



TECHNICAL ASSISTANCE REPORT

MONTENEGRO

Stress Testing the Central Bank Balance Sheet

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Glossary

CBCG	Central Banka Crne Gore
CBST	Central Bank Balance Sheet Stress Test
CiC	Currency-in-Circulation
DNS	Deferred Net Settlement
ECB	European Central Bank
ELA	Emergency Liquidity Assistance
EUREP ¹	Eurosystem's Repo facility
FV	Fair Value
FVOCI	Fair Value Under Other Comprehensive Income
FX	Foreign Exchange
IPF	Investment Project Financing
MCM	Monetary and Capital Markets
NFR	Net Foreign Reserve
OCI	Other Comprehensive Income
OMO	Open Market Operations
SEPA	Single Euro Payments Area
STX	Short-term Expert
TA	Technical Assistance
VaR	Value-at-Risk
RTGS	Real-Time Gross Settlement

¹ EUREP stands for the Eurosystem's repo facility for central banks. Under EUREP, the ECB supplies euros to non-euro area central banks in exchange for high-quality financial assets denominated in euros, which are provided as collateral.

Preface

At the request of the Central Bank of Montenegro (Central Banka Crne Gore), a Monetary and Capital Markets (MCM) Department mission visited Podgorica, Montenegro, from May 5 to 16, 2025, to assist the authorities in central bank balance sheet stress testing.

The mission met with Irena Radović, Governor; Zorica Kalezic, Vice Governor; Valentina Ivanovic, Director of Finance, Accounting and Controlling; Jelena Jankovic, Director of Financial and Banking Operations; Zdenka Boskovic, Head of the Accounting Department; Milena Cavor, Financial Analyst in the Accounting Department; and Irena Lakic, Head of the Controlling Department. The mission wishes to thank them for their cooperation, productive discussions, and hospitality. The mission also met officials of the Ministry of Finance, Crnogorska Komercijalna Banka, and NLB Banka. The mission also thanks Milica Pejovic, Senior Advisor for International Cooperation, for her assistance.

Executive Summary

This report presents a comprehensive framework for applying a Central Bank Balance Sheet Stress Testing (CBST) model tailored to the Central Banka Crne Gore (CBCG). The primary objective is to assess the CBCG's policy solvency under various macroeconomic and operational scenarios and to institutionalize this analytical process.

The CBCG operates in a euroized economy without seigniorage income and faces liquidity constraints similar to those of commercial banks, as its assets are mainly funded by deposits from financial institutions and the government. Service fees are unusually important to its finances for a central bank. However, as a public institution, the CBCG is limited in its ability to take financial risks or raise service prices. Policy solvency—covering monetary and operational costs through earnings—is essential for its financial independence and effectiveness. For the CBCG, both solvency and liquidity constraints are relevant.

The CBCG's fee income from Montenegrin banks' use of the domestic payment service is expected to decline due to Montenegro's accession to the Single Euro Payments Area (SEPA) system. This marks a significant step toward deeper financial integration with the European Union. However, the negative impact of SEPA accession on the CBCG's financial soundness has yet to be fully assessed.

The CBST model forecasts the CBCG's balance sheet and net income using projections of macrofinancial variables and includes satellite models for key items, such as required reserves and fee income. Simple satellite models are employed to project fee income from Montenegrin banks and the government's use of the domestic payment system, as well as supervision fee income.

In the baseline scenario—where the European Central Bank (ECB) policy rate converges to around 2 percent and SEPA accession reduces payment system fee income from banks to zero—the CBCG's equity-to-GDP ratio is projected to increase only slightly over time. This indicates that additional adverse shocks could affect the financial position of the CBCG and potentially raise issues of policy solvency and liquidity constraints if not addressed.

Among the macroeconomic downside scenarios, low interest rates in Europe pose the most significant risk to the CBCG. Persistently low yield curves on European sovereign bonds reduce returns on the CBCG's international bond portfolio. Inflation and real GDP growth in the Montenegrin economy do not influence the ECB's policy rate trajectory and, therefore, have a minor impact on the CBCG's balance sheet.

If term premia are positive, extending the duration of the international bond portfolio can enhance returns, but it also increases the risk of fair value losses.² Therefore, robust interest rate risk management is essential when managing portfolio duration.

At the same time, the CBCG faces planned operating costs that are independent of European interest rate levels. With declining fee income and rising expenses related to SEPA accession and EU integration, there is a risk that the CBCG could incur an operating loss during the forecast period.

It is recommended that the CBCG quantify a sufficient capital buffer to mitigate potential fair value (FV) losses because a sharp rise in interest rates over the year could result in significant FV

² The weighted average duration of the international bond portfolio is around 1.8 years as of December 2024.

losses on the international bond portfolio, posing a material risk of negative equity. The mission team proposes using Value-at-Risk (VaR) methodologies to estimate the necessary buffer for potential FV losses. Note that the current law and IFRS rules do not provide enough flexibility for the CBCG to retain profits so that the buffer is accumulated in a timely manner.

It is also recommended to account for potential losses stemming from systemic liquidity shortages, particularly given the CBCG's inability to issue currency. The Euro System Repo Facility (EUREP) swap line and repo credit line with the Bank for International Settlement help mitigate the risk of liquidity shortfalls in Montenegrin banks by serving as reliable backstops during periods of market stress. Nevertheless, it remains advisable for the CBCG to consider establishing an additional buffer to strengthen its resilience further.

Next, five non-macroeconomic adverse scenarios were analyzed: (i) repayment of a World Bank loan; (ii) loss of fee income from government payment system use; (iii) decline in the settlement account reducing the bond portfolio; (iv) salary adjustments for EU integration; and (v) a combined scenario incorporating all four impacts. Scenarios (ii), (iii), and (iv) could lower equity by 8 to 12 million euros in December 2030, while scenario (i) has a smaller impact of about 1 million euros.

Especially if the government reduces payment service fees, equity would decline by 12 million euros in December 2030. Since these fees make up 21 percent of total fee income—and their share will grow as commercial bank-related fees decline post-SEPA—the impact could be significant.

Additionally, as part of the post-TA analysis, the impact of reducing foreign debt servicing fees and State Treasury order processing fees was assessed. The uncertainty associated with the outcome of the ongoing legal motivated this analysis. This case would have a modest negative effect on equity.

Institutional recommendations include assigning staff to regularly operate the CBST model, enhancing its satellite components, and updating scenario inputs with current data. The model should be run at least annually using diverse scenarios, and its performance such be periodically reviewed.

Separately from the balance sheet projection, the mission team analyzed operational efficiency using cross-country benchmarks. CBCG employs more staff than peers—likely due to limited outsourcing—while offering relatively low salaries. Staff and salary levels were benchmarked against population size and GDP per capita. Operational costs are somewhat high but within statistical norms, driven by limited scale, minimal outsourcing, digitalization efforts, and preparations for EU integration.

It is recommended that the CBCG estimate the operating costs associated with SEPA accession and broader EU integration efforts and include them as other operating expenses in the CBST model. This unified analysis would provide a clearer picture of the institution's financial soundness. This unified analysis is essential for informed decision-making and targeted efficiency gains.

As a supplementary analysis, the mission team estimated seigniorage lost from Montenegro's unilateral euroization. Using historical data on currency in circulation (CiC), seigniorage was calculated by multiplying projected CiC with a proxy for the opportunity cost of holding money. The seigniorage revenue is comparable to the current net fee income, underlining the latter's relevance to the CBCB's revenue.

To institutionalize the CBST model, quants with programming skills and knowledge of accounting and macroeconomics should run and refine it regularly. The responsible department should be based on staff availability, with accounting and macro teams providing data and scenarios.

Finally, government deposit remuneration should be brought more in line with prevailing market rates. This could mean lowering them, but this is subject to conditions of monetary transmission, as well as communication and transparency.

Recommendations

Table 1. Recommendations

Recommendations and Authority Responsible for Implementation	Authority	Priority	Timeframe 1/
Central Bank Balance Sheet Stress Testing			
Quantify buffer required against the fair value losses in the international bond portfolio arising from the interest rate shock. (Paragraphs 64-65)	CBCG	High	Near-term
Run the model on a regular basis (e.g., at least annually), using different macroeconomic and non-macro adverse scenarios, including additional operating costs due to SEPA accession and EU integration. (Paragraph 61)	CBCG	High	Near-term
Re-evaluate the CBST model performance including satellite models (i.e., the model for the buffer against interest-rate risk) on a regular basis. (Paragraph 66)	CBCG	Medium	Near-term
Identify dedicated staff to build relevant modeling capacity. (Paragraph 62)	CBCG	Medium	Near-term
Build a business case to potentially change government deposit remuneration. (Annex V)	CBCG	Medium	Near-term

1/ Near term: < 12 months; Medium term: 12 to 24 months.

Introduction

1. **At the request of the CBCG, MCM conducted a hybrid technical assistance mission to support the authorities in conducting a forward-looking assessment of the CBCG's balance sheet and net income.** The mission also contributed to determining risk-based buffers and to establishing this analytical process as a regular institutional practice.
2. **Montenegro's economy is unilaterally euroized, meaning that the CBCG does not earn seigniorage.** The CBCG does not have currency in circulation as a liability on its balance sheet and, thus, cannot rely on it as a cheap way to finance its income-generating assets. This makes maintaining a strong balance sheet more challenging than it is for a typical central bank. Additionally, unilateral euroization constrains the CBCG's ability to provide emergency liquidity assistance (ELA), making policy solvency a key pillar in ensuring financial stability.
3. **In addition to the balance sheet structure, Montenegro's upcoming full integration into SEPA is expected to significantly affect the CBCG's revenue streams.** Specifically, Montenegrin banks will be able to switch to SEPA payment schemes, starting in October 2025, as the operational readiness date. The primary impact of SEPA is on cross-border payments. However, domestic payments could also eventually be affected by SEPA. This will reduce transaction volumes and revenues from the CBCG's Real-Time Gross Settlement (RTGS) and Deferred Net Settlement (DNS) systems. Also, the CBCG plays the role of a fiscal agent and. Thus, the interest expenses on the deposits from the government also impact the balance sheet. There may also be an impact on the level of deposits held by commercial banks at the CBCG for settlement purposes, as some of these may need to be transferred to correspondent banks used in SEPA.³
4. **The CBCG is governed by a legal framework that mandates allocating 50 percent of realized earnings to general reserves, and the remaining portion is transferred to the state budget.**⁴ This requirement limits the CBCG's ability to build up reserves against future losses and, along with the lack of seigniorage revenues and changing revenue patterns, poses a distinct challenge for the CBCG in maintaining its financial soundness.
5. **In this context, the treatment of losses and deficits under the law becomes particularly important.** The CBCG law stipulates that unrealized deficits on revaluation reserves must first be deducted from annual profits and then from general reserves. However, a recent amendment introduced an exception: deficits on the Fair Value Through Other Comprehensive Income (FVOCI) reserve are no longer deducted from profits or reserves, potentially triggering a recapitalization. This change is based on the rationale that such deficits are typically short term and are expected to reverse over time, either through maturity or through recycling into realized losses or gains in the event of a sale prior to maturity, depending on market conditions at the time of sale. However, if realized losses occur, this may result in a reduction in the CBCG's reserves.
6. **The law contains a further requirement that any loss for the year is initially covered by general reserves.** If the reserve is insufficient to cover the loss, the remaining loss is offset against capital. In this case, the central bank requests a capital injection from the government to

³ There is a third effect, whereby the settlement account declines in the domestic payment system due to the availability of new channels in SEPA. The reduction will be reflected in excess reserves and will thus eventually reduce the size of the international bond portfolio.

⁴ More precisely, up to 10 percent of realized earnings can be allocated to special reserves.

cover the deficit. The government will transfer cash or marketable securities to meet this requirement.

7. **The CBCG faces five types of revenue structure-related uncertainty, apart from macroeconomic uncertainty: the treatment of the loan from the World Bank, payment fee income from the government, the impact of SEPA on the settlement account, and increasing salaries to competitive levels for EU integration.** The fifth scenario combines all four impacts. The mission team investigates these non-macro adverse scenarios.
8. **The World Bank loan will be provided by the World Bank through its Investment Project Financing (IPF) instrument, with a total value of 8 million euros.** The borrower is the Government of Montenegro, represented by the Ministry of Finance, while the CBCG will serve as the implementing agency and final beneficiary for part of the loan. However, there is a possibility that the interest expenses could be paid by the CBCG.
9. **Payment fee income from the government could also change.** Currently, the government is expected to continue using the CBCG's payment system. However, it is worth analyzing how the loss of fee income from the government could impact the CBCG's balance sheet.
10. **Banks' settlement accounts at the CBCG would decline due to new SEPA channels, reflecting a decrease in banks' precautionary reserves.** This would lead to a drop in excess reserves during 2026–30, resulting in a corresponding reduction in the international bond portfolio and its interest income.
11. **In addition to the above uncertainties, the post-TA analysis assessed the impact of reducing foreign debt servicing and State Treasury order processing fees.** This analysis was motivated by uncertainty surrounding an ongoing legal case, which would have a modest negative effect on equity. Note that this scenario is independent of the non-macro adverse scenario, in which only payment fee income from the government is affected, as described in the previous paragraph.
12. **Lowering the remuneration on government deposits would contribute to a better financial position for the CBCG, but it cannot come at the cost of monetary transmission.** The interest expenses of the CBCG on government deposits are significant. Lowering these through a lower remuneration rate would strengthen the CBCG's financial position, but a business case must be made that this does not harm monetary transmission.

I. CBST Framework

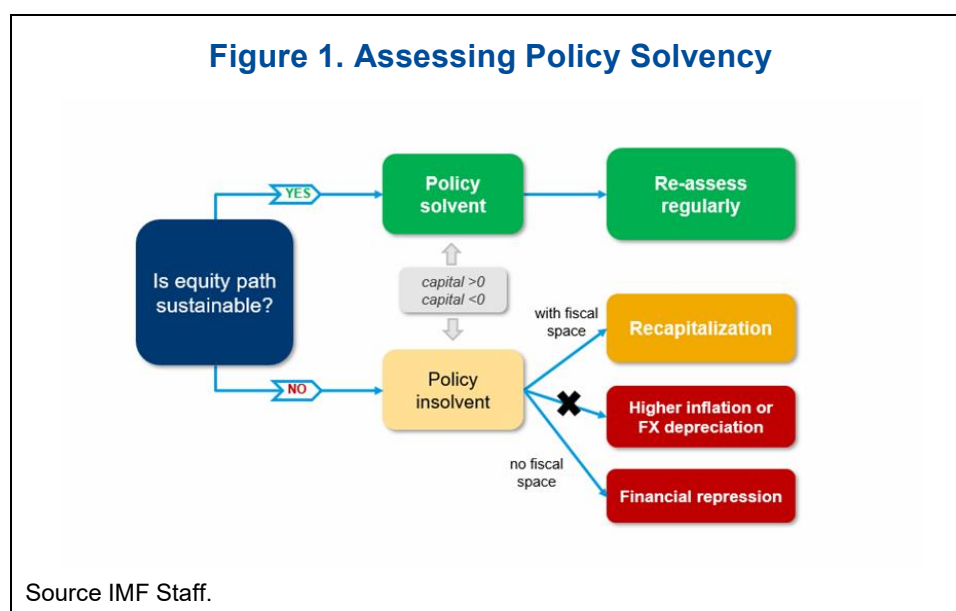
13. **In what follows, the mission report outlines the framework for stress testing the central bank balance sheet.** It begins by introducing the key concept of policy solvency, followed by a high-level overview of the CBST framework. The report then explains the core equations and key satellite models. While this section offers a general discussion not tailored to any specific country, references to Montenegro are included where relevant.

A. Policy Solvency

14. **A central bank is assessed to be policy solvent if its equity is on a sustainable path, which requires positive realized earnings on average over time.** The absolute level of equity is less important, as there are examples of central banks having operated effectively with negative

equity. All these cases involve strong institutional frameworks, central banks with underlying (i.e., realized) profitability, and governments with strong fiscal positions. The dynamics of realized earnings are important because revaluation gains cannot be relied upon to meet operational costs, as they may not be sustainable and could be reversed. Similarly, dividends should not be paid from revaluation gains, as doing so would monetize the gains and possibly undermine policy effectiveness.

15. **If the central bank is not policy solvent, there are three possible outcomes (Figure 1).** If the government has the fiscal space to recapitalize the central bank, it should do so. Alternatively, if the government does not have the fiscal space, the outcomes are limited to either financial repression (e.g., capital controls, negative real interest rates) or a loss of control over financial conditions (e.g., the exchange rate) and, consequently, over inflation.
16. **It is noteworthy that a central bank under euroization or dollarization cannot inflate its domestic debts by depreciating the exchange rate.** Hence, recapitalization from the government or financial repression of domestic banks are the only possible outcomes in the figure below.

