

**Czech University of Life Sciences Prague  
Faculty of Economics and Management**

**Department of Economics**



**Bachelor Thesis**

**Economic analysis of Gold, Silver, and Platinum**

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## BACHELOR THESIS ASSIGNMENT

Anastasia Pisareva

Economics and Management

Thesis title

**Economic analysis of Gold, Silver, and Platinum**

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### Objectives of thesis

Economic evaluation of Gold, Silver, and Platinum consists the economics of the precious metals and the overview of each metals' history and properties. Evaluate the applications of each metal and find out the best options and way of the purchasing the precious metals. Analyse the objectives of investment and the risks management of gold, silver, and platinum.

### Methodology

Theoretical part includes abstractions, observations, deduction and competitive analysis of the precious metals.

The practical part contains the analytical methods, estimation parameters, statistical methods, correlation and trend analysis. It also includes the time series, its production and consumption. The analysis dedicated to evaluating the economic situation of Gold, Silver, and Platinum, its possible growth and the economic forecast for 2020.

## **The proposed extent of the thesis**

40 pages

## **Keywords**

Gold, Silver, Platinum, investment, economic analysis, forecast

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## **Recommended information sources**

- Darst, D. (2013). Portfolio investment opportunities in precious metals. Hoboken: Wiley. ISBN: 1118503031, 9781118503034.
- Downes, J. and Goodman, J. (2003). Barron's finance & investment handbook. Hauppauge, N.Y.: Barron's. ISBN: 0764155547, 9780764155543
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- Wood, I. (2004). Platinum. New York: Benchmark Books. ISBN: 0761415505, 9780761415503

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## **Expected date of thesis defence**

2017/18 SS – FEM

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Prague on 12. 03. 2018

### **Acknowledgement**

I would like to thank Ing. Petr Prochazka for his professional advice and the interest, which he devoted to my work. Also, I would like to thank my mother and my sister for supporting me during the whole study period in the university and helping me with every step of the study period.

## **Declaration**

I declare that I have worked on my bachelor thesis titled “Economic analysis of Gold, Silver, and Platinum” by myself and I have used only the sources mentioned at the end of the thesis. As the author of the bachelor thesis, I declare that the thesis does not break copyrights of any third person.

In Prague on 12<sup>th</sup> March 2018

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Anastasia Pisareva

# **Economic analysis of Gold, Silver, and Platinum**

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## **Ekonomická analýza ze Zlata, Stříbra a Platiny**

### **Summary**

The aim of this bachelor thesis "Economic analysis of Gold, Silver, and Platinum" is to analyse the best precious metal for the investment.

This bachelor thesis divided into two parts – theoretical part and a practical part. The theoretical part provides the economics of precious metals and its objectives of the investment. In this part of the thesis provides an overview of the history, properties of gold, silver, and platinum. The last chapter of this part of this thesis provides the ways and options for purchasing the precious metals and risk management.

The practical part based on the economic analysis of precious metals. The primary part of the thesis is a correlation analysis and trend analysis. It also includes the time series, its production and consumption. The analysis dedicated to evaluating the economic situation of Gold, Silver, and Platinum, its possible growth and the economic forecast for 2020.

**Keywords:** Gold, Silver, Platinum, investment, economic analysis, forecast;

# **Economic analysis of Gold, Silver, and Platinum**

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## **Ekonomická analýza ze Zlata, Stříbra a Platiny**

### **Souhrn**

Cílem bakalářské práce „Ekonomická analýza Zlata, Stříbra a Platiny“ je zanalyzování nejlepšího drahého kovu pro investování.

Tato bakalářská práce je rozdělena do dvou částí – teoretická část a praktická část. Teoretická část poukazuje na ekonomiku drahých kovů a cíle této investice. V této části bakalářské práce shrnujeme historii a vlastnosti zlata, stříbra a platiny. Poslední kapitola této části teze nabízí různé možnosti k nakupování drahých kovů a kontrolu rizik.

Praktická část je založena na ekonomické analýze drahých kovů. První kapitola je zaměřena na korelační analýzu a trendovou analýzu. Obsahuje také časové řady, svojí produkci a spotřebu. Analýza zaměřena na ohodnocení ekonomické situace zlata, stříbra a platiny, možný růst a ekonomickou předpověď na rok 2020.

**Klíčová slova:** Zlato, stříbro, platina, investice, ekonomické analýzy, předpověď.

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## **1 Introduction**

Everything in the Universe made of metals. Precious metals are all around us. We used and contact with the metals on a daily basis every day in many different forms. Metals not only used in the everyday lives that surround us but are also a requirement for the manufacture of many other materials and products that people alloy. For example, without steel, we would not have modern pharmaceuticals or even newspapers. Optical lenses and CDs that pressed in the steel forms, the milk chilled in steel containers which people use it every day and do not realise its appearance. In specific applications metals are used because of their effectiveness in conducting with the heat and electricity. Overall, there is just no functional alternative.

Two hundred year ago, there were not things such as electricity, photography, automobiles, energy computers. Nowadays, all the world built on the metals. People give a little thought to the variety and complexity of the materials we depend on every day, but the fact is, it is tough to find any activity, the structure or an object where metals are absent or at least didn't play any role in the manufacturing processes. All the innovations and applications explain that metals are playing a significant part in helping us meet the challenges of the 21st century. Precious metals are essential commodities for the world' economy. Gold, silver and platinum considered to be consumption' commodities and investment assets. Each of them has its unique characteristics in financial terms and industrial applications. Gold and silver used as monetary media, media of international exchange, and currency. Also, they used for the savings, personal investment, and different industrial purposes.

In the preparation of this bachelor thesis, the aim to provide the overview and economic position of three precious metals and analyse the prices, investment opportunities and classify the most affordable and profitable precious metal. This thesis defines the risks of investing, provides the options to buy or trade in the precious metals. The economic analysis of this bachelor thesis dedicates the correlation analysis which finds out the sensitivity and describes the situation in the markets of individual and precious metals.

Recently there has been an increase in interest in precious metals by economic entities of different countries, including the Republic of Kazakstan. Political instability in the world arena causes the increase in demand for these assets. The imposition of a new

package of EU and US sanctions on the Russian Federation, the increasing flow of migrants from Syria, the mixed situation in the UK, and the political changes in the US cause distrust of the classic instruments of the stock market. The private sector in both the EEA countries and the EU is concerned about the growth of inflation and devaluation in the short term.

## **2 Objectives and Methodology**

### **2.1 Objectives**

- Analyse and evaluate the economic situation of Gold, Silver, and Platinum, and its status
- Identify the options and ways of investing in the precious metals
- Clarify the risk management of the investment into precious metals

### **2.2 Methodology**

This aim of this thesis is to do the economic analysis of precious metals. This bachelor thesis divided into two parts – the theoretical part and the practical part.

The first part of the theoretical part of the thesis determines an overview of each metal, describes the history and the properties of gold, silver, and platinum. The second part of the theoretical part evaluates the applications of precious metals and possible ways of purchasing precious metals. Also, dedicates the overview of the investment and the risk management of investing in precious metals.

