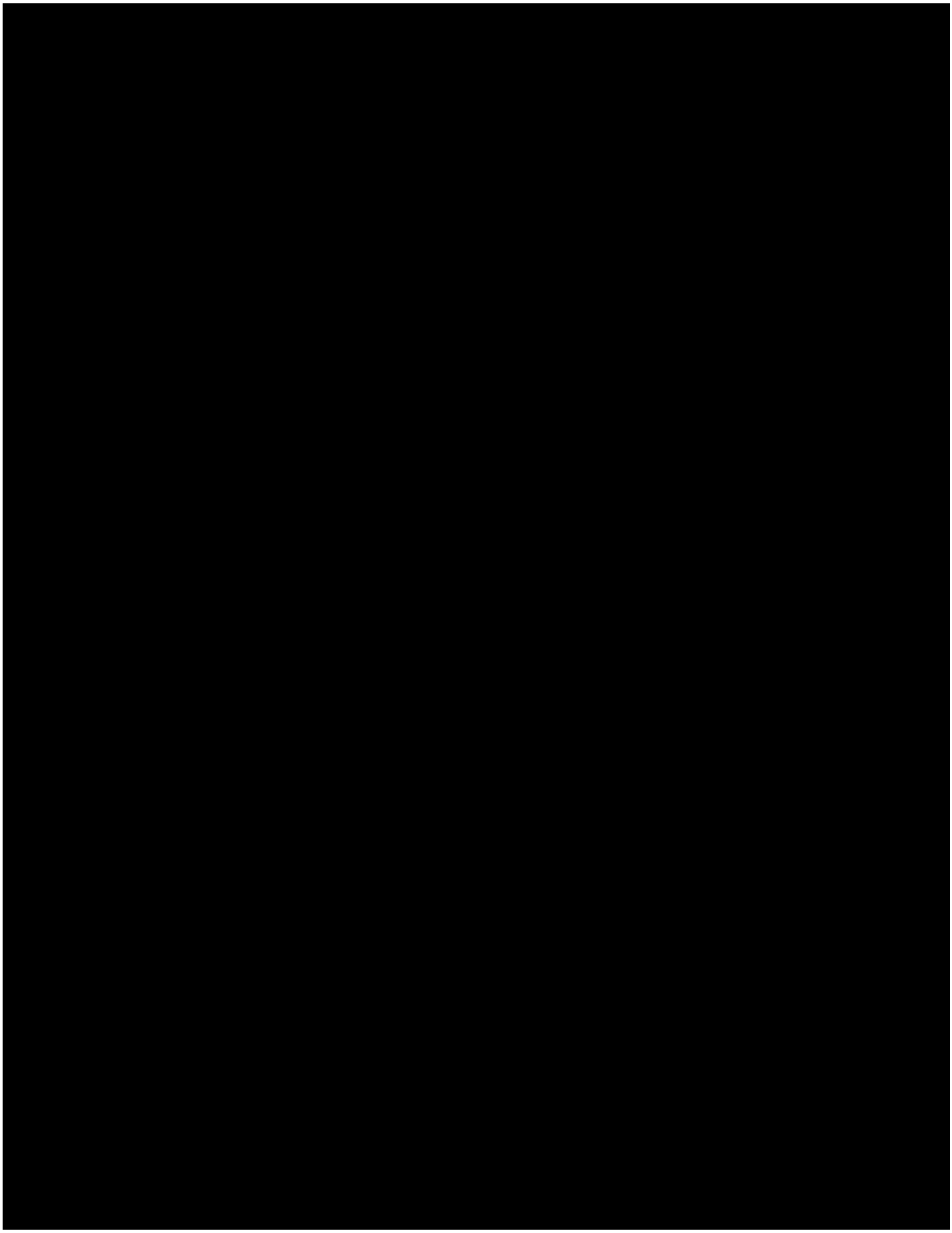

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Assessing Corporate Vulnerabilities in Indonesia: A Bottom-Up Default Analysis

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Authorized for distribution by Luis E. Breuer[1]

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Abstract

Under adverse macroeconomic conditions, the potential realization of corporate sector vulnerabilities could pose major risks to the economy. This paper assesses corporate vulnerabilities in Indonesia by using a Bottom-Up Default Analysis (BuDA) approach, which allows projecting corporate probabilities of default (PDs) under different macroeconomic scenarios. In particular, a protracted recession and the ensuing currency depreciation could erode buffers on corporate balance sheets, pushing up the probabilities of default (PDs) in the corporate sector to the high levels observed during the Global Financial Crisis. While this is a low-probability scenario, the results suggest the need to closely monitor vulnerabilities and strengthen contingency plans.

JEL Classification Numbers: C52, C63, G10

Keywords: Corporate sector, bottom-up default analysis, default risk, scenario analysis, simulation, Indonesia, hazard rate models

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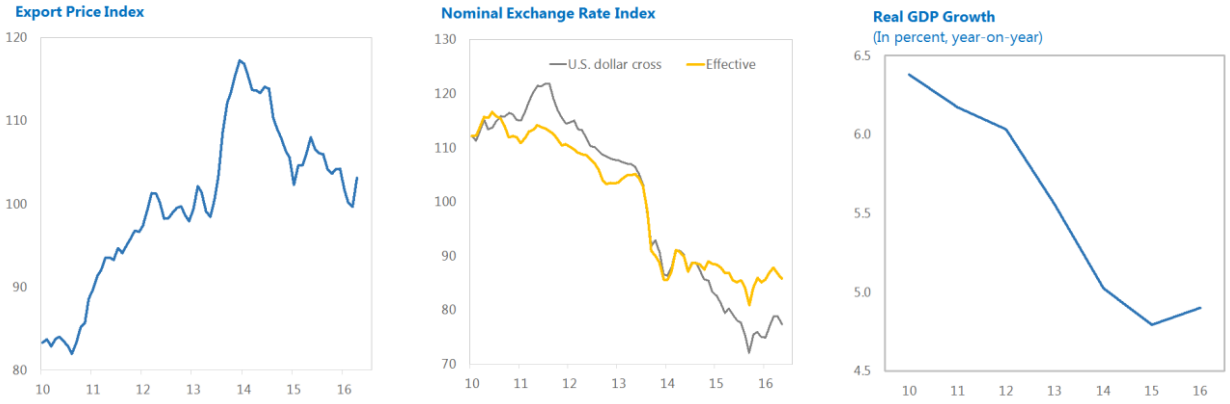
Content

I. INTRODUCTION[2]

There has been a steady rise in corporate debt in emerging market economies during the past decade. The trend accelerated in the aftermath of the Global Financial Crisis, as lower yields in advanced economies amid unconventional monetary policy increased investors' demand for emerging markets (EM) assets, especially corporate debt. A rapid leverage-build up and subsequent deleveraging, if an economy is buffeted by adverse economic shocks, is a potential risk that requires a close monitoring by policy institutions (Acharya and others, 2015; IMF, 2015).