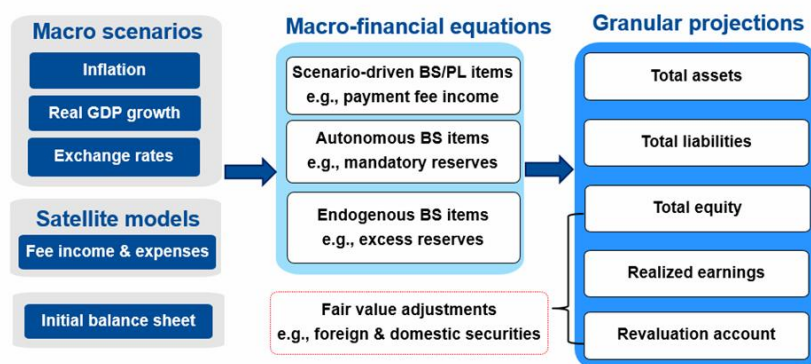


17. **If a central bank is unable to issue its own currency due to euroization or dollarization, it is essential for the central bank to maintain an adequate equity buffer capable of absorbing temporary losses.** While the policy solvency condition represents an intertemporal constraint, it presupposes that the central bank is not bound by liquidity constraints on a period-by-period basis. However, because the central bank does not have the ability to issue currency, it becomes subject to liquidity constraints similar to those of commercial banks.
18. **When a central bank is subject to liquidity constraints, it is important to analyze both instantaneous losses in equity due to fair value losses and the path of equity driven by realized earnings.** Such a separate analysis helps the central bank better understand short-term and long-term risks and, thus, supports more informed decision making.

B. Overview of Central Bank Balance Sheet Model

19. **The central bank balance sheet model generates projections of the balance sheet items from the initial balance sheet using scenarios of macroeconomic variables (Figure 2) over a given time horizon.** Projections of real GDP, inflation, and the exchange rate are centered on area department assumptions, while the policy rate is based on a Taylor rule. The model incorporates accounting rules and equations derived from macroeconomics and finance. All material items on the balance sheet are modeled, generating a path for total equity that is split between retained earnings and the revaluation account. The items can be classified into three groups:
- Exogenous or policy-determined items. These include net purchases of foreign currency and investments in domestic government bonds. These items are not estimated but derived from policy decisions (e.g., regarding the target level of net international reserves).
 - Autonomous items determined by macroeconomic variables that do not explicitly depend on other items on the balance sheet (i.e., currency in circulation). These items are outside the direct and immediate control of the central bank and are therefore not directly related to monetary policy operations, but they can influence the amount of liquidity in the banking system. Therefore, they need to be forecast using the satellite models.
 - Endogenously determined items. Excess reserves are the key endogenously determined item, as they are determined by changes in CiC and required reserves on the liability side and the net purchases of the USD and the investment in the government bonds on the asset side. Excess reserves also reflect interest expenses and operating costs.

Figure 2. Modeling Central Bank Balance Sheet



Source: IMF staff.

Note: "BS" refers to balance sheet; "PL" refers to profit and losses.

C. Core Equations for Central Bank Balance Sheet Model

20. **There are three core equations describing the dynamics of the central bank balance sheet: equity, a clearing item (e.g., excess reserves), and foreign reserves.** These core equations are based on accounting principles and are independent of the assumptions of macroeconomic dynamics.
21. **Total equity can be obtained using two methods.** A model developer can check internal consistency by comparing the values of total equity from these two methods.

$$(1): \text{Equity}_t = \text{Total Assets}_t - \text{Total Liabilities}_t$$

$$(2): \text{Equity}_t = \text{Equity}_{t-1} + \text{Realized earnings}_t + \text{Reval Account}_t$$

The second equation is rewritten as

$$(3) \text{Equity}_t = \text{Equity}_{t-1} + \text{NetInterestIncome}_t + \text{NetFeeIncome}_t - \text{OperatingCosts}_t + \text{Reval Account}_t.$$

In the context of the CBCG, the net interest income mainly consists of interest income from the international bond portfolio minus interest expenses on deposits from the government and deposit insurance funds. Net fee income consists of fee income from the use of the domestic payment system by Montenegrin banks and the State, banking supervision fees, and other fee income, minus fee expenses.

It is important to note that net interest income and the revaluation account are market driven and thus uncertain, while net fee income and operating expenses are predictable to a certain extent.

- 22. Depending on the operational framework, either open market operations (OMO) or excess reserves serve as a clearing item that captures changes in the assets and liabilities that impact realized earnings.** Revaluation gains or losses on these items are not captured, as they are recorded directly against the revaluation account. Where excess reserves are low and constant, the changes in the balance sheet that impact on realized earnings will be reflected in changes in the OMO. In general, these changes arise from: (i) net USD purchases for the foreign reserve accumulation; (ii) net increases in government bond investments; (iii) changes in currency in circulation; (iv) changes in required reserves; and (v) interest income and operating costs. In the case of CBCG, the clearing item is the excess reserves, which earns zero interest rate.

$$\begin{aligned} \text{ExcessRes}_t &= \text{ExcessRes}_{t-1} \\ &+ [\Delta \text{BondPort}_t + \Delta \text{RequiredRes}_t + \text{NetInterestExpense}_t + \text{OperatingCosts}_t] \end{aligned}$$

The above description and the equation are for illustrative purposes. If there are any other changes that need to be captured in the clearing item, they should be incorporated.

- 23. The dynamics of the gross foreign reserve accumulation are driven by three terms: (i) foreign currency interest income; (ii) foreign exchange (FX) revaluation gains or losses; and (iii) net foreign currency purchases for net foreign reserve (NFR) accumulation.** Note that the equation below is shown in the simplest case. In the case of the CBCG, Montenegro is unilaterally euroized, and the CBCG's bond investment portfolio is considered to be the international reserves. All these bonds are denominated in euro (EUR), and thus there are no FX revaluation gains or losses from these bonds.

$$\text{ForeignReserves}_t = \text{ForeignReserves}_{t-1} + \text{FX Interest Income}_t + \text{FX Revaluation} + \Delta \text{BondPort}_t$$

The last term on the right-hand side of the equation reflects the inflow or outflow to foreign reserves. In the context of the CBCG, this term captures the change in the settlement account.

D. Satellite Models for the Central Bank Balance Sheet Model

- 24. Satellite models are developed for three items that have material impacts on equity dynamics.** Unlike the core model equations described above, these assumptions are based on specific macroeconomic circumstances. What follows are parsimonious but sufficiently flexible models for the key balance sheet items. These satellite models can be replaced with simpler or more sophisticated models, depending on the purpose of the CBBS model users.
- 25. Required reserves in EUR are assumed to increase with nominal GDP.** This is because required reserves increase as total bank deposits grow (given a constant ratio of the reserve requirement), and total deposits increase with nominal GDP. Regarding the remuneration, there are two options that model users can select. The first option is a zero interest rate on required reserves. The second option is that interest paid on required reserves is calculated at the policy rate. In the case of the CBCG, the interest rate on the required reserve is zero.⁵ Note that the CBST model user can set parameter η_{Req} to change over time to capture a possible change in the relationship between required reserves and nominal GDP.⁶

$$\text{ResReq}_t = \eta_{\text{Req}} \text{NGDP}_t + i_{\text{req},t-1} \text{ResReq}_{t-1}$$

- 26. There are four different model specifications for fee income, fee expenses, and other operational expenses.** The model explicitly describes the four types of fee income, as well as fee expenses and other expenses, individually. In the first specification, these items are proportional to nominal GDP. In the second specification, their future values are linearly extrapolated from historical data. In the third specification, these items increase with the inflation rate. The fourth specification is based on a deterministic projection specified manually by the user.

Table 2. Modeled Items of Fee Income, Fee Expenses, and Other Expenses

Category	Variable name	Definition
Fee income	Bank fee	Inspection of banks and microcredit financial institutions
Fee income	State fee	State Treasury order procession
Fee income	Payment fee	Sum of (1) Participation in RTGS, (2) Order procession in RTGS and (3) Order processing in DNS
Fee income	Other fee	All fee income components not included in the above
Fee expense	Fee expense	Fee expense
Other expenses	Other op cost	Other expenses below "fee expenses" mainly driven by staff costs

Source: IMF staff.

Note: RTGC refers to real-time gross settlement; DNS refers to deferred net settlement.

- 27. These four different model specifications help conduct counterfactual analyses of fee income and expenses.** By adopting such a granular modeling approach, it becomes possible to closely analyze how the balance sheet evolves as the payment system affects fee income and expenses in different ways.

⁵ The change to set the interest rate on mandatory reserves to zero was made in September 2024.

⁶ For example, if the relationship between required reserves, deposits in the banking system, and nominal GDP changes over time, this parameter can be made to change over time accordingly.

28. The method for quantifying the buffer against interest rate risk in the bond portfolio is proposed based on a tail risk measure. Mathematically, the FVOCI buffer at time t is computed as:

$$Buffer_t = Exposure_t \sum_{i=1}^N w_{t,i} \cdot T_i \cdot \Delta y_{i,\alpha},$$

$$\Delta y_{i,\alpha} = \sigma_i \cdot \Phi(\alpha) \cdot \sqrt{\Delta t},$$

where $\Delta y_{i,t}$ is the change in yield under stressed market conditions. $Exposure_t$ represents the total amount of the bond investments under FVOCI, $w_{t,i}$ denotes the proportion of investments to the i -th country, σ_i represents the volatility of the yield. T_i is the average duration for the i -th country. Δt is time to liquidate, measuring how long it takes to liquidate the position.⁷ $\Phi(\alpha)$ is the cumulative distribution function of the standard normal distribution. Note that the expected shortfall can also be employed. In the above, the method is based on VaR for simplicity.

II. Data

29. In what follows, the mission team presents the initial balance sheet of the CBCG and key input data for the CBST model tailored to the CBCG. It is noteworthy that the initial balance sheet is provided as input for the CBST model. The CBST model captures material balance sheet items and abstracts non-material items.
30. The CBCG balance sheet is lean and mainly consists of foreign reserves, with small interest-bearing liabilities. Table 3 shows the detailed balance sheet. On the asset side, all assets are income-generating; 98 percent are foreign assets, and the remainder are domestic assets. On the liability side, the government's deposit accounts and deposits at the Deposit Protect Funds—key interest-bearing items—are 23 percent and 10 percent of total liabilities, respectively. An aggregation of the balance sheet in Table 4 and the interest rate setting in Table 5 helps explain the key drivers of balance sheet dynamics.

Table 3. CBCG Balance Sheet as of 2024Q4

Asset	Thousands EUR	Liabilities	Thousands EUR
Cash	131,677	SDR allocations (liabilities to IMF)	181,449
Demand deposits	31	Government's deposit accounts	397,004
Time deposits	530,616	Excess reserves	670,282
FVOCI investment in EUR (thousands)	773,812	Mandatory reserves	308,499
Amortized investment in Romania	54,142	Deposit Protection Fund (FZD)	165,609
Amortized investment in Lithuania	21,124	Other bank deposits	5,728
Amortized investment in Slovakia	21,885	Miscellaneous liabilities	982
Amortized investment in Latvia	7,251	Total liabilities	1,729,553
Allowance impairment	(82)		
SDR holdings (assets at IMF)	182,784	Total equity	83,743
Amortized investment in Montenegro	51,437		
Property, plants, and equipments	24,061		
Miscellaneous assets	14,558		
Total assets	1,813,296		

Sources: CBCG and IMF staff.

Note: FVOCI refers to Fair Value Through Other Comprehensive Income: SDR refers to special drawing rights.

⁷ The reason why the time-to-liquidation parameter affects the yield change in the form of a square root is technical, but in simple terms, it originates from the assumption that the interest rate process follows a random walk.

Table 4. Aggregated Balance Sheet

Assets	EUR (thousands)	Liabilities	EUR (thousands)
Net foreign asset	1,593,228	Net claim from banks	1,150,118
Net claim on others	37,637	Net claim from government	397,004
		Total equity	83,743

Sources: CBCG and IMF staff.

Table 5. Interest Rate Setting

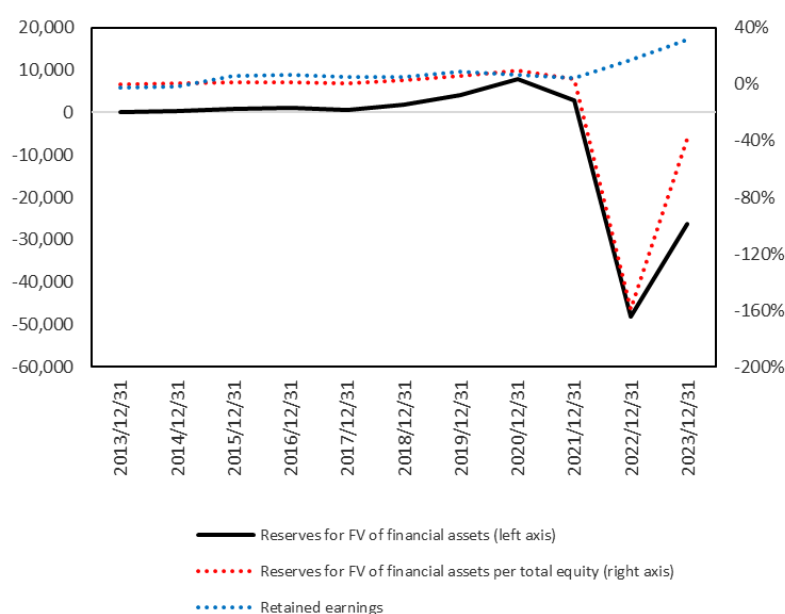
Assets	Assigned interest rate	Liabilities	Assigned interest rate
Cash	Zero	SDR allocations (liabilities to IMF)	SDR interest rate
Demand deposits	EUR short rate	Deposit from Gov't	EUR short rate-15bps
Time deposits	EUR short rate (+spread)	Excess reserves	Zero
FVOCI investment in EUR	EUR short rate (+term premium)	Mandatory reserves	Zero
Amortized investment in Romania	1.36%	Deposit Protection Fund (FZD)	EUR short rate-50bps
Amortized investment in Lithuania	2.84%	Other bank deposits	Zero
Amortized investment in Slovakia	2.86%	Miscellaneous liabilities	Zero
Amortized investment in Latvia	2.79%		
Allowance impairment	Zero		
SDR holdings (assets at IMF)	SDR rate		
Amortized investment in Montenegro	1.90%		
Property, plants, and equipments	Zero		
Miscellaneous assets	Zero		

Sources: CBCG and IMF staff.

Note: FVOCI refers to Fair Value Through Other Comprehensive Income: SDR refers to special drawing rights.

31. It is important to protect the CBCG's balance sheet from potential losses arising from interest rate risk in the international bond portfolio under FVOCI, considering the large impact in the past. Fair value losses resulting from the sharp rise in the euro yield curve exceeded equity in 2022, although they were partially offset by realized earnings.

Figure 3. Reserves for Financial Assets Measured at Fair Value Through Other Comprehensive Income



Sources: CBCG and IMF staff.

- 32. The bond portfolio in the international reserves is diversified, and its duration is kept relatively short.** The Belgian government bond has the shortest duration, while the Spanish bond has the longest duration as of December 2024. The weighted average duration is 1.8 years and thus relatively short.
- 33. All bonds are denominated in euro, and hence there is no FX risk, while the credit risk is mitigated by selecting only investment grade bonds.** Following the guidelines determined by the CBCG investment committee, the fair valued international bond portfolio contains only investment grade bonds. Hence, the main risk embedded in this bond portfolio is the risk of fair value losses.
- 34. There is a trade-off in extending duration.** If the yield curve is upward sloping, extending duration allows the CBCG to earn the term premium. However, this also increases the exposure to mark-to-market losses arising from interest rate fluctuations (i.e., duration risk), creating the trade-off. This underscores the necessity of robust interest rate risk management. Note that the CBST model allows users to set the projection of the term premium, if needed.

Table 6. Composition and Duration of the International Bond Portfolio by Issuer

Issuer	Exposure (Thousands of EUR)	Share	Effective duration (year)
Belgium	125,422	16%	0.51
Italy	113,184	15%	0.63
Spain	100,795	13%	4.38
France	73,590	10%	1.63
UAE	66,997	9%	1.09
Other non-EU	64,257	8%	1.48
Germany	62,380	8%	2.35
Other EU	60,973	8%	2.06
Finland	46,443	6%	2.70
Ireland	23,995	3%	3.74
Poland	17,185	2%	1.16
Slovakia	10,761	1%	3.65
United Kingdom	7,830	1%	0.83
Total	773,812	100%	

Sources: CBCG and IMF staff.

- 35. The additional costs due to SEPA accession and EU integration are used in the projection of the CBCG balance sheet.** The CBCG projects the costs associated with the following plans: increased staff costs due to SEPA and EU integration; TARGET Instant Payment Settlement (TIPS) clone investment and its training costs; costs and income loss due to digitalization; as well as the potential repayment of the World Bank loan. These projections are used for nonmacro adverse scenarios. Note that the net fee income and operating expenses can be made dependent on macroeconomic variables. Also, the World Bank loan interest expenses could be impacted by the EUR interest rates.

