TECHNICAL ASSITANCE REPORT

GHANA

Technical Assistance (TA) on Developing the Forecasting and Policy Analysis System (FPAS) at the Bank of Ghana (BOG)

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Prepared By

Valeriu Nalban (ICDMM)

Authoring Department:

Institute for Capacity Development

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Acronyms and Abbreviations

AFR	IMF African Department
AFRITAC West 2	Regional Technical Assistance Center for West Africa 2
BOG	Bank of Ghana
CIEA	Composite Index of Economic Activity
CPI	Consumer Price Index
FCDO	Foreign, Commonwealth and Development Office
FPAS	Forecasting and Policy Analysis System
FT	Forecasting Team
GHS	Ghanaian cedi
ICD	IMF Institute for Capacity Development
ICDMM	ICD Macro-Modeling and Monetary division
IMF	International Monetary Fund
IRF	Impulse Response Function
MPC	Monetary Policy Committee
MPR	Monetary Policy Report
NTF	Near-Term Forecast
p.p.	Percentage point
qoq	Quarter-over-quarter
QPM	Quarterly Projection Model
RCDC	Regional Capacity Development Center
SARIMA	Seasonal Autoregressive Integrated Moving Average
TA	Technical Assistance
UK	United Kingdom
USA	United States of America
USD	US dollar
VAR	Vector Autoregression
VAT	Value Added Tax
WBG	World Bank Group
WP	Working Paper
yoy	Year-over-year

Preface

At the request of the Bank of Ghana (BOG), a Technical Assistance (TA) Project on developing BOG's Forecasting and Policy Analysis System (FPAS) was conducted by ICD during 2019-2024. A total of seven missions (three in-person and four virtual) were conducted. The project focused on two broad and complementary workstreams, with noteworthy achievements but also some residual room for improvement: (i) developing tools and technical capacity among BOG staff; and (ii) integration of analytical work into BOG's policy processes and external communications. The FPAS TA project has largely achieved its objectives: BOG forecasting team has made remarkable progress and is regularly delivering topnotch analytical support to the policymakers, while FPAS-based work plays a key role in the BOG policy processes and its forward-looking monetary policy formulation.

The IMF TA project team consisted of Valeriu Nalban (ICDMM, Project manager, participated in all TA missions), Shalva Mkhatrishvili (short-term expert, participated in five TA missions), and Martin Fukac (short-term expert, participated in two TA missions during the initial stage of the project). During the in-person missions, the TA team met regularly with First Deputy Governor Dr. Maxwell Opoku-Afari and other BOG Monetary Policy Committee (MPC) members. The mission team would like to express its appreciation to BOG management and staff for their very warm hospitality and excellent cooperation throughout the TA Project lifecycle, as well as to AFRITAC West 2 for continuous financial support. This research is part of the Macroeconomic Research in Low-Income Countries project (Project ID: 60925) supported by the UK's Foreign, Commonwealth and Development Office (FCDO). This TA report was reviewed by Shalva Mkhatrishvili (short-term expert), Eva Jenkner, Gani Gerguri, and Pokuaa Adu (all AFRITAC West 2), Natan Epstein (ICDMM Division Chief). Elisa Manarinjara (ICDMM) provided excellent administrative support.

Executive Summary

The multi-year BOG FPAS TA Project has focused on upgrading and building new institutional capacity for model-based forecasting and policy analysis, along its integration into monetary policy processes and external communications. Starting late-2019, a total of seven missions (three in-person and four virtual) were conducted. The FPAS TA project has largely achieved its objectives.

The BOG forecasting team has made remarkable progress and is currently delivering topnotch analytical support to the policymakers. Staff have built a strong skillset and expanded the relevant knowledge base. They use a rich suite of analytical tools to implement the internal forecast calendar and follow all the necessary steps to prepare model-based results and forecasts. Operational use of the core Quarterly Projections Model (QPM) is at the core of the forecasting process. The model is used to construct baseline forecasts and alternative scenarios, to impose expert judgements, to assemble the forecast narrative and then deliver it to the peers and to MPC. All procedures are performed efficiently and following best central bank practice.

Analytical work plays a key role in the BOG policy processes and its forward-looking monetary policy formulation. Model-based results are the foundation of the regular bi-monthly MPC cycles. The modeling team delivers one presentation to BOG Research Department staff about a week before the MPC sessions, and two presentations to the MPC – on “Initial conditions” and on “Final projections”. Forecasts feature, to some extent, in external communications, including MPC Press Releases and Monetary Policy Reports.

Remaining recommendations relate to ensuring FPAS work sustainability by further increasing the size of the forecasting team, and further streamline external communications. While very efficient and motivated, given the increased role of the analytical work and to remain at the frontier among peers, BOG forecasting team needs to be further expanded and allocate more time for practicing model building and operation. Given the heavy workload and the complexity of transferring and expanding the model-based analytical skills among newest members, the team is still too small to sustainably operate a fully integrated modern FPAS. A larger forecasting team will ensure FPAS continuity going forward, after the project completion, and the further development of the modeling apparatus. Avoiding capacity losses due to staff turnover, as happened in the past, is key to FPAS self-sustainability. A larger team will further enhance the analytical support to BOG policymaking by responding more efficiently to MPC requests and will allow the unique skills and comparative advantage of the forecasting team to be used more productively. Further improvement with the construction and communication of alternative scenarios could play a more prominent role in a shock-prone world, requiring additional time and resources invested by the team.

External communications could be further streamlined. Following relevant FPAS practice in other forward-looking inflation targeting central banks, e.g., Czech National Bank, the content of MPC Press Releases and Monetary Policy Reports could be revisited with the view to further rebalance their structure away from historical data reporting in favor of more forward-looking analysis and implications for the monetary policy conduct. This would also help further anchor market expectations, improve transparency, and build institutional credibility in support to the forward-looking approach to policymaking.

Section I. Overview of the BOG FPAS TA Project

1. During the 2019 Spring Meetings of the International Monetary Fund (IMF) and the World Bank Group (WBG), the BOG representatives (Mr. Maxwell Opoku-Afari, First Deputy Governor) expressed their interest in reviving collaboration with ICD on the development and modernization of BOG's FPAS. Despite the key relevant FPAS architecture being in place – the result of earlier FPAS TA engagements with the Fund – high staff turnover and changes at the management level have led to a significant slowdown of the momentum in developing analytical capacity and FPAS processes. In response, the ICD TA team, supported by AFRITAC West 2, allocated resources to restart the BOG's FPAS development. The initial timeline of the reinstated FPAS TA project was adversely impacted by the pandemic crisis and associated travel restrictions, with TA delivery switching to virtual mode. In total, ICD delivered seven TA missions (four remote and three in-person), which ensured continuous capacity building activities and integration of analytical results into policy processes, in support of the BOG's MPC conduct of a forward-looking monetary policy. A short overview of the FPAS TA is provided in AFRITAC West 2's 10-year anniversary brochure; see AFRITAC West 2 (2024).

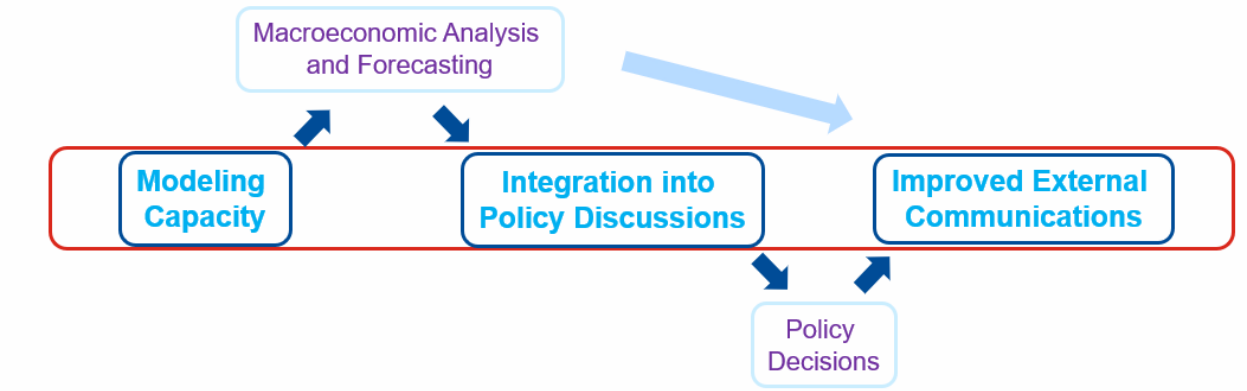
A. ROLE OF FPAS IN CONDUCTING FORWARD-LOOKING MONETARY POLICY

2. Modern central bank practice recognizes the benefits of a forward-looking approach to policymaking. This accounts, inter alia, for the transmission lags and impact of agents' expectations when deciding on the future trajectory of the policy instruments consistent with achieving primary objectives (e.g., in the case of BOG, the main instrument is the short-term policy rate, while the primary objective is inflation at 8%±2pp target). Accordingly, a well-developed analytical toolkit could provide valuable support to the decision-making process.

3. In this context, central banks develop and apply a Forecasting and Policy Analysis System (FPAS) – a set of tools and processes that provide analytical support to the policy making process.[1] The multiyear Bank of Ghana macroeconomic frameworks FPAS TA Project had the overarching objectives to upgrade and build new institutional capacity for model-based forecasting and policy analysis, along with its integration into monetary policy processes and streamlined external communications. Starting from developing modeling tools, particularly the Quarterly Projection Model (QPM), which is the key tool to provide real-time analytical support to policy making, integration into policy processes required some redesigning of the internal procedures to allow for a well-structured communication between staff and policy makers, anchored around regular forecasting rounds and institutionalized by the forecast calendar, with a forward-looking approach to external communications (Figure 1).

[1] Adrian et al. (2018) define FPAS as a "system for organizing efficient and thorough provision of economic information to enable monetary policy committees to make good decisions."

Figure 1: Bank of Ghana FPAS TA Project workstreams



B. OBJECTIVES OF THE BOG FPAS TA PROJECT

4. The TA Project has largely achieved the objectives of building capacity and incorporation of FPAS work into policy-making processes and external communications. The broad outcome indicators and milestones of the project are detailed in the Results-Based Management framework, used for regular monitoring and reporting of the project progression, and presented in a streamlined overview in Figure 2.

