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ASSESSING MONETARY POLICY EFFECTS ON CAPITAL MARKETS: EVIDENCE FROM THE EURO AREA

The focus of the paper is the influence the European Central Bank's monetary policy has on the European capital market. The aim of this research is to investigate the relationship between monetary policy indicators and different segments of the capital market in the Euro area, particularly government, corporate bond and stock markets. We have used a standard structural vector autoregressive (SVAR) modelling methodology based on monthly dataset to evaluate the interrelations between observed six European variables. Impulse response functions and variance decomposition analysis have contributed to the model interpretation. Based on our estimations, we can conclude that each of the observed sectors of the European capital market is interrelated with ECB monetary indicators. The interest rate positive impulses' impact on bond and stock markets' volatility evolved mainly within a short period of time. Government, corporate and stock markets, in general, reacted positively to tight monetary policy, although each segment had its own behaviour throughout projection horizon. The outcome of variance decomposition analysis revealed that the fluctuations of the variables could more widely be explained by the shocks directed to themselves.

Keywords: *ECB monetary policy, capital market, SVAR, impulse response analysis, variance decomposition.*

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INTRODUCTION. Monetary policy is one of the main policies in macroeconomics. The European Central Bank (ECB) is the authority responsible for monetary policy development and realization in Eurozone. Euro area monetary policy research is of primary importance for the implementation of the Eurosystem's monetary policy strategy (Mojon & Peersman, 2001). Monetary policy transmission channels are tightly related to capital markets affecting market indicators and aiming to improve the economic situation. The assessment of the relations between government bond, corporate bond and stock markets with the monetary policy would facilitate the understanding of each market response to certain monetary policy path making it more predictable.

The focus of this research is to investigate the impact the monetary policy changes had on capital markets in the Euro area during January 2000 - December 2023 using a particular set of variables. To gain a deeper insight on the interrelations, we have employed a structural vector autoregressive (SVAR) modelling technique, which is widely used for policy analysis. Impulse response and forecast error variance decomposition analyses have contributed to the model interpretation and to a deeper understanding of interdependencies between monetary policy indicators and capital market fluctuations. We have aimed to compare how each observed segment of the capital market reacted to monetary policy changes in the region, also what the sources of volatility of these variables in the frame of our model are. This research and its results, which are based on the specific variables, their order, the date range and the model estimation selected by us, can bring a scientific novelty to the already existing literature.

LITERATURE REVIEW. Monetary policy and its toolkit play crucial role in overall economies and financial markets. Many studies address the possible effects central banks' monetary policy induces on the financial markets. In the scope of this paper, we have examined various authors' works related to the interrelations between monetary policy tools and capital market segments.

Both the European Central Bank's and the Federal Reserve System's monetary policy tightenings raise domestic bond yields, depress domestic equity markets, slow inflation and output growth (Ca' Zorzi et al., 2020). In the Euro area a monetary policy tightening leads to a significant contraction in output, a tightening of financial conditions, a declining asset price level, similarly to the US (Jarociński & Karadi, 2018).

Lütkepohl and Netšunajev (2018) used five-dimensional cointegrated structural VAR model with monthly data to study the relation between monetary policy and the stock market in the Euro area. The main finding was that contractionary monetary policy shocks, induced by an increase in the interest rate, led to a long-lasting downturn of real stock prices. Bohl et al. (2008) found significant negative relation between unexpected ECB interest rate decisions and European stock market performance. Additionally, those decisions appeared to

be well anticipated by the market, implying that the central bank successfully communicated its monetary policy. Cassola and Morana (2002) emphasized that permanent monetary surprises had a strong, yet temporary, impact on the stock market in the Euro area. Their results suggested that stock market fluctuations could hardly be controlled or avoided through monetary policy actions. ECB monetary policy influence on the Spanish stock market returns was studied by Ruiz (2015). Based on the structural vector autoregressive methodology, the author concluded that monetary policy shocks had a considerable impact on the Spanish stock market in the long run. Stoica and Diaconasu (2012) investigated interest rates and stock prices co-movement in the EU markets. They documented both short-term and long-term interdependence between stock index and interest rate. The latter is considered a monetary policy impact indicator and an instrument of central bank's intervention. The analyses of ECB monetary policy effects on the Euro area interest rates concluded that monetary policy changes had a significant and sizeable impact on medium to long-term interest rates, and the pass-through from the ECB rate to interest rates was effective, which is consistent with the literature and similar to the US situation (Brand et al., 2006 and Creel et al., 2015).

