COMMODITY INVESTMENT MODEL AND ITS SIGNIFICANCE FOR INVESTORS

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Abstract

There are often changes in today's market environment, which force investors and companies to seek new solutions, practices, support new branches, and design new models etc. This article discusses a commodity investment model and its importance for investors. It aims to determine the right price for commodities based on the designed investment model. The main problem with commodities in the investment environment is that it is very difficult to determine intrinsic value, as is required for equities. The result of this paper is a model and its mathematical expression, which determines the right price, including its application to selected commodities. The model will facilitate the decision-making of investors on commodity markets when to buy and when to sell selected commodities. The use of this model in practice can provide investors a competitive advantage on the commodity market.

Keywords: Model, commodities, investor, right price, decision-making

Introduction

Current markets are frequently turbulent, which greatly affects the investment plans of companies and investors. Changes in their decision-making processes and behavior mean new solutions and processes are required, and new branches, new models and their combinations are created. New investment plans should primarily provide a competitive market advantage for both professional as well as non-professional investors, which can be reflected in the generation of profit or elimination of losses.

Nowadays, surplus units as well as some deficit units search for the best value for their free or foreign resources. However, due to globalization the forecast for the future development of the market environment is relatively unstable, which has an effect on the business environment. Changes resulting from current market conditions accompanied by the effects of globalization affect management decisions. Company decision-

making should result in the selection of the investment instruments invested into and models to be used.

The prognosis of price developments on commodity markets for various raw materials is difficult and depends on e.g. mining, climatic influences. The aim of this paper is to determine the right price for investment using the deigned model, which will contribute to better decision-making on investment plans. The main problem that occurs on these markets is that it is very difficult to determine intrinsic value as in the case of stocks and bonds. The result of this paper is a model of investment commodities including its mathematical expression which determines the right price, and its application on selected commodities. The model facilitates investors in deciding on when to buy or sell selected commodities.

Although the new model can yield positive findings, companies still need to decide whether the investment plan should be made according to the proposed model or whether other best practices should be used. These conflicts arise from the legal forms of the companies and the decision-making of senior management. The issues of conflicting situations and defending the priorities of interest groups in corporations are covered by Sejkora, Horčička (2014).

1. Theoretical basis

1.1 Commodities

People see and consume commodities every day; although they are not directly involved in commodity markets they have a significant indirect effect on them. Each consumer has is their favorite food that they consider necessary for everyday consumption e.g. cocoa. Usually they know the price of their favorite food but price levels are significantly influenced by the development of certain goods on commodity markets, which depend on demand and supply.

The daily presence of commodities is confirmed by Rogers (2008), who recommends that investors first understand the functioning of commodity markets and then invest in other instruments such as stocks, bonds, etc. Novice investors should be aware of commodities that stem from their daily work and eating habits. For example, an investor works in an office at a desk made of wood and drinks a cup of coffee with milk every day, so they come into contact with at least three key raw materials traded every day on commodity exchanges all over the world. This is taken up by Tang (2015, p. 121) who highlights the importance of commodities in the provision of catering services in restaurants. "*He states that food prices are rising on average by 2.8% per year, but agricultural commodity prices show signs of volatility due to e.g. climate change, disease, global demand. At the*

same time income from this industry is estimated to reach 683 billion USD in 2014."

Commodity markets offer another opportunity in the form of the commodity stocks of companies whose business activities are mainly related to raw materials. These companies are typically involved in the search for new resources, mining and research of commodities. (Shipman, 2007) Commodity markets also offer sworn stock investors the opportunity to invest in commodities through equities. These can be very risky because many companies are very sensitive to interference from the government and environmental activists, which can manifest itself in the amount of taxation for example.

In addition to stocks and other investment instruments, commodity markets offer further investment opportunities to investors in the form of direct purchase, commodity indices, forwards, futures, options, mutual funds, exchange-traded funds (ETF) or managed futures.

The issue of financial indices including commodities is dealt with by Svoboda (2006), who divides the indices into several regions according to the orientation of the associated commodity exchanges. The indices are divided into several groups according to the composition and focus on the types of commodities that cover these areas - energy, precious metals, industrial metals, agricultural products, livestock and actual commodity indices. One example of a commodity index is the RICI (Rogers International Commodity Index) Metals Index, which consists of ten industrial metals i.e. copper, aluminum, gold, silver, lead, zinc, platinum, nickel, tin and palladium. Four of these metals are most represented in the index, with the largest being gold 19.92%, followed by copper, aluminum and silver, each having the same share of 15.94%, other commodities have less than 10% of the share. (RICI 2015) Jílek (2010) and Loader (2002) support the importance of the commodity derivatives. These represent a replacement of fixed amounts of cash for commodity instruments at an exact date in the future. Trading through commodity derivatives augments an investor's other investment opportunities because it increases the supply of trade in agricultural products, precious metals, industrial metals and energy commodities.

