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## LONG-TERM DETERMINANTS OF THE PRICE OF GOLD

**Summary:** The aim of the paper is to characterize and assess the impact of the most important factors on gold prices in the long term, i.e. world population, investment demand, the volume of mining production, and raw material cycle. They influence both the level of supply and demand in the gold market and, consequently, its prices. To learn the force and direction of impact of these factors on the gold price is of significant importance for strategic investment. After presenting the specificity of gold as a metal and financial asset, a separate analysis of the effect of each of the foregoing factors was conducted. Depending on the character of a factor and available empirical data, the assessment of the influence of these factors on price changes used basic descriptive statistics, graphic representation, and descriptive analysis. Different aspects of impact of the factors on the price were evaluated in the paper. The analysis indicates that an increase in gold prices is highly probable in the long-run.

**Keywords:** gold price, world population, investment demand, the volume of mining production, raw materials cycle.

### Introduction

When deciding to invest in gold it is essential not only to know its price, but also the factors that influence it. Identification of these factors makes it possible to explain changes in gold prices in the past and to make forecasts. This is of great importance for both speculators and investors committing capital in the long term. Gold prices, however, are influenced by a comparatively larger number of factors than in the case of other assets. They cannot be simply reduced to one common denominator, which stems from the very nature of gold and its specificity. It is the only one metal of its kind. Gold is not only the object of investment but also

industrial raw material, and a luxury consumer product (jewelry); it still plays a significant monetary role although the gold monetary system was abandoned (central bank reserves); its price correlates with the price of other assets; it is comparatively rare in nature (as below ground stock) whereas its above ground stock is still moderately sufficient compared with needs. The gold balance (supply and demand) also has its specific characteristics. They manifest themselves in the fact that its stocks may be far higher in relation to production needs than in the case of other raw materials which, despite being lower, require far greater expenses connected with financing raw material stocks. Besides, compared with other segments of the financial markets, e.g. with the bonds market or hedge funds market, the gold market is very small. The unique character of gold as a metal and a financial asset certainly has an impact on its price.

There are short- and long-term determinants of gold price. In the short term these include: the purchasing power of USD, the level of interest rates, seasonality, the official sector, political events, media information and press releases; in the long-term: an increase in the world population, investment demand, the volume of mining production, and the raw materials cycle. The foregoing factors influence the development of supply and demand in the gold market, thereby determining each change in its price. Many researchers point out that there exist certain relationships between considered in this paper long run determinants and gold price: a strong positive correlation between gold and crude oil is observed [Zhang, Wei, 2010], mining costs and expenditures on gold exploration which does not lead to successful discoveries are also mentioned as a cause of probable production level decrease and rising gold price [Müller, Frimmel, 2010], leading gold producers don't have significant impact on world gold prices [Sjaastad, Scacciavillani, 1996], investment demand increase driven by the fear of investors against inflation is an important determinant of gold price rush [Demidova-Menzel, Heidorn, 2007], growing population of China, India and Middle East is the main source of demand for gold jewelry and has an important impact on gold price [Schiemenz, 2011, p. 8].

The aim of the paper is to characterize and estimate the impact of major factors on gold prices in the long term. While short-term factors are important for investors in determining the moments of opening/closing a position, long-term factors are significant for strategic investment. This issue is also important as during the first decade of the 21<sup>st</sup> century an unprecedented period of bull gold market was recorded and is followed, as it seems, by bear market. The original character of research consists in considering long term determinants of gold prices and confronting them with current developments on the gold market, es-

pecially in times of uncertainty on many financial assets markets. Depending on the character of the individual factors and available empirical data, the assessment made use of basic descriptive statistics, graphic representation and descriptive analysis.

## 1. Increase in the world population

An increased demand of the growing world population is undoubtedly a significant long-term determinant of gold prices. It should, consequently, be expected that a considerable number of its members will be willing to purchase jewelry or electronic products, whose manufacture uses gold, or they will be willing to invest in gold bars and coins. However, the growth rate of gold production slowed down: by 2.3% in 1868-1913; by 2.1% 1868-2011; by 2.0% in 1914-2011; by 1.8% in 1946-2011 [Turk, 2012, p. 7]. In 1800-1900, despite increasing production by 1820.0%, the population growth caused *per capita* production to rise only by 1050.0%. In the past century, production increased at a lower pace (by only 574.48%), but continuing fast population growth resulted in a rise in *per capita* production of only 86.96%. Thus, gold production largely failed to keep up with the pace of population growth, whereas in the early 21<sup>st</sup> century, a relatively stable level of *per capita* gold production was recorded (Table 1).

