



TECHNICAL ASSISTANCE REPORT

PANAMA

Follow-Up on Stress Testing – Parts 2 and 3

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Glossary

CVaR	Conditional Value-at-Risk
DR	Default rate
EBIT	Earnings before interest and taxes
EBITDA	Earnings before interest, taxes, depreciation and amortization
ES	Expected shortfall
FED	Federal Reserve
FSAP	Financial Sector Assessment Program
HTM	Held-to-maturity
ICR	Interest Coverage Ratio
IMF	International Monetary Fund
LCR	Liquidity Coverage Ratio
MCM	Monetary and Capital Markets Department
PD	Probability of default
RWA	Risk-Weighted Assets
SBP	Superintendency of Banks of Panama
SCVaR	Stressed Conditional Value-at-Risk
SVaR	Stressed Value-at-Risk
TA	Technical Assistance
VaR	Value-at-Risk

Preface

At the request of the Panamanian authorities, namely the Superintendency of Banks of Panama (SBP), missions of the Monetary and Capital Markets Department (MCM) held meetings in Panama City from January 9 to January 13, 2023, and from April 3 to April 8, 2024, to assist the SBP in strengthening and updating its risk assessment and stress testing framework. The work was focused on implementation of a set of recommendations outlined by a previous mission that took place from May 9 to May 13, 2022, which were related to the improvement of the solvency stress model. Training was also provided on the design of a cash flow-based liquidity stress tool and another system-level liquidity stress testing methodology. Finally, work was carried out on market risk and corporate risk, and the methodology for the liquidity stress test that was used during the 2023 Financial Sector Assessment Program (FSAP) with Panama was explained. The technical assistance (TA) was provided by Torsten Wezel (MCM, activity lead) as well as Manuel Luy (external expert, 2023 mission) and Eduardo Bastante (external expert, 2024 mission).

Meetings were held with staff of the SBP's Financial Studies Department, notably Mr. Javier Motta (Director of Financial Studies), Ms. Ingrid Arboleda (Manager) and Ms. Libny Gonzales, as well as with staff of the Banking Supervision Department. Meetings were also held with Mr. Amauri Castillo (Superintendent of Banks) and Ms. Nahila Melgar (Director of Risk Management) who offered important feedback.

The mission is grateful for the SBP team's excellent cooperation throughout the TA project, especially the productive technical discussions and the support in compiling the required information. Appreciation is also expressed for the logistical support and resources dedicated to the coordination and development of the work agenda.

Executive Summary

This technical assistance (TA) report covers the work and recommendations of two missions during 2023-24. These missions implemented tools and other methodologies in the area of credit risk, liquidity risk, market risk and monitoring of corporate health as described below.

A previous mission in May 2022 had made recommendations on credit risk modeling on which the 2023 mission followed up. The recommendations of the 2022 mission were mainly related to the improvement of *probability of default* (PD) estimation models that were developed during that visit. In relation to the PD model for large borrowers, the 2023 TA mission was able to develop an updated and improved version of the heat map (PD estimation tool at the borrower level). With regard to PD models for retail portfolios, it was necessary to re-estimate the econometric models for PD projections, segment the models of some portfolios (as in the electricity and credit card sectors), and perform lifetime PD calculations for horizons greater than four years.

The 2023 mission also provided training in the design of a liquidity stress model. For this purpose, a cash flow stress template developed by the International Monetary Fund was used (“Treatment of Liquidity Risk in Stress Tests” by M. Catalán, 2015). Furthermore, the mission also introduced another MCM tool for liquidity stress at the systemic level (“Systemwide Liquidity Stress Testing Tool” by H. Oura, 2022) that measures contagion effects of liquidity stress scenarios among banks, non-bank financial institutions, and non-financial economic sectors. This tool could be used at a future stage. A set of recommendations that will allow the use of this tool to be fully implemented in the future was made available to the SBP.

Finally, the 2023 mission carried out preparatory work for the market risk and corporate stress testing tools. In relation to market risk, the mission agreed with the SBP, in the short term, on specific measures to include market risk shocks in the solvency stress template. In the medium term, the SBP could request technical assistance for the updating of the model developed as part of the technical assistance mission for the design of a market risk monitoring model for the investment portfolio, which took place in 2017. In relation to corporate risk, the methodologies used by the MCM were shared with the SBP and the information requirements necessary for the implementation of this analysis were clarified, enabling implementation of the risk indicators during the April 2024 mission.

The current mission, conducted during April 3-8, 2024, implemented a model to calculate market risk, indicators to measure corporate sector risk, and the methodology for liquidity stress testing. The mission assisted the SBP in the development of a methodology for estimating the market risk of investments using modified duration and differentiated interest rate shocks based on the risk profile of the investments as reported monthly to the SBP. The mission also calculated three indicators to assess vulnerabilities in the corporate sector, namely the Debt-to-EBITDA (earnings before interest, taxes, depreciation and amortization) ratio, the Interest Coverage Ratio relating earnings before taxes and interest to interest expense, and the change in cash based on various factors that impact companies’ cash flow. In addition, the mission explained the methodology of the liquidity stress test that was used in the 2023 FSAP, thus enabling the use of this tool in the SBP. Finally, the mission took stock of the progress with implementation of recommendations made by the two earlier missions, finding that while methodologies have been fully implemented, some workstreams are still to be completed after data collection and updating of models, whereas a few others are awaiting regulatory action as a prerequisite (see Appendix I). Some delays may have been caused by absorption of resources during the 2023 FSAP, but there may also be other challenges to implementation (e.g., staffing levels).

