# Monetary policy and capital market interactions in the USA: a VAR approach

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## Դրամավարկային քաղաքականության և կապիտալի շուկայի փոխազդեցությունները ԱՄՆ-ում. VAR մոտեցում

***Դիանա Տերյան Գ.***
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**Ամփոփագիր.** Դրամավարկային քաղաքականությունն իր հիմնական նպատակներին հասնում է փոխանցումային մեխանիզմի միջոցով՝ ազդելով ֆինանսական շուկայի ցուցանիշների վրա: Իրենց հերթին, ֆինանսական շուկայի տատանումները, ներառյալ կապիտալի շուկան, օգնում են ձևավորել դրամավարկային քաղաքականության ուղղությունները: ԱՄՆ-ում դրամավարկային պայմանների և կապիտալի շուկայի փոխազդեցության առանձնահատկությունները ներկայացնելու համար մշակվել է կառուցվածքային վեկտորային ավտոռեգրեսիոն մոդել: ԱՄՆ կապիտալի շուկան մոդելում ընդգրկվել է՝ օգտագործելով պետական պարտատոմսերի, կորպորատիվ պարտատոմսերի և բաժնետոմսերի շուկայի ցուցանիշները: Մոդելի հիման վրա մշակվել են բազային և այլընտրանքային կանխատեսման սցենարներ՝ արդյունքները իրական փոփոխականների հետ համեմատելու նպատակով: Արդյունքների հիման վրա կարելի է եզրակացնել, որ SVAR մոդելը մեծամասամբ ի վիճակի է եղել ներկայացնել ԱՄՆ կապիտալի շուկայի հիմնական միտումները: Այլընտրանքային սցենարով կանխատեսումները ընդգծել են, որ Դաշնային պահուստային համակարգի՝ ավելի ագրեսիվ տոկոսադրույքի բարձրացմամբ խիստ դրամավարկային քաղաքականությունը կհանգեցներ ավելի տատանողական պետական ու կորպորատիվ պարտատոմսերի և բաժնետոմսերի շուկաների ԱՄՆ-ում:
**Հանգուցաբառեր.** դրամավարկային քաղաքականություն, կապիտալի շուկա, ԱՄՆ, SVAR, կանխատեսում, բազային և այլընտրանքային սցենարներ

## Взаимодействия денежно-кредитной политики и рынков капитала в США: VAR подход

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**Аннотация.** Денежно-кредитная политика достигает своих основных целей через трансмиссионный механизм, влияющий на показатели финансового рынка. В свою очередь, колебания финансовых рынков, включая рынок капитала, помогают формировать направления денежно-кредитной политики. Для представления особенностей взаимодействия денежно-кредитных условий и рынка капитала в США была построена структурная векторная авторегрессионная модель. Рынок капитала США был введен в модель с использованием показателей государственных облигаций, корпоративных облигаций и фондового рынка. На основе модели были разработаны базовый и альтернативный сценарии прогнозирования, чтобы сравнить результаты с фактическими переменными. На основе результатов можно сделать вывод, что модель SVAR в основном была способна уловить основные тенденции рынка капитала США. Прогнозы альтернативного сценария подчеркнули, что более жесткая денежно-кредитная политика Федеральной резервной системы с более агрессивным повышением процентных ставок приведет к более волатильным рынкам государственных, корпоративных облигаций и акций в США.
**Ключевые слова:** денежно-кредитная политика, рынок капитала, США, SVAR, прогноз, базовый и альтернативный сценарии

### Introduction

US capital markets are one of the most developed financial markets in the world. A lot of factors affect capital market fluctuations, including monetary policy conditions. The Federal Reserve System is the central bank of the US and is responsible for monetary policy implementation. Monetary policy tools' changes interact with various

areas of the country's economy, as well as financial markets. Thus, Fed's monetary policy is connected with different segments of capital market in the US.

Therefore, in the frame of this article, our main aim is to design a structural vector autoregressive model that would help represent the interactions between US monetary policy and capital market indicators. The model specification will give an opportunity to make forecasts in order to evaluate model's quality and ability to predict market movements. Based on the model, we will plot different forecasting scenarios to compare the results with the actual values of the observed US capital market variables.

So, the key purpose of this research is to show interrelations between Fed's monetary policy and US capital market using vector autoregressive modelling method. Moreover, forecasts of capital market indicators will be calculated based on baseline and alternative forecasting scenarios.

