Financial Markets Interactions between Economic Theory and Practice

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Abstract:

During the last decades many financial analysts, either theorists or practitioners, have dedicated their studies to the interactions between different financial sectors. The results of these researches confirm that commodities, bonds and stock markets are closely related, therefore a thorough analysis of one should includes considerations of the other two. The aim of this article is to demonstrate that, even if from the theoretical point of view financial markets present typical and strong correlations between them, under economic turmoil the correlations change their signs. Both elementary rules of economic theory and examples with real time series are used in the demonstration. The results of our research emphasize that a simple theoretical analysis of financial markets' behaviour through inflation and interest rates cannot define the real interactions of the markets and more robust research approaches are required.

Keywords: financial markets, correlation coefficient, inflation, interest rates, commodities, bonds, stocks, oil price.

JEL Code: E39, E43, E44, G10, G12, G13

1. Introduction

Nowadays, the effects of globalisation process are more and more present in the economic life, and no nation can afford to operate in isolation from the rest of the world. Inflation and interest rate fluctuations travel across national borders around the globe, affecting the worldwide economy.

As Gayed (1990) asserts, the continuation or reversal of a major trend in any market is a function of other trends emerging in other sectors of the economy. From this point of view, at any given time there is always one market more active, that leads the others. The time evolution of financial markets confirm the above theory. For example, in the 1970s the commodities market became very active as speculators sensed accelerating inflation. The demand far exceeded supply and this exercised pressures on prices and inflation. Analysis of the potential impact of inflation on financial markets might have led investors to realize that real assets were going to outperform stocks and bonds. In the early 1980s, the high real interest rates put a dent on inflation, and commodities market subsided. The fixed income sector experienced one of its best advances in history, that, in turn, triggered the raging bull market in equities.

During the last decades more and more financial analysts, either theorists or practitioners, have dedicated their studies to the interactions between different financial sectors. The results of these researches confirm that commodities, bonds and stock markets are closely related, therefore a thorough analysis of one should include consideration of the other two.

The markets interaction means, on the one hand, the relationships between different markets (commodities-stocks-bonds-currency), but also those existing inside of each singular market, at national and international level. Lately, many scholars have analysed the interactions inside each market category in order to observe both the level and the determinative factors of these relationships. We mention here, from among recent studies, researches made by Dalkir (2009) and

Savva (2009) regarding stock markets inner relationship, or Sieczka and Holyst (2009) for the commodities market.

Dalkir (2009) analyses the co-movement in stock market indices during volatile periods and confirms the belief that interdependence between markets are higher during the volatility periods. He emphasizes that this interdependence is due to correlated actions of traders in different markets, thus avoiding correlation to fall to its previous level. Savva (2009), investigating the transmission of price and volatility spillovers across the US and European stock markets, confirms the inner correlation of stock markets and underlines that the magnitude of this correlation is higher not only for negative shocks, but also when a combination of shocks of opposite signs occurs. With regards to the commodities market, Sieczka and Holyst (2009), analysing its inner relationships, show that starting with 2003 this market has become more correlated. Obviously, the above authors and articles represent only a small example among the studies published in this field during the last period.

As mentioned before, financial markets are not influenced only by their own unique fundamental environment, but also by other markets behaviour. Definitely, financial markets are interrelated as they constantly affect each other's performances. "There is a domino-like relationship" and "these intertrend relationships cannot be ignored as they shape final investment decisions" as Michael E.S. Gayed (1990) said. Commodities market, for example, influences interest rate trend, that affects bond market which, in turn, has an impact on stock prices, and all these interactions are based on the fundamental mechanisms of free market economy. In the following sections, empirical examples regarding all these influences are presented.

Some authors, specially the practitioners, consider that the link between commodity market and bond market is the most important in the framework of financial markets interactions. This theory is based on the idea that if a strong link can be established between the commodity sector and the bond sector, than a link can also be established between the commodity market and the stock market because the later is influenced to a large extent by bond prices[1].

