

# INDONESIA'S GROWTH-AT-RISK<sup>1</sup>

*Macrofinancial conditions serve as a useful predictor for downside risks to GDP growth ([Adrian and others, 2019](#)). A principal component analysis shows that tighter financial conditions and elevated macrofinancial vulnerability in Indonesia have been associated with a decline in future GDP growth. Using a country-specific financial condition Index and a macrofinancial vulnerability index for Indonesia, the Growth-at-Risk analysis shows that both financial condition and macrofinancial vulnerability index were at a neutral level at end-2018, and that the 2019 GDP growth rate will be most likely to be 5.2 percent, conditional on two neutral indices.*

**1. In a globally integrated financial system, changes in the domestic and global financial conditions and the evolution of macrofinancial vulnerabilities can provide powerful signals about risks to future economic activity** ([Prasad and others, 2019](#)). As in the runup to the global financial crisis, macrofinancial vulnerabilities often increase in buoyant economic conditions when funding is widely available and risks appear subdued. Once these macrofinancial vulnerabilities are sufficiently elevated, a tightening of financial conditions pose significant downside risks to economic activity over the medium term. Thus, tracking the evolution of financial conditions and macrofinancial vulnerabilities can provide valuable information for policymakers regarding risks to future growth and also a basis for targeted preemptive action.

**2. The growth-at-risk (GaR) framework links both financial conditions and macrofinancial vulnerability to the probability distribution of future GDP growth** ([IMF, 2017](#); [IMF, 2018](#)). The GaR framework offers a number of appealing features that enhance macrofinancial surveillance, which has focused on the central forecast. First, it allows to take into consideration the entire growth distribution—reflecting both downside and upside risks—in addition to the central forecast. Second, it provides a framework to analyze key driving factors for future real GDP growth, including their relative importance over different forecasting horizons.<sup>2</sup> Third, it helps quantify the impact of systemic risk on future real GDP growth and the intertemporal tradeoff associated with a tighter macroprudential stance.<sup>3</sup>

**3. The first step of the GaR analysis is to select relevant macrofinancial variables, group them into partitions (i.e., groupings), and estimate a level of financial conditions and macrofinancial vulnerability.** Using partitions instead of individual variables, one can extract common trends among relevant macrofinancial variables and remove idiosyncratic noise, thereby improving the quality of the subsequent analyses. For Indonesia, the team categorizes macrofinancial variables into three partitions: (1) financial conditions; (2) macrofinancial vulnerability; and (3) external factor. Given high exposures of domestic financial sectors to the global financial

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<sup>2</sup> For example, in the near term, loose financial conditions can help support growth. But, over the medium-term, they can induce a build-up of macrofinancial imbalances that could undermine growth down the road.

<sup>3</sup> While such a tightening could induce a short-term slowdown, it could lower the medium-term downside risks to growth with contained macrofinancial vulnerabilities.

market developments, the first partition captures both the domestic and global price of risk embedded in asset prices, the cost of funding, and the degree of domestic and global financial stress. The second partition represents macrofinancial imbalances which develop endogenously and act as potential amplifiers of negative developments of financial conditions. Lastly, given the role of China as the main trading partner, its growth is included as the external factor that influences future growth in Indonesia (Table 1).

<b>Table 1. Indonesia: List of Macrofinancial Variables for GaR Analysis</b>	
Financial conditions	<ul style="list-style-type: none"> <li>• Real long-term interest rates</li> <li>• Term spread</li> <li>• Sovereign spreads</li> <li>• Corporate spreads</li> <li>• CEMBI market cap</li> <li>• Equity returns</li> <li>• Change in foreign exchange rate</li> <li>• VIX</li> </ul>
Macrofinancial vulnerability	<ul style="list-style-type: none"> <li>• Credit growth</li> <li>• Credit gap</li> <li>• NPL ratios in the banking system</li> <li>• Ratio of external debt to GDP</li> <li>• Ratio of currency account balance to GDP</li> <li>• House price growth</li> </ul>
External condition	<ul style="list-style-type: none"> <li>• China's GDP growth</li> </ul>

**4. Financial conditions serve as a useful predictor for downside risks to GDP growth** ([Adrian and others, 2019](#)). Using the principal component analysis (PCA), the financial condition index (FCI) is constructed by extracting the first principal component from a collection of eight financial variables. As shown Figure 1, the FCI is found to be a good leading indicator of GDP. The accompanying factor loadings show that both domestic and external financial conditions (e.g., sovereign spreads and VIX) play an important role in explaining future GDP growth in Indonesia. The Global Financial Crisis is clearly reflected in the FCI by a sharp tightening, and other episodes, such as the taper tantrum in 2013 and the global stock market in 2015, are also noticeable, which reflect well the heavy reliance on capital flows to finance the current account and fiscal deficits.

