



ISLAMIC REPUBLIC OF MAURITANIA

SELECTED ISSUES

February 2023

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ISLAMIC REPUBLIC OF MAURITANIA

SELECTED ISSUES

December 20, 2022

Approved By
The Middle East and
Central Asia Department

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MAURITANIA: GRADUAL TRANSITION TO GREATER EXCHANGE RATE FLEXIBILITY¹

As a commodity exporter, Mauritania is vulnerable to shifts in the terms of trade. Fluctuations in the current account balance generate macroeconomic and financial volatility that call for exchange rate adjustments. A more flexible exchange rate would help absorb real shocks and dampen growth and financial volatility while preserving external buffers. This selected issue paper discusses the desirable institutional and macro-financial conditions and optimal path toward greater exchange rate flexibility. It also identifies the macro-financial risks that arise, and mitigation measures supporting a smooth transition and discusses reforms needed for a successful and smooth shift, including the need for an alternative nominal anchor and modern monetary policy framework, more developed financial markets, and resilient financial sector.

A. Introduction

1. **Mauritania would benefit from increasing exchange rate flexibility.** A more flexible exchange rate can reduce the economy's vulnerability to external shocks, preserve international reserves, support competitiveness, dampen macroeconomic and financial volatility, reduce the need for sizeable fiscal adjustment, and increase the scope for more independent monetary policy. One of the main benefits that Mauritania derived from a more stable exchange rate is a historically low inflation until the commodity price shock of 2021. However, lower and more stable inflation can be achieved by an alternative monetary policy framework while fully reaping the benefits of a more flexible exchange rate.
2. **The reform of the exchange rate arrangement has greater chance of success when initiated from a position of strength—external, fiscal, monetary, and financial.** In general, there are three main reasons triggering a move to greater exchange rate flexibility: (1) depleted foreign exchange (FX) reserves and overvalued exchange rate, (2) vulnerability to external shocks, or (3) the decision to modernize the monetary policy framework and evolve to an inflation targeting regime. In the first case, the objectives of the reform are often to address FX pressures, realign the exchange rate, and restore competitiveness. In the second case, the objective is rather to allow the exchange rate to serve as an additional instrument to help adjustment and strengthen resilience to future shocks, and the reform should normally not lead to a depreciation if the starting point is more or less balanced macrofinancial conditions supported by a sound monetary policy framework and fiscal discipline. At the same time, evolving the monetary policy framework toward a more forward-looking price-based monetary policy involves less reliance on the exchange rate and more reliance on the interest rate to stabilize inflation, as the BCM has been trying to achieve recently, which falls under the third case.

¹ Prepared by Mariam El Hamiani Khatat. This Selected Issues Paper is extracted from a forthcoming Working Paper: "Moving to Greater Exchange Rate Flexibility in Mauritania: Why, When, and How?".

3. For Mauritania, key elements for a successful transition to greater exchange rate flexibility include: (1) an alternative nominal anchor and modern monetary policy framework, (2) strengthened banks' balance sheets and resilience to shocks, and (3) relatively developed domestic government securities and interbank money and foreign exchange markets to support smoother monetary policy implementation and transmission and reduce reliance on external debt (Figure 1).

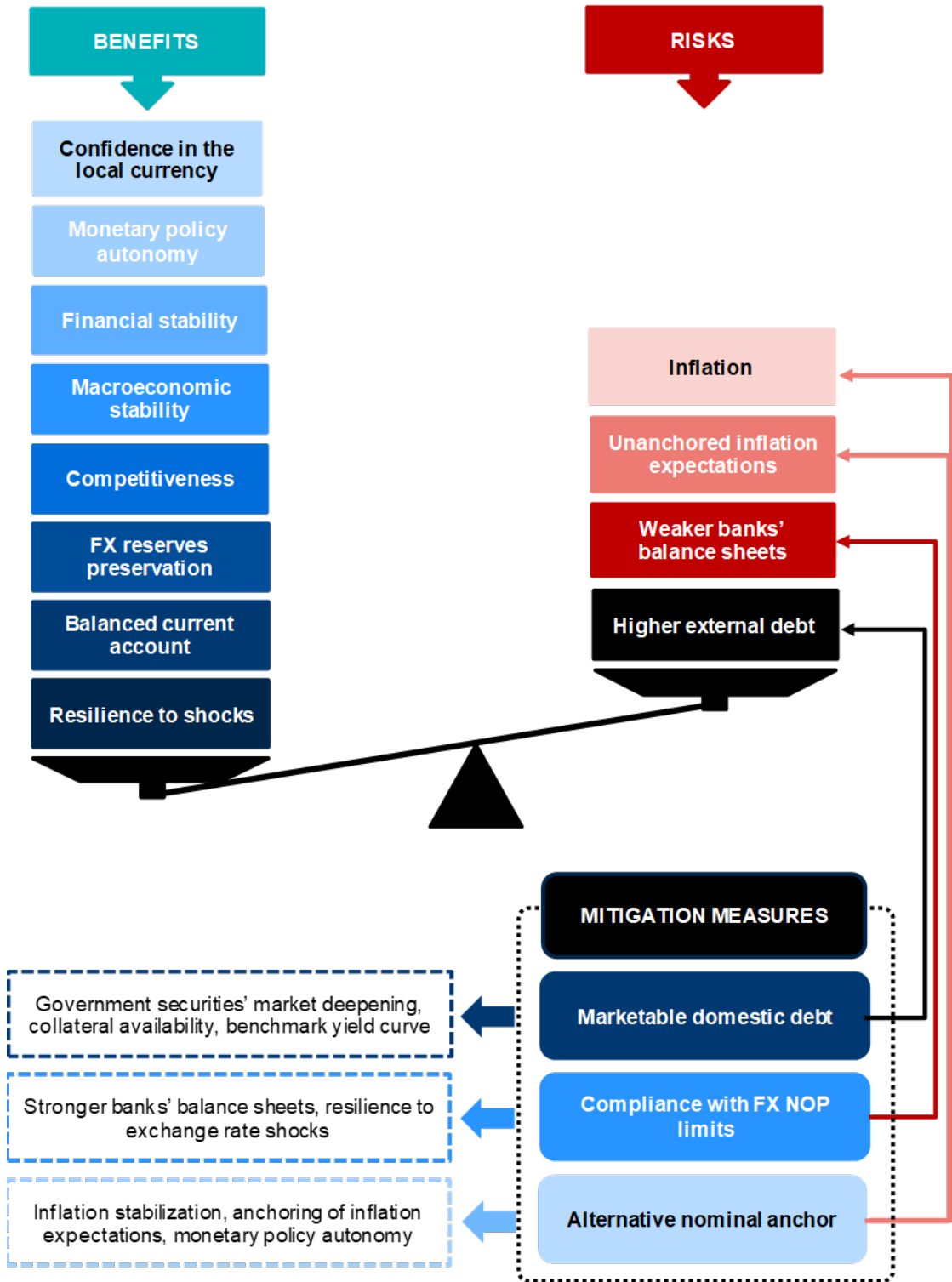
4. The Mauritanian authorities have already launched the preparatory work needed to strengthen the monetary policy framework to support greater exchange rate flexibility. In 2017, the central bank of Mauritania (BCM) issued a new regulation introducing the monetary operations needed to operate an interest rate corridor system. In 2018, the central bank initiated the reform of its collateral framework and introduced a new emergency liquidity assistance (ELA) regulation. The authorities also reformed the central bank law in July 2018 and modernized its governance structures. A new agreement between the central bank and the government on the consolidation of legacy government debt was ratified by parliament in January 2019. In December 2019, the BCM relaxed some of the constraints on FX market activity by allowing the netting of bank client transactions, and in November 2022, it phased out the surrender requirement of receipts from fishing exports of Mauritanian Corporation for Fisch Marketing (SCMP) to accounts at the central bank.

5. Critical remaining steps include: the effective implementation of a narrower interest rate corridor system and deepening of key markets—i.e., the interbank money, FX and government securities' markets—to strengthen monetary policy implementation and transmission, and allow the switch to an alternative monetary policy anchor. The short-term focus could be on (1) gradually narrowing the interest rate corridor, (2) managing liquidity more actively, (3) addressing the constraints on the deepening of the interbank money market, (4) developing the government securities' market, (5) reforming the collateral framework, (6) developing a Forecasting and Policy Analysis System (FPAS) and the central bank's communication, and (7) accelerating the reforms needed to create and gradually deepen the interbank FX market and support the move to greater flexibility.

B. Motivations for Greater Exchange Rate Flexibility

6. Mauritania is a small economy exposed to terms-of-trade shocks. External vulnerabilities are elevated due to limited economic diversification, and a dependence on a few exporting sectors. The economy was hit by two major shocks since 2014: (1) the 2014–15 drop in commodity prices, including Mauritania's main export commodities—iron ore, gold, and copper ore, and (2) the COVID-19 shock. The 2014–15 terms-of-trade shock halved exports, widened the fiscal deficit, and put pressure on international reserves.

Figure 1. Flexible Exchange Rate—Cost/Benefit Analysis



Source: the author.

Growth slowed to 1.3 percent in 2016 compared to 4.3 percent in 2014. The contraction in extractive sectors spilled over the whole economy as non-extractive growth also fell to 1.6 percent in 2016. After a short-lived recovery in 2017–18, the COVID-19 pandemic led to the deepest economic contraction since 2007 (Figure 2.1).

7. Exogenous shocks exacerbate macroeconomic and financial volatility. Under a tightly managed exchange rate, positive external shocks translate into positive liquidity shocks—in the absence of offsetting liquidity management by the central bank—and aggregate demand shock, leading to an overheating of the economy. Conversely negative external shocks generally induce an economic contraction. When not offset by the central bank monetary operations, volatile liquidity conditions lead to credit boom-and-busts and encourage the buildup of precautionary reserves that prevent the development of the interbank market and smooth implementation of an interest rate-based monetary policy.

8. In Mauritania, economic growth has been more volatile than other North African neighbors, including Morocco which maintained an exchange rate anchor according to the Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER 2020), and Algeria which is also highly dependent on hydrocarbon exports (Figures 3 and 4). Growth volatility makes investment decisions harder as sales are less predictable. It also generates larger swings in public revenues leading to fluctuations in the fiscal balance that required, at times, significant fiscal adjustments and flexibility. Domestic liquidity conditions have also fluctuated with external developments, thereby amplifying their impact on economic activity.

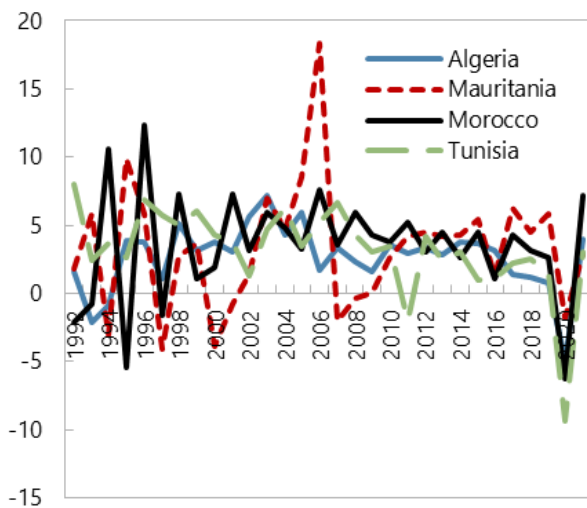
9. The policy aimed at stabilizing the exchange rate has been procyclical. During the 2014–15 commodity price shock, the BCM engaged in unsterilized FX interventions aimed at countering pressure on the exchange rate, which led to tighter liquidity conditions, higher real interest rates, and a credit slowdown in 2016–17. In addition, financial stability risks heightened as liquidity tightened and non-performing loans (NPLs) rose significantly. The authorities responded to the terms-of-trade shock with significant fiscal policy adjustment. They achieved a notable fiscal consolidation of 3 percent of GDP in 2016, while the BCM allowed a gradual exchange rate depreciation against the U.S. dollar and stopped direct FX sales outside the official market (IMF, 2017).

10. The tightly managed exchange rate amplifies the swings in international and bank reserves. Constraining the moves of the exchange rate usually results in positive liquidity shocks in times of FX reserve accumulation. This is precisely what happened in Mauritania during the 2010–11 positive terms-of-trade shock as well as more recently in 2021 with the buildup of FX reserves and artisanal gold purchases by the BCM. The rapid accumulation of net foreign assets (NFA) by the BCM would have called for large-scale sterilization operations in 2010–11. However, because its financial resources were constrained, the BCM was unable to cover the costs of the needed

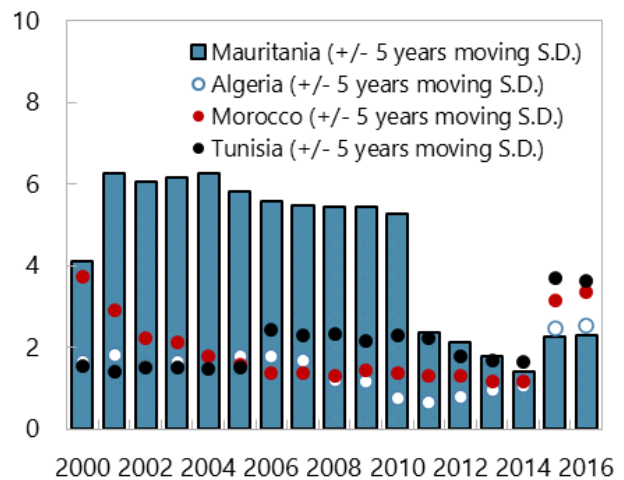
liquidity absorption operations and therefore refrained from undertaking them (Blotevogel, 2013).² Conversely, adverse exogenous shocks result in negative liquidity shocks as experienced during the 2014–15 and the COVID-19 shocks.

Figure 2. Real GDP Growth—Comparison to Peers

Real GDP Growth (1992-2020)



Real GDP Growth Volatility



Note: real GDP growth are estimates for all countries after 2020; S.D.=Standard Deviation.

Sources: World Economic Outlook (WEO) database and author's calculations.

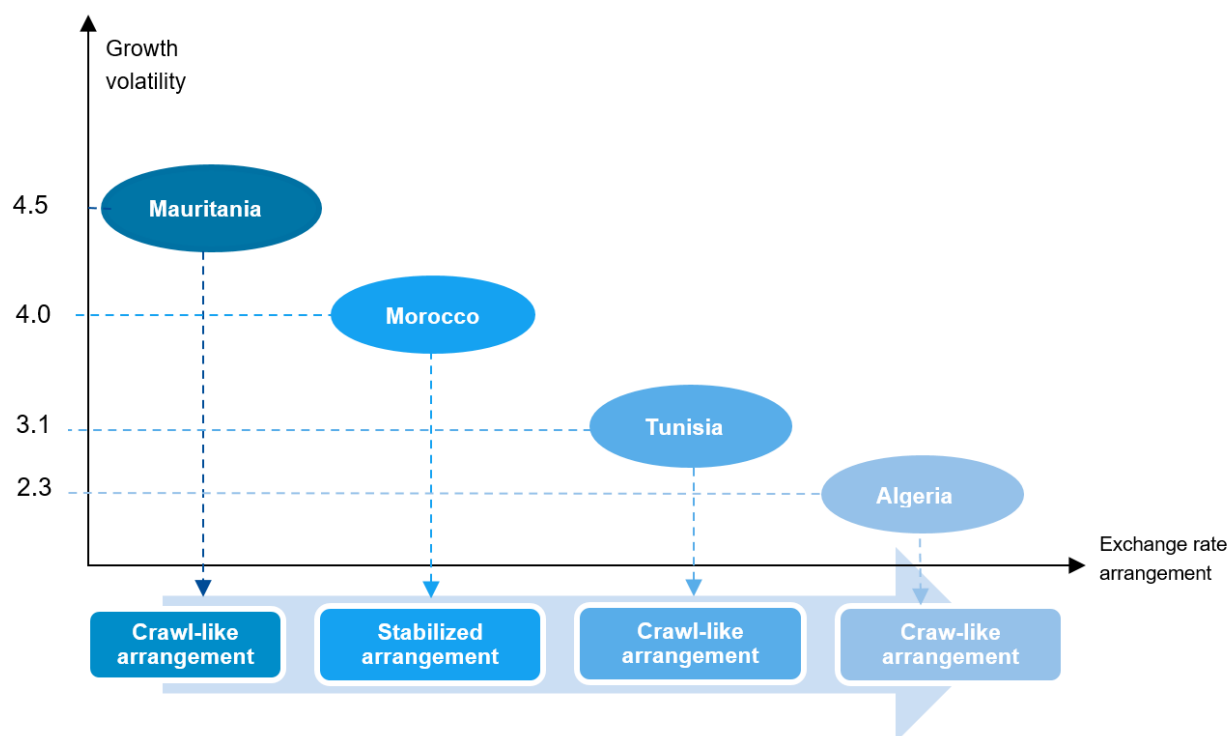
11. The current account deficit is volatile and sometimes sizeable. Over the 2010–20 period, the current account deficit has fluctuated between 3.8 percent of GDP in 2011 and 22.2 percent of GDP in 2014 with an average of 13 percent of GDP. The current account deficit widened substantially after the Arab Uprisings and the 2014–15 commodity price shock. It recovered in 2017–19, helped by fiscal consolidation and controlled exchange rate depreciation (Figures 5.2). In 2019, the current account deficit narrowed on the back of favorable terms-of-trade. Yet, Mauritania's current account deficit remains one of the largest in the middle east and central Asia region as it is inflated by externally financed imports of capital good of extractive industries.³ When excluding these imports, the deficit stood at 3.8 percent of GDP in 2019, with a surplus of

² One of the BCM's biggest assets is a non-tradable claim on the government, carrying below-market interest rates. Since the claim generates little revenue and cannot be traded with banks, it cannot be used in liquidity-absorbing operations (Blotevogel 2013). The BCM law foresees coverage of central bank losses by tradable government securities.