**Methodology and theoretical basis**

Many researchers studied the relations between central bank's monetary policy and capital market indicators. Most of them used vector autoregressive methodology to assess impact of monetary conditions changes on different financial markets and to plot forecasts.

In general, it can be noted that monetary policy effects are mainly investigated using various types of vector autoregressive modelling methods. Researches prove that there are significant interrelations between monetary policy tools and capital market indicators.

Various econometric models are used by researchers when conducting macroeconomic analyses. In recent years vector autoregressive models are considered one of the most important empirical tools. This methodology and its varieties are mainly used for the purpose of forecasting macroeconomic indicators and policy analysis. In VAR models, the variables are a linear function of their past (lagged) values and the past (lagged) values of the other variables included in the model. In structural vector autoregressive models (SVAR), the interactions of variables are interpreted based on economic theory theses.

In this research we utilized vector autoregressive model technique suggested by Sims **[1**; **2]**. The sample period for our SVAR model was from January 2000 to December 2023. We included six US variables with monthly dataset, which present Federal Reserve System's monetary policy and different sectors of US capital market. Cholesky decomposition identification criteria are often used when constructing structural VAR models. We used it in our model specification as well. We performed stationarity and VAR model stability diagnostics. Along with that, we used lag length identification criteria for better model specification. The research results suggested to base the model on 13 lags.

After model construction, we solved the model to make forecasts for relatively short period of time and to compare with actual data. During forecasting we used both static-stochastic and static-deterministic forecast solutions. Apart from baseline forecasting scenario, we designed alternative forecasting scenario with more aggressive monetary policy. We assumed that the main interest rate was raised faster and at a bigger extent leading to more aggressive contractionary monetary policy.

**Results**

In order to investigate the influence of the Federal Reserve System's monetary policy on US capital market we constructed a standard structural vector autoregressive model. We chose such indicators of monetary policy and capital market that give the idea of monetary policy main direction, capital market's different segments features.

The Fed's main interest rate was considered to be a key indicator of monetary policy in the US. We included it in the model taking monthly values of federal funds rate target range's upper limit. The next variable included in the model was M2 monetary aggregate. It is considered to represent overall money in country's economy. Fed monetary policy has an impact on money supply, that is monetary policy changes affect M2 aggregate values. The variable showing inflation level in the US was also included in the model. Since price stability is one of the main responsibilities of the central bank, consumer price index introduced relevant information to the model. To understand the main characteristics of US capital market and to assess monetary policy impact on it, we segmented it into government bond market, corporate bond market and stock market. Government bond market was represented by US government bond monthly yields with 10-year maturity. The indicator for corporate bond market was chosen to be US public corporate debt index. US stock market is one of the most developed capital markets in the world. To include the information about this market in the model we used monthly movements of one of the most famous US stock indices: S&P 500.

Thus, we designed a structural VAR model based on monthly dataset of six variables describing Fed monetary policy and US capital market segments. The sample period spanned from January 2000 to December 2023. We used Cholesky decomposition ordering according to which the following order of the taken variables was applied: central bank's interest rate (R), M2 aggregate, CPI,

10-year government bond yields (GB10), corporate bond yields index (CB) and S&P 500 changes (S&P500_change).

Before the model estimation Augmented Dickey-Fuller, Kwiatkowski-Phillips-Schmidt-Shin (KPSS) and Phillips-Perron unit root tests were conducted utilizing EViews software. According to the results, Fed interest rate, M2, US consumer price index, government and corporate bond yields were stationary at first difference, which meant that the order of the integration was I(1). And only the monthly changes of S&P 500 index were stationary at level which meant that the order of the integration was I(0).

During vector autoregressive modelling lag length analysis plays a crucial role, as incorrect lag numbers could lead to wrong specification of a VAR model. We used Akaike information criterion, Schwarz information criterion and Hannan-Quinn information criterion, but the results obtained with the help of EViews were not satisfying for monthly dataset of the included variables. In practice lag length for monthly data should be 12. Since serial autocorrelation was registered at lag 12, we estimated our structural VAR model with 13 lags. One of the main steps in model identification is VAR stability diagnostics. It expects all inverse roots of the characteristic AR polynomial to be located inside the unit circle. According to research results, our structural vector autoregressive model was stable.