This paper assesses the vulnerabilities that could be potentially present in the non-financial corporate sector in Indonesia. Indonesia's macroeconomic performance has moderated in the past several years, affected by ongoing shifts in the global economy related to lower growth and rebalancing in China and a severe down-cycle in commodity prices, which also had a negative impact on peer economies (Figure 1). Real GDP growth is estimated to have decelerated from 6.4 percent year on year in 2010 to around 5 percent in 2016, notwithstanding a moderate rebound from 2015. The growth deceleration was due mainly to unfavorable commodity price developments, which have pushed the nation's export prices by nearly 15 percent from their peak in end 2013/early 2014. Since 2014, the exchange rate has remained broadly unchanged in real effective terms but depreciated more than 10 percent against the U.S. dollar.

Figure 1. Indonesia: Indicators of External and Real Sector Performance 1/



Source: Haver Analytics; and authors' calculations.
1/ Period average=100 for export price and nominal exchange rate index.

Despite the weakened growth, corporate leverage increased, notably in foreign currency. Rising corporate leverage amid easy global monetary conditions is not unique to Indonesia,

[2] This paper extends the analysis in Indonesia Selected Issues Paper (IMF Country Report No. 16/82) issued in March 2016, and uses available data at the time of the publication. Corporate data cover listed corporates.

however. The corporate debt of nonfinancial firms across major emerging market economies quadrupled between 2004 and 2014 (IMF, 2015).

At the same time, the composition of corporate debt has shifted away from loans and toward bonds in EMs. Greater leverage can be used for investment to boost economic growth but also raised concerns as financial crises in EMs have been preceded by rapid leverage growth. Rising leverage could expose corporates to interest rate and currency risks unless these positions are adequately hedged (Chui and others, 2014). The sheer variety of forms and channels for dollar borrowing can make for different vulnerabilities (McCauley and others, 2015).

Against this backdrop, this paper assesses corporate sector vulnerabilities in Indonesia under plausible, low-probability adverse economic scenarios. The analysis relies on the Bottom-Up Default Analysis (BuDA) framework advanced by Duan, Miao, and Chan-Lau (2015), and currently implemented by the Credit Research Initiative at the Risk Management Institute, National University of Singapore. The BuDA framework exploits the information contained in equity prices together with balance-sheet indicators of profitability and liquidity, among others, to examine how macroeconomic conditions affect corporate probabilities of default (PDs). This approach complements those on debt service capacity (Chow, 2015), and improves on other market-based approaches, such as that of Dwyer and others (2004).

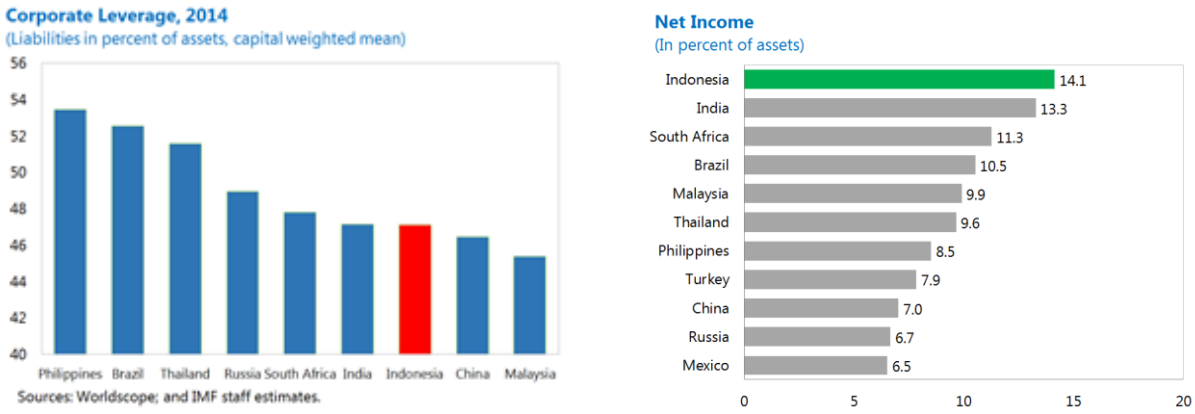
Our analysis suggests risks in the corporate sector are manageable even if the economy were hit by a protracted recession accompanied by a large currency depreciation, reflecting a relative low ratio of aggregate corporate debt to GDP. The qualitative assessment also indicates that on a system-wide basis, near-term refinancing risk is low; and the authorities have been proactive in monitoring corporate vulnerabilities and encouraging proper currency risk management by implementing hedging regulations.

The organization of the remainder of the paper is as follows. Section II discusses key facts about the corporate sector by exploiting a range of macroeconomic and financial market data and by assessing debt repayment capacity. Section III describes the BuDA framework, and Section IV applies it to Indonesia. Section V concludes, describing the results in more detail and advancing a few policy recommendations.

II. Corporate Performance and External Debt Risk in Indonesia

Indonesia's corporate sector remains relatively strong and sound compared to its EM peers. First, aggregate corporate leverage is relatively low, evidenced by the fact that Indonesia's liabilities-to-asset ratio is below that of many EM peers (Figure 2). Many corporates in Indonesia also tend to rely on internal cash flows for funding rather than external financing. Second, corporate profitability is very high. Net income was about 14 percent of total assets in 2014, the highest among the EM peers (Figure 2).