The aim of this article is to analyse the interactions between financial markets, respective the relationships developed between commodities and bond markets, bonds and stocks, commodities and stock markets. These interactions can be explained on the basis of elementary rules of economic theory, and examples from the real activity of financial markets are proposed in order to confirm them. Chosen for presented examples are the monthly data of CRB Commodity Index, Dow Jones Industrial Average, US Treasury Bond 8 3/4% with fixed coupon, US inflation rate on the basis of CPI and effective Federal Funds rate for a period of nineteen years (from 1991 to 2009)[2]. The article is structured in 6 sections. Sections 2, 3 and 4 analyse the interactions between financial markets taken two-by-two, respectively commodities and bonds, commodities and stocks, bonds and stocks, while the Section 4 study the complex relationship that exists between crude oil, commodities, bonds and stocks. The Section 6 presents the research results and concludes the paper.

2. Commodities and bonds

The bond market generally attracts investors who are looking for a steady stream of income with reasonable, but low risk. Most of the bonds issue is made by the government and the public sector to finance future budgetary and long-range planning needs. This is the reason why including bonds in an investment portfolio is considered as a method to reduce risk ratio. Nevertheless,

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[1] John J. Murphy (1991), one of the first supporter of inter-market analysis, declares that "the key relationship that binds all four sectors together (stock-bond-commodity-currency) is the link between bonds and commodities".

[2] For these examples were used information regarding exclusively US financial markets, as they are generally considered the more active

always an investment in bonds is exposed to market risk, that arises from changes in interest rates and in foreign exchange rates[3].

Because of the coupon rate, a bond's appeal is highly dependent on the general level of interest rates. During periods of rising inflation and soaring interest rates, the value of fixed-income securities declines, and vice-versa, when inflation is under control and rate are declining. In the last case, bonds rise as the appeal of safety and income entice investors to buy them. These make us conclude that the relationship between the trend of interest rates and bond market is inverse. In order to illustrate this interaction, the historical monthly price values of US Treasury Bond 8 3/4% with fixed coupon, the monthly US inflation rate on the basis of CPI, and the effective Federal Funds rate were considered and are represented in the Figure 1.

Figure 1: Bond, interest rate and inflation relationship
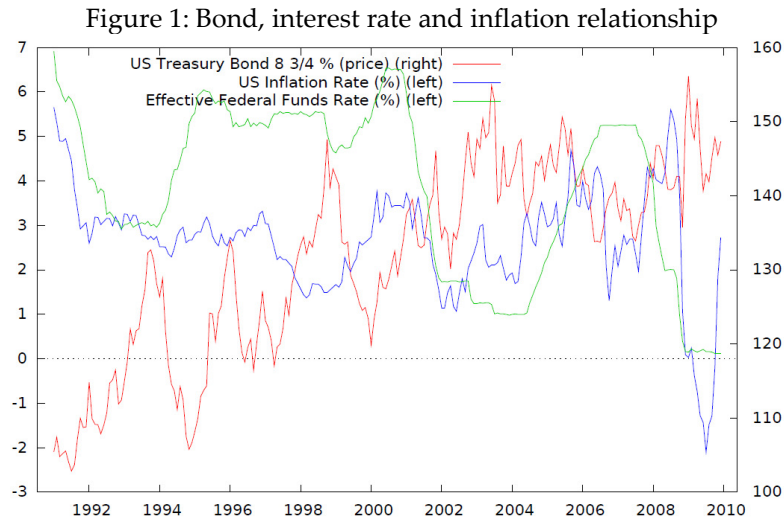
Source: : Thomson Reuters Datastream, Federal Reserve Bank of St Louis

During all the analysed period (from January 1991 to December 2009) the correlations between bond price, interest rate and inflation are strongly negative. In fact, the below correlation matrix shows us that the values of correlation coefficients between bond - interest rate and bond - inflation are corr(USTB, fedfunds) = -0.5584, corr(USTB, Infl) = -0.3269 respectively, with a p-value = 0.0000 under the null hypothesis of no correlation.

Table 1: Correlation coefficients, using the observations 1991:01--2009:12
5% critical value (two-tailed) = 0.1300 for n = 228

US_TB	US_CPI_Infl	US_Interest	
1.0000	-0.3269	-0.5584	US_TB
	1.0000	0.4142	US_CPI_Infl
		1.0000	US_Interest

Source: Correlations calculated on the basis of Thomson Reuters Datastream and Federal Reserve Bank of St Louis times series

There is also a vast literature regarding how bond markets react to monetary and macroeconomic policies and vice-versa, with consequences at both national and international level. Here can be enumerated, among other studies, those made by Barr and Campbell (1997), Andritzky *et al.* (2007), Nimark (2008), Kim and Nguyen (2008), Bredin *et al.* (2010).