³ Foreign company imports needed to expand their oil-related activities financed by foreign direct investment (FDI) increase the current account deficit but should not drive the exchange rate away from the level suggested by the fundamentals. Hence, the current account deficit used to assess the exchange rate misalignment is adjusted by externally financed capital imports of extractive industries.

2.2 percent of GDP achieved in 2020 due to favorable commodity export markets for iron ore and gold, and lower public spending and oil import prices. The current account balance, however, deteriorated starting 2021 on the back of a resumption of public spending and deterioration of the terms-of-trade with the decrease in iron ore prices and increase in food and oil prices.

Figure 3. Exchange Rate Arrangement and Economic Volatility—Maghreb Countries



Note: volatility is estimated by the standard-deviation over the period 1992-2020.

Sources: AREAER 2020, and the author's calculations.

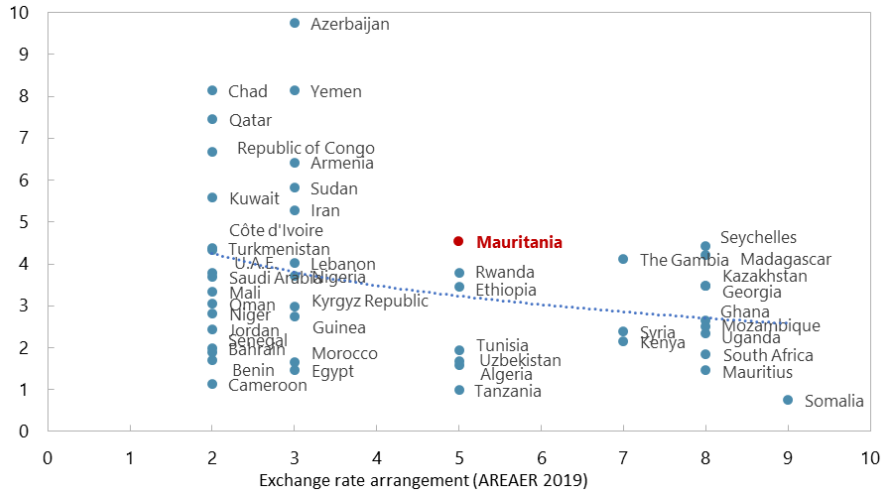
12. International reserves remained adequate until 2021 but are expected to fall around the adequacy threshold due to the negative external shock. According to the latest external sector assessment (2021), the adequate level of reserves was 5.2 months of non-extractive sector imports, assuming a fixed exchange rate. At end 2021, international reserves stood at 7.3 months of prospective non-extractive imports, still above the adequacy threshold. However, due to the surge in international food and oil prices and decrease in iron ore price, the current account deficit is expected to widen to 17.3 percent of GDP at end-2002, thus increasing downward pressures on reserves.

13. Despite adequate FX reserves, the official FX market has been structurally short in FX until 2021. Since the market's establishment in 2007, unmet FX demand—mostly from importers—has been a persistent feature of the market, and the BCM the main supplier of FX. Historically, the BCM captured a large share of FX inflows outside the official market: an important share of export revenues, especially those of mining companies is drained through repatriations. In addition,

before 2022, FX reserves accumulation by the BCM as result of the IMF-supported program and other FX borrowing was not fully channeled to the market. Despite the shortage of FX, the premium between the parallel and official market rate has been generally low (Figures 6).

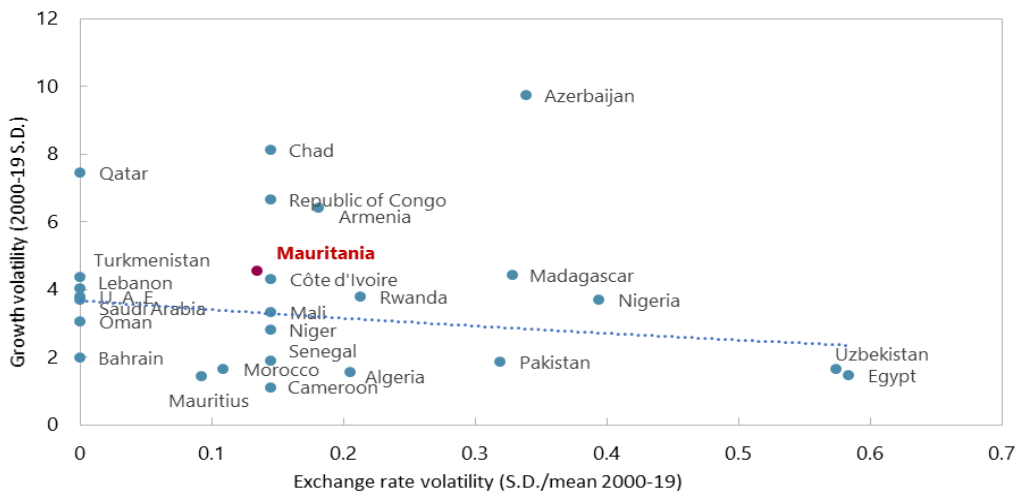
Figure 4. Exchange Rate Regime and Economic Volatility—Selected AFR and MCD Countries

Exchange Rate Arrangement and Growth Volatility

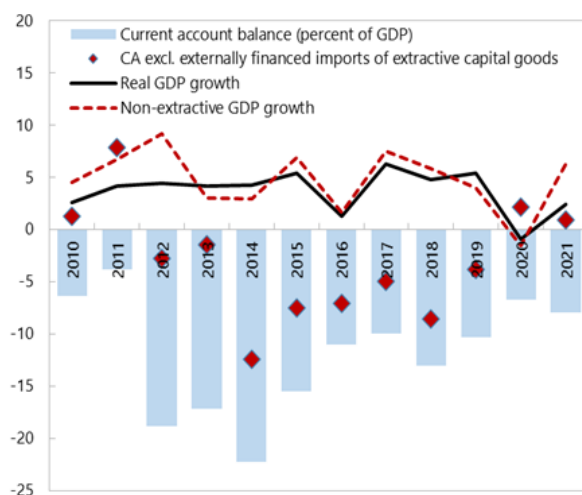
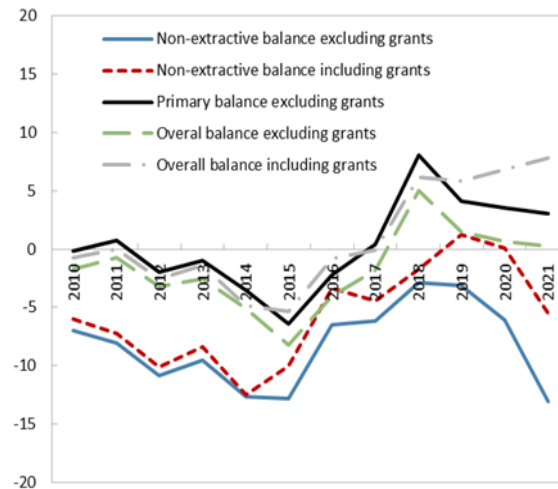


Note: Horizontal axis: 0=no separate legal tender; 1=currency board; 2=conventional peg; 3=stabilized arrangement; 4=crawling peg; 5=crawl-like arrangement; 6=pegged exchange rate within horizontal bands; 7=other managed arrangement; 8=floating; 9=free floating.

Exchange Rate Volatility and Growth Volatility



Sources: WEO database, International Financial Statistics (IFS), and author's calculations.

Figure 5. Current Account and Fiscal Balances (2010-21)**Current Account Balance and GDP Growth****Mauritania Fiscal Balance**

Sources: Mauritanian authorities and IMF staff calculations.

14. In 2022, the BCM changed its rationing policy by increasing its FX interventions to cover current account transactions. This resulted in a decrease of excess reserves from MRU11.3 billion at end-2021 to MRU2.2 billion in September 2022, still above the level of banks' reserve requirements (MRU5.3 billion). With the BCM new intervention strategy, the premium between the parallel and official market rate narrowed in 2022 (Figure 6).

15. Between 2010 and mid-2020, the exchange rate has been anchored on the U.S. dollar, on a broadly depreciating trend. The depreciation accelerated between mid-2014 and mid-2016 to about 18 percent and slowed in 2016–18 and 2021 where the exchange rate has been broadly stabilized. In July 2022, the depreciation accelerated somewhat. The bilateral exchange rate against the Euro has strictly followed the Eurodollar developments and has not been targeted by the central bank. At the onset of the 2014–15 commodity price shock, the nominal and real effective exchange rates (NEER and REER) significantly appreciated until early 2015, before reverting their appreciation trend in April 2015 and subsequently stabilizing. In 2016–17, the effective exchange rates depreciated but started appreciating again in 2018 due to the strengthening of the U.S. dollar. The REER stabilized in 2019, before slightly appreciating through mid-2020.

16. The rigid exchange rate arrangement exacerbated pressures on international reserves.⁴ If the negative terms-of-trade shock is more persistent than expected, the risk of a disorderly exchange rate adjustment with adverse consequences on the monetary and financial stability can also increase. Although the premium between the official and parallel market exchange rate is usually low, it may increase if the exchange rate is persistently misaligned.

17. A more flexible exchange rate would reduce the economy's vulnerability to external shocks and preserve international reserves. Countries that are heavily reliant on a single commodity or a group of commodities need more exchange rate flexibility to respond to changes in world commodity prices and to mitigate their spillovers into other sectors (Husain, 2006). Diversified economies are less exposed to terms-of-trade shocks and thus less vulnerable to sizeable exchange rate movements usually needed to facilitate adjustment to these shocks (Eichengreen and others, 1998). Allowing the exchange rate to absorb terms-of-trade shocks reduces the need for significant fiscal adjustments as exchange rate flexibility plays a counter-cyclical role; a negative external shock would depreciate the exchange rate, encouraging exports while constraining imports, thereby dampening the initial impact of the shock and its contractionary effect on banking system liquidity, credit, and absorption. The depreciation is not expected to lead to higher inflation if an effective alternative nominal anchor is in place.

C. Exchange Rate Passthrough and Monetary Transmission

18. The exchange rate passthrough to inflation limits the scope for sizeable exchange rate fluctuations. To assess the magnitude of the exchange rate passthrough in Mauritania, we build on Burstein and Gopinath (2014) and estimate the following regression using monthly data over the period 2014M1-2020M12:

$$\Delta cpi_t = \alpha + \sum_{k=0}^T \beta_k \Delta er_{t-k} + \Gamma \cdot \mathbf{X}_t + \varepsilon_t \quad (1)$$

where cpi_t is the log of CPI, er_t is the log of ouguiya per U.S. dollar exchange rate, and \mathbf{X}_t a vector of control variables including broad money, and oil, iron ore, and gold prices. β_0 measures the instantaneous passthrough, and $B = \sum_{k=0}^T \beta_k$ the long-term passthrough (with T typically set at 2 years as suggested in Burstein and Gopinath, 2014). We found that the instantaneous pass-through is not statistically significant, but that the long-run pass-through is rather strong (0.46).

19. Muted monetary transmission could lead to inflationary pressures in case of significant exchange rate adjustment. Blotevogel (2013) found no evidence of a statistically significant impact of exogenous monetary policy shocks on bank lending. Banks' concentrated loan portfolios and restricted BCM refinancing—due to the limited available collateral—were identified by the author as key constraints on effective monetary policy implementation and transmission. Banks only lend to a narrow range of customers (related parties, state-owned enterprises, and civil

⁴ According to the AREAER 2020, Mauritania's exchange rate regime is a crawl-like arrangement, a category classified under "soft pegs" by the AREAER.

servants). In addition, since most banks cannot easily access the BCM standard liquidity injection operations to meet unexpected demand on their own liquidity, they tend to build liquidity buffers for precautionary reasons.

20. The empirical evidence shows no reaction of inflation to the BCM’s policy rate. To assess monetary transmission in Mauritania, we estimate a vector autoregression (VAR) model over 2008Q1–2020Q2, broadly following the methodology used by Christiano and others (2005) for the ordering of the variables. The variables included in the VAR are the Index of Industrial Production (IPI), Inflation (INFLATION), the BCM’s policy rate (POLICY_RATE), and broad money (BM). We use the IPI as a proxy of economic activity in the absence of a quarterly GDP. We also include oil, iron ore and gold prices as exogeneous variables. The generated impulse-response functions with a Cholesky decomposition are presented in Figure 7. We found no significant reaction of either inflation or the IPI to a policy rate shock. These results are consistent with those of Blotevogel (2013) who also found no evidence of monetary transmission in Mauritania. The variance decomposition of inflation shows that in the short-run (fourth quarter): (1) 75 percent of inflation variance is explained by its own shock, (2) shocks to economic activity can cause 19 percent of fluctuation in inflation, (3) shocks to broad money growth explain 5.8 percent of inflation variance, and (4) the policy rate plays almost no role in explaining inflation fluctuations (Figure 8). On the other hand, the variance decomposition of economic activity suggests no role of broad money and a limited role of the policy rate in explaining fluctuations in economic activity (Figure 9), an expected result considering the scarcity of policy rate adjustments and a lack of an active liquidity management.

21. Monetary transmission from the BCM’s policy rate to bank retail rates is however somewhat effective. To assess the passthrough from the policy rate to bank deposit and lending rates in Mauritania, we estimate the following regressions over the period 2014M1-2021M2:

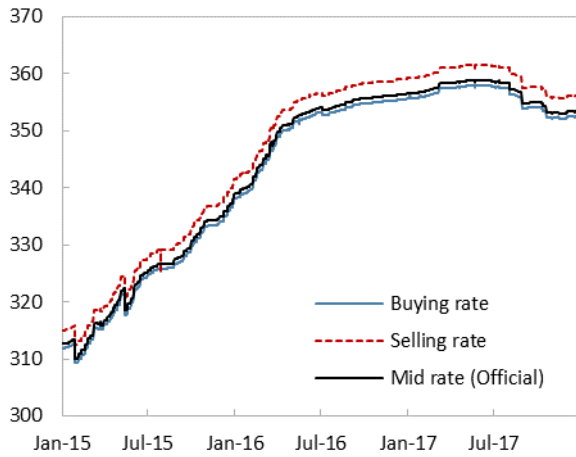
$$\Delta deposit_rate_t = \alpha + \sum_{k=0}^K \beta_k \Delta policy_rate_{t-k} + \Gamma \cdot X_t + \varepsilon_t \quad (2)$$

$$\Delta lending_rate_t = \alpha + \sum_{k=0}^K \beta_k \Delta policy_rate_{t-k} + \Gamma \cdot X_t + \varepsilon_t \quad (3)$$

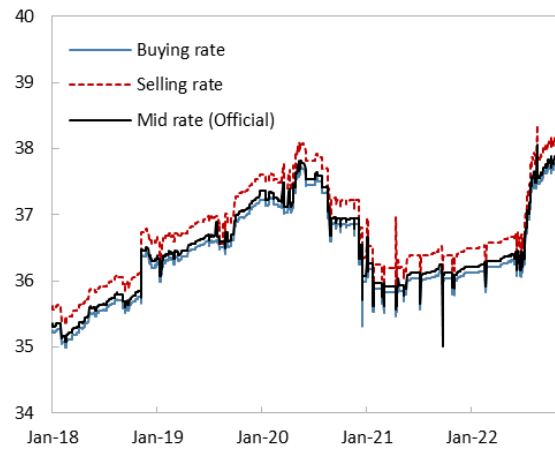
Where X_t is a vector of control variables including broad money growth, the NEER, and gold, iron ore, and oil prices. We found that β_4 is statistically significant in equation (3) where the change in the average lending rate is the dependent variable. In addition, in equation (2) where the dependent variable is the change in the average deposit rate, β_6 and β_7 are also statistically significant, suggesting some transmission from the BCM’s policy rate to bank retail rates (Table 1 and 2).