Figure 2: FPAS TA Project outcome indicators and milestones

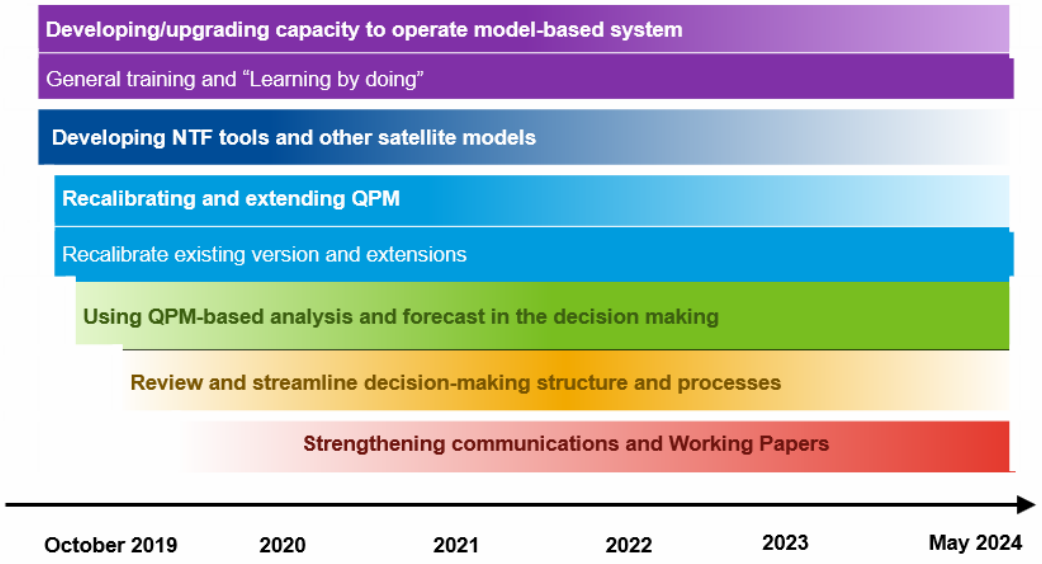
Objective	Outcome	Outcome Indicator/Milestone Description
1. Building FPAS capacity	1.1. Improved economic analysis and forecasting capabilities at the CB	1.1.1. Modeling and Forecasting Unit (MFU) is set up
		1.1.2. A fully operational core Quarterly Projection Model (QPM) is developed
		1.1.3. Fully operational suit of satellite and NTF models is developed
		1.1.4. QPM-based analytical framework is used to produce medium-term forecasts
2. Incorporating FPAS into the decision-making process	2.1. Decision-making process streamlined	2.1.1. Inter-divisional Forecasting Team (FT) created
		2.1.2. Projection Coordinator appointed
	2.2. MPC uses staff projections in policy decision making	2.2.1. MPC understands the structure of QPM and processes behind FPAS
		2.2.2. Forecast Calendar developed
		2.2.3. Interactions b/w MPC and FT take place according to Forecast Calendar
	2.3. Monetary policy communication strategy strengthened	2.3.1. Yearly calendar of regular MPC meetings is published in advance
		2.3.2. Monetary policy strategy developed and published
		2.3.3. Monetary Policy (Inflation) Report is published at least 4 times a year
		2.3.4. Other analytical reports are published routinely on the same frequency
		2.3.5. A wide variety of communication channels is used

5. The building of modeling and forecasting capacity, with the ultimate goal to produce relevant forward-looking analysis and policy recommendations, consisted of several workstreams. These included upgrading the skillset of staff in the Research Department; developing efficient data management procedures; establishing or improving nowcasting, near-term forecasting (NTF) and other satellite tools; and extending the QPM, which represents the key tool for the production of medium-term forward-looking analysis.

6. Incorporation of FPAS analysis into policy processes consisted of streamlining internal organization and processes such as to ensure the forward-looking analysis feeds into decision making. This included: consolidation of a well-functioning Forecasting Team (FT) within the Research Department; (re)designing regular forecasting cycles (forecasting calendar, horizontal/vertical internal communications, meetings, etc.); rationalizing the forecast presentations to MPC, etc. Then, to ensure monetary policy decisions are transparent and well-understood, external communication – including the regular Monetary Policy Report, Press conference and Press statement following the policy decision – should make proper use of forward-looking analytical results.

7. In terms of the timeline, work on the various workstreams was conducted, in large part, in parallel, with development of tools and building analytical capacity among technical staff somewhat more important at the early stage of the project; see Figure 3.

Figure 3: Schematic timeline of TA project workstreams



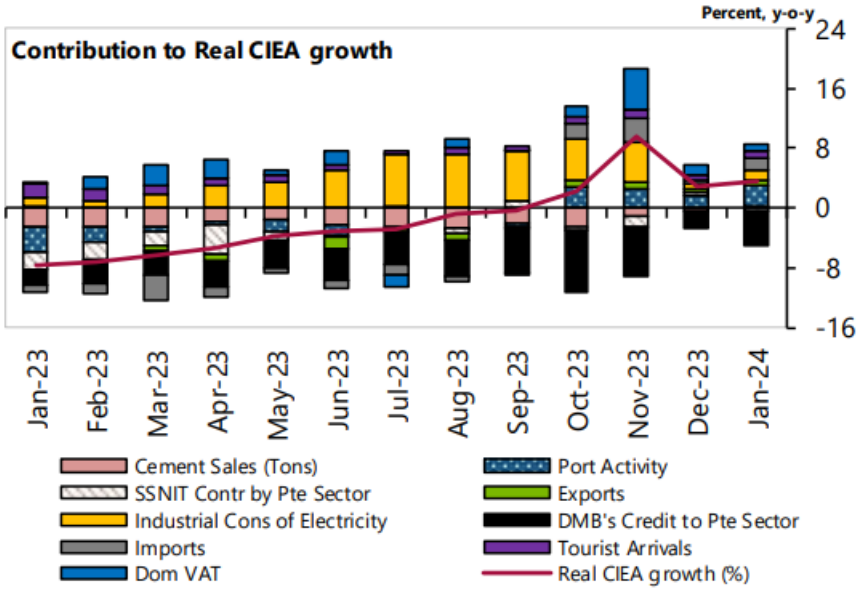
8. Throughout the project, the TA team was in close contact with the AFR Ghana country team. The mission team communicated with the IMF country team prior to every mission and briefed them on the outcomes after each mission completion. The scheduling of the TA missions was also informed by the country team visits and engagements with the authorities, including in the context of preparing the recently agreed 3-year IMF Extended Credit Facility arrangement. The FPAS TA project has repeatedly featured in Article IV staff reports as an important component of Ghana's capacity development strategy, e.g., IMF (2021).

C. DEVELOPING ANALYTICAL TOOLS AND BUILDING TECHNICAL CAPACITY

9. The analytical toolkit underlying the BOG's FPAS was enriched and extended throughout the TA project, while BOG staff was trained to efficiently apply it in support of the MPC decision making process. Besides the QPM, which is the key tool underlying the forward-looking policy analysis

at the BOG and is covered extensively in Section III, the broad suite of analytical instrument comprises empirical-based models for producing nowcasts and NTFs for key macroeconomic variables.[2] Some of these satellite tools are also presented in Bank of Ghana (2022), which provides an extensive overview of the BOG monetary policy framework and its analytical infrastructure – including practical aspects of the BOG FPAS. The data-driven forecasts allow to explore valuable information contained in high-frequency data, which is not explicitly included or considered within the QPM, e.g., confidence indicators constructed based on BOG-run surveys are a leading indicator for economic activity, and correlates well with the current-quarter GDP dynamics. For example, the staff-compiled monthly Composite Index of Economic Activity is used as a coincident and leading indicator of GDP dynamics and is regularly published in BOG's bi-monthly MPRs; see Figure 4.

Figure 4: Real CIEA (Source: BOG MPR March 2024)



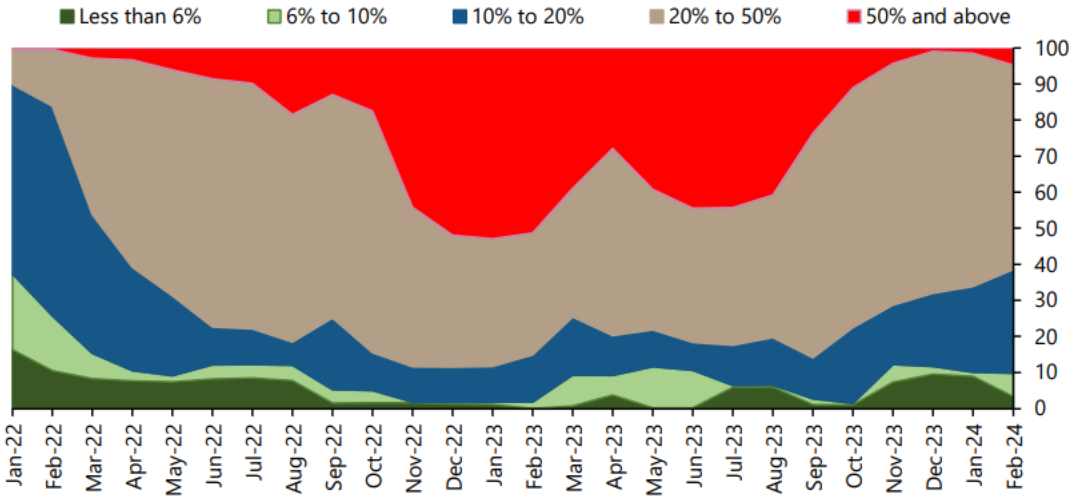
10. The set of NTF tools for main variables of interest (GDP growth and inflation) include several data-driven methods. Among these are the following: simple (and potentially ad-hoc) extrapolations of past trends; univariate methods in Seasonal Autoregressive Integrated Moving Average (SARIMA) family; bridge equations, where the statistical co-movement between GDP and a set of monthly/daily variables – extended over the short-run using simple univariate methods – is explored within a regression-based approach; and vector autoregressions (VARs) to allow for bi-directional causality between GDP and correlated variables.

11. Additional analytical results help assemble the narrative relating to the current economic conditions and inflationary pressures. Among these, the breakdown of CPI basket weights by the inflation rate of narrowly defined items has gained strong support and currently makes regular

[2] This was facilitated by BOG staff attending various IMF courses, both virtually and in-person, which cover analytical and empirical tools.

appearance in the BOG Monetary Policy Reports (MPRs). It helps identify and showcase the breadth of price pressures, e.g., between late-2022 and mid-to-late-2023 a big share of CPI items registered annual inflation rates, in excess of 50%, suggesting broad-based price strains rather than isolated price increases in specific sub-sectors. Afterwards, starting late-2023 the share of items with very high annual inflation rate started to narrow, in line with the disinflation registered at the level of headline CPI; see Figure 5.

