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THE ROLE OF FOREIGN SENTIMENT IN SMALL OPEN ECONOMY

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Abstract:

The role of foreign sentiment is researched for explaining macroeconomic fluctuations in small open economy. The main goal is to find out whether the domestic variables react significantly to the shocks in the foreign sentiment. For this purpose a structural vector autoregression model is constructed for the Czech Republic and the Slovak Republic including relations between foreign environment and domestic variables. Both small open economies considered are highly dependent on foreign demand from euro area. Therefore the foreign development is represented by real GDP in euro area and alternatively is explored the possibility to replace foreign real GDP by economic sentiment indicator of euro area as sentiment indicators are available in advance. The impact of foreign shocks is examined by impulse response functions on the following domestic variables – real gross domestic product, consumer prices and effective exchange rate against euro area trading partners. The study confirms that foreign economic sentiment can be used for explaining fluctuations of domestic variables of a small open economy.

Keywords:

economic sentiment indicator, structural vector autoregression, variance decomposition, impulse response functions

JEL Classification: C51, E32

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1. Introduction

Sentiment indicators belong among promptly available data on future development of economic environment. The so-called soft data, as described by the class of survey indicators, are promptly available qualitative data and as such can be used as a first signal of further economic development. Timely information about e.g. recession development would significantly improve the quality of decisions of economic subjects. There are attempts in the literature to apply sentiment indicators (or survey results) for short-term macroeconomic forecasting or for business cycle analysis. For example, Guégan a Rakotomarolahy (2010) used monthly sentiment indicators for forecasting gross domestic product (GDP) of the euro area. Čižmešija and Sorić (2010) showed on the basis of two VAR models that economic sentiment indicator can help in short-run forecasting of Croatian GDP and private consumption as its main component. Beckmann et al. (2011) analysed the importance of economic sentiment for the financial markets of Central and Eastern Europe. They confirmed that sentiment affects significantly and has some predictive power in the case of securities prices. Also several examples can be found to include survey data into the analysis of business cycle fluctuations. Aguiar-Conraria et al. (2013) investigated the synchronization of business cycles in the euro area by the economic sentiment indicators. Bojesteanu and Bobeica (2011) used survey data for the euro area as a measure for the real economic activity in their transmission models, as economic sentiment indicator is regarded as a leading indicator for the European business cycle. According the empirical analysis of Aarle and Kappler (2012) economic sentiment shocks do have an impact on important macroeconomic variables, more specifically on output, retail sales and unemployment as it was proved for the euro area economy. However, the concept of economic sentiment has still not found solid footing in mainstream modern macroeconomics despite the efforts of OECD to use it in prognostic practice. OECD emphasizes the advantage of very early information as sentiment indicators are published already at the end of the reference month. However, the drawback still remains the fact that it is not easy to observe and quantify sentiment variables in practice.

The major goal of this article is to establish whether the shocks in foreign economic sentiment have influence on small open economy for a case of Czech Republic (CR) and Slovak Republic (SR). For this purpose an analysis was realized how domestic variables react to foreign sentiment. Another goal is to support the role of sentiment in explaining macroeconomic fluctuations.

The Czech Republic and Slovak Republic, as small open economies, are highly dependent on foreign demand. In 2013 the share of their exports in real gross domestic product was 75% in CR and 93% in SR. To characterize the statistical relationship between economic sentiment and real GDP the correlation analysis was used. To analyse whether foreign sentiment shocks do have an impact on important Czech and Slovak macroeconomic variables the Structural Vector Autoregressive (SVAR) technique with long-run restrictions was employed.

In the second chapter the theoretical background for construction of sentiment indicators is more closely introduced and also the economic theory used for transmission of foreign sentiment into small open economy. The third chapter describes the econometric methodology used. The empirical results from estimated models are included in the fourth chapter. Finally, the fifth chapter concludes with the main findings.

2. Theoretical background

The most general soft indicator surveyed and constructed in recent years seems to be the Economic Sentiment Indicator (ESI) constructed by the European Commission (EC). ESI represents (or can be considered to represent) the total economy. There are attempts in the literature to construct more sophisticated sentiment indicators based on the business survey results. However, according to Gelper and Croux (2010) the forecast ability of ESI can compete well with the other indicators.

