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Box 1
The practice of stress testing the banking sector in Taiwan

The global financial crisis drew increasing attention to the need for developing stress testing models that can identify systemic risk in a financial sector. Against this backdrop, both the Financial Supervisory Commission (FSC) and the CBC devoted efforts to developing adequate stress testing frameworks that could assess adverse impacts on the banking sector and its risk-bearing capability to withstand shocks caused by extreme but plausible macroeconomic conditions.

1. The FSC requires domestic banks to conduct a stress test at least annually under pillar 2 of Basel II

In order to urge domestic banks to place importance on stress testing and enhance their capability of implementation, the FSC required domestic banks to conduct stress tests on bank-specific market risk and credit risk in 2010 and 2011, respectively, according to the requirement of pillar 2 of Basel II. These stress tests were performed to estimate one-year-ahead potential losses and their impact on individual banks' capital adequacy ratios (CARs) under the stressed scenarios, and the test results are required to be submitted to the FSC to serve as a reference for financial supervision. The results released by the FSC showed that: (1) the average CARs of domestic banks were above the regulatory minimum of 8%; and (2) all banks could meet the minimum regulatory standard after recapitalization and asset reallocation.

2. The CBC developed macro stress testing models

In accordance with the operational objective that aims at promoting financial stability, the CBC has recently been developing macro stress testing models with a view to assessing the resilience of the whole banking system against adverse macroeconomic and financial shocks. Initially, the CBC cooperated with domestic academics to develop stress testing models from 2007 onwards. These models, which intend to offer a quantitative analysis of the potential fragilities in the domestic banking sector, are viewed as a cornerstone for the development of the CBC's macro stress testing framework.

In 2010, the CBC established a macro stress testing model of market risks.[1] In terms of sensitivity analysis and scenario simulation, this model was developed to gauge the effects of different market shocks[2] on individual banks' CARs and Tier-one capital ratios using their market exposure positions during 2007 to 2009, and in turn to assess domestic

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banks' risk-bearing capabilities in abnormal market conditions. Specifically, a macroeconomic model was then built to verify whether the parameters of the stressed scenarios could be mapped onto the macroeconomic environment by means of a Vector Autoregression (VAR) analysis. The empirical result suggested that domestic banks' capital levels were generally resilient to withstand the market risk shocks simulated by the stress tests done by the CBC.

In 2011, the CBC further developed a framework which was carried out in a top-down fashion for stress testing the credit risk of the banking sector in Taiwan.[3] A macroeconometric model was used to analyze the statistical correlation between the default rates of banks' portfolios and relevant macroeconomic variables (such as Taiwan's real GDP, global real GDP, global exports, interest rates, property prices and unemployment rates). Additionally, a satellite model was applied to link a measurement of the credit risks to the variables that proxy macroeconomic conditions and to map the external macroeconomic shocks onto banks' balance sheets. Accordingly, one-year-ahead potential credit losses for domestic banks' loan portfolios could be estimated so as to scrutinize the effect of shocks on banks' overall profitability and capital adequacy under different macroeconomic stressed scenarios. In the model-based stressed scenarios, the result showed that the banking sector as a whole, given the one-year-ahead predicted values of overall profit and regulatory capital, was well equipped to withstand the impact of adverse macroeconomic conditions on banks' credit risk exposures.

Notes: 1. The CBC's macro testing model of banks' market risk was mainly based on the stress testing template created by Martin Čihák (2007). However, this model also referred to the stress test process in the context of the Financial Sector Assessment Program (FSAP) of the IMF and the methodology of a domestic research project that was outsourced by the CBC for stress testing the financial system in Taiwan.

2. These shocks include the adverse movement of foreign exchange rates, interest rates and equity prices.

3. The CBC's macro stress testing model of banks' credit risk mainly referred to a similar model employed by the Hong Kong Monetary Authority, the methodologies in CBC outsourced papers and other relevant papers. The framework consists of a macroeconomic model and Monte Carlo simulations with stress tests. In the macroeconomic model, the seemingly unrelated regression (SUR) method was applied to estimate the relationship between the default rates of bank loans and different macroeconomic values based on historical data. A variance-covariance matrix was in turn used to capture the joint error terms between macroeconomic variables and the logit-transformed default rates of bank loans. Multivariate regression analysis was then carried out to determine the macroeconomic variables which exhibited considerable explanatory power or a strong correlation with the sector-specific default rate. Under the Monte Carlo simulation, 10,000 future paths of one-year-ahead values of probabilities of default (PDs) were simulated

based on the SUR estimates, and in turn the simulated 10,000 PDs could be applied to construct a frequency distribution of credit losses for each of the baseline and stressed scenarios.

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