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RESEARCH ARTICLE

The Anticipatory Quality of the Yields Spread for Economy and Stock Market: An Analysis on the Case of U.S.

Bistriceanu Gabriel*

Economist, Ph.D. in Finance; National Bank of Romania - Bucharest, Monetary Policy Department, 25 Lipscani Street, Sector 3, zip code: 040421.

*Corresponding Author: E-mail: ***Gabriel.Bistriceanu@bnro.ro*** *or* ***gabriel.bistriceanu@gmail.com***

Abstract

The present paper uses the correlation coefficients statistics in order to determine the anticipatory quality of the yields spread for economy and stock market, the analysis being made on the case of United States of America. We determined the periods of time after that the yields spread has the maximum impact on economic growth and stock market development. In addition, we mentioned some utilities of knowing these issues on the anticipatory quality of the yields spread for the central bank, households, companies, credit institutions and equity investors.

Keywords: *Yields spread, Economic growth, Stock market, Anticipation, Correlation coefficient.*

Introduction

The slope of the yields curve is an useful indicator in forecasting the real econonomic activity; at the same time, it can be used as a leading indicator for stock market developments.

The slope of the yields curve represents the difference between the long term interest rate and the short term interest rate; we call this difference the yields spread.

The yields spread has a positive value at the beginning of a phase of economic expansion and negative value at the beginning of a phase of economic contraction. Thus, an inverted yields curve (with negative slope) will be followed in the most cases by economic recession.

For analysis, it can be used the following interest rates: the interest rate on government bonds with a maturity of 10 years (for the long term-available in most countries), the interest rate on government bills with a maturity of 3 months or the interest rate for interbank deposits with a maturity of 3 months (for short term). It can use the annual change of the real GDP growth as a measure for the economic activity and the annual change of a stock market index as a measure for equity prices developments.

Increasing the short-term interest rate is, broadly, a strengthening of the monetary policy conducted with the aim of reducing inflationary pressures. Conversely, the short term interest rate will fall against the background of lower inflationary pressures.

The long term interest rate (for example with a maturity of 10 years) is an expectation of the market regarding the future evolution of the short-term interest rate. The interest rate on long-term government bonds tends to increase in response to strengthening monetary policy; if short-term interest rates recorded growth on a fairly long period and the market expects a reversal of monetary policy cycle then it is possible that long-term interest rate may not rise so much as the short-term interest rate.

Strengthening monetary policy by raising short-term interest rates has the impact of reducing the annual growth rate of the real GDP, equity market indices, the annual inflation rate and flatten (or even reversal) of the yield curve.
At the same time, expectations of future decrease of short-term interest rate corresponding to the relaxation of monetary policy (in response to slowing economic growth and lower inflation) will generate reduction of the interest rates in the long term.

In the economic literature, there is a lot of empirical studies that have concluded that the

slope of the yield curve is a leading indicator for economic activity.

Estrella and Mishkin [1], Bernard and Gerlach [2] concluded on the basis of their analysis that the slope of the yield curve was a good predictor of recessions in the U.S. since 1950, with one exception in 1967. There is also evidence of the correlation between economic activity and interest rates spread in other countries, such as Germany, Canada, United Kingdom.

On the basis of an empirical analysis, Estrella and Hardouvelis [3,4,5,] showed the possibility of using the yield curve as a predictor for real growth in consumption, investment, and Gross National Product.

In their work, Bordo and Haubrich [6] have used a sample of the data with length from 1875 to 1997 on the U.S. case and have concluded that the leading quality of the yields spread for economic activity of this country has varied over time. Baltzer and Kling [7] reached the same conclusion in their analysis on Germany by using empirical statistical data from the period 1870-2003.

In our paper, in order to determine the anticipatory quality of yields spread for economy and stock market in United States of America (U.S.) we used the correlation coefficients statistics.

The Impact of the Yields Spread on Economic Growth in U.S.

To determine the correlation between the yields spread and annual variation of real GDP in U.S. we used the following data series with a quarterly frequency:

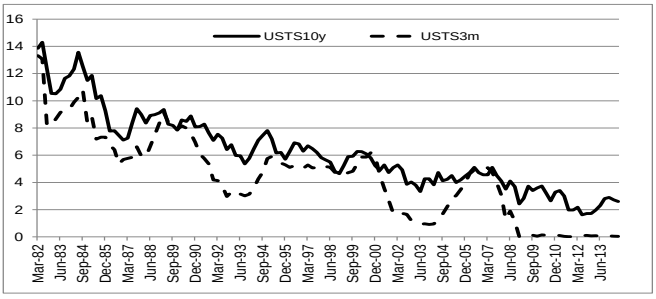
►USTS3m = the interest rate for USD Treasury Securities (U.S. Treasury bills) with a maturity of three months issued by U.S. Treasury;

►USTS10y = the interest rate for USD Treasury Securities (U.S. government bonds) with a maturity of 10 years issued by U.S. Treasury;

►USTSSPREAD = USTS10y - USTS3m, the spread between the long term interest rate and short term interest rate;

►USRGDP = the annual variation of real GDP (economic growth) in U.S..

