Identifying the financial cycle in Slovakia

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A "teaser"

Identifying financial fluctuations has recently become crucial both for monetary policy and financial stability. From a small open economy perspective, as is the case of Slovakia, this becomes on the one hand more important and on the other hand more challenging. We build on and extend current financial cycle modelling approaches in National Bank of Slovakia. We construct a financial cycle indicator which takes into account endogenous co-movement between input indicators and makes use of variables which monitor the build-up phase rather than the materialization of risks.

Biographies

Patrik Kupkovič has been a Junior Researcher at the National Bank of Slovakia since 2016. His main interest is in the field of macroeconomic modelling. Specifically in monetary policy and its real effects; the natural real interest rate modelling; estimation and global vs. country specific determinants; financial stability and financial cycle identification; DSGE modelling and forecast evaluation. He holds a Ph.D. degree in Econometrics and Operations Research from University of Economics in Bratislava.

Martin Šuster is a director of the Research Department at the National Bank of Slovakia. He has joined the NBS in 2004 and worked as an advisor to the deputy governor, head of international economics section and chairman of a Working committee for communication on euro adoption in Slovakia. He also lectures on macroeconomics and economic policy at the Comenius University in Bratislava and the University of Economics. He has received a PhD. in economics at the University of Maryland, College Park, USA, specializing in macroeconomics and labour economics. He currently serves as a deputy chairman of the Slovak Economic Association.

[A] Introduction and related literature

A small open economy is inherently more volatile and more exposed to external shocks. Being also an emerging country with less developed capital markets means there might be fewer internal buffers to help cushion the shocks. Economic policies should utilize any advance warning of a risk of financial crisis.

There are just a few attempts to construct a measure of the financial cycle in Slovakia. The first paper exploring this topic is Červená (2011). Červená constructs an indicator of stress in the financial sector. The indicator is computed as a weighted average of normalized series of several variables expected to influence the financial

cycle. According to the results the financial system in Slovakia was the most stable in 2006, subsequently stress increased until the beginning of 2009 and slowly faded later on.

The need to implement macroprudential policies led to the development of a new indicator called cyclogram (See Rychtárik, 2014). The cyclogram is composed of 13 variables, re-scaled to 0-10, and averaged into the final index. According to the cyclogram the financial system in Slovakia was under constantly growing pressures between 2004 and 2007, reaching a peak at the end of 2007. Pressures started to fall quickly in 2009 and the situation was relatively calm until 2013. In the past two years we could see increasing pressures again, mainly due to fast growing loans to households and increasing property prices. Compared with the older index of Červená the cyclogram seems to be more forward looking, since it was constructed to help setting countercyclical capital buffers.

[A] Construction of financial cycle indicator

[B] Financial cycle definition

In this paper we use a definition of the financial cycle according to Borio (2012) and Plašil et al. (2015). They define the financial cycle as recurrent swings in market participants' attitudes to financial risks.

The main motivation for the construction of the financial cycle indicator (FCI) of this kind is to propose a new indicator which takes into account endogenous co-movement between input indicators and distinguishes between variables which monitor the build-up phase rather than the materialization of risks. Firstly, this approach allows us to identify common movements in the selected indicators. If, for example, property prices and credits are growing rapidly at the same time, the financial cycle indicator should send a stronger signal than in the situation with the opposite direction of the growth in property prices and credits. Secondly, we should differentiate between the build-up phase and the materialization phase of the financial cycle.

[B] Input indicators selection

We can interpret input variables as forward-looking indicators of potential problems in the economy. Many authors such as Reinhart and Rogoff (2011) believe that variables connected with changes in the risk aversion are relevant indicators of future financial crises.

We follow Plašil et al. (2015) methodology when selecting input indicators, but we have done some modifications because of data availability and country-specific properties of some data in Slovakia. We want to cover the widest possible area of the economy that might be affected by changes in the risk aversion. If possible, we distinguish between the non-financial corporations sector and the household sector. All input indicators with adjustments are described in Table 1.