The practical part of the thesis includes:

- Correlation analysis of the prices of precious metals according to London Stock Exchange Metals (LME)
- Analysis of the independence of the prices of individual metals traded according to the LME
- Analysis of the complex of the investment in the market of the precious metals;
- Econometric analysis of the precious metals market
- The coefficient of correlation of the prices analysed Precious Metals on London Stock Exchange Metals (LME)
- Trend analysis of Gold, Silver, and Platinum
- Efficient Complex of investing in Precious Metals
- Economic forecast of Precious Metals for 2019-2020

### **3 Theoretical part**

#### **3.1 Introduction to Precious Metals**

Precious metals are all around us, even if we cannot always see it. The world without precious metals would not have high buildings; it would not have fast cars and also would not be able to have electricity. The modern world overall built on metals. Gold, Silver, and Platinum are old and unique metals which have a substantial historical line. Precious metals highly prized because of its beauty, quality and wealth. These alloys have a remarkable resistance to attack by their environment. They continued to shine in the air and after an extended stay in the water did not succumb to the corrosive acids and excessive temperatures. For a similar set of performance and endurance, inherent in excellence, they were known as precious metals. Whereas, the precious metals can easily combine with other materials to create oxides, sulfides, silicates and other minerals. Precious metals, or in other words "noble metals," can occur evidently in the uncombined state as lode deposits in rocks, or as placer deposits inside the gravel beds of rivers and streams and in alluvial sands. Precious metals occupy a special place among other mineral resources. Their share in the total volume of the mining industry in the world is scanty and amounts to about 0.00005%, at the same time, due to their high cost, in value terms, this is about 5%. In other words, the value of the extraction of precious metals is approximately 100,000 times higher for a unit of mass of any other mineral (except diamond). (Grimwade, 2009)

Gold, Silver, and Platinum were widely distributed all over the world, which confirms why so many nations and civilisations discovered the naturally appeared precious metals. Throughout the ages, fabulous treasures created by artists and craftspersons exploiting the natural uniqueness and its beauty of this precious metals.

#### **3.2 Economics of Precious Metals**

Since the dawn time, gold, silver, and platinum recognised as valuable metals. Traditionally, precious metals considered as protective assets, that is bought them while the situation in the stock market was far from stable, during various crises and financial shocks. Earning on the market for precious metals is possible. Gold, silver, platinum, assume ample opportunities for earnings, but some problems and risks accompany investments into them. First of all, the fact that of buying physical metal, for example, gold bullion is not as easy as

it seems to be. Second of all, it will be even more challenging to sell precious metals, and it already means problems with liquidity. It turns out that it is partly challenging to invest in physical metals not only, but sometimes it is not favourable.

Many people assume that the best time to invest in precious metals is when the economy is planning to take a turn for the worse, and the more inflation seems to dominate our lives. People are looking for a constant to stabilise their sense of lasting wealth in their savings. Apart from the monetary side of owning gold, silver and platinum, there are delights of owning jewellery and decoration has always been a symbol of status. (Michael C. Thomsett., n.d.)

Gold, silver and platinum are bought by investors primarily to hedge against inflation, economic uncertainty and foreign exchange risks. They believe that it is repositories of absolute value, whereas paper currencies and securities denominated in such currencies have relative value and are vulnerable to losses.

The economics of precious metals have much less to do with the process production and industrial demand. The role of these metals significantly diminished monetary than with the psychology of the financial marketplace. These metals are perceived to be the best store of value available when anxiety causes the value of the asset to go into a tailspin. (Downes and Goodman, n.d.)

### **3.3 Gold**

Gold is a mineral which has known and used by humans for lots of years. Gold is a rare metal which has a long history. Gold is a symbol of distinctiveness and wealth. Gold is a very precious metal, which highly prized because of its quality and beauty. Gold is known and used by the human being since ancient times. Gold fascinated people for thousands of years. It is a symbol of wealth and uniqueness. People think of this metal as a precious metal and a symbol of status. There are many different minerals on Earth, but gold has specific properties that make it desirable. In recent years, the interest in gold has further increased due to its use in space research, medicine, electronics and other industries. (La Niece, 2009)

Gold is the second most heavy metal after platinum out of precious metals; The density of gold is 19.32 g / cm<sup>3</sup>. It means that a gold ball with a diameter of only 46 mm will have a mass equal to 1 kg. Here we have indicated the density of chemically pure gold, but since this does not occur in nature, its "natural" frequency depending on the number of impurities can range from 15-16 to 18-19 g/cm<sup>3</sup>. The Weight of gold is a very desirable property for its extraction. The most straightforward technological processes, such as, for example, flushing at the gateway can provide a very high degree of mining of gold from wash rock. (La Niece, 2009)

The value of gold has led many to go to great lengths retrieve it from the earth. It's not easy to find this precious metal, for people who are looking for the gold, need unique skills, equipment and lots of perseverance and patience.

### 3.3.1 Properties of Gold

Gold is metallic which have a yellow colour in mass, whether when gold finely divided it can be black ruby or have a purple colour. Gold is a chemical element (Aurum, Au); the atomic number of gold is 79, and it has a tremendous conductive with the electricity. Gold is the most malleable and ductile out of the all precious metals, 1 ounce (28 g) of gold can be beaten up to 300 square feet. Gold is a soft metal, and it is mostly alloyed to give it more strengths. It is an excellent conductor of the heat and electricity. Also, gold is not affected by the air and many reagents. The most naturally occurring gold compounds are auric chloride (AuCl<sub>3</sub>) and chloroauric acid (HAuCl<sub>4</sub>). (Belval, 2007)

Table 1: Chemical characteristics of gold

Name	Gold
Chemical symbol	Au
Atomic number	79
Atomic mass	196,967
Melting point	1943 °F (1062 °C)
Boiling point	3632 °F (2000 °C)

(Source: Belval, B. (2007). *Gold. 1st ed.* New York, NY: Rosen Pub. Group)



### **3.3.2 The brief history of gold**

It is probable that the gold was the first precious metal to attract the attention of the primitive man and no traces of it found in the dwellings and other relics of the Stone Age. Whether gold was the first metal which has been observed or not, however, it is certain that its lustre, bright colour and its toughness and wide distribution in a native state as pieces in loose sands and gravels, must have led to the collection of gold in very early times.

Gold was well known in Egypt some 6,500 years ago, and probably at that time already passed into the use as a standard value. Thus in the code of Menes, B.C 3600, one part of gold was equal in the amount of two and a half pieces of silver. The words initially used to denote this precious metal seem to have been connected with its glittering appearance and indicated the ideas associated with it in the minds of the early observers. In later times the alchemists called gold sol and denoted it by entirely the same symbol as the sun because it was the most perfect of the noble metals, the Kind of Metals. (Bernstein and Volcker, 2012)

People most likely first discovered gold in streams and rivers all over the world with its beauty and lustre catching the eye. The known history of gold goes back a long way, so far back that, according to the National Mining Association, it was first used by cultures in modern day Eastern Europe in 4000 BC to make decorative objects. Gold was used for a couple of thousand years solely to create things such as jewellery and idols for worship. It was before around 1500 BC when the ancient empire of Egypt, which benefited from the gold-bearing region; Nubia, made gold the first official medium of exchange for the international trades. (Bernstein and Volcker, 2012)

Egypt created a coin which was called the "Shekel", which weighed 11.3 grams and became the standard unit of measure in the Middle East. It made from the naturally occurring alloy called "electrum" which was about two-thirds gold and one-third silver. Also, around this time that the Babylonians discovered a method called the fire assay, one of the most effective ways to test gold's purity, which still used until now. A few centuries later, around 1200 BC, the Egyptians discovered they could alloy gold with other metals to make it stronger and give it different colour pigments. Egyptians also began experimenting at this time with a casting method called lost-wax casting in which a duplicate gold sculpture cast from an original wax sculpture, a process that can be used to create wonderfully-intricate sculptures, so much so that it is also still used to this day. (Belval, 2007)

### **3.3.3 The applications of gold**

Almost every establishes a culture in the world has used gold to symbolise beauty, wealth and power. Firstly, it conducts electricity and very easy to work with because of its softness and flexibility. Secondly, it does not tarnish and alloys with different types of metals.

