

Box 1 Indicator of Additional Probability of Recession

Santiago Gamba
Daniel Osorio*

Taking as a starting point the measurement of GDP-at-risk, which was introduced in Box 1 of the *Financial Stability Report* of the first half of 2018, and following the work of Adrian et al. (2017), this box presents the indicator of additional probability of recession (IAPR). The IAPR seeks to measure the magnitude of the vulnerabilities in terms of economic growth stemming from financial conditions by studying the difference between the left tails of the non-conditional distribution and the conditional distribution of the GDP on financial conditions. This difference is interpreted as the “additional” probability of recession that current financial conditions cause to the economy.

1. GDP-at-risk: the distribution of the GDP and the financial conditions

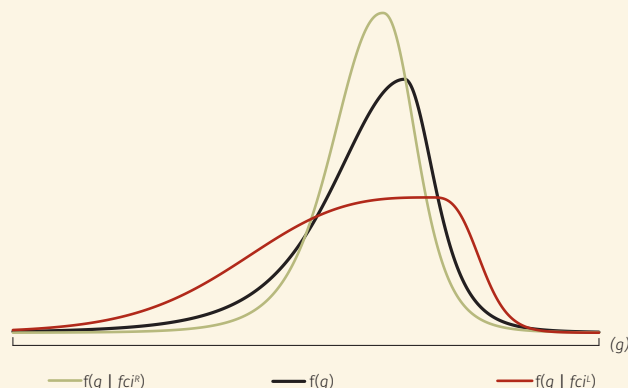
The results of calculating the measurement of GDP-at-risk are illustrated in Graph B1.1 where $f_t(g)$ is the non-conditional density function of future growth at moment t ; $f_t(g|fci_t^L)$ is the conditional density function of future growth in which the financial conditions in are “lax” or in a “credit boom,” and $f_t(g|fci_t^R)$ is the conditional density function of future growth in which the financial conditions in are “restrictive” or in a “credit squeeze.”¹

Starting from the non-conditional distribution of GDP growth, when restrictive financial conditions are controlled for, the distribution is seen to exhibit less variance and shifts

* The authors are part of the Financial Stability Department in *Banco de la República*. The opinions expressed here are the sole responsibility of the authors and do not imply any commitment on the part of *Banco de la República* or its Board of Directors.

1 For the construction of this indicator, the financial conditions are measured with the credit boom indicator. In this respect, financial conditions, in practice, are not binary between “lax” and “restrictive” but rather correspond to a continuous variable.

Graph B1.1
Example of Estimated Distribution of GDP
Growth in Colombia



Source: calculations by Banco de la República.

slightly to the left. The most drastic change is found when it is conditional upon lax financial conditions. In this case, the distribution becomes skewed to the left, its variance rises, and it moves slightly to the right. This, as a result, generates a heavier left tail. In summary, financial conditions are positively associated with the probability that an economic recession will occur in the future.

2. Contribution of the financial conditions to the probability of recession

Using the distributions of growth over time, $L_t^D(h)$ is defined as the indicator of additional probability of recession h periods ahead (downside entropy, according to Adrian et al., 2017) as follows:

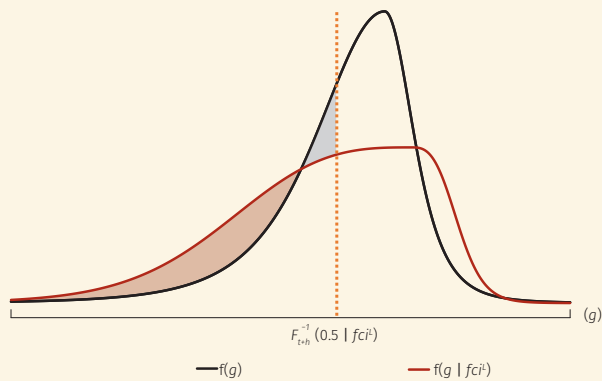
$$L_t^D(h) = - \int_{-\infty}^{F_t^{-1}(0.5|fci_t)} [\log f_{t+h}(g) - \log f_{t+h}(g|fci_{t+h})] f_{t+h}(g|fci_{t+h}) dg$$