So far it was proven the relationship between bonds, interest rate and inflation. However, where is the link with the interactions between bonds and commodities? The key answer is *inflation*.

The importance and influence of commodities price on economy has been analysed frequently during the years. Moosa (1998) addresses the issue of whether or not commodity prices can be

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[3] Dimitris N. Chorafas (2005) – "The management of bond investments and trading of debt", Elsevier Butterworth-Heinemann, Oxford, p. 308.

used as a leading indicator of inflation. The main conclusion of his study is that commodity price can be used as leading indicator of inflation, although some of the characteristics of an "optimal" leading indicator are not met. Awokuse and Yang (2003), re-examining the issue of whether commodity prices provide useful information for formulating monetary policy, found that commodity prices signal the future direction of the economy. Some other authors, such as Pecchenino (1992) or Browne and Cronin (2010), emphasize the relationships that exist between commodity prices and consumer prices. Thus, the literature confirms that the importance of commodities price is due to its role in formulating monetary policy and as leading indicator of inflation.

Considering the above affirmations, here can be said as a general rule that commodity markets and row material prices can give an early indication of prices. Rising demand for industrial and agricultural commodities can reveal a heating economy and mounting inflationary pressures. This rise in commodity prices is the leading indicator of a rise in rates: it is only a matter of time before the monetary policy reacts to the growth of commodities price, which means rising interest rates.

The Figure 2 illustrates the relationship between bonds and commodities from 1991 to 2003, monthly prices.

Figure 2: Bond and commodity relationship
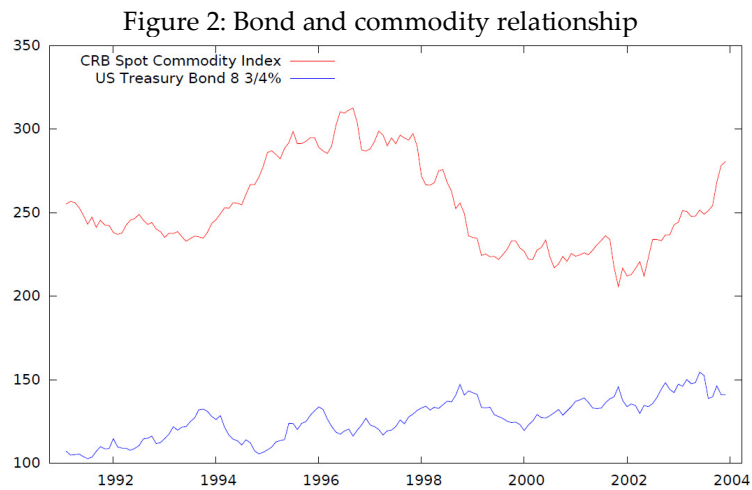
Source: Thomson Reuters Datastream, Federal Reserve Bank of St Louis

As presented at the beginning of this section, there is an inverse relationship between bonds and interest rates, and therefore the rising in interest rates due to the increment of commodity prices causes the decrease of bonds prices. Consequently, there is an inverse relationship between bonds and commodities prices, as can be seen in the Figure 2 and the correlation matrix between CRB Commodity Index and US Treasury Bond 8 3/4% with fixed coupon. Consequently, due to the inverse relationship between bonds and interest rates, a rising in interest rates caused by the increment of commodity prices induces a decrease of bond prices, so there should be an inverse relationship between bonds and commodities.

Table 2: Correlation coefficients, using the observations 1991:02--2003:12
5% critical value (two-tailed) = 0.1577 for n = 155

| CRB_Spot	US_TB	
1.0000	-0.3269	CRB_Spot
	1.0000	US_TB

Source: Correlations calculated on the basis of Thomson Reuters Datastream and Federal Reserve Bank of St Louis times series

3. Commodities and stocks

Commodities often move in the opposite direction to stocks, and theoretically it happens especially in the presence of economic turmoil, when investors prefer to slide from riskier investments like company shares to hard assets like gold or other commodities.