Recommendations

Table 1. Key Recommendations of the 2024 Mission

Recommendations and Authority in charge of Implementation	Priority	Time ^{1/}
Market Risk Stress Testing		
Implement the market risk stress tool in the analysis of the solvency of financial institutions according to the proposed methodology (paragraph 29) Authority in charge: SBP	High	ST
Evaluate the incorporation of convexity in the reporting of information to the SBP and ensure the quality of investment information submitted through Reporting Form 15 (paragraph 30) Authority in charge: SBP	High	ST
Corporate Stress Testing		
Collect key financial statement data of the largest firms for the calculation of representative corporate risk indicators (paragraph 36). Authority in charge: SBP	Medium	MT
Liquidity Stress Testing		
Continue to compile all relevant detailed data to allow for a comprehensive liquidity risk analysis of Panamanian banks (paragraph 42). Authority in charge: SBP	High	ST

1/ ST: less than 12 months: MT: between 12 and 24 months.

I. Introduction

A. BACKGROUND

1. This technical assistance (TA) report summarizes the work of two TA stress testing missions conducted in January 2023 and April 2024. The 2023 mission followed up on a TA mission in May 2022 that implemented the solvency stress test methodology. That TA mission also provided training in liquidity risk and corporate risk methodologies. The 2024 mission implemented these methodologies and also developed the market stress test methodology.

2. Prior to the 2023 mission, the SBP had already made progress with its solvency risk and market risk tools. Regarding solvency risk, the SBP, with technical assistance from the IMF, had developed this tool between 2011 and 2014, following which a series of modifications were introduced that made it very useful during the recent economic crisis related to COVID-19. The SBP, however, considered it appropriate to request technical assistance with its evaluation in order to identify opportunities for improvement. For this reason, two missions were carried out during April-May 2021 and May 2022 to improve PD projection models. In relation to market risk stress, a previous mission in 2017 designed a quantitative tool that made it possible to calculate market risk for the Panamanian financial system.

3. The purpose of the 2023 TA mission was to contribute to the strengthening and updating of the SBP's stress tools. The first objective of the mission was to implement recommendations previously made during the May 2022 mission regarding improvement of the solvency stress model. The second objective was to provide training to SBP staff in the design of cash flow liquidity stress tools. Finally, the last objective involved carrying out preparatory work for the future development of corporate stress and market risk models.

B. SUMMARY OF THE WORK CARRIED OUT

4. The 2024 mission implemented a model to assess market risk, indicators to measure corporate sector risk, and the liquidity stress testing methodology. The mission assisted the SBP in the development of a methodology for estimating the market risk of investments using modified duration and differentiated interest rate shocks based on the risk profile of the investments as reported monthly to the SBP. The mission also calculated three indicators to assess vulnerabilities in the corporate sector, namely the Debt-to-EBITDA (*earnings before interest, taxes, depreciation and amortization*) ratio, the Interest Coverage Ratio relating earnings before tax and interest to interest expense, and the change in cash based on various factors that impact companies' cash flow. Finally, the mission explained the stress test methodology that was used in the 2023 FSAP, thus enabling the use of this tool in the SBP.

5. The 2023 mission managed to achieve the proposed objectives in relation to solvency and market risk tools. With respect to the solvency tool, an updated version of the granular PD model for large borrowers was designed. It was also determined that the PD models for retail portfolios needed to be re-estimated subsequently because the default data were affected up to December 2022 by the COVID-19 crisis and the forbearance measures in this context. With respect to the liquidity tool, training was provided to SBP staff in the use of the cash flow stress template developed by the IMF ("Treatment of Liquidity Risk in Stress Tests," Catalán, 2015). Likewise, the assumptions and modifications necessary to implement this tool in the future were discussed, considering the specific characteristics of the Panamanian financial system.

6. Furthermore, the 2023 mission carried out preparatory work for the 2024 mission on market risk and corporate stress. With regard to market risk, the mission agreed with the SBP on measures to include market risk shocks in the solvency stress template in the short term. To this end, the SBP subsequently requested technical assistance in 2024 for the updating of the model developed in 2017 as part of a technical assistance mission for the design of a market risk monitoring model for the investment portfolio. The update is justified due to the fact that in recent years, considerable changes have been observed in interest rates and asset prices, which could have significantly impacted investment portfolios. Regarding corporate stress, the methodologies used by MCM were shared with the SBP, and the information necessary for the implementation of this analysis were clarified.