The economic sentiment indicator of EC is a composite indicator made up of five sectoral confidence indicators with different weights. It consists of the following sectoral indicators: industrial confidence indicator, construction confidence indicator, retail confidence indicator, services confidence indicator, consumer confidence indicator. Confidence indicators are arithmetic means of seasonally adjusted balances of answers to a selection of questions closely related to the reference variable they are supposed to track (e.g. industrial production for the industrial confidence indicator). The questions in selected sectors are surveyed at managers of companies and reflect their views on current situation and also on future development. The managers have the best knowledge of their new orders and therefore we can suppose that their views are a sort of a leading indicator on future economic activity and employment. ESI is calculated as an index with mean value of 100 and standard deviation of 10 over a fixed standardised sample period. More on the construction of ESI can be found e.g. in the paper by European Commision (2006).

Since, the tendencies in the most important sectors of the economy are being reflected in the ESI, it can be regarded as a broader measure of economic activity and therefore closely linked to the business cycle and also to the dynamics of real GDP. Even Keynes links sentiment to the state of long-term expectations on economic growth (Keynes, 2006). According to many studies, there is a relationship between GDP and economic sentiment (e.g. in Ferrara et al., 2010). Also Santero and Westerlund (1996) found that sentiment indicators derived from business surveys provide valuable information for forecasting output. Therefore, we believe that the economic activity in an open economy should be associated with its economic sentiment, which is derived from the economic sentiment of its foreign trade partners. In order to investigate in more detail the relationship between the foreign ESI and Czech and Slovak GDP growth firstly we apply the pairwise correlation analysis between real GDP at time *t* and current values of the ESI.

In our analysis we suppose that there could be effect of foreign sentiment also on other domestic variables than GDP. Therefore we have included into the VAR models for the

Czech and Slovak Republics the following variables: foreign economic sentiment, domestic product, exchange rate, and domestic consumer prices. For the interactions between variables we used the locomotive theory (e.g. in Bronfenbrenner, 1979). It is a mechanism by which the output growth in country A causes subsequent output growth in country B. This effect is based on a situation in which the countries are below the level of their potential output, which is relevant in the current post-crisis period. According to this theory, when the real product of country A increases, while its propensity to import is constant, also the volume of goods and services imported into country A increases. Import growth will lead to a change in the current account balance and also to a change in the balance of payments as a whole. Thus the balance of payments of country A becomes passive, while the balance of payments of country B becomes active. The initial output growth of country A acts as a stimulus for country B that leads to the growth of its overall output performance. On the basis of this economic theory, we believe that increasing foreign sentiment could significantly increase the real domestic product of a small open economy. The growing foreign demand should lead to an import abroad; and it may be reflected in the growing export of open economy to abroad. Increasing export growth will cause growth in aggregate demand of a small open economy, and also the growth of its product. Once the economy, however, reach the level of its potential output, the locomotive effect turns to the effect of imported inflation. Growth performance abroad there also leads to an increase in the price level. Increasing export of small open economy abroad leads to the growth of its net exports, as well as aggregate demand, thus increasing the price level in a small open economy. Thus the price increase from abroad is imported to a small open economy which exports abroad. Subsequently, we expect increasing product should cause an increase in the domestic price level and increasing exports should be reflected in appreciation of the domestic currency as well.

Econometric model

There exist several approaches used in the analysis of fluctuations in macroeconomic time series to study the propagation of shocks in the economy (dynamic stochastic general equilibrium (DSGE), vector autoregression (VAR) models). In this analysis, VAR approach is used because it is often used in the empirical analysis to study the sources of business cycle fluctuations (e.g. Balcilar and Tuna, 2009; Bayoumi and Eichengreen, 1993). In the analysis using the VAR model it is necessary to identify the structural model, so that we can interpret economic relations in the model. The dynamic impact of structural shocks on the variables can be assessed by generating impulse response functions. The structural VAR model enables economic interpretation of shocks for each variable in the model. Implicit in our modelling approach is the belief that economic theory is most informative about the long-run relationships, as compared to the short-run restrictions that are more contentious (Garratt et al., 2006). This is the main reason why we used long-run restrictions in the structural VAR model. Although the structural model with long-run restrictions is often subject to criticism, among others, the Faust and Leeper (1997), St-Amant and Tessier (1998) demonstrated that long-term approach cannot be abandoned based only on the arguments of Faust and Leeper. However, robust results can be achieved if the VAR model contains a larger number of variables.