Figure 5: Breakdown of overall CPI basket by annual inflation rate (Source: BOG MPR March 2024)



12. The medium-term macroeconomic projections are produced using the semi-structural QPM. It has a New-Keynesian four-block core, along the lines of Berg et al. (2006), which was adapted and extended to better reflect the Ghanaian economy and the BOG's inflation targeting policy framework. In particular, headline inflation is decomposed into food and non-food, while aggregate GDP is decomposed into agriculture, oil, and non-agriculture-non-oil sectors. A detailed fiscal block was also developed, allowing BOG staff to run more realistic and relevant scenarios capturing in a consistent and comprehensive manner the monetary-fiscal interactions. Overall, the sequential model extensions allow to more accurately assesses the fundamental drivers of price dynamics in Ghana, thus providing a richer policy analysis in support of BOG's MPC decision making.

D. INTEGRATION OF FPAS INTO INTERNAL PROCESSES AND EXTERNAL COMMUNICATIONS

13. The model-based results are carried out by the Forecasting Team (FT). Broadly, the FT manages deadlines and responsibilities for deliverables, following the internal forecast calendar. Among the critical tasks that FT performs are:

- Identifies and performs the tasks related to the bi-monthly forecasting cycles;
- Integrates medium-term and near-term forecasts, identify risks, builds alternative scenarios;
- Compiles macroeconomic forecasts by reaching collective and consensual views;
- Drafts materials destined for internal and external communications;
- Presents analysis and interacts with management;

- Builds the forecast narrative based on model outputs and presents policy recommendations consistent with monetary policy objectives.

14. The FT consists of experts performing various roles, which in practice are caried out on a rotation basis among individual BOG staff, where possible, to broaden their skillset and allow for continuous professional development. The key FPAS roles are:

- Coordinator (and backup): leads the FT, communicates with management;
- Model operators: maintain, use and develop the QPM infrastructure, and produce the model-based analysis;
- Database managers: ensure timely, efficient, and error-proof data environment, which are essential for the analytical work;
- Sectoral experts (real sector, inflation, fiscal, monetary, exchange rate, external, etc.): develop sector-specific expertise compatible with FPAS and QPM; real-time monitoring of relevant variables (e.g., daily data for exchange rate and interest rates); near-term forecasting capacity; form a technical-based expert view on the recent, current, and short-term developments in relevant sectoral variables; participate in assembling the broader narrative and presentations to management.

The sectoral expert roles are carried out on a regular ration basis, while the model operator role is somewhat harder to delegate, especially to newer members, given specialized knowledge required. BOG also practices the rotation of the presenter role, allowing all FT members to directly engage with peers and with MPC.

15. The ICD-wide FPAS TA experience across both time and recipient intuitions highlights that BOG's FT sustainability is threatened by several risk factors or vulnerabilities. These, along with the attendant mitigation measures, were extensively discussed with BOG staff and management during the TA engagements and also shared regularly via Aide-Memoires:

- Size of the FT is still too small → extend it by hiring more staff; consider both internal mobility and new hires options;
- FT staff is involved in "non-FPAS work" → FT staff to be formally assigned (close to) full time to FPAS work to alleviate their non-FPAS workload;
- Risk of excessive turnover → make sure there are backup staff; document FPAS tools and processes (internal manuals and user guides with steps to run NTF models, QPM analysis and forecast, etc. were prepared by BOG staff and reviewed by TA team); practice staff rotation to broaden the skillset across individual staff;
- Key person risks → make sure analytical knowledge and skills are spread more broadly and there are backup positions; make use of documentation materials (including published Working Papers) to initiate new staff.

16. The forecasting process and the corresponding analytical workflow takes place on bi-monthly basis, given the BOG policy making process conducted over six MPC sessions per year. The dates of the MPC meetings and decision announcement dates are posted in advance, typically in November for the six meetings over the following year. In practice, the forecasting process is complex, involving many stages, data processing and use, application of a wide suite of models, and various human interactions. As such, the organization of the processes is fundamental for timely and continuous provision of analytical results, as well as for accumulation of capacity. In this context, the internal processes were redesigned to allow open and regular communication between forecasting team (FT), Departments and top-management, anchored around a well-structured forecast calendar. Broadly, the regular internal forecast calendar specifies for each round:

- Timing of meetings, deadlines, responsibilities and deliverables;

- Tasks performed by staff, structure to the overall workflow and internal communications (horizontally and vertically);
- Coordination within FT and with management.

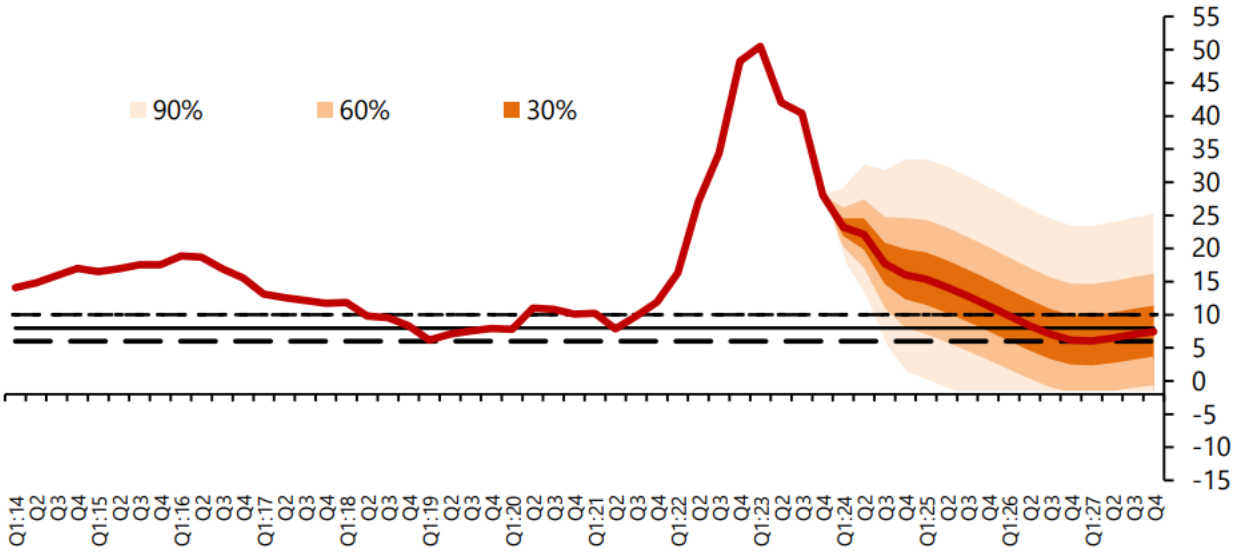
17. BOG's bi-monthly forecasting cycles are somewhat dissimilar with the practice of leading central banks but allows for a more frequent engagement with the policymakers. Most central banks organize four fully-fledged forecast rounds per year, occasionally with additional (mechanical) forecast updates in-between to increase the number of MPC decisions from four to eight per year, e.g., similar to the Czech National Bank practice. Quarterly cycles are aligned with the releases of statistical data, particularly quarterly frequency National Accounts (e.g., GDP). BOG management explained that the current bi-monthly calendar is well-anchored into the BOG monetary policy framework and has multiple objectives: apart for the decision-making process and its announcement, MPC policy sessions facilitate the dissemination of relevant statistical data and other information, and thus shape private sector expectations. Accordingly, BOG management concurred that the current practice is well-aligned with the general functions and objectives of the Bank. In order to mitigate the heavy workload and overstretched use of resources that comes with the bi-monthly MPC process, as opposed to more wide-spread quarterly forecast rounds practiced by other central banks, which match the quarterly frequency of the core model and forecasts, the TA team has repeatedly recommended the two MPC sessions without a new GDP release to feature a mechanical forecast update rather than a fully-fledged projection exercise.

18. Among the key principles, the calendar is allowing – in the context of existing time constraints – for sufficient time to produce analysis and forecasts, incorporation of MPC feedback, new data, and updating the narrative. Chapter 2 in Bank of Ghana (2022) provides a more detailed assessment of the internal FPAS processes at the BOG, in line with the broad principles outlined above.

19. While the FPAS-based analytical work is primarily focused on interest rate policy, regular interdepartmental engagements during the forecasting cycle allow to discuss and integrate the views on various policy instruments within the BOG toolkit. Staff-level meetings and interactions ensure QPM-based macroeconomic projections and policy recommendations prepared by the FT residing in Research Department are presented to experts responsible for other work areas, including Financial Markets Department, in charge of open market operations and foreign exchange interventions, and Financial Stability Department. This approach helps ensuring a unified view about the economic situation and outlook across the institution – before the analysis and forecasts are presented to the MPC – and requires close cooperation and discussions to find staff-level consensus. Even if this exchange of information is mainly of qualitative nature, without a fully model-consistent framework validation, it serves as a useful dissemination device and provides a convenient discussion platform.

20. Given the inflation targeting framework in place, BOG's external communications around the forward-looking policy conduct, including the future trajectory of inflation rate, play a central role. Inflation rate fanchart (central tendency along with confidence bands), produced using the QPM, is regularly presented and discussed in the Monetary Policy Report; see example in Figure 6. This is accompanied by verbal statements regarding the monetary policy trajectory consistent with inflation returning to its target over the medium-term.

Figure 6: Medium-term annual inflation outlook (Source: BOG MPR January 2024)



Section II. Overview of TA missions[3]

A. MISSION 1: OCTOBER-NOVEMBER 2019

21. The first mission focused towards identifying the current status of BOG's FPAS and establish TA needs. The mission evaluated key FPAS components and found several elements that deviate significantly from standard FPAS practices in ICD portfolio: (i) there are 6 MPC sessions (and forecast rounds) per year, each lasting for 3 days – on the first two days various staff teams present developments in their areas of expertise, while the third day is devoted to policy deliberations and decision-making; (ii) the modeling team presents a short model-based analysis to MPC, which is heavily focused on quantitative information and lacks background macroeconomic narrative; (iii) there is little or no interaction with MPC on initial conditions, relevant risks and alternative scenarios, etc. The mission chief met with MPC members (5 out of 7) for an extensive session on a detailed description of QPM equations (as per direct requests) and an overview of FPAS, highlighting the differences between current BOG framework and standard FPAS practices.

22. While model operators had the codes infrastructure and experience to run baseline projections, they had difficulties with explaining model-based output to the MPC and to run more sophisticated alternative scenarios. The mission team provided hands-on training on QPM procedures and committed to continue working in this direction in the future. Mission recommended to increase the size of BOG team and to allow its staff to devote more time to FPAS-related activities. Also, the mission advised staff on specific modalities to properly document FPAS processes, which should help mitigate the staff turnover risk.

