Macroeconometrics
Group Assignment 4

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Group 2

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Abstract

This paper aims at studying the relationship between monetary policies, both domestic and European Area monetary policies, and stock prices in Czech Republic. For this report, we will use the methodology presented by Mara Pirovano in her research on the correlation between domestic and European monetary policies on the price of stocks. In Pirovano's study, the perimeter used is limited to the period between January 1998 and August 2009. In our analysis, we are going to use a different perimeter since we will concentrate on the period between January 1999 and December 2015. The aim of our study is to validate or present a different view to the observations made by Mara Pirovano about the fluctuations of the stock market due to monetary policies in Czech Republic.

In our research, we have found similar correlations with regards to Pirovano's study. In fact, we found evidence that the Euro Area monetary policy had a larger influence on the variation of the stock market index in Czech Republic in comparison to domestic monetary policies.

1 Introduction

With regards to the context presented above and following the methodology from Pirovano's research paper, we will first try to understand the effects of Czech monetary policies on the stock prices. In a second step, the same comparison will be made with European monetary policies. Finally, we will present and decompose the main drivers affecting stock prices movements in Czech Republic. To do so, our study will rely on a structural vector autoregressive model (SVAR) decomposed with 7 variables: The Euro Area interest rate, the log of nominal exchange rate vis-a-vis the euro, the log of industrial production index, the log of domestic price level, the domestic short-term interest rate, the log of monetary aggregate and the log of stock market index such as: $BX_t = \omega_0 + \omega_1 X_{t-2} + ... + \omega_p X_{t-p} + \epsilon_t$

Where X_t will represent a vector of the endogenous variable presented above, and $X_t - 1$ and X_{t-p} the vector of lagged values of the pre-identified endogenous variables. −

From the first model, we obtain obtain a reduced form of the model such as:

$X_t = A_0 + A_1 X_{t-1} + A_2 X_{t-2} + A_p X_{t-p} + U_t$

By imposing few restrictions on the B matrix within the model we will be able to identify the structural changes and shocks allowing to grasp the behavior of our model in the long run. Regarding the methodology employed, we will first conduct a series of test to identify to stationary state of our variable. We will then determine the optimal number of lags according to the BIC and HQ criteria. Following that step, a computation of the roots of the characteristic polynomial will allow us to check for stability of the VAR model. We will then proceed to a robustness check to observe the impact of our variables on stock prices.

2 Czech Republic's Results

2.1 Preliminary Analysis

We start by employing a stationarity test on all the variables, in this an ADF test accounting for just a constant and a constant and trend. The only variable for which we may reject the null, non stationarity, is the consumer price index, and only when accounting for a contant and trend.

All the other variables seem to be non stationary, however, this should not affect our results, as it's been shown that the statistical distributions, when dealing with multiple time series, from which we will derive our results are not affected by non stationary variables.

The next test performed in the paper is an Engle Granger test. We already know that most variables are non stationary, so for the rest of the test we do an OLS regression of one variable on the others, then test the residuals for a unit root with an ADF test. Given that we could not reject the unit root in the residuals we conclude that these are non-stationary and indeed there is evidence of possible cointegration between the variables.

However, this should not pose an issue because we will use the variables in levels without imposing cointegrating relationships.

We now turn to the HQC information criteria to choose the number of lags to use, and it suggests that 2 lags should be selected for our model. The problem is that using only to lags results in a significant autocorrelation of the errors of the VAR equations, so in order to reduce this autocorrelation we decided to use 12 lags. This approach is also in line with the results of the likelihood ratio test. We tested H_0 : Model with 12-n lags is favoured for $n = \in [1, 11]$ against H_1 : The model with 12 lags is favoured. In every test we rejected H_0 at a significance level $p < 0.01$.

Next we check if the VAR model is stable by computing the inverse roots of the characteristic polynomial 1. The inverse roots of the characteristics polynomial of the VAR with 12 lags lying within the unit circle. The model is stable.

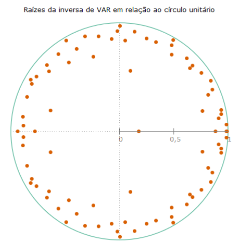
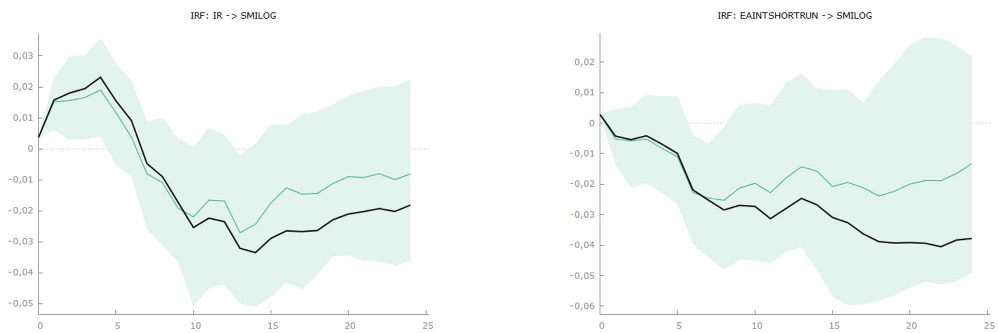