The starting point of the model construction is VAR model. It is a multivariate statistical model where all variables are treated as endogenous. VAR is a system where each variable is regressed on *p* of its own lags and on *p* lags of the other variables. Each equation in the VAR contains the same determining variables and this allows estimating the VAR using ordinary least squares (OLS) method. The reduced form of model VAR in matrix notation is the following:

$$x_t = A(L)x_t + e_t, \tag{1}$$

where x_t denotes the *(n x 1)* vector of endogenous variables, A(L) denotes the matrix of polynomials in the lag operator *L* such that $Lx_t = x_{t-1}$, and e_t is the *(n x 1)* vector of reduced-form errors.

However, the estimated model cannot be directly used for the analysis of variables' behaviour in response to the various shocks, as the errors in e_t are mutually correlated. One possible way to solve this is using Cholesky decomposition to identify the underlying orthogonal shocks. Cholesky decomposition implies a strict causal ordering of the variables in the VAR, e.g. the last positioned variable responds contemporaneously to all other variables, but they do not respond contemporaneously to this variable.

An alternative way of identifying of structural shocks was proposed by Blanchard and Quah (1989) who considered long-run reactions to shocks, later applied by King et al. (1991) or Galí (1999). They applied restrictions resulting from long-run neutrality of demand shock. It means that they assumed non-existence of long-run reaction of some variables to shocks from some equations. In order to identify the structural shocks the long-run restrictions can be applied to their reduced-form counterparts from the structural moving average representation of unrestricted model VAR. The moving average representation of unrestricted VAR model is the following:

$$x_t = B_0 e_t + B_1 e_{t-1} + \ldots = \sum_{k=0}^{\infty} B_i e_{t-i} = \sum_{k=0}^{\infty} B_i L^i e_t = B(L)e_t \ , \tag{2}$$

where B(L) is the inverted coefficient matrix, $B_i = A^{-1}A_i$. To obtain true structural and uncorrelated shocks the relation (2) can be inverted to Wold moving average representation:

$$x_t = u_t + C_1 u_{t-1} + \ldots = \sum_{k=0}^{\infty} C_i u_{t-i} = \sum_{k=0}^{\infty} C_i L^i u_t = C(L)u_t \ , \tag{3}$$

where C(L) is a polynomial variance-covariance matrix of responses of variables x_t to the underlying structural disturbances and u_t is a vector of uncorrelated shocks.

From the relations (2) and (3) we can see that

$$u_t = B_0 e_t\,, \tag{4}$$

where B_0 is the matrix representing the contemporaneous correlations between the shocks. In order to transform reduced-form residuals from the vector autoregression to the true structural shocks we have to identify the matrix $\mathrm{B_0}$. The identification scheme is based on normalizing of the original matrix, an assumption of the structural shocks orthogonality and the long-run identifying restrictions. The number of long-run identifying restrictions is *n(n-1)/2*.

Based on country-specific features of small open economy, the both SVAR models proposed for the Czech Republic and Slovak Republic contain four variables: real foreign product determined by foreign economic sentiment (*esi*), real domestic product (*y*), nominal effective exchange rate (*e*), and domestic consumer prices (*p*). Foreign economic sentiment is used for the euro area as the most important trading partner of both economies.

Our choice of data extends the model of Blanchard and Quah (1989) to incorporate external shocks via the inclusion of foreign variable (*esi*). To be consistent with the assumption of a small open economy, domestic shocks are not allowed affecting world product in the long run (essentially also in the short run), which requires the restrictions on coefficients. Specifically, domestic variables as GDP, prices, and exchange rate are not allowed to influence the foreign sentiment.