23. Some improvements in the core macroeconomic model were introduced and MPC presentation was redrafted. The model updates included recalibration of the Phillips curve, inclusion of seasonally adjusted quarterly GDP data (instead of annual data only), and realignment of the fiscal deficit to the current design of the fiscal rules. Additional hands-on training on NTF models for GDP and inflation was also provided. In order to support FPAS tools and model-based analysis integration into policymaking at the BOG, the mission worked with the modeling team on redrafting the MPC presentation and facilitated a mock presentation in a new format to MPC members during the last day of the mission. In this context, redrafted materials were aligned with the standard FPAS practice of having an "Initial conditions" meeting with the MPC members before the final "Macroeconomic projections" meeting. The MPC members who were present during the session admitted the need to formalize the "Initial conditions" meeting. This would ensure that staff and MPC exchange views and work towards consensual view on initial economic conditions, thus providing a consistent starting point for macroeconomic and policy projections. The MPC also praised the content of the mock policy presentation and highlighted many aspects of economic reality that it opened-up for discussion and for taking into account when formulating monetary policy. Going forward, the MPC requested staff to follow the new format of the presentation when reporting model-based analysis and projections (which they do to the current day).

[3] This section is based on the Aide-Memoires shared periodically with BOG and on Back to Office reports prepared after each TA mission.

B. MISSION 2: JULY 2020 (VIRTUAL)

24. The first virtual TA mission conducted in the early pandemic period focused on building and developing analytical capacity around BOG's FPAS processes and organization. The mission engaged in producing model-based analysis amidst the COVID-19 crisis, in the context of the forecasting cycle associated to the July 2020 MPC meetings. The delivery was conducted via daily Webex Meeting calls, which allowed for an efficient audio and video interaction, as well as the implementation of "share screen" facility. The latter was used primarily by the BOG staff, whereby they shared their desktop and the mission team instructed verbally on the operations to be performed. This approach was likely to be more efficient at ensuring knowledge absorption as compared to the opposite (i.e., the mission team members sharing the desktop and operating the files, and the BOG staff only visually observing). BOG staff were connected individually from their offices at the BOG premises or from their homes. Internet connection within the BOG premises has proven to be strong, with no significant disruptions. Nevertheless, despite minimal technical issues and enhanced WebEx platform, virtual delivery was proven to be only an imperfect substitute for in-person TA delivery in the field.

25. A significant amount of time was dedicated to enriching the understanding, assessment and narrative around the COVID-19 impact on current and future economic activity. To this end, the mission provided training on adapting and extending specific tools that allow to evaluate aggregate GDP decline starting from the sectoral-level assessment of the lockdown restrictions. The results were corroborated with the NTF tools used regularly by the BOG and the estimated monthly composite indicator of economic activity, as well as to construct alternative forecast scenarios (e.g., more pessimistic view as compared to the baseline forecast). These satellite outcomes offered a quantitative assessment of the uncertainty around the future economic activity and were incorporated into the QPM analysis and the associated narrative. The mission collaborated with the BOG modeling team on interpreting the QPM shocks by integrating into the MPC documentation additional high frequency indicators, like mobility data, lockdown restriction index, survey-based indicators reflected within the BOG surveys and the Purchasing Managers Index, etc.

26. An additional focal point was the construction of alternative scenarios – especially related to fiscal developments. The mission instructed the BOG staff on the technical implementation of alternative scenarios, including with anticipated versus unanticipated shocks, immediate or delayed monetary policy reaction, interpretation of the differences with respect to the baseline scenario, building narratives around the results and incorporating these in MPC documentation.

C. MISSION 3: SEPTEMBER 2020 (VIRTUAL)

27. In the context of the previous mission, the BOG staff and management expressed the urgency to extend the BOG's QPM to accommodate the decomposition of headline CPI into food and non-food baskets. The previous modeling of the headline CPI alone cannot properly account for the evidence that the increase in inflation above the upper band of the target (8%±2pp) during previous months was driven exclusively by food prices, in the context of excessive demand amidst the pandemic-related uncertainty and adverse confidence sentiments. During this period, on the other hand, non-food prices evolved in line with the target range. These heterogenous developments at the sectoral level have important implications for the monetary policy conduct. In order to ensure a smooth transition to the new model structure, the mission had assisted the BOG modeling team in adjusting all relevant FPAS elements and processes – code infrastructure, databases, NTFs, reports, presentations, etc.

28. The mission collaborated with the BOG on additional recalibration of the QPM. This exercise covered: increasing the persistence of the exchange rate process (in order to avoid significant exchange rate movements in the first quarter of the forecast interval); adjusting the definition of fiscal impulse entering aggregate demand equation (changed to four-quarter moving average in order to avoid noisy spikes on account of intra-year volatility in fiscal flows); and imposing tunes on the output gap/trend dynamics in the context of the COVID-19 crisis, including on the account of the realized 2020Q2 GDP drop being significantly larger as compared to the nowcast value used in the previous forecasting round.

29. The model extension also featured in a dedicated section of the MPC presentation, highlighting the motivation for and an overview of the updated QPM. The mission assisted the BOG staff in preparing the corresponding slides, as well as in adjusting the standard MPC presentation in light of the new model structure.

D. MISSION 4: MARCH 2021 (VIRTUAL)

30. The extended QPM was employed to provide a richer narrative about the economic developments and the corresponding implications for the monetary policy conduct in the context of the March 2021 MPC forecasting cycle. The mission provided enhanced NTF tools for forecasting GDP growth and headline CPI. In the case of the former, the Matlab-based bridge equations system explores the availability of monthly indicators published in advance of quarterly GDP data. For the latter, the bottom-up approach considers forecasting individual items and aggregating these to the headline inflation. The mission persuaded the BOG modeling team in streamlining the model-based analysis by defining initial conditions and the starting point for forecasts to be represented by the current quarter 2021Q1, rather than 2020Q4 under their regular approach. This provided a more meaningful role to model filtration via assessment of the current position in the business cycle and the monetary policy stance, which was also appreciated by the MPC.

31. A considerable amount of time on mission was dedicated to the incorporation of the just-announced fiscal package and to the design of relevant alternative scenarios. The details were published on March 12, with measures to be applied starting April 1. Some of the measures were unexpected, including VAT rate increases for specific items, with direct implications for BOG achieving its inflation target over the medium term. Accordingly, the mission team and the BOG modeling unit put an additional effort in incorporating the relevant information into the medium-term projection and build the corresponding narrative. A range of alternative scenarios were developed, highlighting to the MPC the tradeoffs between returning inflation within the target band and avoiding sharp depreciation on one hand, and supporting the still fragile economic recovery on the other.

E. MISSION 5: NOVEMBER 2021 (VIRTUAL)

32. The mission worked towards enhancing the short-term forecasting architecture, revisiting and conducting simulations with the QPM, and studying the performance of BOG staff's historical out-of-sample forecasts. The GDP growth nowcasting and NTF procedure based on the bridge equations framework introduced during the March 2021 mission was enhanced by adding new high frequency indicators and selecting a robust set of predictors based on rolling window quasi-real time recursive forecasting exercises. At the request of the BOG team, the mission revised the relative prices block in the QPM and conducted counterfactual model simulations for different inflation target levels starting from

various non-steady state initial conditions. The mission trained the BOG team in developing a flexible, user-friendly, and comprehensive procedure to analyze the out-of-sample forecasting accuracy of the BOG staff's QPM-based historical forecasts (i.e., the baseline forecasts presented in the MPC meetings during past forecast cycles).

33. As part of the broad TA agenda, ICD was conducting an Analytics & Development project on documenting BOG's FPAS components in the form of a User Guide for BOG's internal use. At that moment, the BOG-ICD teams had already concluded the documentation of QPM codes' operational use and submitted to BOG management a high-level description of the current QPM. The latter has been incorporated as a dedicated chapter in a comprehensive BOG paper (covering the BOG analytical framework) that the Bank has published; see Bank of Ghana (2022) and Section III. Following this publication, the BOG-ICD teams agreed to collaborate on the drafting of a jointly authored IMF Working Paper describing the current QPM in more technical detail; see Section III.

F. MISSION 6: JULY 2022

34. The mission extended the QPM by decomposing GDP into agriculture value added, oil value added, and non-agriculture-non-oil GDP. The latter was assumed to better capture the demand-side inflationary pressures, given that oil and agriculture sectors do not follow the aggregate business cycle and affect CPI dynamics differently. The interest rate policy transmission is also stronger in the case of non-agriculture-non-oil GDP. Thus, the decomposition allows to more accurately assesses the fundamental drivers of price dynamics and provides richer policy analysis. In addition, the extension could approximate, in a reduced-form manner, the climate change effects within the QPM, given the causality from weather-related phenomena to the dynamics of agri-food prices and quantities observed in the Ghanaian data; in this respect the food inflation Phillips curve was enriched with the agriculture value added gap term; see Section III. Using the extended modeling environment, the mission assisted the BOG team in preparing the real-time analysis and forecasts for the July 2022 MPC sessions.

35. During the concluding meeting, chaired by the First Deputy Governor, Mr. Maxwell Opoku-Afari, the mission team provided an overview of the TA Project. Key achievements within the TA Project were discussed, alongside specific FPAS processes where progress has been slow, i.e., the size of the forecasting team (which remained inadequately small in mission's view); organization of internal forecast calendar, in particular the timing of MPC meetings within a forecast round ("Final projections" meeting is only two days after the "Initial conditions" meeting); frequency of MPC sessions and Monetary Policy Report (MPR) publications (currently six full forecast rounds per year, each with a MPC session and a MPR release, against the more standard quarterly frequency, i.e., four rounds per year); content and timeliness of external communications (forward-looking analysis is outweighed by data reporting content; the timespan between MPC decision announcement and MPR publication should be reduced to within one week from currently few weeks).

G. MISSION 7: APRIL-MAY 2024

36. This final in-person TA mission envisioned under the Ghana TA project allocation worked towards concluding the building of analytical capacity, developing FPAS processes at the BOG, and providing final recommendations. The latter included suggestions to hire new staff within the FT, streamline FT staff's workload towards FPAS-related activities, and consider further enriching external communications with forward-looking elements. These were put in parallel with the IMF stock-taking

paper on FPAS TA in Mæhle et al. (2021) and the recently published review of the Bank of England forecasting process in Bernanke (2024).

37. The BOG's QPM was refined to properly account for the sectoral price dynamics, with additional analytical tools introduced to broaden model-based assessment. At the initiative of the BOG team, inter-sectoral (food and non-food) price spillovers were incorporated into the QPM, allowing to enhance the propagation mechanism of supply shocks and refine the ensuing monetary policy reaction. Historical shock decompositions helped disentangling the driving forces behind key variables' dynamics: e.g., the well above-target inflation during 2022-23 was driven primarily by supply, exchange rate, and external shocks, whose impact was modestly counterbalanced by deflationary domestic demand shocks. Counterfactual simulations highlighted the major trade-offs between price stability and economic growth: e.g., a counterfactual interest rate trajectory that follows the Taylor-type reaction function during 2022-23 suggests a tighter policy stance, which would lower inflation rate by about 5-6 percentage points compared to actual outcomes but at the cost of 1-1.5 percent lower output. First Deputy Governor highly appreciated the exercises and charged the BOG team to present these results during the next MPC session.