Figure 6. Official and Parallel Market Daily Exchange Rates Against the US Dollar

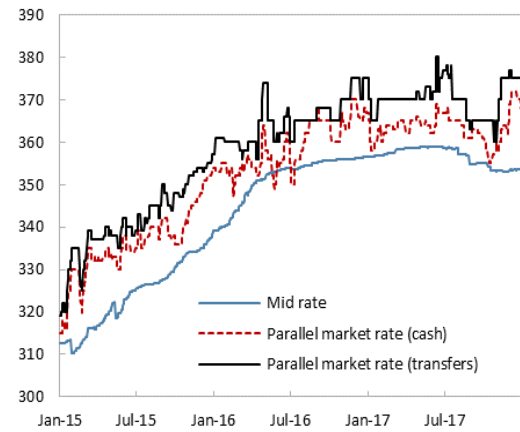
Official Market Rates 2015–17



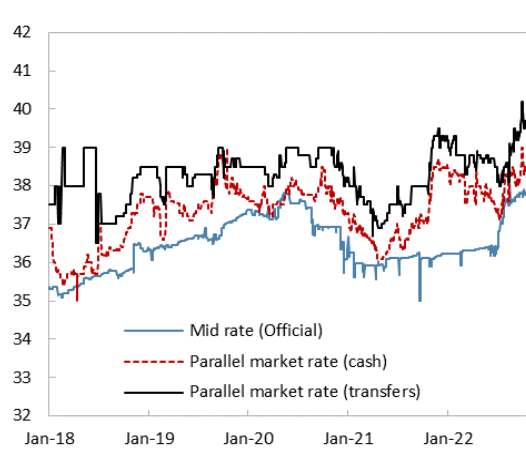
Official Market Rates 2018–22



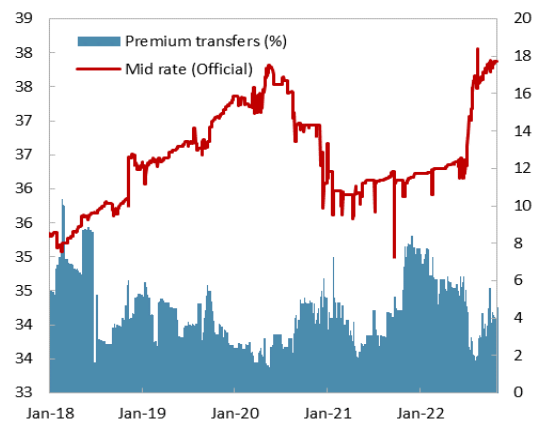
Parallel Market Rates 2015–17



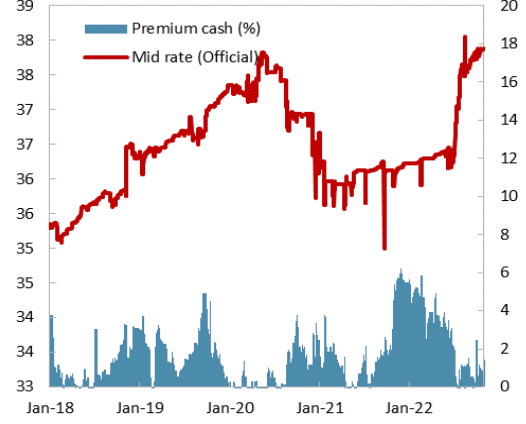
Parallel Market Rates 2018–22



Parallel Market Premium (transfers) 2018–22



Parallel Market Premium (cash) 2018–22



Sources: Mauritanian authorities and IMF staff calculations.

Figure 7. VAR Impulse Responses

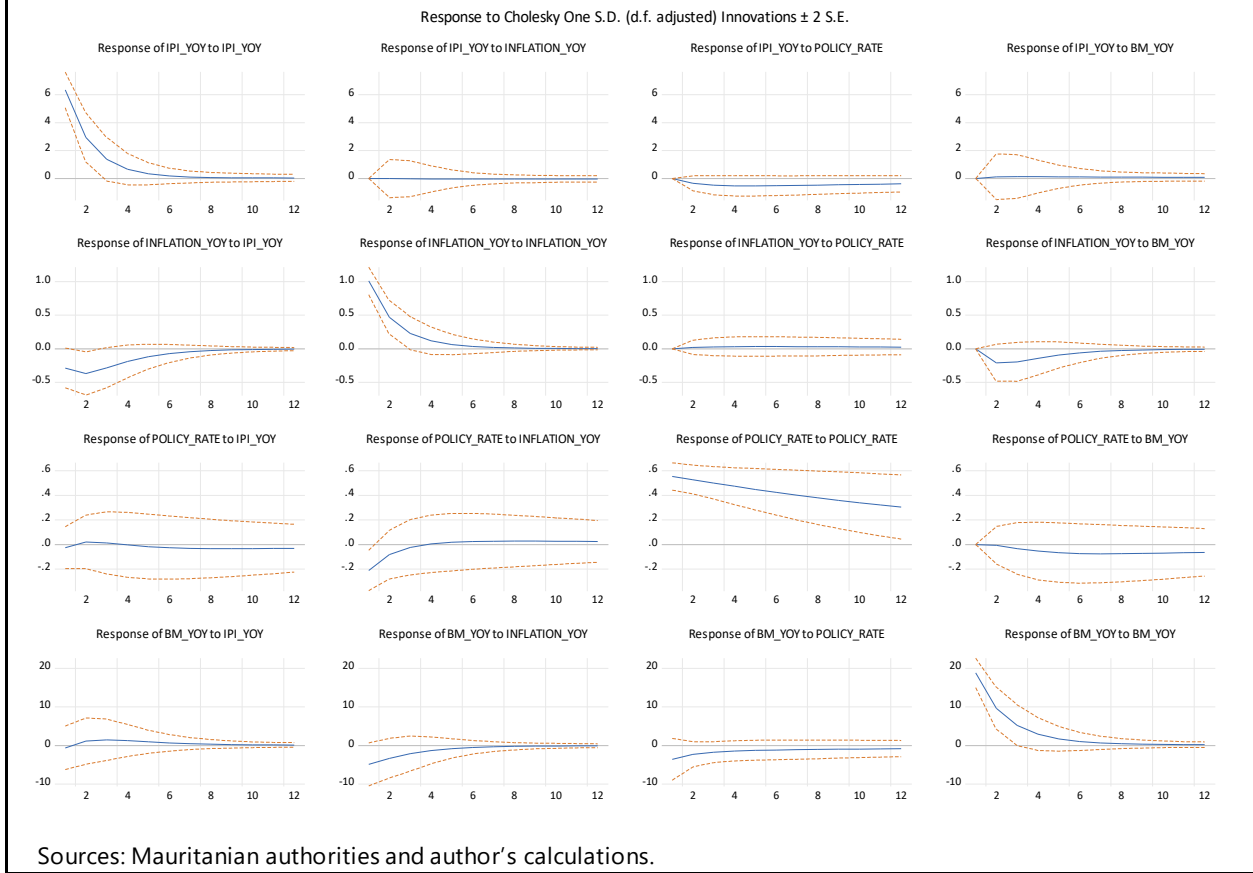


Figure 8. Variance Decomposition of Inflation

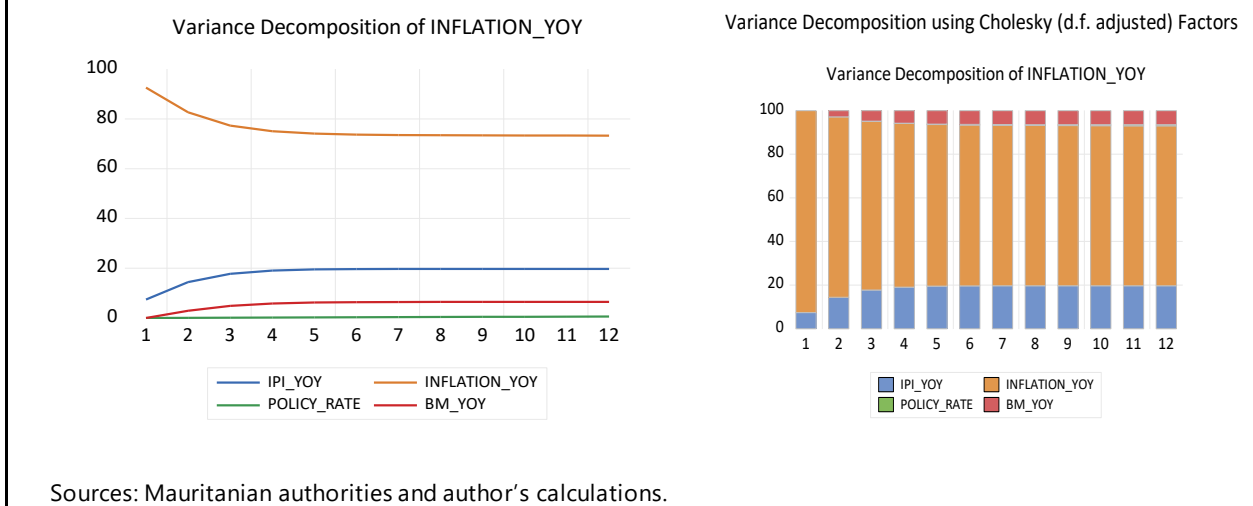
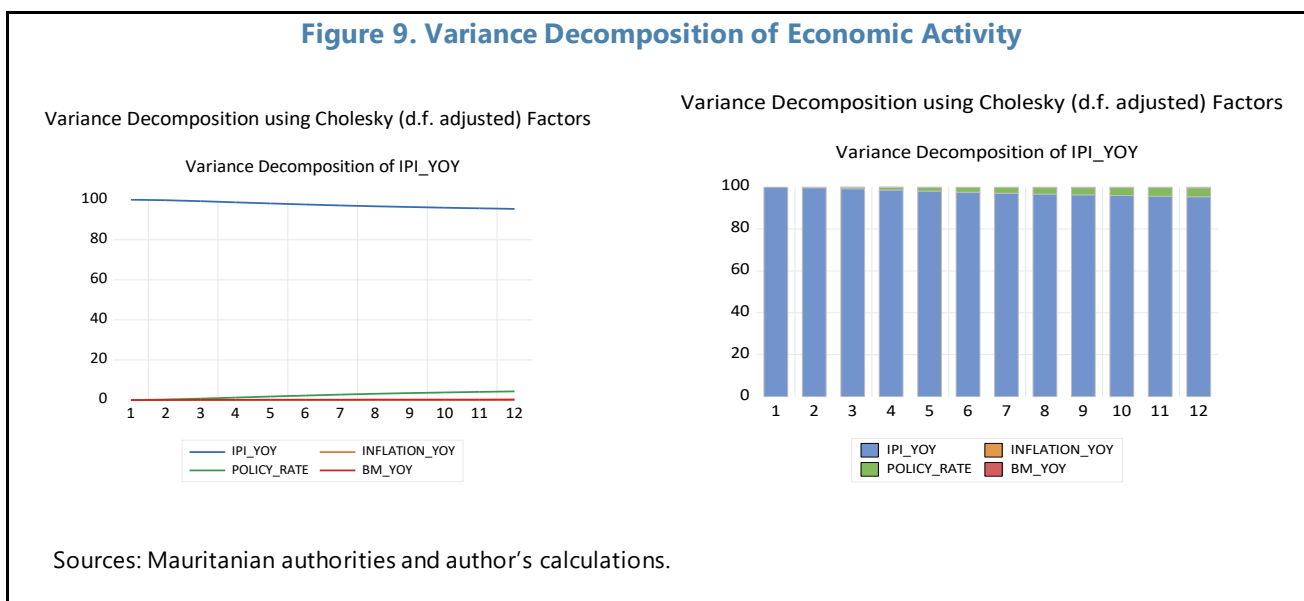


Figure 9. Variance Decomposition of Economic Activity

22. The balance sheet effect limits the scope for large exchange rate movements. The balance sheet effect of a large depreciation can impact banks' capital ratios and raise solvency concerns. In Mauritania, short FX NOPs have been large since 2018, and further widened since end-2019 and more recently with increasing prices of imported food and energy. In the absence of alternative investment options, banks' most profitable activity in Mauritania is import financing through letters of credit. In the past, banks used to hold large amounts of government securities, but the significant drop in yields caused many banks to reduce, or even eliminate, their holdings.⁵ Sizeable short FX NOPs can pose risks to the stability of the financial sector in the case of significant exchange rate depreciation. Strengthening the Monetary Policy Framework to Mitigate Inflation Risks

23. The BCM is not a conventional monetary targeter. Under a conventional monetary targeting framework, monetary policy implementation relies on the central bank's control over reserve money, with its evolution signaling when and why to intervene to attain reserve and broad money targets (Laurens and others, 2015). However, this is not exactly the way monetary policy operates in Mauritania; monetary operations are not conducted with the objective of keeping bank reserves consistent with periodic (i.e., quarterly, monthly) targets of reserve and broad money that achieve stable inflation (price stability objective). ;*De facto* the BCM limits exchange rate fluctuations within a narrow band (2 percent) to contain inflation pressures. In addition, it recently started using its policy rate as an additional instrument to tighten monetary policy, increasing it by 200 basis points in August 2022.

⁵ Islamic Republic of Mauritania—Financial System Stability Assessment—Stability Module, January 2015.

Table 1. Mauritania: Passthrough from the Policy Rate to Bank Deposit Rate—Regression Results

	Change in average deposit rate (DDEPOSIT_RATE)
<i>Change in the policy rate at t-6 (DPOLICY_RATE(-6))</i>	-0.095683** (0.041511)
<i>Change in the policy rate at t-7 (DPOLICY_RATE(-7))</i>	-0.216962* (0.043135)
<i>Change in broad money growth at t-1 (DBM_YOY)</i>	-0.014721** (0.005881)
<i>Change in NEER at t-3 (DNEER(-3))</i>	-0.045324** (0.014433)
<i>Change in NEER at t-4 (DNEER(-4))</i>	0.046946* (0.015414)
<i>Change in NEER at t-5 (DNEER(-5))</i>	-0.047704* (0.014337)
<i>Change in NEER at t-6 (DNEER(-6))</i>	0.030858** (0.014329)
<i>Change in NEER at t-6 (DNEER(-10))</i>	-0.058496* (0.014626)
<i>Change in gold price at t-4 (DGOLDP(-4))</i>	-0.000646*** (0.000329)
<i>Change in iron ore price at t-4 (DIRONOREP(-4))</i>	-0.005824* (0.002072)
<i>Change in iron ore price at t-11 (DIRONOREP(-11))</i>	-0.004011** (0.001941)
R-squared	0.549730
Adjusted R-squared	0.478259

Sources: Mauritanian authorities and author's calculations.

Note: Dependent variable: change in average deposit rate. Standard errors in parentheses. * $p < 0.01$; ** $p < 0.05$; *** $p < 0.1$.

Table 2. Mauritania: Passthrough from the Policy Rate to Bank Lending Rate—Regression Results

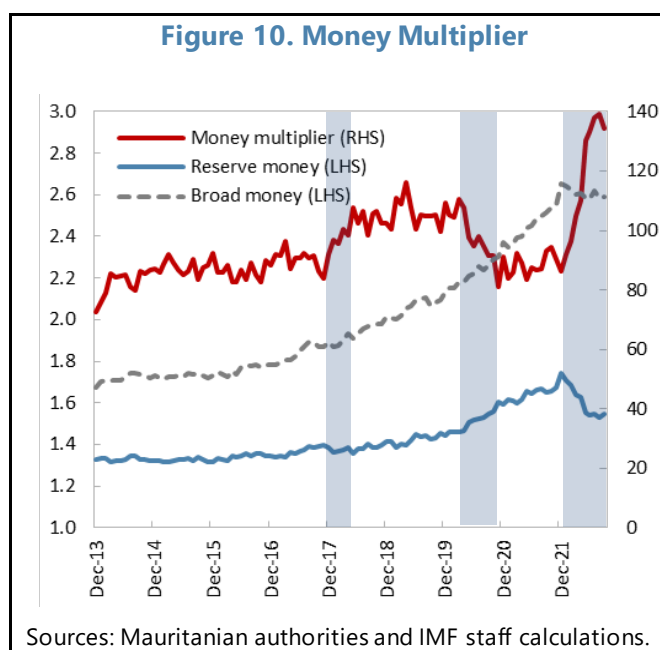
	Change in average lending rate (DLENDING_RATE)
Change in the policy rate at t-4 (DPOLICY_RATE(-4))	0.144375* (0.048164)
Change in NEER at t-1 (DNEER(-1))	-0.047343* (0.015422)
Change in NEER at t-10 (DNEER(-10))	0.036112** (0.016357)
Change in oil price at t-5 (DOILP(-5))	0.009494* (0.002691)
Change in gold price D(GOLDP)	0.000817** (0.000374)
R-squared	0.292115
Adjusted R-squared	0.251664

Sources: Mauritanian authorities and author's calculations.

Note: Dependent variable: change in average lending rate. Standard errors in parentheses. * $p < 0.01$; ** $p < 0.05$; *** $p < 0.1$.

24. Mandatory use of bank accounts in 2018 and more recent gold purchases by the central bank and start of mobile banking led to structural breaks in the money multiplier.