Then our structural model is expressed as follows:

$$x_t = C(L)u_t\,, \tag{5}$$

where x_t denotes the (*nx1*) vector of endogenous variables $x_t = (esi_t\; e_t\; p_t\; y_t)'$, $u_t = \left(u_t^{esi}\; u_t^{e}\; u_t^{p}\; u_t^{y}\right)'$ is the (*nx1*) vector of structural innovations, where the first shock is assigned to foreign variable esi_t. *C(L)* is an infinite order matrix lag polynomial defined as $C(L) = C_0 + C_1(L) + C_2(L)^2 +..$ in the lag operator L, and C_0 is an identity matrix. The long-run restrictions mean that the effects of particular shocks u_t (innovations) on the endogenous variables are zero in the long-run: $\sum_{k=0}^{\infty} c_{ij}^{(k)} = 0$. In order to correctly identify the structural shocks 6 restrictions are needed for model to be just-identified. The long-run restrictions are imposed in matrix *C*, which means that the effects of particular shocks u_t (innovations) on the endogenous variables are zero in the long run, i.e. domestic variables are not allowed to effect foreign sentiment in the long run. The following identification scheme was used:

$$C(1) = \begin{pmatrix} C_{11}(1) & 0 & 0 & 0 \\ C_{21}(1) & C_{22}(1) & 0 & 0 \\ C_{31}(1) & C_{32}(1) & C_{33}(1) & 0 \\ C_{41}(1) & C_{42}(1) & C_{43}(1) & C_{44}(1) \end{pmatrix} \tag{6}.$$

Model identifies one external structural shock – foreign demand shock represented by the economic sentiment of the euro area.

3. Empirical results – structural analysis

The proposed analysis was realized for the period from 1996q1 – 2014q1 on quarterly seasonally adjusted data. The time series used in the analysis are as follows:

- economic sentiment indicator (*esi*) – aggregate indicator for euro area – 18 countries, *source: Eurostat*;
- real gross domestic product (*y*) – for SR and CR, at constant prices (chain-linked volumes with reference year 2005), mil. EUR, *source: Eurostat*;
- nominal effective exchange rate[1] (*e*) – for SR and CR, 18 trading partners of euro area, index 2005=100, *source: Eurostat*;
- price level (*p*) – for SR and CR, harmonized consumer price index (2005=100), *source: Eurostat*.

Firstly the relationship between foreign economic sentiment and real GDP is researched by the correlation analysis (Table 1). The pairwise correlation coefficient between ESI as an aggregate for 18 euro area countries and corresponding real GDP for euro area reached the value of 0.54 for the period 1996q1-2014q1. Also the relationship between foreign economic sentiment indicator and GDP of SR and GDP of CR is characteristic with similar values of correlation coefficients, mainly in the case of CR. These results confirmed the positive linear relation between ESI and GDP and based on these result we used ESI as a measure of foreign economic activity in our models.

Table 1 Results of correlation analysis between ESI and GDP

ESI of euro area 18	GDP of EA18	GDP of SR	GDP of CR
Correlation coefficient	0.54	0.32	0.51

All the time series in the models are used in the form of quarterly rates except for ESI. Quarter-on-quarter rates were chosen, as they are more similar to business cycle fluctuations than yearly growth rates. Economic sentiment enters the model in levels since it is already defined as a deviation from its long-run average. ADF unit root test confirmed the stationarity of all the time series in models. Firstly the VAR models in reduced form were estimated.

The model VAR for SR was estimated with lag of 2 (the suitability of this lag is confirmed by Akaike and Swartz criteria). The estimated reduced-form VAR model is stable, without autocorrelation and heteroskedasticity in residuals. However, the normality of residuals was not confirmed by statistical tests. After structural factorization of the model

[1] NEER or trade-weighted currency index of a country aims to track changes in the value of that country's currency relative to the currencies of its principal trading partners. It is calculated as a weighted geometric average of the bilateral exchange rates against the currencies of competing countries.