There are not significant scientific studies regarding commodities and stocks interactions[4], but the explanation of this movement of investors between commodities and stocks is quite simple, according to economic theory. As previously said, it is only a matter of time before monetary policy reacts to the growth of commodity prices by rising interest rates. So that interest rates have a positive correlation with commodities prices. But the growth in interest rates induces a decrease in borrowing activity, which implies falls in economic activity. The reduction of demand for products and services has as consequence the decline in both consumption and production, therefore a contraction in business activities that leads to changes in the value of company shares, a decrease of the value in this case. An example is made in order to confirm the above economic mechanism.

Thus, the Figure 3 represents the price evolution for CRB Commodity Index and DowJones Industrial Average during a period from January 1991 to December 2003, monthly data. An obvious negative correlation between the two indices can be seen, with a correlation coefficient equal to $\varrho_{CRB,DJI}$= -0.3633, which confirm the inverse relationship between commodities and stocks during the analysed period. Even so, the analysis of historical correlations between commodity and stock prices does not confirm always this theory.

Figure 3: Commodities and stock relationship
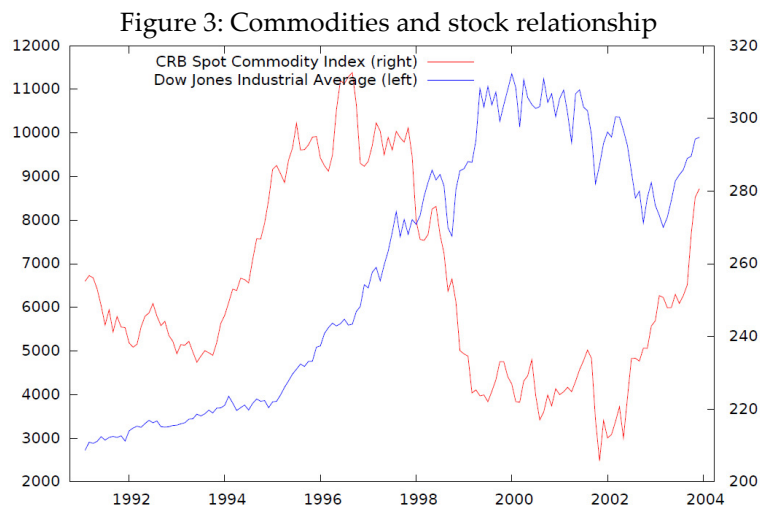
Source: Thomson Reuters Datastream

4. Bonds and stocks

Studies examining the relationship among financial markets have largely focused on the interactions between bonds and stocks. This is explained by the fact that stock-bond correlations are very important for risk management and are related to the optimal allocation of financial assets.

There exists a very vast literature that presents different opinions regarding bond and stock relationship . Lim *et al.* (1998), analysing the relationship between bond markets and stock markets, find that bidirectional causality exists between the two markets. Previously, other scholars investigated the same interrelationship, for both domestic markets (Shiller and Beltrani, 1992) and international markets (Solnik *et al.*, 1996). These papers confirm the relationship between bonds and stocks and suggest that domestic stock prices tend to overreact to domestic bond yields, and the reaction could extend to foreign equity markets, due to the high degree of integration between major equity markets of the world. Maslov and Roehner (2004) consider the question of

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[4] There are not numerous studies regarding commodity markets indices and stocks relationship, but there is a vast literature that analyses the interactions between stocks and singular significant commodity market, such as crude oil, natural gas and other important commodities and raw materials markets.

relationship between stock and bond prices both a natural and important one, and show that there is a strong connection between stocks and bonds during crash-rebound episodes.

The stock market is influenced by many factors, but the direction of inflation and interest rates are considered two of the most important. Because inflation normally occurs during periods of economic expansion, theoretically stock prices tend to rise at the same time that inflation rates increase. Nevertheless, there are often times when the governments need to step in to control inflation during periods of economic expansion via their fiscal and monetary policies. Thus, the result of the inflation rise is a tight monetary policy with negative influences on corporate profits and stock market returns. Therefore, there should be a strong positive relationship between bonds and stocks, due to their common theoretical reaction to inflation and monetary policy.

