of overall growth.

Table 8. Beta coefficient during 01/01/2012 - 01/01/2018

Gold		Silver	
DJIA	-0,23	DJIA	0,02
S&P500	-0,18	S&P500	0,10
FTSE	-0,12	FTSE	0,14

5 Conclusions

Investing in precious metals is a complicated and time-consuming process that requires certain financial knowledge and attributes of a global mindset. Numbers and charts are only a part of the big picture that is used to simplify and present information. The bottom of the successful investing decision starts with the definition of personal motivation and goals. In other words, an investor has to know him/herself when it comes to the intentions that, in turn, are based either on greed or fear. Investing psychology plays a crucial role at the very beginning of the decision-making process. Collection of credible historical data is required: the process itself adjusts personal exceptions due to the analysis of the information that happened de facto and, hence, can be used as a starting point regarding investment decision. It is also extremely important to remember that calculated results are retrospective. In other words, they indicate what happened rather than what will happen. At the same time, history repeats itself. In other words, past gives us examples of the dynamics of things and, in this case, the allocation of capital all over the globe within different time periods. A fundamental perspective of the thesis was to examine the performance of so-called “safe haven” assets under different economic cycles such as expansion and correction. Collected secondary data has significantly affected the initial perceptions and delusions about the assets. The overall interdependence of gold and silver is based on several pillars that relate to both history and present.

According to the results, the financial performance of the metals has positive dynamics providing significant correlation coefficient around 0,8 within 16 years and

positive returns within both economic cycles: a period of robust economic growth and contraction. During the crisis period (01/01/2008 - 01/01/2012) gold and silver became a safe haven place for investor all over the world that was trying to maintain the existing value of the capital. In fact, market correction affected both metals, with its peak resulting in to a 50% depreciation of silver in October 2008. Gold, in turn, lost 25% of its market value in the second half of 2008 (Dirkmaat 2018). However, after the significant market correction both of the metals started their uptrends reaching their historical peaks in 2011 and 2012. In other words, while the markets were severely down, the bull cycle in gold and silver was aiming for new historical highs generating positive returns year after year. The financial crisis of 2008 underlined the market and investment importance of precious metals such as gold and silver in terms of safe haven assets and hedging tools. Investors all over the world and their financial decisions under the period of uncertainty favored gold and silver like one of the most trustworthy instruments for hedging. Annualized returns of the metals within the crisis period indicate that the capital reallocation was massive and global.

As it has been mentioned above, silver follows the market pattern of gold with a lagging effect (Radomski 2017). The correction cycle that lasted for 33 months confirms the statement above: gold was the first asset that ended up the correction phase and started its uptrend whereas silver took several months to follow the pattern compensating by the pace of growth. The correlation coefficient within the examined period remained significantly high and stable that can be considered as an indicator of mutual dependence in the world of finances.

Gold is not correlated with the chosen benchmarks such as SP500, DJIA, and FTSE whereas silver has a certain dependence on market performance. Despite the fact that gold and silver are favored by investors in the times of uncertainty, the metals are extremely volatile in comparison to the levels of the market. In the case of silver, the asset should be considered as extremely risky one due to its high volatility. On the other hand, annualized returns of gold and silver have been showing two digit dynamic since 2002 and until the beginning of contraction cycle in 2012, therefore compensating the higher volatility with higher results.

It can be concluded that investments in precious metals within the examined period provided high levels of returns. The metals are significantly correlated: silver follows the pattern of gold with a higher level of volatility that is compensated by higher returns even during the crisis peak. Stocks volatility was remarkably high in comparison to the indexes. The analysis of the crisis period provided some significant results that can and should be examined further. For example, 1) The crisis of 2008 has affected the stock performance of the metals in the short-term, 2) During the crisis silver's volatility peak was reaching 45% per year, 3) Gold has a more stable performance, however silver generates greater returns, 4) The end of contraction cycle in equity markets triggered the correction phase of the metals, 5) Investing in gold and silver should be considered not only from the hedging perspective.

It would be unfair not to mention that the global financial world is constantly developing and changing. It becomes more and more holistic and dependent on several factors that, in turn, can cause severe changes. In turn, it can be argued that the financial world is a complex system where events occur in cycles. Growth is followed by a correction, which then leads to new highs. Successful investors are the ones who can identify a change and adjust their portfolios according to it, yet arguably, the definition of success can occur retrospectively.