II. Strengthening and Updating of Stress Tests (2023 Mission)

A. STRENGTHENING THE CREDIT RISK STRESS TOOL

7. The previous mission conducted in May 2022 implemented a revamped credit risk stress toolbox. In the case of large business borrowers, due to the fact that this is a low default portfolio, a PD calibration methodology based on a *heat map* was designed in the following way: (i) Select a set of macroeconomic, sectoral and idiosyncratic variables that represent different dimensions of the debtors' creditworthiness; (ii) calibrate thresholds for each of these variables to determine risk buckets (the number of levels must be aligned with the dispersion of information about the companies); (iii) assign to each bucket a PD based on historical information (transition matrices) or external information (credit ratings) and align the results with the characteristics of the Panamanian economy and the portfolio's overall default rate; and (iv) calculate the debtor's intrinsic PD as the weighted average of the PD of each variable. In the case of retail portfolios, econometric panel data models were used. To estimate these models, historical information on defaults and macroeconomic, sectoral, and idiosyncratic variables of each financial institution were used. The estimates were made at the level of credit types (nine different models) and financial institutions, to take advantage of the greatest possible heterogeneity.

8. That mission left some recommendations to be implemented in the short term. First, in the case of the model for large business borrowers, it was deemed necessary to increase the number of observations for which the model was estimated (the initial version of the model considered only six borrowers), as well as the variables used in the estimation. Second, in the models for retail portfolios, it was recommended that the segmentation of some portfolios, such as credit cards and the industrial sector, be improved. Likewise, it was suggested that the models be updated when the default series stabilize around a new post-pandemic normal, since the pandemic-related recession and forbearance actions (creation of the "modified loans" portfolio) distorted the NPL series. Finally, in the case of lifetime PD estimates, it was suggested that default rate (DR) estimates be made for horizons greater than four years, to analyze how DR curves converge to a long-run stable level.

9. The 2023 mission made significant progress in relation to the stress model for large borrowers. First, the number of borrowers for which the model is estimated was increased from 6 to 23. Second, the model was updated with information from 2022. Third, new variables that reflect the borrowers' ability to pay were used, such as profitability indicators (ratio of net income to sales income) and liquidity (ratio of cash to accounts payables). Finally, the weights of the heat map were recalibrated based on the inclusion of new variables in the model. To continue improving the granular tool, the SBP is implementing a project led by its supervisory unit, the objective of which is to continue increasing the number of financial statements of large business borrowers. This effort is distinct from work on corporate indicators below.

10. In relation to the stress model for retail borrowers, it was recommended that the default models be re-estimated. In December 2022, the migration of the “modified portfolio” (loans with rescheduling measures due to COVID-19) to the fully performing portfolio was completed. It was estimated that the new post-pandemic equilibrium of the series could be reached in 2023. Likewise, if and when the default series show the desired normalization, the segmentation of the credit card and industry sector portfolios would be carried out, as well as the estimation of the lifetime PD series for horizons greater than four years.

B. TRAINING IN LIQUIDITY STRESS TOOLS

11. The 2023 mission provided training to SBP staff in the use of liquidity stress tools. These tools assess the ability of each banking institution and the system as a whole to withstand extreme but plausible funding shocks. They also allow the authorities to identify priority policy actions that may include reducing certain exposures or building liquidity buffers.

12. For the training, the cash flow stress template developed by the IMF was mainly used (Catalán, 2015). This tool is based on Excel and allows for the identification of vulnerabilities that are not necessarily included in the Basel III Liquidity Coverage Ratio (LCR). The main difference is that the LCR simulates stress outflows over a fixed 30-day horizon, while the liquidity stress template used simulates liquidity inflows and outflows for different time horizons.

13. The main assumptions of the cash flow stress template are run-off rates, roll-off rates, and haircuts on the prices of banks’ financial instruments. *Run-off rates* indicate the fraction of liabilities that will be withdrawn (or not rolled over) for each time horizon. *Roll-off rates*, on the other hand, indicate the fraction of assets that may be converted into liquidity (and not rolled over) by the financial institution for each time horizon. Finally, *haircut rates* relate to the discounted sales price of the securities that must be sold to cover negative liquidity gaps in the stress scenarios (*counterbalancing capacity*).

14. The mission also informed about a new systemic liquidity stress tool. This tool (“Systemwide Liquidity Stress Testing Tool” by H. Oura, 2022) assesses the impact of a high degree of aggregate liquidity stress across the economy and evaluates the contagion effect among banks, non-bank financial institutions, and non-financial corporate sector. This methodology could be implemented at a future stage.

15. The 2023 mission recommended taking preparatory steps for the implementation of the liquidity testing tool at the level of individual banks. The recommendation was to adjust the parameters of the model (run-off rates, roll-off rates, and haircuts) based on historical information on liquidity crises and the particular characteristics of Panama’s financial system.

C. UPDATING OF MARKET RISK STRESS TOOLS

16. The 2023 mission also followed up on a TA mission in 2017 that had designed a quantitative tool to calculate market risk for the Panamanian financial system. That technical assistance mission for the design of a market risk monitoring model for the investment portfolio, which took place in 2017, built statistical models to calibrate risk indicators such as Value-at-Risk (VaR), Stressed Value-at-Risk (SVaR), Conditional Value-at-Risk (CVaR, or *expected shortfall*, ES) and Stressed Conditional Value-at-Risk (SCVaR) at the level of financial institutions and the financial system as a whole. The statistical models used information from the position of financial institutions in bonds and stocks. The 2023 mission was able to identify the institutions most exposed to market risk to design a regulatory framework of capital requirements to mitigate these risks.