**Table 1.** Production of gold, world population and *per capita* gold production in 1800-2014

| Year   | 1800 | 1850 | 1900 | 1950 | 2000 | 2005 | 2010 | 2011 | 2012 | 2013 | 2014 |
|--|------|------|------|------|------|------|------|------|------|------|------|
| Gold production (in tones)                   | 20   | 88   | 384  | 838  | 2590 | 2561 | 2742 | 2846 | 2875 | 3061 | 3133 |
| Population (in millions)                     | 981  | 1244 | 1634 | 2528 | 6086 | 6456 | 6831 | 6916 | 6992 | 7118 | 7207 |
| <i>Per capita</i> gold production (in grams) | 0.02 | 0.07 | 0.23 | 0.33 | 0.43 | 0.40 | 0.40 | 0.41 | 0.41 | 0.43 | 0.43 |

Source: [Turk, 2012, p. 14; Gold Survey, 2015, p. 8; www 2].

As far as the influence of world population on gold price is concerned, an important thing will be to consider not only its total increase, but also (most importantly) in Asian countries which are characterized, first of all, by the highest population growth and by a special attitude towards gold – attaching considerable importance to this metal (especially in India) which is traditionally higher than in Europe. Therefore, the gold market in those countries is so important for the development of the world market. At the same time, in many developing countries (China, India, Brazil), the living standards of the growing population

are rising, as a consequence there is a growing demand for luxury goods and the possibilities of purchasing them are stronger<sup>1</sup>. In all those countries, except China, a continuous population growth is expected (Table 2).

**Table 2.** Expected population growth (in thousands)

| Country | 2015      | 2025      | 2050      |
|---------|-----------|-----------|-----------|
| India   | 1,230,484 | 1,351,801 | 1,572,055 |
| China   | 1,410,217 | 1,470,787 | 1,462,058 |
| Brazil  | 201,393   | 218,980   | 247,244   |

Source: [www 2].

The growth of the world population and changes in population structures in different countries, from a pure statistical point of view, should be considered in terms of increasing demand for gold and, in the long term, a trend of increasing prices. This is the only way to interpret those dependencies.

## 2. Investment demand

Gold occurs in nature relatively rarely and has an internal value as a metal. At the same time, it is perfectly homogenous, in contrast to other natural resources such as: diamonds, precious stones or Kauri shells, that is why it can be divided or combined in any way. It can be easily transported, it cannot be artificially manufactured and multiplied at will. It is highly optical. It holds a magical attraction, especially as far as jewelry is concerned, as it is treated as investment in Asian countries. Those features of gold make it a well known object of desire. Gold is recommended to investors who do not need the knowledge of the future and believe that even if its price fluctuates for a long or short time, the purchasing power of the metal will return to a constant value, the so-called *golden constant*<sup>2</sup>. There are even such investors who measure the value of gold in ounces, not in Euros or dollars. They are convinced that certain amounts of gold, measured from a specific level, guarantee that they will never become poor. For them, it is an issue of unforeseeable future [Bandulet, 2010, pp. 176-177].

The demand for gold has become significantly higher in the last decade and it seems that the phenomenon will last for a long time. During a financial crisis

<sup>1</sup> In China, for example, where until 1982 any possession of gold was prohibited, there is a deferred demand for jewelry which is especially high as no Chinese woman can expect that she will be able to wear or will inherit her mother's jewelry, which is a rule in many other countries [Schwarze, 2010, p. 211].