Figure 1: Inverse roots of the characteristics polynomial for a VAR with 12 lags

2.2 Baseline Model results

After estimating the baseline model defined by the paper, according to the conditions and assumptions stated by Pirovano, it is of paramount importance to scrutinize its main results, mainly in terms of how certain variables interact with each other. For the purpose of this study, our main interaction of interest lies in the impact that domestic and external interest rate policy has on the stock market index value. In order to focus on such a matter, one must examine the Impulse Response Functions and the variance decomposition of the stock market index.



(a) Domestic int rate shock

(b) Euro Area Int rate shock

Figure 2: IRF of spi to shocks in euro area and domestic interest rate

According to the IRF's, when facing shocks related to a contractionary monetary policy set by European authorities, the stock price index reacts positively at first, but it swiftly outsets a negative trend, 2b, an expected type of behaviour, since contractionary policy involves raising interest rates, cooling down the entire economy, which usually reflects on the stock market. However, if that shock is induced by the same contractionary approach enforced by internal monetary policy, 2a, the stock price index initially soars, taking more than 7 months to reflect the changing policy orientation, finally dropping. As it seems, changes in the external interest rate impact more vigorously the stock market index than domestic ones. Interestingly enough, the obtained results are quite symmetrical when compared to the paper's results, since the estimation based on Pirovano's data showed that the initial positive behaviour was displayed by the external policy shock and not by the internal one. In that sense, the present estimation probably conveys better the paper's main denouement, that the stock market index reacts more strongly to external policy settlement, but there may be other factors at stake before taking any definite conclusion.

When studying the variance decomposition, one confirms once again that, in the long run, the external affairs (EAINTSHORTRUN) account for a higher impact than domestic ones (IR),3 .

2.3 Robustness Check

Let's now estimate the first model for the robustness check, this first model only differs from our baseline in the fact that it assumes that the central bank reacts to changes in output (industrial production index) and domestic price level. The test for over identification showed a p-value of $pval = 2,38398e - 008$.

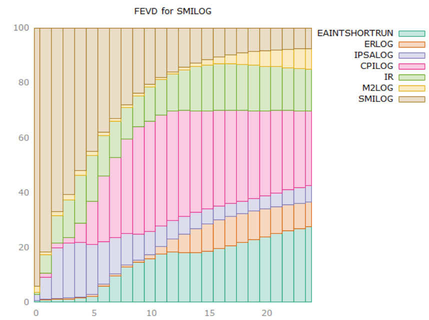


Figure 3: Variance decomposition of the spi fo 12 lags

Analyzing the IRF of the stock price index (spi) 4a , when there are shocks in the domestic interest rate one may see that there is a positive reaction to the shock, and after around 7 months the effects of the shock become negative as expected. When it comes to shocks in the Euro area interest rates 4b, the spi reaction is at first positive but it quickly becomes negative as expected. However, this shock appears to be stronger than the shock to the domestic interest rate.

When it comes to the effect shocks in the other variables have in the spi, it's safe to say that none of the shocks are permanent, confirming the stability of the SVAR model, we say this because we plotted the same function for a larger time horizon, plot in the appendix. On top of that we recognize that the effects of a shock to the domestic and euro area interest rates on spi are basically the same as the ones we see on the baseline model, meaning the model is passing the robustness test.

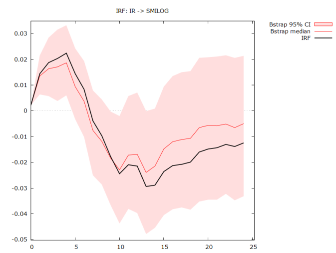
The variance decomposition of the spi index 5a, one may find evidence that in the short run the domestic interest rate and the industrial production index seem to be the most relevant when it comes to variations to the spi, not accounting for the spi itself. When it comes to the long run European interest rate, consumer price index, nominal exchange rate and monetary aggregate account for the largest fraction of variation to the spi. The domestic interest rate also has a growing impact with time, but it does not seem to account for more than 10 % of the variation of the spi.

Whereas foreign policies seem to account for a bit over 20% of the variation in the spi in the longer run.