The 2018 reduction in reserve money growth and simultaneous acceleration of broad money, induced an increase in the money multiplier in 2018 (Figures 10). The shift in the money multiplier coincided with the change in the currency and its redenomination at a rate of 1:10 in January 2018. The sharp rise in broad money growth was due to influx of demand deposits into the banking system owing to the mandatory use of bank accounts for exchanging large amounts of old currency into the new one.⁶ The decrease of reserve money growth was mostly driven by the slowdown of the



⁶ IMF (2018).

currency in circulation (CIC) in end-2017/early-2018. Other structural breaks in the money multiplier occurred in 2020 and 2022 as reserve money started growing faster than broad money during the second half of 2020, mainly due to gold purchases by the BCM, while CIC and bank reserves decreased in 2022 with the start of mobile banking activities and increasing FX interventions by the BCM.

25. The overall banking system has been historically in surplus, as assessed by the positive structural liquidity position.⁷ However, liquidity is unevenly distributed across banks and constrained for some of them. Banks do not reallocate excess reserves in local currency; most of them hoard liquidity due to the lack of available collateral (treasury bills) for interbank transactions and the constraint of maintaining excess reserves to access the official FX market. Although positive, the structural liquidity position is volatile; it contracted in early 2020 with the COVID-19 shock, eased in the second half of 2020 with the accumulation of FX reserves, and contracted again in 2022 with increasing FX interventions to accommodate current account transactions.

26. Constrained liquidity management prevented the smooth implementation of monetary policy. The relative stability of the money multiplier before 2018 suggests that a traditional monetary targeting framework could have been envisaged. However, sterilization cost concerns constrained the implementation of a reserve money contraction under a traditional monetary targeting regime. In addition, the dominant share of CIC in reserve money may also limit the magnitude of a reserve money contraction. At the same time, the implementation of a quantitative monetary expansion is constrained by limited government securities in banks' balance sheets and the tightly managed exchange rate.

27. The key ingredients for the conduct of a price-based monetary policy are not fully in place. Monetary operations do not target the objective of steering a short-term interbank rate close to the policy rate. The BCM conducted limited monetary operations to limit both its sterilization cost and liquidity injections that can increase the demand for FX. The policy rate was kept high until 2018 to discourage banks' access to the central bank refinancing operations. The absence of an active liquidity management, and effective implementation of a narrower mid-corridor system is not conducive to interbank market trading. The shallow interbank market is a constraint on the implementation and smooth transmission of an interest-rate based monetary policy. At the same time, the modes of fiscal financing limit the availability of High Quality Liquid Assets (HQLAs) in banks' balance sheets that can be used as collateral for monetary policy implementation and interbank transactions, as well as the development of the sovereign bond market needed to support the formation of a benchmark yield curve and monetary transmission.

28. In the absence of a clear monetary policy framework, inflation expectations may become unanchored. Article 48 of the BCM Law (amended in 2018) points to price stability as the

⁷ The structural liquidity position of the banking system is the sum of bank reserves in local currency at the central (reserve requirements and excess reserves), before any liquidity management operation has been undertaken by the central bank (El Hamiani Khatat, 2018). The structural liquidity position of the banking system has been positive in Mauritania as a result of the past monetary financing and accumulation of FX reserves and purchases of gold by the BCM in 2020-21.

main objective of the BCM.⁸ In order to fulfill its price stability mandate, the BCM designs and implements monetary policy (Article 58 of BCM Law). However, the BCM is neither a monetary targeter nor an inflation targeter. Mauritania’s monetary policy framework is classified under “other” by the AREAER since 2010 (Box 1). This leaves the BCM’s monetary policy framework without a nominal anchor which exposes the Mauritanian economy to the risk of inflation especially in the event of a disorderly exchange rate adjustment.

29. Monetary transmission could strengthen with more active use of standard liquidity management instruments and strengthened monetary policy framework. Active liquidity management provides comfort to banks that they would be able to borrow liquidity from (place liquidity with) the central bank in case of unexpected negative (positive) liquidity shock, which would reduce the incentive of maintaining excess reserves and encourage interbank trading. An active interbank market would allow the existence of a daily benchmark interbank rate and the activation of the first stage of monetary transmission: from the policy rate to the interbank rate. Brandao-Marques and others (2020) found that having a modern monetary policy framework—adopting inflation targeting and having an independent and transparent central bank—matters for monetary transmission, possibly more than financial development.

30. Monetary transmission could also be more effective with more active use of the policy rate. El Hamiani Khatat, End, and Kolsi (2020) found evidence for stronger interest rate transmission in Tunisia when the central bank of Tunisia (BCT) started using its policy rate more actively. The transmission from the policy rate to bank retail rates is effective in Tunisia, as an important share of bank credit and deposit rates are indexed on the interbank rate. The level of financial development in Tunisia does not appear to be a constraint to the implementation of an interest rate based monetary policy, as monetary transmission works through the banking sector that is sufficiently developed although financial markets are still shallow. Nonetheless, a daily money market reference rate (the TMM) that the BCT uses as operational target already exists in Tunisia.

Box 1. Definitions of Monetary Policy Frameworks

The IMF AREAER defines three monetary policy frameworks with a clearly identified nominal anchor: (1) Exchange Rate Anchor; (2) Monetary Aggregate Target; and (3) Inflation Targeting Framework (IMF, 2020). Countries that have no explicitly stated nominal anchor but rather monitor various indicators in conducting monetary policy are classified under “other” by the AREAER.

Under an Exchange Rate Anchor, the monetary authority buys or sells FX to maintain the exchange rate at its predetermined level or within a range. The exchange rate thus serves as the nominal anchor or intermediate target of monetary policy. These frameworks are associated with exchange rate arrangements with no separate legal tender, currency board arrangements, pegs (or stabilized arrangements) with or without bands, crawling pegs (or crawl-like arrangements), and other managed arrangements.

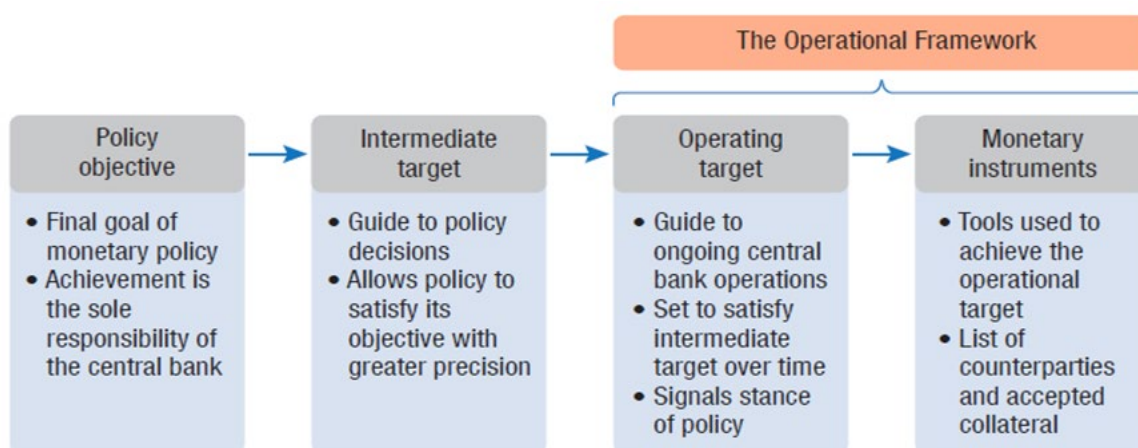
⁸ In addition, without prejudice to the objective of price stability, the BCM pursues the stability of the financial system and contributes to the implementation of the general economic policies defined by the Government.

Box 1. Definitions of Monetary Policy Frameworks (concluded)

Under a Monetary Aggregate Targeting regime, the monetary authority uses its instruments to achieve a target growth rate for a monetary aggregate, such as reserve money, M1, or M2; the targeted aggregate becomes the nominal anchor or intermediate target of monetary policy.

Inflation Targeting involves the public announcement of numerical targets for inflation, with an institutional commitment by the monetary authority to achieve these targets, typically over a medium-term horizon. Additional key features normally include increased communication with the public and the markets about the plans and objectives of monetary policymakers and increased accountability of the central bank for achieving its inflation objectives. Monetary policy decisions are often guided by the deviation of forecasts of future inflation from the announced inflation target, with the inflation forecast acting (implicitly or explicitly) as the intermediate target of monetary policy (Box 1. figure 1).

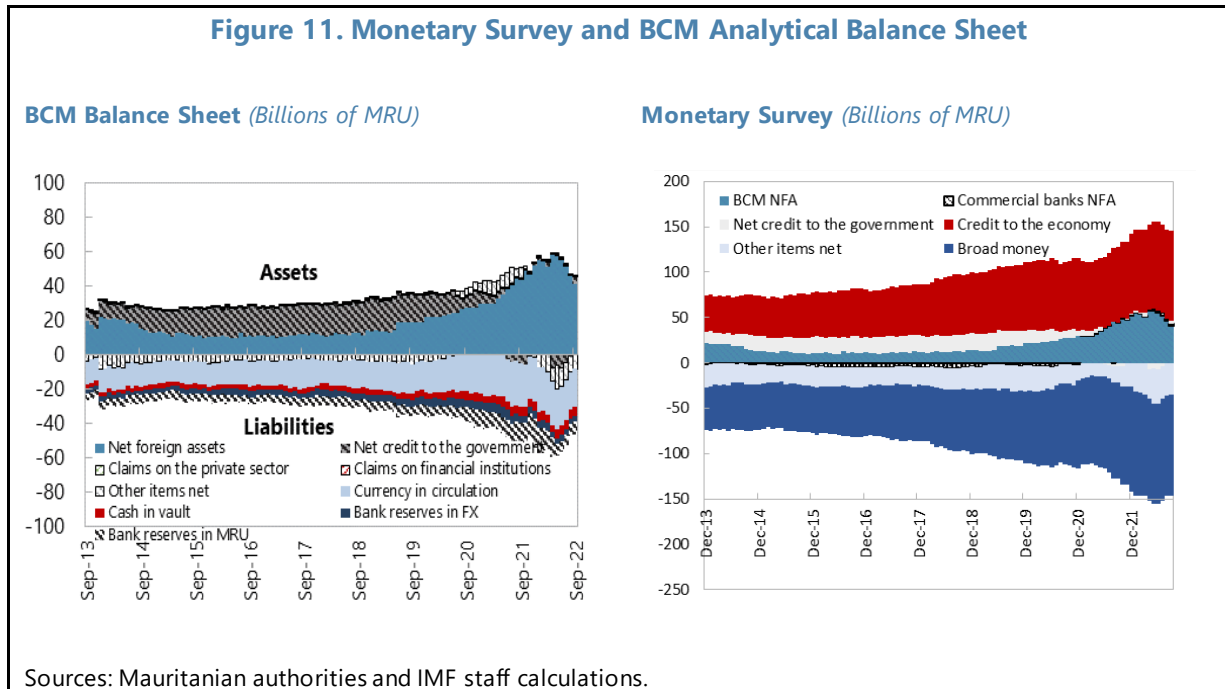
Monetary Policy Frameworks—The Building Blocks



Sources: AREAER, and Adrian and others (2018).

D. Supporting Macroeconomic Conditions

31. The literature identifies the macroeconomic, financial, and institutional conditions supporting the move to greater exchange rate flexibility. Key macroeconomic conditions include a balanced current account, absence of significant exchange rate misalignment, as well as monetary and fiscal discipline. From the institutional perspective, key monetary and financial building blocks include: (1) developing a deep and liquid FX market, (2) formulating an intervention strategy consistent with the new exchange rate regime, (3) establishing an alternative nominal anchor in the context of a new monetary policy framework and developing supportive markets, and (4) reviewing exchange rate exposures and building the capacity of market participants to manage exchange rate risks and of the supervisory authorities to regulate and monitor them (Ötoker-Robe and others, 2007).

Figure 11. Monetary Survey and BCM Analytical Balance Sheet

32. There are two important elements to consider when initiating the transition to greater exchange rate flexibility: (1) the macroeconomic conditions, and (2) institutional capacity to operate under a flexible arrangement. From the macroeconomic perspective, Mauritania would be better off with a more flexible exchange rate as it will reduce the economy's vulnerability to external shocks, preserve international reserves, support competitiveness, and dampen macroeconomic and financial volatility. Although Mauritania has a relatively closed capital account, it is prone to sizeable current account shocks with potentially destabilizing effects on its internal balance. In addition, low, and stable inflation can be achieved with an alternative monetary policy framework, and a flexible exchange rate arrangement doesn't imply higher inflation when fiscal dominance is curtailed and the monetary policy framework strong.

33. Institutional capacity is still to develop to support the move to an alternative nominal anchor. Credibly committing to low inflation policies can be challenging in the absence of a strong institutional track record, sound liquidity management, modeling and forecasting capabilities, and a stable financial system supporting monetary policy implementation and transmission. Therefore, Mauritania—like many other countries—may consider institutional rather than macroeconomic criteria in its choice of an exchange rate arrangement. Countries may adopt pegs or tightly managed exchange rates even when many of the macroeconomic criteria fail to apply, and when they choose to borrow the monetary policy credibility of another country or when the institutional capacity to implement flexible exchange rate regimes is still to develop (Levy-Yeyati and Struzenegger, 2010; and El Hamiani Khatat and Veyrone, 2019).

34. A balanced current account, adequate FX reserve buffers, and absence of significant exchange rate misalignment can help achieve an orderly transition. The state of the FX market usually reflects the broader macro-financial conditions, and conditions where the central bank accumulates FX reserves by buying FX from market participants on a well-functioning official FX

market are reflective of lower depreciation pressures and thus more supportive to the introduction of fully competitive FX auctions. Conversely, depleted international reserves, a sizeable current account deficit, and excess demand for FX are usually not supportive to the introduction of a multiple price FX auction as market participants may bid at a more depreciated exchange rate than what the central bank is willing to accept.

35. Fiscal policy can help achieve a smooth transition to greater exchange rate flexibility.

Prudent fiscal policy generally contains aggregate demand and imports thereby helping in achieving a more balanced current account. Supportive fiscal and broader macroeconomic policies are expected to reduce potential pressures in the FX market and allow for a smoother transition to greater exchange rate flexibility. In Mauritania, the confinement measures and economic slowdown resulted in a fiscal surplus in 2020 and 2021; fiscal discipline should be preserved considering the need for fiscal space to raise social spending and to evolve to a more flexible exchange rate.

36. The transition to a flexible exchange rate requires an alternative nominal anchor and redesign of the monetary policy framework.

A credible monetary policy framework is essential in stabilizing market expectations and maintaining or regaining credibility during the transition to greater exchange rate flexibility. Many countries that have successfully achieved the transition to floating exchange rates (e.g., Chile and Poland) have favored inflation targeting frameworks over monetary targeting regimes. Inflation targeting, however, requires extensive preparation, with substantial amount of capacity and credibility building, and thus planning ahead for the transition is critical to achieving an orderly exit (Ötoker-Robe and others 2007).

37. The effective implementation of a narrower interest rate mid-corridor system is key in supporting a smooth transition.⁹

The BCM has introduced in 2017 all the necessary instruments needed to operate a mid-corridor system—i.e., 7-day main refinancing operations and BCM deposit auctions and bills, overnight standing lending and deposit facilities, fine-tuning and long-term operations, as well as reserve requirements. However, as mentioned earlier, these tools are not actively used due to the sterilization cost and lack of monetary policy collateral. The two most common ways for banks' short-term refinancing are the interbank market and central bank refinancing. In Mauritania, both are constrained which creates incentives for banks to accumulate excess liquidity (Blotevogel, 2013).

38. Monetary policy design and implementation could be guided by the principles laid down in IMF (2015b) during the transition.

The IMF board paper sets seven principles that characterize effective monetary policy frameworks in Low Income Countries (LICs) and other developing countries with evolving monetary policy frameworks and scope for independent monetary policy.

⁹ Corridors that are too narrow or too wide discourage interbank trading and tend to dampen market and yield curve development, weakening the interest rate channel. A too narrow corridor allows better control over interest rates but can hamper market development as banks have less incentive to engage in interbank transactions. On the other hand, if the cost of accessing the marginal lending facility is too high, banks are encouraged to increase the precautionary reserves in order to avoid this cost, instead of trading (Russian Federation: Selected Issues, IMF Country Report No. 12/218, August 2012).

Box 2. Principles for Evolving Monetary Policy Frameworks

Principle I. The central bank should have a clear mandate in terms of its goals, and operational independence to pursue these goals, within the context of public accountability. The central bank's monetary policy mandate should be set in the law. The central bank should have an effective governance and organizational structure. It should be free from fiscal dominance and political pressures to ensure a clear separation between fiscal and monetary policy, so that monetary policy has the operational space to attain its goals. Given a clear goal, operational independence, and appropriate transparency arrangements, the central bank should be accountable for fulfilling its objectives.

Principle II. Price stability should be the primary or overriding objective of monetary policy over the medium term. The consensus view is that (i) monetary policy is one policy instrument that cannot be expected to deliver on multiple inconsistent objectives, and (ii) monetary policy is ultimately limited in its ability to directly influence real variables in the long-term (such as output growth) and is instead most effective in providing a nominal anchor. Clarifying that price stability is the overriding objective of monetary policy over the medium-term provides a focal point for policy deliberations and helps ensure that policy decisions are consistent with this objective.