After model construction, we solved it to be able to make short-term forecasts. Our aim was to compare forecasted indicators with the actual values of the model variables. This would give us an opportunity to assess model forecasting ability. The model forecasts were estimated for the period spanning from January 2022 to December 2023. Based on our model and using EViews software toolset, we forecasted indicators for US government bond, corporate bond and stock markets. In order to evaluate model performance, we selected static-stochastic forecast method, which takes into consideration the uncertainty. Figure 1 represents US 10-year government bond yields' actual and forecasted values.

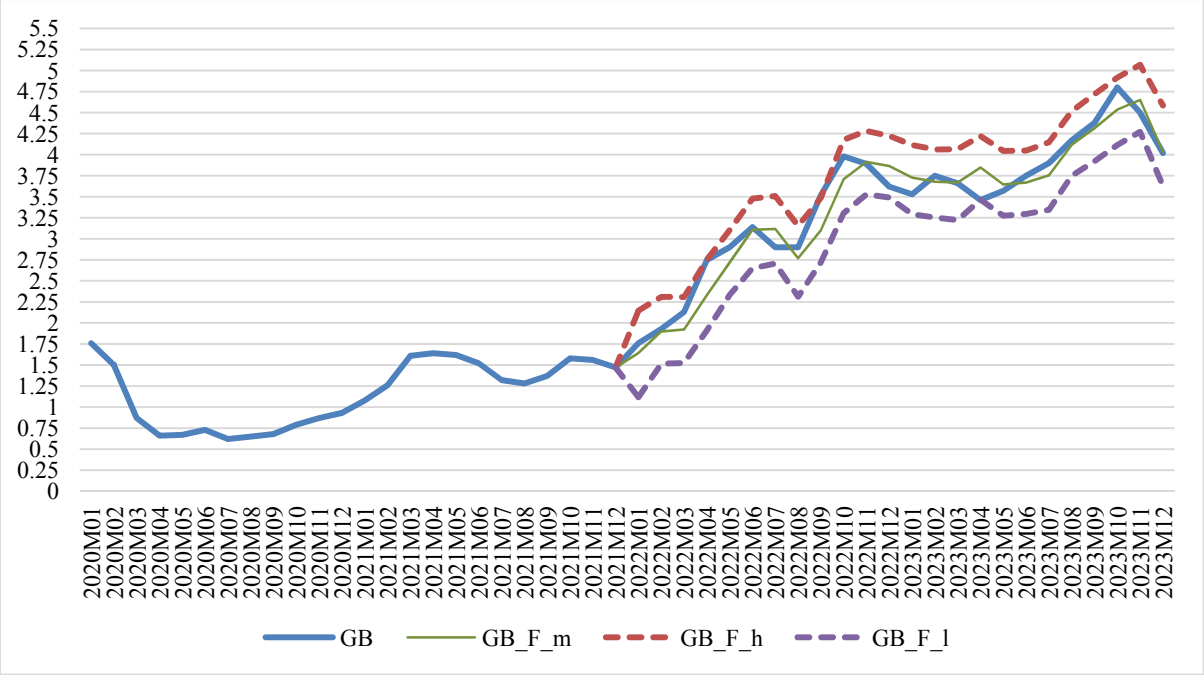


**Figure 1.** *US government bond actual yields and SVAR forecasted values with confidence bounds (%)* [**3**]

Throughout the forecast period, the average values of the forecasted US government bond yields (GB_F_m on Figure 1) were very close to the actual indicators. The predictions that were based on the model, in general, were able to predict the fluctuations of the US government bond market. Actual yields were located between the upper (GB_F_h on Figure 1) and lower (GB_F_l on Figure 1) confidence bounds over the entire projection horizon, although in some cases the actual values were very close to the highest limits of the forecasted range.

Figure 2 shows US corporate bond yields' actual and forecasted values. In case of corporate bond market, the pattern was similar to the forecasted indicators obtained for US government bonds. The forecasted mean values (CB_F_m on Figure 2) deviated little from the actual yields. Throughout the prediction period, US corporate bond actual yields were located in the confidence interval between CB_F_h and CB_F_l. This

suggested the good quality of the forecasts and the good forecasting capacity of our vector autoregressive model.