6 References

30 Years of Gold Highs Lows. BBC News, 13 March 2008. Accessed on 19 November 2018. Retrieved from: http://news.bbc.co.uk/2/hi/business/7284184.stm

Akrani, G. 2012*. Types of Risk – Systematic and Unsystematic Risk in Finance.* Accessed on 27 November 2018. Retrieved from: https://www.saipa.co.za/wp-content/uploads/2017/09/Types-of-Risk.pdf

Aliaga M., & Gunderson B., 2002. *Interactive Statistics*. Thousand Oaks.

Amadeo, K. 2018*. History of Gold Standard*. The Balance, 7 November 2018. Accessed on 18 November 2018. Retrieved from:https://www.thebalance.com/what-is-the-history-of-the-gold-standard-3306136

Amadeo, K., 2016. *Hedging and How it Works.* The Balance, 18 October 2016. Accessed on 23 November 2018. Retrieved from: https://www.thebalance.com/hedge-what-it-is-how-it-works-with-examples-3305933

Balcilar, M., Gupta, R., & Piedzioch, C., 2016. *Does Uncertainty Move the Gold Price? New Evidence from a Nonparametric Causality-in-Quantiles Test*. Resources Policy49, 74-80. Accessed on 27 November. Retrieved from: https://www.up.ac.za/media/shared/61/WP/wp_2015_92.zp75835.pdf

Baur D,G, & Lucey B,M, 2010. *Is gold a hedge or safe haven?* The financial review, 2010. Accessed on 25 November 2018. Retrieved from: https://brianmlucey.files.wordpress.com/2011/05/gold_safehavenorhedge_fr.pdf

Bilello C., 2018. *How Do Changes In Real Interest Rates Affect Gold?* Pension Partners, 26 March 2018. Accessed on 30 November 2018. Retrieved from: https://pensionpartners.com/how-do-changes-in-real-interest-rates-affect-gold/

Bordo, M,. & Schwartz, A,. 2012. *A Retrospective on the Classical Gold Standard, 1821 - 1931.* Chicago: University of Chicago Press.

Bordo, M., 1991. *The Classical Gold Standard: Lessons for today*. Federal Reserve Bank of St. Louis.

Bordo, M., Eichengreen, B. 1993. *Retrospective on the Bretton Woods System.* Chicago: Chicago University of Chicago Press.

Carmines, E,. & Zeller, R,. 1979. *Reliability and Validity Assessment.* Newbury Park.

Christensen, D,. 2017. *How to interpret a beta coefficient*. Sciencing. 24 April 2017. Accessed on 30 December 2018. Retrieved from: https://sciencing.com/interpret-beta-coefficient-8500491.html

Cohen, Benjamin J. 1977. *Organizing the World's Money: The Political Economy of International Monetary Relations.* New Your: Basic Book

Constable S., 2018. *Central Banks Go On Gold – Buying Spree Over Dollar Worries.* Forbes, 11 September 2018. Accessed on 20 November 2018. Retrieved from: https://www.forbes.com/sites/simonconstable/2018/09/11/central-banks-on-gold-buying-spree-over-dollar-worries/#32a40b771fc2

Conzett, J., *The History of Money. Money Museum*. Accessed on 7 November 2018. Retrieved from: https://www.moneymuseum.com/pdf/yesterday/02_Accross_the_Times/28%20The%20History%20of%20Money.pdf

Cooper, C,. 2015. *6 economists who predicted the global financial crisis*. Intheblack, 7 July 2015. Accessed on 20 December. Retrieved from: https://www.intheblack.com/articles/2015/07/07/6-economists-who-predicted-the-global-financial-crisis-and-why-we-should-listen-to-them-from-now-on

Darst D.M., 2013. *Portfolio Investment Opportunities in Precious Metals*. John Wiley & Sons.

Davenport, J. 2012. *Gold, silver in Medieval Europe*. Creamer's Media Mining Weekly. 24 August 2012. Accessed on 12 November 2018. Retrieved from: http://www.miningweekly.com/article/gold-and-silver-in-medieval-europe-2012-08-17

Davies G., 2010*. History of Money: From Ancient Times to the Present Day.* University of Wales Press; 4th Ed edition (30 Sept. 2010)

Davies, G., 2002*. History of Money.* University of Whales Press.

