Statistical Office of the Slovak Republic
Production Statistics Department

Economic Sentiment Indicator and Confidence Indicator in Services in the new weight System (Dagmar Blahova, Edita Holickova, SO SR)

Composite indicators and econometric models

(Jan Haluška, INFOSTAT)

In November 2005 at workshop, we presented experimental calculations of Economic Sentiment Indicator with new weights, in which we included also Confidence Indicator in Services. But time series of indicator in services is relatively short – only from 2002.

We ask Infostat – Institute of Informatics and Statistics for retropolation and extension of time series up to 1997 retrospectively via model solution. In this work, we try to present results of this reconstruction.

The current situation

Economic Sentiment Indicator as composite indicator of opinion and expectations of participants of economic environment and opinions and postures of consumers is calculated on a monthly base since 1997. It is aggregated from results of processing of business tendency survey in industry, construction, retail trade and from results of processing of opinion of consumers on current economic situation.

Economic Sentiment Indicator is calculated as weighted arithmetic mean of four partial components – confidence indicators in industry, construction, retail trade and consumers by the following formula:

IES = a*ICI + b*BCI + c*RCI + d*CCI

a, b, c, d are weights
ICI is Confidence Indicator in Industry having weight 40 %
BCI is Confidence Indicator in Construction having weight 20 %
RCI is Confidence Indicator in Retail trade having weight 20 %
CCI is Consumer Confidence Indicator having weight 20 %

Confidence Indicator in Industry (ICI) is composite indicator calculated as weighted arithmetic mean of business balances of the level of total demand, inventories of finished goods (with opposite sign) and expected volume of industrial production.

Confidence Indicator in Construction (BCI) is composite indicator calculated as weighted arithmetic mean of business balances of the total demand and expected employment.

Confidence Indicator in Retail trade (RCI) is composite indicator calculated as weighted arithmetic mean of business balances of current and expected business situation and inventories (with opposite sign).

Consumer Confidence Indicator is composite indicator describing expected total consumer confidence of population. It is calculated as weighted arithmetic mean of balances of expected development of economy, unemployment (with opposite sign), expected development of financial situation and savings in household.

Experimental calculations - including services

Economic Sentiment Indicator including Confidence Indicator in Services has begun to be calculated at the end of 2004. It was not officially released considering the short time series of available data. Economic Sentiment Indicator is calculated as weighted arithmetic mean from five partial components – Confidence Indicator in Industry, Construction, Retail trade, Services and Consumer Confidence by the following formula:

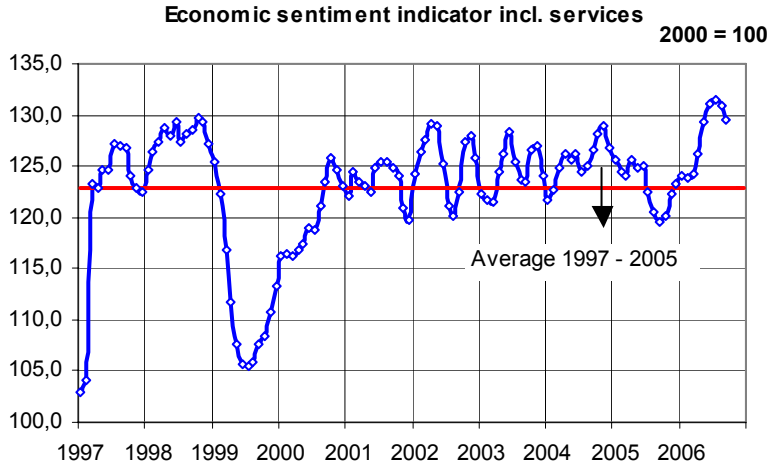
IES = a*ICI + b*BCI + c*RCI + d*SCI + e*CCI

a, b, c, d, e are weights

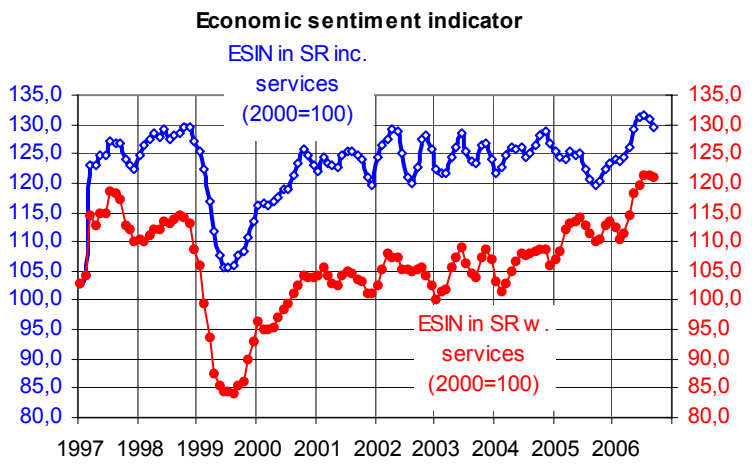
ICI is Confidence Indicator in Industry having weight	40 %
BCI is Confidence Indicator in Construction having weight	5 %
RCI is Confidence Indicator in Retail trade having weight	5 %
SCI is Confidence Indicator in Services having weight	30 %
CCI is Consumer Confidence Indicator having weight	20 %

Confidence Indicator in Services (SCI) is composite indicator calculated as weighted arithmetic mean of business balances of opinions of current business situation and of current and expected demand development.