US stock market forecast results were worse than government and corporate bonds indicators (Figure 3). Over almost the entire projection period, the actual values were located within the confidence interval (between sp500_change_F_h and sp500_change_F_l on Figure 3). In general, the forecasted average (sp500_change_F_m on Figure 3) values were able to predict the main trends and directions of the US stock market movements. Compared to the bond markets, worse forecasting indicators in case of the stock market might indicate that, in addition to the variables included in the model, the stock index was influenced by other macroeconomic indicators: investor expectations, crises, wars, etc.

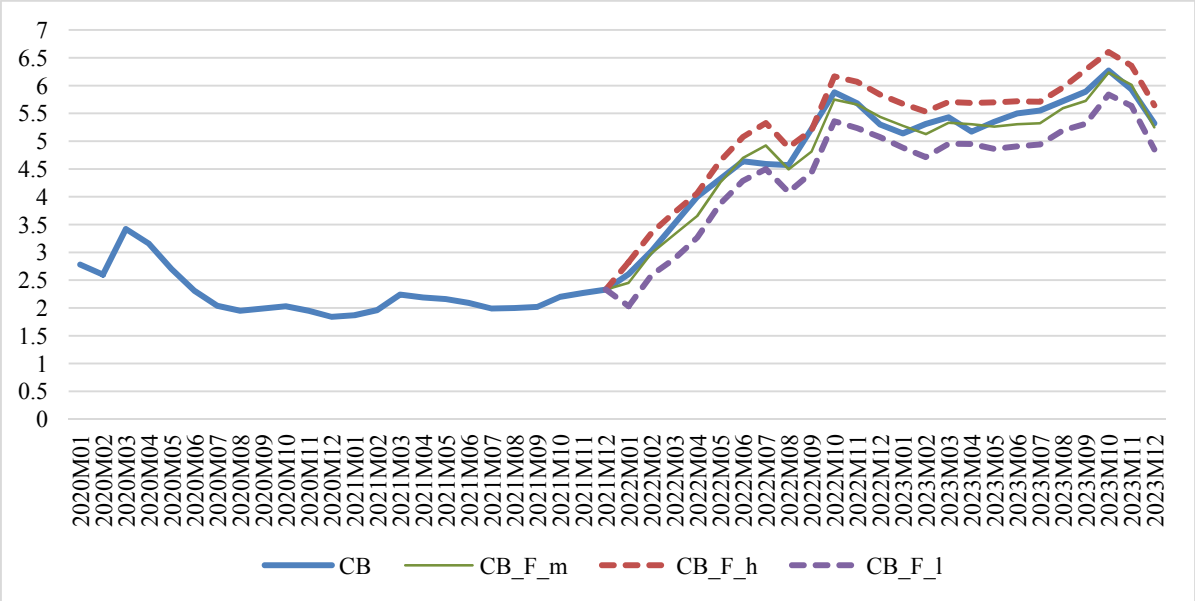


**Figure 2.** *US corporate bond actual yields and SVAR forecasted values with confidence bounds (%)* [**4**]

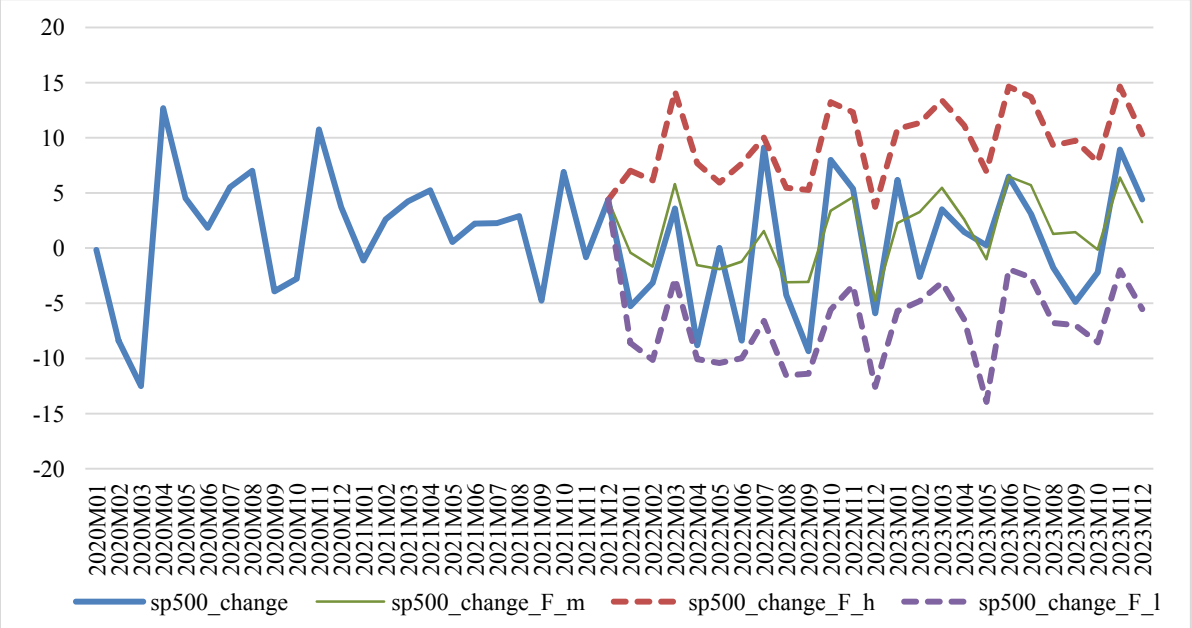


**Figure 3.** *S&P 500 index actual and SVAR forecasted monthly changes with confidence bounds (%)* [**5**]

After making forecasts based on our structural VAR model, we developed a new, alternative forecast scenario to examine the behavior of the US bond and stock markets in case