During the last years, a significant number of researches have analysed the implication of economic fundamentals in the bond-stock relationship. It is important to mention here the affine asset pricing model of D'Addona and Kind (2006) that enables to derive endogenous correlation and to explain how economic fundamentals influence the correlation between stock and bond returns. Other studies consider macroeconomic indicators such as the business cycle, the inflation environment and monetary policy, in order to examine the correlation between stocks and bonds (Connolly *et al.* (2005), Boyd *et al.* (2005), Kim *et al.* (2006), Andersen *et al.* (2007), Connolly *et al.* (2007), Yang *et al.* (2009)). Consequently, an interaction between bonds and stocks exists and this relationship is conditioned by the evolution of macroeconomic indicators. Another important aspect of the stock-bond correlation is what market influences the other one, and some analysts, particularly the practitioners, take bonds as a leading indicator for stocks[5]. The Figure 4 illustrates for example the strong positive correlation between Dow Jones Industrial Average and US Treasury Bond 8 3/4%, monthly prices from 1991 to 2009, with the correlation coefficient $\varrho_{DJI,USTB}$ = 0.7332.

Figure 4: Bonds and stocks relationship
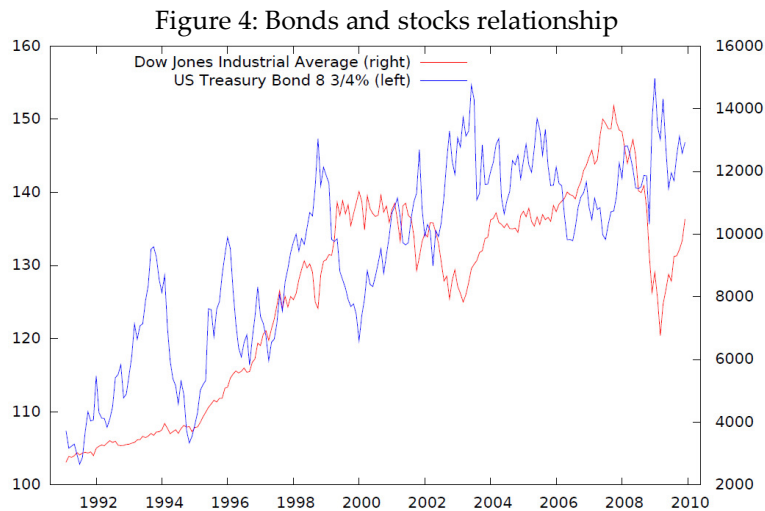
Source: Thomson Reuters Datastream

The correlation matrix between DJI, US Treasury Bond, inflation and interest rates indicates also negative correlation coefficients between stocks, inflation and interest rate.

Table 3: Correlation coefficients, using the observations 1991:02--2009:12
5% critical value (two-tailed) = 0.1303 for n = 227

DJI	US_TB	US_CPI_Infl	US_interest_Rate	
1.0000	0.7332	-0.0389	-0.1592	DJI
	1.0000	-0.3138	-0.5596	US_TB
		1.0000	0.3943	US_CPI_Infl

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[5] John J. Murphy (2009) for example considers that "the bond market usually turns first", and "when the two markets begin to trend in opposite direction the analysts should begin to worry".

	DJI	US_TB	US_CPI_Infl	US_interest_Rate
				1.0000 US_Interest_Rate

Source: Correlations calculated on the basis of Thomson Reuters Datastream and Federal Reserve Bank of St Louis times series

5. Oil, commodities, bonds and stocks

One of the most important commodities, with above-average impact, is crude oil, due to its influence both on other commodities and general economic activity. John Baffes (2007) analyses how oil spills on other commodities and finds that the pass-through of crude oil price changes to the overall non-energy commodity index is 0.16. So, there is a response from other commodities to crude oil price. The rise or fall of oil prices has a broad impact on the cost structure of business in all sectors of the economy because crude oil enters into the process of production of a wide variety of goods and services. Any price fluctuation in the cost of a barrel of oil is quickly reflected in the price of almost all goods and services, therefore crude oil plays a vital role in determining the outlook for inflation. This is the reason why crude oil is one of the most important, among other commodities, to monitor.