The data source for our analysis is Federal Reserve Bank of St. Louis Economic Data (the so called **FRED**).



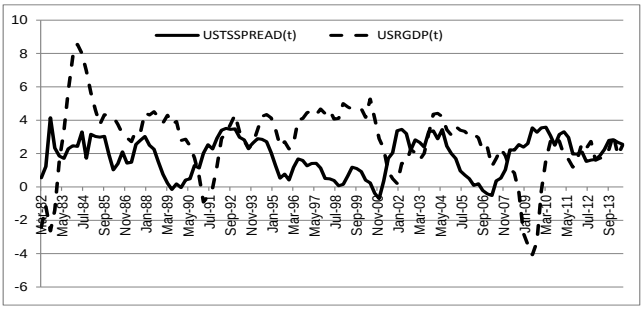


Fig. 1: **Interest rates, their spread and the annual variation of real GDP in U.S. (in %)**
Data source: Federal Reserve Bank of St. Louis Economic Data

The data sample used is from the first quarter of 1982 to the second quarter of 2014.The series of data mentioned above are shown in Figure 1.We can observe in Figure 1 above that on the sample data 1982 until 2014 there were mainly three cases in which the yields spread was negative: (i) the last three quarters of 1989; (ii) the last two quarters of 2000; (iii) the last two quarters of 2006 and the first quarter of 2007. These negative yields spread were followed in the first and third case by negative economic growth. (see below in the paper). The negative yields spread in 2000 was followed by small economic growth (around 0.5 percent).

As well, high positive yields spreads in 1982, 1987, 1992, 1996 and 2004 were followed by high economic growth in U.S. after several quarters.

For the correlation coefficient we used the following formula:

$$C = \frac{\sum (x-\bar{x})(y-\bar{y})}{\sqrt{\sum (x-\bar{x})^2 \sum (y-\bar{y})^2}},$$

where: C = the coefficient of correlation, x and y are the two variables and $\bar{x}$ and $\bar{y}$ are their averages. The range values for the correlation coefficient is [-1,1]. The correlation coefficient is -1

when it is maximum negative relationship between the two variables x and y. Conversely, the correlation coefficient is 1 when it is maximum positive relationship between the two variables x and y.

We used the lags of the yields spread for the calculation of the correlation coefficients given that the yields spread has an impact with delay on the real GDP dynamic. The results are presented in Table 1.

Table 1: Correlation coefficients C (j) between the yields spread and the annual change of the real GDP in U.S.

j quarters	C(j)	j quarters	C(j)
1	-0.07	13	0.15
2	0.04	14	0.11
3	0.12	15	0.08
4	0.17	16	0.07
5	0.22	17	0.04
6	0.26	18	0.00
7	0.30	19	-0.03
8	0.32	20	-0.08
9	**0.34**	21	-0.09
10	0.32	22	-0.09
11	0.27	23	-0.08
12	0.21	24	-0.07

Quarterly data sample (the first quarter of 1982 to the second quarter of 2014) C (**j**) = the coefficient of correlation between the yields spread with a lag of **j** quarters and the annual variation in real GDP real at the moment of time **t**.

From the economic point of view, we are interested for the purpose of analysis to find positive coefficients of correlation between the two variables and as larger as possible. The idea of the correlation coefficients analysis on multiple lags is to find the highest correlation coefficient such that for the previous and posterior lags the correlation coefficients are less than the highest correlation coefficient.

Thus, looking at the results presented in Table 1, we can say that in U.S. the change (increase or decrease) of the yields spread at the present moment of time will generate a maximum increase or decrease of the annual rate of change in real GDP after a period of 9 quarters. (see Fig. 2).

Notations in Figure 2: USTSSPREAD (t-9) = the yields spread with a lag of 9 quarters; USRGDP(t) = the annual change in GDP at the present time **t**.