These are some of the many uses of gold in the world:

- Jewellery
- Finance
- Medicine and Dentistry
- Engineering and Aerospace
- Environment
- Electronics
- Trophies and crowns

## **3.4 Silver**

Silver is delicate, almost to be creamy whiteness and rareness of the metal made it the natural choice for representing wealth in the forms of small, transportable token which we call coins nowadays. Silver highly prized since the earliest days of civilisations. Silver considered being the most valuable precious metal after gold. All people have something which made of silver, because of the availability and different applications in many different industries. (Watt, 2003)

### **3.4.1 Properties of silver**

Silver is a lustrous, white, corrosion-resistant metallic element. Outstanding features of silver include its excellent electrical and thermal conductivity. Silver is a heavy precious metal (density 10.49 g/cm<sup>3</sup>), extremely plastic (1 kg it can be pulled into the wire 2 km or more), well polished, not oxidised in the air. Its symbol, Ag, is an abbreviation of the Latin name for the component - Argentum. Silver has protons which have the atomic number; Its atomic number is 47, positively charged protons in each atom. The number of protons and electrons is always the same, which mean that there are 47 negatively charged electrons revolve around the nucleus of each silver atom.

Table 2: Chemical characteristics of Silver

<b>Name</b>	<b>Silver</b>
<b>Chemical symbol</b>	Ag
<b>Atomic number</b>	47
<b>Atomic mass</b>	107,87
<b>Melting point</b>	1,763 °F (962 °C)
<b>Boiling point</b>	3, 923 °F (2,162 °C)

(Source: Cavendish, M. (1999). *The elements*. New York: Marshall Cavendish.)

Silver is a rare precious metal, pure deposits of this metal do exist, but the element usually found combined with other components in the forms of compounds. The chemical processing needed to extract pure silver from the compounds and minerals in which they found. The most significant silver mineral is "Argentine" (Ag<sub>2</sub>S, silver sulfide). Also, silver found combined with lead and copper Oreos and an electron which naturally occurring blend of gold and silver. (Belval, 2007)

### **3.4.2 A brief history of Silver**

Silver is one of the oldest known precious metals. The first known efforts by humans to mine silver from the earth found in Anatolia, in the country which is presently known as Turkey. The ancient Egyptians also occupied more productive than average silver deposits in the gold they mined. They eventually learned how to separate the precious metals, and refine the silver into what was known and called as "white gold". By 2500 BC, the Chaldeans purified silver from ores of lead they mined. It is a more efficient technique to refine silver and led to a flood of silver across the ancient world. The other ancient culture prominent in silver' history was the Greeks, who discovered rich deposits of silver near ancient Athens. It discoveries eventually led to the infamous Laurium mines, which produced silver for the hundreds of years.(Blair, 1986)

By 2000 B.C.E., smelting and mining of silver-lead ores were common. The Laurium silver-lead deposit an ancient Greece was a significant source of silver approximately around 500 B.C.E. to 100 C.E. In the sixteenth century, Spanish explorers discovered silver mines in Mexico, Bolivia and Peru. These New World mines were more productive in silver, that is why South Africa and Central America became to be the most prominent silver' producing areas in the world. The valuable silver deposit which called "Comstock" lode found in the

Sierra Nevada region, which make the United States another most prominent silver' producing country. (Belval, 2007)

### **3.4.3 The applications of Silver**

Silver alloys can use in a plenty different ways. Silver has a reputation for its use in jewellery and coins. Nowadays, silver is primary use in industry, whether, in cell phones or solar panels, innovations continuously take advantage of silver's unique properties. Silver became a material of changes that appear in many unexpected places, such as:

- Electronics
- Energy
- Brazing and Soldering
- Chemical production
- Coins and Investment
- Jewellery and Silverware
- Photography
- Mirrors and Glass
- Engines
- Medicine and Dentistry

Since a long time, silver made ornaments, signs of power, religious items, trimmed dagger-hilts and scabbard conventional weapons. The high plasticity of silver contributed to the emergence of applied arts in the aesthetic treatment of metal – toreutics survived to the appearance, lifestyle and Ethnography of the peoples of the past millennia. (Belval, 2007)

Silver, like gold, has long been used as money. Today the alloys of silver are extraordinarily diverse. About a fifth of the silver produced in the world is used in electronics (for conductors of specific devices, for the manufacture of critical electrical contacts, silvered wire for high-frequency electrical engineering), in the nuclear industry (for neutron radiation indicators). Silver is necessary for photochemical (for the production of photosensitive emulsion for film and photographic materials) and pulp and paper industry, aviation, rocket science, in the military, in the chemical industry, in aviation, rocket science.

### 3.5 Platinum

Platinum is a very ductile, dense and malleable precious metal, grey-white transition metal which is resistant to the corrosion. It is a rare precious metal which occurs as only 0,003 ppm in the Earth's crust. Today, platinum is the most valuable out of all precious metals, because of its requirements in many industrial applications. Platinum is estimated that one-fifth of the everything we use either includes platinum or requires platinum in its manufacture. (Wood, 2004)

Platinum occurs native and accompanied by small quantities such as iridium, osmium, palladium, ruthenium and rhodium, which belong to the platinum group. Platinum group metals found in the alluvial deposits of the Ural mountain, Columbia and certain Western American states. Platinum has a coefficient of expansion, therefore used to make sealed electrodes in glass systems. The metal does not oxidise in air at any temperature but it is corroded by halogens, cyanides, sulfur and caustic alkalis. Platinum is insoluble and physically unique precious metal in hydrochloric and nitric acid. (Wood, 2004)

#### 3.5.1 The properties of Platinum

Platinum is the heaviest of a group of six metals which are called the platinum group metals and its chemical symbol is Pt; Its density is 21.45 g / cm<sup>3</sup>. The other five group metals are palladium (Pd), iridium (Ir), osmium (Os), rhodium (Rh), and ruthenium (Ru). Platinum can withstand very high temperatures. Platinum's atomic number is 78; each atom contains 78 protons and electrons; The protons and neutrons combine to give the atom its mass. Platinum has an atomic mass of 195 and contains 117 neutrons. (Wood, 2004)

Table 3: Chemical characteristics of Platinum

Name	Platinum
Chemical symbol	Pt
Atomic number	78
Atomic mass	195,09
Melting point	3,215 °F (1,769 °C)
Boiling point	6,921 °F (3,827 °C)

(Source: Wood, I. (2004). *Platinum*. New York: Benchmark Books)

Platinum is dense and relatively soft metal. Platinum is unreactive precious metal; it resists corrosion by water and oxygen in the air.