Nesnídal (2007) highlights of the future importance of commodity markets and argues that there is a change in investment behavior, whereby investors that invest in shares today will invest in commodities in the future. This statement once again underlines the importance of worldwide commodity markets.

The importance of raw materials has led in the past and still leads to political and military conflict, which clearly illustrates how commodities such as oil, gold, and silver are key for the economies of several countries. It

is important to realize that every country has a limited amount of raw materials and some are irreplaceable and indispensable for industry, which again adds to the importance of commodity exchanges over others e.g. stock exchanges. This division is pointed out by Fabozzi (2008), who divides commodities into two basic groups - renewable and non-renewable. One of the irreplaceable precious metals to affect humanity from the very beginning is gold. No other metal is so popular, desirable or sought-after. Many authors look at this commodity, which has influenced generations all over the world from different perspectives e.g. from industrial use, through art, to investment, including the branches this precious metal has influenced. The issue of gold is dealt with from several completely different viewpoints by Struž (2005), Bocker (2009), Bernstein (2000), Batterson (2009), and Revenda (2013). Yet it still maintains its dominant role in investment companies either in the form of jewelry or investment ingots etc.

Like any other investment commodity it has its shortcomings compared to investment securities. If an investor decides to create a long-term conservative portfolio, consisting only of investments in physical forms e.g. gold, silver, copper, then they will not generate any additional income in the form of interest, rents or dividends, which can be achieved by investing in equities. In this case an investor can only achieve capital growth.

1.2 Investment models

Investment models should be viewed as tools that are generally applied in the decision-making of professional as well as non-professional investors. Market economies are characterized by market turbulence, which leads to the greater risk and complexity of decision-making, which has a direct effect on shortening the validity of certain investment and financial models. The issue of forecasts is dealt with by Plummer (2014), who focuses on the psychology of investing in the financial markets. Investments, either in the form of financial or real, should be viewed the same way as finances. They contribute to the regulation and control of the economic processes and systems of individual countries.

These attributes were further exacerbated as a result of the global crisis in 2008. This was initiated by the US real estate market, where there was a bursting of the speculative bubble in connection with an abrupt rise in prices and the granting of mortgage loans to individuals who were not able to meet their obligations. The issue of price bubbles in real estate markets is dealt with by Shiller (2008), Hunter (2003). Although this crisis took place quite recently some authors such as Ren (2012), Funke (2013), and Tsai (2011) draw attention once again to the speculative bubble in the Asian real estate market. In some areas of investment e.g. real estate or commodities it is very difficult to determine the correct price. Newly designed or even

already existing models should allude to and prevent negative phenomena occurring on financial markets.

The assumptions on which each model is based are important. If these conditions are not met then the rule cannot be applied. It is also necessary to simplify and apply a model correctly to show the most objective results that lead to the investment decisions. A factor may appear on the market that is not included in the model, whereby its predictive ability decreases or becomes inadequate and then it must be modified to the current conditions developing in the market environment. The issue of financial models is dealt with by e.g. Zmeškal (2013), Shreve (2005), and Rachev (2011). Factor models and their application on the commodity markets are described by West and Wong (2014), who used them for changes not only to real but also nominal prices of selected commodities represented by e.g. lead, gold, corn, and coffee.

2. Methodology

When creating a commodity investment model the correct scientific method needs to be applied. One of the main scientific methods applied in this paper is analysis which was applied to the search of literature relating to investing in commodity markets. Analysis is further supplemented by synthesis which links knowledge from available resources that have paired relationships. This is followed by abstraction, the result of which is a model in the form of a graphic expression including a verbal description. The modeling method was further used to create the commodity investment model shown in Figure 1. During the evaluation of mathematical calculations of the obtained data, the design of the proposed model and the results, the principles of logic and reasoning were used, particularly in the application of methods which are paired to each other e.g. analysis-synthesis.

3. Design and mathematical expression of the commodity investment model

3.1 Design of the investment model

The design of the model relies on technical analysis through graphic representation i.e. bar graphs with a top (upper limit) and base (lower limit). It is also possible to design an investment model based on numerical values without any graphical representation. Firstly, a specific time interval needs to be selected for determining the right price of a commodity, i.e. t_0 to t_1

The process for designing the model and determining the right price is expressed in Figure 1 and consists of the following eight steps:

1. Line p leads from the highest point in the monitored period i.e. the top B around the last known price C – thus line p is determined by points B and C.