Table 7. Net Fee Income, Operating Expenses, and Additional Costs by Source

(Thousands of EUR)

Year	All scenarios		All scenarios except status-quo scenario			Non-macro adverse scenarios		
	(A) Net fee income with SEPA impact under base scenario	(B) Business costs (sum of other operating expenses+staff costs+misc-other income & gains)	(C) Increase in staff costs due to SEPA & EU integration	(D) TIPS Clone investment & training costs	(E) Costs and income loss due to digitalization	(F) WB loan interest expenses (projection)	(G) WB loan fixed payment (projection)	Reduction in fee income from State
12/31/2025	12,436	14,081	337	2,230	1,000	251	20	3,540
12/31/2026	12,436	14,081	1,012	630	500	249	-	3,279
12/31/2027	12,436	14,081	1,687	630	500	249	-	4,290
12/31/2028	12,436	14,081	1,687	630	500	249	-	3,825
12/31/2029	12,436	14,081	1,687	630	500	249	-	4,635
12/31/2030	12,436	14,081	1,687	630	500	249	800	4,635

Sources: CBCG and IMF staff.

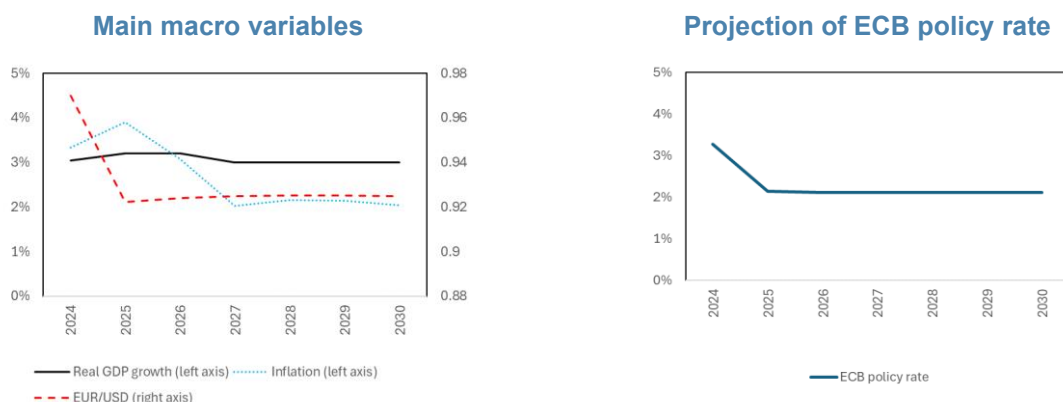
III. Results

36. The mission report presents results under different scenarios. First, the team discusses the status quo and baseline scenarios. Second, the team analyzes the four macroeconomic adverse scenarios. Third, the team examines five nonmacro adverse scenarios. Fourth, the team investigates a revenue loss mitigation scenario. Finally, the team investigates buffers against potential losses. Note that the impact of uncertainty associated with the ongoing legal case is assessed in Annex IV.

A. Status Quo Scenario

37. In the base and status quo scenarios, the Montenegrin economy is assumed to grow modestly but steadily. Real GDP growth is expected to stabilize around 3.0 percent in the medium term. Inflation increases in 2025 but is expected to decline to 2.0 percent over time. The EUR appreciates against USD in 2025 but is expected to stabilize in the medium term. The ECB's policy rate declines and converges to around 2 percent in the medium term.

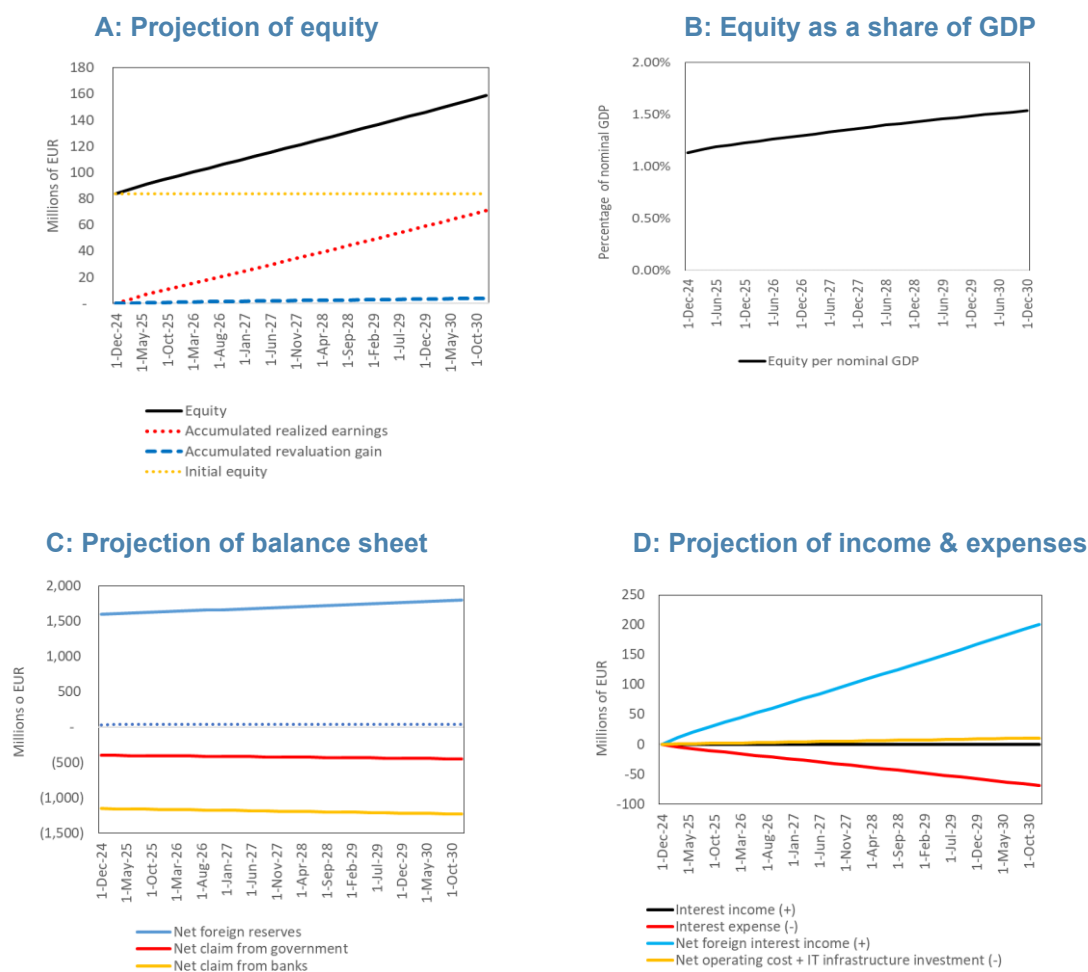
Figure 4. Base Scenario



Source: IMF staff.

38. The equity per nominal GDP increases strongly over time when there is no impact from SEPA. Figure 5 shows projections of the balance sheet when there is no impact of SEPA on fee income from payment system service. To do so, payment fee are assumed to increase proportionally to nominal GDP. Additional costs due to SEPA accession, such as TARGET Instant Payment Settlement (TIPS) clone investment and training are not included. There are four observations. First, equity increases over time in euro terms, and it increases slightly in terms of nominal GDP. Second, net operating costs are close to zero. Third, foreign interest income is larger than domestic interest expenses, and thus accumulated realized earnings increase over time. Fourth, the revaluation gain is essentially zero, as there is no FX revaluation gain or loss.

Figure 5: Projecting CBCG's Balance Sheet Under Status Quo Scenario



Source: IMF staff.

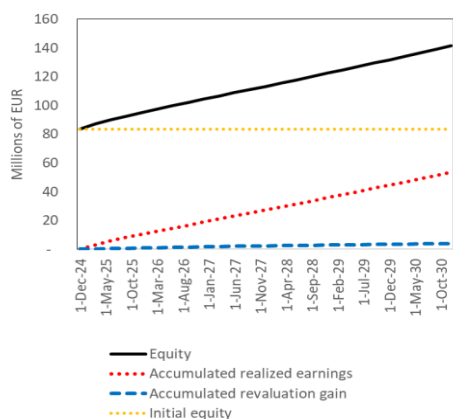
B. Base Scenario

39. The equity per nominal GDP increases only slightly as the migration to the SEPA payment system reduces fee income from payment services to Montenegrin banks. Figure 6 shows projections of the balance sheet, as well as income and expenses, when there is an impact of SEPA on fee income from payment system services to the banks. The assumption is that

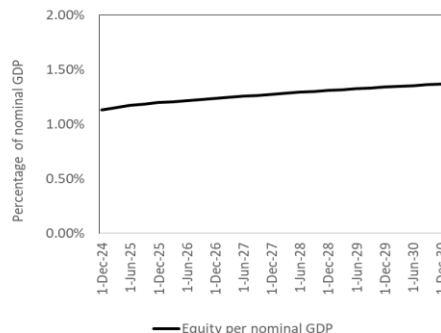
payment fee income from banks decreases by 1 million in 2025 from the 2024 level and then become zero during 2026–30 to make the projection conservative. The projections are shown in the figure below. There are three observations. First, equity increases over time in euro terms, but it increases only slightly in terms of per nominal GDP. Second, net operating costs are clearly higher than those under the zero-impact EPA scenario due to the loss of payment fee income. Third, foreign interest income is larger than domestic interest expenses and increased net operating costs, and thus accumulated realized earnings still increase over time.

Figure 6: Projection of CBCG's Balance Sheet Under Base Scenario

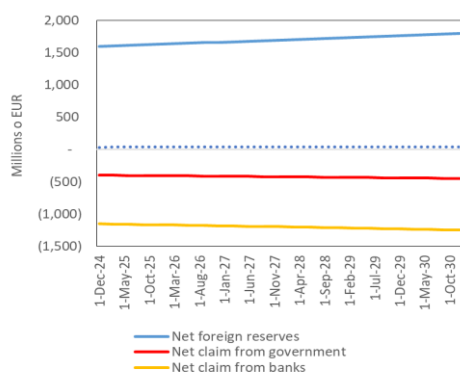
A: Projection of equity



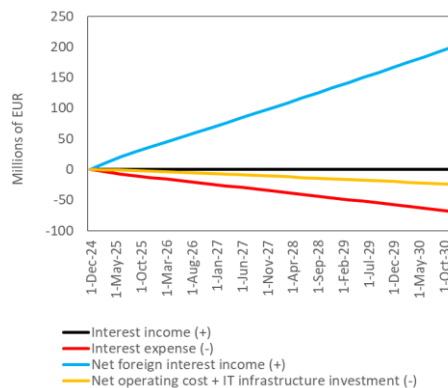
B: Equity as a share of GDP



C: Projection of balance sheet



D: Projection of income & expenses



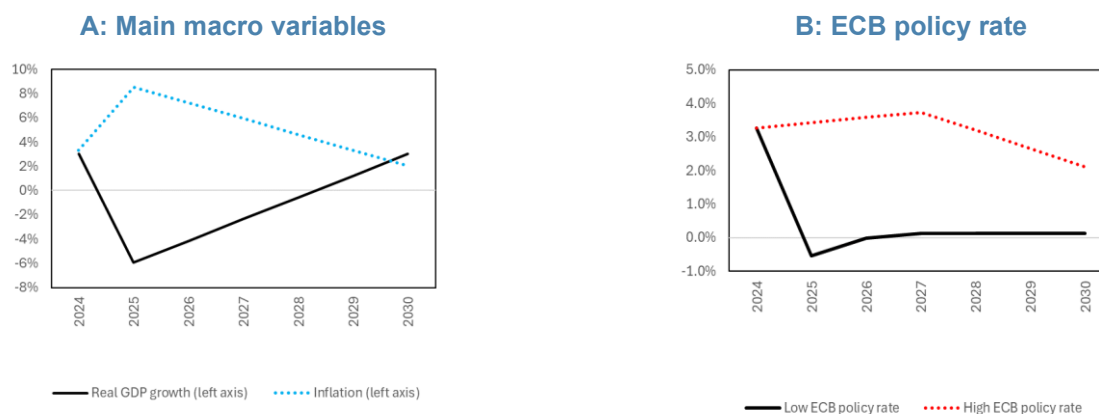
Source: IMF staff.

C. Macroeconomic Adverse Scenarios

40. The mission team employs four different macroeconomic adverse scenarios: Inflation-at-Risk, Growth-at-Risk, and two Interest-rate-at-Risk scenarios to stress test the balance

sheet of CBCG.⁸ The main risk is interest risk because of the large international bond portfolio relative to the equity. The mission team analyzes both low- and high-interest rate paths compared to the base scenario. FX-at-risk is excluded because there is no material FX exposure in the CBCG's balance sheet.⁹

Figure 7: Macroeconomic Adverse Scenarios



Source: IMF staff.

41. The equity path does not differ significantly under the adverse inflation scenario from that under the base scenario in euro terms. Figure 8 shows the projection under the Inflation-at-Risk scenario. This is because there are no inflation-sensitive balance sheet items.¹⁰ Typically, the following two opposing effects arise. On the one hand, higher inflation leads to a larger currency in circulation, which reduces interest expenses and thus has a positive impact. On the other hand, higher inflation leads to a higher domestic policy rate and thus increases interest expenses on interest-bearing liabilities such as excess reserves. These effects do not arise in the case of CBCG because: (i) there is no CiC on the CBCG's liability; and (ii) inflation in Montenegrin economy does not impact ECB policy rate. Note that the path of equity per nominal GDP is worse than under the base scenario, but this is a mechanical result because nominal GDP is larger under Inflation-at-Risk scenario than under the base scenario.

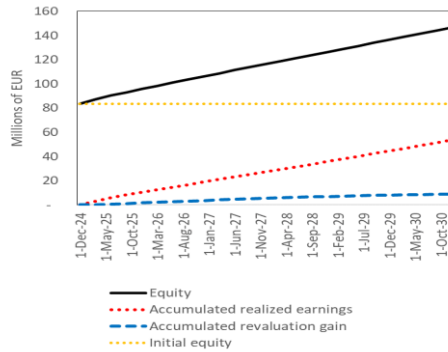
⁸ In this at-Risk scenario design, the 95th percentile is used for inflation and high interest rate scenarios. The fifth percentile is used for low interest rate scenarios. The 10th percentile is used for real GDP growth scenarios.

⁹ More precisely, there are claims to and from the IMF, but the SDR exposure is not material.

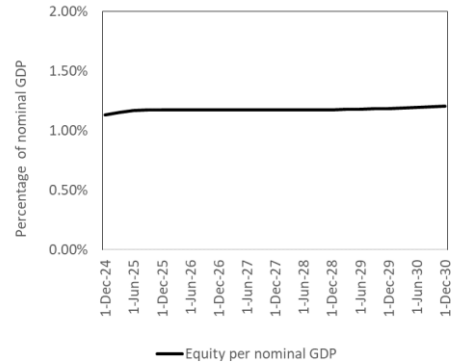
¹⁰ To be precise, the mission team assumes that "property, plant, and equipment" increase over time with inflation, but this item is not important. Also, when the user selects the model specification for fee income, fee expenses, and the operating costs to be dependent on inflation or nominal GDP, inflation affects these items.

Figure 8. Adverse Inflation Scenario

A: Projection of equity



B: Equity as a share of GDP

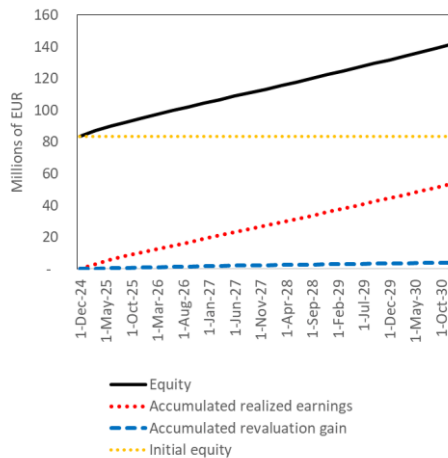


Source: IMF staff.

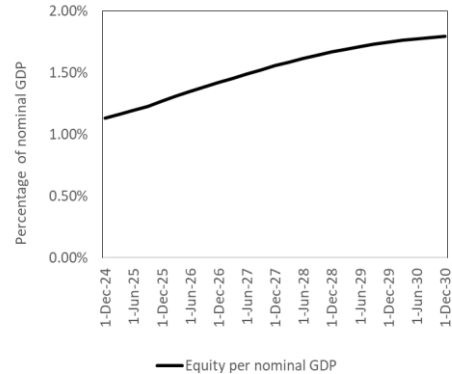
42. Similar to the adverse inflation scenario, the equity path under the adverse real GDP growth scenario does not differ significantly from the base scenario in euro terms. Figure 9 shows the projection under real GDP Growth-at-Risk scenario. This is because there are no real –GDP growth-sensitive balance sheet items. Typically, lower real GDP growth leads to a lower domestic policy rate and thus decreases interest expenses on interest-bearing liabilities such as excess reserves. This effect does not arise in the case of the CBCG. Note that the path of equity per nominal GDP is higher than under the base scenario, but this is a mechanical result because nominal GDP is smaller under the real GDP Growth-at-Risk scenario than under the base scenario.