The only substance which can dissolve platinum is "aqua regia" - the mixture that concentrates nitric acid (HNO<sub>3</sub>) and hydrochloric acid (HCl). It used for the separating platinum from its ores. (Wood, 2004)

### **3.5.2 A brief history of Platinum**

People first began to use platinum around 2,000 years ago in Egypt and South America. The Europeans did not find out about the platinum until the sixteenth century; when the Spanish began their conquest of South America. During the archaeological searching for the gold, Spanish conquistadors found massive lumps of the unknown metal, they called it "platina del Pinto" which means "little silver of the Pinto River". Platinum was called like that because of finding much platinum in the sand of the Pinto river in Colombia. The Spanish brought some of the sample of this metal to Europe. After that, in 1557, Italian-French scientist Julius Caesar Scaliger (1484-1558) analysed the pieces of platinum' samples. He found out that it was not silver, it was an entirely new metal. After that, Europeans forgot about the new metal for around two hundred years. In 1735, Spanish scientist Antonio de Ulloa (1716-1795) refound and discovered platinum in South America. At the end of nineteen century, platinum was in high demand for jewellery and many different industrial uses.(Wood, 2004)

### **3.5.3 The applications of Platinum**

Platinum and platinum group metals used for the manufacture of refractory and acid-resistant cookware, they produce distillation, acid-resistant and heat-resistant factory equipment. Today, platinum acts as a catalyst (in particular, in the production of gasoline with a high octane number), hydrogenation of chlorinated aromatic amines (raw materials for the production of pesticides, herbicides, synthetic paints and various pharmaceutical products). Also, in other branches of the chemical industry, glass production, automotive and aviation industries, marine engineering, electronics and power equipment.

These are some of the primary applications of platinum:

- Automobile Catalyst
- Petroleum Industry
- Jewellery
- Electrical and Electronics
- Hard disks
- Chemical
- Medicine
- Fuel Cells
- Investment
- Glass

Platinum alloys used in electrical engineering as contacts and fuses. Platinum alloys with gold, iridium and palladium used in jewellery (in Russia, a sample of 950 installed in jewellery for platinum), dental work, in the production of radio equipment. Because platinum is very stable in molten glass, it produced from melting crucibles for cooking optical glass.) Fillers made of platinum are used for the production of fibreglass.

### **3.6 The options and ways to purchase Gold, Silver, and Platinum**

Precious metals merely traded commodities which is possible to buy and sell at the open market. Investment in precious metals has many different reasons and perspectives for the holder come in a variety of products that suit all levels of investors and collectors. The precious metals market is the unique and diverse because of the vast options available. Precious metals not only diversify any collector's portfolio, but they also provide a level of protection against currency values and economic insecurity.

These metals are perceived to be the best store of value available when anxiety causes the value of the asset to go into a tailspin. Investment in precious metals as commodities (not as the value of currency) owned by investors in physical form or securities, because of its presumed value as stores of wealth and hedges against the inflation and economic uncertainty. (Downes and Goodman, n.d.)

There are some of the best possible ways to buy precious metals:

- Stocks and mutual funds holding shares in mining companies
- Exchange Traded Funds (ETF) that hold bullion:
- Gold SPDR (GLD)
- Platinum (PPLT)
- Silver (SLV)
- Antique coins (many have collector value that exceeds the meltdown value)

#### **Newly minted coins:**

- Gold: American Eagle, Canadian Maple Leaf, South African Krugerrand, British Sovereign, Vienna Philharmonic, Mexican Gold 50 Pesos, U.S. Mint 24K Gold Buffalo
- Silver: Canadian Silver Maple Leaf, Silver American Eagle, Austrian Vienna Philharmonic
- Platinum: American Eagle, Australian Koala, Canadian Maple Leaf



Bullion bars produced by some government mints, as well as private companies such as:

- Johnson Matthey
- Wall Street Mint
- Credit Suisse
- Engelhard
- Produits Artistiques de Métaux Précieux (PAMP)
- Sunshine Minting and Pan American Silver

### **3.7 The objectives of investment in Precious Metals**

Financing for the future is significant, especially in an uncertain economy. When people invest in Gold, Silver or Platinum, they think firmly about the future, and they are setting up long-term financial goals. Precious metals represent a safe-haven approach to diversification, but it also can act as a hedge against the future uncertainties. (Downes and Goodman, n.d.)

Before the investment in precious metals, the prospective holder should consider the following questions:

*How to buy precious metals and sell them?* Depending on the form of ownership, it can purchase from various dealers and brokers. Also, certificated and coins are bought and sold through significant banks.

*Is there any minimum purchase amount?* Gold, Silver and Platinum are possible to buy with almost any amount of the money; it depends on the form of investment.

*What are the fees and charges involved?* Bullion involves the dealer markup, varying with the quantity of its metal. Certificates cost around 3% and upper, with storage and insurance around 1% or more and the sales fees of 1% or higher.

*Is it possible to sell precious metals quickly?* Usually yes, but platinum is less liquid compared with gold and silver. Larger ingots and less popular precious metals' coins can have the uncertain liquidity. Domestic and foreign securities and other variations of investment such as mutual funds are the subjects of the standard fees and commissions; Also, taking into consideration the form of the ownership, other costs include sales, taxes, shipping and handling, fees, insurance and safekeeping.

*Should the owner purchase precious metals if the objective is income?* Many forms of the owners such as stocks and mutual funds may provide income, while the others, like physical ownership, do not offer and may cause adverse returns. Overall, precious metals not purchased for the profit.

### **3.8 The risk management of Precious Metals**

For centuries, gold, silver and platinum have served as the store of value, as the medium of exchange and sometimes as the unit of account. In periods of economic uncertainty to potential crises or financial dislocations, investors have increased portfolio exposure to the precious metals. Gold, silver and platinum have been considered a hedge against the inflation in general price level.

Global population, income, monetary and economic growth tended to exceed the annual growth rate in the physical stock of precious metals. Precious metals have tended to view as the asset class with diversification properties because of its underlying supply and demand characteristics. Also, low correlations of returns with many other asset classes. The price of precious metals can be subject to the political and geopolitical factors and their expectations considering the likelihood of significant deflation or inflation in the price level. Physical precious metals do not pay any dividend and might cumbersome to store, subdivide, insure or transport in quantity. Demand, supply and disposition of the precious metals may subject to the trends in the exploration, production, lending, sales and financing strategies of select companies and the industry overall. (Darst, 2013)

## **4 Practical part**

### **4.1 Econometric analysis of the precious metals market**

Recently, there has been an increase in interest in precious metals by economic entities of different countries, including the Republic of Kazakhstan; The increase in demand for these assets is caused by political instability in the world arena. The imposition of a new package of EU and US sanctions on the Russian Federation, the increasing flow of migrants from Syria, the mixed situation in the UK, and the political changes in the US cause distrust of the classic instruments of the stock market. The private sector in both the EEA countries and the EU is concerned about the growth of inflation and devaluation in the short term.

For the analysis of the precious metals market, gold, silver and platinum futures were selected - monthly quotes for the last six years from June 23, 2016, to June 23, 2017. Over the past six years, there has been a long-term decline in prices for selected assets. This is due to the constant growth of the US and EU economies, as evidenced by the growth of the stock index S & P500 and DAX. After the crisis of 2007-2011. Prices for precious metals began to decline. For six years, the price of gold fell from 1628.3 USD per ounce to 1258.35 USD - by 22.7%. Silver and platinum declined by 58.21% and 47.94%, respectively. In turn, the indices of S & P500 and DAX increased by 88.6% and 77.8% respectively. To more accurately describe the relationship between stock indices, the US Federal Reserve's interest rate and the price of precious metals, vector autoregression models were constructed that analysed functions of the response of futures contracts prices to a single shock of stock indices. Endogenous variables - prices for futures contracts and stock indices, exogenous - the interest rate of the US Federal Reserve and the US dollar index (USDIX). The analysis of the response to the shock of the stock indices is shown in Figure 1. The pulse of the stock index - the gap in the values of S & P500 - the difference, between the original time series and its trend component, extracted using the Hodrick-Prescott filter. Thus, it is possible to analyse short-term fluctuations of the index around the trend. Based on the results obtained, it can be concluded that in the short term, the effect of a single shock of S & P500 on gold (negative response) reaches a minimum for the second month and is statistically significant at 10%. After the second month, this effect fades out and becomes statistically insignificant. Similarly, the momentum transmitted by a single shock of breaking the S & P500 into silver and platinum reaches its maximum for the second month, the effect disappears on the fourth month. All effects are recognised as statistically significant by the Granger test.