<sup>2</sup> More on the golden constant, compare [Jastram, 1977].

many investors, whose number is gradually increasing, lose their confidence in the dollar, euro and other *fiat* currencies<sup>3</sup>. They look for the investments which will ensure safety and maintain value in the long run. They consider gold to be such an investment. Paper money has been in existence for many years, the reserves not secured by gold are an experiment which is not more than 40 years old, while gold has been present in human history for 6000 years and for the most part of the period it was used as a means of exchange and storing value<sup>4</sup>. Essentially, it does not matter whether paper currencies are shown in a bad light or not because uncertain situations in international financial markets will lead to investors' increased interest in gold [Schwarze, 2010, p. 89-90].

The data on the total investment demand for gold are based on estimates because a large part of it is realized in the highly nontransparent OTC market. Hence literature describes difficult-to-identify investment demand, all investment purchases of gold being explicitly regarded as such, except for the activities of central banks [Schwarze, 2010, p. 66]. Because of the long history of gold there are many kinds of investment products present in the gold market. Not all of them, however, satisfy the investment requirement and only in some cases investors are able to fully participate in the upward trend of the gold price. As an object of investment demand only physical gold products (bars, coins) and the demand expressed by investment funds, basing on gold (ETFs and similar products), can be taken into consideration (Table 3).

**Table 3.** Identified investment demand for gold in 2003-2014 (in tons)

| Year | Physical gold |       |       | ETFs and similar products (net) | Total investment demand | Price of gold (annual average in USD/oz) |
|------|---------------|-------|-------|---------------------------------|-------------------------|--|
|      | Bars          | Coins | Total |                                 |                         |  |
| 1    | 2             | 3     | 4     | 5                               | 6                       | 7  |
| 2003 | 177           | 133   | 310   | 39                              | 349                     | 363.32                                   |
| 2004 | 215           | 146   | 361   | 133                             | 494                     | 409.17                                   |
| 2005 | 261           | 155   | 416   | 208                             | 624                     | 444.45                                   |
| 2006 | 236           | 192   | 428   | 260                             | 688                     | 603.77                                   |
| 2007 | 236           | 200   | 436   | 253                             | 689                     | 659.39                                   |
| 2008 | 659           | 257   | 916   | 321                             | 1237                    | 871.96                                   |
| 2009 | 548           | 283   | 831   | 623                             | 1454                    | 972.35                                   |

<sup>3</sup> *Fiat money* – a term defining fiduciary money or money of trust. The term is a combination of Latin and English: *fiat* – Latin “let it be” and English – “money”. It mocks *fiat lux* “Let there be light” from the biblical Genesis 1:3. It then means “Let there be money”! The term *Fiat money* stresses that that kind of money is made of nothing, i.e. it has no real value [www 1].

<sup>4</sup> Money was mentioned in Genesis 44:8 for the first time. “We even brought back to you from the land of Canaan the silver we found inside the mouths of our sacks. So why would we steal silver or gold from your master’s house?” [Morgan, 2007, pp. 17, 63].

| 1       | 2     | 3     | 4     | 5     | 6      | 7       |
|---------|-------|-------|-------|-------|--------|---------|
| 2010    | 934   | 287   | 1221  | 382   | 1603   | 1224.52 |
| 2011    | 1230  | 326   | 1556  | 185   | 1741   | 1571.52 |
| 2012    | 1039  | 304   | 1343  | 279   | 1622   | 1668.98 |
| 2013    | 1394  | 380   | 1774  | -880  | 894    | 1411.23 |
| 2014    | 829   | 251   | 1080  | -160  | 920    | 1266.40 |
| Average | 646.5 | 242.8 | 889.3 | 136.9 | 1026.3 | 955.6   |
| SD      | 415.5 | 74.7  | 486.5 | 355.7 | 464.3  | 446.7   |
| V       | 0.64  | 0.31  | 0.55  | 2.60  | 0.45   | 0.47    |

Source: [Gold Survey, 2013, p. 9; 2014, p. 8; 2015, p. 8].

As shown in Table 3, the total investment demand was increasing in the analyzed period, except for the last two years in which it dramatically fell together with the increase in the price of gold. The major component of investment demand was physical gold. Gold bars accounted for 72.70%, on average, of the structure of the demand, whereas coins comprised 27.30%. The demand for bars was characterized by a considerably higher volatility (64.0%) than that for coins (31.0%). Quite apart from a temporary collapse in demand in some years, the demand followed the increase of prices in the case of both physical gold products.