Figure 9. Adverse Real GDP Growth Scenario

A: Projection of equity



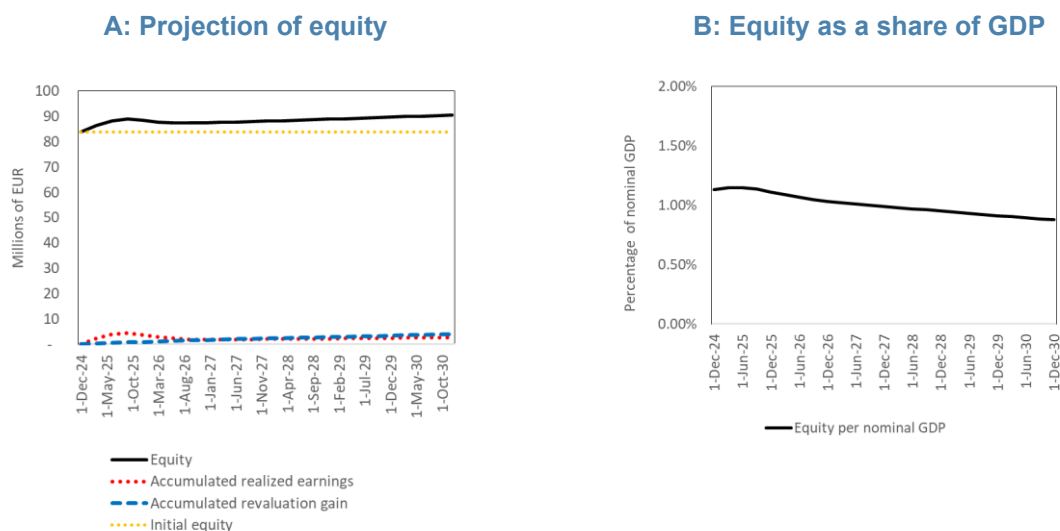
B: Equity as a share of GDP



Source: IMF staff.

43. By contrast, the equity path is much worse under the low-interest-rate scenario than under the base scenario in euro terms. Figure 10 shows the projection under the scenario of low interest rates. Notably, equity per nominal GDP declines over time. This is because lower interest rates lead to lower foreign interest income and domestic interest expenses. The negative impact of lower foreign interest income exceeds the positive impact of decreased domestic interest expenses. Hence, the net effect on realized earnings is negative. It is also noteworthy that there is a floor on interest rates for deposits from the government and the Deposit Protection Funds (FZD). Hence, the CBCG does not earn income from these liability items under the ECB's negative rate policy.

Figure 10. Low-Interest Rate Scenario

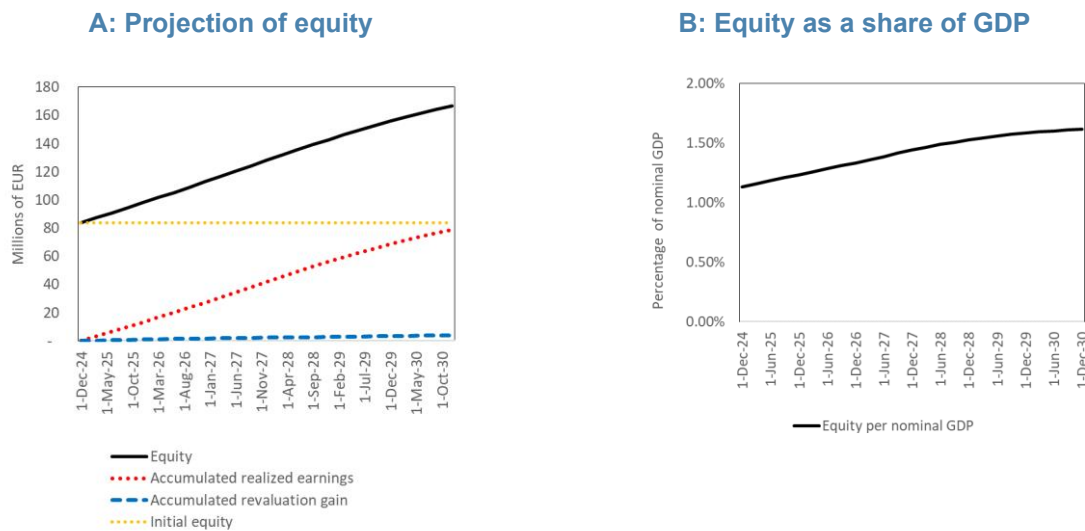


Source: IMF staff.

44. The equity path is higher under the high-interest-rate scenario than under the base scenario in euro terms. Figure 11 shows the projection under the scenario of high interest rate. Equity increases strongly in euro and per nominal GDP terms. The economic mechanism behind this result is the same as in the low-interest-rate case. The positive impact of the increased foreign interest income exceeds the negative impact of the increased domestic interest expenses. Hence, the net effect on realized earnings is positive. Note that the mission team assumes that the duration of the international bond portfolio is short, so that fair value losses do not arise explicitly.¹¹

¹¹ It is possible to extend the model to capture instantaneous FV losses, but it complicates the satellite model.

Figure 11. High-Interest Rate Scenario



Source: IMF staff.

D. Non-Macro Adverse Scenarios

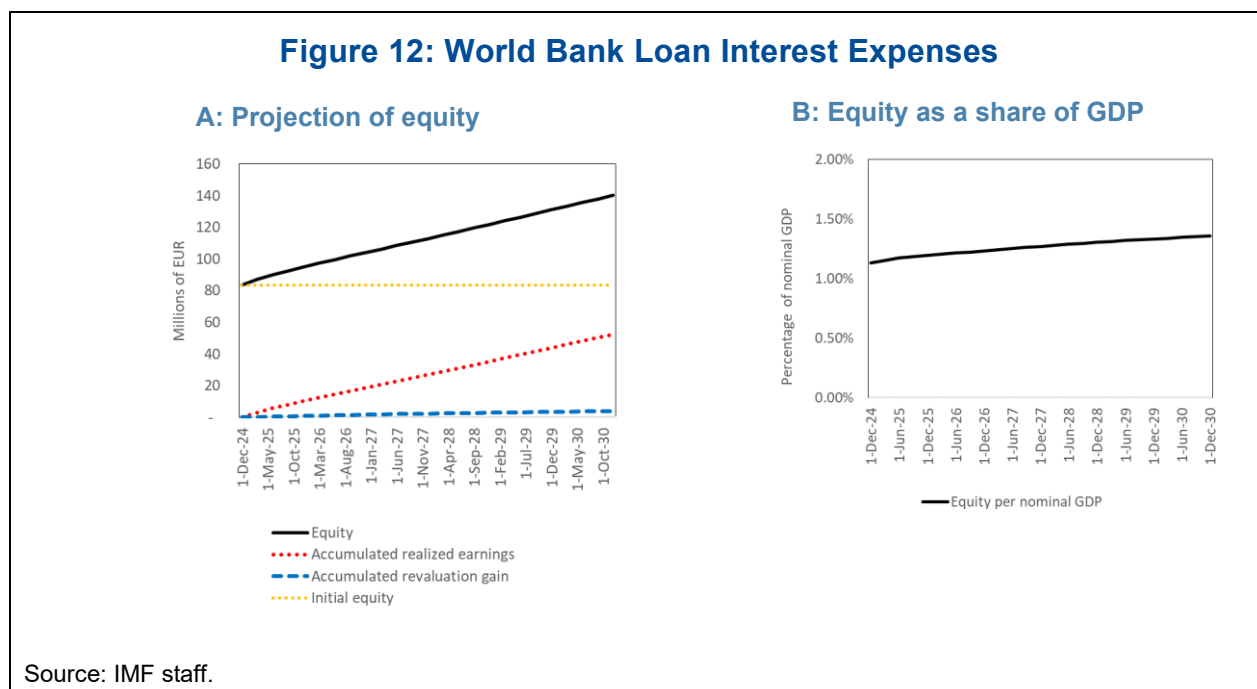
45. The mission team examines five non-macroeconomic adverse scenarios to assess the robustness of the balance sheet of the CBCG.

- (1) Increased interest expenses from the World Bank.
- (2) Loss of fee income from the government's use of the domestic payment system.
- (3) Reduction in excess reserves due to SEPA migration.
- (4) Salary increases to align with competitive levels in the context of EU integration.
- (5) Combined scenario incorporating all four non-macroeconomic shocks.

Under the first scenario, the CBCG incurs additional interest expenses on loans from the World Bank. The second scenario involves a loss of fee income resulting from reduced government use of the CBCG's domestic payment system. Under the third scenario, excess reserves decline due to the transition from the domestic payment system to a new channel based on SEPA accession. This shift reduces the size of the international bond portfolio and leads to lower interest income. Under the fourth scenario, personnel costs increase due to salary adjustments intended to align compensation with competitive levels in the context of EU integration.

46. In addition, the post-TA analysis examines the potential outcome of an ongoing legal case under consideration by the constitutional court that could significantly reduce foreign debt servicing fees and State Treasury order processing fees. This result is presented in Annex IV.

47. Under the first non-macro adverse scenario of World Bank loan interest expenses, the impact on equity is relatively small. Figure 12 shows the projection under this scenario. The equity in December 2030 decreases by around EUR 1.1 million, although the additional interest expenses on the World Bank loan are around EUR 2.3 million. Note that this additional interest expense reduces realized earnings and thus decreases the dividend to the Ministry of Finance.¹² Note that it is assumed that the principal repayment only arises in 2030 due to five-year grace period of this loan.



48. For the second non-macro adverse scenario, the projected decrease in payment service fees from government usage is based on the CBCG's estimate. The projected impact is shown on the table below.

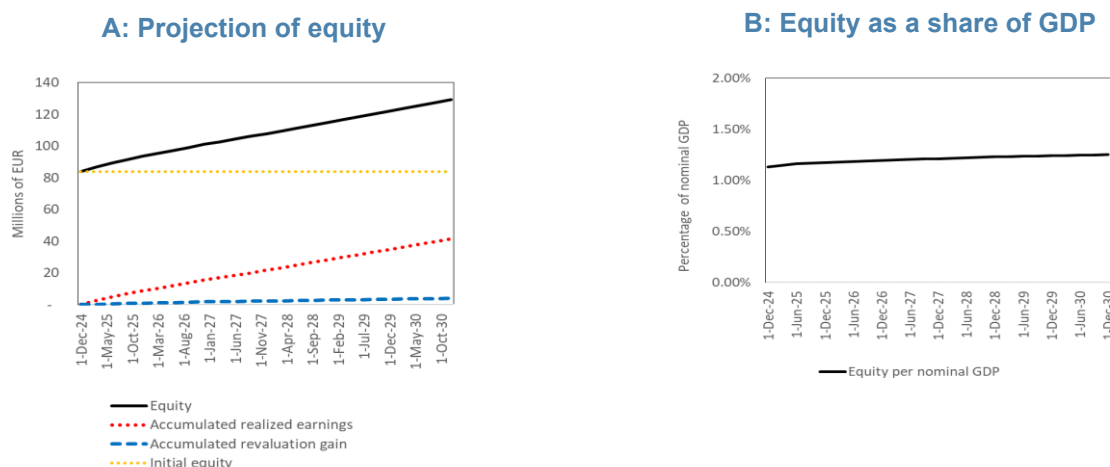
Year	Reduction of payment fee from State (thousands of EUR)
December, 2025	3,540
December, 2026	3,279
December, 2027	4,290
December, 2028	3,825
December, 2029	4,635
December, 2030	4,635

Sources: CBCG and IMF staff.

¹² Recall that 50 percent of realized earnings are assumed to transfer to the MOF.

49. Under the second non-macro adverse scenario—namely, a reduction in payment service fees from government usage—the equity path is modestly negatively affected. Figure 13 illustrates the projection under this scenario. This analysis is based on the CBCG's projection of reduced government-related payment service fees during the 2025–29 period. The mission team extrapolates it to December 2030. These payment service fees account for approximately 21 percent of total fee income. Furthermore, the share of government-related payment service fees is expected to increase as fee income from commercial bank's use of the domestic payment system declines following the SEPA accession. Consequently, the reduction in government-related payment service fees could have a material financial impact on total fee income.

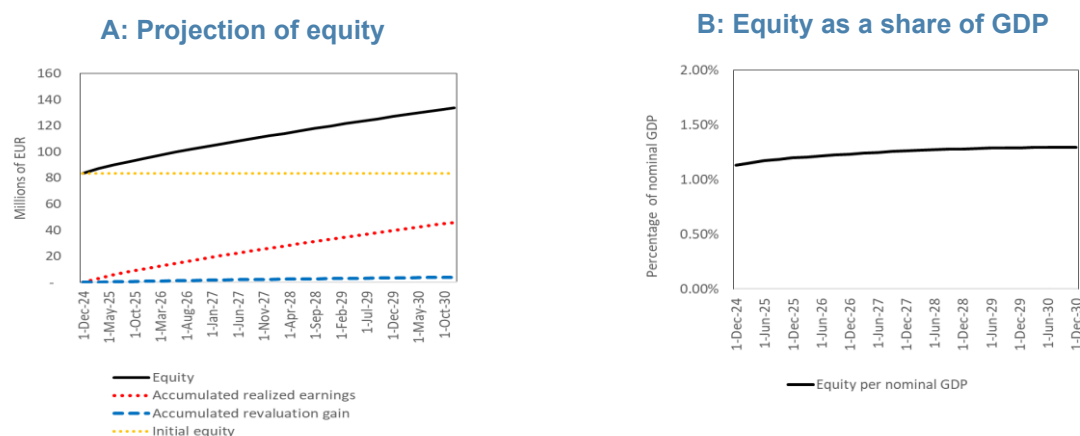
Figure 13: Loss of the Payment Service Fee from the State's Usage



Source: IMF staff.

- 50. The third non-macro adverse scenario is a decrease in the settlement account, which leads to the decrease in interest income from the international bond portfolio.** Specifically, precautionary reserves from Montenegrin banks in the form of the settlement account decrease due to the availability of new channels in SEPA. The decrease in the settlement account is captured as a decrease in excess reserves and thus eventually reduces the size of the international bond portfolio. Consequently, interest income from the international bond portfolio declines.
- 51. The mission team assumes a value for the impact of SEPA on the settlement account at the CBCG, as no robust estimate is available at this stage.** The team assumes that excess reserves would decrease by EUR 300 million during 2026–20. This amount is consistent with the lowest level of assets in commercial bank accounts at the CBCG over the last ten years, from which commercial banks make such transfers. Consequently, the size of the international bond portfolio decreases by the same amount in EUR.
- 52. Under the third non-macro adverse scenario of a reduced settlement account, the equity path is modestly negatively affected.** The figure below shows the projection under this scenario. Foreign interest income decreases by around EUR 15.4 million, and the equity decreases by around EUR 7.7 million in December 2030 compared to the base case.

Figure 14: Decrease in Settlement Account Combined with the Reduction of the Size of the International Bond Portfolio

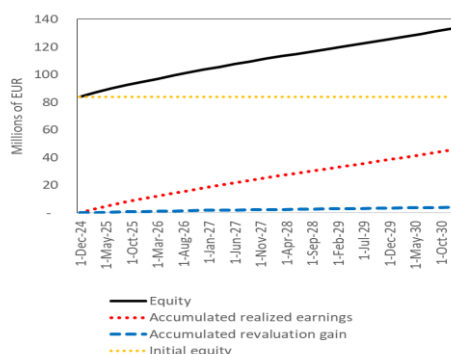


Source: IMF staff.

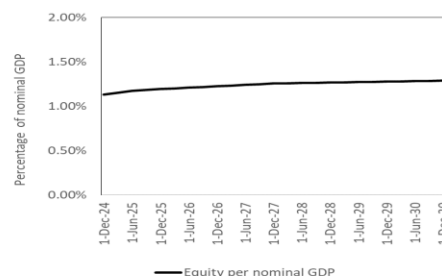
- 53. The decrease in excess reserves due to SEPA accession needs to be updated once the robust impact on the settlement account becomes available.** The CBST model allows users to set the net decrease in the bond portfolio equal to the decrease in the excess reserves.
- 54. The fourth non-macro adverse scenario is a salary increase to a competitive level in the context of EU integration.** This is motivated by the need to avoid brain drain of staff from the CBCG to other institutions after EU integration. Specifically, the mission team computes the projection of staff costs by assuming that staff costs increase with inflation, real GDP growth, and an additional growth rate for competitive level adjustment. The growth rate is zero during 2025–26 and 10 percent in 2027 and 30 percent per year during 2028–30. In total, the salary is assumed to increase by 100 percent. This is based on the cross-country analysis discussed below, which shows that the salary at the CBCG is lower than the benchmark based on per capita GDP.
- 55. Under the fourth non-macro adverse scenario, the equity path is modestly negatively affected.** The figure below shows the projection under this scenario. Operating costs increase by around EUR 16.5 million and equity decreases by around EUR 8.3 million in December 2030.