Table 1: Input indicators, variable transformations and data availability

	Indicator	*Units and transformations made*	*Data availability (frequency)*
1.	Change in the stock of loans to households	euro, million, absolute y-o-y change	1993-now (monthly)
2.	Change in the stock of loans to non-financial corporations	euro, million, absolute y-o-y change	1993-now (monthly)
3.	Property prices	y-o-y change in price index, %	2005-now (quarterly)
4.	Growth of households debt to gross disposable income	euro, million, bank loans / annual moving sum of monthly income, y-o-y change, %	loans: 1993-now (monthly) disposable income: 1999-now (quarterly)
5.	Growth of non-financial corporations debt to gross operating surplus	euro, million, bank loans / annual moving sum of monthly surplus, y-o-y change, %	loans: 1993-now (monthly) operating surplus: 1999-now (quarterly)
6.	Spread between rate on loans to households and 3MEURIBOR	% p.a.	Interest rate: 1997-now (monthly)
7.	Spread between rate on loans to non-financial corporations and 3MEURIBOR	% p.a.	Interest rate: 1997-now (monthly) 3MBRIBOR: 1994-2009 (daily) 3MEURIBOR: 2009-now (daily)
8.	SAX stock index	three-month average	1995-now (daily)
9.	Current account deficit-to-GDP	euro, million, %	2004-now (quarterly)

Note: Variables with quarterly frequency were transformed to monthly frequency using linear interpolation method.
Source: ECB, Eurostat, National Bank of Slovakia, author's own calculations.

Loans to households and non-financial corporations: Drehman and Borio (2009), among others, claim that excessive credit growth is one of the best explanatory variables for future problems in the financial sector

Property prices: Sharp growth in residential and commercial property prices is a factor that can lead to or accelerate the outbreak of most financial crises (see, for example Drehman et al. (2012).

Debt sustainability: Higher growth in debt than in disposable income means that either households or non-financial corporations will spend an increasingly large proportion of their income on repaying loans in the future.

Credit conditions: Giese et al. (2013) state that credit and lending conditions represent the financial risk attitude on the credit supply side and are useful indicators of future financial crises.

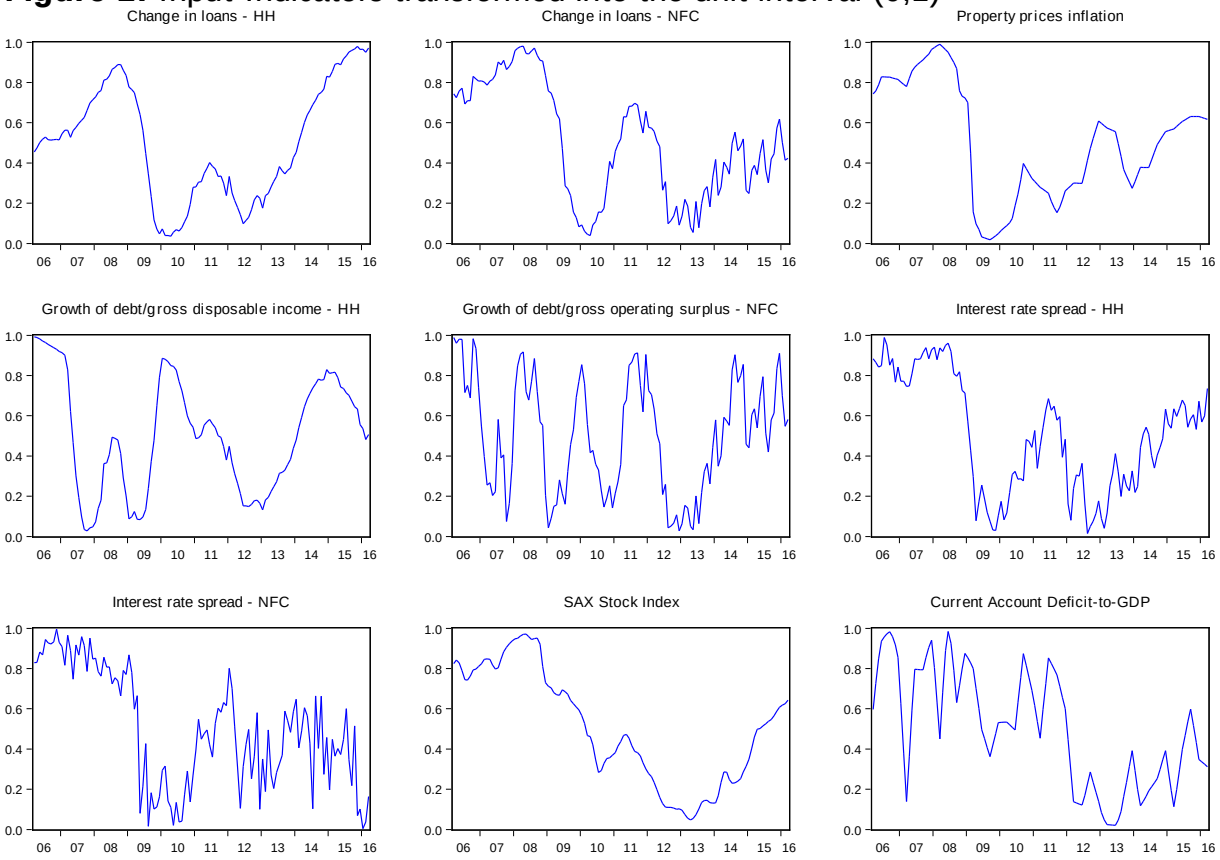
Stock index: Plašil et al. (2015) claim that the stock index may complete the overall picture of the market participants' expectations and reveal over-optimism about future asset prices.

