Discussion note

NÁRODNÁ BANKA SLOVENSKA
EUROSYSTÉM

Index of borrower-based measures in Slovakia

The National Bank of Slovakia has been active in implementing borrower-based measures (BBMs) since 2014. Currently a comprehensive set of measures is implemented, including Loan-to-Value (LTV), Debt-to-Income (DTI) and Debt service-to-Income (DSTI) limits. Therefore, a composite measure may prove useful for an analysis or econometric model asking for a single indicator of BBMs. The heterogeneity and complexity of these measures requires both accounting for the constraints these limits impose and capturing the intensity of how these limits are binding. We propose an index that combines the BBMs based on their effect on loan volumes. The composite index increases gradually since 2014, which reflects an increasing systemic risk related to the credit cycle, household indebtedness and rising property prices.

There has been an increasing use of macroprudential policy measures after the Great Financial Crisis. Therefore, there is an increasing need to also take them into account in macroeconomic analyses. For the purpose of econometric analysis[1], one of the simplistic options is to include a single index of macroprudential measures. However, the construction of such an index is challenging. First, one needs to consider not only the existence of the measures, but also their intensity, i.e., how strict they are. Second, the aggregation of different measures should be based on the respective stringency of the macroprudential stance. Although capital-based macroprudential policy measures are also important, we only focus on borrower-based measures. First, because the two sets of measures use different tools to secure prudence. While capital-based measures increase the resilience of banks and are applied to stocks, borrower-based measures increase the resilience of borrowers and are applied to flows. Second, the aggregation of capital-based measures is more straightforward as these measures are all expressed as a share of risk exposure amount.

We define the composite index as a function of the three most frequently used borrower-based measures: LTV, DTI and DSTI limit. The advance of their setting and modifications since 2014 is provided in the Appendix. To construct the index, the respective limits are adjusted based on the method described in Eller et al. (2020). First, if there are exceptions for a given limit, we compute a weighted limit, based on the possible share of new businesses within legal exemptions[2].

[1] An index of macroprudential measures is in general used in VEC, VAR or DSGE models.

[2] E.g., the LTV limit between 1 July 2017 and 1 July 2018 was 80%, 40% of the newly granted loans could have been granted above 80% and 10% of the newly granted loans could have been granted with an LTV between 90%

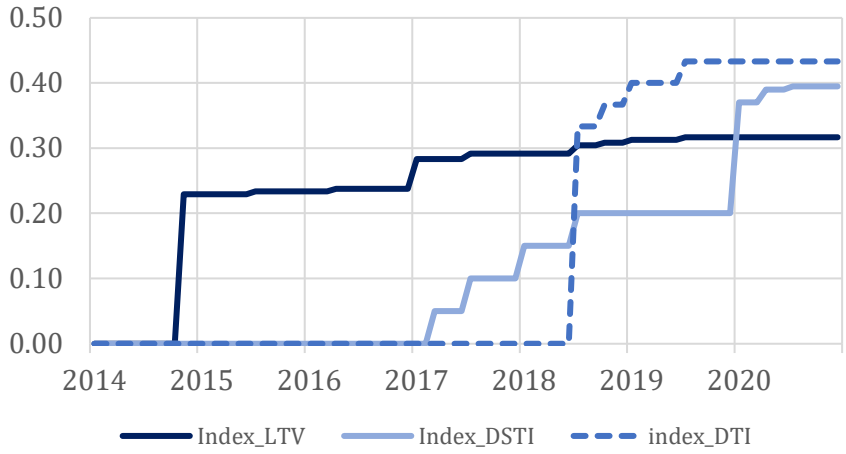
Thus, the index does not take into account any responses from the supply side, but exclusively the operation of the regulatory framework.

Second, we transform these weighted limits into the [0,1] space[3], using the following transformation:

$$Index = (Limit_{maximum} - Limit_{actual})/Limit_{maximum},$$

i.e. the stricter (lower) is a limit, the closer is the transformed index to 1. While the maximum value of a given limit is arbitrary, we use a maximum value of 120% for the LTV, 100% for the DSTI limit and a value of 15 for the DTI[4]. The transformed limits are illustrated on Chart 1. Larger increases of the respective indices are due to the tightening of the limits, while smaller and gradual increases are due to several phase-in periods.

Chart 1 Transformed borrower-based limits



Source: NBS, own calculations.

Finally, we aggregate the sub-indices into one composite index of borrower-based measures. However, choosing weights for the aggregation are not straightforward. We offer three options:

- Option 1: equal weights
- Option 2: weights are based on the distribution of loans, i.e., based on the share of new businesses "close" to the respective limits
- Option 3: weights are based on stringency of limits in terms of their impact on the volume of new businesses.

---

and 100%. I.e., that one quarter of the loans that can exceed 80% can exceed 90% as well, so if a bank uses these exceptions to the full extent, 30% of newly granted loans could be granted with an LTV between 80% and 90%. Thus, the weighted LTV limit is calculated as 0.6*80% + 0.3*90% + 0.1*100% = 85%.

[3] While the theoretical maximum of the index is 1, it cannot be expected to reach this maximum, as it would require the BBM limits to be set as 0. However, for econometric analysis the historical development of the index is more important than its theoretical extremes.