38. At an earlier request from the BOG, and given the relevance of fiscal developments for the domestic economy and monetary policy conduct, the TA team developed a fiscal sector satellite. It features the distinction between domestic and foreign debt (including the corresponding term premia), and a fiscal authority concerned with debt stabilization and provision of countercyclical support; see Section III. The extension allows to assess the impact of certain shocks more accurately: e.g., foreign interest rate shocks lead to more expensive external debt and requires a tighter fiscal stance, which aggravates domestic demand relatively more as compared to the core QPM. Non-linear simulations using a "tipping point" constraint on government debt revealed the adverse impact of large debt shocks – resembling the developments during the recent crisis in Ghana. Given the additional resources – occasioned in part by data limitations – needed to produce a fully-fledged forecast with the fiscal extension, its recommended use is to run alternative scenarios and simulations, while the core QPM should remain the main tool for (baseline) forecast production.

39. The remaining recommendations and plans shared by the TA team were related to ensuring FPAS sustainability, further streamline external communications, and engaging with the BOG FT on drafting IMF Working Paper(s). Given the increased role of the analytical work within the BOG policy process and the aspiration to remain at the frontier among (regional) peers, the FT needs to be further expanded and allowed to invest more time in model building and operation. This will ensure FPAS work continuity after the project completion and will avoid capacity losses due to staff turnover, as happened in the past. A large FT will respond more efficiently to MPC requests and will allow staff's unique skills and comparative advantage to be used more productively. While the TA project concluded, the ICD TA team plans to remain engaged with the BOG staff on drafting IMF Working Paper(s) (and organization of an IMF internal seminar) on the extended core QPM and the fiscal satellite (see next section). This will further reinforce the BOG's communication strategy and ensure the sustainability of FPAS capacity.

40. Future dedicated technical engagements concentrating on QPM satellites can be considered, with support from and in coordination with AFRITAC West 2 – as preliminary discussed with all stakeholders. Relevant model extensions include introducing balance of payments flows; a detailed banking sector; and consistent interaction of various monetary pools tools – e.g., foreign exchange interventions and/or macroprudential instruments in addition to interest rates – following IMF's Integrated Policy Framework and analytical contributions in QPM-type setting presented in Berg et al. (2023).

Section III. Tangible outputs

A. IMF WORKING PAPER WP/22/169

41. IMF Working Paper 22/169 "Quarterly Projection Model for the Bank of Ghana", co-authored by the mission team and the BOG staff, was published in September 2022; see Abradu-Otoo et al. (2022). The paper describes the BOG's QPM that underlies the BOG's FPAS, in the model version after the completion of November 2021 mission, which focused on the CPI decomposition into non-food (core) and food components. The New Keynesian semi-structural model incorporates the main characteristics of the domestic economy, key transmission channels and current monetary policy framework.

42. The paper provides a set of stylized facts motivating the structure of the BOG's QPM. The model core consists of four blocks or sets of equations: aggregate demand, Phillips curves, exchange rate, and monetary policy reaction function; see also the canonical representation in Berg et al. (2006). It approximates two key policy transmission channels – via interest rate and via exchange rate – in a gap-trend decomposition environment characterized by rational expectations. Central bank decides on the interest rate trajectory following a forward-looking policy reaction function aimed at stabilizing medium-term headline inflation rate close to the 8% target. The model was adapted and extended throughout the TA project to capture various Ghana-specific features: differentiated dynamics of core and food inflation, aggregate demand effects of fiscal policy, monetary policy credibility, imperfect exchange rate flexibility and interest rate pass-through, etc.

43. Impulse response functions (IRFs) to key structural shocks helped visualize the propagation mechanisms embedded in the model, and the stabilization effects of the interest rate policy. As an example, Figure 7 presents the effects of an unexpected aggregate demand shock. IRFs reveal a demand-driven raise in headline inflation, on account of higher non-food prices. In response to higher inflation and inflation expectations, as well as higher domestic demand (positive output gap), the central bank tightens the interest rate stance, which also leads to nominal and real appreciation. After the initial surge in non-food inflation, driven by excess domestic demand, as the real monetary conditions – through both interest rate and exchange rate components – become tighter, it returns to pre-shock equilibrium. At the same time, non-food inflation decelerates right away, given the real marginal cost structure is tilted towards imported inputs, which are relatively cheaper on account of exchange rate appreciation.

44. Equation decompositions, using the Kalman filter estimates, confirm the usefulness of the QPM in assembling sensible and consistent historical narratives. Overall, the QPM provides a compelling narrative with respect to the historical macroeconomic developments in Ghana, including the identification of the business cycle fluctuations and the key drivers of inflation dynamics. These model outputs are regularly presented to the MPC and are an important component of the BOG policy process. Figure 8 presents, as an example, the aggregate demand decomposition of output gap, as detailed in Abradu-Otoo et al. (2022). Output gap widened into negative territory during 2009, at the heights of the Global Financial Crisis, due to weak external demand (USA GDP gap) and negative fiscal impulse, reflecting the post-election fiscal consolidation. The episode of moderately excess demand during 2011-12 was the result of both looser fiscal and monetary conditions, and favorable demand shocks. The abrupt fall in output gap in early-2020 reflects the adverse effects of COVID-19 containment measures, quantified in the model by record-negative demand shocks. Other determinants of below equilibrium

economic activity during the period were weak external demand and unfavorable sentiment and expectations regarding future economic conditions. The extent of the output gap contraction was moderated by the provided policy support, with policy rate cuts reflecting an accommodative monetary policy stance and loose fiscal measures captured by a positive fiscal impulse.

Figure 7: Aggregate demand shock (Source: Abradu-Otoo et al. (2022))

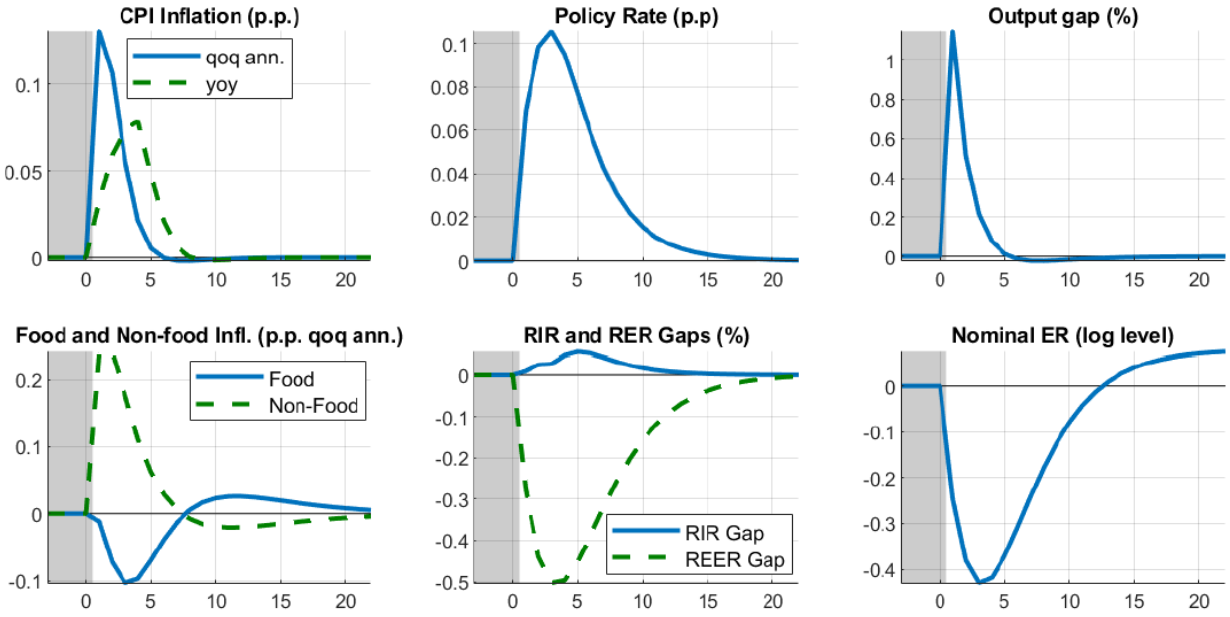
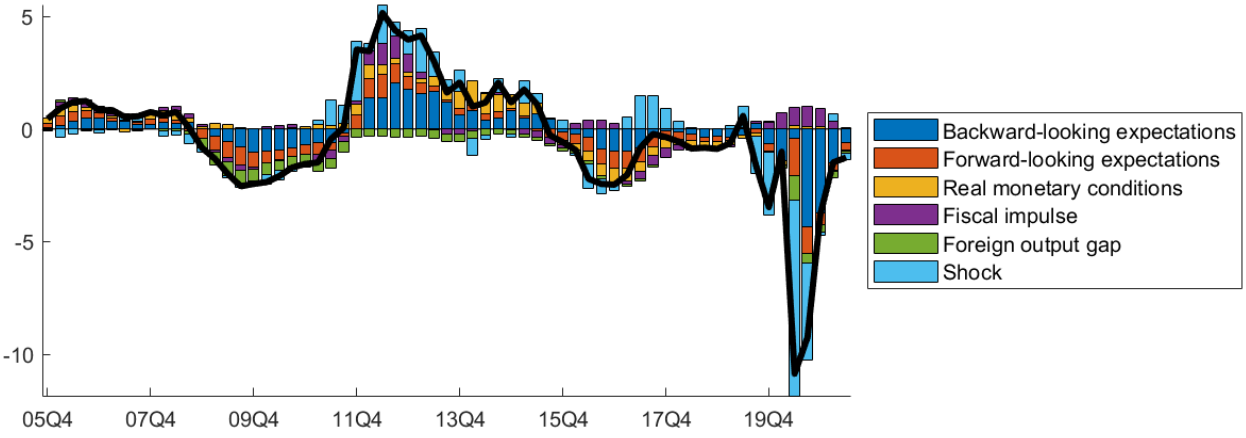