Current account deficit-to-GDP ratio: We can interpret a current account deficit as a situation in an economy where more is invested than saved by the private sector and the government. Because of these imbalances, the economy can overheat which may results in future difficulties in repaying loans financed by flows from abroad.

[B] Financial cycle indicator construction

The input indicators are transformed into the unit interval (0,1) using the kernel estimate of the cumulative distribution function (we assume Gaussian kernel), see Figure 1. Input variables are mutually comparable and it helps aggregating different types of variables into the one composite indicator. The lowest value of the transformed variable represents the through of the cycle and the highest value represents the peak of the cycle.

Figure 1: Input Indicators transformed into the unit interval (0,1)



Source: Author's own calculations.

After variable transformation, we apply Holló et al. (2012) aggregation method to obtain the financial cycle indicator:

$$FCI_t = (w \circ s_t)' C_t (w \circ s_t). \quad (1)$$

In (1) $w = (w_1, w_2, ..., w_9)$ is a vector of weights which indicates the relative importance of the particular input indicator; $s_t = (s_1, s_2, ..., s_9)$ is a vector of indicators at time t; $(w \circ s_t)$ represents the element-by-element multiplication of the above

mentioned vectors. Finally, the matrix C_t contains the values of pairwise correlation coefficients $\rho_{i,j}$ between indicators *i* and *j* at time *t*. The result of the aggregation method (1) is the financial cycle indicator. **The higher the indicator, the higher is the degree of financial risk tolerance** generally observed among market participants in the economy. In other words, **low values indicate high risk aversion while high values indicate low risk aversion**.

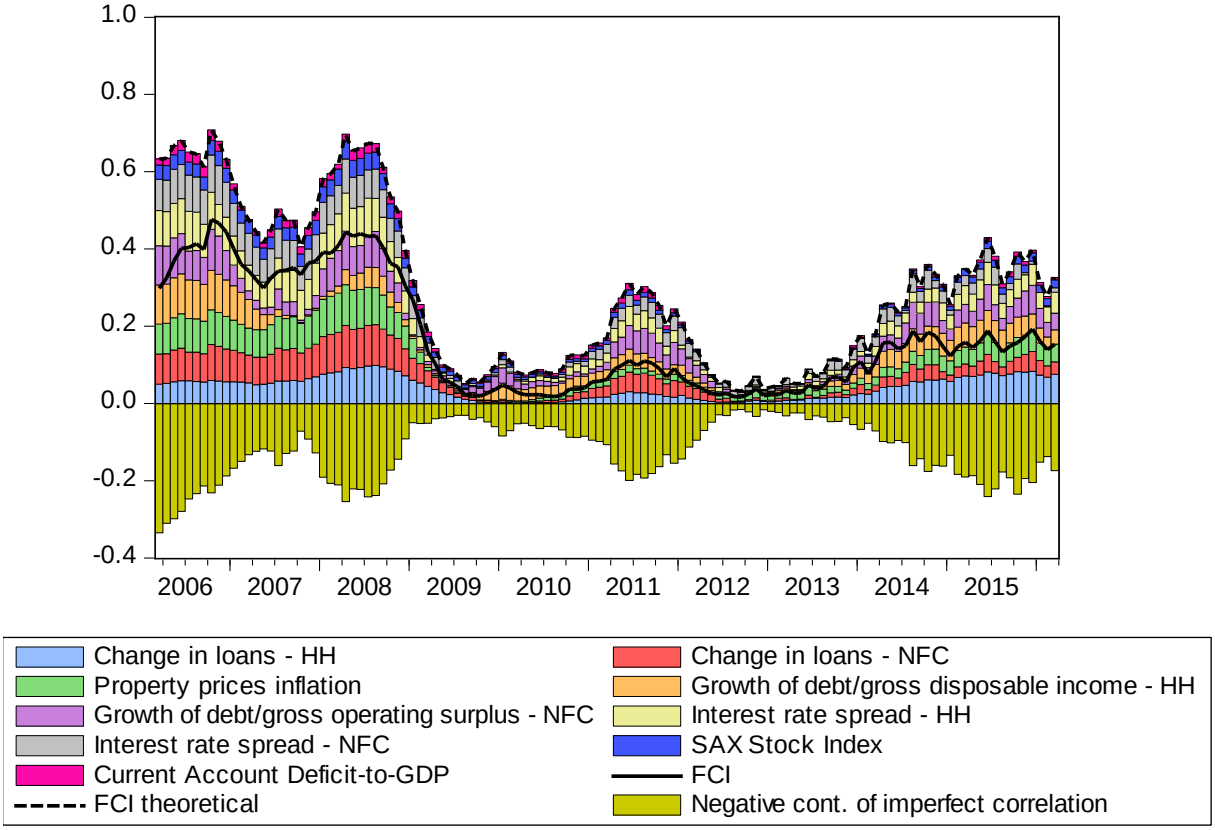
If the correlation of inputs is perfect, the FCI attains its theoretical maximum. The value of the FCI can thus be divided into two parts: the positive contribution of each indicator and the negative contribution of the imperfect correlation between indicators. Variables with a strong positive correlation have larger positive effect on the value of the FCI. With mixed or diverse developments across input indicators there is no clear information about the direction of risk perceptions.[1] Following the Plašil et al. (2015) approach, values of weights are set by simulation techniques. In more detail, we use 100,000 different sets of weights satisfying the condition $w_1 \geq w_2 \geq ... \geq w_9$. These sets were plugged into equation (1). At the end, we saved the vector of weights, which gave us the best predictions of the non-performing loans in Slovak banking sector.