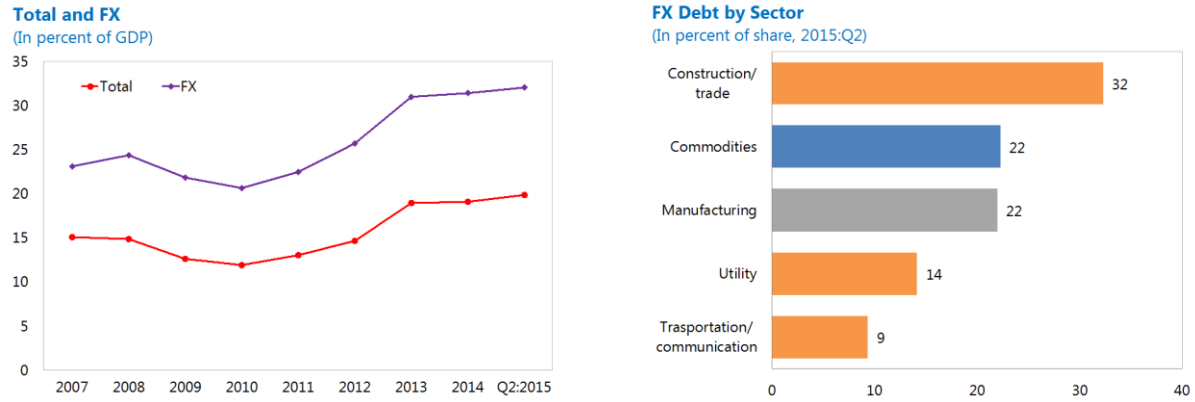
Figure 2. Corporate Leverage and Profitability in Emerging Markets, 2014 1/



Sources: Worldscope; Bloomberg L.P.; Datastream; and authors' calculations.
1/ Net income of listed companies, capitalization-weighted average.

Nonetheless, risks started to emerge as foreign currency (FX) denominated corporates debt increased rapidly over the past years. FX corporate debt (including that owned to domestic banks) doubled from 2010, reaching around 20 percent of GDP in the second quarter of 2015 (Figure 3). The level remains relatively low but the fast pace of increases could be a risk factor. Around 90 percent of debt securities issued in 2014 were FX denominated, and FX debt now accounts for around 60 percent of the total corporate debt. Looking at the distribution, FX corporate debt is concentrated in the commodities and selected non-tradable sectors (Figure 3). FX debt issuance moderated in 2015, after supply (i.e., higher risk aversion towards EMs generally) and demand (i.e., weak private investment amid the prolonged commodity down cycle) factors both weakened. However, external borrowing could accelerate, as infrastructure spending is expected to rise in the coming years, driven by the government's push for economic development.

Figure 3. Indonesia: Corporate Debt by Currency and Sector



Sources: Bank Indonesia; CEIC; and authors' calculations.

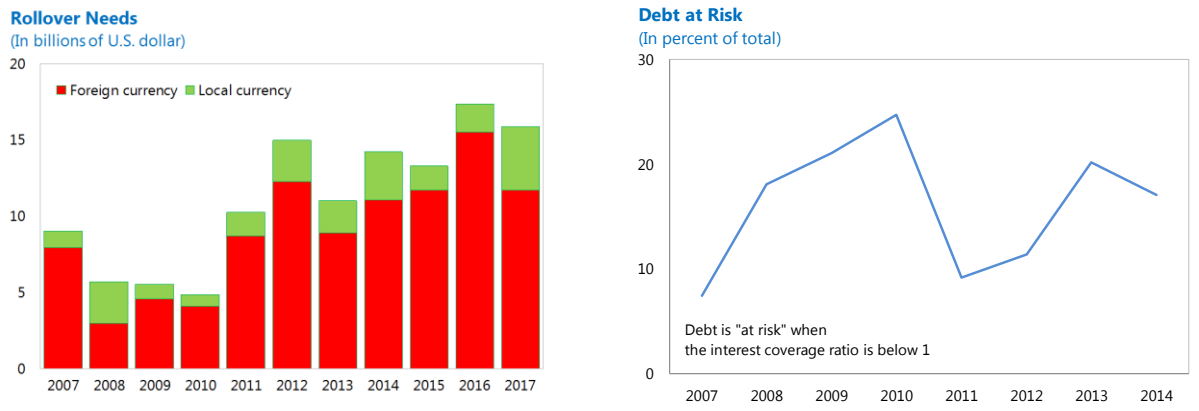
Looking ahead, several risks need to be monitored carefully if commodity prices remain subdued and the rupiah weak. These are currency mismatches, refinancing risk, and default risk (Figure 4).

- *Currency mismatches*: A portion of the FX debt is estimated to be unhedged partly as hedge costs are generally high. While Bank Indonesia (BI)'s hedging regulations have helped corporates manage currency risk (see Box), some corporates have only partial hedge positions, given high hedging costs. Other corporates are appeared to be using derivatives instruments which knock out at a certain level. Thus, if the rupiah depreciates substantially, FX exposure is likely to jump, causing losses and leading to a default.

- *Refinancing risk*: Rollover needs of FX debt securities are set to rise in 2016 and a large proportion of maturing debt is leveraged or high-yield. The capacity of those corporates to rollover could be adversely affected by BI's new requirements that only corporates with investment grade credit ratings can issue FX debt starting from 2016. However, there are mitigating factors: two-thirds of non-bank private corporates' external debt maturing within a year is owned to affiliates and, despite peaking, the rollover needs within a year appear manageable.

- *Default risks*: The interest coverage ratio has fallen sharply, with a fifth of the sector witnessing the interest coverage ratio falling below 1.[3] Corporates in the resource sector were under the most pressure, while some corporates faced increased default risks in the past few years. This is mirrored in a recent rise in nonperforming loans (NPLs) and special mention loans in the banking system.

Figure 4. Indonesia: Corporate Debt Rollover Needs and Interest Coverage



Sources: Bank Indonesia; Dealogic; Orbis; and authors' calculations.

[3] The interest coverage ratio is calculated by dividing a firm's earnings before interest and taxes (EBIT) by the firm's interest expenses for the same period. Bank Indonesia's analysis shows that ICR is above 1 for all economic sectors due likely to differences in methodology and data sources.

Box 1. Bank Indonesia's Foreign Exchange Regulations on Corporates

FX regulations. To encourage corporates with external debt to enhance risk management, BI introduced a set of prudential measures in October 2014.

- *Hedging ratio*. The hedging ratio is defined as the ratio between the total value hedged and the net short-term foreign liability position. The minimum hedging ratio is 20 percent for 2015 and 25 percent for 2016, and is applied to the net foreign currency liabilities with a maturity period up to three months, and those that mature between three and six months. Exemptions are made for export-oriented corporates—corporates with a ratio of export revenue to total revenue exceeding 50 percent of the previous calendar year—with financial statements issued in U.S. dollars.

Indonesia: Bank Indonesia's Foreign Exchange (FX) Regulations on Corporates

	Phase 1 2015	Phase 2 2016	Phase 3 2017 onwards
Object of regulation	Governs all foreign currency debt		
Hedge ratio ? 3 months 3-6 months	 20 percent 20 percent	 25 perent 25 percent	
Liquidity ratio (? 3 months)	50 percent	70 percent	
Credit rating	Not applicable	Minimum rating of BB-	
Counterpart of hedging transaction	Not necessarily be done with a bank in Indonesia		Must be done with a bank in Indonesia
Sanctions	As of 2015:Q4	Administrative sanctions will be imposed	

Source: Bank Indonesia.