The price of this commodity has shaped the monetary policy for the past decades. Rising oil prices are perceived by investors as inflationary and, under such circumstances, the monetary policy reacts. This implies higher interest rates and bond market suffers in an environment of rising inflation and high interest rates. Thus, when crude oil prices rise, bonds fall and vice-versa. This relationship between bonds and crude oil is crucial, because it determines the trend of interest rates, the behaviour of interest rate sensitive sectors of the economy and the equities market overall (Gayde, 1990).

As in the case of bonds, the crude oil, among other commodities, has maybe the most important influence on stocks. The influence channels of oil price dynamic on stock returns can be observed both at macroeconomic and microeconomic levels. At the macro level, for example, one of the channel is the supply shocks determined by the variation of oil price. In this case, the changes of crude oil price result in transfer of wealth from firms in net oil importing countries to firms in net exporting countries Barsky and Ikilian (2004), with opposite consequences at the level of stock markets. At the micro level, the effects may be observed fallowing the behaviour of households and agents who tend to consume less of goods and services that are complementary to crude oil extracts (Hamilton, 2000).

The argument regarding the interactions between crude oil price changes and stock market returns has been widely approached by financial economists during the years. Therefore an affluent literature is available. Here could be mentioned, among other authors, Mork (1989) who has identified significant negative correlations between oil price increase and output growth, or Jones and Kaul (1996), which in particular showed that both current and lagged oil price variables are negatively related to stock returns in US and Canada.

A special attention has to be given to the position of the studied markets in the framework of international oil trade when crude oil - stocks interaction is analysed. Recent studies emphasize the different correlations that exist between oil and stock returns in oil countries and non-oil countries, and they also notice the changes happened in the last years. Akoum *et al.* (2010) for example, conclude that even if, for an extended period of time, the stock returns in oil countries[6] have not shown strong correlation with crude oil prices, this behaviour has changed from 2007 onwards, when growing correlation between the oil prices and the stock markets is noticed.

The different dynamics of the oil price rises and the stock market returns for oil-producing and oil consuming economies are caused by the different reaction of economic activity to oil price changes.

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[6] They considered data from six countries of Gulf Cooperation Council (GCC) as oil countries (Saudi Arabia, Kuwait, United Arab Emirates, Quatar, Bahrain, and Oman), and two non-oil countries (Egypt and Jordan), over the period 2002-2009

In the case of oil-producing countries, higher oil prices mean an increase in liquidity, so a financial system flooded with cash, which allows more lending to households and a growth of demand for stocks. At the same time, there are increments in government spending and corporate profits rise. This economic environment backed by geopolitical certainty induces higher stock returns.

Higher oil prices mean for, oil consuming countries, a rising cost of imported essential goods and raw materials, therefore higher production costs. The prices rise determines inflation, and as consequence a tight monetary policy that induces the decline of real output. The higher production cost along with real output decline cause the corporate profit decline, and further, lower stock market returns. All the interactions presented above are illustrated in the Figure 5.

Figure 5: Dynamics of oil price rises and stock market returns
in oil producing and oil consuming economies
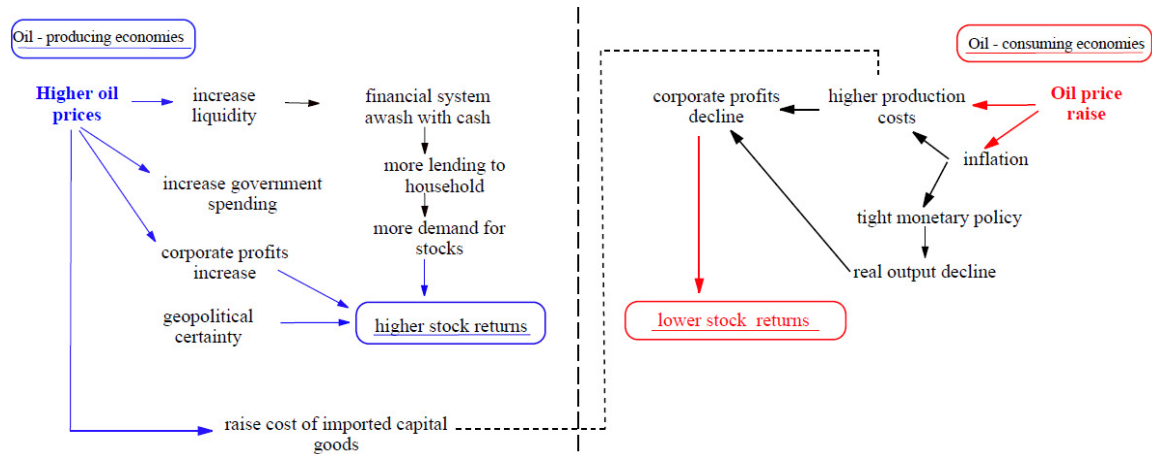
Source: According to Akoum I. *et al.* (2010), *Co-movement of oil and stock prices in the GCC Region: A wavelet analysis, Manuscript.*