the Federal Reserve System pursued a more aggressive monetary policy. More aggressive forecast scenario assumed that the main interest rate of Fed was raised faster and by a greater amount, namely one percent, over the entire projection period. In this case, we used static-deterministic forecasting approach. The forecast was once again made for the period from January 2022 to December 2023. The main purpose of this

analysis was to study the forecasted values of baseline and alternative scenarios compared to the actual variables of US capital market segments.

US government bond actual yields and forecasted values based on the abovementioned two scenarios are presented in Figure 4.

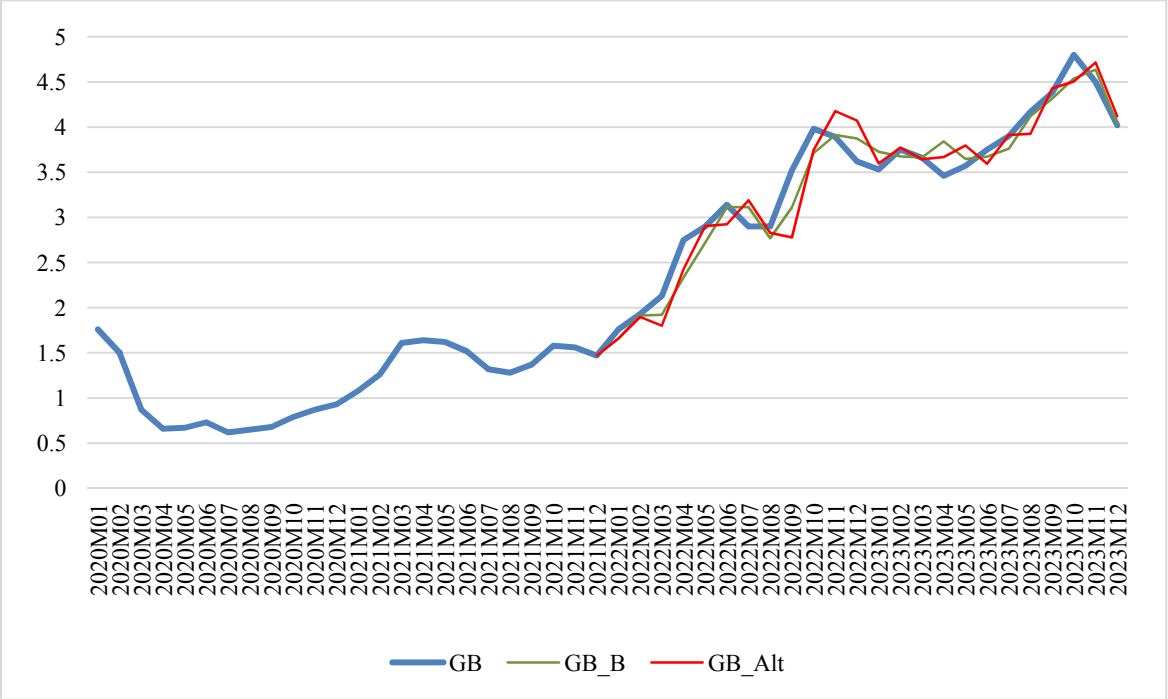


**Figure 4.** *US government bond actual yields, baseline and alternative forecasted values (%)* [**3**]

As a result of a more aggressive increase in the main refinancing rate, alternative forecast values of US government bonds (GB_Alt on Figure 4) showed greater volatility compared to the baseline forecast (GB_B on Figure 4) and actual values. Despite this, both scenarios were able to represent main trends and movements in the market.