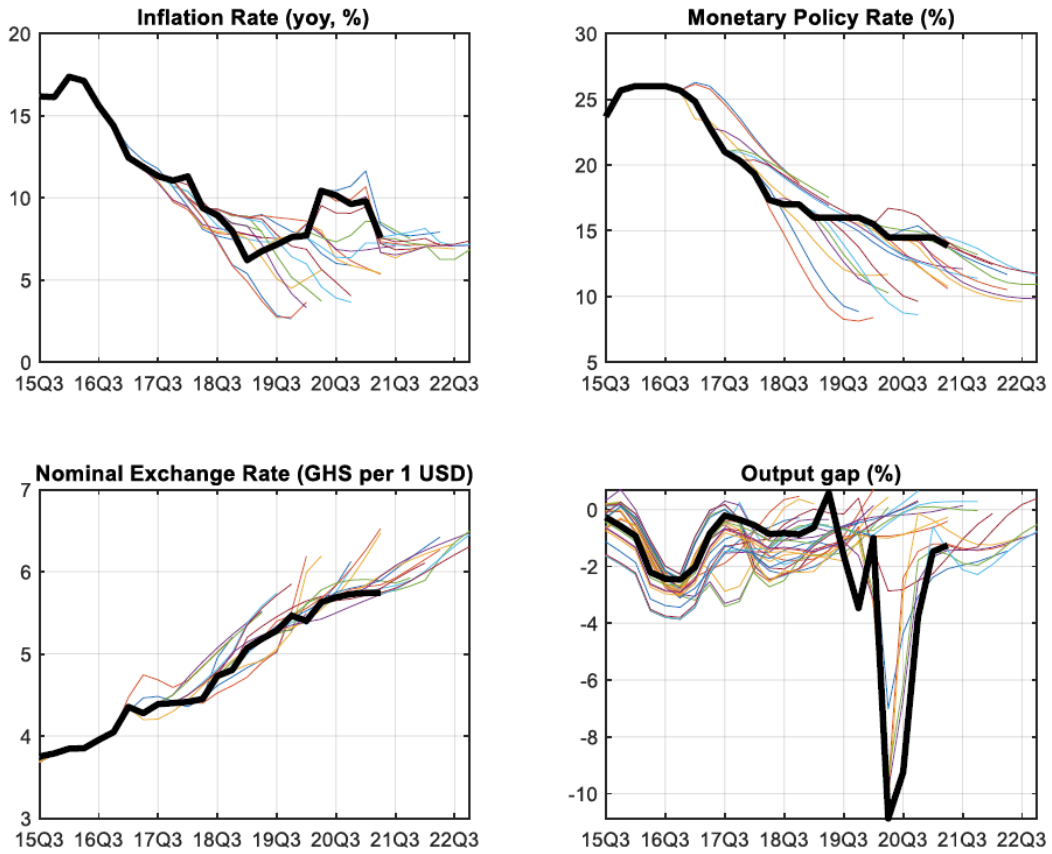
Figure 8: Output gap decomposition (Source: Abradu-Otoo et al. (2022))



45. Satisfactory out-of-sample forecasting accuracy validates empirical coherency of the BOG's QPM. Figure 9 shows the sequential model-based baseline forecasts for key macroeconomic variables presented to the MPC over 2017Q1 to 2021Q4 regular forecasting cycles. Overall, the forecasts capture

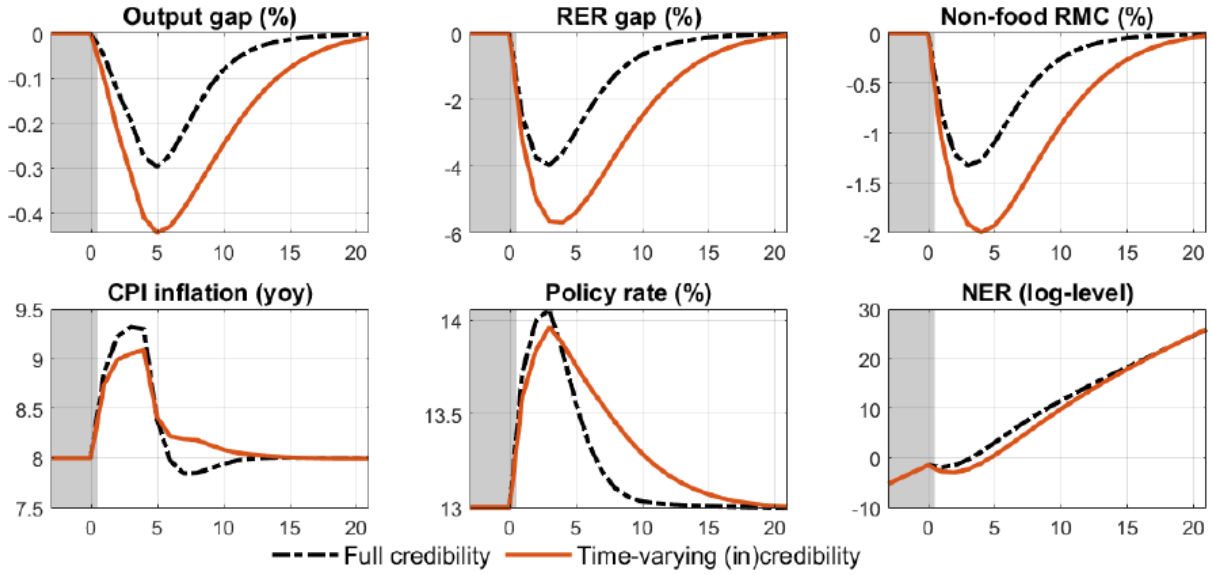
well the short-term dynamics and general trends for the four analyzed variables. Apart from late-2018 to mid-2019 period, the model tended to underestimate inflation and, consequently, interest rates, given the predominance of supply-type shocks during this interval; see Abradu-Otoo et al. (2022). The exchange rate depreciation trend is captured reasonably well, with a marginal medium-term upward bias. Pre-pandemic, output gap estimates and forecasts tended to be revised upward, i.e., the latest trajectory is overall above the earlier estimates. Given the unexpected nature of the pandemic shocks, output gap estimates for 2020 are characterized by significant forecast errors.

Figure 9: Out-of-sample forecasts and actual data (black) (Source: Abradu-Otoo et al. (2022))



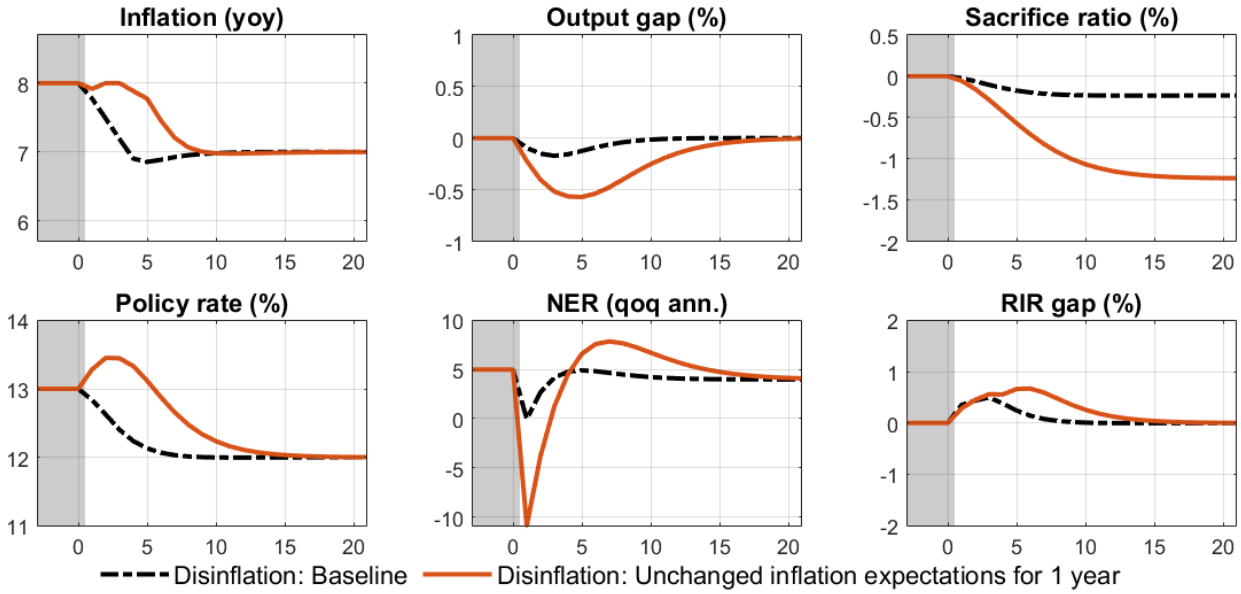
46. BOG's QPM includes a monetary policy credibility channel, which accommodates the observed stylized facts related to the persistency of inflationary episodes in Ghana. The credibility variable captures the historical deviations of inflation from its target and is included in the expectations' formation mechanisms in the Phillips curves. Figure 10 highlights that compared to a counterfactual simulation that assumes full central bank credibility, in the case of reduced monetary policy credibility – e.g., from a "bad" track-record of achieving inflation target in the past – a supply shock is generating more persistent inflation on account of sticky expectations. Consequently, the central bank runs the tightening cycle for longer, implying a stronger exchange rate and a lower level of aggregate demand. Overall, the presented outcomes highlight the worse inflation-output tradeoff entailed by supply shocks in the case of partial central bank credibility.

Figure 10: Cost-push shocks: full vs. time-varying credibility (Source: Abradu-Otoo et al. (2022))



47. Simulation exercises highlighted the importance of the monetary policy credibility during the disinflation process. In particular, a counterfactual exercise in which the inflation target is reduced by 1 percentage point showed that even if the current inflation target had achieved enough credibility, an announcement of a lower one might not be fully credible initially, unless the central bank shows early resolve towards achieving the new target. Figure 11 showcases such a scenario, which assumes unchanged inflation expectations around the current target of 8% for one year, even if agents have already taken note of the newly announced 7% target. The results show that in the case of weakly-anchored expectations and low central bank credibility, an initial increase in policy rate is required in order to stabilize inflation around the new lower target over the medium-term. This tightening however comes at the cost of much lower output. Since the central bank acknowledges that inflation expectations are not anchored initially and cannot support the disinflation towards the new target, it needs to commit to a tighter policy stance, which sharply appreciates the exchange rate initially and leads to a bigger decline in the output gap. The implied sacrifice ratio (cumulative output loss as a ratio of cumulative inflation decline) equals 1.3 percent of annual GDP. The conclusion of this counterfactual scenario suggests that in the case of low central bank credibility and sticky inflation expectations disinflation can be relatively costly. Accordingly, (i) central bank communication and transparency could be deployed to efficiently anchor inflation expectations and (ii) guarding against inflation expectations de-anchoring and losing central bank credibility is important to avoid large output costs.