Principle III. Consistent with the primacy of price stability, the central bank should have a medium-term inflation objective that serves as the cornerstone for its monetary policy actions and communications. Establishing and maintaining an explicit numerical inflation objective operationalizes the price stability mandate. The numerical inflation objective should be distinct from the near-term inflation forecast. The inflation objective should only be modified rarely, and not due to short-term political pressures or conjunctural circumstances, but rather as part of a systematic and transparent review of the entire monetary policy framework. The central bank should clearly explain to the public how the inflation objective facilitates price stability, thereby bolstering the transparency and credibility of this objective. A transparent and credible inflation objective can in turn help anchor inflation expectations and provide a simple and transparent benchmark against which to measure performance. The focus on the medium-term recognizes that inflation in the short-run is beyond the direct control of the central bank. The inflation objective needs to be both achievable and, over time, achieved to be credible. Therefore, the medium-term horizon should be soon enough to shape current instrument setting and long enough so that inflation can be reasonably expected to converge to its objective under appropriate monetary policy.

Principle IV. In determining the magnitude and pace of monetary policy adjustments warranted by the inflation objective, the central bank should carefully take into account the implications for macroeconomic activity and financial stability. The level and volatility of output, unemployment, and the exchange rate may be important factors that the central bank should consider when determining the course of monetary policy. Consideration may also be given to financial stability issues, including the quantity of credit and asset prices. While it is important to take into account other economic and financial variables, this should not come at the expense of undermining the central role of the medium-term inflation objective for policy formulation. Any significant erosion of the central bank's credibility can unhinge inflationary expectations, with related undesirable effects on real activity and financial stability.

Principle V. The central bank should have a clear and effective operational framework and it should align market conditions with its announced policy stance. It should choose an operating target, with the policy stance being set and announced in terms of a specific level for this target. The operating target should facilitate the communication of the policy stance, and its setting should be clearly linked to the attainment of the medium-term inflation objective. Central bank operations should align market conditions with this announced policy stance. An effectively implemented operational framework supports the functioning of money markets, allowing banks to predictably place surplus liquidity with, and obtain short-term funding from each other or the central bank at rates that are reasonably stable.

Box 2. Principles for Evolving Monetary Policy Frameworks (concluded)

Principle VI. The central bank should have a transparent forward-looking monetary policy strategy that reflects timely and comprehensive assessments of the monetary transmission mechanism. Given the dynamic nature of monetary policy and the lags with which it affects the key economic variables (output, inflation, exchange rate), policy should be formulated in terms of a forward-looking strategy that encompasses: (i) a full assessment of the economic outlook; (ii) a path for policy that is consistent with the inflation objective, while allowing for the macro and financial stability considerations noted above; and (iii) evaluation of future risks and contingency plans in the event of large shocks. The central bank should also assess the extent to which intermediate targets may be useful in formulating and communicating the monetary policy strategy. All available information and analytical tools should be used in devising the policy strategy, including an up-to-date evaluation of the transmission mechanism.

Principle VII. The central bank's communications should be transparent and timely, because clear communication enhances the effectiveness of monetary policy. The focus of communication should be on explaining past outcomes and actions necessary to align expected inflation outcomes with the policy objective, with emphasis on the variables that matter for private sector behavior. Effective communication helps reduce uncertainty, improves monetary policy transmission, and facilitates accountability, thereby building credibility. Clear communication can also help anchor inflation expectations when "words" are confirmed by actions and outcomes ("say what you do and do what you say"). It is also important to explain deviations from targets, and remedial actions.

Source: IMF (2015b).

39. Banks' FX NOPs need to be narrowed to avoid further deterioration of their balance sheets. In Mauritania, short FX NOPs widened to 53.2 percent of bank's capital in March-2022 before narrowing to 38 percent in September 2022, while FX NOPs limits are 20 percent for all currencies and 10 percent per currency, . Short FX NOPs are mostly related to letters of credit but have widened since 2019 following the drop in fishing exports, and even further recently with the increase in global food and energy prices; short FX NOPs can pose risks to financial stability in the case of disorderly exchange rate adjustment. To mitigate the potential risks and increase banks' resilience to exchange rate shocks, the BCM should enforce better compliance with NOP limits. More generally, strengthening banks' balance sheets is crucial to foster market deepening and allow for the implementation of an alternative monetary policy anchor.

E. Sequencing the Move to Greater Exchange Rate Flexibility

40. The experiences of countries that have managed a transition to a flexible exchange rate vary greatly. Some countries that put significant emphasis on preparedness for further exchange rate flexibility chose a cautious and gradual approach while establishing the necessary supportive elements of a flexible exchange rate. In other countries, exits from pegs occurred under market pressure and sizeable external imbalances, and flexible exchange rates were adopted with little preparation. Countries that achieved a gradual and orderly transition to a floating exchange rate include Chile and Poland. Gradual increases in exchange rate flexibility helped the FX market to deepen, contributing to establish one of the key elements supporting greater flexibility. The countries ultimately exited to a free float with explicit inflation target (Ötoker-Robe and others, 2007).

41. The international experience revealed that fiscal dominance threatened countries' capacity to operate under flexible exchange rate arrangements. Direct or indirect monetary financing often generates excess liquidity that put pressure on the exchange rate while at the same time weakening the central financial position and its ability to sterilize the excess at the appropriate level of interest rate. In many countries, fiscal dominance not only accelerated the pace of depreciation and FX reserves' depletion but also weakened monetary policy implementation and transmission and the capacity of the central bank to operate an interest-rate based monetary policy.

42. Mauritania should be able to successfully allow gradual exchange rate flexibility if well-planned and supported by the institutional and macro-financial building blocks: an independent central bank with an alternative monetary policy framework in place, a sound financial sector, a well-planned gradual path toward flexibility, balanced macroeconomic conditions, and supportive fiscal policy.

43. Some emerging market economies and LICs did not achieve a smooth transition due to lack of preparation and supporting institutions and policies. Overvalued exchange rates, distorted FX markets, sizeable parallel market premia, lack of central bank independence and alternative monetary policy framework, expansionary monetary and fiscal policies, fiscal dominance, rapid and unplanned transition under unfavorable macro-financial conditions were often the reasons explaining disorderly transitions.

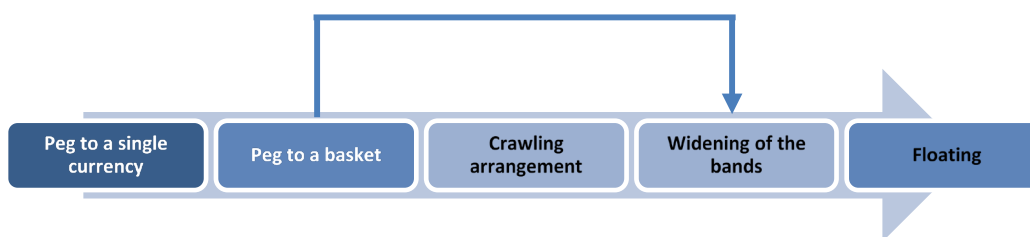
44. Countries that have achieved a successful transition have often implemented a currency basket. This is, for example, the case of Russia and Poland, but also Morocco that engaged in greater exchange rate flexibility starting from a peg to a currency basket. In addition, some countries have opted for a crawling arrangement along the road (e.g., Poland), while others have chosen a gradual widening of the exchange rate bands (e.g., Morocco) (Figure 12). When early transitioning from a peg to a more flexible exchange rate arrangement, transitional arrangements can include moving from a peg to a single currency to a basket in a first phase, and a gradual widening of the exchange rate bands in a second phase (El Hamiani Khatat, Buessing-Loercks, and Fleuriet 2020).

45. At the early stage of the gradual transitions, the interbank FX market was shallow and dominated by the central bank. The central bank's role through its fixing mechanism was gradually reduced as markets developed; fixing formally ended in Poland in 1999. In most cases, market development began only after some exchange rate flexibility was introduced: in Chile, after widening of the band to ± 5 percent; and in Poland, following the adoption of a crawling band with a ± 7.0 percent width. In most cases, the market mechanism began as a direct interbank market and in all cases the FX spot market was the first to develop, followed by derivatives' markets. In Poland, the FX market was developed in conjunction with other financial markets and was supported by the scope for greater exchange rate flexibility.

46. Central banks played a significant role in market development by removing obstacles and creating the necessary infrastructure. They stimulated market development by (1) widening the trading bands; (2) reducing their market role by ceasing to be a single market maker and

ending fixing interventions (Czech Republic, Poland) or by discontinuing narrower inner bands or undeclared target levels (Poland, Uruguay); and (3) removing obstacles to market activity and eliminating limits to market access (Chile), liberalizing the bank-client market (Czech Republic), and encouraging trading through the interbank market (Czech Republic, Uruguay). Central banks also contributed to market development by upgrading infrastructure. Gradually increasing the exchange rate flexibility led to a growing awareness of FX risks and helped the development of derivatives' markets in Chile, the Czech Republic, and Poland (Ötoker-Robe and others, 2007).

Figure 12. Stylized Transitional Exchange Rate Arrangements



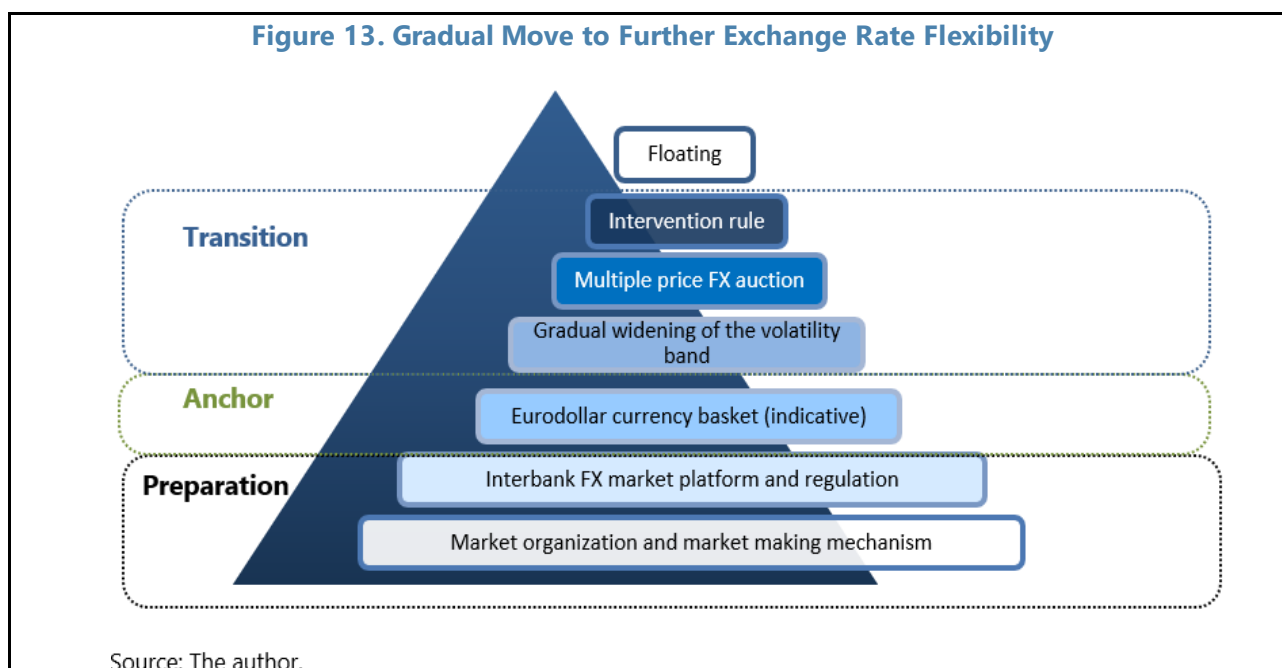
Source: El Hamiani Khatat, Buessing-Loercks, and Fleuriet (2020).

47. The reform of the interbank FX market is critical to supporting the move to greater exchange rate flexibility. The BCM has already initiated the necessary work to strengthen the implementation of its monetary and exchange rate policy. The central bank launched the preparatory work needed to set up the technical platform for interbank FX transactions. Earlier in December 2019, the BCM allowed the netting of bank client transactions, and in November 2022, it phased out the surrender requirement of receipts from fishing exports of SCMP to accounts at the central bank. Remaining reforms to support the transition to greater exchange rate flexibility include allowing interbank FX transactions by adopting the new regulation and establishing the related technical platform, deepening the interbank FX market by allowing fluctuations of the exchange rate within a larger volatility band, moving to fully competitive multiple price FX auctions, designing an intervention rule, and transitioning to a fully market-determined exchange rate.

48. A flexible exchange rate requires sufficiently liquid FX market to support price formation. A well-functioning FX market allows the exchange rate to respond to market forces, helps minimize disruptive daily fluctuations in the exchange rate, and eases FX risk management. Deepening FX markets entails eliminating market-inhibiting regulations, improving market microstructure, and increasing the flow of information in the market, while reducing the central bank market maker role. Avoiding excessive smoothing is critical so as not to inhibit the nascent markets and useful market signals and to avoid sending confusing messages about policy intentions (Ötoker-Robe and others 2007).

49. An active interbank FX market will support the smooth transition to a fully market-determined exchange rate. Beyond the technical platform, reducing market segmentation, channeling FX inflows through the official market, and allowing the exchange rate to fluctuate in a wider volatility band are needed to support the deepening of the interbank FX market. Ultimately,

when sufficient experience has been acquired and an interbank FX market has emerged, the BCM intervention strategy could evolve from stabilizing the exchange rate to managing the volatility of the market-determined exchange rate using an intervention rule (Figure 13).



F. Conclusion

50. From the macroeconomic perspective, Mauritania would be better off with a more flexible exchange rate. A more flexible exchange rate would ensure the consistency between the exchange rate and the fundamentals. It would help absorb real shocks and dampen growth and financial volatility while preserving external buffers. A flexible exchange rate would also enhance competitiveness and provide greater monetary policy autonomy and flexibility in responding to shocks. Key risks involved with the transition to greater exchange rate flexibility include rising inflation volatility, FX risks, and external debt. Yet, lower and more stable inflation can be achieved by an alternative monetary policy framework. In addition, exposures to FX risk of the public and financial sectors can be mitigated through the deepening of the domestic government securities' market and tighter FX NOPs.

51. From the institutional perspective, the international experience shows that transition to a more flexible exchange rate requires adequate preparation. An alternative nominal anchor, the effective implementation of a corridor system, sound financial sector, and well-functioning money and FX markets are key in supporting a smooth transition. In the short term, the preparation would involve a focus on narrowing the interest rate corridor and deepening of the interbank money, FX, and government securities' markets to strengthen monetary policy implementation and transmission and allow the switch to an alternative monetary policy anchor. The BCM could further develop its macro-forecasting models and monetary policy communication.

52. As other countries, Mauritania should be able to successfully transition to greater exchange rate flexibility if well-planned and supported by the institutional and macro-financial building blocks. The gradual transition should, however, be carefully sequenced, and the appropriate timing of the reform should consider the supporting macrofinancial conditions as well as the institutional requirements.

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MAURITANIA: ECONOMIC IMPACT OF CLIMATE CHANGE¹

Mauritania is facing enormous adaptation challenges, stemming from more temperature extremes, droughts, floods. The interplay between worsening natural hazards and moderate climate resilience is likely to increase human damages, land degradation and water and food insecurity. Our analyses showed that climate disasters and higher temperatures are dampening growth and adaptation needs are significant. Key measures to address climate challenges and offset medium-term growth losses should include developing a national adaptation plan (NAP) with policy priorities, enhancing domestic revenue mobilization and gradually reducing untargeted energy subsidies, which combined with increased external financing could help finance the adaptation needs; (while also contributing to mitigation); a medium-term gender and climate responsive budget with a clearly defined fiscal anchor that integrate climate-related expenditures linked to the NAP priorities; and reforms to improve financial and social resilience. Mauritania can offset a portion of its medium-term growth losses from climate disasters such as droughts and floods through improving access to finance, health, electricity, and telecommunication.

A. Introduction

1. Mauritania is suffering from climate change. In recent years, temperatures, droughts and floods have risen and the number of climate change disasters have grown. These disasters are taking a toll on the economic performance, particularly through agriculture, livestock and fishing. The consequences are most pronounced for lower-income households who are least equipped to handle the consequences of these shocks.

2. The economic impact of climate change on Mauritania is significant. Using various empirical analyses (IMF, 2022; Pondi and al, 2022), the paper examines how climate-related disasters impact medium-term economic growth and how a combination of fiscal policies, structural reforms and adaptation policies would be most effective in reducing its adverse economic and social consequences in Mauritania.