Figure 15: Increase in Salary to the Competitive Level

A: Projection of equity



B: Equity as a share of GDP



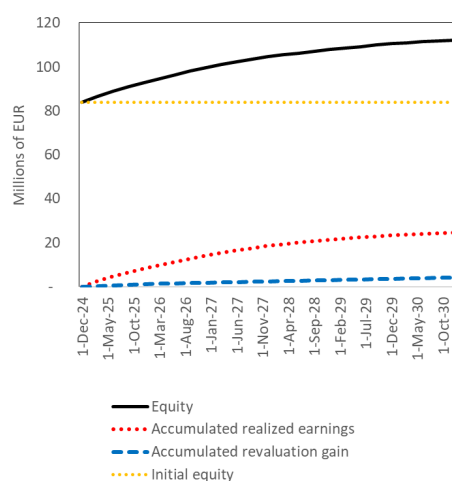
Source: IMF staff.

56. The final non-macro adverse scenario combines the shocks of all four non-macro adverse scenarios. The reason for doing this is to understand the ultimate effect when the four shocks occur simultaneously.

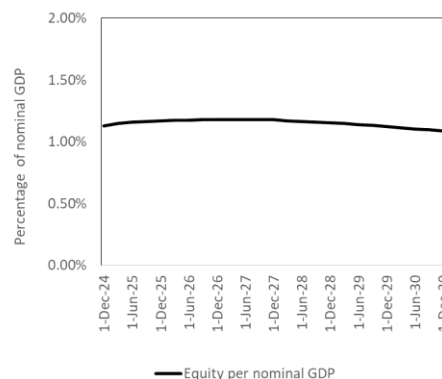
57. Under the final non-macro adverse scenario, the equity path is strongly negatively affected. The figure below shows the projection under this scenario. Equity decreases by around EUR 29.2 million in December 2030, compared to the base case.

Figure 16: Combining All Four Non-macro Scenarios

A: Projection of equity



B: Equity as a share of GDP



Source: IMF staff.

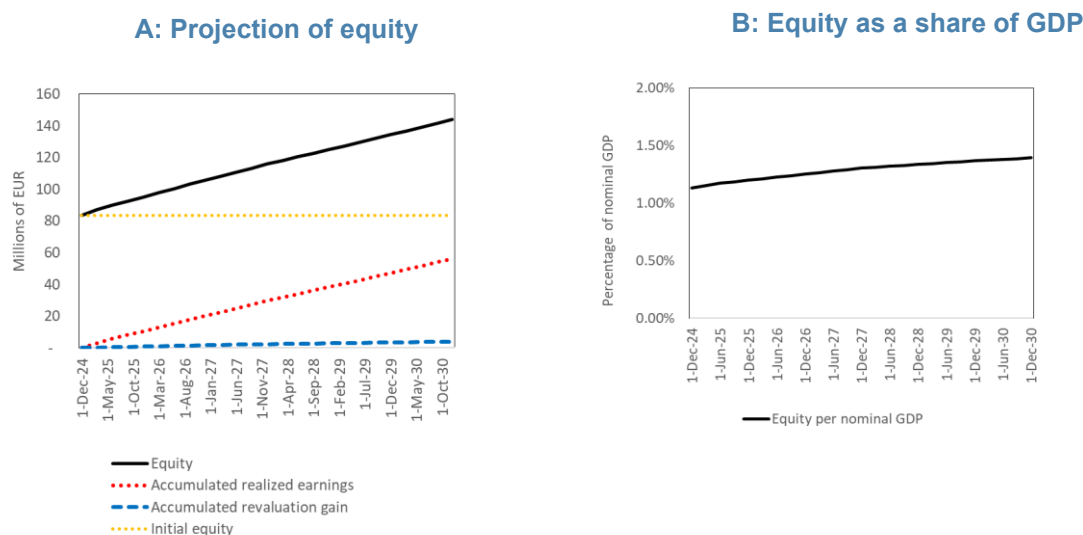
58. Additionally, as part of the post-TA analysis, the potential outcome of an ongoing legal case under consideration by the constitutional court that could significantly reduce

servicing and treasury processing fees, is assessed. This would result in a modest equity impact, with equity approximately EUR 10.9 million lower by December 2030 compared to the base case. The details are presented in Annex IV.

E. Revenue Loss Mitigation Scenario

- 59. The mission team analyzes a loss mitigation scenario.** Specifically, the CBCG takes measures so that Montenegrin banks partially continue using the existing system to mitigate the impact of SEPA. This scenario is sufficiently plausible, given that some Montenegrin banks will face higher costs if they make domestic payments through their parent banks and thus need to pay additional regulatory or legal fees. The mission team assumes that domestic payment fee income will be maintained during the 2025–27 period but will drop to zero during 2029–30. In other words, compared to the base scenario, the CBCG continues to earn payment fee income from banks for two additional years.
- 60. The equity path is slightly higher in the case of the reduced impact on payment service fee income from commercial banks than under the base scenario.** Figure 16 shows the projection under this scenario. Operating expenses are reduced by EUR 5.1 million because of continued payment fee income from banks during the 2025–27 period. Consequently, equity increases by EUR 2.6 million in December 2030.

Figure 17: Mitigating Impact of SEPA on the Payment Service Fee from Banks



Source: IMF staff.

F. Summary of All Scenarios

- 61. Table 9 summarizes the projected impact of each scenario on equity and the equity-to-GDP ratio by December 2030, with the base scenario serving as the benchmark.** Among the

macroeconomic scenarios, a low ECB policy rate path has the most negative impact, while the non-macro adverse scenarios moderately reduce equity, and a revenue mitigation measure offers slight improvements.

Table 9: Summary of Results under All Scenarios

Category	Scenario feature	Equity level (millions of euros)	Equity per GDP
Status quo scenario	No SEPA impact	159	1.54%
Base scenario	Base scenario	141	1.37%
Macroeconomic adverse scenarios	Inflation-at-Risk: high inflation	146	1.20%
	Growth-at-Risk: low real GDP growth	141	1.80%
	High foreign interest rate path	167	1.61%
	Low foreign interest rate path	91	0.88%
Non-macro adverse scenarios	Interest expenses on World Bank loan	140	1.36%
	Reduced payment fee income from the government	129	1.25%
	Reduced settlement account	134	1.29%
	Salary increase	133	1.29%
	Integrating all non-macro scenarios	112	1.09%
Revenue loss mitigation	Impact of SEPA on payment fee income	144	1.39%
Post-TA scenario	Impact of potential reduction in servicing fees	131	1.26%

Source: IMF staff.

Note: Both the equity level and the equity-to-GDP ratio represent projected values as of December 2030.

62. It is recommended to run the model regularly—ideally on an annual basis—using a variety of macroeconomic and non-macro adverse scenarios. These should include stress factors such as additional operating costs stemming from SEPA accession and EU integration to ensure comprehensive risk assessment and preparedness.

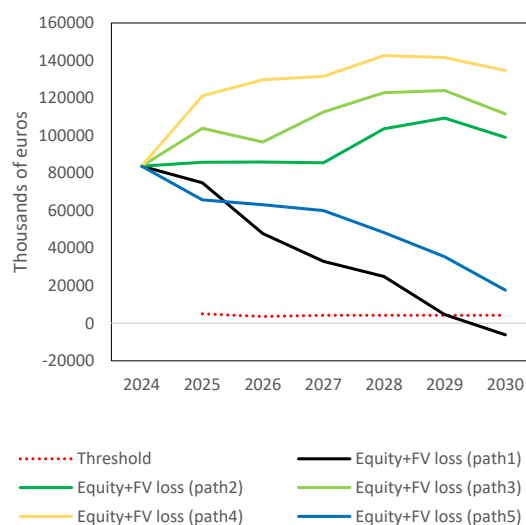
63. To institutionalize the CBST model, it is recommended to identify dedicated staff with relevant modeling capacity. Ideally, quants with programming expertise and a solid understanding of accounting and macroeconomics should be responsible for running and refining the model regularly, supported by accounting and macro teams that provide the necessary data and scenario inputs based on staff availability.

G. Quantifying Buffer Against Fair Value Losses

64. It is crucial to assess the equity path by considering both market-driven components and planned components in a unified manner. As discussed in the subsection on the core equation, equity changes over time due to: (i) net interest income and revaluation gains or losses; and (ii) net fee income and the operating expenses. (i) is driven by bond markets, while (ii) is predictable or controllable to some extent for the central bank. The conceptual figure below shows simulated paths of equity minus fair value losses under the conservative assumption of zero interest income.¹³ The threshold represents planned operating costs minus net fee income, which is set equal to (B)+(C)+(D)+(E)–(A) in Table 7. If equity minus fair value losses falls below the threshold, equity becomes negative. Note that Figure 18 is for illustrative purposes.

¹³ The volatility of equity is calibrated to historical data to make this conceptual figure reasonable.

**Figure 18: Simulated Paths of Equity with Fair Value Losses
(Illustrative Purpose)**



Sources: CBCG and IMF staff.

- 65. To quantify the buffer against fair value losses from the international bond portfolio, the mission team demonstrates a VaR-based buffer under different risk tolerance parameters.** The team computes the VaR of the bond portfolio under different risk tolerance parameters for the CBCG. The risk tolerance parameter is represented as the percentile of the VaR of yield changes that impact the bond portfolio. For example, a 95th percentile VaR loss can be interpreted as a loss that could happen once in 20 years. It is noteworthy that VaR depends on the assumption of the underlying statistical distribution.¹⁴

Table 10: Buffer under Different Risk Tolerance Parameters

Country	Exposure (Thousands of EUR)	Share	Effective duration (year)	95%-tile yield change	99%-tile yield change	99.9%-tile yield change	95%-tile VaR loss	99%-tile VaR loss	99.9%-tile VaR loss
Belgium	125,422	16%	0.51	1.6%	3.0%	3.6%	1,030	1,456	1,935
Italy	113,184	15%	0.63	2.2%	4.2%	5.0%	1,583	2,239	2,974
Spain	100,795	13%	4.38	2.7%	5.1%	6.1%	12,001	16,974	22,547
France	73,590	10%	1.63	1.6%	3.0%	3.6%	1,931	2,731	3,628
UAE	66,997	9%	1.09	2.7%	5.1%	6.1%	1,985	2,808	3,730
Other non-EU	64,257	8%	1.48	2.7%	5.1%	6.1%	2,585	3,656	4,857
Germany	62,380	8%	2.35	1.6%	3.0%	3.6%	2,360	3,338	4,434
Other EU	60,973	8%	2.06	2.7%	5.1%	6.1%	3,414	4,829	6,415
Finland	46,443	6%	2.70	2.7%	5.1%	6.1%	3,409	4,821	6,404
Ireland	23,995	3%	3.74	2.7%	5.1%	6.1%	2,440	3,450	4,583
Poland	17,185	2%	1.16	2.7%	5.1%	6.1%	542	766	1,018
Slovakia	10,761	1%	3.65	2.7%	5.1%	6.1%	1,068	1,510	2,006
United Kingdom	7,830	1%	0.83	1.6%	3.0%	3.6%	105	148	197
Total	773,812	100%					34,452	48,727	64,727

Sources: CBCG and IMF staff.

¹⁴ In the table, the risk tolerance parameters are very close to one. This is because the buffer is computed under the assumption of a normal distribution for the interest rate shock. If non-normality is accounted for (e.g., using Cornish-Fisher expansion), smaller percentiles of VaR can produce losses of a similar magnitude.

66. The risk tolerance parameter for the bond portfolio needs to be determined by the CBCG.

The historical worst loss is 48.163 million euros recorded in 2022, which is slightly below the 99th percentile VaR losses. Therefore, it is recommended that the CBCG set a risk tolerance parameter so that the buffer is more conservative than the historical worst event.

67. It is recommended to regularly re-evaluate the performance of the CBST model, including its satellite components. This ensures that elements such as the buffer against interest rate risk remain robust and aligned with evolving financial conditions and modeling standards.

H. Considering Buffer Against Systemic Liquidity Shortage

68. The CBCG should consider establishing an equity buffer against systemic liquidity shortages. There is no well-established method to quantify systemic liquidity shortages in previous studies by academia and central bank economists. Yet, it is important to consider a buffer for managing systemic liquidity shortages. This is because the CBCG cannot create liquidity by itself due to unilateral euroization. Several Montenegrin banks have parent banks abroad and thus could obtain liquidity injections from their parent banks, but not all of them do.

69. The EUREP swap line significantly reduces Montenegrin banks' potential liquidity needs by providing a reliable backstop in times of market stress. Through this arrangement, the CBCG can access up to EUR 250 million in liquidity from the ECB, ensuring preparedness for any disruptions in international funding markets. Established in June 2020, this temporary facility supports non-euro area central banks by offering liquidity against high-quality euro-denominated collateral. Although Montenegro has not yet drawn on these funds—underscoring the resilience and stability of its financial system—the existence of the EUREP line itself serves as a crucial safeguard, reinforcing confidence and mitigating the risk of liquidity shortfalls during periods of financial turbulence. In addition, the CBCG has a renewable repo credit line of EUR 100 million from the Bank for International Settlements to provide systemic liquidity to credit institutions in case of emergency.¹⁵

I. Operational Efficiency Analysis

70. Central banks are expected to make efficient use of the resources at their disposal in pursuing of their policy objectives, particularly as they face renewed scrutiny amid rising operational losses. While central banks' mandates—typically centered on price stability—constitute a public service rather than a profit-maximizing function, they are nonetheless expected to rationalize the cost of their operations. This is especially important, as sustained losses may necessitate fiscal support and undermine the credibility of the institution. Monetary policy costs, such as interest expenses, are largely exogenous and driven by the pursuit of price stability. In contrast, central banks exercise greater control over operational expenditures, including staffing and currency issuance costs, and may seek compensation for unfunded mandates such as government services, banking supervision, consumer protection, and AML/CFT obligations.

71. Despite their relevance, operational expenses often receive less attention than policy-driven costs. In this context, Veyrune and Zerbo (2023),¹⁶ using public income statement data

¹⁵ Refer to <https://www.cbcbg.me/en/core-functions/monetary-policy/euroisation>.

¹⁶ Refer to "Estimation and Determinants of Cost Efficiency: Evidence from Central Bank Operational Expenses" by Romain Veyrune and Solo Zerbo (IMF Working Paper 23/195, 2023).

and stochastic frontier analysis, find significant cross-country variation in operational efficiency, with better outcomes associated with single-objective mandates, stronger institutional frameworks, and more developed financial systems.

72. At the CBCG's request, the mission team conducted an operational cost efficiency analysis. The mission team suggests assessing potential improvements in the operational cost efficiency of the CBCG based on cross-country analyses.

73. The CBCG employs a larger number of staff compared to its cross-country benchmark, while offering lower-than-benchmark salaries (Figures 19 and 20). Staffing levels are assessed based on a cross-country analysis controlling for population size, whereas salary levels are evaluated using GDP per capita as the controlling variable.

74. The observation of higher-than-benchmark staff numbers is not in itself negative, as there can be several factors that give rise to this result. For example, some central banks are not responsible for banking supervision, while others are. Some central banks outsource various support functions, such as cleaning and security, while others employ their own staff. This warrants further research.

