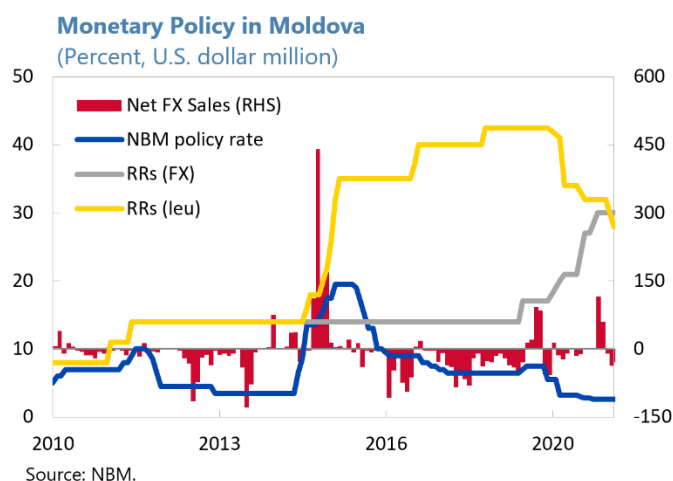


CHALLENGES OF IT IMPLEMENTATION IN LLMICS: A CASE STUDY OF MOLDOVA¹

The implementation of an inflation targeting (IT) regime in developing economies faces several practical challenges. Underdeveloped financial markets, limited cross-border capital mobility, high degrees of dollarization, and subpar lending opportunities constitute frictions in the transmission from policy rate changes to inflation. Moreover, foreign exchange interventions (FXIs)—often used to curb excessive exchange rate volatility—could reduce the effectiveness of the monetary transmission mechanism and undermine the credibility of the IT regime. This paper conducts an empirical study of the effectiveness of the monetary transmission mechanism (MTM) in Moldova ten years after implementing IT. It finds that the transmission mechanism in Moldova is active, but impaired by inadequate financial market development and frequent interventions in the FX market. Since the 2014 banking crisis, its effectiveness has further decreased due to a large structural liquidity overhang, lingering legacy of the banking fraud, and explosive growth of feebly regulated non-bank credit organizations. The paper proposes some policy recommendations to enhancing the MTM, including with respect to strengthening implementation of the recently developed FXI strategy.

A. Monetary Policy Frictions and Challenges

1. The National Bank of Moldova (NBM) formally adopted IT in 2013 after a three-year transition period. According to the NBM's Monetary Policy Strategy, its first objective is to keep inflation at 5 percent with a variability range of ± 1.5 percentage points, at a horizon of 18–24 months. Its secondary objective is to promote growth and employment. The policy rate is the official main instrument, which is transmitted through open market operations in the market for NBM certificates. The interest rates on the standing facilities establish a symmetric corridor at ± 3 percentage points around the policy rate. Other policy tools influencing monetary conditions are reserve requirements (RRs) and FXIs. Since 2020, FXIs are guided by a formal FXI strategy that specifies intervention criteria indicating disorderly market conditions and/or excess exchange rate volatility.



2. The IT regime was successful in reducing average inflation and inflation volatility, but doubts over the effectiveness of monetary policy transmission remain. After the introduction of

¹ Prepared by Julia Otten. Julia would like to thank Samuel Romero Martinez for excellent research assistance.

IT, both average inflation and inflation volatility fell substantially. Recent levels are well in line with a group of peer countries in the wider region (both low-income countries (LICs) and emerging markets (EMs)) that have also adopted IT frameworks over the last two decades. Yet, Moldovan authorities have expressed concerns about the effectiveness of the policy rate in steering inflation. This paper seeks to identify potential challenges and frictions in the MTM and provides some policy recommendations to enhance its effectiveness. It thereby identifies monetary transmission frictions that are present in many low-income and lower-middle-income countries (LLMICs) as well as some features unique to Moldova.