**5. Financial conditions in Indonesia have tightened to a neutral level at end-2018.** This tightening has been mainly driven by worsening external financial conditions and global trade tensions, whose developments Indonesia remains exposed to. It was also partly contributed by BI's policy rate hikes, which was done as a response to the global market turbulence and the EM sell-off in 2018. However, financial conditions in Indonesia are still at the neutral level by historical standards and are expected to loosen a bit in 2019:Q1, based on growing optimism about U.S.-China trade negotiations and expectations that major central banks would take a more patient

approach to monetary policy normalization. Thus, they would continue to be supportive of growth in the near term for Indonesia.

**6. Macrofinancial vulnerability index (MVI) captures credit boom-bust cycles and macrofinancial imbalances in the housing market and external sector in Indonesia.** The first principal component from a list of slow-moving credit aggregates and sectoral indicators summarizes the level of systemic risk in Indonesia. As shown in Figure 2, current account deficits and credit gap are the two most important variables to explain the level of macrofinancial vulnerability in Indonesia.

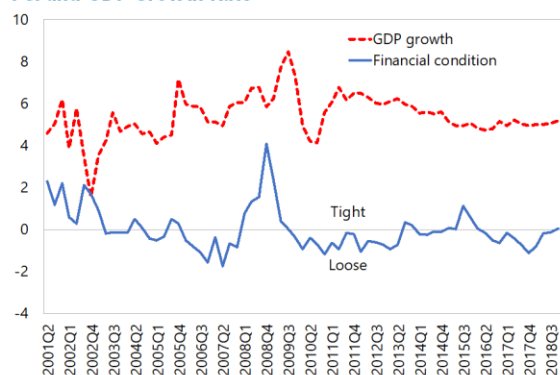
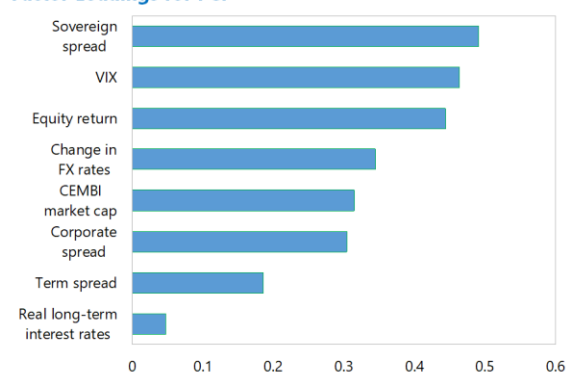
**7. As of end-2018, macrofinancial vulnerability is broadly contained.** Indonesia's external debt is still moderate and sustainable. The credit cycle moved out of a prolonged downturn with credit gap closing, and the banking system remains broadly sound with large capital buffers, strong profitability, and asset quality improvement. However, the vulnerability level turned to slight positive as current account deficits were widened and corporate external debt increased.<sup>4</sup> It can be elevated further if credit, especially to the corporate sector, grows rapidly without reins.

**8. In general, tighter financial conditions and elevated macrofinancial vulnerability are associated with a decline in future GDP growth** (Figure 3). Quantile regressions, which estimate relationships between selected explanatory variables (e.g., financial conditions, macrofinancial vulnerability partition) and quantiles of future GDP growth rates, find that the relationships vary over the forecasting horizon and differ across quantiles in Indonesia. Tight financial conditions are negatively correlated with economic activities in the near term. However, as financial conditions revert to their historical average, they tend to boost growth over the medium term. In contrast, when macrofinancial vulnerability is elevated, risks to future GDP growth is also high not only in the near term but also over the medium term.

**9. Given the neutral financial conditions and macrofinancial vulnerability, the 2019 GDP growth rate is most likely to be 5.2 percent under the baseline** (Figure 4). The distribution of 4-quarter ahead GDP growth is derived by fitting a t-skew distribution to predicted values of the conditional quantile regressions. The predicted growth mode for one-year ahead closely tracks the realized growth, especially since the global financial crisis (the bottom left chart). The GaR at 5 percent is 2.7 percent, implying that there is a 5 percent chance that real GDP in 2019 will grow by at most 2.7 percent. The probability of a recession is less than 1 percent in 2019 (the bottom right chart). The interquartile interval of the GDP forecast ranges from 3.9 to 5.3 percent at the end of 2019, with the mode and median being 5.2 and 4.5 percent.