Comparison of results



Economic Sentiment Indicator (without Services) had downward trend after relatively favourable development in 1997 up to autumn of 1998, when parliamentary elections were held and it fell considerably in the first half of 1999. After considerable increase at the end of 1999, which still speeded up during the 2000, it oscillated about average value in 2001 up to 2004. Favourable development in the first half of 2005 having considerable rising tendencies was stopped in July and downward trends continued up to September 2005. The trend in the second half of 2005 was influenced by relatively considerable fall of consumer's confidence that decreased mostly under influence of non-stable political situation in this period (the government lost majority support in the parliament). From economic aspects, increasing of prices of oil and petroleum products reflected on non-favourable expectations of price development and development of the whole economy had the most significant effect. In the first half of 2006, it came to its more considerable growth caused by all its components particularly by Confidence Indicator in Construction and optimisms of consumers.

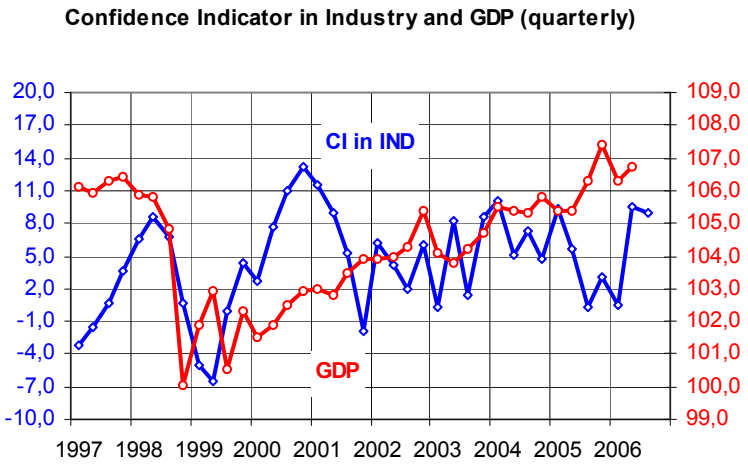


Development trends did not change considerably after inclusion of services into calculation of Economic Sentiment Indicator. The level of reached values of Economic Sentiment Indicator increased markedly and the long-lasting average of the Indicator went up by 17,7 points as a follow-up hereto.

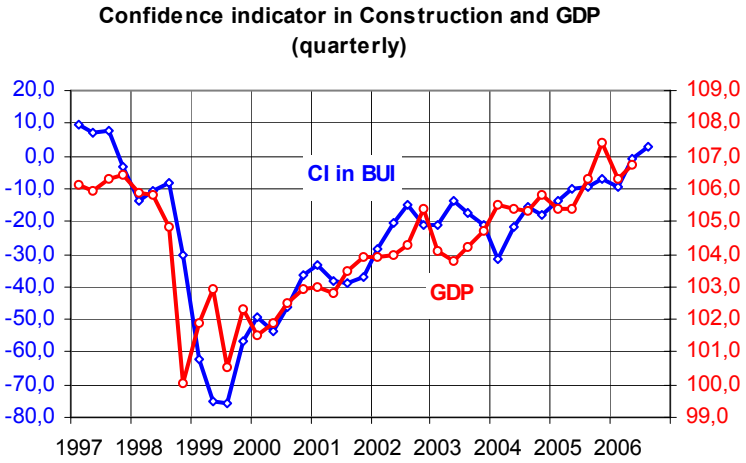
Comparison of IES components with GDP development

Development trends of Economic Sentiment Indicator that is at higher-level zone and of gross domestic product indicate the same tendency of development. Development trends did not change significantly after inclusion of Indicator of Services. But values of the Indicator shifted to higher positive values considerably.