The reactions of increased demand to price increase prove that in the time of financial crisis and later, investors started to be anxious about the security of their assets in other forms than gold. Soaring prices turned their attention to that metal and were attracting others to the market, which increased the demand and contributed to a further price increase. The relationships reflect the values of demand correlation coefficients and investment product prices.

The correlation coefficients of demand and gold prices of both investment products had positive values and were very high (Table 4). The bars were characterized by a higher correlation coefficient. The positive values of the correlation coefficients prove that the investors' demand reactions to a price change were unusual. The price increase resulted in an increased demand for both physical gold products.

**Table 4.** Correlation coefficients of demand and prices of gold investment products in 2004-2013

| Demand     | Price of gold | R <sup>2</sup> |
|------------|---------------|----------------|
| Coins      | 0.910617      | 0.829223       |
| Bars       | 0.930395      | 0.865635       |
| Total gold | 0.934823      | 0.873894       |

Source: Based on: [Gold Survey, 2014, p. 8].

In conclusion, the collapse of the whole financial system in 2008 which resulted in development of state rescue programs, costing the taxpayers billions and trillions dollars to save many credit institutions from bankruptcy, caused gold to become a far more attractive investment. The investors assumed that the end of the boom on the bull market would not come for a long time, and entering the market with high prices would still bring profits. As a result, incredible prosperity in the market of physical gold (bars and coins) occurred which in Europe and USA was characterized by a level of demand which was previously unknown and by bottlenecks and delays in supply [Schwartz, 2010, p. 69]. The growing investment demand should be treated as a signal for an increase in prices. Only after a sharp rise in prices the demand will be met and it will determine strategic decisions of investors in the gold market.

### **3. Mining production**

Gold is a special precious metal whose stocks, accumulated in different forms by humanity, are estimated to be 160,000 tons. If they were melted, a cube whose sides would be about 18 meters long would be formed [Bocker, 2010, p. 44]. Global supply of gold is determined by four basic sources: mines, *hedging*, the official sector, scrap gold, and recycling. In recent times the source of gold supply is almost exclusively the production of mines which is a major factor deciding about the price<sup>5</sup>. Analyzing the data for the last century, gold production gradually grew: 384 tons (1900), 838 tons (1950), 2590 tons (2000) [Turk, 2012, p. 14]. The temporary production slumps, which occurred at that time, should be considered in the context of two world wars, the Vietnam war, and their effects. Although in the early 2000's a relative stabilization of gold production of about 2,500 tons/year was observed, in the middle of the decade a temporary fall was recorded. The situation was determined by resource depletion, on the one hand, and by lack of investment in the 1990s resulting from low prices of gold. However, a fast increase of gold prices in that decade caused opening of unprofitable mines and a continuous surge of exploration from 2429 tons in 2008 to 3133 tons in 2014 (Table 5).

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<sup>5</sup> In the case of gold the term “a mine” should be understood in the broad sense of the word. There are not only classic mining techniques, such as an open pit and underground mines, but also small tunnels in which the inhabitants of South America and Central Africa search for gold and dig it illegally; there is also a traditional method of gold seekers in Alaska – using a pan to find gold in water.

**Table 5.** World supply of gold, production and supply of gold mines in 2003-2014 (in tons)

| Year                              | 2003  | 2004  | 2005  | 2006  | 2007  | 2008  | 2009  | 2010  | 2011   | 2012  | 2013  | 2014   |
|-----------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|--------|-------|-------|--------|
| <b>Total supply*</b>              | 3953  | 3426  | 4035  | 3560  | 3556  | 3659  | 4140  | 4272  | 4082   | 3969  | 3901  | 3896   |
| <b>Production of mines</b>        | 2631  | 2504  | 2561  | 2496  | 2499  | 2429  | 2612  | 2742  | 2846   | 2875  | 3061  | 3133   |
| <b>Share (in %)</b>               | 66.56 | 73.09 | 63.47 | 70.11 | 70.28 | 66.38 | 63.09 | 64.19 | 69.72  | 72.44 | 78.47 | 80.42  |
| <b>Hedging (de-hedging) net</b>   | (289) | (438) | (92)  | (434) | (432) | (357) | (234) | (106) | 18     | (40)  | (39)  | 103    |
| <b>Supply by mines</b>            | 2342  | 2066  | 2469  | 2062  | 2067  | 2072  | 2378  | 2636  | 2864   | 2835  | 3022  | 3236   |
| <b>Share in production (in %)</b> | 89.02 | 82.51 | 97.46 | 82.61 | 82.71 | 85.30 | 91.04 | 96.13 | 100.63 | 98.61 | 98.73 | 103.29 |

\* Includes production of mines, scrap gold, hedging (de-hedging) by producers, and net purchases (sales) of the official sector.