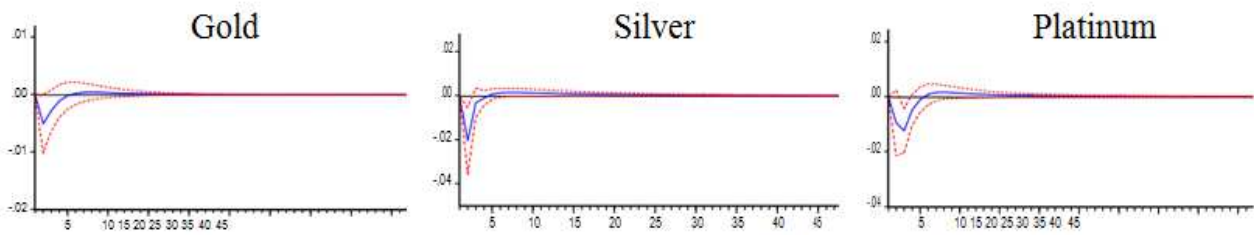


Figure 1 - The response function of the VAR-model to the momentum of the US stock index S & P500<sup>1</sup>

To analyse the effect of the S & P500 stock index, the US Federal Reserve's interest rate and the US dollar index on the futures contracts prices of the precious metals under consideration. Econometric models were built with the preliminary logarithm of the variables to scale the indicators and a more convenient interpretation of the estimated elasticity coefficients.

Table 4 - Analysis of time series for the presence of a single root<sup>2</sup>

Variety	Index	Specification	ADF		PP	
			crit.	obs.	crit.	obs.
Gold	Gold	I(1) const	-2.9	-1.68	-2.9	-1.53
Silver	Silver	I(1) const	-2.9	-2.13	-2.9	-2.11
Platinum	Platinum	I(1) trend	-3.47	-3.22	-3.47	-3.17
S&P500	S & P500 value	I(1) trend	-3.47	-2.59	-3.47	-2.43
US.IR	The rate of the US Federal Reserve	I(1) trend	-3.47	-2.82	-3.47	-2.98

Because all the rows are first-order integrated (the check for unit root was carried out with the help of the extended test of Dickey-Fuller and Flips-Perron - table 1), three models were constructed to test for cointegration.

<sup>1</sup> [mineconomikiro.ru/m5/m53/2018-2020/deflators\\_conservative.xlsx](https://mineconomikiro.ru/m5/m53/2018-2020/deflators_conservative.xlsx)

<sup>2</sup> <https://apecon.ru/tsena-na-zoloto-prognoz-tsen-na-zoloto-na-zavtra...>

- by the test of Engle-Granger:

$$Gold_t = 13.10 - 0.78 \times SP500_t + 0.24 \times US.IR_t, DW = 0.86$$

$$Silver_t = 14.45 - 1.51 \times SP500_t + 0.36 \times US.IR_t, DW = 0.84$$

$$Platinum_t = 12.34 - 0.70 \times SP500_t, DW = 0.57$$

Based on the Durbin-Watson statistics in the constructed models, it can be concluded that all models are a co-integration model for Engle-Granger, and the stationarity of the remainder of the constructed models is verified by the Dickey-Fuller test with the None specification without lags. The resulting models are models of cointegration, but in all, there is autocorrelation of the first order. To eliminate it, AR (1) variable was introduced into each model, and some variables were lagged to improve the quality of the models:

$$Gold_t = 4.34 - 0.26 \times SP500_t + 0.10 \times US.IR_t + 0.67 \times Gold_{t-1}, R^2 = 0.905, DW = 2.22$$

$$Silver_t = 4.64 - 0.48 \times SP500_t + 0.14 \times US.IR_t + 0.67 \times Silver_{t-1}, R^2 = 0.92, DW = 2.10$$

$$Platinum_t = 2.43 - 0.16 \times SP500_{t-1} + 0.82 \times Platinum_{t-1}, R^2 = 0.91, DW = 2.23$$

Based on the conducted econometric analysis it was possible to prove the statistically significant negative influence of the growth of the stock index S & P500 on the prices of futures contracts for the precious metals under consideration. It can be noted that now is the time for portfolio investments in precious metals with long and short positions, and not for their purchase in the expectation of price increases.

## 4.2 Paired coefficients of correlation of prices of analysed goods on LME

Metals and alloys are the basis of most modern construction materials and advanced technologies. Steel and semiconductors, precious, rare and refractory metals used in various industries. As for some other commodities, world metals prices set by the results of trading on the London Stock Exchange, the Shanghai Futures Exchange, the Brazil Commodity Futures Exchange, the Tokyo and New York Commodity Exchanges, etc. However, the bulk of the world's non-ferrous metals trade is accounted for by the London Stock Exchange metals (LME). Thus, according to the LME report for 2017, the exchange registered a record trading volume of 171.1 million lots, which is 7.1% more than in 2016. This volume is equivalent to 4 billion tons or 14.6 trillion USD. At the end of 2017, the share of LME in the global market for commodity futures for metals exceeded 84%. The needs in the manufacturing sector determine the prices set for the LME and serve as global targets for the sale of metals. The level and dynamics of prices for non-ferrous metals are essential pricing factors for a wide range of goods. In this case, changes in demand for a particular metal in a certain way correspond to fluctuations in the market situation of other metals. In this regard, it is significant to study the interdependence of prices of individual metals traded on LME.

To analyse these dependencies, LME prices for primary non-ferrous metals, as well as prices for precious metals and liquid fuel and energy resources (FER), were investigated within the framework of the work performed to identify possible additional links. Data on daily prices were analysed for the period from 01.01.2012 to 01.11.2017 inclusive - a total of 1766 values. Primarily from the time series of costs for the above products were removed trend components, seasonal and cyclical components and autocorrelation. This made it possible to obtain from them the necessary random variables, which were subsequently used to construct the appropriate regression models/ Since the values for different time series differed by order of magnitude, they were standardised as follows:

$$z_t = \frac{X_t - M(X)}{\delta_x}, \quad (1)$$

Where:

- $Z_t$  is the standardised values of the time series;
- $X_t$  - non-standardized values of prices for selected goods on the t-th day;
- $M(X)$  is the mathematical expectation of the values of the series;
- $\delta_x$  is the standard deviation of the values of the series.