Thus, it is not improper to conclude that the price changes of crude oil means changes on overall economy and financial markets. Due to the interactions that exist between financial markets, studies regarding the concurrently influence of oil price on financial market returns could be useful for risk management and optimal allocation of financial assets.

6. Research results and conclusions

In the previous sections it was briefly explained how, through inflation and interest rate, financial markets interact each other, and what sign their correlations should theoretically have. All this analysis is summed up in the Figure 6.

Figure 6: Theoretical interactions between financial markets
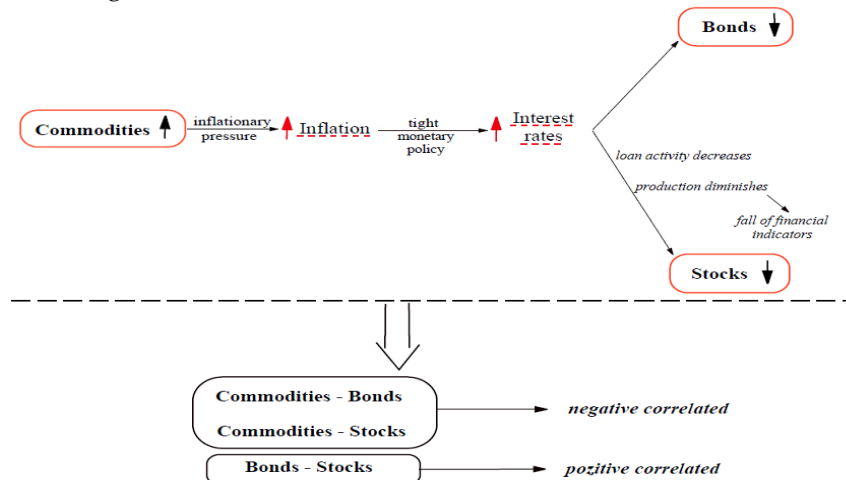
Thus, markets like commodities and bonds, or commodities and stocks should be negative correlated, while bonds and stocks are positive correlated. The empirically observed data of bond,

commodity and stock prices and their interactions do not always confirm this simplest economic logic. The contradiction between empirical data and theoretical interactions happens particularly when there are specific episodes marked by a crash fallowed by a rebound of the economy.

In the case of commodities and bonds, for example, the relationship presented in the Section 2 changes after December 2003. Using data with the same frequency in order to calculate the correlation coefficient between CRB Spot and US Treasury Bond during 2004 - 2009, the result has still a negative value (ϱ_{CRB,US_TB} = -0.2114), but the higher p-value (equal to 0.0742) does not allow to say that there are opposite trends between commodities and bonds. Even more, a correlation matrix CRB Spot - US Treasury Bond for the entire period 1991 - 2009, monthly data, shows a correlation coefficient ϱ_{CRB,US_TB} = 0.3394 accompanied by a p-value = 0.0000, which means a strong positive correlation bonds-commodities (see Table 4).

It has to be mentioned here that the relationship between bonds and interest rate did not change during any above analysed period, remaining always strong negative. Instead, changes regarding commodities - interest rate interaction could be noticed . Thus, if during the first period of time, 1991 - 2003, the correlation was strong positive, for the second period (2004 - 2009) the high p-value (equal to 0.0397) does not confirm the same correlation, even if the coefficient is still positive. During the entire period 1991 - 2009, the sign of correlation coefficient changes completely, reaching -0.1800 with a p-value=0.0065, which reflects a negative correlation commodities - interest rate.