Figure 11: Simulation of reducing inflation target by 1 percentage point: baseline vs. fixed inflation expectations for one year (Source: Abradu-Otoo et al. (2022))

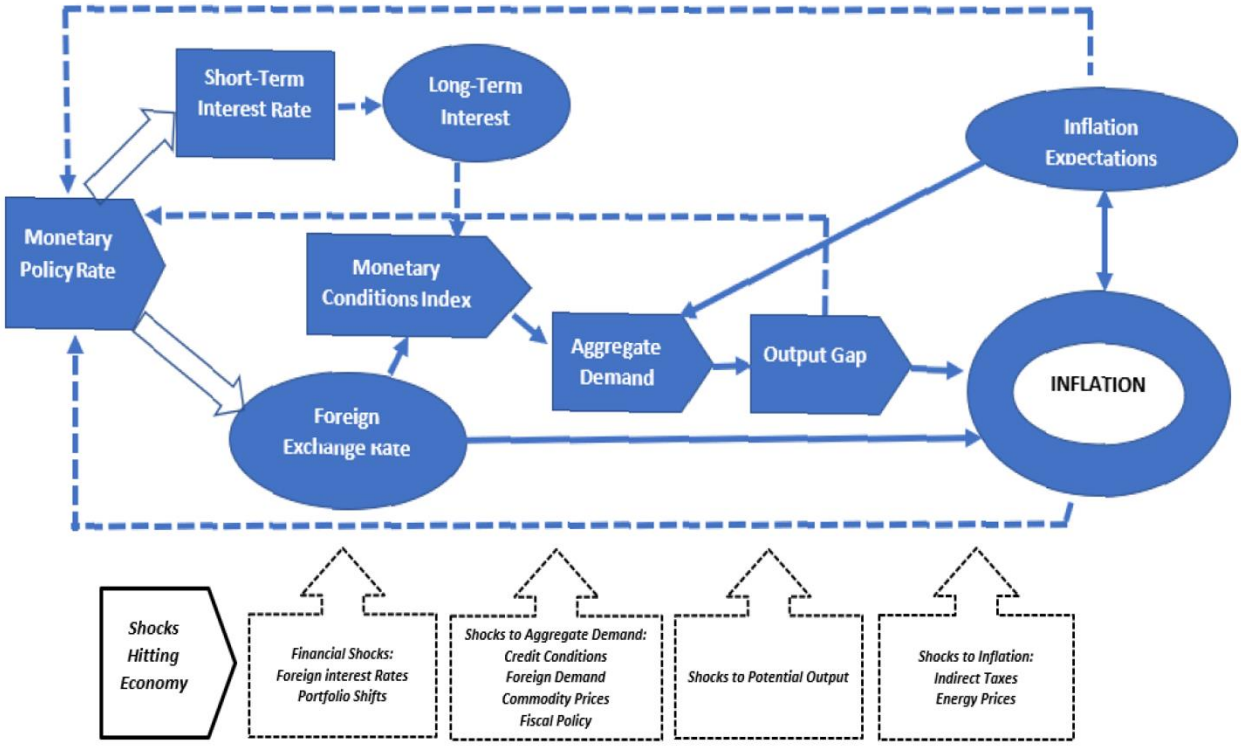


48. The QPM has become a key component of the BOG's analytical framework. Given the inclusion in the model of the key Ghanaian economic characteristics and policy framework, the shock propagation mechanisms considered in the QPM validate its theoretical consistency. At the same time, out-of-sample forecasting accuracy supports its empirical robustness. Historical track record of real-time policy analysis and medium-term forecasting conducted by BOG team using the QPM – as a component of the broader FPAS analytical system of the Bank – establishes its critical role in supporting the BOG's forward-looking monetary policy framework.

B. BANK OF GHANA OCCASIONAL PAPER NO. 1/2022

49. In 2022 BOG published Occasional Paper No. 1/2022 "Bank of Ghana's Forecasting and Policy Analysis System", authored by BOG staff and reviewed preliminarily by the mission team. The paper covers in extenso the monetary policy framework in Ghana and how it evolved over time, the decision-making process and MPC procedures, the QPM (both the initial version of the model, before the starting of the FPAS TA Project, and the version developed during the initial phase of the project, reflecting the CPI decomposition into food and non-food as documented in Abradu-Otoo et al. (2022)) – represented diagrammatically in Figure 12, and its properties; see Bank of Ghana (2022).

Figure 12: Stylized monetary policy transmission in BOG's QMP (Source: Bank of Ghana (2022))



50. As part of the broad TA agenda, in parallel with the work on Bank of Ghana (2022), ICD conducted together with the BOG FT an Analytics & Development project on documenting the Bank's FPAS components in the form of a User Guide for BOG's internal use. This included the detailed step-by-step instructions on preparing the database, running NTF models, produce initial conditions, baseline forecast and alternative scenarios using the QPM. It was submitted and approved by BOG management. Going forward, the documentation will help integrate prospective new staff thus ensuring FPAS sustainability. The publication of both the BOG paper on its analytical framework (Bank of Ghana (2022)) and the IMF Working Paper on Ghana QPM (Abradu-Otoo et al. (2022)) has contributed to strengthening the BOG's communication strategy, which is an important objective of the broader FPAS TA project agenda.

C. FORTHCOMING ENGAGEMENTS

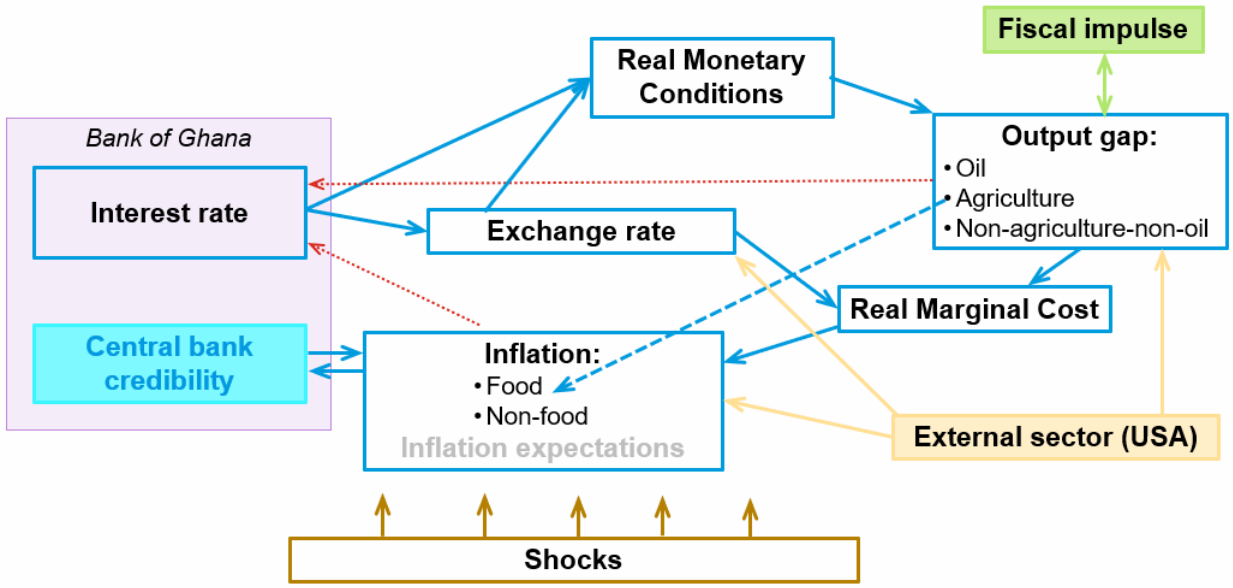
51. Looking ahead, while the TA project concluded, the ICD TA team remains engaged with the BOG forecasting team on drafting additional Working Paper(s). In the second part of the TA project, after the publication of IMF WP 22/169, several other QPM extensions were developed. These are being documented into other paper(s), co-authored by the mission team and BOG staff, and expected to be issued over the next months. This will further reinforce the Bank's communication strategy and ensure the sustainability of FPAS capacity.

52. One representative model extension was the decomposition of GDP block into dedicated modeling of agriculture value added, oil value added, and non-agriculture-non-oil GDP. This allows

to consider the importance of the agriculture sector in Ghana (about 20% of GDP) and incorporate the evidence that it does not follow closely the broader business cycle or monetary conditions, being affected primarily by climate and other exogenous factors (e.g., droughts, volatile costs of fertilizers). Agriculture production also affects domestic prices differently relative to aggregate GDP, having a direct (inverse) impact on food prices. On the other hand, non-agriculture-non-oil GDP reflects the underlying aggregate demand side inflationary pressures and is likely to register a relatively stronger transmission from interest rate stance.

53. The interaction between agriculture value added and food prices opens doors for analyzing and discussing climate related shocks. In addition to being less persistent and more volatile as compared to core prices, food prices are directly affected by agriculture supply and thus climate events (rainfalls, harvest), which are difficult to predict. In theory, domestic business cycle is relatively more important for non-food inflation, which reflects underlying inflationary pressures, while exchange rate and import prices are relatively more important for food inflation; see Figure 13 for a diagrammatic representation of the extended BOG QPM.

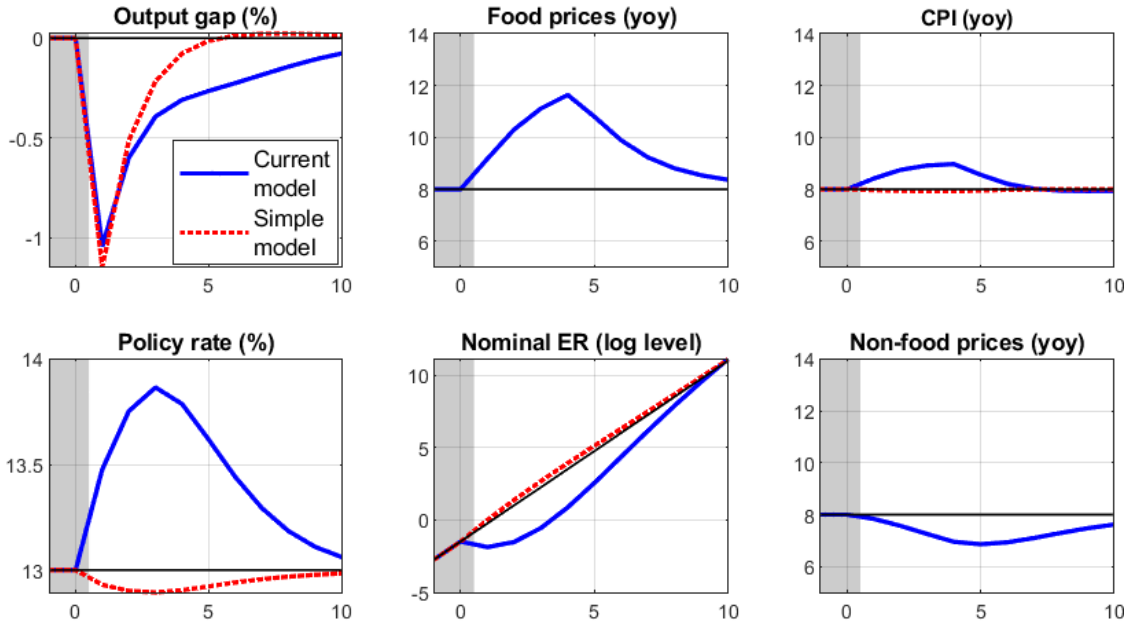
Figure 13: Stylized representation of extended BOG QPM (Source: forthcoming WP)



54. The critical policy implication revealed by the extended model is that it allows to more accurately separate demand and supply pressures, including those originating from climate-related events. For example, a reduced agriculture output (e.g., on account of bad harvest) decreases total output and increases food – and headline – inflation. In order to minimize the risks of second round effects and avoid unanchored expectations, interest rates are hiked, leading to stronger exchange rate and lower non-food prices. On the other hand, in the initial model version (with no separation of agriculture sector and food inflation), lower total aggregate output due to adverse agriculture production is interpreted as (slightly) deflationary, resembling an adverse demand-type shock. This calls for interest rate loosening, which depreciates the currency. Overall, as showcased in Figure 14, the described

scenario is interpreted as a supply shock in the current extended model and as a demand shock with overall small effects in initial one-sector model. Accordingly, there are important differences in terms of tradeoffs and implications for monetary policy.