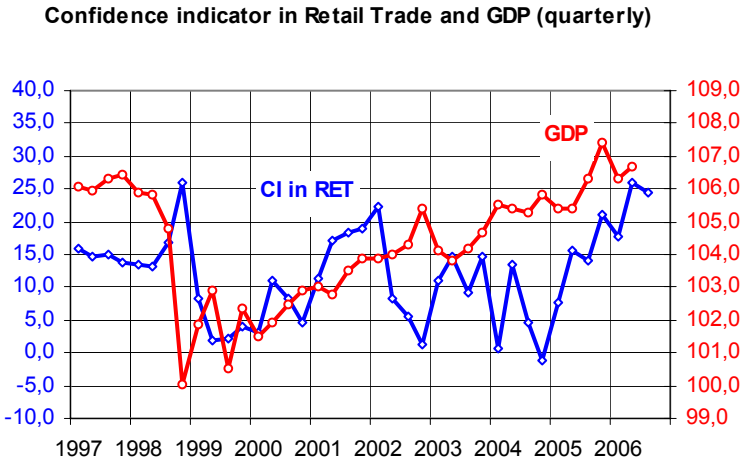
In comparison of GDP development with individual components of Economic Sentiment Indicator – indicators of confidence by branches and consumers, relatively high rate of similarity of developments trends of all components is obvious except for partial deviations in industry and from 2005 also in services.



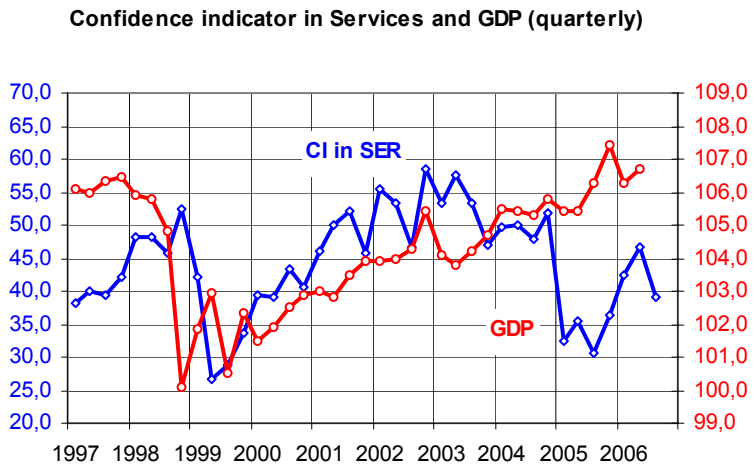
The greatest similarity of tendencies is between GDP and Confidence Indicator in Construction.



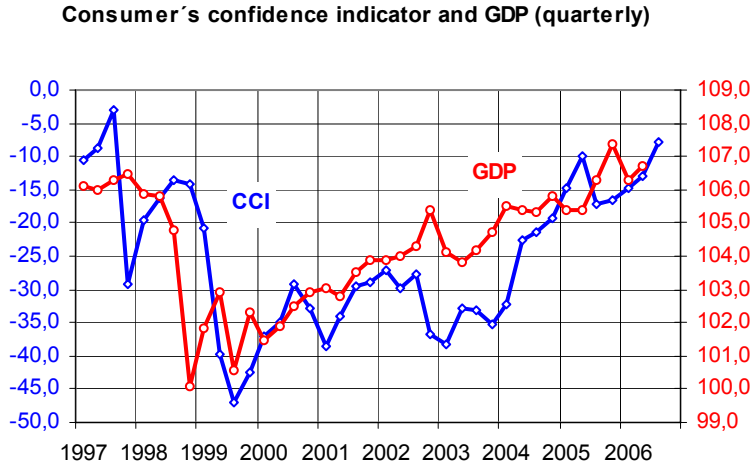
After almost equal development to 2002 Confidence Indicator in Retail trade is oscillating around the GDP development tendency in the following years.



Considerable similarity is also between GDP development tendencies and Consumer Confidence Indicator.



GDP development tendencies and Confidence Indicator in Services report low rate of development similarity. Regardless services are significant part on GDP production (almost 60 %), development tendencies are not coincident, mostly on the turn of 2004/2005. The development of Confidence Indicator in Services indicates to analyse comprehensively the sample of respondents for 2007.



Conclusions

From January 2007, we prepare publication of official results of IES with inclusion of Confidence Indicator in Services based on reconstructed time series from 1997 – 2001 and with using of real data from 2002 – 2006. Contemporaneously with previous weights we will maintain the original time series of IES some period of time.

To the first publication of IES in new weight structure.

- We release new weight system and methodology of calculation
- We will inform economic public about this measures in advance

Composite indicators and econometric models

In the branch of the ŠÚ SR the research in regard to the construction and use of models has for a long time been carried out by INFOSTAT. From the methodological point of view there are econometric models [5,8].

Since 2005, their development has received a further stimulus in the fact that the ŠÚ SR is obliged to compute and publish in advance a flash estimate of GDP and total employment – always by 45 days after the end of each quarter. It is in this context that model tools for computing flash estimates of these indicators were created and applied during the course of 2005 [6]. As far as GDP is concerned, Economic Sentiment Indicator (ESI) is considered as a reference indicator for its growth (compared to the same period of the previous year). The ESI is a composite indicator, which is calculated on the base of business tendency survey results. Two model tools for flash estimates of GDP based on the ESI are presented in this article.