In recent years, a growing number of studies have been dedicated to unconventional monetary policy effects. The shocks of unconventional tools have a significant positive impact on economic activity, stem financial market stress episodes and increase economic sentiment (Evgenidis & Papadamou, 2021). Though the ECB unconventional policies mostly affected financial markets in the Euro area, they also had spillovers to global markets by increasing equity prices (Fratzscher et al., 2014).

RESEARCH METHODOLOGY. In order to identify the effects monetary policy of the ECB might have on European capital markets, we have applied structural VAR modelling technique, which was suggested by Sims (1980, 1992). A standard structural vector autoregressive model, we have used in the scope of this research, can be generally represented as:

$$AX_t = \beta_0 + \beta_1 X_{t-1} + u_t \quad (1)$$

X_t is the matrix of variables. Matrix A reflects the contemporaneous relations between variables. β_0 is the vector of constants, β_1 is the vector of coefficients. X_{t-1} represents a matrix of the endogenous variables lagged for one period. u_t is the vector containing structural shocks, which are the components of the endogenous variables not explained by the system. Vector X_t depends on its lag and u_t structural shocks.

We have imposed restrictions to the structural VAR using Cholesky decomposition identification criteria. In the Cholesky ordering, the order of the variables plays a crucial role. The first-ordered variable does not respond to

other variables' changes included in the model contemporaneously. Consequently, the last variable bears contemporaneous and lagged effects of all endogenous variables in the model.

We have designed a standard structural vector autoregressive model (SVAR) with monthly time-series of six variables introducing both the ECB monetary policy and the European capital markets. The sample period is from January 2000 to December 2023.

Furthermore, in order to assess the relations between the ECB monetary policy indicators and different segments of the capital market in the Euro area, impulse response functions and forecast error variance decomposition analyses have been conducted. The approach to impulse responses gives an opportunity to estimate the reaction of the model's endogenous variables to structural shocks. Variance decomposition sheds light on how much of the endogenous variables' volatility can be explained by the exogenous shocks.

RESULTS. The European Central Bank is responsible for monetary policy design and implementation in the Euro area. Its primary goal is to maintain price stability in the European Union countries that use the euro as a national currency. ECB monetary policy interrelates with European financial markets, simultaneously having spillover effects on international financial indicators.

The instrument of ECB primary monetary policy is the set of policy rates: the interest rate on the main refinancing operations, the rate on the deposit facility and the rate on the marginal lending facility[1]. Through the transmission mechanism, changes in monetary policy official interest rates affect banks and money-market interest rates, asset prices, savings, expectations, investment decisions, aggregate demand, etc.[2].

ECB's interest rate on the main refinancing operations has been considered a key monetary policy indicator to represent changes in policy directions in the framework of this research. Studies that are supposed to investigate relationships between monetary policy and other economic indicators mostly use key interest rate as a policy parameter. Similarly, the rates of Federal Reserve Fund can be considered as Fed policy indicator (Bernanke & Blinder, 1992). The data for the ECB interest rate can be found in Figure 1.

[1] Source: European central bank, Monetary policy decisions, https://www.ecb.europa.eu/mopo/decisions/html/index.en.html

[2] Source: European central bank, Transmission mechanism of monetary policy, https://www.ecb.europa.eu/mopo/intro/transmission/html/index.en.html

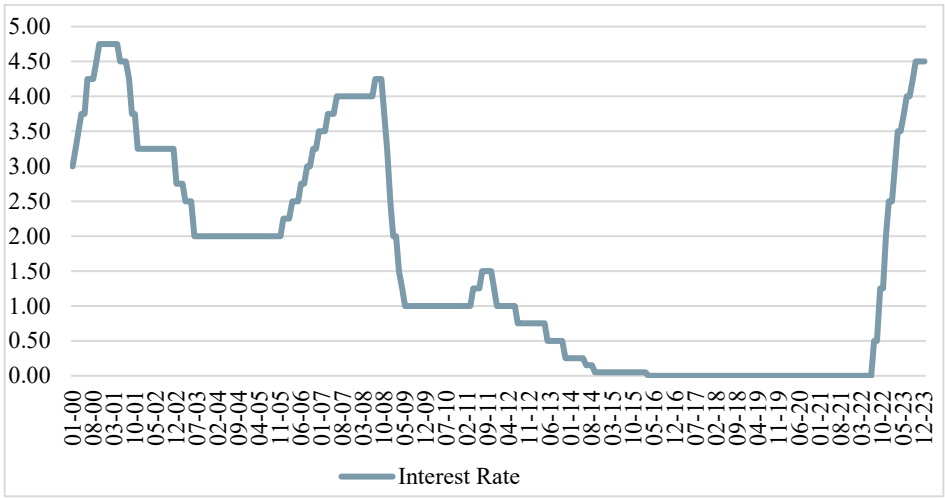

Figure 1. ***The ECB main refinancing operations interest rate 2000-2023 (%)***[3]