- *Liquidity ratio.* The liquidity ratio is defined as the ratio between short-term foreign currency assets and short-term foreign currency liabilities. The minimum ratio is 50 percent for 2015 and 70 percent for 2016.

- *Credit rating requirement.* Nonbank corporates should have a credit rating of no less than BB or equivalent issued by an authorized rating agency, including Moody's (Ba3), S&P (BB-), and Fitch (BB-). The validity of the credit rating is up to two years. Corporates can use a parent company's credit rating for the external debt of parent companies or external debt secured by parent companies. Exemptions are made for external debt related to infrastructure projects, external debt secured by multilateral institutions, refinancing, and trade credit.

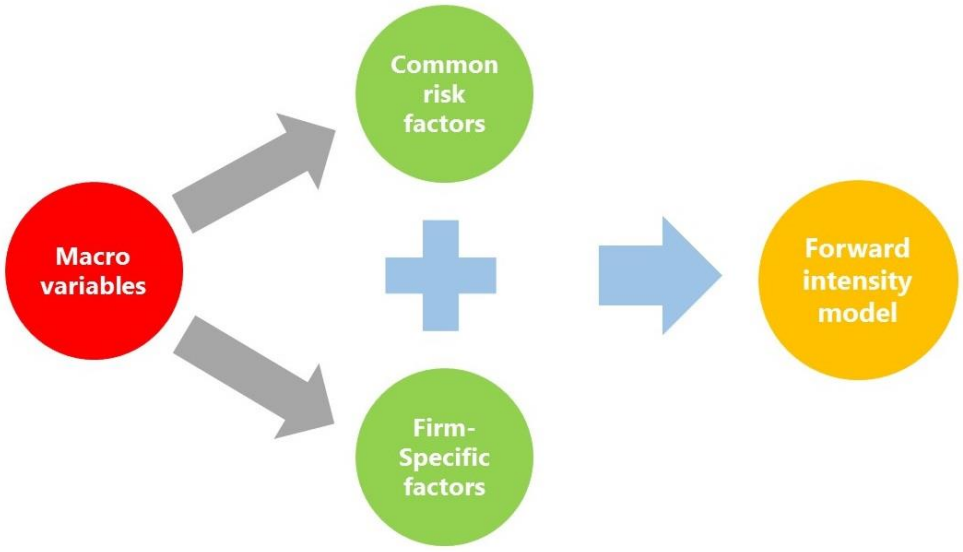
Reporting requirement. BI has also strengthened monitoring on external borrowing of corporates. Corporates with external borrowing should submit quarterly reports to BI regarding their hedging and liquidity ratios for each quarter, starting from 2015. The report covers a corporate's hedging ratio, liquidity ratio, and credit rating, and all supporting documentation.

Sanctions. To implement these regulations effectively, BI will impose administrative sanctions from 2016, in the form of warning letters to "related parties" in the transactions, including to the lenders which are providing the non-compliant debt, the Ministry of Finance, the Minister of State Owned Enterprises (in the case of borrowers that are state-owned enterprises), the Financial Services Authority (OJK) and the Indonesia Stock Exchange (in the case of listed-company borrowers).

III. Bottom-Up Scenario Analysis of Corporate Default Probability

This section provides a bottom-up forward-looking assessment of corporate sector vulnerabilities. In a nutshell, corporate default probabilities are projected under different macroeconomic assumptions via both economy-wide and firm-specific risk factors selected as risk transmission channel. These risk factors are assumed to be influenced by the macroeconomic variables and serves as input to the forward intensity model to produce default probabilities of individual firms. The schematic is shown in Figure 5.

Figure 5. Schematic of Bottom-Up Scenario Analysis



Projection of PDs Using the Bottom-Up Default Analysis (BuDA) Framework

PDs of individual firms under different macroeconomic scenarios are calculated upon the projection of economy-wide and firm-specific risk factors. The projection is obtained by BuDA, a Bottom-Up Default Analysis platform jointly developed by researchers from the Credit Research Initiative (CRI) at the Risk Management Institute, National University of Singapore (NUS-RMI) and the International Monetary Fund, with the active support of the CRI team (Duan, Miao and Chan-Lau, 2015). [4]

BuDA builds up on three key elements. First, the forward intensity model of Duan, Sun, and Wang (2012) for multiperiod corporate default prediction; second, the stress-testing regression (risk-factor forecasting regression) coupled with a sensible way of handling mix-frequency data for parameter estimation in Duan, Miao, and Wang (2014); and third, the CRI

[4] The BuDA platform serves to support applied economic surveillance work. See for instance, Chapter 3 in IMF (2015), and Chapter 2 in IMF (2016).

(continued…)

database of the economy-wide and firm-specific risk factors that covers over 60,000 exchange-listed firms in 119 economies around the world.[5]

BuDA follows a two-step approach to project PDs of individual firms in a given economy and industrial sector:

- In the first step, conditional on the paths of the economic and financial variables included in the macroeconomic scenarios, BuDA simulates paths by using the estimated risk-factor forecasting regression model for a set of economy-wide and firm-specific risk factors proven effective for predicting default risk at the firm level.

- In the second step, conditional on the simulated paths of the risk factors, BuDA generates simulated paths for individual firm's PDs via the Duan-Sun-Wang (DSW) forward intensity model calibrated by the CRI.

The Matlab implementation of BuDA integrates the dataset and models' computation engines required in these two steps.

The risk factors

Results by Duan, Sun, and Wang (2012) narrow the choice of risk factors for default prediction in the United States to a set of twelve variables. These twelve variables are then used by the CRI default prediction system and have been proven very effective so far for economies around the world including Indonesia. The economy-wide risk factors are the domestic stock index return, and a representative short-term interest rate. The remaining ten risk factors come from six firm-specific attributes, four of which are used in terms of both level and trend. Two firm-specific attributes are financial-statement based, namely liquidity and profitability; while the other four are market-based, namely volatility-adjusted leverage,[6] relative size, market misvaluation and idiosyncratic volatility. Table 1 presents all the risk factors used in BuDA.

[5] The firm-specific factors selected for BuDA provide the best fit to the data, among a large number of different firm-specific factors initially tested guided by theory and practice. While the paper focuses on one-year ahead PDs, the model performs well in forecasting default events up to a five-year horizon. The model maximizes a quasi-likelihood function calibrated using data for thousands of firms in emerging economies. Information on interconnectedness, which could be useful to further refine the model, is not available for all the countries and firms included in the estimation.