[B] Financial cycle indicator results and its robustness

Figure 2 shows the evolution of the FCI from 2006 to 2016. A period from the start of 2006 to the end of 2008 can be viewed as an expansionary phase of the financial cycle, accompanied by a rapid economic growth. It is hard to identify a precise peak of the financial cycle in this period, but we can interpret this period as a period with a relatively low risk aversion among the economic subjects. Lending conditions were loosening, thus the households and the non-financial corporations were borrowing more and more, and as a result, property prices were going up. This was followed by a steep decrease in the risk perception at the beginning of 2009 due to the effects of the global financial crisis. These low values of the FCI indicated a high risk aversion in the overall economy. This period lasted from 2009 to 2013 with a small peak in 2011 due to an increase in the loans and in the ratio of debt to gross operating surplus of the non-financial corporations. We could say that from 2013 Slovak economy has been on an expansionary phase of the financial cycle. Currently (first quarter of 2016), the FCI value is rather elevated, but the level seems to be stable.

[1]The correlation structure follows from variances and covariances which are estimated recursively using the exponentially weighted moving average (EWMA) method. For technical details see RiskMetrics (1996) or Holló et al. (2012).

Figure 2: FCI and its decomposition



Note: Figure 2 shows the estimated evolution of the FCI (the black line), its theoretical maximum (the black dashed line), its decomposition (the bar chart), and the negative contribution of the imperfect correlation between indicators (the yellow bar). Financial cycle indicator takes values from <0,1>, low values of the FCI (FCI→0) indicate a high risk aversion in the economy, high values of the FCI (FCI→1) indicate a low risk aversion in the economy. The vector of weights is w [0.137; 0.133; 0.130; 0.129; 0.129; 0.129; 0.123; 0.056; 0.034]. The order of weights corresponds to the order of the indicators in Table 1. Sample 2006M03-2016M03.
Source: Author's own calculations.

In robustness exercises we used the same dataset as in Plašil et al. (2015) and similar weights for each input indicator. The main finding was that different variants of the FCIs had very similar developments, although the indicator with the Plašil et al. (2015) dataset suffers from a short data sample.

[A] Conclusions

The aim of this paper was to propose a new index for identifying the financial cycle in Slovakia, which will take into account endogenous co-movement between input indicators and distinguish between variables which monitor build-up rather than materialization of risks.

The results suggest that a period from 2006 to 2008 could be interpreted as an expansionary phase of the financial cycle with a low risk aversion. This period was followed by a rapid reversal in a risk aversion at the beginning of 2009 as a result of the financial crisis. A period from 2009 to the end of 2013 is characterized by a very high risk aversion and it can be viewed as a recessionary (downward) phase of the

financial cycle. Currently, the Slovak economy may be on an expansionary phase of the financial cycle.

The proposed financial cycle indicator may serve as an additional tool for the macroprudential purposes. However, because of data availability and quality, policy makers should use this indicator with caution.

[A] Literature

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