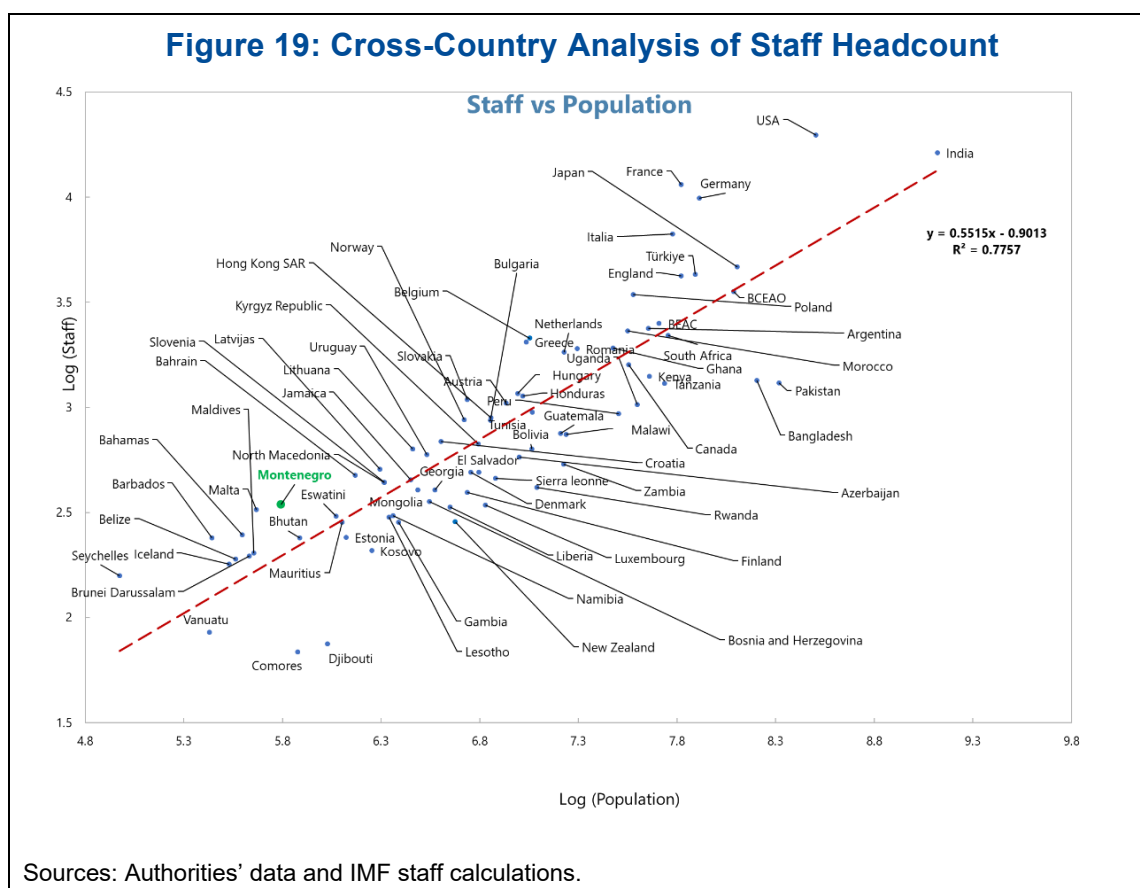
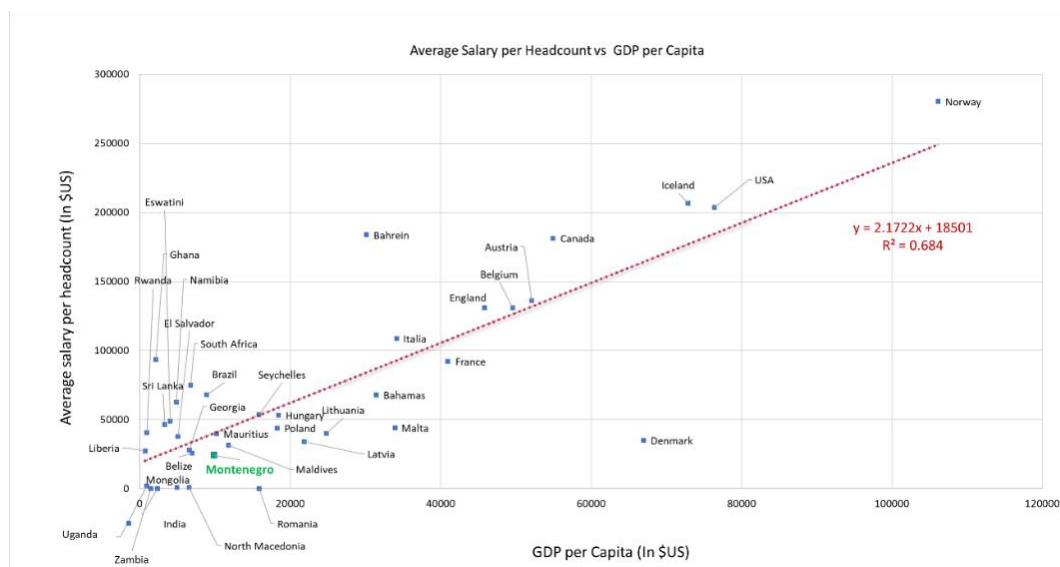


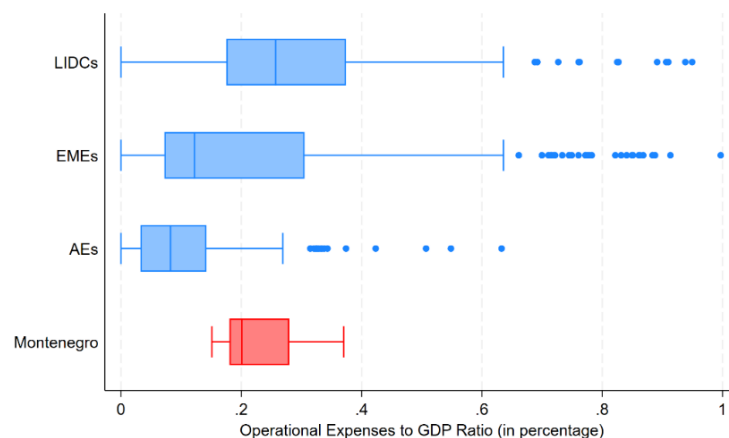
Figure 20: Cross-Country Analysis of Staff Salary



Sources: Authorities' data and IMF staff calculations.

75. A more refined analysis suggests that there might be opportunities for the CBCG to further enhance its operational efficiency (Figure 21 and Annex II). When not controlling for heterogeneity across countries, the CBCG's operational costs as a percentage of GDP are within the confidence interval of emerging market and developing economies, suggesting that the CBCG's operational costs are reasonable. After controlling for country-specific characteristics, the CBCG has a median score below the median operational cost efficiency of the full sample, indicating potential for improved cost efficiency (refer Annex II for more details on the estimation of the cost efficiency score).

Figure 21: Operational-Expenses-to-GDP Ratio



Source: Authorities' data and IMF staff calculations.

- 76. Several factors may help explain the operational efficiency results discussed above.** These include, but are not limited to: (i) the lack of economic scale; (ii) limited outsourcing of facilities staff;¹⁷ (iii) ongoing efforts to advance digitalization and innovation within the financial system; and (iv) broader preparations for EU integration.
- 77. The costs associated with departments and activities that will be further extended in the context of SEPA accession, and more broadly, EU integration, should be incorporated under other operating expenses in the stress testing analysis.** This approach would enable a more accurate assessment of the financial soundness of the CBCG.
- 78. In addition, the CBCG can employ a multi-year budget framework to accurately assess the growth of operational expenditure given SEPA accession and EU integration.** Such a framework is integrated with the CBST framework. Planning over a period of, for example, three years, would support the CBCG in maintaining control over its operational costs.
- 79. Finally, the CBCG, when observing certain conditions, could bring its remuneration of government deposits in line with “prevailing rates in Montenegro,” as mandated by law, and reduce its expenditure in the process (see Annex V).** Government deposits are currently remunerated at ESTR minus a spread (currently 15 bps; ~1.78 percent at 12/15/2025). There are indications that equivalent market rates in Montenegro are lower (at ~0.5–0.7 percent at 12/15/2025). Indirect evidence suggests that the government has a substantial cash buffer at the CBCG that seems larger than economically necessary. By bringing its remuneration in line with that of local markets, the CBCG incentivizes the government to optimize its cash management and save on its interest expenses in the process. It may also be more in line with the law that states that *“the Central Bank shall pay interest on deposited funds [...] that shall not exceed the market rates prevailing in Montenegro.”*
- 80. Important conditions for changing the remuneration rate are as follows:** (i) the CBCG must clearly and transparently show that local rates are indeed much lower than the current remuneration; (ii) remuneration decisions are secondary to monetary policy transmission considerations, meaning that if monetary policy transmission strengthens, the remuneration should be more aligned with the operational target; and (iii) the remuneration policy should be communicated and periodically (every 3–5 years) reviewed.

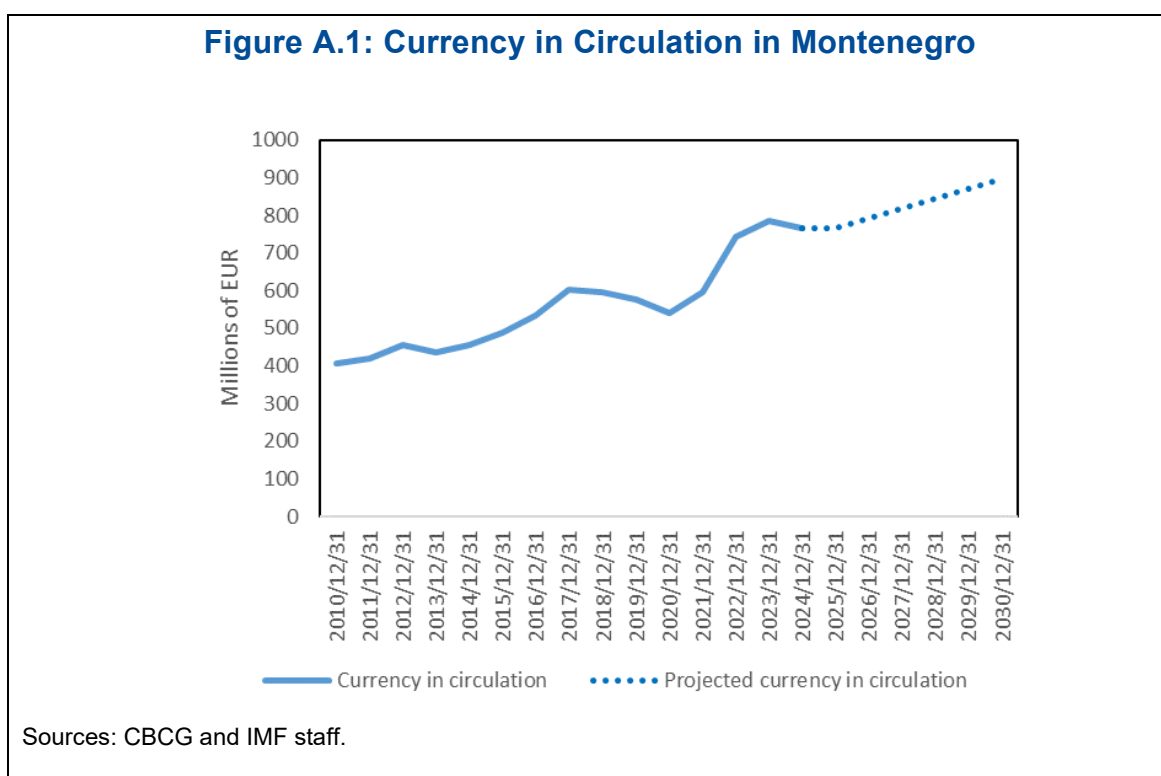
¹⁷ This is due to a law requiring the facilities staff to be permanent employees of the CBCG.

Annex I. Estimating Seigniorage Lost Due to Euroization

The mission team conducts a counterfactual analysis to estimate the seigniorage lost due to unilateral euroization in this annex. To quantify the seigniorage that could have been earned by the CBCG, currency in circulation (CiC) and a proxy for the opportunity cost are needed.

The mission team uses the historical data on CiC obtained from the CBCG's balance of payment team, as shown below. A TA report written by the IMF Statistics Department explains how CiC in the Montenegrin economy is calculated.¹

To compute the projection of the seigniorage benefits during 2025-2030, the mission team employs a linear extrapolation method for simplicity. In the figure, the solid line is the historical data, while the dotted line is the projection of CiC based on the linear extrapolation of the data for this annex.



The mission team also estimated CiC using an alternative method. Specifically, the mission team employs the formula:

$$CiC_{MNE} = \frac{CiC_{EUR}}{Nominal\ GDP_{EUR}} \cdot Nominal\ GDP_{MNE}.$$

One key assumption is that the ratio of CiC to nominal GDP is the same in Montenegro as in other countries. The estimated ratio is 12 percent. Using the formula above, the estimated CiC in Montenegro is

¹ Refer to IMF "Technical Assistance Report – Report on External Sector Statistics Mission," prepared by Joji Ishikawa, 2018.

around 8.2 million euros in 2023. The mission team considers that this estimate is comparable to the official number.

Once the projection of CiC is obtained, the seigniorage benefit is computed by multiplying it by the nominal interest rate. One of the challenges is constructing the nominal interest rate that would have prevailed in the absence of unilateral euroization. For simplicity, the mission team considers observable euro interest rates.

The standard approach is based on the opportunity cost which is proxied by the nominal short-term rate. The team employs the ECB policy rate, which is projected to be around 2 percent during 2025-30 and is consistent with the base scenario. In the standard approach, the average annual seigniorage is around 17.6 million euros.

In the alternative approach, the mission team considers that CiC is a liability with infinite maturity. It can be viewed from an asset liability management (ALM) perspective that the returns associated with CiC are comparable to those of very long-term bonds. The team employs the 10-year German government bond as of December 2024, which is around 2.2 percent. In the alternative method, the average annual seigniorage is 18.3 million euros.

In both approaches, the annual seigniorage is found to be comparable in scale to net fee income, highlighting its significance. Note that the net fee income in the 2024 financial statement is 16.0 million euros.

Table A.1: Estimates of Seigniorage Lost Due to Euroization

Year	Projection of CiC (millions of EUR)	Opportunity cost approach		Maturity-matching approach	
		Assumption of ECB policy rate	Seigniorage (millions of EUR)	Assumption of EUR long-term rate	Seigniorage (millions of EUR)
2025/12/31	767.6	2.1%	16.4	2.2%	16.9
2026/12/31	793.5	2.1%	16.7	2.2%	17.5
2027/12/31	819.5	2.1%	17.3	2.2%	18.0
2028/12/31	845.5	2.1%	17.8	2.2%	18.6
2029/12/31	871.5	2.1%	18.4	2.2%	19.2
2030/12/31	897.4	2.1%	18.9	2.2%	19.7
		Average	17.6	Average	18.3

Sources: CBCG and IMF staff.

Annex II. Operational Efficiency Analysis

This annex explains the methodology for the operational efficiency analysis at a high level. For more details, refer to the IMF Working Paper 2023/195 titled “Estimation and Determinants of Cost Efficiency: Evidence from Central Bank Operational Expenses,” by Romain Veyrune and Solo Zerbo.

The mission benchmarked the CBCG’s total operational expenses using a stochastic frontier analysis (SFA) to control for more exogenous variables than GDP. The stochastic frontier method consists of estimating a cost function using a panel of 94 central banks that included staffing (indispensable for cost function estimates) in their financial statements from 2008 to 2022. The panel consists of 24 central banks in low-income countries, 46 in emerging economies, and 24 in advanced economies.

- **The estimations use the logarithm of operating expenses as an endogenous variable, with a mix of output and input variables under a Cobb–Douglas production approach.**
- *Cobb–Douglas with tangible assets only.* Two output measures are included in the cost function: total assets and interest income. For input measures, the mission team considers central banks’ employees and equity. The mission team adds variables that reflect (i) the size of the country (population and country size); (ii) the level of development proxied by GDP per capita; (iii) a dummy variable for advanced economy central banks (e.g., inflation targeting); and (iv) a set of time dummies to control for unobserved time-dependent variations in costs common to all countries in the sample.
- *Cobb–Douglas with tangible and intangible assets.* In addition to the inputs and outputs in the previous model, the mission team includes the price stability objective as an output and also controls for the cost of monetary policy proxied by interest expenses:

$$\log(\text{operating cost}) = cte + \sum_{j=1}^p \alpha_j \log(\text{Output})_{jit} + \sum_{j=1}^q \beta_j \log(\text{Input})_{jit} + v_{it} + \varepsilon_{it}.$$

The cost function represents the central bank’s desire to minimize its operational costs with respect to its inputs and outputs (all in logarithm terms). In the above equation, the error term has two components: a component v_{it} that represents an inefficiency term, and a component that represents an idiosyncratic error. Cost efficiency can be explained as the percentage of cost that is used efficiently and is estimated as follows:

$$\text{Cost efficiency Score}_{it} = \frac{\widehat{\text{Cost}}_{\text{frontier}}}{\widehat{\text{Cost}}_{it}} = \exp(-\widehat{v}_{it}).$$

The cost efficiency score is measured on a scale ranging from 0 to 1. A score of 1 indicates that the central bank has effectively utilized all its resources (maximum efficiency). Conversely, a score of 0 reflects complete inefficiency in the operation of a central bank.

The results show that individual inefficiency can explain a large part of the variance in the production process of central banks. Table A.1 presents the results of 4 model specifications from the SFA estimation. In each model, the mission team estimates the share of inefficiency explained by the stochastic frontier approach. In model 4, the underlying inefficiency of a central bank can explain 80 percent of the variation in overall inefficiency observed, while in our baseline model (model 1), it represents 73 percent. Put differently, 80 percent of the deviation from the frontier is due to technical inefficiency in model 4, while in model 1, it accounts for 73 percent.