D. EXPLORING CORPORATE STRESS TOOLS

17. Finally, the 2023 mission carried out preliminary work for the implementation of corporate risk indicators. The methodologies were shared with the SBP, and the information necessary for this analysis were clarified. The required information includes the balance sheet, profit and loss statement, and cash flow statement of corporate borrowers. Corporate stress analysis would simulate the impact on selected financial indicators of adverse economic shocks such as a drop in operating profit, an increase in short-term debt, and an increase in interest expense.

III. Market Risk Stress Testing (2024 Mission)

A. DATA AND METHODOLOGY

18. Panamanian banks' investment portfolios consist mainly of fixed-income instruments measured at market value and amortized cost. For the purpose of the stress tests, permanent investment positions were excluded. The total investment portfolio is defined as the sum of the exposures measured at market value and held-to-maturity investments. In this regard, equity instruments account for only 2 percent of the investment portfolio; hence the stress methodology focuses on fixed-income instruments.

19. The investment portfolio was divided into three groups according to the uncertainty of the associated market risk. The first group is made up of equity instruments and those that do not have a specific classification; a haircut factor of 30 percent to their reported book value is applied to these instruments. The second group is fixed-income instruments that do not have a market price or subordinated instruments; a haircut factor of 20 percent to their book value is applied to these instruments. Finally, there is the fixed-income investment portfolio measured at market value; the modified duration-based methodology is applied to these instruments.

20. Four principal groups of instruments were defined to carry out a sensitivity analysis for interest rate risk. Owing to the particular characteristics of different issuers of fixed-income instruments, the sensitivity analysis was segmented into the following groups of instruments: (i) Panama's sovereign bonds; (ii) sovereign bonds of other countries; (iii) locally rated corporate instruments; and (iv) internationally rated corporate instruments.

21. To determine the shocks to stress the bond portfolio, the mission assessed the interest rate behavior between December 2021 and December 2022. For the four groups of issuers, the mission identified the adverse shocks by analyzing the variation of interest rates during 2022 differentiated for their risk profile based on the modified duration of the instruments and their initial yields. These interest rate shocks were differentiated with respect to the average rate shock in order to determine the impact for each type of instrument.

22. The process of determining yield variations by instrument is based on the historical relationship between the variation in the Federal Reserve's (FED) effective interest rate and the variation in bond yield during 2022, which was 75 percent. In this regard, the methodology proposes the use of the historical relationship between the annual variation of the FED's effective rate and the variation of average bond yield rates and then apply the sensitivity percentages by group, tenor and risk profile. However, the methodology may be improved by incorporating a rate term structure analysis and not just a weighted average of rates (FED's effective rate).

23. Applying the FSAP's methodology for market risk, the stress impact of each bond position was calculated by multiplying the interest rate shocks of the group and risk profile by the modified duration. In this regard, the information on the modified duration, the initial interest rates and the market value of the bonds comes from the information report made by financial institutions, so the quality of the data is key to guarantee the reliability of the results.

24. The price impact methodology using the modified duration has some limitations that may be overcome using the convexity of each instrument. Given information limitations, however, the convexity data of the financial instruments are not available. Therefore, for the time being, the use of the modified duration is recommended.

25. Instruments measured at amortized cost had to be adjusted to market value before applying the price change resulting from interest rates. Although the nature of a held-to-maturity investment is not linked to its market value, it was considered that under stress the original intention may no longer apply, and the institution may need to liquidate these securities. In this regard, it should be noted that to be considered as liquidity buffer, all securities must be adequately adjusted to market value under stress.

26. The incorporation of instruments measured at amortized cost within the market risk stress should be reviewed once the liquidity stress incorporates this effect. The liquidity methodology used by the SBP may establish a hierarchy of use of investment instruments (e.g., sale of instruments measured at amortized cost to cover a liquidity gap in a stress scenario). It is recommended that the losses resulting from the impairment of instruments measured at amortized cost be incorporated into the liquidity stress test, and the losses on instruments recorded at fair value be incorporated into the market risk stress test.

B. RESULTS AND RECOMMENDATIONS

27. The mission estimated the impact of a policy rate hike. After applying a shock of 300 basis points to the Federal Reserve's effective rate on the investment portfolio as of December 2023, it was estimated that the impact of market risk stress would be \$2,553.5 million (see Table 2). In this calculation, the investment portfolio that measured at market value accounts for \$1,107.8 million and the portfolio measured at amortized cost accounts for \$1,445.7 million. These results were calculated for each financial institution and each instrument so that SBP officials can analyze the impact and identify the sources of risk associated with the investment portfolio and its sub-components.