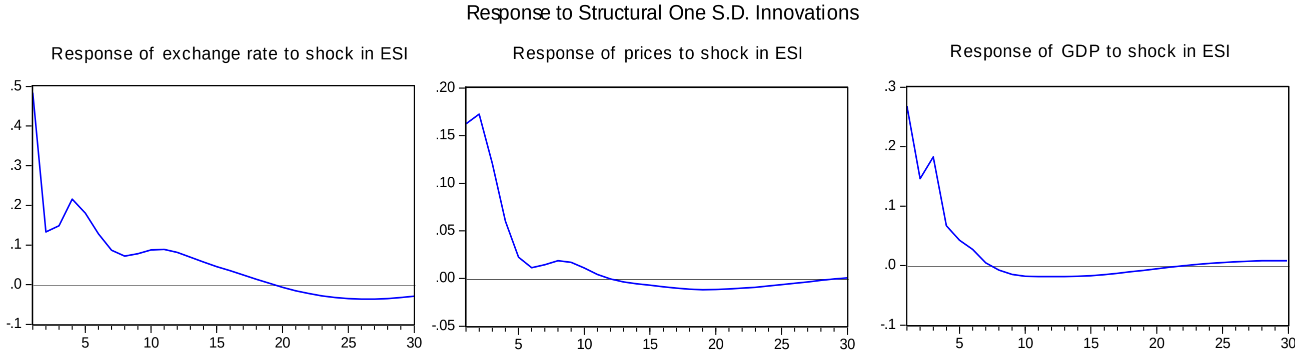
through the matrix *C*, all coefficients appear significant at the significance level of 1%. Final estimated coefficients are given in the Appendix 1.

The model VAR for CR was estimated also with lag of 2 (the suitability of this lag is confirmed by Akaike and Swartz criteria). The estimated reduced-form VAR model is stable. However the statistical tests for residuals are questionable. After structural factorization of the model through the matrix *C*, all coefficients appear significant at the significance level of 1% except for $C_{32}(1)$ whose estimated value is negligible. All estimated parameters are given in the Appendix 1 as well.

The comparison of the final estimated parameters of both models showed that their values for most parameters are similar. For both models, the positive coefficients are estimated for the relationship between foreign sentiment and domestic product and for the relationship between foreign sentiment and nominal effective exchange rate as well, which is consistent with our theoretical expectations. In the event of increasing foreign sentiment both domestic product and nominal effective exchange rate grow; it means that the effective exchange rate appreciates in both countries. Different coefficients were estimated in case of the relationship between the foreign sentiment and domestic prices. In case of increasing foreign sentiment price level in Czech Republic decreases and in Slovak Republic increases.

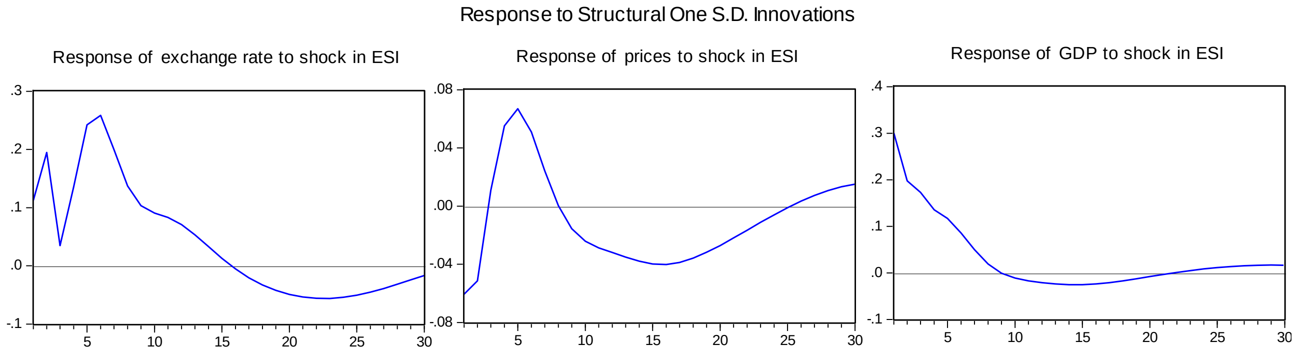
Both estimated SVAR models were used for the analysis of impact of foreign sentiment on domestic macroeconomic variables. The responses of domestic variables (GDP, prices, and exchange rate) to the structural one standard deviation shock in foreign sentiment were computed as well (Graph 1 and Graph 2).