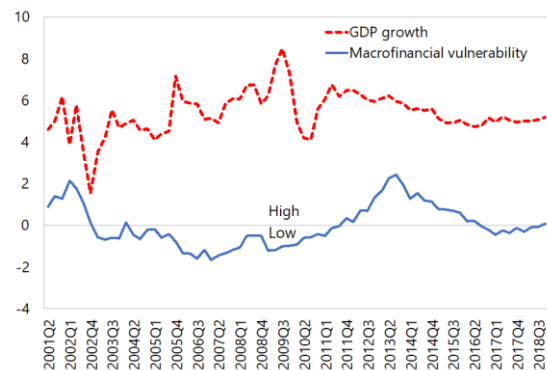
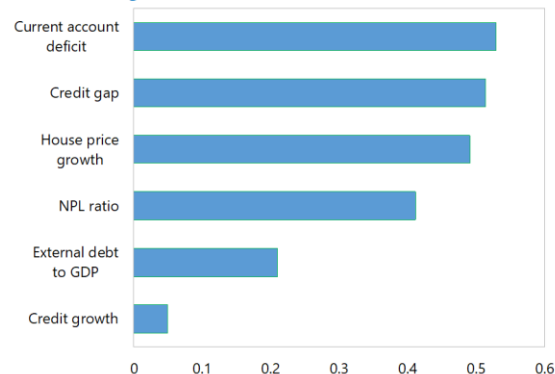
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<sup>4</sup> Current account deficits are expected to gradually narrow over the medium term.

**Figure 1. Indonesia: Financial Condition Index 1/****FCI and GDP Growth Rate****Factor Loadings for FCI**

Source: IMF staff estimates.

1/ The FCI is normalized to have zero mean and a standard deviation of one over 2001–2018.

**Figure 2. Indonesia: Macrofinancial Vulnerability Index 1/****MVI and GDP Growth Rate****Factor Loadings for MVI**

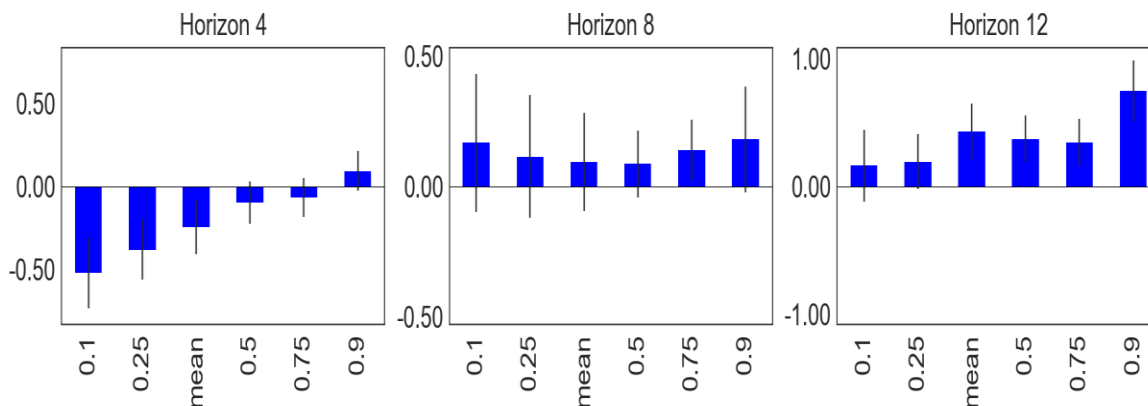
Source: IMF staff estimates.

1/ The MVI is normalized to have zero mean and a standard deviation of one over 2001–2018.