Drkmaat, Olav,. 2018. *Why gold prices fell in 2008.* Gold Republic, 4 April 2018. Accessed on 4 December 2018. Retrieved from: https://www.goldrepublic.com/news/why-gold-prices-fell-in-2008

Ebeling, M.R. 2015*. Paper Money versus the Gold Standard. The Future of Freedom Foundation*, 7 December 2015.Accessed on 22 November 2018. Retrieved from: https://www.fff.org/explore-freedom/article/paper-money-versus-the-gold-standard-an-explanation/

Eichenberger, B.J., & Flandreau, M. 1997. *Gold Standard in Theory & History*. Hoboken Taylor & Francis Ltd.

Elton E.J, …[et al.] 2014. *Modern Portfolio Theory and Investment Analysis, 9th edition*. Willey Press, 8 edition.

Evans, G,. 2013. *Financial Economics*. Darden Press.

Fabozzi F.J., & Grant J.L., 2001. *Modern Portfolio Theory, Capital Market Theory, and Asset Pricing Models*. Willey.

Friedman M., 1990. *Bimetallism Revisited*. Journal of Economic Perspectives 4, Fall 1990, 85-104.

Ghauri, P,. & Gronhaug, K. 2005. *Research method in business studies.* Harlow, Pretince Hall.

Ghazali M,F,. Lean, H-H,. & Bahari, Z. 2013. *Is gold a hedge or a safe haven?* International Business and Society, 3 November 2013. Accessed on 22 November 2018. Retrieved from: http://www.ijbs.unimas.my/repository/pdf/Vol14No3paper7.pdf

Gog, J.M., *4 medical uses of gold*. Mims Today, 28 February 2017. Accessed on 5 November 2018. Retrieved from: https://today.mims.com/4-medical-uses-of-gold

Gold, M,. & Shah, N. 2016. *Gold and Silver, similar but different*. October 2016. Accessed on 28 November 2018. Retrieved from: https://etfs.wisdomtree.eu/Documents/Investment-Insights-Gold-and-silver-similar-but-different-ETF-Securities.pdf

Goodrich, L. C. 1957. *A Short History of the Chinese People*. London

Grimwade, M., 2009. *Introduction to Precious Metals: Metallurgy for Jewelry and Silversmiths*. Brunswick, Maine: Brynmorgen Press

Gulati I.S. & Mody A., 1982. *International gold price movements.* Centre for Development Studies.

Harold van B. 1976. *The international Monetary system in the Interwar Period*. In Benjamin M. Rowland, ed., *Balance of Power or Hegemony: The Interwar Monetary System*, pp. 1-60. New York: New Your University Press

Harrison, M. 2013. *Did the Gold Standard Work?* Enterprising Investor, 16 April 2013. Accessed on 24 November 2018. Retrieved from: https://blogs.cfainstitute.org/investor/2013/04/16/gold-and-international-reserve-currencies/

Hunt E.S., 2002. *The Medieval Super-Companies: A study of the Peruzzi Company of Florence*. Cambridge: Cambridge University Press

Jagerson J., & Wade S.H., 2011. *All About Investing in Gold – The Easy Way to Get Started*. McGraw Hill.

Jones A.T., & Sackley W.H., 2016. *An uncertain suggestion for gold-pricing models: The effect of economic policy uncertainty on gold prices.* Journal of Economics and Finance40, 367–379. Accessed on 26 November 2018. Retrieved from: https://link.springer.com/article/10.1007%2Fs12197-014-9313-3

Knight F.H., 1921. *Risk, Uncertainty, and Profit*. New York: Hart, Schaffner, and Marx.

Kobata, A., 1965. *The Production and Uses of Gold and Silver in Sixteenth and Seventeenth Century Japan.* The Economic History Review. Published on behalf of Wiley of the Economic History Society.

Lawrence C., 2003. *Why is Gold different from other assets?* Empirical Investigation. World Gold Council.

Mayo, H.B. 2016. *Investments: An Introduction*. Boston: Cengage Learning.

McGuire S., 2010. *Hard Money – Taking Gold to a Higher Investment Level.* John Wiley & Sons.

Medina, R.G. 1988. *Business Finance*. Quezon City: Rex Book Store

Messick, S,. 1989. *Validity.* Educational measurement. New York: Macmillan

Morgan D., & Marchese, C. 2015. *The Silver Manifesto*. PM Industries Press, 1st edition.

Morys, M. 2012. *The emergence of the Classical Gold Standard*. University of York Economic History Working Paper

Moskal, B.M., & Leydens, J.A. 2000. *Scoring rubric development: Validity and reliability*. *Practical Assessment, Research & Evaluation*. Accessed on 08.01.2019. Retrieved from http://pareonline.net/getvn.asp?v=7&n=10].