28. The impact of stress on financial institutions is heterogeneous, ranging from 0.3 percent to 30 percent of the book value of the investment portfolio. Of the 38 financial institutions analyzed with the market risk stress methodology, an average impact of 8.9 percent of the portfolio's book value was obtained. Eight institutions exceeded 15 percent in terms of the impact of stress on their market value (see Figure 1). A detailed analysis of this impact and on-site verification of the quality of the investment portfolio at these institutions is recommended if the impact is material compared to total assets.

29. The SBP would benefit from implementing the market risk stress tool developed by the mission and incorporating it into the analysis of the solvency of financial institutions. Given that the results obtained are granular and the interest rate impact tables are adjustable, the SBP could incorporate this methodology into its assessment of the solvency of financial institutions and into the liquidity assumptions of investments in such a way as to obtain integrated stress test results.

30. The quality of information received by the SBP on investments must be ensured and improved to optimize the market risk stress methodology. Given the limitations of staff headcount and access to

information, the methodology presented is based on the use of the modified duration calculated by financial institutions as the basis for estimating the impact of changes in interest rates on the investment portfolio. In this regard, it is necessary to enhance data quality controls by validating the information among the different institutions or performing on-site verifications of the quality of the reported data. It is also recommended that the inclusion of convexity be evaluated as an additional indicator that would allow for greater precision in estimating the impact of the rate hikes.

Table 2. Main Results of Market Risk Stress Test
(as of December 2023)

Securities	Group ¹	Book Value (US\$ million)	Impact (US\$ million)	Impact (perc. RWA)
Securities at Fair Value	1st	1,111.3	333.4	0.3%
	2nd	1,043.6	208.7	0.2%
	3rd	10,338.0	565.7	0.6%
	Subtotal	12,492.9	1,107.8	1.1%
Securities at Amortized Cost	1st	1,159.7	347.5	0.3%
	2nd	570.7	127.7	0.1%
	3rd	8,036.2	970.5	1.0%
	Subtotal	9,766.6	1,445.7²	1.5%
Total		22,259.5	2,553.5²	2.6%

¹Groups as detailed in paragraph 19:

1st group: Equity instruments and those that do not have a specific classification.

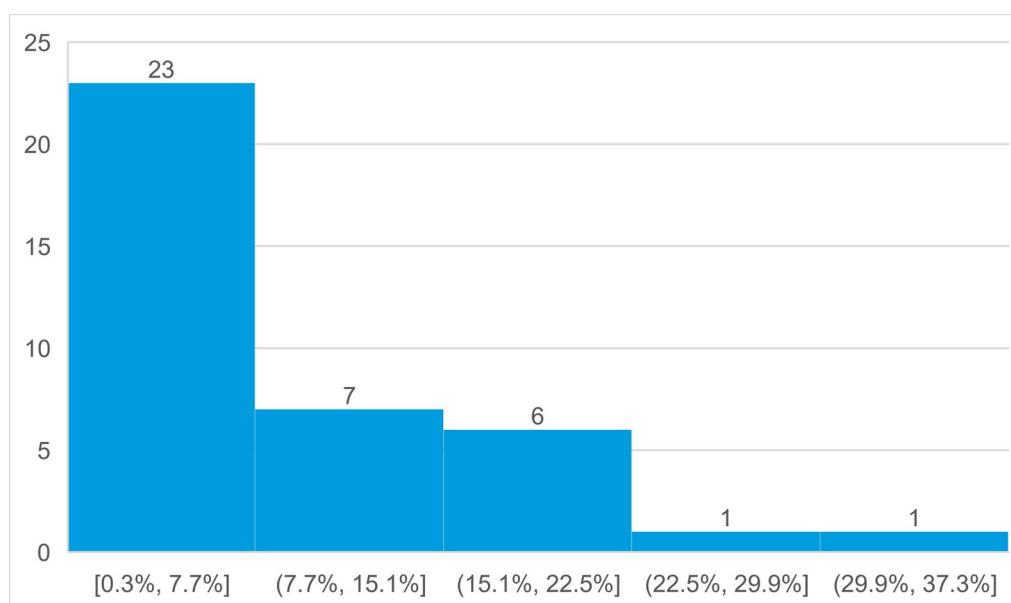
2nd group: Fixed-income instruments that do not have a market price or subordinated instruments.

3rd group: other fixed-income investments.

²US\$448.5 million (0.6% of RWA) are due to the gap between book and market value.

Source: SBP data and mission calculations.

Figure 1. Distribution of Banks by Impact of Market Risk Stress Test



Source: SBP data and mission calculations.