Capital markets have been segmented into government bond, corporate bond, and stock markets. Monetary policy relates to the overall capital markets affecting each of the segments separately, thus indicators representing them have been included in the research.

Government bond markets' dynamics is shown through Euro area 10-year Government Benchmark bond yield provided by the ECB (Figure 2). The performance of Euro denominated corporate debt publicly issued in European markets has been regarded as corporate bond market indicator (Figure 3).

Figure 2. ***Euro area 10-year Government Benchmark bond yield 2000-2023 (%)***[4]

[3] The data are from European Central Bank, Key ECB interest rates, https://www.ecb.europa.eu/stats/policy_and_exchange_rates/key_ecb_interest_rates/html/index.en.html

[4] The data are from the European Central Bank, ECB Data Portal, https://data.ecb.europa.eu/data/datasets/FM/FM.M.U2.EUR.4F.BB.U2_10Y.YLD

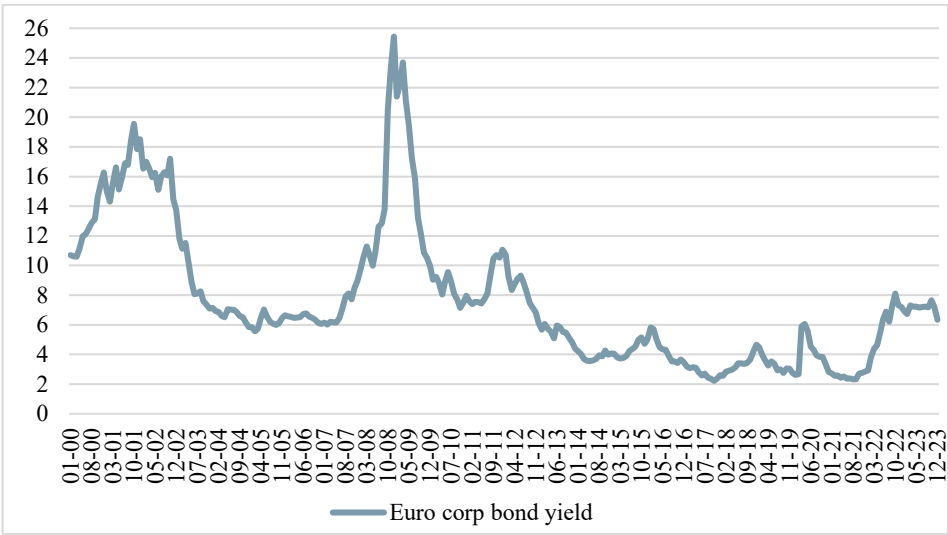

Figure 3. ***Euro denominated corporate yield 2000-2023 (%)***[5]

Finally, European stock market movement has been represented by EuroStoxx 50 index, whose monthly changes have been considered as stock market returns indicator Figure 4).

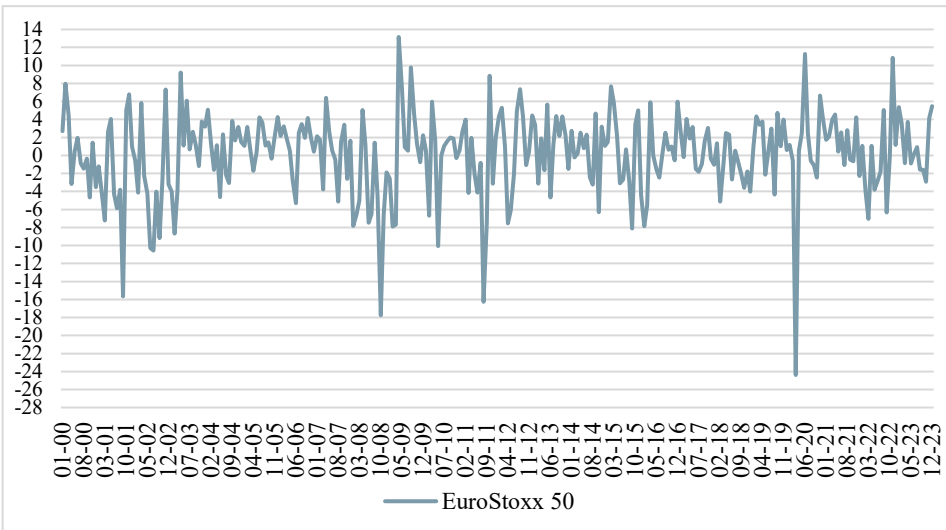

Figure 4. ***EuroStoxx 50 stock index historical changes 2000-2023 (%)***[6]