[6] See Duan and Wang (2012) for detail on volatility-adjusted leverage.

Table 1. Economy-Wide and Firm-Specific Risk Factors

Nature	Description	Level/Trend 1/ 2/
Economy-wide	Return of domestic stock market index	Current
	Short-term domestic interest rate	Current
Firm-specific	Financial statements-based factors	
	Liquidity (cash + short-term investments/total assets)	Trend and level
	Profitability (Net income/total assets)	Trend and level
	Market-based factors	
	Distance-to-default (volatility adjusted leverage) 3/	Trend and Level
	Size (market capitalization relative to median market capitalization)	Trend and Level
	Market misvaluation (market cap + total liabilities/ total assets) 3/	Current
	Idiosyncratic volatility	Current

1/ The level is computed as the 12-month average value of the factor.
2/ The trend is computed as the difference between the current value of the factor and its 12-month average
3/ These indicators are constructed using both market and financial statement information.

Liquidity is measured as the ratio of cash and short-term investments to total assets; and profitability is measured as the ratio of net income to total assets. Both measures of liquidity and profitability use publicly available data and easy to construct. The measure of the volatility-adjusted leverage is the distance-to-default (DTD), estimated using the Merton-based structural default prediction model (1974) with the KMV assumption (Crosbie and Bohn, 2002) on the debt maturity and size. In contrast to the traditional DTD, the one used in BuDA corrects for the higher leverage financial firms exhibit relative to non-financial firms, following Duan, Sun and Wang (2012).

The relative size of the firm is set equal to the natural logarithm of the ratio of the market capitalization of the firm to the median market capitalization of the firms in the economy. Larger firms are less likely to default than smaller firms are. Market misvaluation is measured as the market-to-book asset ratio. Finally, the idiosyncratic volatility of a firm is set equal to the standard deviation of the residuals obtained after regressing a firm's equity returns on the returns of the domestic market index.

The risk-factor forecasting regression

One of the features of the BuDA platform is a module that forecasts risk factors conditional on a set of macroeconomic and financial variables. To analyze corporate sector vulnerability, BuDA typically involves many firms of consideration, up to over 60,000 worldwide. Attempting to estimate individual equations for each firm-specific risk factor for each individual firm rapidly results in severe high-dimensional issue for parameter estimation,

Instead of estimating individual equations, BuDA follows the two-stage regression approach in Duan, Miao, and Wang (2014) for forecasting firm-specific risk factors. In the first stage, it forecasts the average value of the firm-specific risk factor for all firms in a given industrial group of the economy using a regression of the form:

$$\Delta\bar{Y}_{i,j,t} = \beta^{Y}_{i,j,0} + \sum_{i=1}^{n} \beta^{Y}_{i,j,k} Z_{k,t} + \sum_{j=1}^{p} \gamma^{Y}_{i,j,p}\, \bar{Y}_{i,j,t-p} + \epsilon^{Y}_{i,j,t}, \quad (1)$$

where $\bar{Y}_{i,j,t}$ is the *i*-th country-industry average of the *j*-th firm-specific risk factor at time *t*, $Z_{k,t}$ is the *k*-th economic or financial variable included in the macroeconomic scenario, Δ is the one-period difference operator, and $\epsilon^{Y}_{i,j,t}$ is the error term or innovation.[7]

Similarly, the regression equations for the economy-wide factors in each economy are of the form:

$$\Delta X_{m,t} = \beta^{X}_{m,0} + \sum_{i=1}^{n} \beta^{X}_{m,k} Z_{k,t} + \sum_{j=1}^{p} \gamma^{X}_{m,p}\, X_{m,t-p} + \epsilon^{X}_{m,t}, \quad (2)$$

where $X_{m,t}$ is the *m*-th economy-wide risk factor, and $\epsilon^{X}_{m,t}$ is the error term or innovation.

Note that in equations (1) and (2) the sample frequency of the risk factors is monthly while that of some of the economic variables is quarterly. It is not possible to use the mixed-data sampling (MIDAS) regression (Ghysels, Sinko, and Valkanov, 2007), since it does not accommodate the case of a dependent variable sampled at a higher frequency than the explanatory variables. A suitable interpolation converting data from quarterly to monthly could help but the estimation bias may arise. To mitigate the estimation bias, BuDA deduces from equations (1) and (2) to a time-aggregated form that allows for maximum likelihood estimation.[8]

After estimating the time-aggregated form of equations (1) and (2), the second stage involves modeling the "distance" of individual firms to their industry averages for each firm-specific risk factor. The distance is the difference between a firm's value and its industry average value:

$$d\left(Y^{k}_{i,j,t}, \bar{Y}_{i,j,t}\right) = Y^{k}_{i,j,t} - \bar{Y}_{i,j,t}, \quad (3)$$

where $Y^{k}_{i,j,t}$ denotes the value of the *j*-th firm-specific factor of firm *k* in the *i*-th industry, and $\bar{Y}_{i,j,t}$ denotes the *i*-th industry average value of the *j*-th firm-specific factor. BuDA assumes

[7] The use of the country average factor is analogous to the use of the market return in the CAPM model. For instance, in the latter model, the returns of an individual firm are regressed on the returns of the aggregated market, to which the individual firm contributes. In this case, for the risk factors, we use the country average as a common risk factor, and model firm-specific deviations from it.

[8] See Duan, Miao, and Wang (2014) for details. The default settings in BuDA, used in our analysis, are twelve-month aggregation, and the use of two lags of the dependent variable in equations (1) and (2).

[6] The "LASSO-OLS hybrid" is originated from the "LARS-OLS hybrid" proposed by Efron, Hastie, Johnstone, and Tibshirani (2004), with the variable selection in the first step replaced from LARS to LASSO. LARS is short for least angle regression, an efficient model selection algorithm; while LASSO is short for least absolute shrinkage and selection operator, a model selection method. A simple modification of the LARS implements the LASSO. BuDA uses *AR* (*3*) by default.