Average Inflation and Inflation Volatility in Moldova and Peer Countries

	Average inflation			Inflation volatility		
	2005-2009	2010-2014	2015-2020	2005-2009	2010-2014	2015-2020
Albania	2.7%	2.5%	1.7%	0.5%	0.9%	0.3%
Armenia	4.1%	5.4%	1.4%	3.1%	2.6%	1.7%
Georgia	7.7%	3.5%	4.1%	3.4%	4.4%	1.5%
Kazakhstan	10.3%	6.6%	7.8%	4.2%	1.2%	3.5%
Romania	6.8%	4.1%	1.7%	1.7%	2.0%	2.4%
Russia	11.4%	7.0%	6.2%	2.1%	1.3%	4.8%
Serbia	...	6.9%	1.8%	...	3.3%	0.7%
Ukraine	15.3%	6.0%	16.6%	6.1%	5.5%	16.3%
Average EMs*	7.2%	5.2%	3.5%	2.5%	2.2%	2.1%
Kyrgyz Rep.	10.4%	8.4%	3.2%	8.3%	5.2%	2.7%
Tajikistan	11.7%	7.3%	6.5%	5.6%	3.0%	1.7%
Uzbekistan	14.7%	2.2%
Average LICs	11.0%	7.8%	8.1%	6.9%	4.1%	2.2%
Moldova	10.0%	5.9%	5.7%	5.6%	1.5%	2.4%

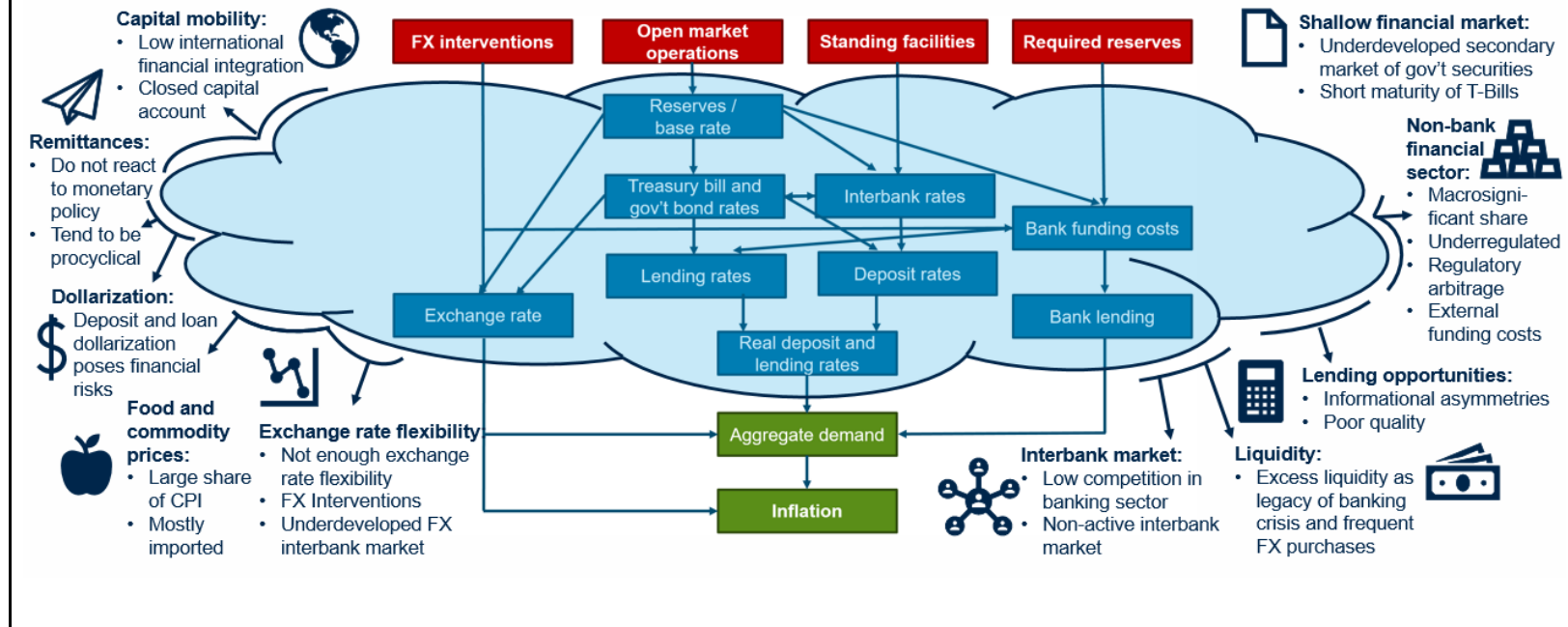
Source: Haver Analytics and IMF staff calculations.