Additionally, M2 monetary aggregate and EU Harmonised Index of Consumer Prices (HICP) have been included in our model to reduce the possibility of overlooking the information that might interact with monetary policy decision-making process and capital markets' fluctuations. More details on M2 and HICP dataset can be found in Figure 5 and Figure 6 correspondingly.

[5] The data are from FRED, ICE BofA Euro High Yield Index Effective Yield, https://fred.stlouisfed.org/series/BAMLHE00EHYIEY#0

[6] The data are from the European Central Bank, ECB Data Portal, https://data.ecb.europa.eu/data/datasets/FM/FM.M.U2.EUR.DS.EI.DJES50I.HSTA

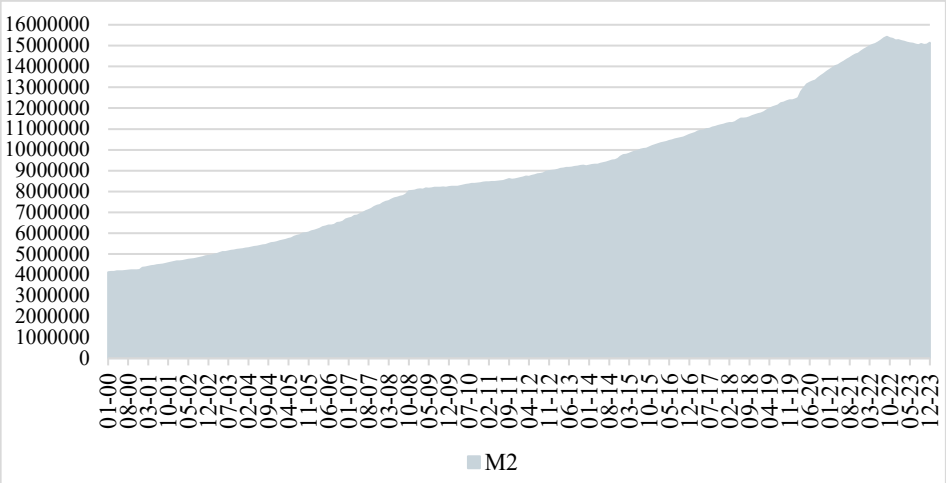

Figure 5. ***M2 monetary aggregate 2000-2023 (millions of Euro, seasonally adjusted)***[7]

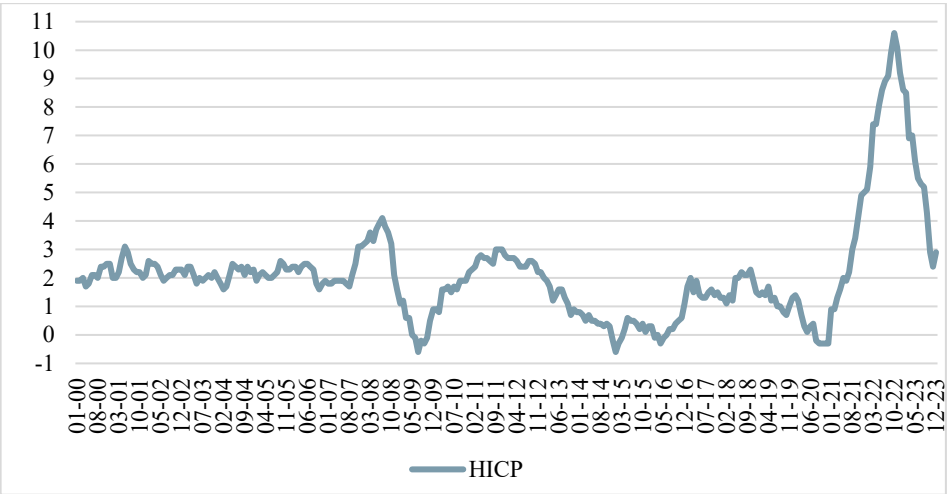

Figure 6. ***EU Harmonised Index of Consumer Prices (HICP) 2000-2023 (%)***[8]

Thus, in order to estimate the structural VAR model, we have utilised six variables describing the Euro area monetary policy and capital markets salient features. The order of mentioned variables has been as follows: ECB key interest rate (R), M2 aggregate (M2), HICP, 10-year government benchmark bond yields (GB10), Euro denominated corporate bond yields (CB) and EuroStoxx 50 index changes (stoxx50_change).