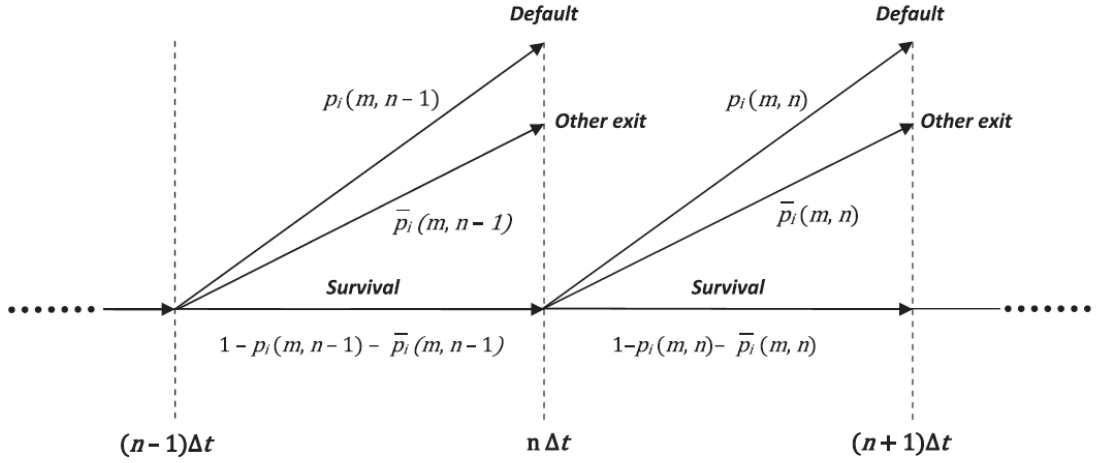
the distance follows an autoregressive process of order *p*, *AR* (*p*), estimated over a two-year moving window. To reduce potential biases, BuDA uses the so-called LASSO-OLS hybrid to estimate the autoregressive process.[6] The LASSO-OLS hybrid uses LASSO for model selection and OLS for coefficient estimation.

The Duan-Sun-Wang (DSW) Forward Intensity Model

BuDA uses the DSW forward intensity model to calculate PDs of individual firms using the risk factors as input based on a forward time structure. The DSW model is a reduced form model, more specifically, a doubly stochastic Poisson intensity model operating on forward time instead of spot time as in Duffie, Saita and Wan (2007). It has the advantage, however, of not having to introduce an auxiliary model for state variables, which inevitably has a dimensionality many times higher than the number of firms. In short, the DSW model allows predicting the PD of a firm at different horizons using only as inputs the current value of the risk factors at the time of default prediction.

Contrary to earlier default prediction models, the DSW model takes into account a firm's exit for reasons other than default such as merges and acquisitions. This is an important but somewhat neglected feature: the "survival" of a public firm requires that the firm remains listed in the exchange and has not defaulted. Since exit for other reasons greatly exceeds the number of defaults, an accurate default prediction model should accommodate the two competing risks of both default and other exit.

Figure 6. Default-Other Exit-Survival Tree for Firm *i*, Viewed from Time $t = m\Delta t$



The default and other exit are modeled using two independent Poisson processes, each with their own intensity function where the risk factors serve as inputs. This assumption allows for the realization of only one of three possible states at any point in time: survival, default, or other exit.

Figure 6 illustrates this situation in a discrete time framework, where $p_i(m, n-1)$ and $\bar{p}_i(m, n-1)$ are the probabilities that the firm exits due to default or other reasons between periods (n-1) Δt and $n\,\Delta t$ respectively. The figure highlights the dependence on past probabilities. For instance, the probability that the firm defaults between periods (n-1) Δt and $n\,\Delta t$ measured at time $m\Delta t$ is:

$$\text{Prob}_{t=m\Delta t}[\tau_i = n, \tau_i < \bar{\tau}_i] = p_i(m, n-1) \prod_{j=m}^{n-2} [1 - p_i(m, j) - \bar{p}_i(m, j)] , \qquad (4)$$

where τ_i and $\bar{\tau}_i$ are the default time and other exit time measured in months. The cumulative default probability of defaulting at or before $n\,\Delta t$ at time $m\Delta t$ is:

$$\text{Prob}_{t=m\Delta t}[m < \tau_i \leq n, \tau_i < \bar{\tau}_i] = \sum_{k=m}^{n-1} \{ p_i(m, k) \prod_{j=m}^{n-2} [1 - p_i(m, j) - \bar{p}_i(m, j)] \}. \qquad (5)$$

For modeling purposes, the conditional probabilities of default and other exit are functions of their forward intensities, $h_i(m, n)$ and $\bar{h}_i(m, j)$, respectively:

$$p_i(m, n) = 1 - \exp[-\Delta t\, h_i(m, n)], \qquad (6)$$

$$\bar{p}_i(m, n) = \exp[-\Delta t\, h_i(m, n)] \left[1 - \exp[-\Delta t\, \bar{h}_i(m, n)]\right], \qquad (7)$$

and where the forward intensities are exponentials of an affine function of the risk factors:

$$h_i(m, n) = \exp[\beta(n - m).Z_i(m)], \qquad (8)$$

$$\bar{h}_i(m, n) = \exp\left[\bar{\beta}(n - m).Z_i(m)\right], \qquad (9)$$

and β and $\bar{\beta}$ are coefficient vectors dependent on the number of months between the observation date and the beginning of the forward period (n-m), and $Z_i(m)$ is a vector collecting the economy-wide and firm specific risk factors together with a unit vector, i.e. $Z_i(m) = (1, X(m), Y_i(m))$.

BuDA estimates PDs for horizons ranging from 1 month to 60 months, which requires estimating one set of coefficients β and $\bar{\beta}$, for each horizon, for sixty sets, one for each horizon. To keep the estimation tractable, the coefficients are constrained to follow Nelson-Siegel functional form of the forward-starting time. The sequential Monte Carlo pseudo-Bayesian estimation method developed in Duan and Fulop (2013) yields the parameters after pooling firms together in combined geographical regions, based on similar stages of development and geographical location. For example, in the case of Latin American economies, the estimation of the model uses pooled data including firms in the region as well as in emerging Asia Pacific, the Middle East, and Africa. For details on the estimation method and individual economies included in the estimation groups, see RMI-CRI Technical Report (2015).

The Simulation-Based Projection of PDs

BuDA simulates PD projections of different predication horizons for the period covered by the macroeconomic scenarios. Specifically, to generate one simulation of the PD paths for a sample of firms, BuDA uses the estimated equations (1-3) to generate paths for the economy-wide risk factors as well as for each firm-specific risk factors under the prescribed macroeconomic scenario. These simulated risk factors are then used as input in the DSW forward intensity model to generate PD projections for the sample of firms. For each simulation round, BuDA calculates the median of the PDs for the sample of firms, and then reports its average across simulations, as well as other percentiles. The calculations reported here use the average value of median PD projections. The accuracy of the PD model in predicting future corporate defaults in emerging markets is high.[9]

IV. CASE STUDY: INDONESIA

The variables used for the scenario analysis for Indonesia are summarized in Table 2. Macroeconomic conditions are characterized by variables commonly used in the literature of stress testing. GDP growth proxies for the growth in incomes and earnings of firms. Unemployment rate affects the consumption and spending of households and in turn corporate sales. Inflation can signal macroeconomic uncertainty, as high inflation raises costs and impairs credit quality but also reduces real debt burden. Exchange rate performance affects firms through net exports and balance sheet channels. Short-term interest rates are an indicator of the cost of funding for corporates. Common risk factors are the domestic equity price index and short-term interest rates, which define the market conditions and in turn affect the state of individual firms. Firm specific factors for more than 400 corporates (both financial and nonfinancial) capture characteristics including liquidity, profitability, and size.