Table A.1: SFA Results

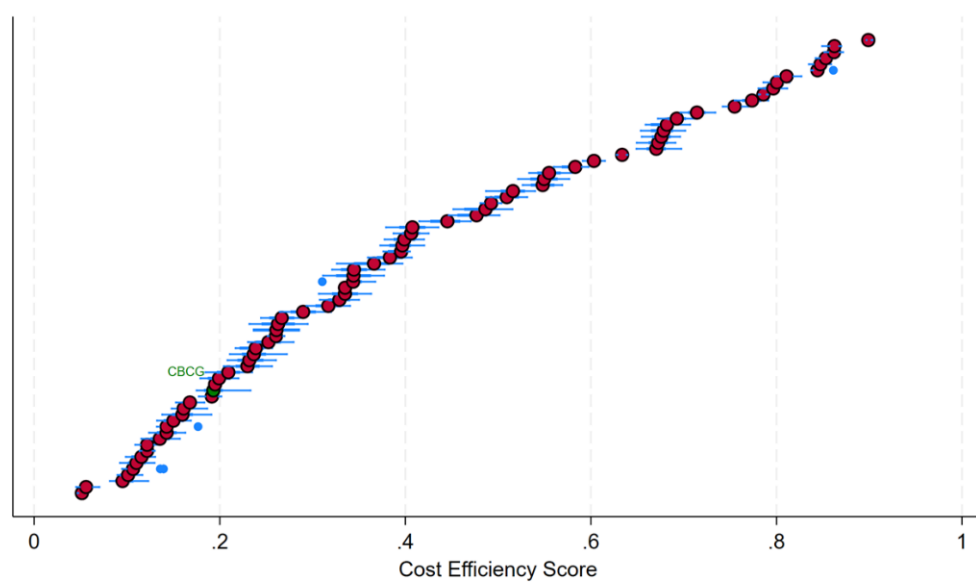
	(1)	(2)	(3)	(4)
Log (Asset)	0.392*** (0.0352)	0.444*** (0.0385)	0.510*** (0.0305)	0.517*** (0.0310)
Log (Staff)	0.407*** (0.0708)	0.577*** (0.0939)	0.378*** (0.0808)	0.402*** (0.0857)
Log (Interest Income)	0.165*** (0.0282)	0.167*** (0.0277)	0.213*** (0.0274)	0.222*** (0.0288)
Log (Equity)	0.0691*** (0.0232)	0.0704*** (0.0231)	0.110*** (0.0237)	0.104*** (0.0240)
Log (GDP per Capita)		-0.146*** (0.0485)		
Log (Population)		-0.150** (0.0741)	-0.253*** (0.0681)	-0.260*** (0.0645)
Log (Country size)		-0.0350 (0.0348)	0.0777** (0.0336)	0.0633* (0.0372)
Log (Inflation)			-0.0262 (0.0239)	-0.0294 (0.0247)
Dummy (Inflation Targeting)				0.172 (0.145)
Log (Interest Expense)				-0.0119 (0.00999)
Observations	820	819	783	776
Wald Chi2	1972	2096	2922	2758
Time FE	Yes	Yes	No	No
Sigma_u	0.722	0.683	0.951	0.915
Sigma_v	0.434	0.435	0.459	0.460
Share of Inefficiency	73%	71%	81%	80%

Sources: Central bank websites; IMF staff computations.

Note: The table reports the regression coefficients. The dependent variable is operating expenses. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Stochastic frontier analysis points to possible efficiency gains. Each red circle measures the median efficiency of a central bank, and the interquartile range captures efficiency variation over time. The CBCG is highlighted in green. The CBCG's median efficiency score (0.19) is below the group median (0.43) for the whole sample. The findings are also stable through time, as shown by the intervals presented in Figure 18.

Figure 18: Cost Efficiency Score



Sources: Authorities' data; IMF staff calculations.

Note: Stochastic frontier analysis with tangible and non-tangible assets.

Annex III. At-Risk Methodology

This annex explains the methodology for at-Risk scenarios. At-risk models, which rely on explanatory variables and projections of future distributions based on specific economic conditions, are valuable for designing “extreme but plausible” macroeconomic scenarios. The at-Risk methodology has several components and is therefore complicated but sophisticated.

The mission uses “at-risk” models to forecast conditional distributions for real GDP growth and inflation in Montenegro. Additionally, the mission utilizes the at-risk methodology to generate stressed scenarios for the ECB policy rate, given its significant implications for balance sheet dynamics. It is noteworthy that the central bank can replace at-Risk scenarios with its internal adverse scenarios whenever those scenarios are considered more appropriate.

Four steps are required to obtain a full distribution of the variable of interest. (i) dimensionality reduction on explanatory variables to avoid overfitting and multicollinearity problems; (ii) conditional average prediction using the Theil-Sen model to accommodate small and “noisy” samples; and (iii) skewness estimation of the distribution by the Firth model. In the final step, (iv) under an assumption of Theil-Sen variance, the method parameterizes an asymmetrical Gaussian distribution. This method was developed for an IMF Financial Sector Assessment Program mission to the West African Economic and Monetary Union.¹

The synthetic variables used in the at-risk models are obtained through data reduction based on a set of variables. The common trend of several variables with the same “theme” (see the complete lists in Tables A1, A2, and A3) are extracted through partial least squares regression.² The partial least squares estimator models the covariance between two datasets, denoted Y and X, based on the latent structure of the underlying data. The latent structure is obtained by projecting both the Y and X matrices onto a lower-dimension subspace, such that the covariance between the projections of Y and X in this new subspace is maximized. The partial least squares method is useful for analyzing data with numerous multicollinear variables that are potentially noisy and may even have incomplete observations. Data reduction through partial least squares is particularly appropriate for aggregating numerous collinear data in X, with an objective to maximize the correlation with a supervisory variable Y.

¹ Refer to “Financial Sector Assessment Program for West African Economic and Monetary Union: Technical Note on Stress Tests, Credit, Concentration, and Interest Rate Risks.” (IMF Country Report 22/279).

² Refer to the methodology developed by S. Wold, M. Sjostrom, and L. Eriksson (2001), “PLS-Regression: A Basic Tool of Chemometrics,” *Chemometrics and Intelligent Systems*, 58 (2), pp. 109-30.

Table A1. Synthetic Regressors and Underlying Variables for Growth At-Risk Model

<u>Domestic Macro</u>	<u>External Demand</u>	<u>Domestic Financial Conditions</u>
		Inflation (percentage change)
Real GDP growth lag		Policy rate (percentage change)
Private consumption (percentage change)	Gold index (percentage change)	Predominant overdraft rate (percentage change)
Public consumption (percentage change)	Crude oil index (percentage change)	Euribor 1 week rate (percentage change)
Central government deficit/surplus as percentage of GDP (first difference)	Inflation rate - (China, Croatia, Germany, Greece, Serbia)	Deposit rate (percentage change)
Gross fixed capital formation (percentage change)	Real GDP growth – (China, Croatia, Germany, Greece, Serbia)	Private credit (percentage change)
Industrial production	REER (percentage change)	MONEX stock exchange index (percentage change)
	Imports (percentage change)	
	Exports (percentage change)	

Sources: CEIC Data; Haver; IMF staff calculations.

Note: REER refers to real effective exchange rate. First difference and percentage change are calculated on a year-on-year basis unless otherwise indicated.

Table A2. Synthetic Regressors and Underlying Variables for Inflation-at-Risk Model

<u>Domestic Macro</u>	<u>External Demand</u>	<u>Monetary Factor</u>
		Policy rate (percentage change)
		Deposit rate
		M2
Real GDP growth	USD/YUAN (percentage change)	Lending rate
Imports (percentage change)	USD/EUR (percentage change)	Private credit
Exports (percentage change)	REER (percentage change)	Predominant overdraft rate (percentage change)
MONEX stock exchange index (percentage change)		Interbank rate (percentage change)

Sources: CEIC Data; Haver; IMF staff calculations.

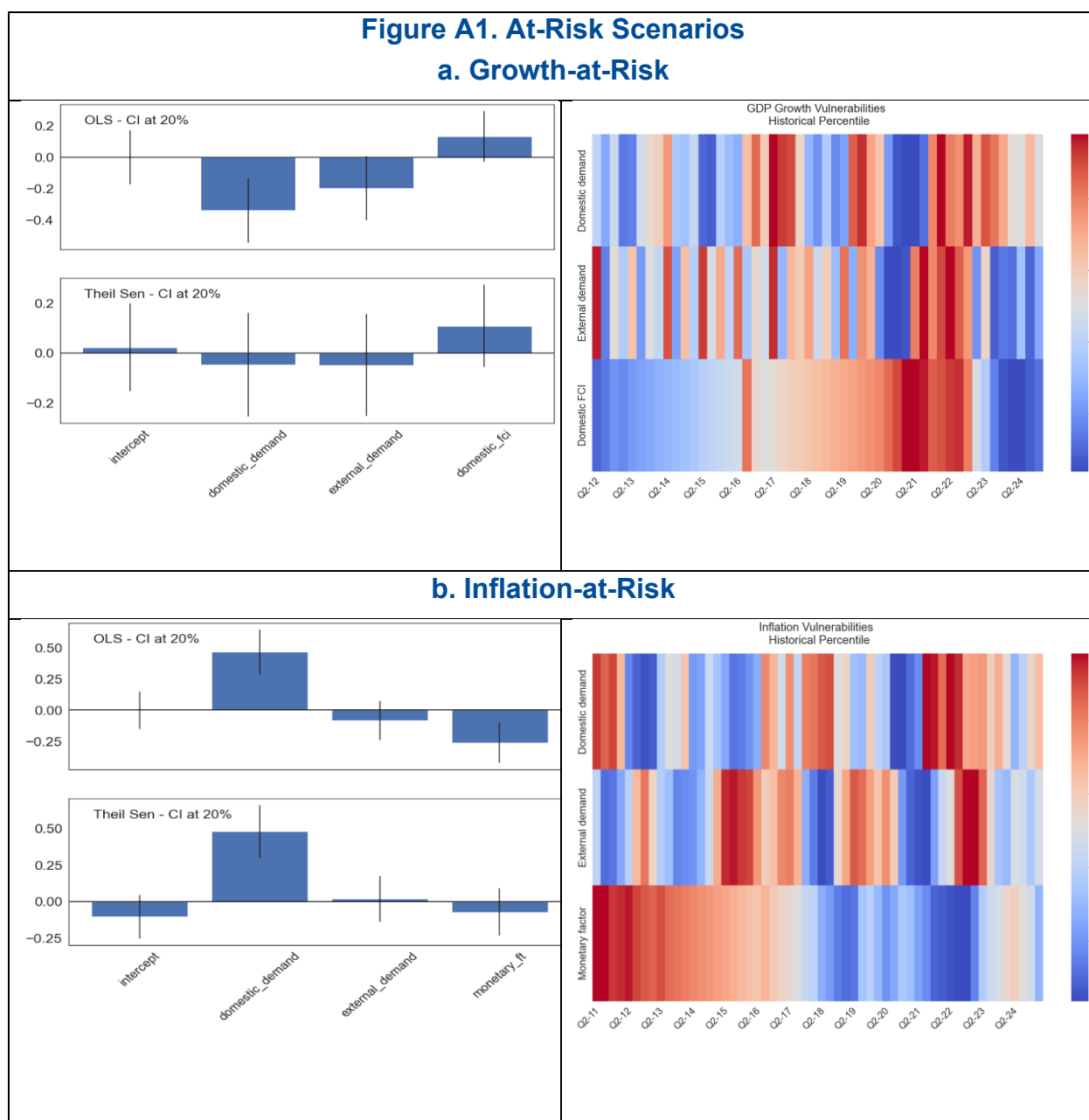
Note: REER refers to real effective exchange rate. First difference and percentage change are calculated on a year-on-year basis unless otherwise indicated.

Table A3. Synthetic Regressors and Underlying Variables for ECB Policy Rate-at-Risk Model

<u>Domestic Macro</u>	<u>Inflation and Interest Rate</u>	<u>Balance of Payment</u>
Real GDP growth	Inflation	Current account balance to GDP (percentage change)

MONEX stock exchange index (percentage change)	Policy rate (percentage change)	Reserves and related items (percentage change)
	Predominant overdraft rate (percentage change)	Financial account balance (percentage change)
	Interbank rate (percentage change)	
	Deposit rate (percentage change)	

Sources: CEIC Data; Haver; IMF staff calculations.
Note: First difference and percentage change are on a year-on-year basis unless otherwise indicated.



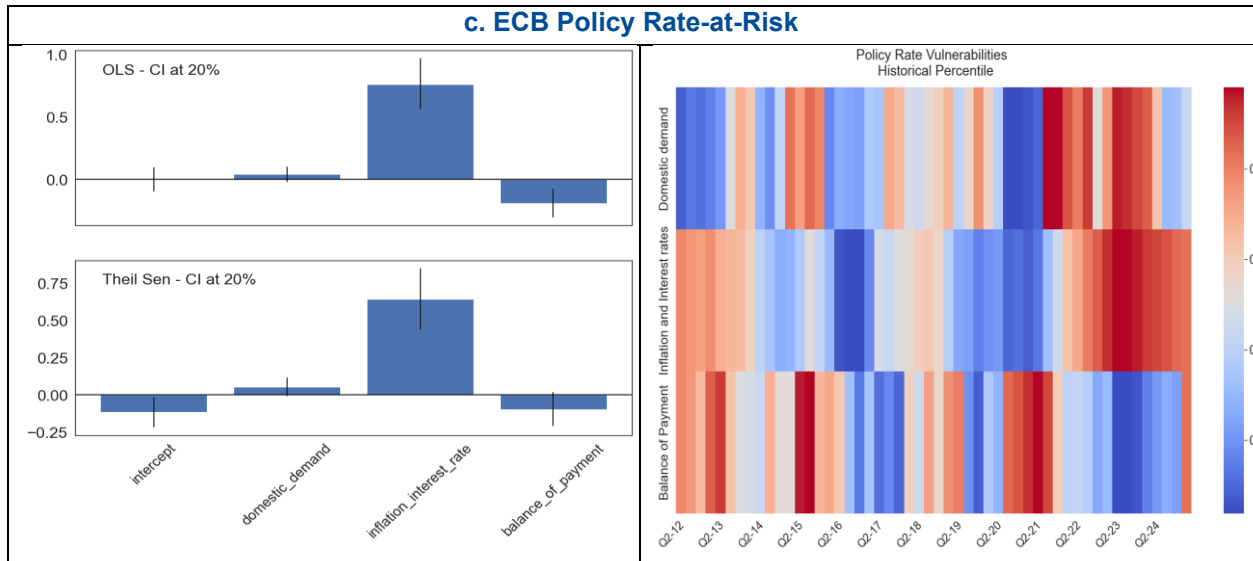
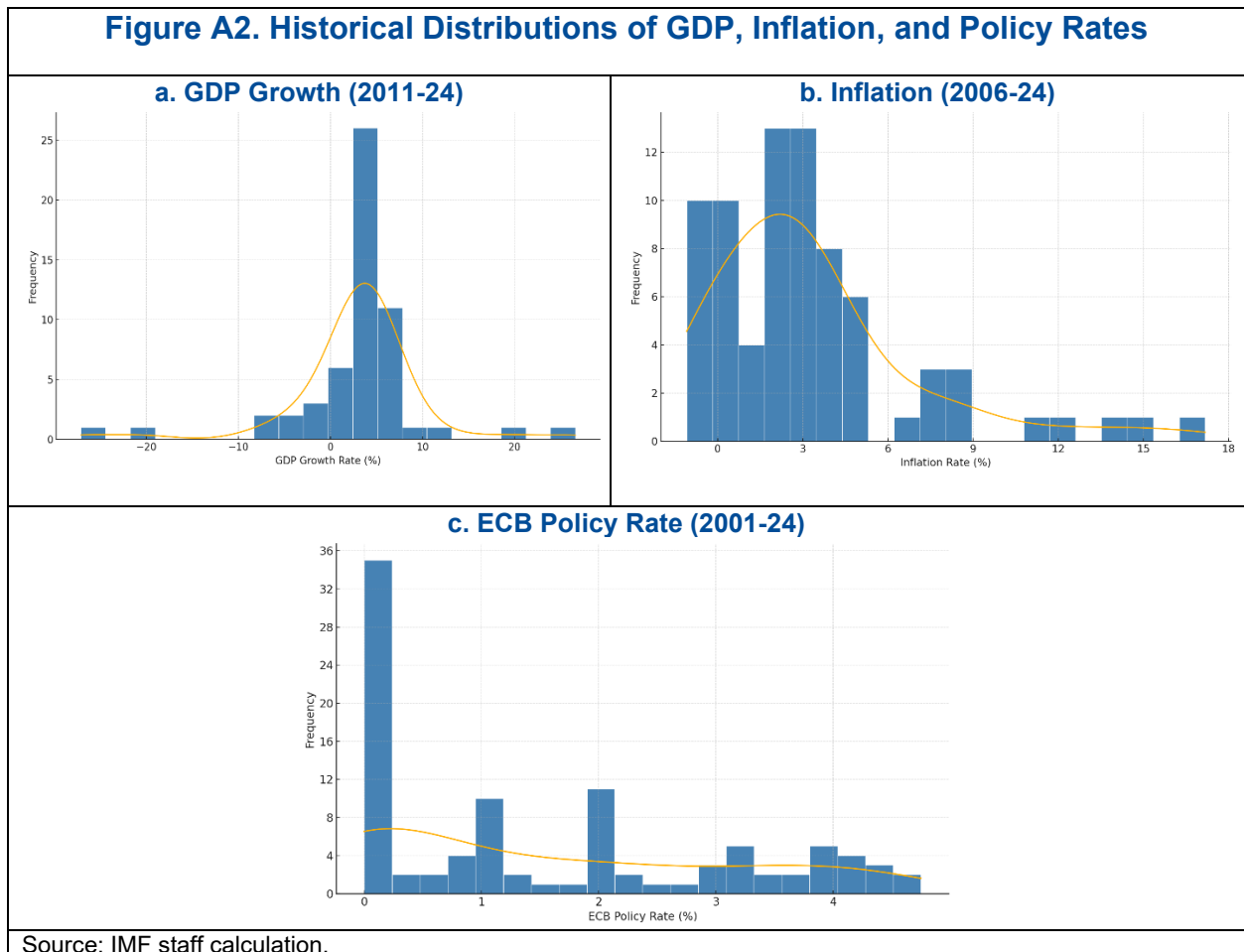
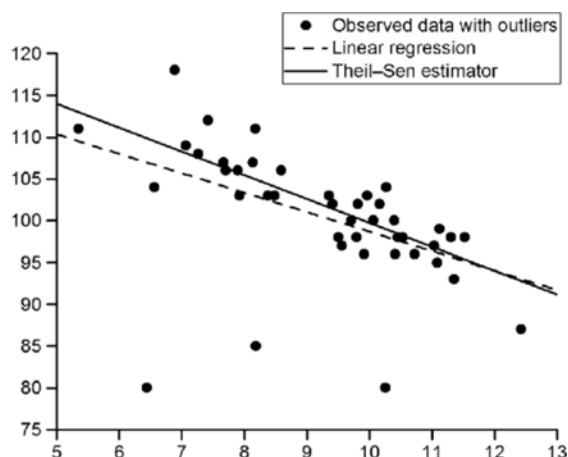


Figure A2 shows the historical distributions of GDP, inflation, and the ECB policy rate, indicating that the highest inflation was 17.18 percent during the period under consideration; the lowest real GDP growth, on the other hand, was -27.10 percent during 2011–24; and the ECB policy rate peaked at 4.75 percent during 2001–24.