Notes: Average inflation is computed as the average of monthly year-on-year CPI inflation. Inflation volatility is the standard deviation of annual year-on-year CPI inflation.

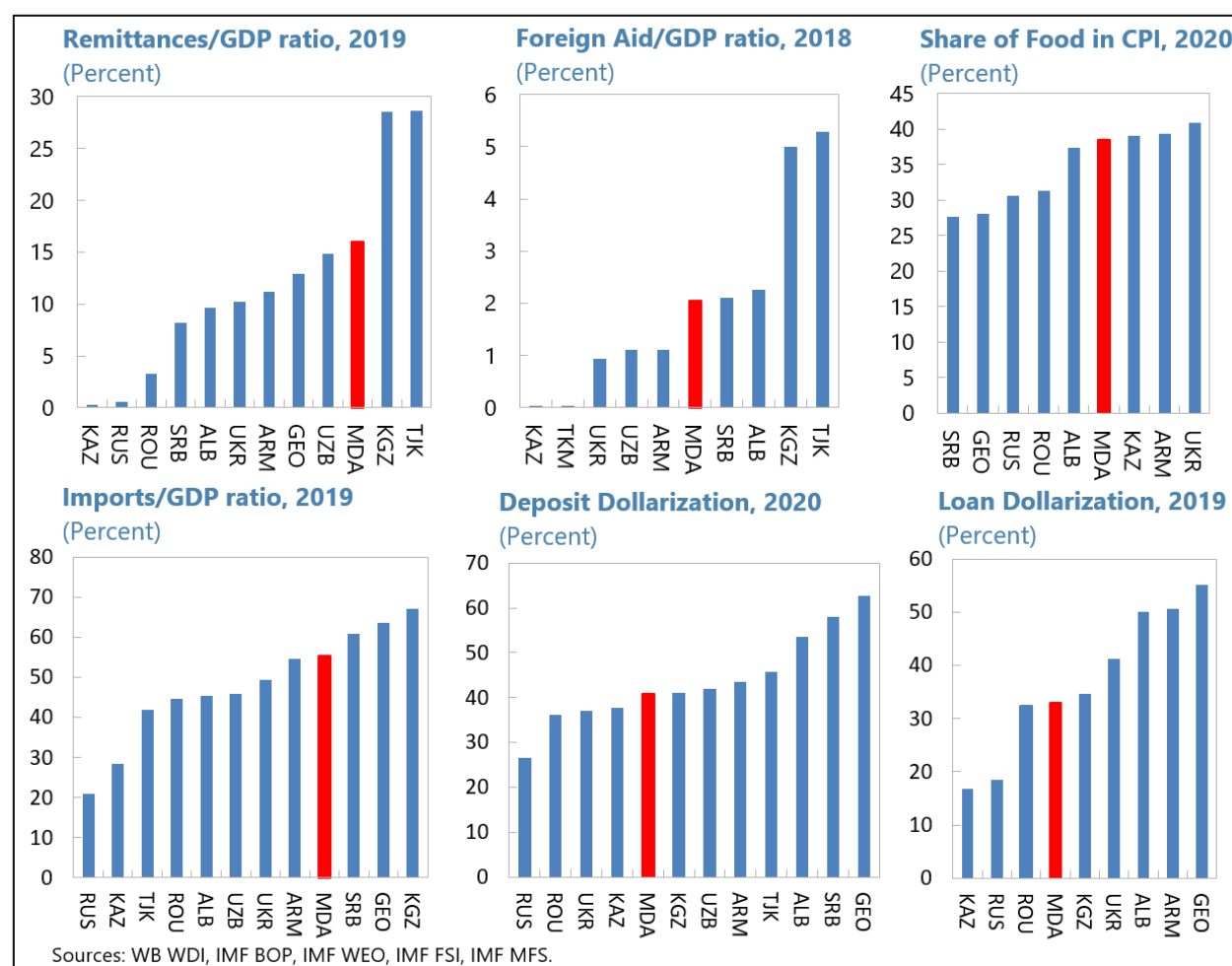
* Average excludes Ukraine.