**Figure 3. Indonesia: Quantile Regression Results**

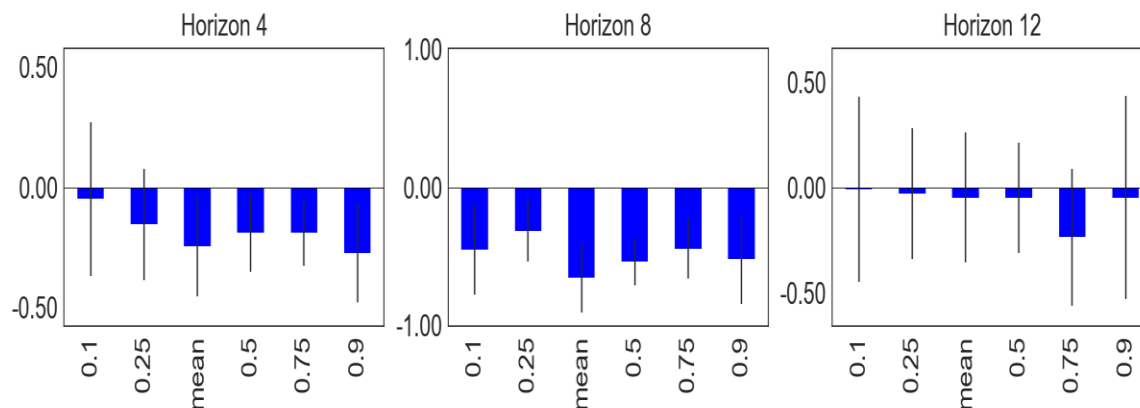
Tighter financial conditions are associated with lower GDP growth in the next year, when economic activity is weak, while they are associated with stronger GDP growth over the medium term.

#### Quantile Regression Coefficient for Financial Conditions over 4-, 8-, and 12-Quarters Ahead



Elevated Macroeconomic vulnerability is associated with weaker growth regardless of the horizon, but the impact of potential shock amplification is larger over the medium term.

#### Quantile Regression Coefficient for Macroeconomic Vulnerability over 4-, 8-, and 12-Quarters Ahead

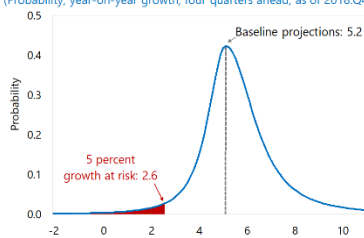


Source: IMF staff estimates.

**Figure 4. Indonesia: Growth-at-Risk Results**

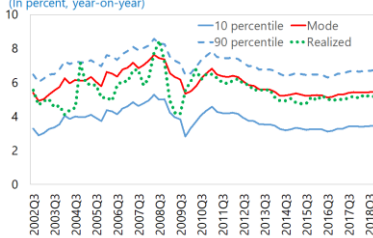
#### Conditional Distribution of the 2019 Real GDP Growth

(Probability, year-on-year growth, four quarters ahead, as of 2018:Q4)



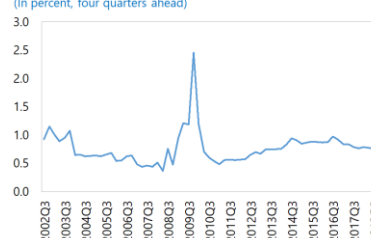
#### Forecasted GDP Growth Distribution

(In percent, year-on-year)



#### Probability of Recession

(In percent, four quarters ahead)



Source: IMF staff estimates.

## Appendix I. Data Source

Variables	Description	Source
Change in Long-Term Real Interest Rate	Percentage point change in the 10-year government bond yield, adjusted for inflation	Bloomberg Finance L.P.; IMF staff estimates
Term Spreads	Yield on 10-year government bonds minus yield on 1-year government bonds	Bloomberg Finance L.P.; IMF staff estimates
Sovereign Spreads	Yield on 10-year Indonesia government bonds minus yield on 10-year U.S. government bonds	Bloomberg Finance L.P.; IMF staff estimates
Corporate Spreads	Commercial banks' lending rates for corporate working capital minus interbank interest rate	CEIC data Co.; IMF staff estimates
CEMBI market cap	Market capitalization of Indonesia corporate debt securities in CEMBI	Bloomberg Finance L.P.
Equity Returns (local currency)	Log difference of the Jakarta stock market index	Bloomberg Finance L.P.
Exchange Rate Movements	Change in U.S. dollar per national currency exchange rate.	Bloomberg Finance L.P.; IMF staff estimates.
CBOE Volatility Index (VIX)	A measure of expected price fluctuations in the S&P 500 Index options over the next 30 days	Bloomberg Finance L.P.
Credit Growth	Year-on-year growth rate of loans to private sectors	CEIC data Co.; IMF staff estimates
Credit Gap	the difference between the credit-to-GDP ratio and its long-term trend, which is estimated with one-sided HP filter	CEIC data Co.; IMF staff estimates
NPL Ratio	Ratio of nonperforming loans to total loans in the banking system	Haver Analytics; IMF staff estimates
External Debt to GDP	Ratio of external debts to GDP	Haver Analytics; IMF staff estimates
Currency Account Deficits (relative to GDP)	Ratio of current account deficits to GDP	Haver Analytics; IMF staff estimates
House Price growth	Year-on-year growth rate of residential property price index	Haver Analytics; IMF staff estimates
Real GDP Growth for Indonesia	Percent change in GDP at constant prices for Indonesia	IMF, World Economic Outlook database
Real GDP Growth for China	Percent change in GDP at constant prices for China	IMF, World Economic Outlook database