The conditional mean is estimated using a Theil-Sen model (Theil 1950; Sen 1968). This is a regression model that improves the ordinary least squares estimator, making it more accurate for estimation on small samples and, in particular, robust to outliers.

Figure A3. The Theil-Sen Estimator and Linear Regression



Source: Scikit-Learn documentation.

A “jackknife” Theil-Sen estimator—one that systematically removes one observation at a time from the initial sample—is constructed. For example, if the sample contains 20 observations, it creates 20 subsamples of 19 observations, with a different observation removed from the original sample at each iteration. It then estimates a standard ordinary least squares regression on each subsample, thus obtaining 20 values for each coefficient. The Theil-Sen estimator is the average of these 20 values, that is, the average of the ordinary least squares coefficients estimated on each of the subsamples. It is thus highly robust to outliers, to the extent that the impact of such observations is diluted in the estimators for each subsample. Taking the median makes it possible to reduce the impact of coefficients that are too extreme. The specification of the Theil-Sen model is similar to that of an ordinary least squares model:

$$y_{t+h} = \alpha + \beta^{TS} X_t + \epsilon_t^{TS},$$

where y_{t+h} is the real GDP growth in $t+h$, X_t is a vector of conditional variables, α is the intercept, and ϵ_t^{TS} are the residuals of the Theil-Sen regression.

The Firth model, a logistic regression model with penalized likelihood, is employed to estimate the asymmetry around the average projection of growth, inflation, or the exchange rate. Like the standard logistic model, the Firth model estimates the binary probability of an event. This probability may be coded as a binary 0/1 indicator, taking 1 if the event occurs and 0 if it does not. This event is coded as the dependent variable y_t , higher than a given value $\bar{y}$. Thus, the specification of the Firth model is written as a standard logistic model:

$$\mathbb{P}[y_{t+h} > \bar{y} | X_t] = \alpha + \beta^{LR} X_t + \epsilon_t^{LR},$$

where y_{t+h} is the real GDP growth in $t+h$, $\bar{y}$ is a given growth threshold, X_t is a vector of conditional variables, α is the intercept, and ϵ_t^{LR} are the residuals of the logistic regression.

Firth’s innovation relies on the estimation method. For small and noisy samples, or samples with a weak degree of separation (many 1 and little 0, for example), the standard logistic estimator is biased. Firth

shows that, by modifying the likelihood function (the logistic models are estimated based on maximum likelihood) and by introducing a penalizing term, it is possible to eliminate the estimation bias.³

The Theil-Sen/Firth dual model thus estimates two moments in the conditional distribution of the variable of interest, and the third moment is obtained based on a parametric assumption. The first statistic is the conditional expectation estimated by the Theil-Sen model $\mathbb{E}[y_{t0+h}|X_{t0}] = \hat{\alpha} + \hat{\beta}^{TS}X_{t0}$, while the second is the asymmetry of the distribution, obtained as the cumulative density estimated at the conditional mean⁴ $F(y_{t0}|X_t) = \hat{\alpha} + \hat{\beta}^{LR}X_{t0}$. These two statistics are not sufficient to parameterize a distribution, as the second-order moment is missing, that is, the variance.

To address this, estimating the conditional variance on a limited sample is discouraged, as the estimators of conditional variance required substantial information to estimate heteroskedasticity (as in the case of an ARCH/GARCH model, for example). Thus, the at-risk model makes the simplifying but realistic assumption that the variance is unconditional and equal to the residual variance of the Theil-Sen estimation (i.e., heteroskedasticity is assumed to be constant over the course of time). This approach also addresses a recurring problem of projection models, that is, that the variance of the projection tends to increase with the projection horizon. With constant heteroskedasticity, there is no inflation in the variance. Thus, under this assumption, the at-risk model obtains three conditional moments: the expectation (Theil-Sen projection), the variance (constant heteroskedasticity, derived from Theil-Sen), and the skewness (obtained from the Firth logistic model).

The team parameterizes an asymmetric Gaussian distribution from the three estimated moments. The at-risk model further stabilizes the projection by using an overparameterized fit, in which the distribution is assumed to follow an asymmetric Gaussian process. This assumption is realistic, insofar as an asymmetric Gaussian distribution naturally encompasses both standard normal distributions and asymmetric ones. This approach retains a high degree of generality while maintaining simplicity. It presents the most relevant metrics for economists (central tendency, interquartile range, and balance of risks). The choice of an asymmetric Gaussian, rather than another asymmetrical distribution, is constrained by the number of moments.

To estimate an asymmetric Student distribution, four moments are needed (including the kurtosis), which, due to the limited size of the sample, is feasible. Another approach consists of using nonparametric distributions, such as kernels, but again, the limited size of the samples makes this approach unsuitable. Finally, a major advantage of the asymmetric Gaussian distribution is that it provides simple analytical relationships between moments, cumulative density, and parameters. This property greatly simplifies the distribution fit to conditional moments, as the parameters are derived manually in closed algebraic form and not through optimized approximation.

³ Refer to D. Firth (1993), "Bias Reduction of Maximum Likelihood Estimates," *Biometrika*, 80 (1), pp. 27–38.

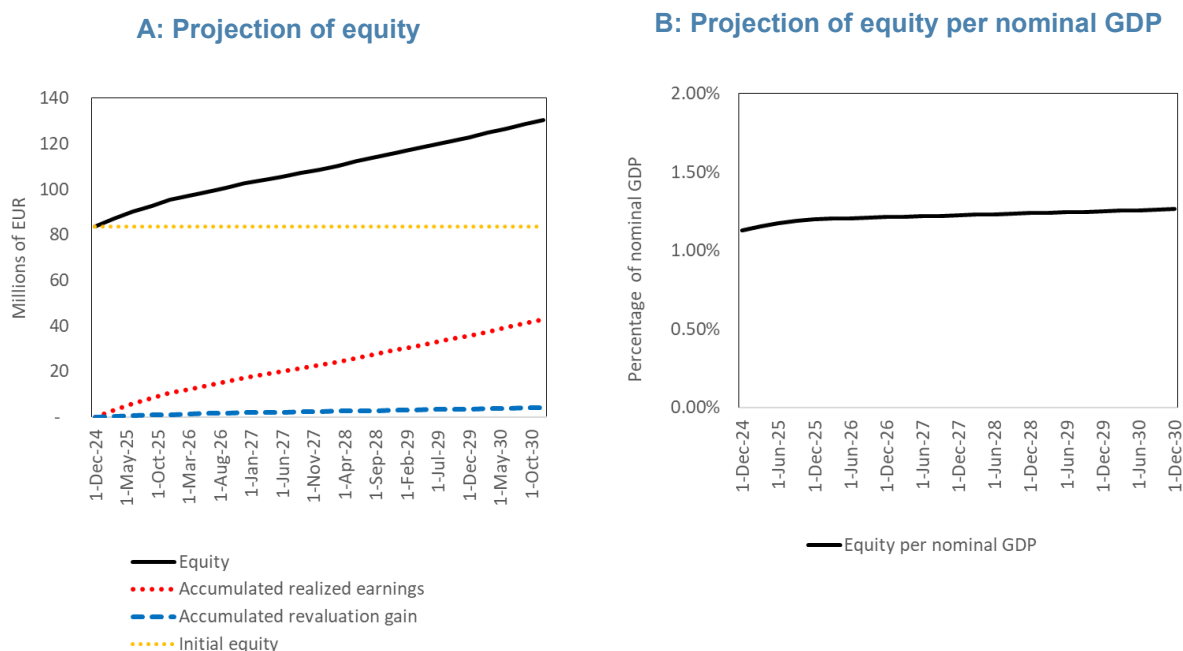
⁴ This quantity is not directly a measure of asymmetry. However, in the case of an asymmetrical Gaussian distribution, it is possible to infer the asymmetry coefficient from $F(y_{t0}|X_t)$ via a simple bijective transformation.

Annex IV. Impact of Potential Reduction in Levels of Servicing and Processing Fees

81. In this annex, the impact of potential reductions in the levels of servicing and processing fees is analyzed. This analysis is motivated by an ongoing legal case. Although the court decision is not yet made, the following adverse impact is assumed: a reduction in the servicing fee on foreign debt, with the total reduction during 2026–30 estimated at around 6.245 million euros, and a reduction in the State Treasury order processing fee, with the total amount during 2026–30 estimated at around 1.657 million euros, about 90 percent lower than in the base case.

82. Under this special adverse scenario, the equity path is modestly affected. The figure below shows the projection under this scenario. The equity as of December 2030 is reduced by around 10.9 million euro, and equity –to-GDP is reduced by 0.1 percent compared to the base case.

Figure A.4: Impact of Potential Reduction in Levels of Servicing and Processing Fees



Source: IMF staff.

Annex V. Remuneration of Government Deposits

A. Key Principles the Central Bank Should Balance

- **Incentivizing efficient cash management and enhancing liquidity management:** A Treasury Single Account (TSA) at the central bank enables the government to maintain optimal cash reserves and limit new overdrafts or debt. Additionally, it mitigates the government's credit exposure to the banking system. Furthermore, a TSA supports central bank liquidity management by reducing uncertainties and costs related to absorbing government funds, aiding monetary policy transmission. However, in environments characterized by excess liquidity, this may become less significant from the central bank's perspective.
- **Ensuring that market neutrality is maintained:** The management of government deposits should not create unnecessary inefficiencies for liquidity management or impair the smooth functioning of money markets. From a broader perspective in more developed markets, the central bank may also weigh not disintermediating commercial banks in offering deposits to the government and choose a dynamic rate that “breathes with” market conditions.
- **Protecting the central bank's balance sheet:** Paying market-level interest on large government deposits can increase expenses and reduce financial independence, especially if asset yields are lower. This is particularly important when the central banks' liabilities are in a currency it does not issue and it therefore does not have seigniorage income. This principle is not fiscal in nature but rather a prudential step to maintain operational autonomy, financial resilience, and credibility in the conduct of monetary policy operations.

B. Benefits of the Government from Its Account with Its Central Bank

- The government derives various benefits from its central bank account that it does not receive through commercial bank deposits, including:
 - a. Discrete payment facilities that may be used for diplomatic or confidential transactions;
 - b. No credit risk exposures to the banking system;
 - c. Reduced operational and reputational risks.
- **In practice, the central bank should operationalize these principles through a transparent, rule-based framework.** This begins with a clear governance and coordination mechanism between the central bank and the MoF (or debt management office, DMO), setting out roles, information-sharing protocols (in an MoU), and operational procedures and limits for government deposits (in an SLA).¹ A regular exchange of short-term cash-flow forecasts allows the central bank to anticipate autonomous liquidity factors more accurately, while the treasury gains a clearer view of its financing needs. By linking the remuneration of deposits to a published reference (such as the policy rate or market rate), the framework remains transparent, predictable, and adjustable as monetary conditions evolve.

¹ Refer to [Liquidity Forecasting—Part I: The Institutional Arrangements](#), a IMF technical assistance handbook.

- **To maintain market neutrality, the central bank should ensure that the remuneration rate on government deposits neither crowds out short-term market instruments nor distorts the relative pricing of liquidity in money markets.** Given the benefits over market-based options, this may involve setting a rate below the policy or market rate or applying tiered remuneration linked to the volume or maturity of deposits. Governments, in turn, should be incentivized to minimize idle balances by investing surplus cash in short-term market instruments or repos when appropriate. This preserves liquidity discipline and ensures that both monetary and fiscal operations support the smooth functioning of money markets and monetary policy implementation.
- Balance-sheet protection can be achieved by aligning remuneration rates with the central bank's financial capacity and income outlook. In cases of external dependencies or compressed asset returns, it may be appropriate to apply a lower rate—provided this is communicated clearly as a prudential measure rather than a fiscal transfer. The framework should include periodic reviews to reassess the rate formula, operational limits, and the impact on liquidity management. By institutionalizing these arrangements through published terms and periodic joint reviews, both the central bank and the government can ensure that their respective mandates—price stability and prudent fiscal management—remain mutually reinforcing.

C. Some Options Observed in Practice

- Remunerating government deposits in local currency at the policy rate or at a representative market rate (such as €STR) maintains close alignment with monetary policy operations and money market conditions. This approach is most appropriate where market development and interest rate transmission are key objectives. It ensures that returns on government balances adjust automatically with market liquidity, although it may introduce some circularity since government deposits themselves influence those market rates.
- **Remunerating government deposits in local currency at the policy or market rate, minus a spread, encourages the MoF to optimize its core balances and place excess cash in the market.** The spread reflects the value of access to the risk-free, highly liquid central bank balance sheet. It also promotes more stable and predictable liquidity conditions. Within the Eurosystem, since 2023, the remuneration ceiling for non-monetary deposits has been set at €STR minus 20 basis points, reflecting the view that a modest discount supports market intermediation and discourages excessive accumulation of government deposits at the central bank.²
- Remunerating government deposits in local currency on a fraction of government balances and amounts above that level earn zero, pushing the MoF to place excess cash in the market. The fraction of government deposits (a prearranged balance) would be determined in the context of the structural liquidity surplus, which would improve liquidity forecasting for the central bank. Amounts above this prearranged balance could be placed in the money market. The drawback is that the government becomes a direct competitor to the central bank for adjustments in reserves.
- **Setting the remuneration rate at zero provides the strongest disincentive for the government to hold idle balances at the central bank.** While this may reduce the stock of deposits over time, it also makes the government's cash placement behavior less predictable, complicating the central bank's liquidity forecasting. The effect is nonlinear: when market and policy rates are high, the opportunity cost of holding cash at the central bank increases,

² The ECB confirms the remuneration ceiling for euro area government deposits and adjusts remuneration of other non-monetary policy deposits. <https://www.ecb.europa.eu/press/pr/date/2024/html/ecb.pr240417~1f4431a9d4.en.html>.

amplifying uncertainty and potentially weakening monetary transmission. Within the Eurosystem, the Bundesbank is currently the only central bank that has publicly adopted this approach.³

- **Remunerating government deposits in foreign currency at the average rate of return on international reserve investments minus management fees is standard market practice.** From an asset-liability management perspective, considerations for remuneration of government deposits in foreign currencies are different from those previously mentioned. The central bank could remunerate at the average rate of return while charging a management fee in line with market practice.

³ Refer to "Bundesbank Adjusts Remuneration of Domestic Government Deposits.

<https://www.bundesbank.de/en/press/press-releases/bundesbank-adjusts-remuneration-of-domestic-government-deposits-914060>.