[9] The predictive accuracy of the PD model for corporate defaults in emerging markets over a one-year horizon is 77 percent, if the accuracy ratio is used, and 89 percent, if the area under the receiver operating characteristic curve is used. A perfect predictive model would score 100 percent under both measures, and an uninformative model 50 percent.

Table 2. Data for Simulating Corporate PDs in Indonesia

Macroeconomic variables	
Indonesia specific	Real GDP growth
	Unemployment
	CPI inflation
	NEER
	Short-term interest rate
Common	Jakarta Composite Index
	SBI yield, 3 months
Firm specific variables	Distance-to-default
	Liquidity (Cash/Total Assets)
	Profitability (Net Income/Total Assets)
	Size (relative to median)
	Market-to-book value
	Idiosyncratic volatility

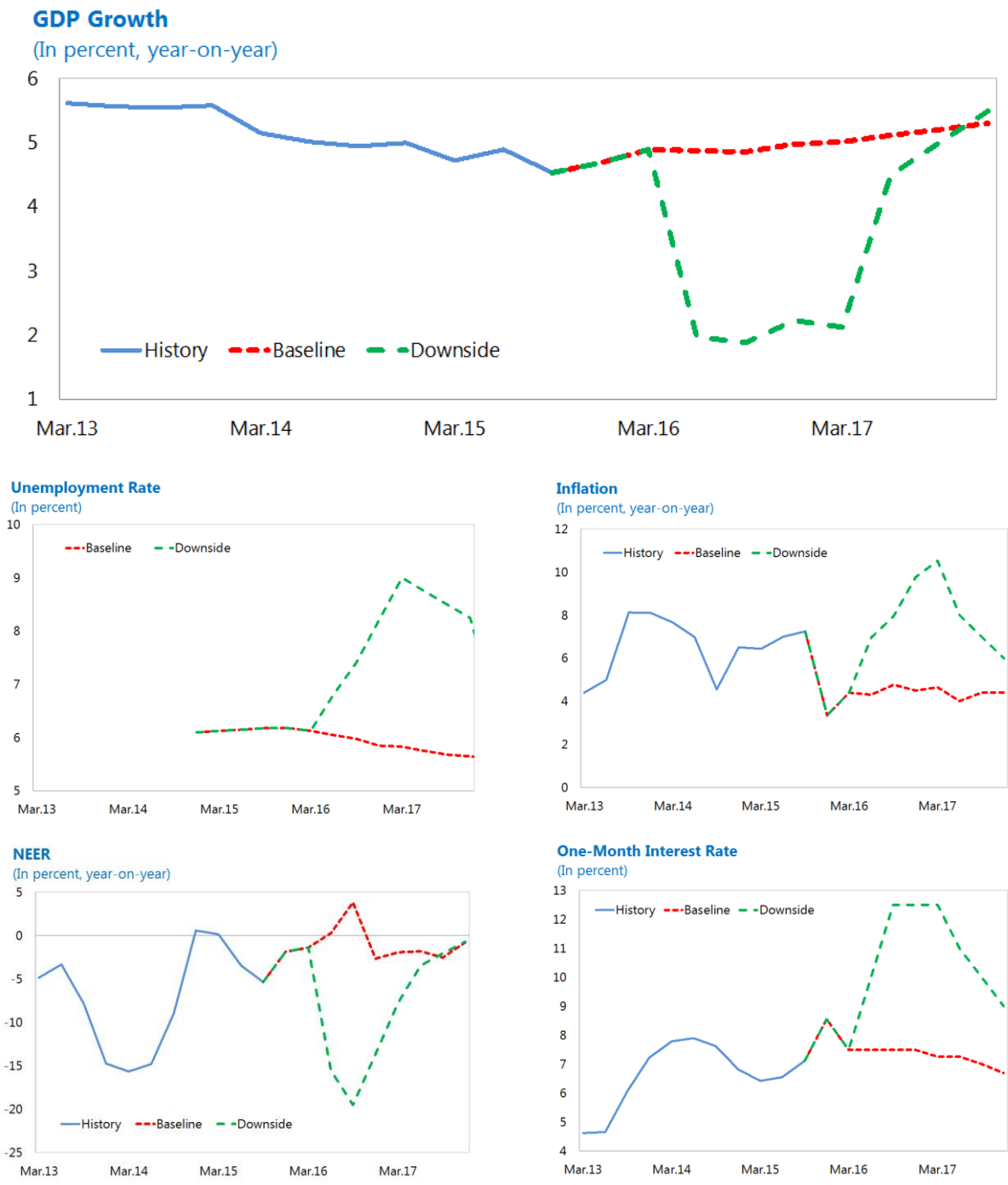
Sources: NUS; and authors' calculations.

The simulation starts by assuming two different paths of quarterly macroeconomic variables through 2017 (Figure 7). The trajectories of macroeconomic variables are in turn used to project common risk factors and firm specific risk factors. Finally, these risk factors are used as inputs to a forward intensity model, which is simulated to generate a distribution of PDs.

- The baseline scenario assumes GDP growth would moderately increase to around 5.3 percent. The unemployment rate would decline gradually to 5.7 percent, while inflation would fall to 4.4 percent. The rupiah's movement would range between –3 percent to 4 percent year-on-year (y/y) every quarter and the one-month JIBOR interest rate decline moderately to 6.7 percent.

- The downside scenario is characterized by a sharp drop in GDP growth to below two percent y/y. The unemployment rate would jump to nine percent and return to somewhat above eight percent. Inflation would surge to above ten percent on account of path-through effect before returning to 6 percent. The rupiah would depreciate by 14–20 percent y/y for three quarters. The JIBOR interest rate would jump to exceed 12 percent for three quarters and return to 9 percent.

Figure 7. Projected Macroeconomic Variables



Sources: CEIC; and authors' estimates.