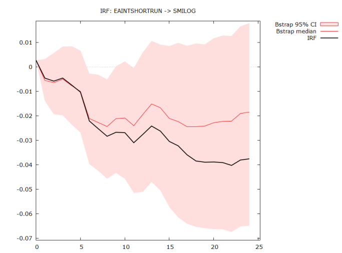
Even though the consumer price index does seem to have a big role in the variance of the spi, overall this would corroborate the authors findings, euro area monetary policies that have a more significant impact in the spi than domestic monetary policies.

To complete our robustness check we estimate a second and third models proposed by the author. the author estimates a fourth one, however none of the algorithms use by GRETL to estimate this fourth SVAR model manages to converge, so we'll skip this model. For the third robustest we're imposing a Choleski identification scheme on the A matrix of contemporaneous coefficients and estimate the repulse the response function 4c and 4d. Imposing this scheme yields to a lower triangle in the lower triangular A matrix.The resulting model differs from the baseline model in a way that now the Central Banks' monetary policy actions are contemporaneously influenced by the Euro Area interest rate, exchange rate, output and price level.

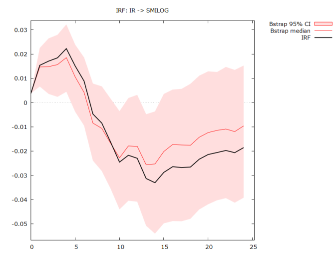
For the last robustness check, we estimate a second Choleski decomposition model, changing the ordering of the variables of the VAR such that ER moves from the second order to the sixth in the estimation. Here, the model is stable, and we don't find evidence of overidentification. When looking on the IRF 4f of the SMI response on a Euro interest rate shock, we see that the response is negative as expected and similar to the baseline model. The response to a domestic interest rate shock 4e is positive for a short period of about 5 months, but then declines and becomes negative until it reaches a negative peak after 15 months and then slowly converges to 0. Analysing the FEVD 5c of SMI one can say that the nominal exchange rate is in the short run the most important driver of the variance in this model, not taking SMI itself into account. When looking on the long run, SMI variances are mostly driven by the Consumer Price Index and the Euro Area interest rate. This is in line with the baseline model and the robustness checks. In this model, the authors findings that the Euro Area interest rate influences the variance of the SMI more than the domestic one is supported by our findings.



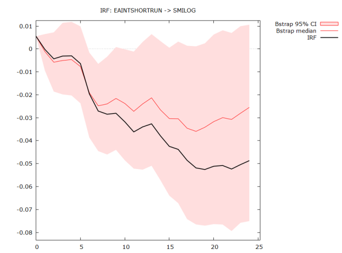
(a) 1st robustness check: Domestic int rate shock



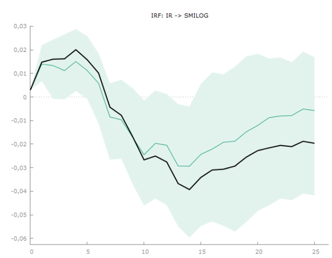
(b) 1st robustness check: Euro Area Int rate shock



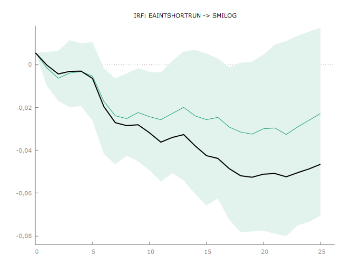
(c) 2nd robustness check: Domestic int rate shock



(d) 2nd robustness check: Euro Area Int rate shock



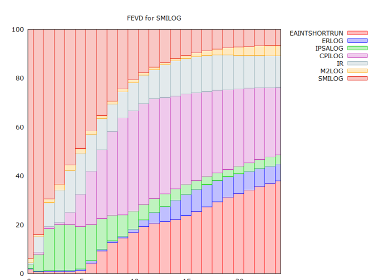
(e) 3rd robustness check: Domestic int rate shock



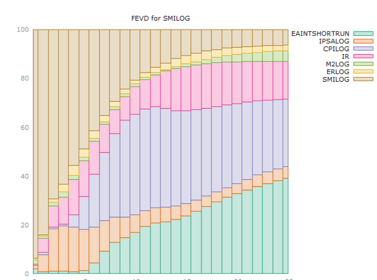
(f) 3rd robustness check: Euro Area Int rate shock

Figure 4: Robustness check: IRF of spi from a one σ shock in euro area and domestic interest rate

(a) 1st robust check



(b) 2nd robust check



(c) 3rd robust check

Figure 5: Robustness check: FEVD of spi for all 3 robustness check models

3 Conclusion

In this Assignment we were replicating Pirovano's approach (Pirovano 2012) on estimating a SVAR model to analyse the response of the domestic stock market to domestic and Euro Area monetary policy shocks. The results of our replication are similar to those of the paper, and we find no significant differences in the baseline and robustness check models. In general, the authors findings that the Euro Area monetary policy influences the stock market index in Czech Republic more than domestic one is supported by our findings.