IV. Corporate Risk Indicators (2024 Mission)

A. DATA AND METHODOLOGY

31. After introducing the methodology¹ during the 2023 visit, the mission in 2024 implemented the risk indicators for corporate stress testing, but in a limited fashion given data restrictions. On the basis of a small sample of Panamanian firms collected by the supervision department during on-site inspections, the mission calculated three risk indicators that were also stressed: the net Debt-to-EBITDA² ratio, the Interest Coverage Ratio (ICR)³ and the concept of cash balance that reflects various corporate cash flows, including under stress. However, the implementation is only partial because the small sample of only 22 firms is biased and not representative of the universe of larger firms. More specifically, the small sample consists of firms of very much different size (i.e., not the largest) that have a relatively low credit classification (half of the firms are in special mention or lower). It also has some issues with data completeness and reliability.⁴

32. The first of the three indicators, the Debt-to-EBITDA ratio, assesses the ability of a firm to repay its debt stock from cash flows. The relevant (net) debt stock is defined as gross debt minus cash and cash-like instruments because the firm could always use its cash to partially pay down the debt. The relevant concept of debt comprises short- and long-term obligations but typically not transitory positions like accounts payable (or trade credit more broadly). As a measure of leverage the ratio is more informative than the debt-to-equity or debt-to-assets ratio because it also accounts for the capacity of the firm to sustain a certain level of leverage. In this sense, the debt stock is typically considered sustainable if the ratio is not larger than 5 (i.e., it would take the firm five years to repay the debt from cash flow) or 7 (for capital-intensive firms). Ratios beyond these thresholds or negative ratios because of negative EBITDA imply non-sustainable debt.

33. The second indicator, the ICR, refers specifically to the sustainability of debt service.⁵ A firm should be able to safely meet its debt service obligations, here defined as interest payments, from available earnings, here defined as earnings before interest and taxes (EBIT). The absolute minimum for debt service sustainability is a ratio of 1 or more but some studies have used a minimum threshold of 1.5. The ICR can be stressed by assuming a lower EBIT and, possibly, higher interest payments (e.g., due to a lower creditworthiness of a firm under stress and thus higher loan rates).

34. Finally, the concept of a sustainable cash balance evaluates the ability of a firm to remain liquid under stressed cash flows. The definition of the cash balance ideally comprises not only cash but also cash equivalents in net terms, notably short-term investments and accounts receivables net of accounts payables and other short-term liabilities (see Tressel and Ding, 2021); however, as the sample currently does not include data on short-term investments, only cash is used as the starting balance. The intra-year variation of this cash balance is determined by:

¹ Details of the methodology can be found in Tressel and Ding (2021).

² EBITDA stands for earnings before interest, taxes, depreciation and amortization and is commonly considered a cash flow proxy.

³ The ICR relates earnings before interest and taxes (EBIT) to interest payments.

⁴ Several firms have incomplete data or data with a wrong sign (e.g., negative amount for capital expenditure).

⁵ For details of the ICR, please refer to Chow (2015).

- (i) income from operations (here: EBIT);
- (ii) the net cost of financing (interest payments, disaggregated by payments on short- and long-term obligations);
- (iii) the net inflow of financing (i.e., more-than-full or less-than-full rollover of maturing funding);
- (iv) depreciation and amortization; and
- (v) the cost of acquisition of fixed assets (also known as capital expenditure, CAPEX).⁶

All these factors may be stressed in the tool except depreciation and amortization because the charge-off schedule is assumed pre-determined as well as the cost of long-term debt obligations because the interest cost is assumed fixed in the short term.

B. RESULTS AND RECOMMENDATIONS

35. As the sample is small and not representative, the mission calculated the corporate risk indicators and their stressed values only for illustrative purposes. Mindful of the fact that half of the sample firms are already classified as having issues, it is not surprising that almost all are overindebted even before stress (they have a ratio of above 5 (or 7) or negative earnings; see Table 3). However, the situation is less dramatic when assessing debt service capacity using the ICR, with half of the sample firms (two do not report interest payments) being above the threshold of 1.5 under baseline conditions (Table 4); the stress factors are assumed ad-hoc in both cases. Finally, the cash balance of most firms is reduced significantly when assuming a 40 percent drop in EBIT (as in Tressel and Ding, 2021), a five percent higher cost of short-term financing, and an incomplete rollover of short-term debt (only 95 percent), with about one-third of sample firms exhaust their cash under such stress.

36. The mission recommends revitalizing the effort to collect financial statement data of the largest Panamanian firms and so make the sample more representative. So far, the data collection has not focused on firm characteristics but is a product of random compilation of financial statements during on-site inspections. To obtain a more significant sample, the SBP should:

- Collect the necessary data for the 100 largest firms as measured by the amount of bank credit.
- With this data collection effort, obtain more granular data on short-term investments and short-term obligations and also include information of the economic sector in which the firm is mainly active and whether it is part of a conglomerate.
- Identify and correct any data issues such as missing observations or implausible zeros as well as observations with an unexpected (negative) sign.

⁶ Following Tressel and Ding (2021), capital expenditure is capped by the amount of depreciation and amortizations because under stress the firm is assumed to just replenish but not expand the capital stock. In the tool, the lower of depreciation & amortization and capital expenditure is taken (i.e., if the firm has already restricted investment to below the depreciation schedule, it is assumed to continue doing this under stress as well).

37. Once the data collections process is finished, the analysis would be expanded in a number of ways. First, with the envisaged 100 observations it will be possible to obtain meaningful distributions of the indicators as was done for example in the corporate risk analysis referred to during the 2024 mission's presentation to SBP staff (see Wezel, 2021). Second, the sample could be segmented to compare the performance of firms with mainly bank financing and those with more diversified funding sources or by main economic sector. Finally, the firm-level corporate stress test results could be used as early warning indicators in the supervisory process of the SBP.