Graph 1 Impulse responses from SVAR model for Slovak Republic



Source: EViews

Graph 2 Impulse responses from SVAR model for Czech Republic



Source: EViews

According to the results the increase in foreign demand caused a growth of domestic economic activity represented by real GDP in both countries. The results of variance decomposition (Table 2 and 3) show that the ratio of fluctuations in domestic GDP explained by foreign sentiment is around 30% in CR and around 27% in SR in the first quarter after the shock and then the influence of foreign sentiment on GDP slowly fades out. The positive shock in foreign economic sentiment was translated also to the increase in exchange rate in both countries.

Table 2 Variance decomposition of Slovak variables to the shock in foreign sentiment

Quarter	% of variance of *e*	% of variance of *p*	% of variance of *y*
1	48.42	16.24	26.81
2	13.32	17.26	14.62
3	14.86	12.08	18.26
4	21.54	6.01	6.68
8	7.19	1.86	-0.77

Source: EViews

Table 3 Variance decomposition of Czech variables to the shock in foreign sentiment

Quarter	% of variance of *e*	% of variance of *p*	% of variance of *y*
1	11.24	-6.06	30.02
2	19.48	-5.14	19.73
3	3.48	1.08	17.27
4	13.58	5.51	13.56
8	13.73	0.02	1.89

Source: EViews

Concerning the response of domestic price level, foreign sentiment explains around 17% of price movements in the first and second quarters in SR, however is almost negligible in explaining the fluctuations in price level in CR. Concerning the exchange rate, the positive shock in foreign sentiment resulted also in a slight appreciation of nominal effective exchange rate. The variance decomposition for exchange rate implies that changes in foreign sentiment are very important in the short run in SR, as foreign sentiment explains almost 50% of fluctuations in the exchange rate in the first quarter after the shock. In CR the response of exchange rate is highest in the second year after the shock.

4. Conclusion

The presented results confirmed the important role of economic sentiment in macroeconometric analysis. Estimated SVAR models were used for analysis of dynamic responses of Czech and Slovak macroeconomic variables on the shock in foreign demand represented by economic sentiment indicator in their largest foreign trading partner – euro area. The response of Czech and Slovak GDP and nominal effective exchange rate on the shock in foreign sentiment is high, but the influence on prices is mostly negligible. However, it is necessary to emphasize that sentiment indicators are qualitative data and therefore this issue needs further research. The future research should be oriented also to adding more variables to further specification of the model, e.g. variables characterising the situation at labour market.

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Appendix 1

Estimated coefficients for structural VAR model for Czech Republic

Results of SVAR estimation	Coefficient	Std. Error	Prob.
$C_{11}(1)$	16.520	1.396	0.000
$C_{21}(1)$	1.349	0.328	0.000
$C_{31}(1)$	-0.224	0.067	0.001
$C_{41}(1)$	0.993	0.291	0.001
$C_{22}(1)$	2.577	0.218	0.000
$C_{32}(1)$	0.048	0.064	0.454
$C_{42}(1)$	0.951	0.266	0.000
$C_{33}(1)$	0.532	0.045	0.000
$C_{43}(1)$	-0.754	0.246	0.002
$C_{44}(1)$	1.986	0.168	0.000

Estimated coefficients for structural VAR model for Slovak Republic

Results of SVAR estimation	Coefficient	Std. Error	Prob.
$C_{11}(1)$	16.352	1.382	0.000
$C_{21}(1)$	1.756	0.359	0.000
$C_{31}(1)$	0.527	0.109	0.000
$C_{41}(1)$	0.616	0.232	0.008
$C_{22}(1)$	2.737	0.231	0.000
$C_{32}(1)$	0.355	0.095	0.000
$C_{42}(1)$	0.821	0.215	0.000
$C_{33}(1)$	0.755	0.064	0.000
$C_{43}(1)$	1.153	0.179	0.000
$C_{44}(1)$	1.256	0.106	0.000