Source: Based on: [Gold Survey, 2013, p. 8; 2014, p. 8; 2015, p. 8].

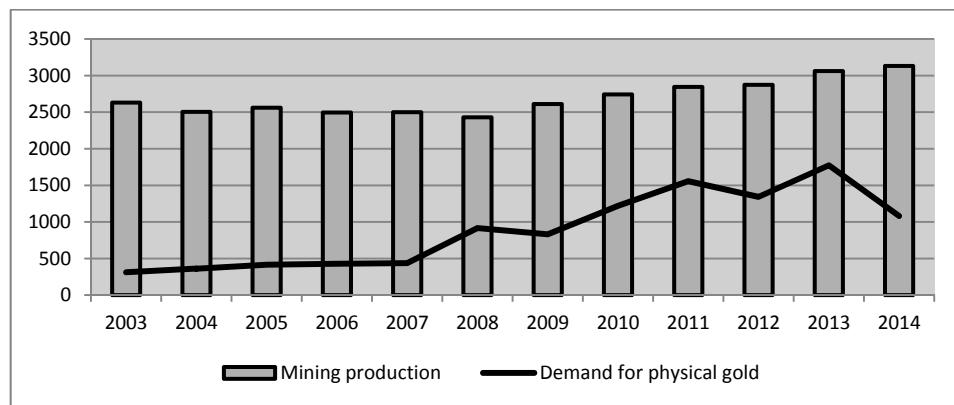
The yearly supply of gold in 2003-2014, according to the foregoing sources, stood at *ca.* 3870 tons. The highest percentage belonged to the production of mines – from 63.09% in 2009 to 80.42% in 2014. Two sources are decisive for the supply of gold mines: production of a mine and net *hedging (de-hedging)*<sup>6</sup>. As a result, total supply by mines does not equal their production as mines are included twice in the balance of gold supply. The consequence of *hedging* is that the supply of mines is higher, whereas in the case of *de-hedging* the supply is lower than actual extraction of gold. The growing prices in the last decade caused most producers to significantly limit or discontinue their protection programs. *Hedging* was also at a disadvantage because of high leasing rates on the gold borrowing market in comparison with the last decade of the 20th century<sup>7</sup>. Net *hedging* was recorded only in 2011 (11 tons) and in 2014 (103 tons), while net *de-hedging* prevailed (figures given in brackets), i.e. gold purchases by mines were higher than sales which were aimed at *hedging*. The level of net *de-hedging* fluctuated from 40 tons (2012) to 438 tons (2004). The supply of the mines, adjusted for *de-hedging*, was most frequently lower than production and oscillated between 82.51% and 98.73%. This means that less gold was offered on the market than a superficial glance at the production stream would suggest.

<sup>6</sup> *Hedging* is aimed at safeguarding production of mines from a drop of gold prices. Many instruments are used, with which they can sell more gold than they produced. The opposite measure is *de-hedging* which consists in purchasing gold in order to fulfill earlier payment obligations.

<sup>7</sup> An increase in leasing rates means *hedging*, hence the gold demand decreases and its price is kept at a higher level. In other words, low leasing rates are a source of all kinds of misfortunes on the gold market [Cross, 2000, p. 123].

The total supply of the mines, in spite of a production growth, was slightly limited by the wave of *de-hedging*. The high level of *de-hedging* is always conducive to a price increase [Gburek, 2003, p. 86].

The argument for a probable rise of gold prices in the long term can be a comparison of trends in the amounts of mining production and investment demand for physical gold products (Fig. 1).