Autocorrelation function analysis did not reveal seasonal and cyclic components. The trend component of the "standardised" price series deleted as follows:

$$Z_i^* = Z_i - (a + b \cdot t), (2)$$

Where:

- a and b are the coefficients of linear pair regression in the equation

$$Z_i = a + b \cdot t; Z_i^*$$

The values obtained from the time series after the trend removed. From the autocorrelation were disposed of as follows:

$$Z_i^{**} = Z_i^* - (c + d \cdot Z_{i-1}^*), (3)$$

Where:

- $Z_i^*$  - the values of the time series after the removal of the trend;
- $Z_{i-1}^*$  - the values of the time series after the trend removal, offset one day ago;
- c and d are the coefficients of linear pair regression in the equation:

$$Z_i^* = (c + d \cdot Z_{i-1}^*); Z_i^{**}$$

The standardised random values obtained from the time series after the removal of the trend and autocorrelation. After removing the autocorrelation, 1765 values of each price remain. Residual components of steel were random variables, over which correlation analysis was subsequently carried out using the Pearson linear test (Table 5,6,7)<sup>3</sup>.

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<sup>3</sup> According to data in [www.investprognoz.ru/gold.htm](http://www.investprognoz.ru/gold.htm)

Table 5: Coefficient correlation of prices of analysed individual metals on LME

	Aluminium	Copper	Nickel	Tin	Lead	Zink
Aluminium	1					
Copper	0,59	1				
Nickel	0,65	0,54	1			
Tin	0,47	0,40	0,52	1		
Lead	0,60	0,52	0,55	0,51	1	
Zinc	0,65	0,55	0,59	0,51	0,79	1

Table 6: Coefficient correlation of prices analysed Gold, Silver, Platinum and Palladium on LME

	Gold	Silver	Platinum	Palladium
Gold	1			
Silver	0,76	1		
Platinum	0,69	0,67	1	
Palladium	0,49	0,56	0,72	1

Table 7: Coefficient correlation of prices analysed goods on LME

	Oil Brent	Oil Light	Fuel Oil	Petrol
Oil Brent	1			
Oil Light	0,82	1		
Fuel Oil	0,87	0,80	1	
Petrol	0,75	0,69	0,74	1



Based on the correlation matrixes, correlation constants constructed. The figures show the most reliable links between prices identified in the analysis process.

From the correlation galaxies, one can see that the most significant correlation coefficients among themselves are the prices of goods of homogeneous groups. It can be explained by the relative synchronism of fluctuations in demand for goods having a similar consumer purpose. However, it is entirely unexpected that there are bonds of approximately the same strength of all three commodity groups through the price of copper. Identification of such a fact as a result of statistical analysis gives a particular opportunity to use LME prices for copper as an average indicator of market fluctuations both for non-ferrous and precious metals markets, as well as for liquid fuel and energy resources. Explain this dependence can be statistically equal to the sensitivity of demand for copper to changes in the situation in the markets of industrial metals, hydrocarbons and investments in 2012-2017.

### **4.3 Trend analysis of Precious Metals**

Gold may rise in price against the backdrop of risks in the global economy and raise the Fed's rates and provoke a rise in the price of platinum. The cost of silver will increase due to the growth in investment demand, palladium will not allow a significant drop in the world production of gasoline cars, and the price for iridium and rhodium will remain significantly higher than last year due to the continuing deficit of these metals in the market.

#### **4.3.1 Gold**

The current price for an ounce of gold today is \$ 1,431. For ourselves, at the moment we have set a range of \$ 1402 - \$ 1490 per ounce, and we do not plan to revise these expectations yet. The current price is relatively high, but there is potential for its further growth. The primary factor in this growth may be another increase in Fed rates - the news background around this event will push gold up to the level of 1400-1450. The demand for gold is generated mainly by investors, which means that it will grow with any potential risks in the global economy: sanctions, crises, etc.

#### **4.3.2 Silver**

Silver is trading at \$ 31.6 per ounce; this is a reasonably low price. At this level, we see an increase in investment demand for silver (from the world industry, demand remains stable), so in the second half of 2017, we expect the price to be within \$ 32-33. The primary driver for moving up the silver is the decline in the US dollar index.

#### **4.3.3 Platinum and Palladium**

Palladium actively traded on the world market in June-July this year. At the same time futures for palladium were several percents cheaper than physical metal due to the latter's deficit. Thus, there was a situation rare for the market when physical demand exceeded the real offer. During this time palladium has significantly risen in price. For a while, it traded at \$ 920 per ounce but quickly fell below \$ 900. The price is still high. We believe that this trend will decline in the near future. The main feature is a threefold increase in the guaranteed security of palladium. The exchange sees that the market has developed a dangerous conjuncture. The change in the collateral creates a situation for the growth of

volatility, that is, the price for palladium will go sharply either downward or upward. We believe that we should not expect substantial growth - the situation with the presence of physical metal has normalised, the market of physical metal and futures has now levelled off, and the difference in value that pushed palladium up ceased to be the driver of the movement. On the other hand, there should not be a significant fall. That is, we are waiting for the growth of price fluctuations but in a somewhat narrow range. The fact is that a significant share of the demand for palladium in the world generates consumption in the automotive industry. The higher the sales of cars, the more palladium is required by manufacturers. Sales of cars in Europe, China, Japan in 2017 showed growth; in the US there is a decline in the market, but insignificant. At the same time, it is essential that the demand for gasoline cars exceeded the demand for diesel, mainly against the background of "dieselgate". In the catalytic systems of gasoline vehicles, the share of palladium used is 70%, and in diesel systems - about 30%. Therefore palladium, if it shows a decline, then to the border \$ 800-820.

Compared to last year, exports of platinum from Russia are stable, with a slight increase. In the market of North America (Canada, USA) the situation is reversed - stable exports with a small minus. In South Africa, there is a decline in the production of platinum and palladium. The demand for platinum on the part of both investors and industry is declining. It is also typical for Russia, whose platinum market, in general, follows the world market.

Therefore, the price per ounce of platinum is relatively low and is at the level of \$ 1,900. Nevertheless, platinum may break through the psychological mark of \$ 1,900 by the end of the year and reach the level of \$ 1,920 per ounce. It can happen, mainly, against the backdrop of a rise in the price of gold to the expected \$ 1,300 per ounce. Platinum may be pushed up by further appreciation of palladium and the depreciation of the US dollar. If the price of platinum falls, and, according to the forecasts, very small, up to \$ 1,910 -1920.

#### 4.4 The efficient complex of investments in the market of Precious Metals

The long-term trend of growth in the market value of precious metals especially amplified in the periods preceding and immediately after the crisis, which is explained by the opportunity provided for preserving and multiplying capital under conditions of intensive manifestation of factors of randomness and uncertainty. An active investment here is an investment of funds that provide minimum risk and yield the required profitability. In the gold, silver, platinum and palladium market, investors, of course, have less opportunity to diversify compared to the stock market. However, as follows from the following, a toolkit is available to reduce the risk at the required level of return on investments due to complex investments in several precious metals. The article examines the dependence of the minimum investment risk on the requirement for their profitability, as well as the risk reduction indicators due to diversification. The approach applied below includes the estimation of the vector of the average profitability index of investments in precious metals; and the covariance matrix of these returns, the formation of an efficient investment structure and the definition of its transformation depending on the required yield, and an analysis of the benefits of diversification in the precious metals market, search for the effective complex investments.

By analogy with an active portfolio of securities, under efficient complex investments, precious metals will be understood as investment funds that provide the required yield and at the same time have minimal risk. Following Markovitz's model, the standard deviation of yield used as a measure of risk, namely:

$$\sigma_{\tilde{n}}(\bar{\mathbf{w}}) = \sqrt{\bar{\mathbf{w}}^T \cdot \text{Cov}(\bar{\mathbf{R}}) \cdot \bar{\mathbf{w}}}$$

Where:

- $\tilde{n}(\mathbf{w})$ -standard deviation of the return on investment, depending on the structural solution determined by the vector column  $\mathbf{w}$ , whose elements are equal to the selected investment shares of each of the precious metals;
- $T$  is the symbol corresponding to the transposition of the vector;
- $\mathbf{R}$  is a vector composed of investment returns to each of the metals;
- $\text{Cov}(\mathbf{R})$  is the covariance matrix of returns on investment in precious metals.