Müller, H. 1988. *Modern Portfolio Theory: Some Main Results*. Astin Bulletin.

Panic, M. 1992. *European Monetary Union: Lessons from the Classical Gold Standard*. Macmillan Press, London (citation)

Pappas, S. 2016. *Facts about gold*. Live Science, 15 April 2016. Accessed on 3 November 2018. Retrieved from:https://www.livescience.com/39187-facts-about-gold.html

Parikh, V. 2012*. Advantages and Disadvantages of Gold Standard*. Let's Learn Finance, 28 August 2012. Accessed on 10 November 2018. Retrieved from: http://www.letslearnfinance.com/advantages-disadvantages-gold-standard.html

Popescu D., 2016. *Gold and Silver Correlation*. Gold Broker, 1 August 2016. Accessed on 25 November 2018. Retrieved from: https://www.goldbroker.com/news/gold-and-silver-correlation-988

Radomski P., 2017. *Gold – Silver Ratio.* Investor's Perspectives. Accessed on 28 November 2018. Retrieved from: https://www.sunshineprofits.com/media/cms_page_media/2017/7/12/gold-silver-pair-trading.pdf

Religare. 2016*. Is Gold-Silver ratio saying something?* Accessed on 29 November 2018. Retrieved from: http://www.religareonline.com/mediagalary/religare_research_docs/201603181409182774384-is%20gold%20silver%20ratio%20saying%20something.pdf

Reuters T., 2018. *World Silver Survey 2018*. Accessed on 29 November 2018. Retrieved from: http://sprott.com/media/1834/the-silver-institute-world-silver-survey-2018.pdf

Richards C., 2012. *The Behavior Gap: Simple Ways to Stop Doing Dumb Things with Money*. Portfolio.

Ronald I., & McKinnon. 1979. *Money in the International Exchange: The Convertible Currency System.* Oxford University Press

Saunders, M., Lewis, P., & Thornhill, A. 2009. *Research Methods for Business Students. 5th ed*. Essex: Pearson Education Limited.

Scammell, W.M,. 1965. *The Working of the Gold Standard.* New York University Press

Stoeferle R.P., & Valek M.J., 2015. *In Gold We Trust – Extended Version*. In Gold We Trust Report.

Stoeferle R.P., & Valek M.J., 2018*. Gold and the Turning of the Monetary Tides*. In Gold We Trust Report.

Taylor, C,. 2018. *How to calculate a sample standard deviation*. ThoughtCo. 17 August 2018. Accessed on 5 December. Retrieved from: https://www.thoughtco.com/calculate-a-sample-standard-deviation-3126345

The relevance of gold as a strategic asset. 2018. World Gold Council. Accessed on 30 November 2018. Retrieved from: file:///H:/Thesis/the-relevance-of-gold-as-a-strategic-asset.pdf

Wagner, D,. 2018. *Advantages & Disadvantages of Using Paper Currency*. Pocket Science, 25 October 2018. Accessed on 26 November 2018. Retrieved from: https://pocketsense.com/advantages-disadvantages-using-paper-currency-8353738.html

Wallace, K,. 2011. *Is an "annualized" return the same as an average?* MorningStar. 21 September 2011. Accessed on 4 December 2018. Retrieved from: http://www.morningstar.co.uk/uk/news/68719/is-an-annualised-return-the-same-as-an-average.aspx/

Wang L,. 2012. *Investing in Gold: An Empirical study of the Gold Return from the 90s to 21st.* Master's Thesis. Copenhagen Business School. Department of Economics. Accessed on 14 November 2018. Retrieved from: http://studenttheses.cbs.dk/bitstream/handle/10417/3182/lujia_wang.pdf

Welker, M,. & von Hagen, J. 2014*. Money as God?* Cambridge: Cambridge University Press

Wiz, W,. 2018. *Correlation Coefficient DAX Formula*. Bit Wizards, 11 January 2018. Accessed on 4 December 2018. Retrieved from: https://bitwizards.com/thought-leadership/blog/2012/november-2012/correlation-coefficient-dax-formula

Yglesias, M,. 2015. *The Fed and the 2008 financial crisis*. Vox, 13 May 2015. Accessed on 20 December. Retrieved from: https://www.vox.com/2014/6/20/18079946/fed-vs-crisis