**Fig. 1.** Mining production and investment demand for physical gold products in 2003-2014 (in tons)

Source: Based on [Gold Survey, 2013, p. 8; 2014, p. 8; 2015, p. 8].

Figure 1 shows, except for 2014, a gradually narrowing gap between mining production and a growing demand for physical gold. With a slight rise of gold production, the demand increased more than three times (2012) and almost five times (2013).

Mines also have to meet the industries' demand for gold. It seems, however, that with the present state of the art, the peak values of gold production have been reached. The world gold resources are becoming limited and mining production is carried out in geological conditions which are becoming increasingly difficult (Table 6).

**Table 6.** Excavation depth and share of Greenfield primary gold areas in the world in 1945-2013

| Excavation area   | 1945-1954 | 1955-1964 | 1965-1974 | 1975-1984 | 1985-1994 | 1995-2004 | 2005-2013 |
|-------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| Greenfield        | 20        | 7         | 9         | 13        | 13        | 12        | 19        |
| Brownfield        | 50        | 16        | 33        | 45        | 44        | 101       | 104       |
| Average           | 23        | 9         | 14        | 20        | 19        | 36        | 41        |
| Greenfield (in %) | 90        | 78        | 78        | 78        | 80        | 73        | 74        |

Source: [Schodde, 2014b].

Table 6 shows that between 1945 and 2013 gold deposits, in spite of temporary fluctuation, were explored at ever-increasing depths. The average depth rose by 78.0%. This is especially connected with the deposits located on the areas which were already explored (a rise of 108%). At the same time, a downward trend of the percentage of exploitation in new areas (*Greenfield*) can be observed. It follows that the areas of the planet where gold can still be found are shrinking dramatically.

A measure of success is not only discovering gold but, above all, successful actions leading to commencing mining activities. Not all of the discovered deposits are later extracted. For example, from 1294 *primary deposits* which were discovered after 1975 only 603 (i.e. 47.0%) were further developed. Another important issue is the time which passes from the moment of discovering to exploiting a deposit. Experience shows that many years pass before new deposits are developed to such an extent that they can be explored. At the same time 69.0% of the deposits which were discovered needed as many as 40 years from the discovery to launching the extraction, whereas only 25% of them required 5 years [Schodde, 2014a]. Successful exploration is hardly sufficient to replace current production<sup>8</sup>.

To sum up, exploring gold deposits is becoming less profitable and newly discovered deposits are increasingly less accessible. It should be assumed that in the foreseeable future the world gold production will not grow perceptibly without applying modern technologies in the mining industry. This concerns both tedious exploration, i.e. searching for gold deposits and their optimal use. At present there is no threat of gold oversupply [Bandulet, 2010, p. 234]. Only the discovery of new mines and application of new exploitation technologies could lead to an increased gold supply in the world market and a drop in its price. Stagnation or a production decline with the increasing demand will cause gold to be one of few natural resources whose shortages will be permanent. To even out that imbalance between supply and demand, an increase in gold prices is inevitable in the long term [Schwarze, 2010, p. 210]<sup>9</sup>.

<sup>8</sup> Eg. the *Tarkwa Gold Fields* in Ghana, which gains quite reasonable profits, obtains only 1 gram of gold from a ton of ore. The leading gold mines (*Barrick, Newmont, Anglogold, Gold Fields*) assess the situation positively if current output can be successively replaced by new reserves [Bandulet, 2010, p. 197].

<sup>9</sup> It is worth adding here that the factor conducive to a price increase, which is not mentioned frequently, will be also the process of concentration in the gold mining industry which started at the turn of the 19<sup>th</sup> and 20<sup>th</sup> centuries. The gold supply controlled by a few big producers lessens the risk that small producers will put pressure on a drop in gold prices [Gburek, 2003, p. 85].