B. Climate Change Challenges

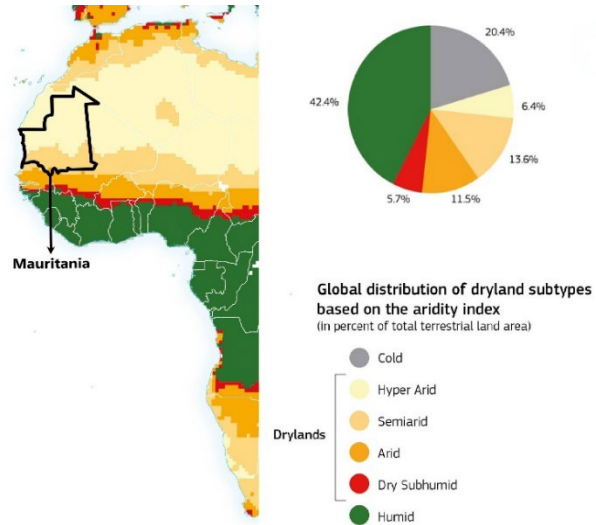
3. Mauritania is suffering from the ramifications of global climate change. Mauritania is essentially a desert country, with about 90 percent of its territory lying in the Sahara Desert, vast expanses of pastoral land and only 0.5 percent of arable land (Figure 1). Historically, Mauritania's average annual temperature has been higher than its neighboring regions. Due to the degrading

¹ Prepared by Anta Ndoye, Jarin Nashin, and Eric M. Pondi.

global climate conditions, climate conditions have harshened in recent decades with higher temperatures, more irregular precipitations.

Rain variability has been much higher in Mauritania than the average for emerging and developing economies in the last two decades (Figure 2),. The average frequency droughts and floods has also increased as well as the total number of disasters (Figure 2). Annual temperatures have increased by about 0.75° C on average in Mauritania over the past three decades, faster than in emerging and developing economies. Mauritania is one of the 10 in the MENA region that has more than 100 days of extreme heat per year (IMF, 2022).

Figure 1. Map of Mauritania’s Drylands, 1981-2010



Source: World Atlas of Desertification (2018)

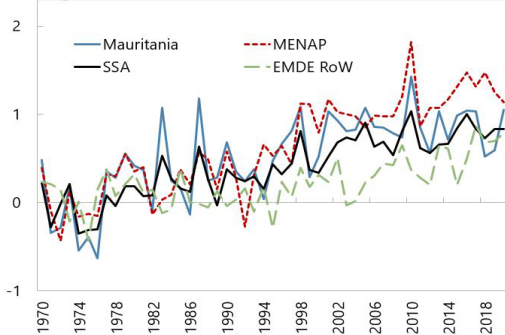
Note: Drylands are arid, semi-arid, and sub-humid areas with an Aridity Index of less than 0.65. Aridity is a measure of “dryness” of the climate expressed as the ratio of precipitation to evapotranspiration. the lower the ratio the drier the climate.

Figure 2. Climate Trends and Climate Hazards in Mauritania

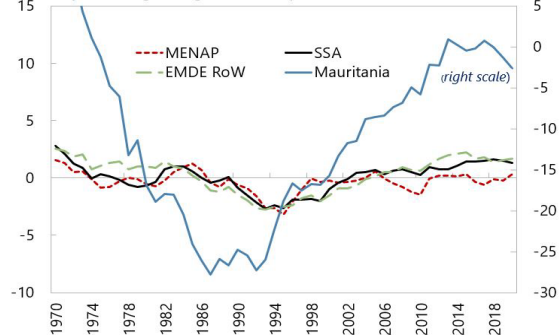
Climate Trends, 1970-2020

(Mean deviation of countries' annual weather averages from their respective 1901-50 averages)

1. Temperature (Degree celsius)

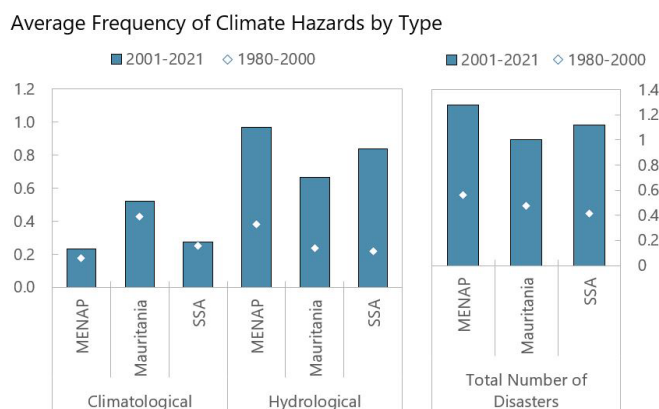


2. Precipitation (10 year rolling average deviation, percent)



Sources: World Bank; and IMF staff calculations.

Figure 2. Climate Trends and Climate Hazards in Mauritania (concluded)



Sources: EM-DATA; WB WDI; World Bank; IMF WEO; and IMF staff calculations.

Climatological: A hazard caused by long-lived, meso- to macro-scale atmospheric processes ranging from intra-seasonal to multi-decadal climate variability, such as- drought and wildfire

Hydrological: A hazard caused by the occurrence, movement, and distribution of surface and subsurface freshwater and saltwater, such as- flood and landslide.

EM-DAT maintains database on disasters following the criteria: (1) 10 fatalities or more, (2) 100 people affected or more, and (3) a declaration of an emergency state and/or call for international assistance.

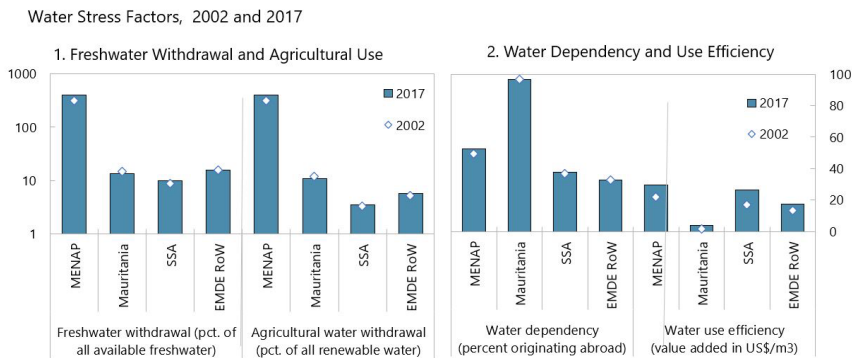
4. Harshened climate conditions are reinforcing climate challenges such as land and infrastructure degradation, water stress and inflation and food insecurity. While Mauritania's freshwater usage is in line with the emerging and developing economies' average, water dependency exceeds the level seen elsewhere in the world with almost 100 percent originating outside of country borders ((Figure 3, Panel 1). At the same time, Mauritania has lower levels of water use efficiency than the average of emerging and developing economies in the rest of the world (Figure 3, Panel 2). The climate change challenges described above are also eroding arable land size and fertility, surface and underground waters (which sustain farming, fishing, and hydropower), and in turn contributing to water and food insecurity (Figure 3, Panel 3, World Bank 2022).² Both water and food insecurity are likely to exacerbate inflationary pressures.

5. They have also caused human losses and raised socioeconomic challenges in Mauritania. Vulnerability to climate is high (Figure 4). This reflects particularly high numbers of people affected by climate disasters, and some very severe events. The latter includes, for instance, the 2017 drought in Mauritania (that affected 91 percent of the population and the 2021 drought which led to 20 percent of the population impacted by acute food insecurity (Cadre Harmonise, March 2022). Moreover, from 2000-2020, on average, almost 10 percent of the population has been impacted by climate hazards, which is the highest share in the MENA region. Lastly, human climate-related losses have been important in Mauritania, with about 0.15 percent of the population having died due to climate hazards (IMF, 2022). The consequences are likely to be more

² <https://www.ipcc.ch/sr15/chapter/chapter-3/>

pronounced for low-income households and women (Box 1). At the same time, the country's ability to leverage investments for adaptation to climate change remains moderate (Figure 4).

Figure 3. Water Stress Factors and Food Insecurity



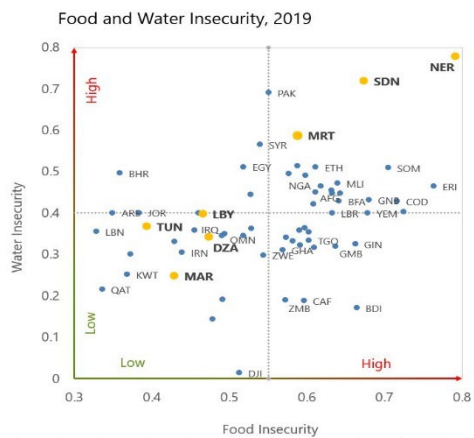
Sources: FAO; and IMF staff calculations.

Freshwater withdrawal (pct. Of all available freshwater): Total freshwater withdrawn in a given year, expressed in percentage of the total renewable water resources (TRWR). This parameter is an indication of the pressure on the renewable water resources.

Agricultural water withdrawal in a given year, expressed in percent of the total renewable water resources (TRWR). This parameter is an indication of the pressure on the renewable water resources caused by irrigation.

Water dependency refers to long-term average quantity of water annually entering the country through transboundary flow (rivers, canals, pipes).

Water Use Efficiency (WUE) at national level is the sum of the efficiencies in the major economic sectors weighted according to the proportion of water withdrawn by each sector over the total withdrawals.



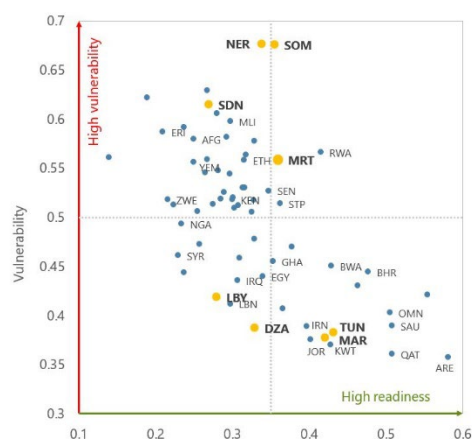
Sources: FAO; and IMF staff calculations.

Freshwater withdrawal (pct. Of all available freshwater): Total freshwater withdrawn in a given year, expressed in percentage of the total renewable water resources (TRWR). This parameter is an indication of the pressure on the renewable water resources.

Agricultural water withdrawal in a given year, expressed in percent of the total renewable water resources (TRWR). This parameter is an indication of the pressure on the renewable water resources caused by irrigation.

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Water Use Efficiency (WUE) at national level is the sum of the efficiencies in the major economic sectors weighted according to the proportion of water withdrawn by each sector over the total withdrawals.

Figure 4. Climate Change Readiness and Vulnerability, 2019

Source: University of Notre Dame Global Adaptation Index and IMF staff calculations

A country's ND-GAIN index score is composed of a vulnerability score and a readiness score.

Vulnerability measures a country's exposure, sensitivity and capacity to adapt to the negative effects of climate change. ND-GAIN measures overall vulnerability by considering six life-supporting sectors – food, water, health, ecosystem service, human habitat, and infrastructure. Readiness measures a country's ability to leverage investments and convert them to adaptation actions. ND-GAIN measures overall readiness by considering three components – economic readiness, governance readiness and social readiness.

Box 1. Gender and Climate Change in Mauritania¹

Climate change carries important implications for gender equality in Mauritania. In addition, gendered resource disaggregation influences individuals' capacity to respond to the increasingly variable environment.

Mauritania is facing both higher frequency and severity of climate-related natural disasters, which threaten the health of its population, critical infrastructure, social and economic stability, and economic growth.

At the same time, gender inequality in Mauritania hampers economic growth and stability. Women in Mauritania have on average, about two fewer years of schooling than men and face discriminatory legal barriers in employment, access to credit, marital status, and asset ownership (World Economic Forum, 2022; World Bank 2022).

On average, only 14 percent of Mauritanian women have an account at a financial institution compared to 26 percent of men. The gender gap in those who have been able to save any money at all stands at almost 10 percentage points (37 percent for women versus 46 percent for men).

Looking at the nexus between climate change and gender inequality, a growing literature shows that women experience climate change differently than men. Women are disproportionately reliant on natural resources; however, climate variation makes the dependance on these resources a challenge (Sorenson et al. 2011). During droughts, women and girls must venture more than an hour to collect a few liters of water (UNICEF 2016), and the added distance they must travel exposes them to greater risk of violence and the associated social repercussions of sexual assault (Sorenson et al. 2011). The lack of legislation that adequately define and

Box 1. Gender and Climate Change in Mauritania (concluded)

criminalize sexual violence in Mauritania further expose women in rural areas. Female laborers more often rely on breeds of livestock that are not as well adapted to the challenges of climate change. In comparison, men have better access to the types of networks, financial capital, and information to not only acquire, but also to raise more durable breeds of livestock (McOmber 2020).

To encourage women's full participation in the green economy, a study by the African Development Bank and UN Women (2021) points to several key policy recommendations. First, addressing gender gaps in education, particularly in STEM fields and reskilling women will be crucial. However, in Mauritania, only 43 percent of women are literate compared to 64 percent of men (World Economic Forum 2022; World Bank), making access to knowledge on climate change and adaptation and reskilling more difficult. Second, legal barriers pose further challenges in creating a level playing field. Mauritania directly inhibits women's abilities to participate in sectors projected to be less affected by climate change (e.g. underground operations in mining). The country also lacks legislation on sexual harassment in employment. Finally, social norms and lack of access to finance further hinder women's ability to own land or invest in new agricultural tools and inputs.

¹ Prepared by Lisa Kolovich and Sahar Priano

6. Conflicts in Mali, natural resource competition, and natural disasters are also triggering migration. People are moving to Mauritania to escape conflicts in Mali and harsher climate conditions. Migration flows disrupt communities, harm local economies, and put stress on locations that house refugee camps or receive large numbers of migrants or displaced people, especially in the Hodh Chargui region, where currently around 90,000 Malian refugees, and around Mauritanian locals are vulnerable to water and food insecurity. This large influx of refugees is increasing pressure on natural resources, especially with herding communities on both sides of the border (Stavropoulou and Harper, 2022).

7. Global climate change is set to further intensify Mauritania's current climate stress trends. Mauritania is likely to see temperatures rise according to multi-model climate projections (Figure 5). Higher temperatures, aggravated by more irregular rainfalls will worsen existing geographic challenges. They could also accelerate desertification in Mauritania. Higher global surface temperatures are set to magnify climate anomalies, including hotter and drier weathers. This will exacerbate extreme hazards, such as warm spells and drought severity in Mauritania (Figure 6). The intensification of climate stresses combined with population growth would markedly worsen human damages. It would also further aggravate Mauritania's challenges of land degradation, water stress and food insecurity.

C. Macroeconomic Impact of Climate Change in Mauritania

8. Climate change poses macroeconomic policy challenges. These include lower growth, higher inflation, shifting GDP and employment shares, as well as larger fiscal and external imbalances (IMF, 2022). Climate effects can also erode the soundness of financial institutions, including insurance companies. Channels include a deterioration of balance sheets, deposit withdrawals, nonperforming loans, and reevaluation of stranded assets used as collateral or asset (IMF 2020b). Disasters can also damage the infrastructure of payment systems.

Figure 5. Projected Temperatures Increase (2020-2099)

Sources: Climate Impact Lab and IMF staff calculations.