2. Create line q passing the lowest point A, which represents the base parallel to the x axis.

3. Point D is then the intersection of lines p and q.

4. Create line r passing point B parallel to the x-axis.

5. Create line s passing point D parallel to the y-axis.

6. Point E is then determined based on the intersection of lines s and r.

7. Create another line t, which is determined by points A and E.

8. Point F is then the intersection of lines t and p, which is the right price for the investor.

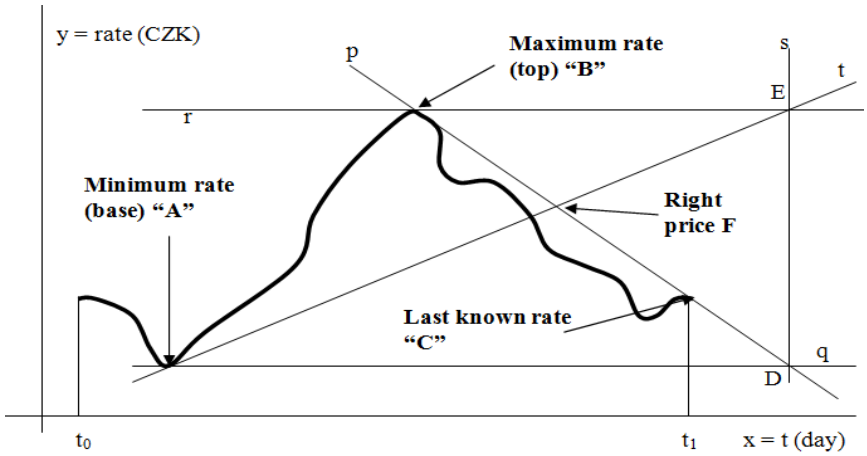

Figure 1: Pocess for designing the model and determining the right price of a commodity
Source: own adaptation based on (Novotny, 2014)

3.2 Matemathitical formulation of the commodity investment model

Mathematical formulation of the commodity investment model consists of the following eight steps that are listed in Section 3.1 which lead to the derivation of a formula for determining the correct price of selected commodities. The resulting formulation of the model is as follows:

$$y = \frac{-c_x\, b^2{}_y + c_y\, b_y\, b_x - a_x\, b_y\, c_y + a_x\, b^2{}_y - b_x\, a^2{}_y + c_x\, a^2{}_y}{2a_y\, c_x - 2a_y\, b_x - 2b_y\, c_x + b_x\, b_y + c_y\, b_x - a_x\, c_y + a_x\, b_y}$$

Identification and explanation of the individual data in the formula:

1. Points A, B, C.

Point A [a_x; a_y] = minimum price of the commodity in the monitored period.

Point B [b_x; b_y] = maximum price of the commodity in the monitored period.

Point C [c_x; c_y] = last known price of the commodity in the monitored period.

2. In the orthogonal coordinate system used in the calculation the coordinate x-axis is aligned with the time period (day), the y-axis is the

selected currency expressed in monetary units, e.g. Czech Crowns, US Dollars, Euros.

3. To simplify the calculation the coordinate system is shifted in the direction of the x-axis to point A and the x-coordinates of the basis points (i.e. A, B, C) are calculated according to the given unit starting from 0.

4. Verification of the investment model for selected commodities

The model is applied to investments on commodity markets. The industrial metal palladium was chosen for the application for a selected time interval of three months from October 27, 2014 to January 27, 2015 in Czech Crowns per ounce. Table 1 shows data for the calculation of the right price, which was obtained for the selected time interval. The lowest rate in Czech Crowns in the period amounted to 16,700.95 per ounce on November 6, 2014, the highest value was 19,668.16 on January 13, 2015, and the last known rate was 19,240.02 on January 27, 2015. (Kurzy, 2015) Figure 2 shows the verification and quantification of the investment model using a practical example.

Table 1 – Data for calculation of the correct price

Points A, B, C	**No. of days /price of comodity**		**Coordinates**
Point A	No. of days	0	x coordinate of point A
	Price in CZK	16,700.95	y coordinate of point A
Point B	No. of days	42	x coordinate of point B
	Price in CZK	19,668.16	y coordinate of point B
Point C	No. of days	52	x coordinate of point C
	Price in CZK	19,240.02	y coordinate of point C

Source: own work

The data in Table 1 is substituted into the following formula:

$$y = \frac{-52 \cdot 19668{,}16^2 + 19240{,}02 \cdot 19668{,}16 \cdot 42 - 0 \cdot 19668{,}16 \cdot 19240{,}02 + 0 \cdot 19668{,}16^2 - 42 \cdot 16700{,}95^2 + 52 \cdot 16700{,}95^2}{2 \cdot 16700{,}95 \cdot 52 - 2 \cdot 16700{,}95 \cdot 42 - 2 \cdot 19668{,}16 \cdot 52 + 42 \cdot 19668{,}16 + 19240{,}02 \cdot 42 - 0 \cdot 19240{,}02 + 0 \cdot 19668{,}16}$$

$$y = 18\,529{,}56 \text{ Kč}$$

The result of the calculation shows that the industrial metal is currently over priced. The investment decision is as follows: an investor who decides to invest in palladium should wait and not buy this commodity until the rate reaches the right price i.e. 18,529.56 CZK/ounce. An investor holding this metal should sell because the price is overvalued for the selected time interval.