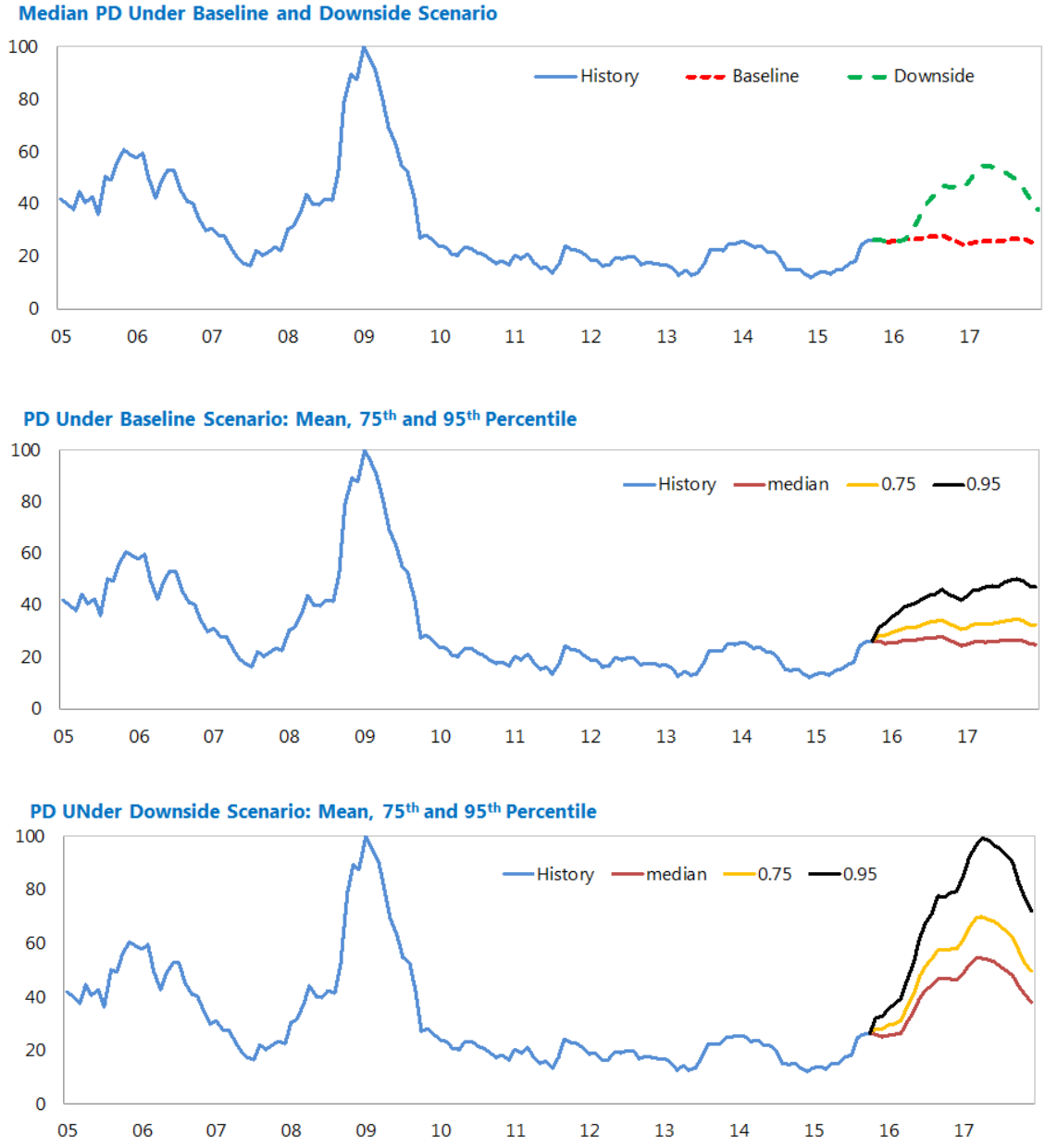
Several key observations emerge from estimated results.

- First, the firm-specific factors may have recently taken less supportive values than in previous periods after growth slowdown and rupiah depreciation have weakened corporate balance sheet conditions amid rising corporate foreign currency leverage. Under the baseline scenario, the median corporate PD is projected to rise to levels somewhat higher than those during the taper tantrum in 2013 and moderates somewhat toward the end of 2017 (Figure 8, upper panel, red broken line). This is the case despite projected macro fundamentals being broadly comparable to those in 2013—GDP growth is somewhat lower, but the rupiah's performance is more favorable and inflation is lower.

- Second, weaker macroeconomic performance would naturally lift corporate PD to higher levels. The median PD under the downside scenario would rise to about one half of the maximum registered during the Lehman crisis (Figure 8, upper panel, green solid line). This reflects a sharp GDP growth slowdown and deterioration in other macro variables. However, the PD would decline as economic activity regains momentum.

- Third, corporate distress can worsen materially if weak macroeconomic performance is accompanied by severe financial market jitters. Under the downside scenario, the 95th percentile estimate, with remote chance of occurrence, rises to very close to the maximum registered during the global financial crisis (Figure 8, lower panel, light green broken line). Meanwhile, cross-border spillovers of a negative shock could be large in an environment of elevated uncertainty and financial market volatility. Under such circumstances, what is considered as a low-probability outcome (with a high impact) could become a real threat.

Figure 8. Indonesia: GDP Growth and Corporate Default Probability
(Lehman peak = 100)



Sources: Authors' estimates.

V. CONCLUDING REMARKS

Overall, the risk from the corporate sector remains manageable in Indonesia, and the authorities have strengthened the monitoring framework. The aggregate corporate debt-to-GDP ratio remains small, and on a system wide basis, near-term refinancing risk appears moderate. The authorities are monitoring corporate vulnerabilities closely, and the implementation of the BI's hedging regulations has helped corporates manage currency risks. The authorities' ongoing work to upgrade the framework and inter-agency coordination on corporate surveillance is also in the right direction.

Nonetheless, close monitoring and granular analysis on maturing FX debt are warranted. Even though the overall risk of the corporate sector is manageable, a group of corporates faced heightened debt risks, some of which are connected to large business groups. Close monitoring, therefore, is required for FX debt of corporates with rupiah income, as well as unhedged, non-affiliated, or maturing FX debt, together with bank linkages. Strengthening policy coordination should also continue, coupled with data analysis to assess the dimensions of the debt problems of specific corporates in vulnerable groups. The authorities should consider reviewing the corporate resolution framework (including the bankruptcy regime) to ensure that it is capable of dealing with large and systemically connected conglomerates. In the medium-term, deeper financial markets will help reduce the costs of hedging and develop domestic corporate bond issuance and trading.

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