Each bar corresponds to average summer temperatures increase for a given country/region in one time period corresponding to the period

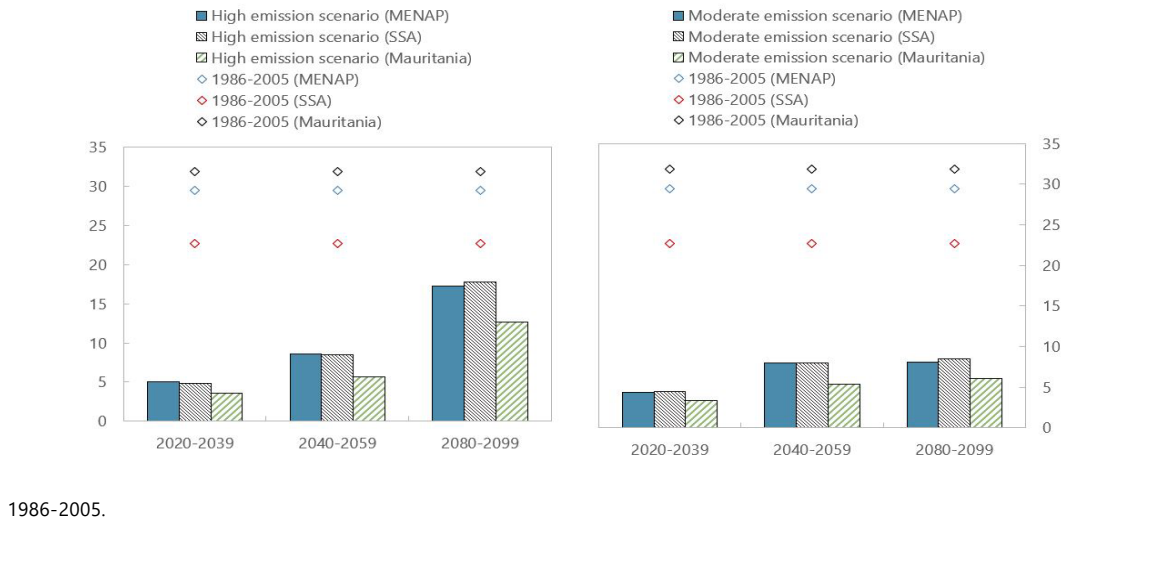
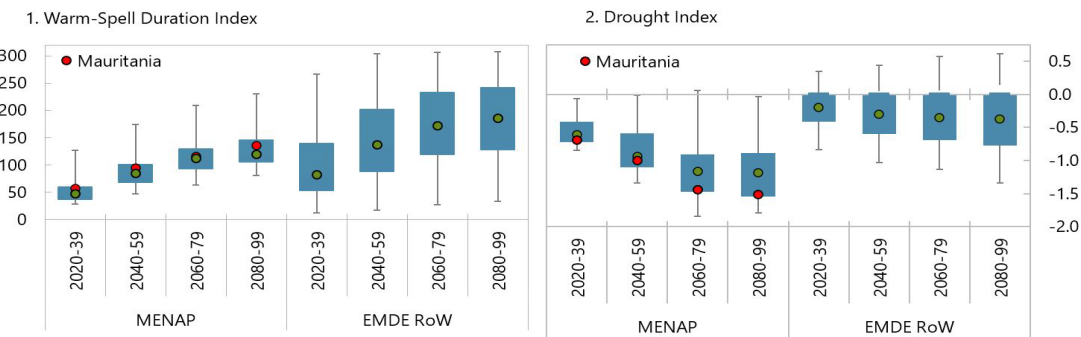


Figure 6. Predicted Median Intensification of Weather Anomalies

Predicted Median Intensification of Weather Anomalies, 2020-99
(Absolute change relative to the reference period 1986-2005, RCP 4.5 scenario)



Sources: World Bank and IMF staff calculations. The green dot shows the averages of the median changes across each region and the red dot shows the median changes for Mauritania, the blue box the 10 and 90 percentiles, and the whiskers the minimum and maximum. The WSDI captures the average number of days per year over a climatological interval that are part of a sequence of six or more days in which the projected daily maximum temperature exceeds the 90th percentile of daily maximum temperatures found in the reference period. The SPEI (Standardized Precipitation-Evapotranspiration Index) for a 12-month period uses the daily difference between precipitation and potential evapotranspiration to determine droughts.

9. We assess the effects, on growth, of the frequency and intensity of climate-related disasters for Mauritania, using a model developed by Pondi and al (2022). In accordance with the Emergency Events Database (EM-DAT) compiled by the Centre for Research on the Epidemiology of Disasters (CRED), climate-related disasters are defined as climate-related hazards

that lead minimally to one of the following tolls: at least 10 people dead, at least 100 people affected, a declaration of a state of emergency, or a call for international assistance. Both intensity and frequency of climate-related disasters can alter economic outcomes, therefore, the econometric strategies rely on introducing quantitative proxies of disasters, factoring in intensity and frequency, into a growth model à la Barro (1991). However, past findings confirm that the intensity of a disaster matters more than its frequency, as higher adverse effects on medium-term growth are found to be associated with intensity.

The regression is based on a five-year aggregation of a yearly model following Islam (1995). The model assesses the effects, on growth, of the frequency and intensity of climate-related disasters is as follows.

$$\bar{G}_{i,p} = a\overline{\text{Log}(\bar{Y}_{i,p})} + b_1\overline{\text{Inten}_{i,p}^k} + b_2\overline{\text{Freq}_{i,p}^k} + B_3\bar{X}_{i,p} + c_{2,p} + d_{2,i} + \varepsilon_{1,p} \quad (1)$$

where p is a 5-year period, going from $t_{p,1}$ to $t_{p,5}$, $\overline{\text{Inten}_{i,p}^k} = \frac{1}{N} \sum_{t=t_{p,1}}^{t_{p,5}} \text{Inten}_{i,t}^k$ (with N_k the number of disasters of type k during the 5-year period) and $\overline{\text{Freq}_{i,p}^k} = \frac{1}{N} \sum_{t=t_{p,1}}^{t_{p,5}} \text{Freq}_{i,t}^k$. Moreover, $\bar{G}_{i,p}$, $\overline{\text{Log}(\bar{Y}_{i,p})}$ and $\bar{X}_{i,p}$ are the averages, over the 5 years, of per capita GDP growth, per capita GDP and additional controls, respectively, $c_{2,p}$ and $d_{2,i}$ are time and country specific effects, respectively, and $\varepsilon_{1,p}$ is the error term. In this specification, the intensity and frequency proxies are the rate of disruptive disasters and the average relative fatalities over 5 years, respectively. In this model, the frequency and intensity proxies correspond to the average frequency and the relative intensity over a 5-year window, respectively.³

10. The analysis shows that there is a significant negative impact of climate-related disasters on medium-term growth, with most of the significant effects originating from droughts and floods (see Table 1, Annex I for detailed results). If a drought intensifies by 10 percentage points, medium-term annual per capita growth can decline by almost 0.8 to 1 percentage points in Mauritania. An intensification of floods by the same amount takes one-fifth to one-fourth the toll on medium-term growth. The negative impact of droughts on Mauritania growth is up to 3 times that in emerging and developing economies. Another empirical study (IMF, 2022) also shows that a temperature increase of one degree Celsius in Mauritania, would lead to an immediate two percentage point drop in per capita economic growth, with agriculture and industry and construction sectors being the most severely impacted.

11. We then look at the relative gains in resilience to climate-related disasters from advancing structural reforms in areas such as telecommunication, health, financial depth, education and, electricity and agriculture modernization for Mauritania. The following model is considered:

$$\bar{G}_{i,p} = aG_{i,p-1} + b_1\overline{\text{Dis}_{i,p}^k} + b_2\overline{\text{Dis}_{i,p}^k} \cdot z_{i,p} + b_3z_{i,p} + c_p + d_i + \varepsilon_{1,p} \quad (2)$$

³ The intensity proxy is defined with a dummy variable that provides information on whether the total annual effect of disasters weighs on over 0.01 percent of the population (see Annex I).

where i represents countries, p is a 5-year period, $\bar{G}_{i,p}$, c_p and d_i are defined as in equation (1), $z_{i,p}$ is a policy variable—representing a structural area—and $DDis_{i,p}^k$ is either the intensity proxy or the frequency proxy associated with a climate-related disaster of type k in country i and period p . The analysis focuses on the sign and significance of parameter b_2 (which is the slope for the interaction term). Policy variables (or structural reform areas) are analyzed one at a time. In accordance with the results from the previous section, b_1 would be negative. Hence, a positive and significant estimate for b_2 would mean that the policy variable (or structural area) helps improve resilience to the type of climate-related disaster being analyzed.

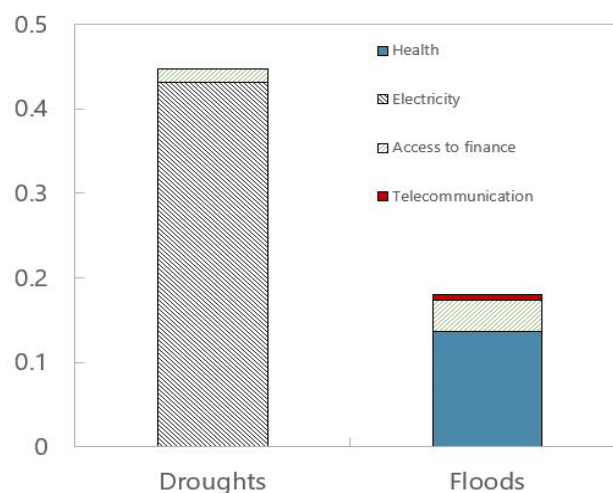
12. The results, summarized in Table 2 (Annex I), show that resilience to climate-related disasters is significantly improved by raising access to telecommunication, finance and electricity as well as improving health, education, and mechanization. For Mauritania, Figure 7 shows that better access to electricity can halve the majority of the medium-term economic loss from a drought. Electricity is essential for powering irrigation systems and deep tube-well pumps, which are critical for rural populations and the urban poor during prolonged dry spells and water shortages. Access to finance also contribute to halving a small proportion of the loss. Access to finance for households and small and medium enterprises allows them to invest in weather-resilient infrastructure (such as irrigation systems and electricity) and provides post-disaster buffers. The analysis also indicates that the bulk of the medium-term growth loss from floods could be avoided with better health care, followed by, access to finance and telecommunication. Health care acts through several channels to protect economies from the adverse consequences of floods—especially in terms of food security, income, and employment. Telecommunication and access to finance are also resilience-building areas.

D. Mauritania’s Climate Commitments and Policies

13. Although Mauritania contributes to only around 0.03 percent of global GHG emissions, it has pledged to achieve net-zero emissions by 2050. Mauritania submitted nationally Determined Contributions (NDCs,) under the Paris Agreement and updated those NDCs at the COP26 meeting in Glasgow, with a new target to cut greenhouse emissions by 11 percent in 2030. The commitments cover energy, agriculture, land use and forestry and waste (Box 2). 92 percent of this ambitious target in terms of reduction of its greenhouse gas emissions is conditional on the country receiving substantial support from external sources

14. Mauritania’s adaptation commitments cover a wide range of areas, including agriculture and livestock; conservation of ecosystems, biodiversity and forests; water and sanitation; energy and infrastructure; gender and social protection; land use planning; health; education; and fisheries and aquaculture (Box 2).

Figure 7. Reduction in Impact of Disasters on Mauritania's Medium-Term Growth if Structural Factors Improve



Note: The figure shows Mauritania's reduction in the impact of disasters on per capita annual medium-term growth, when structural factors are improved to the EMDEs average and when the intensity proxy increases by 10 percentage points.

Electricity is proxied by Access to electricity, percent of population (WDI); Access to finance is proxied by Domestic credit to private sector, percent of GDP (WDI); Telecommunication is proxied by Mobile cellular subscriptions per 100 people (WDI). Health is proxied by Life expectancy at birth (WDI)

15. Mauritania has low-carbon economic growth strategies with a strong focus on developing their renewable energy potentials, and specific renewable energy targets. It plans to increase renewable energy (hydro, solar, wind) to 50 percent of the energy mix by 2030 from 38 percent currently. In addition to setting these targets, it also plans to achieve universal energy access by 2030. However, resilience and climate risks are largely absent in sector planning, even though climate change greatly affect power system assets and harm the availability of hydropower resources (World Bank, 2022). As the result of these issues and others, energy tariffs are high, both the on-grid and off-grid markets in the country are subsidized and do not allow the state to recover operating costs, contributing to the electricity utility's high deficits. Mauritania has recently revised its electricity code to promote consumption and production of renewable energy.

16. The Mauritanian government recently signed an agreement with an international company to develop green hydrogen production and export site in Mauritania. This project (AMAN) aims to build 30GW of hybrid wind (18 GW) and solar (12 GW) generation capacity to produce renewable energy for zero emissions power and green hydrogen and ammonia for both domestic use and export.

Box 2. Mauritania's Climate Policy Commitments in the NDCs

Mitigation Policy Measures Focus on Energy, Transport, Livestock, Forestry and Waste.

- Evaluate country's available resources on renewable energies and green hydrogen
- Update legislation and legal framework to encourage clean energy production
- Promote energy efficiency production
- Develop clean public transport
- Develop and implement a National Solid Waste Management Plan and a waste recovery
- Build technical landfill centers consistent with the international standards
- Step up reforestation by increasing reforested areas (to 30,000 ha by 2030) and fight against deforestation
- Expand protected areas
- Develop genetic improvement of breeds to increase productivity and reduce emissions from the livestock sector (create 20 artificial insemination farms)

Adaptation Policy Measures Focus on Water, Agriculture, Forestry, Livestock, Fisheries, Health, Infrastructure.

- Strengthen access to clean water, develop desalination of seawater and improve sanitation systems in top five cities at high risk of flooding (Nouakchott, NDB, Rosso, Atar and Kaédi)
- Promote agroecological production practices (6000 ha) and sustainable breeding
- Support sustainable management of the fisheries sector
- Set up an appropriate insurance schemes for farmers, breeders and fishermen
- Develop and adopt sustainable construction standards for buildings and other infrastructure
- Develop a national land use plan resilient to climate change
- Implement the Great Green Wall Program: 2000 ha / year
- Promote assisted regeneration of forests: 2,500 ha / year - and aerial seeding: 10,000 ha / year
- Fight against coastal erosion-Protect the coastline, coastal and marine ecosystems
- Develop knowledge / data on the health-related risks associated with climate change, improve health capacity and promote health system access to all
- Conduct vulnerability risk assessments and improve information system on climate change; develop early warning systems and risk management capacity.
- Raise awareness among local stakeholders of environmental and climate issues

Integrate environment and climate into educational programs for all levels

To qualify as "green hydrogen", it must be produced from non-fossil fuel sources and non-emitting processes, more specifically using renewable energy to power large-scale electrolysis to separate and capture hydrogen from water. At full 30 GW renewable capacity, the project will generate an estimated 110 TWh of electricity per annum. If directed fully to hydrogen production, the project is expected to produce 1.7 mtpa of green hydrogen or 10 mtpa of green ammonia for both local

industrial consumption and export. The project will require an estimated capital investment of US\$40 billion over the next 8 to 10 years and would be entirely funded by private foreign direct investment. Those expenditures will be required for a) the installation of wind and solar power infrastructure, b) the construction of an industrial complex with production facilities for hydrogen/ammonia synthesis, electricity storage and distribution, and ocean water desalination, and c) supporting transport, storage, communications, and residential infrastructure. It will support the government's efforts to increase electricity and water supply, as well as develop the manufacturing sector (green steel) to boost growth and create jobs.⁴ It is also looking into providing locally-produced green electricity and hydrogen to help power SNIM's iron ore production, and to pursue zero-emission production of steel, for example hot-briquetted iron (HBI), adding local value prior to export.

17. The Great Green Wall movement, to which Mauritania belongs, is a reforestation initiative that aims to grow an 8,000-kilometre-long barrier to combat environmental degradation and drought in the Sahel. This initiative, across 20 countries, including Mauritania aims to combat desertification and drought with the planting of new trees to restore degraded land - in total over 100 million hectares will be restored. The restored land is expected to sequester 250 million tons of carbon and create 10 million new green jobs. The project was launched in 2007, but only 4 percent of the goal was met as of 2021.⁵

18. The authorities are strengthening their adaptive social protection system to respond to climate shocks. As noted in the previous section, climate-related shocks are having a substantial negative impact on the well-being of the households in Mauritania. More generally, the quality of the rainy season constitutes a major driver of food insecurity variations in rural areas. The World Food Program estimates that 90 percent of agriculture production is subsistence based in Mauritania, resulting in a large number of people being vulnerable to droughts, failed harvests, and desertification due to climate change (World Bank, 2021). The government has two cash transfers programs to respond to climate shocks. The Elmaouna program is implemented during each lean season to support households affected by climate-related shocks (mainly drought but response to rapid-onset shocks such as floods is also being piloted). "Tekavoul choc" respond to shocks by expanding vertically (temporary transfer increase) and horizontally (increase in number of beneficiaries selected from the Social Registry) in areas where Elmaouna does not operate. They reached a total of 69,000 households in 2022 in response to the highest level of food insecurity ever recorded in Mauritania. In addition, the authorities recently set up a unified institutional framework to manage the entire cycle of prevention, preparation, coordination, implementation, monitoring, and capitalization of the national response plan to food insecurity and nutrition shocks. They have established a contingent fund to help the Government secure and streamline the sources of domestic and external funding. They are in the process of defining rules to allocate

⁴ A macro-economic study, commissioned by the international company, estimated the project could boost Mauritania's GDP by 40 to 50 percent by 2030, and by 50 to 60 percent from 2035 onwards, including a boost to employment in industry by 23 percent, and a reduction in total national unemployment by almost a third by 2035.

⁵ [Mauritania takes steps to protect agriculture by planting trees | Africanews](#)

the necessary resources to respond to food security and nutrition shocks as well as boost households' resilience before a climate shock hits.

E. Climate Adaptation Financing

19. Funding needs for adaptation efforts to climate change are large. The cost of climate change can be significantly reduced through achieving greater level of adaptation. For example, upfront investment in adaptation would be considerably less costly than frequent climate disaster relief—ranging from up to 3 times less costly for droughts (Cantelmo and others 2019, IMF 2022). According to the authorities' NDCs, adaptation financing needs could amount to up to US\$10.6 billion over 2021–30, or an average annual investment of 12 percent of 2021 GDP. Under a medium-growth scenario for Mauritania, World Bank staff estimates that NDC adaptation investments (if financed through public resources) would absorb an average of 69 percent of annual tax revenues between 2023-30 (World Bank, 2022).⁶ While NDC reporting is managed by ministries in charge of environment or climate, it is essential that the ministries in charge of budgeting and planning are involved in NDC implementation, reporting, and refining of data.⁷

20. The authorities are planning to tap both domestic and external sources. Funding plans currently rely heavily on contributions from the international community (approximately 92 percent of the total amount). The NDC report outlines several potential sources for funding for climate adaptation in Mauritania, including from the private and financial sector. An action plan is expected to be finalized by end-2023.