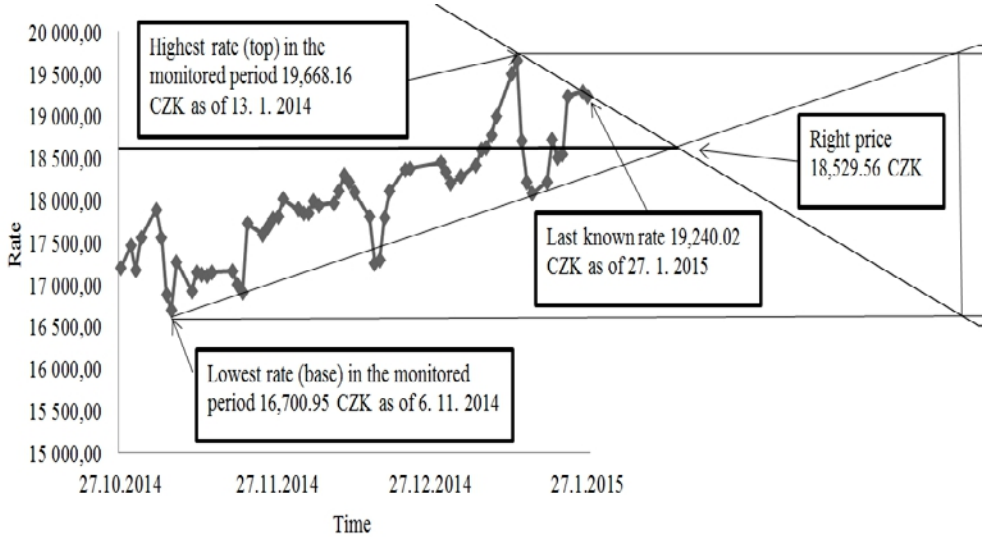

Figure 2: Verification of the investment model
Source: own work

5. Discussion

The presented commodity investment model provides new knowledge that could lead to better decision-making of professional and non-professional investors in their investment plans. However, the model is based on several assumptions and without these conditions it is not possible to design and use the model. One is that the model is based on numerical data or graphical representation. This implies that the investor must know the historical price trend of the commodity or the model cannot be compiled. After a certain period of time the top or base may have new values, then the right price will have a new current value. It may then take several days or months before the selected commodity begins to develop above or below the right price. Prior to application of the model the investor must decide what time interval to select for determining the right price and based on this make investment decisions.

To demonstrate greater objectivity of the results it would be useful to verify the model further in practice. The subject of further examination will be its use and testing not only on commodities but also on currency and equity markets, where it will be compared with the intrinsic value of shares. New time intervals will also be used. Selecting other time intervals and setting new right prices for each selected time interval can create a fluctuation band of right prices, which will help to imporve the process. A fluctuation band in which the right price moves for a long period of time will eliminate extreme price fluctuations and will objectify the actual value of the commodity. The investor can then decide when to buy and when to sell based on the fluctuation of the price within the band. Incorporation of these

modifications will yield better results, which can help investors make better decisions on their investment plans.

Conclusion

In a market economy under the conditions of globalization investors need to use investment models to obtain better results. Only then can they gain a competitive advantage. This advantage can translate into profits and reduce losses, costs, etc. The models should be regularly updated and modified as required by market conditions in order to continuously provide meaningful results. The validity of each model is limited. Professional and non-professional investors must respond to new situations on financial markets, which may affect their investment practices and the models used.

Certain prerequisites need to be met for a commodity investment model to be used in practice. Practical use demonstrates the application and quantification of the model for the selected industrial metal of palladium. As with any investment instrument, the investor has a key moment for when to buy or sell and the presented model facilitates this decision. Furthermore, it should be based on knowledge of investing on commodity markets. Making investment plan decisions for selected commodities based on the quantification of the proposed model can be regarded as an entirely new approach to knowledge-based investment.

The current market environment is extremely volatile and rapidly changing. Nowadays, investors must make decisions and respond quickly to these changes, with the right conclusions and the best possible results. This requires good theoretical and practical knowledge of the appropriate management methods and decision-making models.

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