Table 3. Debt-to-EBITDA Ratio (Baseline and Stressed)

Firm	Net debt	EBITDA	Stress factor:		Debt-to-EBITDA Ratio (stressed)	
			20%	-30%		
			Debt-to-EBITDA Ratio (baseline)	Net debt stressed	EBITDA stressed	
1	126,800,466	40,627,990	3.12	152,160,559	28,439,593	5.35
2	31,152,846	-6,453,428	-4.83	37,383,415	(8,389,456)	-4.46
3	453,682,000	77,255,000	5.87	544,418,400	54,078,500	10.07
4	70,883,701	4,939,944	14.35	85,060,441	3,457,961	24.60
5	44,444,569	3,582,432	12.41	53,333,483	2,507,702	21.27
6	5,787,001	694,841	8.33	6,944,401	486,389	14.28
7	21,329,280	381,593	55.90	25,595,136	267,115	95.82
8	59,937,631	-409,652	-146.31	71,925,157	(532,548)	-135.06
9	63,895,197	8,960,560	7.13	76,674,236	6,272,392	12.22
10	4,527,467	355,609	12.73	5,432,961	248,926	21.83
11	92,422,856	3,749,875	24.65	110,907,427	2,624,913	42.25
12	87,529,378	658,297	132.96	105,035,254	460,808	227.94
13	10,604,508	1,851,153	5.73	12,725,410	1,295,807	9.82
14	2,109,280	12,839	164.29	2,531,136	8,987	281.63
15	30,457,632	-859,742	-35.43	36,549,159	(1,117,664)	-32.70
16	7,454,922	-183,694	-40.58	8,945,906	(238,802)	-37.46
17	34,894,075	1,906,096	18.31	41,872,890	1,334,267	31.38
18	2,826,261	347,218	8.14	3,391,513	243,053	13.95
19	125,931,231	16,463,852	7.65	151,117,477	11,524,696	13.11
20	116,127,494	4,286,084	27.09	139,352,993	3,000,259	46.45
21	88,962,884	14,247,598	6.24	106,755,461	9,973,319	10.70
22	388,503,884	236,772,825	1.64	466,204,661	165,740,978	2.81

Source: SBP data and mission calculations.

Table 4. Interest Coverage Ratio (Baseline and Stressed)

Firm	EBIT	Interest payments	Stress factor:	-40%	5%	Interest Coverage Ratio (stressed)
			Interest Coverage Ratio (baseline)	EBIT stressed	Interest payments stressed	
1	27,285,011	3,558,962	7.67	16,371,007	3,736,910	4.38
2	-1,789,197	-2,135,720	0.84	(1,073,518)	(2,242,506)	0.48
3	25,144,000	11,273,000	2.23	15,086,400	11,836,650	1.27
4	2,050,944	2,263,222	0.91	1,230,566	2,376,383	0.52
5	3,582,432	814,077	4.40	2,149,459	854,781	2.51
6	694,841	626,936	1.11	416,905	658,283	0.63
7	286,816	129,706	2.21	172,090	136,191	1.26
8	-598,607	251,637	-2.38	(359,164)	264,219	-1.36
9	7,337,096	2,593,913	2.83	4,402,258	2,723,609	1.62
10	146,589	235,454	0.62	87,953	247,227	0.36
11	-4,211,125	4,660,182	-0.90	(2,526,675)	4,893,191	-0.52
12	429,706	3,933,229	0.11	257,824	4,129,890	0.06
13	1,291,096	725,843	1.78	774,658	762,135	1.02
14	7,286	2,975	2.45	4,372	3,124	1.40
15	-1,127,073	682,742	-1.65	(676,244)	716,879	-0.94
16	-210,077	238,622	-0.88	(126,046)	250,553	-0.50
17	446,953			268,172	-	
18	325,164			195,098	-	
19	16,388,712	32,100	510.55	9,833,227	33,705	291.74
20	3,131,260	1,071,224	2.92	1,878,756	1,124,785	1.67
21	13,124,862	5,648,578	2.32	7,874,917	5,931,007	1.33
22	198,855,621	28,056,312	7.09	119,313,373	29,459,128	4.05

Source: SBP data and mission calculations.

V. Liquidity Risk Stress Testing (2024 Mission)

A. DATA AND METHODOLOGY

38. An enhanced liquidity stress testing tool was provided to the SBP.⁷ It was the tool that was used in the 2023 Panama FSAP, as well as for other recent FSAPs. It expands on previously existing cash flow based liquidity stress test models in three dimensions: (i) by properly computing the forward flows of maturing and reinvested/rolled over assets and liabilities along the liquidity simulation horizon; (ii) by operating with only one counterbalancing capacity, and its underlying detailed asset components, to serve as buffers and as cash inflow-generating at the same time; and (iii) by incorporating a calculation for losses that may arise when bonds in the held-to-maturity investment category would have to be sold, and therefore result in adverse feedback to banks' solvency ratios.