So that, drawing a conclusion, the theoretical opposite interaction between commodities and bonds is not always true and, sometimes, under the real economy influences, commodities and bonds could have strong positive correlation.

The same problem is met in the case of commodities and stocks relationship, that theoretically should have a negative correlation. The time series illustrated in Figure 7.a. reflect a strong negative relationship, which, after December 2003, changes into a strong positive correlation as presented in the Figure 7.b. In fact in the Figure 7.b., where the selected time series are represented for the entire period 1991 - 2009, can be easily noticed that starting the end of 2003 the opposite trends have changed, following the same direction.

Figure 7: Commodities and stocks relationship
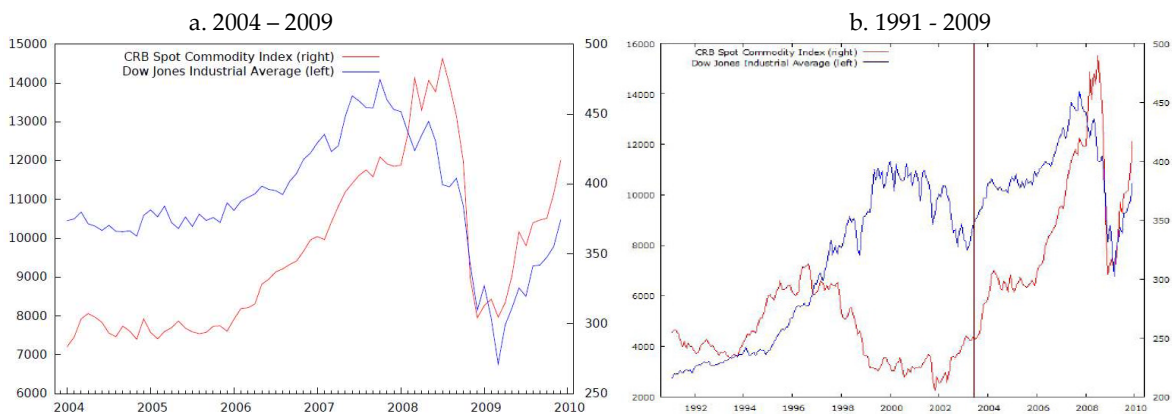
Source: Thomson Reuters Datastream

An even more special case is the relation between stocks and commodities with a major influence on economic activity, as crude oil and natural gas are, for example. In these situations, commodity-stock interaction is depending of the position of economy in the framework of international trade, exporting-economy or consuming-economy, as underlined in the Section 5.

The basic relationships of the markets presented in each part of this article assume an inflationary economic environment. Nevertheless, the real economic environment is not always inflationary, and in this case certain presented relationships will shift. On the other side, there are response lags

between each of the markets' reactions, so not everything happens at once. During these lags many other factors could come into play, so that the markets' movement is not only due to the inflation pressures and interest rate changes. The Table 4 centralizes the theoretical correlations that should exist between financial markets in the case of an inflationary economic environment, and the real correlation coefficients calculated for the time series representing CRB Commodity Index, Dow Jones Industrial Average, US Treasury Bond 8 3/4% with fixed coupon, US inflation rate on the basis of CPI and effective Federal Funds rate from 1991 to 2009, monthly data.

Table 4: Financial markets correlations

	1991 – 2003	2004 – 2009	1991 - 2009	Theoretical correlation
CRB – US_TB	-0.2468	-0.2117	0.3394	negative
	(0.0020)	(0.0742)	(0.0000)	
CRB - DJI	-0.3633	0.5624	0.4306	negative
	(0.0000)	(0.0000)	(0.0000)	
US_TB - DJI	0.7062	-0.5472	0.7332	pozitive
	(0.0000)	(0.0000)	(0.0000)	

Source: Correlations calculated on the basis of Thomson Reuters Datastream and Federal Reserve Bank of St Louis times series

So, it is obvious that a simple theoretical analysis of financial markets behaviour through the inflation and interest rate cannot define the real interactions of the markets. Understanding the nature of linkages between financial markets, whether intra- or international, is fundamental to establishing the limits of diversification, to security pricing and to successful asset allocation. Therefore, depth analysis of financial markets interactions should be made, considering all possible endogenous and exogenous factors that could interfere and using robust research approaches.

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