When constructing model tools for the computation of flash estimates or short-term predictions, the time series of business balances may either be used independently in their original form or they may be presented as components of so-called composite confidence indicators. In compliance with the methodology recommended by the European Commission (EC) confidence indicators are being built up in industry, construction and retail trade as well as Consumer's Confidence Indicator in the Slovak Republic (SR). The goal of their construction is to describe in detail the development in the given branches and in this way help to signalise a potential improvement or worsening of their current development tendencies in advance. This is their main advantage compared with the reference statistical indicators that are being constructed by the principles of quantitative statistics. The ESI is represented by monthly time series, which starts in January 1996 in the SR[1].

One of the possibilities how to utilize business and consumer surveys effectively for flash estimates or short-term forecasts is to use their results to build an econometric model. The comparative advantage of a model capable of using these surveys consists in updating of estimates or forecasts due to promptly available information. An example of this type of econometric model is the model BUSY, which the EC has been using since 1982 [9]. It is being used in particular for the short-term forecasting of GDP and components of its use at the EU-15 level. But the EC is not the only institution that uses models based on the results from business and consumer surveys. Other example of their application is the model of the Italian economy created in Banca d'Italia [7], which can be used either autonomously or combined with a quarterly econometric model.

Modelling of GDP based on ESI in Slovakia

In this part we show the methodological approach and econometric-type model relationships that use the ESI to represent GDP development. As the starting hypothesis about the functional form of the model relationship can be formulated differently, model tools presented here have different form as well. Either it is a classical econometric model (not affected by error correction term) or it is a model relationship in the form of ECM.

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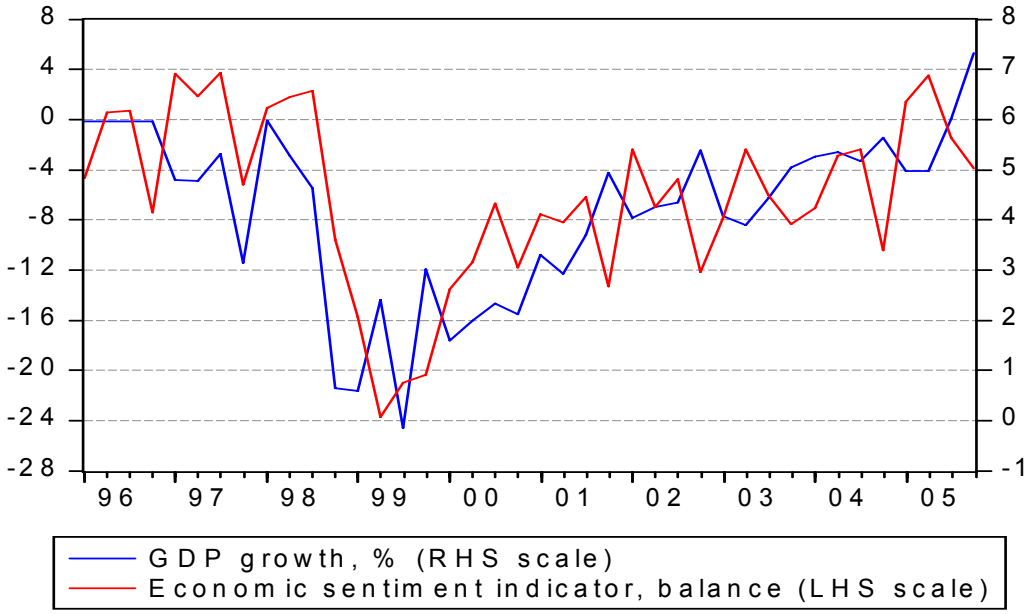
[1] In connection with the EU enlargement in May 2004, a so-called "new ESI" started to be constructed for the euro area alongside the "old ESI". Unlike the old ESI, the new ESI includes the confidence indicator in services. The new ESI also has a changed weight scheme under which industry accounts for 40%, services 30%, consumers 20%, construction 5% and retail 5% [4].

The results of estimation are based on original (not seasonally adjusted) time series of relevant quantitative and qualitative indicators in combination with seasonal dummies [2,3]. The quarterly time series of the ESI was created by transformation from its original, i.e. monthly time series. Parameters of model relationships are estimated by means of OLS method using EViews 5 [1].