Figure 14: Agriculture-related shocks in extended and initial BOG QPM (Source: forthcoming WP)



55. The GDP decomposition allows for a richer assessment of the business cycle position. Pandemic-related lockdowns in 2020Q2 were not binding in agriculture and oil sectors, given their strategic importance for the economy. Activity in other economic sectors was, however, directly impacted by the epidemiological restrictions. Consistent with these industry-level evidence, estimated output gaps in oil and agriculture sectors are higher (positive and less negative, respectively) than in the non-agriculture-non-oil one. Accordingly, the detailed GDP breakdown provides a more realistic assessment of the lockdowns' impact on economic activity in different sectors.

56. Counterfactual simulations conducted with the QPM are used for policy evaluation to highlight the tradeoffs faced by the central bank. As an example, Figure 15 presents a counterfactual simulation in which the interest rate is kept fixed at the level prevailing in 2021Q4, before the recent tightening cycle implemented by the BOG. In this scenario, lack of monetary policy tightening leads to significant economic instability, with a considerably overheated economy (including possibly on account of a significant drop in potential GDP (due to price instability and the resulting inefficiencies) and substantial increase in inflation (to triple-digit levels) and exchange rate depreciation.

Figure 15: Counterfactual simulation: fixed interest rate (Source: forthcoming WP)

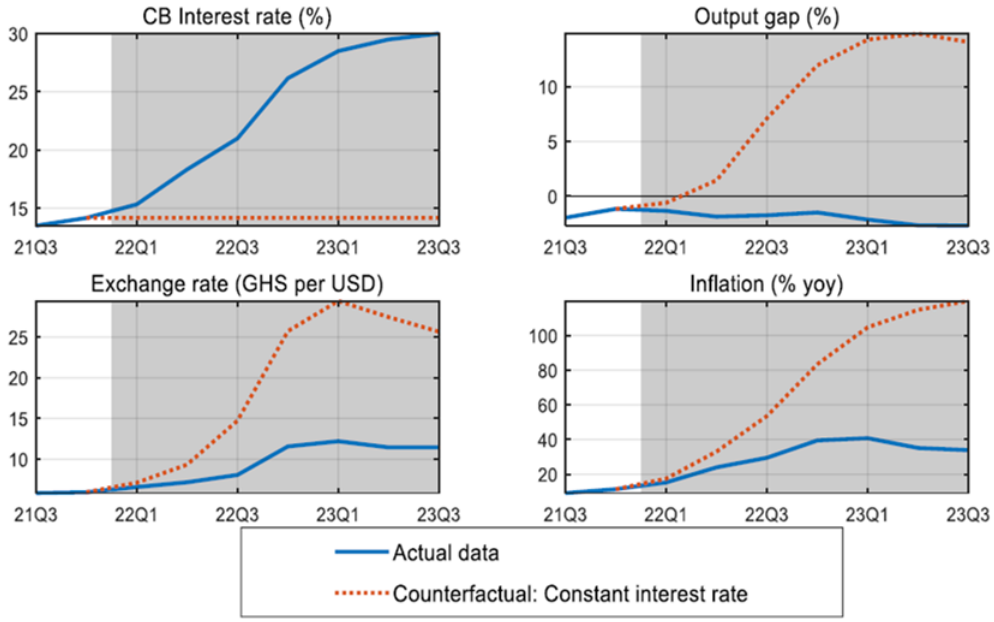
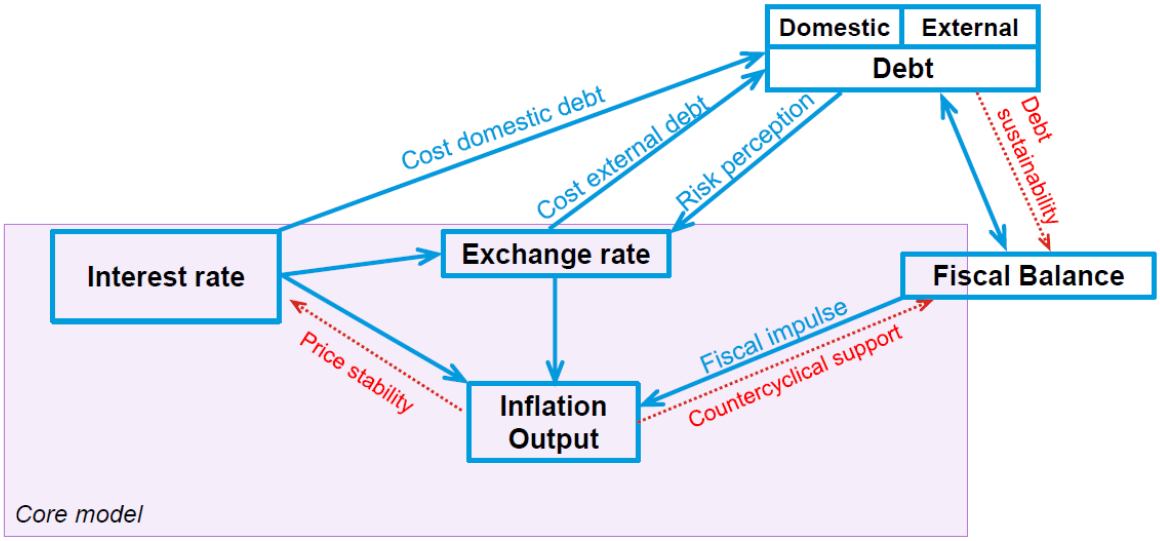


Figure 16: Schematic representation of extended BOG's QPM (Source: forthcoming WP)

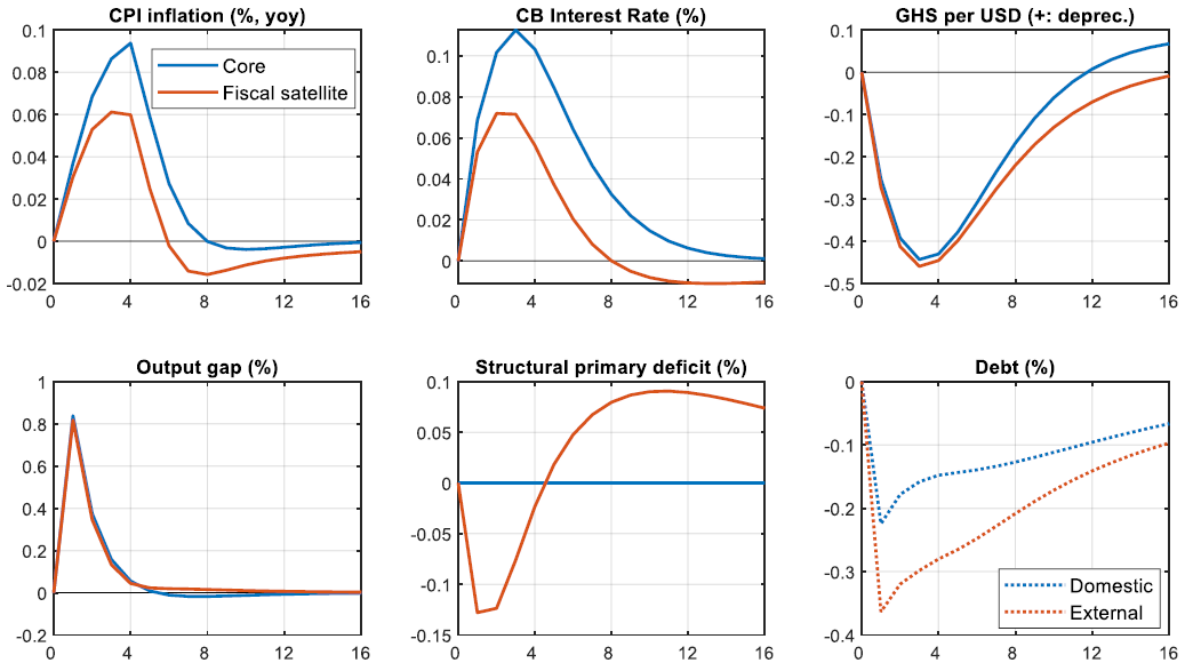


57. The final model extension, implemented during the last TA mission, covered a detailed fiscal block. Responding to requests from BOG staff and given the relevance of the fiscal developments for aggregate economic activity in Ghana, the QPM was extended with a detailed representation of the fiscal sector, enabling a more comprehensive analysis of fiscal-monetary interactions. The introduced structure follows existing portfolio of ICD FPAS TA projects, as well as (elements of) the new ICD workhorse model for macroeconomic forecasting and analysis FINEX, as presented in Berg et al. (2023). The extension features debt accumulation (differentiated between domestic and external), interest costs, overall and

primary deficit, and a fiscal policy reaction function in terms of structural primary deficit reacting to achieve two objectives – debt sustainability and countercyclical support; see Figure 16. The primary intended use is for alternative scenarios and simulations, while the baseline projections will be constructed using the previous model version.

58. The fiscal extension allows to assess the impact of certain shocks more accurately. As an example, Figure 17 presents the propagation of an aggregate demand shock in the extended model against the previous "core" model. With the addition of another countercyclical policy or instrument, i.e., structural primary deficit, the effects of the shock are overall smaller, with milder inflation deviations from the target. In addition, the required interest rate increase is smaller, given that some of the excess demand caused by the shock is "removed" by a more restrictive fiscal policy. Another example is an exchange rate shock. In "standard" small open economy models, currency depreciations increase output gap via competitiveness gains and improvements in net export. But with the fiscal satellite, since depreciation increase the foreign currency government debt burden, it forces consolidation and constraints output.

Figure 17: Aggregate demand shock (Source: forthcoming WP)



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