Where $f_t(g|fci_t)$ corresponds to the conditional density of future growth with respect to financial conditions in (as a continuous variable) and $F_t^{-1}(g|fci_t)$ represents the inverse conditional distribution function of future growth with respect to the same variable. $L_t^D(h)$ seeks to measure to what extent financial conditions suggest a greater probability that a recession will occur in comparison to what is estimated when financial conditions are not taken into account. This indicator will hereinafter be referred to as IAPR. The IAPR follows a trend that is similar to the one presented by the area between the left tail of the conditional distribution and the left tail of the non-conditional distribution (Graph B1.2). Thus, when financial conditions are relaxed, this area tends to increase, which indicates that the probability of a recession rises due to laxer financial conditions.

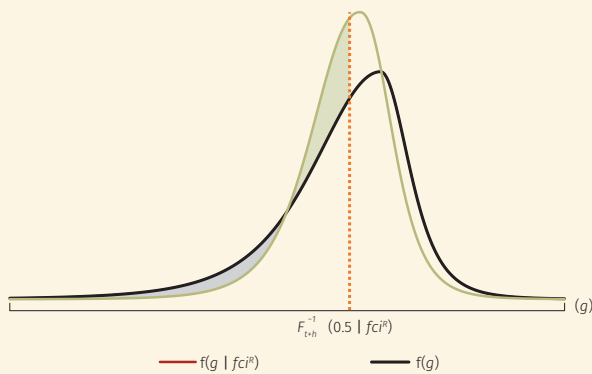
Graph B1.3 shows the evolution of IAPR over time with a horizon of one year. In recent history, this indicator has presented its highest values during periods prior to the times of greater financial turbulence. First of all, between June 1997 and December 1998, while the growth rate of the loan

Graph B1.2
Graphic Estimate of the IAPR

A. Facing lax financial conditions



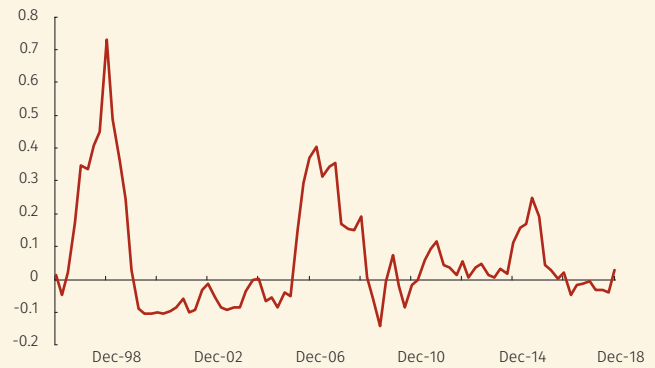
B. Facing restrictive financial conditions



Source: DANE, calculations by Banco de la República.

portfolio increased, the IAPR surged in anticipation of the financial crisis of the late 1990s. Second, between June 2006 and March 2007 the IAPR pointed to a rise in the probability of low future economic growth, an event that occurred subsequently in the wake of the materialization of credit risk that had accumulated and the global financial crisis. Finally, over the last few periods, the IAPR has remained at low levels in consonance with the weak growth of credit and the disappearance of large financial imbalances in credit markets.

Graph B1.3
IAPR



Source: calculations by Banco de la República.

References

- FMI (2017). "Is Growth at Risk?" cap. 3, *Global Financial Stability Report*, pp. 91-118, Oct.
- Adrian, T.; Boyarchenko, N.; Giannone, D. (2017). "Vulnerable Growth", Staff Report, no. 794, Federal Reserve Bank of New York, Nov.
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