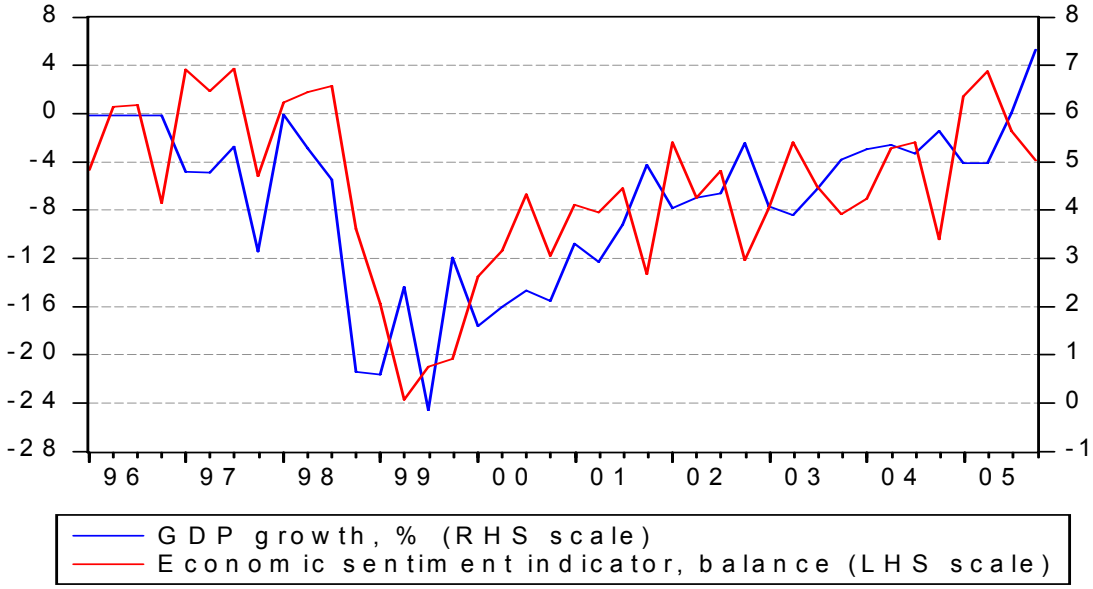
Figure 1

Slovakia - Correlation between ESI and GDP growth



Model relationship without error correction term

Construction of this model relationship is based on the starting hypothesis that the ESI is considered as a reference indicator for GDP in constant prices. To be more precise, it is assumed that there exists statistically significant dependency between the percentage growth rate of GDP (compared to the same quarter of the previous year) and the ESI. The hypothesis formulated in this way was tested using quarterly time series of these indicators for the period 1st quarter 1996 to 4th quarter 2005, i.e. from 40 observations. Figure 1 presented below shows that a close relationship exists between the evolution of the ESI (expressed in balances) and the growth of GDP (in %):



Correlation analysis of these two time series indicates that there exists relatively high level of statistical dependency between them. The correlation coefficient calculated over the whole period of 40 observations is 0.632. However, in case that time shift of the ESI by 1 quarter ahead is taken into consideration which may also be identified visually (especially since 1998) correlation coefficient increases to 0.734. Consequently, it can be assumed that the model relationship in question will more accurately capture the dependence of year-on-year relative changes in GDP on the ESI if it takes into consideration given time shift in their development.

If the starting hypothesis is extended by the assumption that model relationship is log-linear then estimation of parameters of linearized regression equation - which takes into account results of correlation analysis - provides results presented in Table 1.

Table 1

Dependent Variable: DLOG(GDP,0,4)
Method: Least Squares
Sample(adjusted): 1996:1 2005:4
Included observations: 40 after adjusting endpoints
DLOG(GDP,0,4)=C(1)+C(2)*IES(1)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	5.273498	0.246618	21.38326	0.0000
C(2)	0.181385	0.027063	6.702212	0.0000
R-squared	0.541725	Mean dependent var		4.183646
Adjusted R-squared	0.529665	S.D. dependent var		1.709889
S.E. of regression	1.172658	Akaike info criterion		3.205130
Sum squared resid	52.25485	Schwarz criterion		3.289574
Log likelihood	-62.10261	Durbin-Watson stat		1.654116

The results of estimation show that the ESI (shifted one quarter ahead) is a statistically significant explanatory factor for relative changes in GDP - over the analysed period, it explains more than 54% of the variance in GDP changes[2]. Its parameter is positive, as expected, and its value is interpretable in such a way that a change in the ESI (balance form)

[2] If the ESI operates without a time shift of one quarter ahead, the model relationship explains around 40% of the variance in GDP changes.

by 1 percentage point results in a change of real GDP growth by around of 0.18 percentage point.

Given that the development of the time series of macroeconomic indicators is usually determined to a significant effect by (own) inertia, the specification of the model relationship may be extended with a time-lagged endogenous variable. Estimation of parameters of this model relationship gives the results presented in Table 2 and Figure 2.