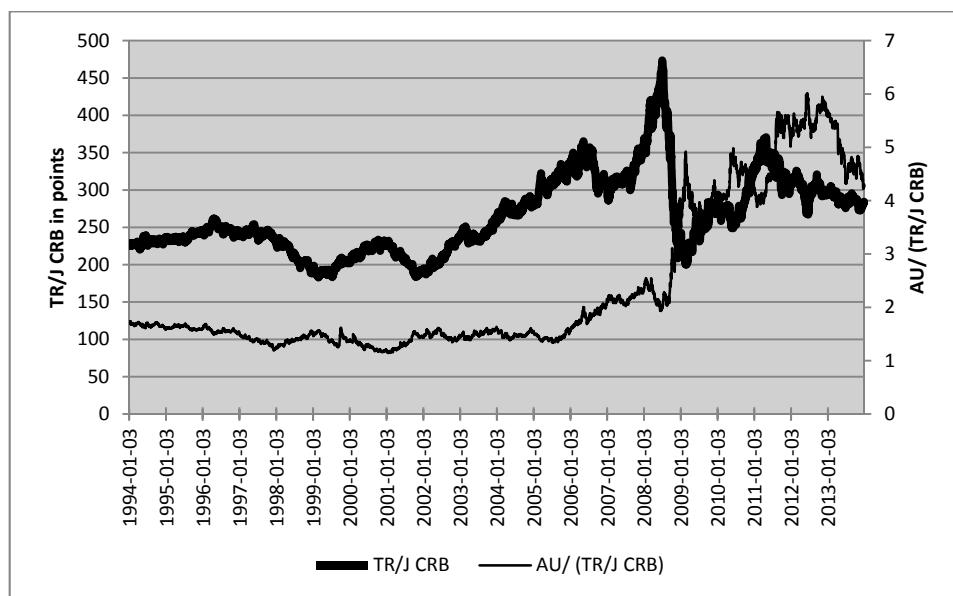
#### 4. Raw materials cycle

Among many known groups of raw materials, only three of them are traded on the stock exchange: agricultural crops, energy-producing raw materials, and industrial minerals which include basically seven metals: aluminum, copper, lead, nickel, tin, zinc, and iron – traded as iron ore. Metals also comprise precious metals, like gold, unless they are a form of investment – for example bars and coins [Nauckhoff, 2011, pp. 52, 173]. A phenomenon which can influence gold prices in the future is the so-called raw materials cycle. According to the theories of a cycle on the raw materials market, there are certain phases characterized by both considerable growth and falls of prices of basic industrial and raw materials, as well as energy fuels. The demand for these raw materials increases together with the rise of industrial production and economic recovery and reaches a peak at the climax of economic activities [Bloch, Dockery and Sapsford, 2006, p. 107]. The increased demand, especially for copper and crude oil, can be treated as an early signal of future economic growth, and the levels of copper prices are the best barometer of economic cycle developments [Hammoudeh, Sari and Ewing, 2009, p. 263]. At the same time, there is a strong positive correlation between changing prices of those materials and changing prices of gold. It results at least from the fact that gold, apart from many other uses, is also used in industry. In contrast to share prices, the periods of boom and decline on the raw materials market, historically, can be observed during a considerably longer time, turning into a supercycle which can last for many decades [Schwarze, 2010, p. 2014].

The first raw materials boom started about a hundred years ago and lasted until 1918 (the end of WW1). The second boom occurred shortly after the burst of the speculative bubble in 1929 and ended with the end of WW2 in 1945. The third speculative period of growth in the goods and raw materials market began in the mid-1960s during the Vietnam War. It finished in 1980 after the Iranian Hostage Crisis was settled. The countries “responsible” for the last price rise were, first of all Germany, but also Japan, which at that time became big industrial nations and needed large amounts of natural resources for the purpose. A similar phenomenon could be noticed earlier, in 1880-1900, when the USA was undergoing industrialization. In 1980-2000 the investors focused on the stock market and then again on raw materials and gold markets. It is highly probable that now we are experiencing the fourth boom in the raw materials cycle which is particularly visible at the end of the stock market boom as all periods of prosperity on the raw materials market start at the end of the boom on the stock market [Bergold and Eller, 2006, p. 21].

The development of raw materials and commodity markets is illustrated by different indexes. The oldest one, published since 1957, was *Commodity Research Bureau Index* (CRB) which after several reviews took the name of *The Thomson Reuters/Jeffries CRB Index* (TR/J CRB). The TR/J CRB Index shows the price changes of the futures basket of 19 raw materials and commodities, divided into four groups. The biggest share in the basket belongs to petroleum products (33%), soft goods (21%), industrial metals (13%), and grains (13%) [Miziołek, 2009, pp. 200-201]. The analysis of changes of that index because of the raw materials and commodities which it represents, can be a good illustration of the course of the cycles in the raw materials market. From the dynamic point of view the relationship between the gold price and raw materials price is illustrated by the gold price index /(TR/J CRB index) (Fig. 2).