The investment limits for all the  $N$  metal candidates that are being considered for the investment set are the following:

$$\sum_{k=1}^N w_k = 1,$$

$$w_k \geq 0, \quad k = \overline{1, N}.$$

The following scalar product determines the yield of complex investments depending on the structural solution:

$$R_c(\bar{w}) = \bar{R}^T \cdot \bar{w},$$

As well,

$$R_c(\bar{w}) = R_{mp},$$

Where:

- $R^T$  - the required return on complex investments.

The search for an efficient complex investment now reduces to solving a problem in which it is necessary to minimise the objective function (1) with constraints (2), (3) and (5).

For practical search for effective complex investments in precious metals, it is first necessary to estimate the covariance matrix of returns and the average yield vector. Consider examples of investments in gold, silver, platinum and palladium for the period from February 2012 to March 2017 in the most straightforward investment scheme: the acquisition of assets at the beginning of each month of this period followed by the sale at the end of the month.

The yield was defined as the relative change in the price of precious metals per month. The primary data for the calculations were exported from [www. finam.ru](http://www.finam.ru). The following estimates of the elements of the covariance matrix are obtained (see Table 8).

For the average yield vector of investments for the month, the following estimates are presented, presented in Table. 8 Of course, the profitability of complex investments can

be increased as a result of a successful speculative game. Conversely, buying precious metals at moments of rush may lead to losses. The chosen approach to the assessment of profitability helps to determine how the increase in the complexity of investments in precious metals can reduce investment risks. If one looks at data gathered in Table 8, all precious metals rates of return have low correlation coefficients with stock indexes, this statement is confirmed. For the majority of them (except silver) correlations are statistically significant at  $p < 0,05$ .

Table 8. Investment yield covariance<sup>4</sup>

	<b>Gold</b>	<b>Silver</b>	<b>Platinum</b>	<b>Palladium</b>
<b>Gold</b>	0,002962	0,005156	0,002189	0,001245
<b>Silver</b>	0,005156	0,013081	0,005135	0,00439
<b>Platinum</b>	0,002189	0,002189	0,004061	0,00369
<b>Palladium</b>	0,001245	0,00439	0,00369	0,006519

Underlined correlations are significant at  $p < 0,05$ .

Table 9. The average return on investment per month<sup>5</sup>

<b>Gold</b>	<b>Silver</b>	<b>Platinum</b>	<b>Palladium</b>
<b>0,01276</b>	<b>0,02375</b>	<b>0,00736</b>	<b>0,02303</b>

Distributions of rates of return for all analysed assets rates of return were checked for the normal distribution. The following zero hypothesis was tested:

$$H_0: E[ | G(x) - F(x) | ] = 0 \text{ for } x \in (-\infty, +\infty)$$

Where:

- $G(x)$  – values of rates of return from analysed assets (the empirical distribution)
- $F(x)$  – values of the theoretical normal distribution

<sup>4</sup> According to <https://ru-precious-met.livejournal.com/tag/прогнозы>

<sup>5</sup> According to <https://ru-precious-met.livejournal.com/tag/прогнозы>

## **4.5 Economic forecast of precious metals for 2019-2020**

### **4.5.1 Prediction for Gold prices**

In 2018, the price of gold increased by 30% to a record \$ 1,431 / oz. This trend will continue most likely in the coming year, as investors still need a safe haven. Mitigating monetary policy in the US and fears about inflation will also support gold.

The sluggish debt crisis in the peripheral EU countries forces investors to seek protection. This is confirmed by the growing contributions to exchange-traded index funds (ETF). Significant investments in ETF are expected in 2019.

The demand for gold coins and ingots will also be high. Liquidity in the market stimulates inflationary fears. Low-interest rates will also increase the attractiveness of gold as an alternative currency. In addition, speculative investors contributed to the rise in prices for yellow metal, sharply reducing long positions.

The demand for gold jewellery has adapted well to high prices, as seen from the volume of imports from large consumers. For example, according to the Bombay Bullion Association, India imported 700 tons of precious metal in 2017, which is 25 percent more than in 2017. Gold imports also rose in Turkey, the world's third-largest gold consumer after India and China. In 2018-2020, these countries will continue to purchase.

In China, the gold market is becoming more liberal. The interest of private investors in gold is growing every day due to the improvement of the standard of living in the country.

In 2019, as already noted, the Central Banks will finally turn into the status of gold buyers. In early 2018, the International Monetary Fund (IMF) completed the sale of 403.3 tonnes of gold approved by the Fund's Board of Directors in September 2016. Asian state banks will become the primary gold buyers in 2018 to diversify their reserves - unlike Western banks, gold almost not present in their reserves.

Commerzbank expects gold prices to reach \$ 1,600 / ounce by the end of 2019, and by the end of 2020 - \$ 1,700 / ounce. The risk of strengthening the US currency exists, but this will have a positive impact on the value of gold in euros.

#### 4.5.2 Prediction for Silver prices

In 2017, silver was included in the list of the best commodity investments. For the year it grew in price by 83% and breaking the record of 30 dollars/ounce. Silver throws a huge shadow on his older brother - gold. The ratio of gold and silver fell significantly in the second half of last year.

More attractive silver makes its hybrid character - precious metal, industrial metal and asset-shelter. Therefore, nothing is surprising in that since the beginning of the financial crisis; silver has outrun not only gold but also copper.

According to GFMS, industrial demand for silver in 2017 increased by 18% compared with 2016. However, in other sectors, this dynamics has not been observed. Demand for jewellery and silverware is falling due to high prices, demand in the photo industry fell by 11% last year<sup>6</sup>.

Recently, the volume of silver scrap processing has been increasing. However, despite recent records, the price of silver is still too low to significantly increase the processing of silver scrap.

It is expected that the global economy, in particular emerging markets, will support industrial demand for the metal. It is worth noting that China, in the past the largest exporter of silver, became its main importer. Also, the Central Bank of China no longer intends to reduce the state reserves of precious metals.

The largest silver ETF last year bought 45.9 million ounces of silver, thereby increasing its reserves by 15 percent to 351 million ounces. The demand for coins and ingots of silver increased by 23%<sup>7</sup>. It is expected that the investment demand for silver will grow in 2019.

First, the driver for investors will be brewing concerns about a possible devaluation of world currencies;

Secondly, extremely low-interest rates are also favourable for silver, since alternative costs are minimal;

Moreover, finally, the rise in prices will lead to a kind of euphoria among the participants of the financial market, with the exception of jewellers and industrial consumers.

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<sup>6</sup> <https://mr-andynet.livejournal.com/>

<sup>7</sup> [https://interactive-plus.ru/ru/article/119207/discussion\\_platform](https://interactive-plus.ru/ru/article/119207/discussion_platform)



Many financial investors follow the trend, and some of them have already had an impact on prices. Such an influence will grow, as the silver market is small in volume. To date, the cost of annual consumption of silver is estimated at \$ 25 billion, which is one-seventh of the value of the gold market (175 billion dollars)<sup>8</sup>.