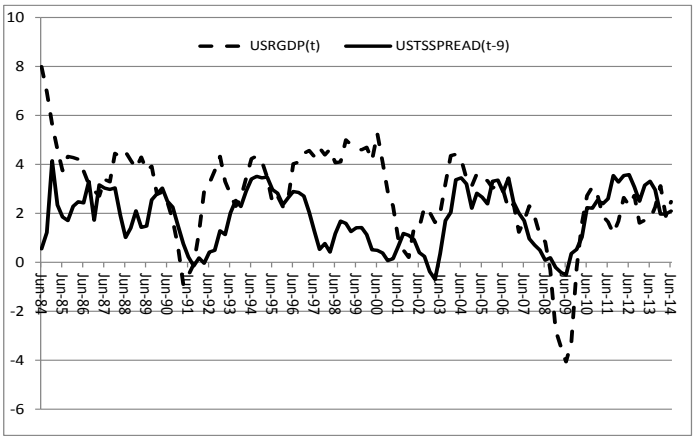


Fig. 2: Interest rates, yields spread and the annual variation of the real GDP in U.S. (in %)

As we can see, in Figure 2, the negative yields spreads in 1989 and 2006-2007 were followed by real GDP negative growths, after around 9 quarters, in 1991 and 2008-2009. As well, high positive yields spreads in 1982, 1987, 1992, 1996 and 2004 were followed by high economic growth in U.S. after around 9 quarters, in 1984, 1989, 1994, 1998 and 2006 respectively.

In the following, we mention some utilities of 9 quarters anticipatory period of the yields spread. Given that the U.S. has the largest economy in the world and there is high probability that the current globalization trend to continue in the future, we can say that the interval of 9 quarters after that the yields spread dynamic will have maximum effect on economic activity can be used for the cases of other developed and even emerging economies.

Knowing the number of 9 quarters lags after which the yields spread has the greatest impact on economic activity is useful for many participants from the economy as it results from the aspects below: (i) when the central bank observes that the yields spread becomes negative, then it will start to cut monetary policy interest rate and, possibly, inject liquidity into the system during the entire period of 9 quarters following the time when the yields spread was negative. After passed those 9 quarters, when the yields spread is again positive and growing from one quarter to another, then the central bank will have to start increase the monetary policy interest rate and stop injecting liquidity into the financial system; (ii) when the households and companies see that the yields spread is negative, then they can reduce or stop the development of risky activities (i.e. financial and real-estate investments, loans from the banks), thus becoming more conservative. Also, after the 9 quarters have passed from the time interval when the yields spread was negative, the households

and companies will begin to embark in the activities of investment projects or to obtain loans from the banks, taking into account that there will be a period of economic boom; (iii) at the moment when the yields spread will become negative, the banks (or credit institutions) will have to become cautious, decrease the indebtedness degree of borrowers and reduce or even stop risky investments in financial markets and real estate. After the 9 quarters have passed from the time interval when the yields spread was negative, there will be good for the banks to restart risky activities because it will start a new period of economic prosperity.

The Impact of the Yields Spread on Stock Market Developments in U.S.

In order to study the quality of the yields spread as an anticipatory indicator for U.S. stock market developments, we proceeded similar to the previous paragraph calculating the correlation coefficient between the yields spread and the annual change in the Dow Jones Industrial Average.

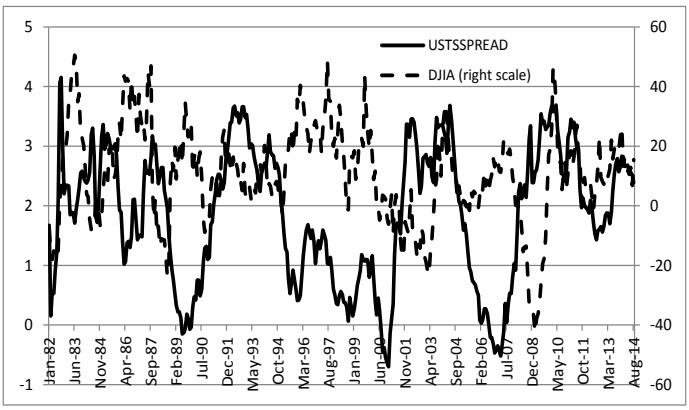


Fig. 3: Yields spread and the annual change in the Dow Jones Industrial Average (in %)
Data source: Federal Reserve Bank of St. Louis Economic Data

We used the following data series with monthly frequency:

►USTSSPREAD = USTS10y - USTS3m;
►DJIA = the annual change in the Dow Jones Industrial Average index.

The data sample used is from January 1982 to August 2014.

Above data series are presented in Figure 3.In Figure 3 above, the negative yields spread during 1989, 2000 and 2006-2007 periods were followed by negative change of the stock market index DJIA. As well, high positive yields spreads in 1982, 1987, 1992, 1996 and 2004 were followed by high stock market prices.

The results for the degree of correlation between yields spread and stock prices index in U.S. are presented in Table 2.

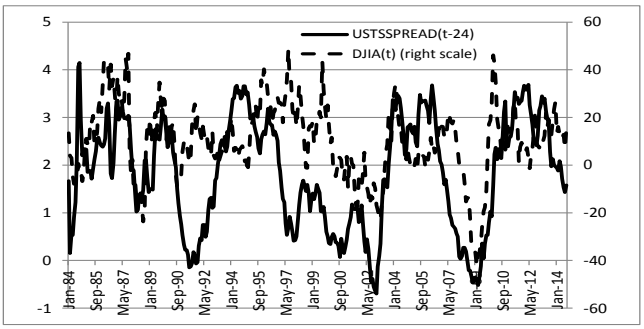
Monthly data sample (January 1982 – August 2014) C (i) = the correlation coefficient between the yields spread with a lag of **i** months and the annual change in the Dow Jones Industrial Average at time **t**.