As Fig. 2 shows, in 2001 there was a strong surge in prices of basic raw materials, measured by TR/J CRB index. It resulted from enormous demand for resources in developing countries, mainly India and China, and from limited mining activities, obstructed by low prices [Morgan, 2007, p. 28]. A short-term considerable downturn, caused by the economic crisis, occurred in 2008. After a brief recovery of prices, the value of the index fell again in 2011.



**Fig. 2.** TR/J CRB index (in points) and the rate: gold price/(TR/J CRB index) in 1994-2013

Source: Based on: [www 3; www 4].

During the analyzed period there was a high positive relationship between fluctuating prices of raw materials and commodities and changes of gold prices. The correlation coefficient between the return rates from TR/J CRB index and gold was comparatively high and became positive  $\rho = 0.52$ , whereas the coefficient of determination was  $R^2 = 0.2704$ . In dynamic terms the rise of the gold price / TR/J CRB index rate means a faster increase (slower fall) in gold prices than those of basic raw materials, while a drop means a faster increase (slower fall) in gold prices. The gold price (TR/J CRB index) rate was a nearly constant function until 2006. Then the price of gold, despite fluctuations, rose even faster than the prices of basic raw materials. Not until 2012 did the decrease of the gold price (TR/J CRB index) rate occur, which means a certain delay in relation to the index itself. This fact supports, even more, the influence of prices of basic raw materials on gold prices and confirms the cycle theory.

Because of the exceptionally significant shortage of resources, determined by high growth rates in developing countries, a decrease in their prices should not be expected. With the current bull market another supercycle will occur in the resources market and it may last for a number of years [Schwarze, 2010, p. 90]. Thus, under the theory of a raw materials cycle the upward trend of gold prices should prevail in the long term.

## **Conclusions**

In the long term the gold market, and consequently gold prices, is determined by several factors, among which world population, investment demand, mining production, and raw materials cycle are considered the most significant in the literature on the subject. Separate analysis of the impact of mentioned above factors on gold price carried out in this paper showed their significant role in determining this precious metal's value. The growth of world population and changes in its structure in favor of the countries whose inhabitants are interested in purchasing gold, as well as the lack of stability on the financial markets, boost the investment demand. Furthermore, gold is extracted in increasingly difficult conditions with a falling number of new discoveries and a noticeable boom on the raw materials market. The analysis shows that there are significant dependencies between the factors which were discussed in the paper and the price formation. Investors should take them into consideration while taking strategic investment decisions because in that situation an upward long-term trend of gold prices can be expected with a good deal of probability.

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### **DETERMINANTY CENY ZŁOTA W OKRESIE DŁUGIM**

**Streszczenie:** Celem artykułu jest charakterystyka i ocena wpływu najważniejszych czynników na cenę złota w okresie długim, tj. liczby ludności świata, popytu inwestycyjnego, produkcji kopalń oraz cyklu surowcowego. Kształtują one łącznie poziom popytu oraz podaży na rynku złota i w konsekwencji jego cenę. Poznanie wpływu oraz kierunku oddziaływania tych czynników na cenę złota ma istotne znaczenie dla inwestycji strategicznych. Po przedstawieniu specyfiki złota jako metalu i aktywa finansowego przeprowadzono odrębną analizę oddziaływania każdego z wymienionych czynników na cenę. W analizie wykorzystano, w zależności od charakteru danego czynnika i dostępności danych empirycznych, podstawowe statystyki opisowe, wykresy graficzne oraz analizę opisową. Oceniano różne aspekty wpływu tych czynników na cenę. Przeprowadzona analiza wskazuje na duże prawdopodobieństwo wzrostu ceny złota w okresie długim.

**Slowa kluczowe:** cena złota, liczba ludności świata, popyt inwestycyjny, produkcja kopalń, cykl surowcowy.