## Appendix II. Parametric Estimation of Future Growth Distribution

### *Estimation of the Conditional Quantiles*

For a set of horizons  $h \in \{4, 8, 12\}$  where  $h$  represents the quarters ahead, the following specifications are estimated:

$$y_{t+h} = \alpha^\tau + \sum_{i \in I} \beta_i^\tau X_{i,t} + \varepsilon_{i,t}^\tau$$

Where  $y_{t+h}$  represents future GDP growth  $h$  quarters ahead,  $X_{i,t}$  is the partition  $i$  (financial condition, macrofinancial vulnerability, and external factor),  $\beta_i^\tau$  the coefficient of the  $\tau$  quantile regression,  $\alpha^\tau$  the associated constant and  $\varepsilon_{i,t}^\tau$  the residual. The quantile regressions are estimated at different points of the distribution of  $y_{t+h}$ ,  $\tau \in \{10, 25, 50, 75, 90\}$ . A quantile regression at the 10<sup>th</sup> percentile would estimate a relationship when GDP growth is relatively weak, while a quantile regression at the 90<sup>th</sup> percentile would show one when growth is strong. Using quantile regressions for estimating the conditional distribution has many advantages: first, under standard assumptions, quantile regressions provides the best unbiased linear estimator for the conditional quantile; second, quantile regressions are robust to outliers. Finally, the asymptotic properties of the quantile regression estimator are well-known and easy to derive.

### *Parametric Fit of the Conditional Distribution of Future GDP Growth*

The conditional quantiles are sufficient statistics for describing the full conditional cumulative distribution function (CDF). From the CDF, we derive the probability distribution function using a parametric method to fit the conditional quantiles for the sake of robustness with regards to quantiles crossing and extreme quantiles estimation. Following Adrian and others (2016), a parametric t-skew fit is used to represent more accurately fatter tails. The skew version of the t-distribution is useful to model tail events, given that most of the macro-financial variables present this feature.

Fitting the CDF estimated from the quantile regressions represents another robust dimensionality reduction, after the data partitioning presented above. The Student t-skew distribution is fully characterized by five parameters (location/mode, degree of freedom, scale/variance, kurtosis, and skewness) which represents a good compromise between describing the distribution as accurately as possible and keeping a low number of parameters to avoid over-fitting.

The estimation of the t-skew distribution parameters is done in two different steps. First, degrees of freedom are computed directly while the mean parameter of the conditional distribution can be retrieved from OLS fit, with the same specification as the quantile regressions:

$$mu^* = g(E[y_{t+h}|\{X_i\}_{i \in P}]) = g(\hat{\alpha}^{OLS} + \sum_{i \in I} \hat{\beta}_i^{OLS} X_{i,t})$$

Second, the sigma, the kurtosis, and the skewness, which are truly the quantities of interest, are estimated via the following minimization program:

$$\begin{aligned}
& \sigma^*, \text{skew}^*, \text{kurtosis}^* \\
& = \underset{\tau}{\operatorname{argmin}} \left[ \sum [tskew.quantile(\tau, \mu^*, df^*, \sigma, \text{skew}, \text{kurtosis}) \right. \\
& \quad \left. - Q(y_{t+h}, \tau | \{X_i\}_{i \in P})]^2 \right]
\end{aligned}$$

Once the optimal three t-skew parameters have been estimated from the conditional quantiles, it is straightforward to derive the fitted t-skew cdf and pdf, therefore allowing to estimate the associated Growth-at-Risk.



## References

- Adrian, Tobias, Nina Boyarchenko, and Domenico Giannone, 2019, "Vulnerable Growth," *American Economic Review*, Vol. 109, No. 4, April.
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