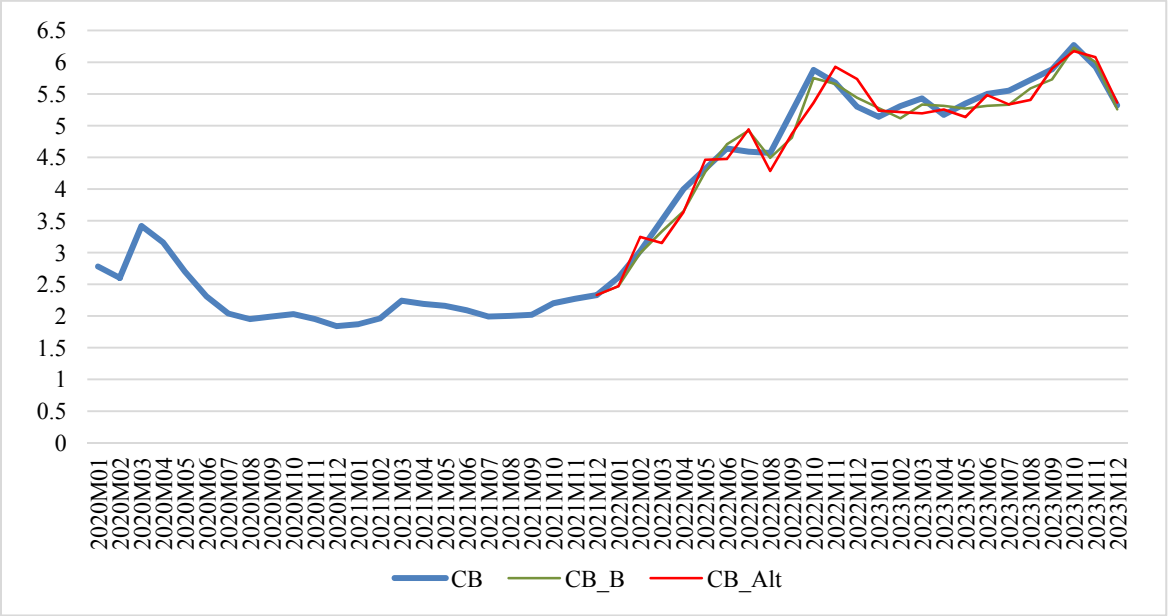


**Figure 5.** *US corporate bond actual yields, baseline and alternative forecasted values (%)* [**4**]

Figure 5 illustrates US corporate bond actual yields, baseline and alternative forecasted values. As in case of the government bond market, in this market also the alternative scenario deviated to a greater extent from the actual values, compared to the baseline scenario. Both the baseline and alternative scenarios were mostly able to predict the main directions of market fluctuations during the considered period.