In general, the silver market is impressive. Despite the fact that in the short term, price adjustment is possible, the long-term outlook is optimistic. By the end of 2019, the price of silver will reach \$ 35 / ounce.

#### **4.5.3 Prediction for Platinum prices**

Platinum for the year increased in price by 21% and proved to be worse than other precious metals. However, it has a significant price potential.

According to Johnson Matthey, the surplus of platinum will continue to decline, in 2017 the reserves of precious metals declined by half, or by 290 thousand ounces. This is due to the growing demand from the auto industry in Europe and North America, where diesel engines are popular.

In the past year, industrial demand for platinum increased by 51%. Demand from the jewellery sector will grow moderately on par with investment due to high prices.

According to Johnson Matthey, investment demand fell significantly in 2017. However, platinum ETFs increased their reserves by 500,000 ounces to 1.2 million ounces. World consumption of platinum will remain at the level of 6 million ounces, but there are also risks. Especially in South Africa (76% of world production), where companies have to deal with severe geological conditions, strikes and power cuts, as well as with a stable South African currency. All this can lead to higher prices for precious metals.

In the II quarter of 2018, a moderate price correction is expected, after which prices will rise to \$ 1,900 / ounce, and by the end of 2019, \$ 2,000 / ounce will be reached<sup>9</sup>.

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<sup>8</sup> [mineconomikiro.ru/m5/m53/2018-2020/deflators\\_conservative.xlsx](http://mineconomikiro.ru/m5/m53/2018-2020/deflators_conservative.xlsx)

<sup>9</sup> [mineconomikiro.ru/m5/m53/2018-2020/deflators\\_conservative.xlsx](http://mineconomikiro.ru/m5/m53/2018-2020/deflators_conservative.xlsx)

## 5 Conclusion

The international precious metals market is the sphere of economic relations between participants regarding transactions with precious metals and securities, which are listed in gold (gold certificates, bonds, futures, etc.).

The precious metals include gold, silver and four other metals of the platinum group. These metals are distributed unevenly in the world. Most stocks are in countries such as South Africa, Russia, Australia, the USA, Canada, Brazil, and China. These same countries are the most significant producers of precious metals. Most of the mined precious metals fall on large OLS. The extracted gold is sold in international and domestic markets, where it is bought by other market participants (Central and commercial banks, dealers, brokers, and investors). Large world markets are in England, Switzerland, the United States and Japan, where prices for precious metals are formed.

Prices for precious metals are formed, as on other goods, under the influence of supply and demand. Many factors influence the price change (crises, warriors, etc.).

The offer in the international market of precious metals is formed from three sources: extraction, processing of scrap and sale from the state reserves. The extraction of precious metals has long been maintained at a stable level and, as a rule, there has been no drastic change in output. Moreover, the volumes of processed scrap can vary for some reasons. For example, after the global financial crisis, sales of scrap sharply increased due to the high price of precious metals. The sale of precious metals by central banks from state reserves is gradually declining.

The structure of demand in the international market of precious metals depends on the type of metal. For example, the bulk of demand for gold is the demand from jewellery manufacturers, and in the structure of demand for platinoids, the automotive industry is the most.

Operations in the precious metals market can be divided into two groups:

- transactions related to the trade in physical metal;
- Transactions with gold as a financial instrument.

In the structure of the international market of precious metals, the significant part of turnover is occupied by the gold market.

In the structure of gold mining in recent years, there have been significant changes. Current trends are such that the share of the most extensive gold-mining countries in the total

volume of gold mined is declining. The shares of developing countries are increasing. This trend is observed in the silver market and the platinum market. Moreover, the shares of the most significant gold mining companies, on the contrary, are growing. Also, smaller companies are absorbed by larger companies.

After 2002, gold prices began to rise after a prolonged stagnation. During this extended period of stagnation, prices for other goods have increased several folds. Therefore, since 2002, gold, can say, began to catch up with the rest of the goods. Also, investment demand for gold begins to grow, and with the onset of the global financial crisis, this trend has intensified even more. In the first quarter of 2009, for the first time, investment demand for gold exceeded demand from the jewellery industry. At the same time, demand from the jewellery industry, dentistry, and industry fell. It should be noted that after the global financial crisis, the investments in securities for precious metals are growing rapidly.

The silver market follows the money market after the gold market. Silver gradually disappears from the state reserves, and today there are a few reserves in the countries. The investment attractiveness of silver is growing. Just like in the case of gold, mainly because of fear and to reduce risks after the onset of the global financial crisis, also to diversify the investment portfolio. In the structure of silver production, there is no change.

Platinum is considered the most expensive metal and regarding turnover in monetary terms slightly inferior to silver. The automotive industry is the most significant consumer of platinum. Tighter legislation on emissions in developed countries led to an increase in the demand for platinum, which was mainly active between 1999 and 2003. For environmental reasons, automakers have increasingly equipped their cars with diesel particulate filters with a high content of platinum. As a result, the volume of platinum used in the industry has grown significantly. The growth in demand from the automotive industry was offset by an equally sharp drop in demand for platinum in the jewellery sector. The rise in the price of platinum led to a sharp drop in the popularity of jewellery made from this type of precious metal. The tendency to increase the use of platinum is noted in the chemical industry and oil refining, while in the electronics industry and glass production, consumption volumes are gradually declining.

Regarding investment, platinum is the third precious metal after gold and silver. There is a tendency for an increase in investment for the same reasons.

In early 2008 (at the peak of prices), the most significant buyers of platinum were European index funds, and sellers - Japanese. At the same time, profit-taking and massive sales of platinum by European ETFs in the second half of 2008 on the background of a general decline in metal prices led to a sharp drop in prices. This opportunity was used by the Japanese ETF, who bought platinum during the price hopper.

The primary producer of platinum in South Africa. By its scale, the palladium market is significantly inferior to other precious metals. In 2008, the market volume amounted to about \$ 4 billion. Like platinum, the palladium market is focused primarily on the automotive industry, where 47% of the total consumption of this type of metal was used. Total demand for palladium in 2008 was 213 tons.

There is an inverse relationship between the demand for platinum and palladium, which in turn depends on the development of technologies in the production of automotive catalyts. Both metals repeatedly succeeded each other as dominant in the production of this auto component. Moreover, if in the production of cars with gasoline engines in the past, palladium dominated sharply, then in the production of diesel - platinum. In the early 2000s, there was a tendency for more active use of platinum (more precisely, platinum-rhodium alloys) in the production of gasoline vehicles, and therefore the consumption of palladium in the industry fell from 182.9 tons in 1999 to 94.9 tons in 2002. The average price level of palladium fell from \$ 681 / oz in 2000 to \$ 201 / oz in 2003.

To date, the demand for palladium is gradually recovering, which is due to the introduction of new technologies in the production of catalyts. In 2008, 136.2 tons of palladium was used in the industry, including 36.2 tons due to the recycling of spent catalyts. However, the level of prices for it is still low, at only \$ 270 / oz. As a result, if in 2000 palladium was the most expensive type of precious metal, now it occupies an intermediate link between gold and platinum on one side and silver on the other.

In addition to the automotive industry, palladium is used in the chemical and electronics industries, in dentistry, as well as in the jewellery industry. Moreover, as the prices for gold, silver and platinum increased, the popularity of palladium jewellery, whose prices became more attractive, increased noticeably from 2000 to 2005.

Like other types of precious metals, palladium is used for investment purposes. However, the demand for it is more stable and less subject to the influence of the conjuncture in the world financial markets.

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