Prior to the model estimation, stationarity analysis has been conducted. The results of Augmented Dickey-Fuller, Phillips-Perron and Kwiatkowski-Phillips-

[7] The data are from the European Central Bank, ECB Data Portal, https://data.ecb.europa.eu/data/datasets/BSI/BSI.M.U2.Y.V.M20.X.1.U2.2300.Z01.E

[8] The data are from the European Central Bank, ECB Data Portal, https://data.ecb.europa.eu/data/datasets/ICP/ICP.M.U2.N.000000.4.ANR. It is "harmonised" because all the countries in the European Union follow the same methodology. This ensures that the data for one country can be compared with the data for another.

Schmidt-Shin (KPSS) tests have suggested that the involved variables' orders of integration are I(0) or I(1). Stock index historical changes have been stationary at level (I(0)), the remaining monetary and capital market indicators have been stationary at first difference (I(1)). Furthermore, lag length analysis has been performed to spot proper lag length for correct model identification. Lag numbers have been assessed using the following lag specification criteria: Schwarz information criterion, Akaike information criterion, Hannan-Quinn information criterion. Although suggested lag lengths were ranging from one to three, we have counted the results to be too short, which might lead to model misspecification. We have decided to base our model on 12 lags, which is a common length used for monthly datasets. The Autocorrelation test results have shown that there is no autocorrelation at lag 12, which is the main requirement in lag length identification. The VAR stability condition check has suggested that our structural VAR model is stable, i.e. all inverse roots of the AR characteristic polynomial lie inside the unit circle.

As mentioned previously, the ECB main refinancing rate has been considered to be the base monetary policy indicator in the model. Thus, monetary policy changes in Euro area could be represented as shocks to the interest rate. We have assumed that interest rate is an exogenous variable and we have investigated the reactions of other endogenous variables to monetary policy shocks. For that purpose, impulse response analysis has been carried out. Figure 7 illustrates the endogenous variables' responses to the one-standard deviation shock of ECB interest rate.

Though the analysis has been plotted for a 24-month horizon, the effects of the ECB interest rate shock have gradually faded away after a short period of time. Generally, the reactions are quite subdued. The interest rate response to its own shock is positive and significant. M2 aggregate responded positively throughout the first three months but started decreasing in the fourth month reaching its peak. Euro area HICP response is mainly negative within the observed timeframe. The interest rate positive shock has a slight positive effect on Euro area government bond yields, but they have started increasing after the second month reaching their peak within the third month. After the third month government bond yields have begun to fall becoming negative by the fourth month. Initially, corporate bond yields have responded negatively to the interest rate positive shock. Then, starting from the third month following the shock, the response has become positive and peaked in the fourth month. This positive effect has continued within around 11 months, after which it has turned into negative. In case of the stock market, the stock index has responded positively to the ECB interest rate shock, but this reaction is relatively short-lived. The impact has begun reducing and has become negative within the fifth month.