39. Three versions of the tool suite—from simple to more advanced—were provided. They differ regarding their required input data. The simplest version requires no maturity profile data as inputs, neither for assets nor liabilities. The intermediate version requires maturity profile data for liabilities. The advanced version needs maturity ladder data for both assets and liabilities. All three versions need some selected market risk parameters as input (that is, in addition to current market values, also book values, current yields, and durations). The advanced model version was used for the 2023 FSAP and is therefore most likely the one that the SBP will operate going forward. A guidance note detailing the methodology will be made available to the SBP in due course.

40. The liquidity tool uses a granular set of data. The tool requires detailed information on various types of funding (deposits, available credit lines and other funding, disaggregated by several maturity buckets up to 180 days) as well as cash and cash equivalents, bonds (separated not only by maturity but also by fair value and amortized cost) and other securities, including stocks. One item that deserves special attention for the SBP is the liquidity generating credit lines that Panamanian banks maintain with their foreign correspondent banks (given that Panama has no central bank). Bespoke counterfactuals can be and were being conducted with the model during the FSAP in this context.

B. RESULTS AND RECOMMENDATIONS

41. Illustrative results were calculated using a mock sample. Assuming a certain pecking order of asset use to meet outflows, the tool calculated at what stage the sample bank ran out of liquid assets in a certain maturity bucket and also produced the liquidity gap and losses caused by fire sales of HTM securities that should feed into the solvency stress test.

42. The recommendations with respect to liquidity stress testing center on data compilation and application for surveillance. Specifically, the SBP should keep compiling all relevant, detailed data to allow for a comprehensive liquidity risk analysis of Panamanian banks, with support of the liquidity stress test models that were left with the SBP as part of the TA.

⁷ Mr. Marco Gross (Monetary and Capital Markets Department of the IMF) delivered one session to cover the liquidity stress test model topic.

References

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Appendix I. Follow-up on Previous TA Recommendations

Recommendation	Status	Comments
<i>Granular Model for Large Business Borrowers (2022 Mission)</i>		
Continue the process of collecting information from financial statements to expand the number of borrowers for which the granular model is applied and the selection of variables used for the heat map. Authority in charge: SBP	In progress	The model was updated, new variables were included, and the number of borrowers was increased. It is expected that the information from the financial statements will continue to be increased for further improvements to the model.
<i>Econometric Models for Massive Portfolios (2022 Mission)</i>		
Improve the segmentation of some credit portfolios (such as credit cards and industry) to improve the goodness-of-fit of the estimated models. Authority in charge: SBP	In progress	The data for 2023 are already available and the activities to be segmented have been selected.
Update the models when a convergence is observed toward a new normality of the DR series and post-COVID-19 macroeconomic/sector variables. Authority in charge: SBP	In progress	The data for 2023 are already available. The models will therefore be updated.
<i>Proposed Methodology for Calculation of the Lifetime PD (2022 Mission)</i>		
Increase the data available for implementation of the methodology, which entails calibration and projection of lifetime PD for credits in Stage 2. Authority in charge: SBP	In progress	The data for 2023 are already available. The calibration of the PD projections will therefore be updated.
<i>Next Steps for Strengthening Risk Management (2022 Mission)</i>		
Conduct a stress analysis of the corporate sector that provides a more detailed view than is provided by the macroeconomic aggregates. Authority in charge: SBP	In progress	The methodologies used by the MCM were shared with the SBP and the information requirements necessary for the implementation of this analysis were clarified.
<i>Proposed Methodology for Solvency Stress (2023 Mission)</i>		
Continue to work on compiling financial statements from large borrowers to extend PD granular model estimates. Authority in charge: SBP	In progress	In 2024, financial statements will be collected from a sample of larger (local) corporate borrowers.
Update and further segment the PD models for retail portfolios and calculate the lifetime DR for transitions greater than four years when the default series show signs of post-pandemic stabilization, which is expected to occur in 2023. Authority in charge: SBP	In progress	The data for 2023 are already available and the activities to be segmented have been selected.

<i>Proposed Methodology for Liquidity Stress (2023 Mission)</i>		
Calibrate the parameters of the model (run-off, roll-off, and haircut rates) based on historical information on liquidity crises and the particular characteristics of Panama’s financial system. Authority in charge: SBP	Completed	During the TA, the IMF provided the files for a new liquidity stress testing tool. The Financial Research Directorate will familiarize itself with the tool and then use it to conduct liquidity stress tests.
<i>Proposed Methodology for Market Stress (2023 Mission)</i>		
Assess the need to update and refine the market risk stress tool through granular investment analysis and use of VaR and <i>Expected Shortfall</i> tools. Authority in charge: SBP	Completed	During the TA, the IMF provided a file for a new market risk stress testing tool. From now on, it will be used to carry out market risk stress exercises.
<i>Proposed Methodology for Corporate Risk (2023 Mission)</i>		
Increase the number of companies with financial statements and approximate variables of the level of indebtedness, liquidity, and solvency of companies in the real sector to carry out the stress exercise. Authority in charge: SBP	In progress	In 2024, financial statements will be collected from a sample of larger (local) corporate borrowers.