In Table 2, the highest values of the correlation coefficient between the yields spread and the

Table 2: The correlation coefficients C(i) between the yields spread and the annual change in the Dow Jones Industrial Average

i months	C (i)	i months	C (i)	i months	C (i)	i months	C (i)
1	-0.16	13	0.08	**25**	**0.40**	37	0.23
2	-0.15	14	0.11	26	0.39	38	0.23
3	-0.14	15	0.14	27	0.39	39	0.23
4	-0.13	16	0.18	28	0.38	40	0.23
5	-0.12	17	0.22	29	0.37	41	0.22
6	-0.11	18	0.25	30	0.36	42	0.22
7	-0.09	19	0.29	31	0.34	43	0.22
8	-0.07	20	0.32	32	0.32	44	0.22
9	-0.04	21	0.35	33	0.29	45	0.21
10	-0.01	22	0.37	34	0.26	46	0.21
11	0.02	23	0.39	35	0.23	47	0.20
12	0.05	**24**	**0.40**	36	0.22	48	0.18

stock market index is for i = 24 and i = 25. Under these conditions, it can be said that the U.S. Treasury yields spread has a maximum leading impact on stock prices developments after a period of 24 – 25 months. So, in U.S., the changes in the yields spread (increase or decrease) are transmitted into upward or, as appropriate, downward evolution of stock prices after around 2 years. (see Figure 4)



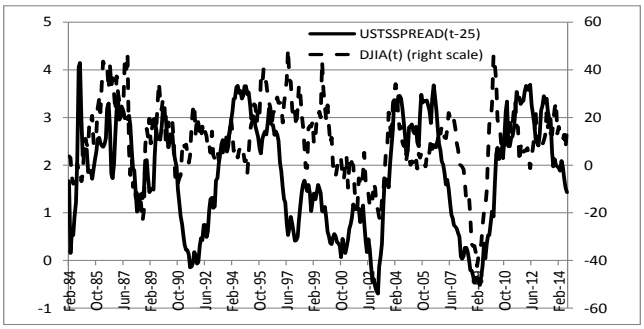


Fig. 4: Yields spread and the annual change in the Dow Jones Industrial Average (in %)

Notations in Figure 4: USTSSPREAD(t-24) = yields spread with a lag of 24 months; USTSSPREAD(t-25) = yields spread with a lag of 25 months; DJIA(t) = annual change in the Dow Jones Industrial Average at the present time **t**.

Against of the background of high effect of globalization in the case of stock markets, the stock index DJIA developments are translating to other equity markets from developed and even emerging economies. So, the interval of 2 years after that the yields spread dynamic will have maximum effect on stock market prices could be used for the cases of those economies too.

Equity investment implications of the fact that yields spread has a maximum leading impact on stock prices developments after a period of around 2 years are the following: (i) when the yields spread becomes negative, then the investors have to start diminishing their exposures on equity market, orientating themselves towards safer investments (such as bank deposits or government bonds); (ii) after the 2 years period has passed from the time interval when the yields spread was negative, the investors will increase their exposure to shares issued by companies - taking into account that there will be a period of equity prices increase.

Conclusions

In this paper, we used the correlation coefficients statistics in order to determine the anticipatory quality of the yields spread for economy and stock market. The paper has two main findings. First, in U.S., the change (increase or decrease) of the yields spread at the present moment of time will generate a maximum increase or decrease of the annual rate of change in real GDP after a period of 9 quarters. The interval of 9 quarters after that the yields spread dynamic will have maximum effect on economic activity can be used for the cases of other developed and even emerging economies given that the U.S. has the largest economy in the world and there is high probability that the current globalization trend to continue in the future. Second, the changes in the yields spread (increase or decrease) are transmitted into upward or, as appropriate, downward evolution of stock prices after around 2 years.

The interval of 2 years after that the yields spread dynamic will have maximum effect on stock market prices could be used for the cases of other equity markets from developed and even emerging economies, especially considering the fact that the effect of globalization on stock markets is high. These two findings are useful for many participants from the economy in their activities: (i) the central bank, for the dynamics of monetary policy interest rate and financial system liquidity; (ii) the households and companies, for the engagement in risky activities (i.e. financial and real-estate investments, loans from the banks); (iii) credit institutions, for loans granting and achievement of more risky activities like investments in financial markets and real estate; (iv) investors, for their exposures on equity market.

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