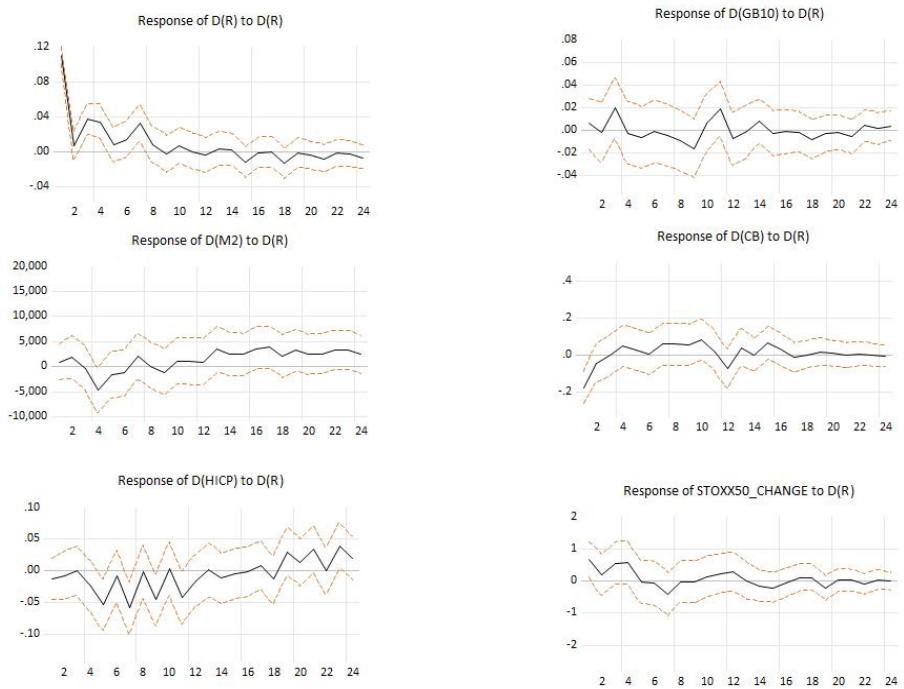

Figure 7. ***Responses of the variables to the ECB interest rate (D(R)) Cholesky One S.D. (d.f. adjusted) innovations ± 2 S. E.***[9]

In addition to impulse response functions and in order to study the interrelations between the observed monetary and capital market indicators more deeply, we have conducted forecast error variance decomposition analysis. The results have been plotted for a 24-month horizon using Cholesky decomposition. As the ECB interest rate is placed first in the model's ordering, other variables have no contemporaneous impact on it in the first period. Throughout the observed period, interest rate fluctuations have mainly been explained by the shocks directed to themselves. The impact of those shocks has decreased over time reaching around 56% by the end of the observed period. Other variables' effects on the interest rate have increased over time. The most significant effect belongs to corporate bond yields, up to 18%. In case of M2 aggregate, the volatility is most widely explained by its own shock. The other main sources of variability of M2 have been the interest rate, HICP and government bond yields in the long term. The movements of consumer prices can be explained by their own shocks. In the long run corporate bond yields and interest rate effects have become notable for HICP. Euro area government bond yields' variability in the short term could be mainly explained by its own changes. In addition to this, other long-term noteworthy factors are HICP and M2 aggregate, according to

[9] The data are based on our VAR model estimation and impulse response analysis using EViews software.

our results. The main source of the fluctuations of corporate bond yields has been their own shocks and, to a small extent and in the long run, the shocks to the interest rate, stock index and M2 aggregate. Finally, in case of the stock market indicator, the volatility could be explained by the impulses to the stock index itself, corporate bond yields and, over the longer period, to M2 aggregate.

CONCLUSION. In the frame of this article, our primary goal is to investigate the effects the ECB monetary policy might have on different segments of the European capital market, in particular government bond, corporate bond, and stock markets. To measure the mentioned effects, we have constructed our structural vector autoregressive model utilizing monthly European dataset of specific variables selected to analyze the relations for the period spanning from January 2000 to December 2023.

The main contributions of impulse response analysis are the following:

- Euro area government bond yields have responded positively to the interest rate shock, which is an expected behaviour, though the effects have become more considerable after the second month following the impulse. So, we may conclude that in case of government bond market, monetary policy tightening has led to higher yields, and this effect has been maintained throughout roughly four lags.
- In case of corporate bond yields, the initial reaction is negative, unlike government bond market. The contractionary monetary policy starts to have a positive effect on the corporate bond market after the third lag and lasts longer compared to other segments of the capital market.
- The interest rate shock's impact on the stock market is positive at the beginning, and this effect starts to fade after the fifth lag, according to the model estimations, although it is believed that stock prices commonly fall in response to tighter monetary policy.
- Overall effects of the observed variables have developed mostly in the short run.

Based on the results of the forecast error variance decomposition analysis, the following conclusions can be made:

- The volatility of the variables included in our model could be more largely explained by the shocks directed to themselves. Other variables become a source of fluctuations over a longer period.
- The fluctuations of the government bond yields are caused by themselves in the short run and additionally by changes to M2 aggregate and consumer prices by the end of the plotting period.
- In case of corporate bond market, the yields' movements are affected by volatility of the stock index, ECB interest rate and M2 aggregate.
- The stock market changes during the observed horizon are mainly conditioned by corporate bond yields and M2 aggregate volatility.

The outcome of this research on the relations between the chosen ECB monetary policy and European capital market indicators can be valuable for comparability with further studies on the influence monetary policy exerts on capital markets in different countries for the observed period.

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