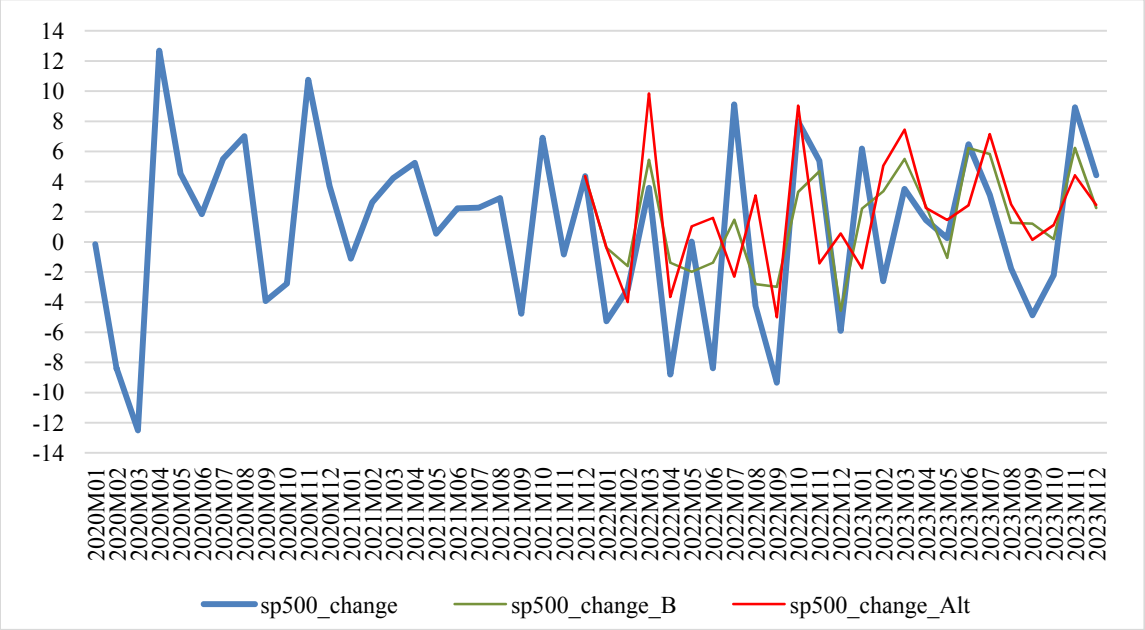


**Figure 6.** *S&P 500 index actual, baseline and alternative forecasted values (%)* [**5**]

US stock market actual, baseline and more aggressive forecasted values are represented in Figure 6.

In case of the alternative scenario, the quality of the forecasted values was noticeably worse than in case of the base scenario. In spite of some exceptions, this scenario was able to predict US stock market leading trends as well. In general, we can conclude that in the conditions of a more aggressive monetary policy, the US stock market would have recorded greater volatility.

**Conclusion**

We constructed a standard structural vector autoregressive model based on monthly time-series of six variables describing monetary conditions, government bond, corporate bond and stock market features in the US. We used Cholesky ordering, and the variables order in the model was the following: the Federal Reserve System's funds rate, M2 monetary aggregate, consumer price index, government bond yields, corporate bond yields and S&P 500 stock index changes. We conducted several tests for model specification and correct identification. The structural model was used to make short-term forecasts of capital market indicators to compare them with the actual values. The forecasted values, based on static-stochastic solution, for the observed markets were mainly within the upper and the lower 95% confidence limits over the projection horizon. Some deviations were registered in case of S&P 500 stock index, which could be due to other factors not included in the model and impacting US stock markets.

Based on our structural VAR model, we plotted an alternative forecasting scenario with more aggressive interest rate hike. This time static-deterministic forecasting solution was used. Alternative scenario gave an idea about US government bond, corporate bond and stock markets behaviour in more contractionary monetary conditions.

Our SVAR model and both baseline and alternative forecasting scenarios' results can be used to investigate monetary policy and capital markets interdependencies in the United States. Based on the constructed model, other various alternative scenarios can be plotted to forecast how different segments of US capital market would react to Fed's monetary policy changes.

In the scope of this research our primary goal was to create a model that would be able to present relations between monetary policy and different parts of capital market in the US. We managed to design a standard structural vector autoregressive model that introduces main features of the observed variables. It allowed us to make short-term forecasts, and the forecasting results suggested that our model generally was able to predict the main trends and movement directions in US government, corporate bond and stock markets. The results of the alternative forecasting scenario suggested that in case of tighter monetary policy the observed segments of the US capital market acted more volatilely, compared to the baseline forecasting scenario and the actual values of the model variables.

**References**

1. **Sims, Ch. A.**, "Macroeconomics and reality". Econometrica: journal of the Econometric Society, 1980, pp. 1-48. https://doi.org/10.2307/1912017

2. **Sims, Ch. A.**, “Interpreting the macroeconomic time series facts: The effects of monetary policy”. European economic review, 36(5), 1992, pp. 975-1000. https://doi.org/10.1016/0014-2921(92)90041-T
3. The actual values are from the Federal Reserve System official website (https://www.federalreserve.gov/releases/h15/). The forecasted values are extracted from EViews software.
4. The actual values are from https://fred.stlouisfed.org/series/BAMLC0A0CMEY. The forecasted values are extracted from EViews software.
5. The actual values are from https://www.investing.com/indices/us-spx-500-historical-data. The forecasted values are extracted from EViews software.

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