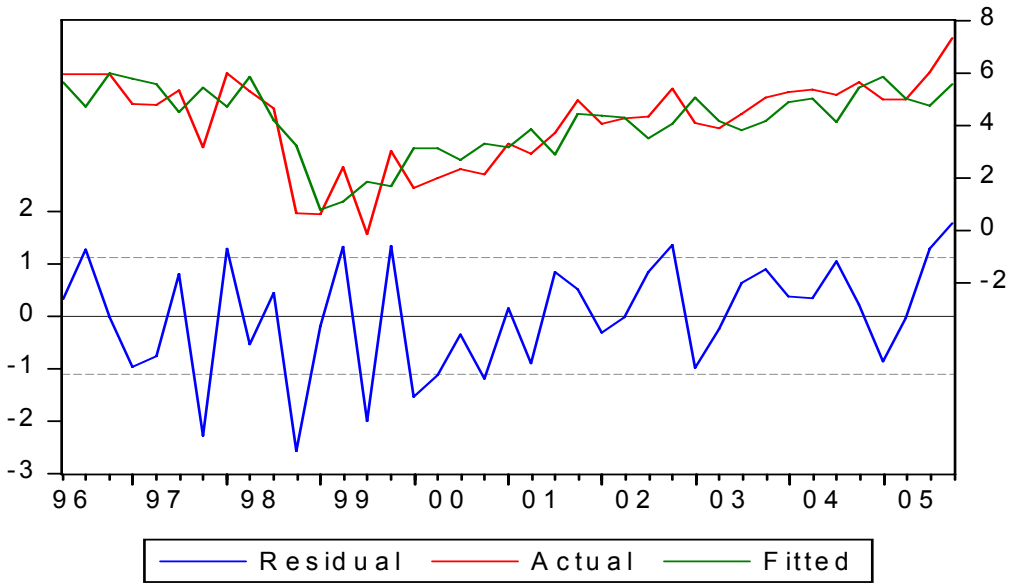
Table 2

Dependent Variable: DLOG(GDP,0,4)
Method: Least Squares
Sample: 1996:2 2005:4
Included observations: 39
DLOG(GDP,0,4)=C(1)+C(2)*IES(1)+C(3)*DLOG(GDP(-1),0,4)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	3.298699	0.816322	4.040929	0.0003
C(2)	0.116080	0.036214	3.205396	0.0028
C(3)	0.379281	0.152125	2.493221	0.0174

R-squared	0.600570	Mean dependent var	4.137967
Adjusted R-squared	0.578379	S.D. dependent var	1.707337
S.E. of regression	1.108614	Akaike info criterion	3.117901
Sum squared resid	44.24489	Schwarz criterion	3.245868
Log likelihood	-57.79908	Durbin-Watson stat	2.298183

Figure 2



By taking into account the effect of the time-lagged endogenous variable, the explanatory power of the model relationship is higher – it now explains 60% of the variance in GDP growth. Although the parameter of the time-lagged endogenous variable is relatively small, it is statistically significant. It may therefore be said that the year-on-year changes in GDP are significantly determined also by the effect of inertia within their development. The ESI parameter remained statistically significant, but in comparison with its previous size, it is smaller by about one third. It is clear from the value of the Durbin-Watson index (2.39) that the residuals may be considered as mutually uncorrelated.

The charting of the actual and fitted values of the relative changes in GDP shows that the model relationship captures their main development trends, including changes in their direction. It cannot, however, completely express some extreme fluctuations - especially the slowdown in GDP growth during the 4th quarter of 1998 and the 3rd quarter of 1999. In these quarters, the real slowdown in GDP growth was greater than that indicated by the ESI (one quarter earlier).

The acquired model relationship is relatively simple, but its explanatory power is rather low. The main problem, however, is that the relationship is based on non-stationary time series and therefore it cannot be excluded that it is affected by the problem of so-called spurious regression. Indeed, the ADF test results show the time series of both indicators (GDP, ESI) are of type I(1), which means the time series of their first differences are stationary. For that reason, the model relationship was also estimated in ECM form.

Model relationship in ECM form

In this case, the construction of the model relationship is based on a modified starting hypothesis according to which GDP grows at a basically constant pace, however, under the effect of changes in the ESI, its pace becomes variable[3]. The hypothesis so formulated results in a following model relationship that is assumed to be long-term one:

$$GDP = \alpha * e^{b * TIME + c * ESI}$$

or

$$\log (GDP) = a + b * TIME + c * ESI$$

As regards methodology, the construction of the ECM model relationship is based on two steps. First, the equilibrium relationship between the non-stationary variables is estimated, and, second, the ECM model relationship is estimated using the stationary time series of residuals derived from long-term relationship. This is a model in which the deviation from long-term equilibrium in one period is partially corrected in the following period. The parameters of the long-term relationship were estimated for the period from the 1st quarter of 1996 to the 4th quarter of 2005 (i.e. from 40 observations) and the estimation gave the results presented in Table 3.