21. To date, external financing for climate adaptation has been limited for Mauritania. Between 2010- 2020, international commitments for adaptation have only reached \$500 million, according to the OECD's climate financing data, with the majority in the form of grants, and the rest through concessional loans (Figure 8). The main donors are the EU, World Bank, Germany, Islamic Development Bank and France and these top five donors have covered around 72 percent of the total adaptation-related development finance the country has received in the last decade (Figure 8). This raises concerns about prospects for success on climate commitments, given the reliance on external funding.

22. Climate funds are one form of concessional financing that could be tapped much more in Mauritania. A climate readiness assessment is currently being developed by the Green Climate Fund to develop bankable projects eligible for climate financing. Direct access to climate funds would allow better engagement with stakeholders and control over a climate project, and improve capacity to implement similar projects. Mauritania could upgrade its capacity to access existing climate finance, including by incorporating lessons from other countries' experiences. For example, the County Climate Change Funds (CCCFs) in Kenya and the Acuerdo Verde in Chile contributed to the country's national climate goals as well as helped with attracting financing from climate funds for climate projects. When developing climate

⁶ The medium-growth scenario is based on historical episodes of sustained growth performance in each country

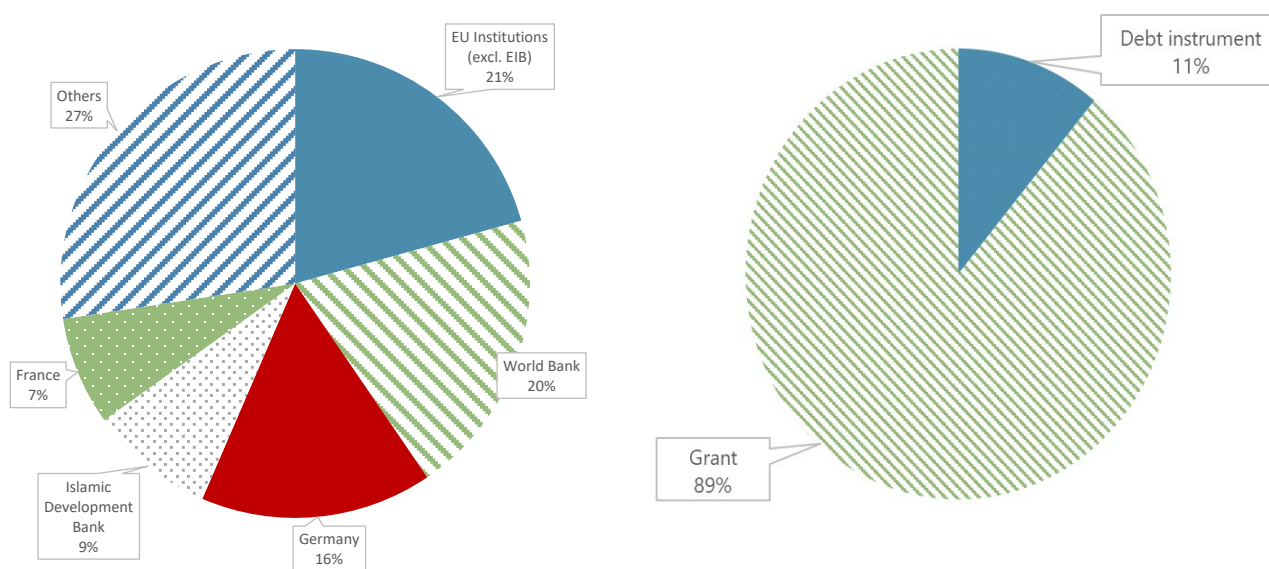
⁷ Estimating adaptation costs raises difficult methodological issues. Two approaches exist: (1) top-down, relating expected climate change to climate impacts and sectoral costs and (2) bottom-up, aggregating detailed cost estimates of specific adaptation strategies.

projects, the experiences of Madagascar, and Tanzania with climate funds could be useful—especially learning from their execution and disbursement challenge.

23. Climate insurance could be a useful tool to improve resilience among households and businesses and the government against the impact of climate change and natural disasters.

Climate insurance, which operates like standard insurance system, would have a positive impact on the stakeholders' investments and macroeconomic outcome as well as complement targeted social assistance (Surminski, Bouwer, and Linnerooth-Bayer, 2016). The lack of data on weather and meteorological services and capacity to translate them into an assessment of risks are key obstacles to expanding climate insurance in Mauritania.

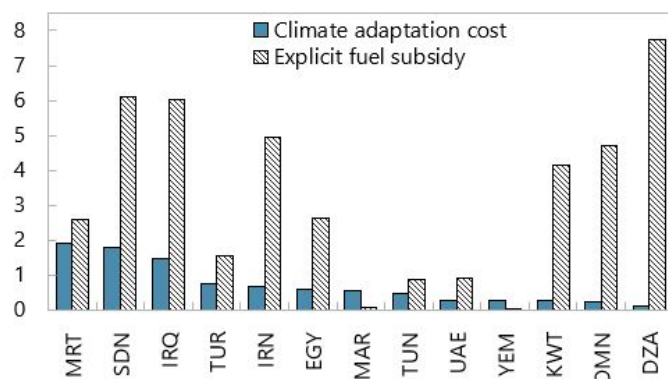
Figure 8. International Commitments for Adaptation Received, 2010-2020



Sources: OECD; and IMF staff calculations

24. On the domestic front, a few additional sources of funding could be considered.

There may be scope to redirect some of the existing spending (for example, from fossil fuel subsidies) to cover climate adaptation costs for infrastructure resilience (Figure 9). Mobilizing domestic revenues would also be a way of increasing fiscal space to raise adaptive investment for greater resilience. Boosting the efficiency of tax collection systems and streamlining exemptions would support this objective. Carbon taxation could also be considered to generate additional revenue and could help raise of more than 4 percent of GDP in Mauritania (IMF, 2022). This would require increased capacity to collect such revenues within the revenue administration.

Figure 9. Climate Adaptation Costs and Subsidies, 2020

Sources: Parry, Black, and Vernon (2021), IMF WEO, and IMF staff calculations.

Note: The data do not reflect subsequent subsidy reforms, including the 30 percent fuel price increase in MRT in 2022. Climate adaptation costs cover floods, and storms and do not capture investments needed to protect against other risks, including droughts and heatwaves and represent total financing from 2016-19.

F. Concluding Comments and Policy Recommendations

25. This paper shows the enormous adaptation challenges that climate change poses for Mauritania. The interplay between worsening natural hazards (especially droughts, and floods), extreme temperatures and moderate climate resilience is likely to increase human losses, land degradation and water and food insecurity. The empirical analyses showed that climate disasters and higher temperatures are dampening growth, with losses of up to one percentage point of medium-term per capita growth if droughts intensify by ten percentage points, one-fifth to one fourth of this impact if floods intensify by the same amount and two percentage points of medium-term per capita growth if temperatures increase by one Celsius in Mauritania. Mauritania can offset a portion of its medium-term growth losses from climate disasters such as droughts and floods through improving access to finance, health, electricity and telecommunication.

26. The authorities are taking a number of commitments to address these climate challenges, including through their NDCs, which estimated adaptation needs at around 12 percent of 2021 GDP annually between 2021-30. Given insufficient adaptation progress with these commitments, more and urgent action will be needed to further Mauritania's adaptation agenda:

- **National Adaptation plan:** An integrated and well-coordinated approach to climate change adaptation between donors and ministries is lacking and urgently needs to be developed and implemented to advance the adaptation agenda. In view of the large adaptation needs, adaptation policy priorities should be developed, and the funding needs should be further refined and linked with the country's macro-fiscal framework. They could be embedded within a guiding framework, while considering Mauritania's specific climate risks and capacity. The National Adaptation Plan (NAP) under the United Nations Framework Convention on Climate Change (UNFCCC) framework helps countries refine and update national initiatives and

incorporate them in a cohesive climate adaptation plan, integrate climate change into national decision-making, and guide implementation and regular review.

- **Fiscal Measures:** To make space for adaptation spending while preserving debt sustainability, Mauritania should continue to implement measures to enhance domestic revenue mobilization and could consider carbon taxation. Expenditure efficiency could also be further improved, including by gradually eliminating generalized energy subsidies and replacing them with targeted measures for the poorest households.
- **Fiscal Framework:** Medium-term gender and climate responsive budgeting will also be key, with a clearly defined fiscal anchor and a medium-term expenditure framework consistent with public debt sustainability and that integrate climate-related expenditures defined in the NAP. Incorporating and labeling climate issues throughout the budgeting process, transparent procurement, and pertinent risk management will be critical to planning, implementing, monitoring, and reporting on climate-related projects.
- **Climate resilience Infrastructure:** Targeted investments in climate resilience infrastructure are needed. More frequent flooding for example demands higher protection over the country's infrastructure system. The 2020 Fiscal Monitor estimated that Mauritania would need 2 percent of GDP annually to invest in infrastructure for climate resilience. The economic and social outcomes of these investments depend crucially on the efficiency of public investment management, including from the climate change perspective. Mauritania could identify potential improvements in public investment and processes to build climate-resilient infrastructure. These range from climate-aware planning to coordination between entities, project appraisal and selection, budgeting and portfolio management and risk management.
- **Renewable energy:** The authorities should press ahead with their current efforts to expand renewable energy production, which would help deliver a reduction of GHG emissions while pivoting toward greener sources of energy production. An enabling environment and appropriate legislation should be developed to support the development of green hydrogen, given the potential to increase domestic revenues for adaptation needs and energy and water supply.
- **Climate Adaptation Financing.** Climate adaptation needs are likely to remain significant, especially as climate challenges increase in the next few decades. External financing for climate has been limited so far and more external financing, particularly on concessional terms to preserve debt sustainability, will be crucial. An enabling business environment, better governance, a cohesive climate adaptation plan and support from the international community could help crowd-in private investment and increase external finance. Pursuing partnerships with climate funds can help unlock untapped resources. The IMF can provide financial support to member countries hit by adverse climate effects through existing facilities and with balance of payment (BOP) needs. In addition, the recently proposed Resilience and Sustainability Trust (RST) can help support member countries address risks to prospective BOP stability stemming from selected long-term structural climate challenges.
- **Financial and Social Resilience:** Given existing climate vulnerability and increase in the occurrence of climate disaster, it is important to strengthen disaster preparedness and coping capacities, both for droughts and floods. In particular, the authorities should move ahead with

the operationalization of their recently adopted institutional framework to respond to food insecurity and nutrition shocks. Reforms to enhance the efficiency and effectiveness the social safety net program should continue to be implemented, with a particular focus on ensuring that the social registry and existing social programs can be used to respond to climate shocks. Efforts to develop climate insurance schemes should be pursued to improve resilience of households and firms. This will require better data on weather and meteorological services and capacity to translate them into an assessment of risks along with progress on financial inclusion.

Annex I. Growth Regression and Impact of Structural Reforms on Climate Resilience

Intensity Proxy

1. The intensity proxy is defined with a dummy variable that provides information on whether the total annual effect of disasters weighs on over 0.01 percent of the population. To be specific, following Fomby et al. (2013), the intensity, during the year t , of disasters of type k in country i , is measured as follows:

$$Intensity_{i,t}^k = \begin{cases} 1, & \text{if } \frac{Fatalities_{i,t}^k + 0.3 * Affected_{i,t}^k}{Population_{i,t}} > 0.0001 \\ 0, & \text{otherwise} \end{cases}$$

where $Fatalities_{i,t}^k$ and $Affected_{i,t}^k$ represent the total deaths and total affected that are associated with disasters of type k in country i during year t . $Population_{i,t}$ is the population of country i in year t .

EM-DAT defines "Affected" as "People requiring immediate assistance during a period of emergency, i.e. requiring basic survival needs such as food, water, shelter, sanitation and immediate medical assistance."

Frequency Proxy

2. The frequency proxy considers the total effects related to the occurrence of disasters during the year. Because of the non-linear cumulative effects of successive disasters, considering only the number of disasters as the frequency proxy would be misleading.⁴ For this purpose, following Loayza et al. (2012), the frequency proxy associated with disasters of type k , during the year t in country i , is defined as follows:

$$Frequency_{i,t}^k = \frac{Fatalities_{i,t}^k}{Population_{i,t}}$$

where $Fatalities_{i,t}^k$ and $Population_{i,t}$ are defined as previously. A frequency proxy that considers both fatalities and affected people in its numerator is applied as a robustness check.

3. The proxies build on human capital destruction (as opposed to physical capital destruction). This strategy is mainly driven by data availability, as the EM-DAT database provides information mostly on fatalities and affected people associated with natural disasters. A strategy based on physical capital destruction could also be used, but the data on economic costs are scarce. However, physical capital deterioration could be captured through conventional growth model controls.

4. Note that, although both types of proxies gather information on the overall severity of disasters, the intensity proxy aims at distinguishing disasters that have a priori significant

macroeconomic impacts while the frequency proxy includes all disasters without any ex-ante consideration with regard to their severity.

5. The first regression is estimated using GMM methods to correct for potential correlation between the unobserved effects and the lagged regressor, as the model builds on a dynamic panel. The instruments are selected to ensure exogeneity while the endogenous variables are the per-capita GDP and the disaster proxies.

Annex I. Table 1. Mauritania: Growth Regression

	Selected economies: Growth models with disaster indicators (SSA)							
	GMM				Fixed effects			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Log of per capita GDP	-2.774*	3.090	0.039	4.239	-2.369	-1.566	-1.509	6.724
	(1.422)	(2.340)	(1.329)	(2.597)	(1.433)	(1.373)	(1.069)	(3.936)
Drought Intensity	-11.328*				-7.810***			
	(6.118)				(2.157)			
Drought Frequency	-0.448***				-0.412***			
	(0.076)				(0.042)			
Flood Intensity		-3.216***				-1.192**		
		(1.219)				(0.564)		
Flood Frequency		-0.053				-0.178**		
		(0.115)				(0.084)		
Epidemic Intensity			-0.770				-0.532	
			(0.633)				(0.409)	
Epidemic Frequency			0.169				-0.010	
			(0.175)				(0.161)	
Storm Intensity				1.071				0.320
				(1.381)				(0.996)
Storm Frequency				-1.106				-12.262
				(6.585)				(11.267)
Education	0.056	-0.113*	-0.004	-0.131	-0.051	-0.075*	-0.056	-0.159
	(0.047)	(0.068)	(0.036)	(0.083)	(0.059)	(0.039)	(0.050)	(0.160)
Investment	0.040**	0.031	0.041	0.001	0.032***	0.049*	0.046**	0.088
	(0.019)	(0.038)	(0.027)	(0.064)	(0.010)	(0.024)	(0.021)	(0.062)
Government Consumption	0.012	-0.002	-0.031	-0.041	-0.006	0.060*	0.055**	0.084
	(0.026)	(0.039)	(0.020)	(0.046)	(0.021)	(0.030)	(0.025)	(0.058)
inflation	0.001	-0.002***	-0.002***	0.070	0.001	-0.001***	-0.001***	0.065
	(0.001)	-	(0.001)	(0.066)	(0.001)	(0.000)	(0.000)	(0.058)
Trade Openness	2.842*	-0.081	3.412**	1.724	0.628	1.741	4.524**	-1.525
	(1.586)	(1.483)	(1.564)	(1.449)	(1.268)	(1.416)	(1.869)	(4.765)
Change in terms of trade	-0.275***	0.084	0.046	0.008	-0.115	0.069	0.063*	-0.027
	(0.095)	(0.093)	(0.060)	(0.284)	(0.088)	(0.062)	(0.036)	(0.357)
Intercept	31.844**	-15.547	-1.006	-27.931	26.846***	12.288	7.993	-46.390
	(14.145)	(14.858)	(8.775)	(19.670)	(9.383)	(9.117)	(8.791)	(27.146)
Observations	113	163	158	67	113	163	158	67
Number of instruments	45	46	46	45				
R2					0.666	0.514	0.536	0.503
Arellano-Bond test for AR(1)	0.048	0.024	0.015	0.062				
Arellano-Bond test for AR(2)	0.269	0.527	0.119	0.431				
Hansen test	0.987	0.798	0.698	1.000				
Difference-in-Hansen test	0.115	0.011	1.000	0.879				

Note: (1), (2), (3) and (4) represent models for droughts, floods, epidemics and storms, respectively. *, ** and *** indicate statistical significance at 10, 5 and 1 percent, respectively. Year-dummy parameters are not presented.

The second regression is different from the previous model. It helps investigate the growth effects of policy variables that are not necessarily relevant for growth models and each policy variable is included separately. To mitigate any potential multicollinearity issues, the intensity and the

frequency proxies are included separately. The estimation strategy is the same as before, with GMM and MDE models.

Annex I. Table 2. Mauritania: Impact of Structural Policies on Climate Resilience		
Mauritania: Intensity (Fixed effects)		
	Droughts	Floods
Telecommunication		0.009**
Access to finance	0.026*	0.016**
Education		
Health		0.086**
Mechanization	-0.000**	0.000**
Electricity	0.114***	

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