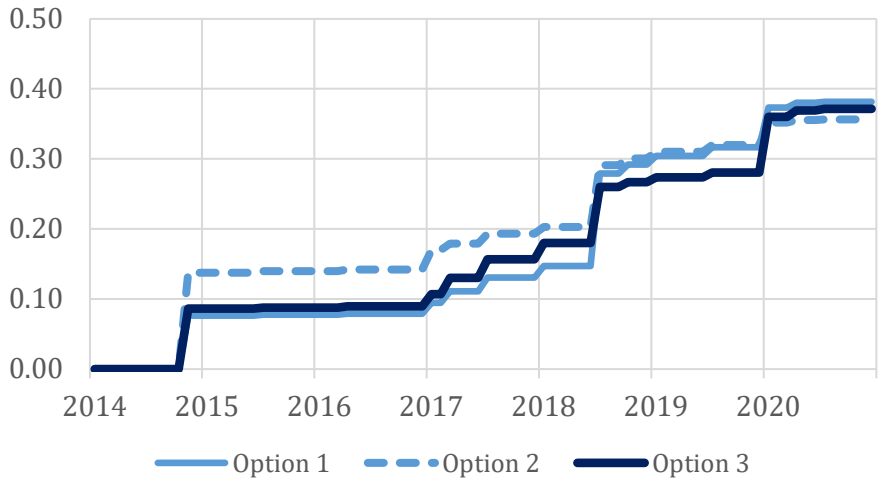
[4] These maximum values were selected to have prudent upper floors. Before Slovakia had been setting limits on the LTV, banks used to grant loans with LTV above 100%, the practice adopted also in other EU countries. The maximum for the DSTI has been set to 100%, as monthly instalments should not exceed the disposable income of the borrower. Based on reporting, banks granted a non-negligible amount of loans with DTI exceeding 12 before the introduction of the limit.

In Option 2, we calculate the share of new businesses in 2019, i.e., the last (regular) year before the pandemic, with an LTV between 75% and 80%, DSTI between 75% and 80% and DTI between 7.5 and 8. Thus, the respective weights are 60% for the LTV index, 19% for the DSTI index and 21% for the DTI index.

Option 3 is based on the estimated impact of the respective borrower-based measures on new businesses in 2019. The methodology and the results are published in Cesnak et al. (2021). In this case, the weights are 38%, 47% and 15%, respectively.

Beside the tightening, or easing of a limit, the distribution of loans can also depend on the respective response of banks. By adjusting internal limits, banks can increase the share of loans granted closer to the limits[5]. Therefore, while we show option 2 as a possible way to aggregate the limits, our preferred option is option 3.

Chart 2 Aggregated index of borrower-based measures



Source: NBS, own calculations.

A gradual tightening trend of the measures is clear irrespective of the composite index applied. The first increase of the index in 2014 is related to the implementation of BBMs into the policy toolkit of the NBS and the consequent introduction of the LTV limit. A gradual increase of the index in 2017 and 2018 reflects gradual tightening of the LTV and DSTI limits, driven, inter alia, by increasing residential real estate prices. The two latest increases of the index are related to the increasing household indebtedness, the first due to the introduction of the DTI limit in 2018 and the second due to the tightening of the DTI limit in 2020. Since option 2 attributes higher weight to the LTV limit, its rise is stronger in 2014 and remains the highest of the three composite indices until the implementation of the DTI limit in 2018. On the other hand, equal weights of option 1 result in a higher gain of the index at the time of the implementation of the DTI limit in 2018. Under option 3, there are no such shifts and the impact of the DSTI limit is more pronounced.

Since the composite index should reflect a macroprudential policy stance, the aggregation of the respective sub-indices should be based on the stringency of policy measures. Therefore,

[5] This is also documented in Cesnak et al. (2021).

our preferred option is to use weights of sub-indices associated with their impact on the loan volumes. Such an index, (option 3) can prove useful as a simplified index of borrower-based measures for statistical or econometric analysis.

References

Cesnak, M., Klacso, J. and, Vasil', M. (2021). *Analysis of the Impact of Borrower-Based Measures.* NBS Occasional Paper, 3/2021.

Eller, M., Martin, R., Schubert, H. and Vashold, L. (2020). *Macroprudential policies in CESEE – an intensity adjusted approach.* Focus on European Economic Integration, Österreichische Nationalbank (Austrian Central Bank), issue Q2/20, pages 65-81.

Ján Klacso
analytici@nbs.sk

Appendix 1 Overview of the most important borrower-based measures implemented by the NBS

		LTV		DSTI		DTI	
		Maximum	**Exception**	**Maximum**	**Exception**	**Maximum**	**Exception**
Recommendation	**XI.2014**	100%	25% between 90% - 100%				
	III.2015			100%			
	VI.2015		20% between 90% - 100%				
	I.2016						
	IV.2016		15% between 90% - 100%				
NBS Decree	**I.2017**		10% between 90% - 100%, 50% between 80% - 100%	Specification of the definition of DSTI			
	III.2017			95%			
	VII.2017		10% between 90% - 100%, 40% between 80% - 100%	90%			
	I.2018			85%			
	VII.2018	90%	35% between 80% - 90%	80%		8 years	Exception 20%
	X.2018		30% between 80% - 90%				Exception 15%
	I.2019		25% between 80% - 90%				Exception 10%
	VII.2019		20% between 80% - 90%				Exception 5% + 5% for young borrowers
	I.2020			60%	15% between 60% and 80%		
	IV.2020				5% between 60% and 80%		
	VII.2020				5% between 60% and 70%		