Table 3

Dependent Variable: LOG(GDP)
Method: Least Squares
Sample: 1996:1 2005:4
Included observations: 40
LOG(GDP)=C(1)+C(2)*IES+C(3)*T

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	4.892437	0.020012	244.4734	0.0000
C(2)	0.001761	0.000954	1.846232	0.0729
C(3)	0.038140	0.002244	16.99885	0.0000

R-squared	0.887008	Mean dependent var	5.191545
Adjusted R-squared	0.880901	S.D. dependent var	0.118582
S.E. of regression	0.040924	Akaike info criterion	-3.482186
Sum squared resid	0.061965	Schwarz criterion	-3.355520
Log likelihood	72.64371	Durbin-Watson stat	1.832149

[3] The model relationship in BUSY II is based on a starting hypothesis formulated in this way.

The results show that all estimated parameters are statistically significant. Next experiments showed that the explanatory power of the long-term relationship might be increased by taking into account seasonality in GDP (seasonal decline in the 1st quarter (SD1) and seasonal increase in the 3rd quarter (SD3)). The results of estimation of long-term relationship are presented in Table 4 and Figure 3.

Table 4

Dependent Variable: LOG(GDP)
Method: Least Squares
Sample: 1996:1 2005:4
Included observations: 40
LOG(GDP)=C(1)+C(2)*IES+C(3)*T+C(4)*SD1+C(5)*SD3

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	4.912797	0.010596	463.6599	0.0000
C(2)	0.001854	0.000475	3.899690	0.0004
C(3)	0.037270	0.001096	34.01405	0.0000
C(4)	-0.071196	0.007809	-9.117372	0.0000
C(5)	0.020298	0.007882	2.575293	0.0144

R-squared	0.974644	Mean dependent var	5.191545
Adjusted R-squared	0.971746	S.D. dependent var	0.118582
S.E. of regression	0.019932	Akaike info criterion	-4.876474
Sum squared resid	0.013905	Schwarz criterion	-4.665364
Log likelihood	102.5295	Durbin-Watson stat	1.031292

Figure 3

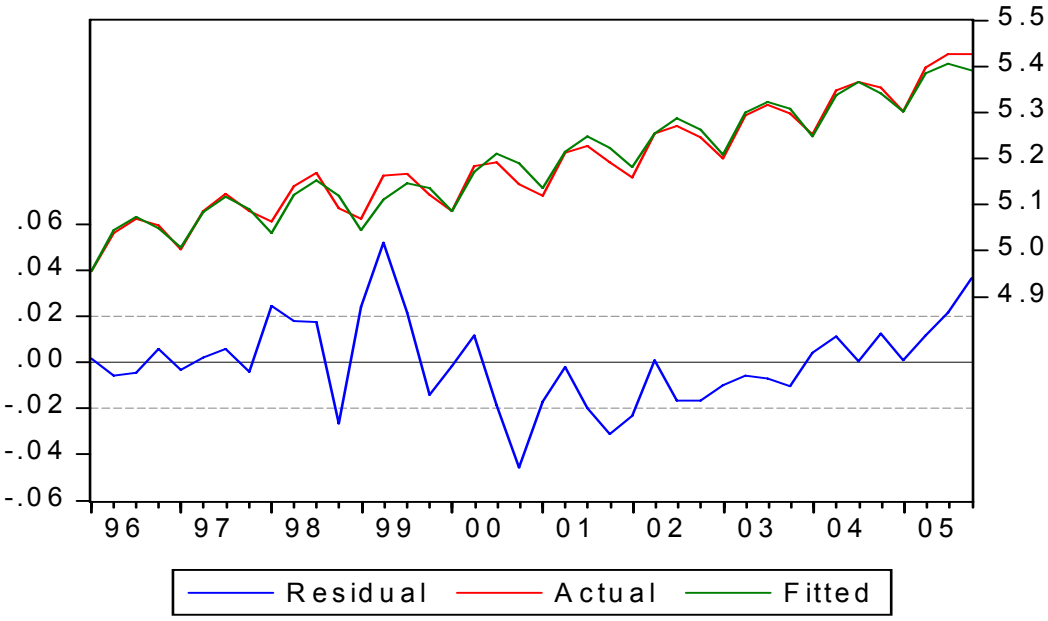


Table 4 and Figure 3 show that the explanatory power of long-term model relationship is sufficiently high. The parameter of TIME variable expresses that GDP in the analysed period was increasing by 3.7% per year (in average). The estimation of ECM model relationship for GDP, using the residuals from the long-term relationship (RZGDP)[4] gave the results presented in Table 5 and Figure 4[5].

[4] On the basis of the Engle-Granger test, the time series of the residuals may be considered as stationary at a 10% significance level.

[5] In this case, the quarter-to-quarter relative changes in GDP are approximated by the difference of the logarithm as follows: dlog(GDP)=log(GDP)-log(GDP(-1))=(GDP-GDP(-1))/GDP(-1).

Table 5

Dependent Variable: DLOG(GDP,0,1)
Method: Least Squares
Sample(adjusted): 1996:2 2005:4
Included observations: 39 after adjusting endpoints
DLOG(GDP,0,1)=C(1)+C(2)*D(IES)+C(3)*RZDGDP(-1)+C(4)*D(SD1)
+C(5)*D(SD3)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.009660	0.002851	3.388669	0.0018
C(2)	0.001590	0.000573	2.773058	0.0089
C(3)	-0.559202	0.167844	-3.331684	0.0021
C(4)	-0.072537	0.004437	-16.34754	0.0000
C(5)	0.023796	0.004492	5.297835	0.0000

R-squared	0.903324	Mean dependent var	0.012076
Adjusted R-squared	0.891951	S.D. dependent var	0.054000
S.E. of regression	0.017750	Akaike info criterion	-5.105616
Sum squared resid	0.010713	Schwarz criterion	-4.892338
Log likelihood	104.5595	Durbin-Watson stat	1.716195

Figure 4

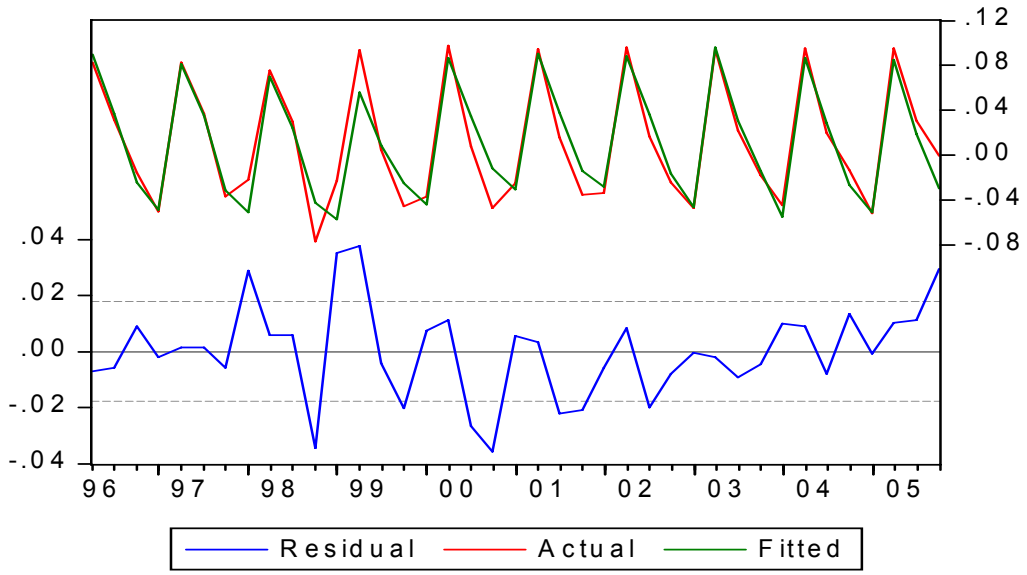


Table 5 and Figure 4 show that the ECM model relationship for GDP has high explanatory power. The influence of the ESI on GDP is statistically significant also in the short-term period, while the short-term elasticity of GDP to the ESI is not substantially different from the long-term one[6]. The effect of seasonality on GDP is statistically significant from the short-term point of view too. The largest deviation between actual GDP and the GDP values generated by the model relationship occur at the turn of 1998 and 1999, in other words at the beginning of macroeconomic stabilization of the Slovak economy which eventuated in soft lending (in 1999).

[6] The quarter-to-quarter absolute changes in the ESI are expressed by the differences as follows: d(ESI) = ESI-ESI(-1).

Conclusion

The results presented in this article show that the ESI can be considered as statistically significant indicator of GDP development and that it may be used to construct model relationships for flash estimates of GDP. However, a comparison of the statistical characteristics of the acquired relationships shows that their explanatory power differs – as far as the past is concerned – and that it is significantly higher for the ECM model. In this regard, it may be assumed that the potential how to improve the explanatory power of these model relationships and, thereby to make GDP flash estimates more reliable, depends above all on expanding the ESI with the confidence indicator in services. Indeed, the services sector accounts for more than 50% of GDP in Slovakia. However, the time series of the Confidence Indicator in Services were very short at present as the ŠÚ SR started to compile it in January 2002.

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