3. The effectiveness of the MTM in many LLMICs is threatened by several frictions and impediments. Mishra et al. (2010) argue that the typically weak financial market development in LLMICs reduces the effectiveness of the asset channel, while ineffective central bank communication and a high degree of financial illiteracy impedes the expectations channel. Policy rate changes can therefore only be expected to transmit to inflation through the interest rate channel, the credit channel, and the exchange rate channel. Yet, also the effective transmission via these remaining channels depends on several conditions that are often not met in LLMICs. The interest rate channel rests on pass-through of policy rate changes to changes in market rates through various arbitrage conditions that rely on deep and well-developed securities and interbank markets. Transmission of policy rate changes to changes in loan supply (the credit channel) is contingent on a well-regulated and competitive financial sector with high-quality and transparent lending opportunities. Finally, a functioning exchange rate channel depends on an open capital account and a freely floating exchange rate. The following empirical evidence points to several frictions that are likely to disrupt the MTM in Moldova.

Figure 1. Frictions in Monetary Transmission



4. Supply shocks and remittances limit the scope of stabilization policies. Like many other LLMICs, Moldova features a high share of food and energy in its consumer price index (CPI), making it prone to supply shocks. In 2020, the share of food stood at almost 43 percent, a high value even relative to the group of peer countries. An additional factor that restricts the scope of stabilization policies are significant remittances inflows (around 16 percent of GDP) and foreign aid (2 percent of GDP). (See also Box 1.) Both influence domestic demand in an acyclical fashion and are not responsive to monetary policy.

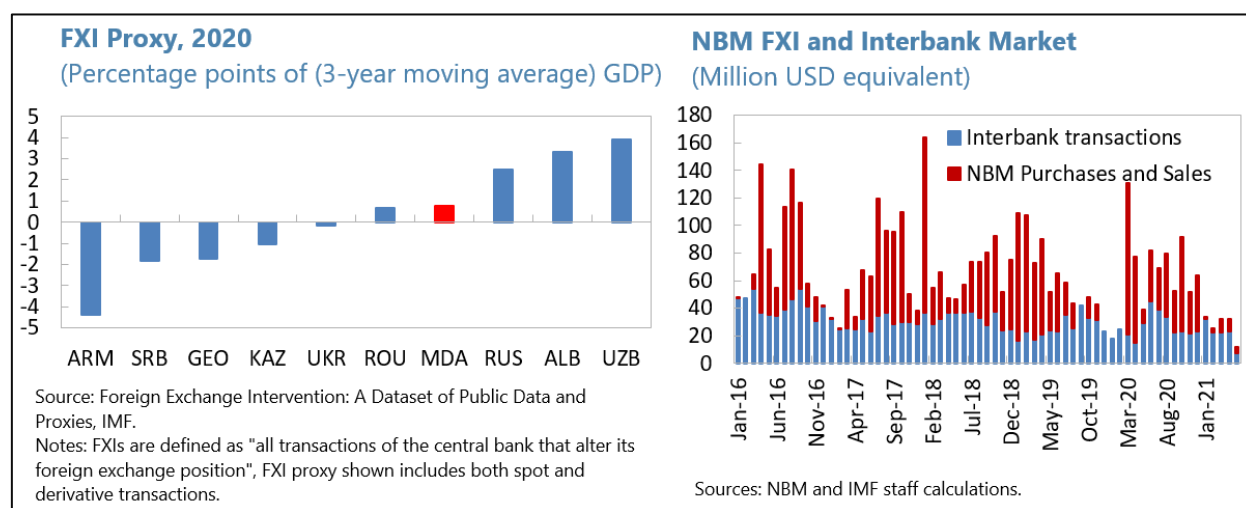


5. Exchange rate swings affect import prices and the valuation of partially dollarized domestic debt, inducing “fear of floating” and continuing interventions in the FX market on the part of the NBM. The Moldovan economy is sensitive to exchange rate swings in either direction. Dollarization has decreased over the years and is at medium levels compared to other countries in the region (standing at 33 percent for loan and 41 percent for deposit dollarization).²

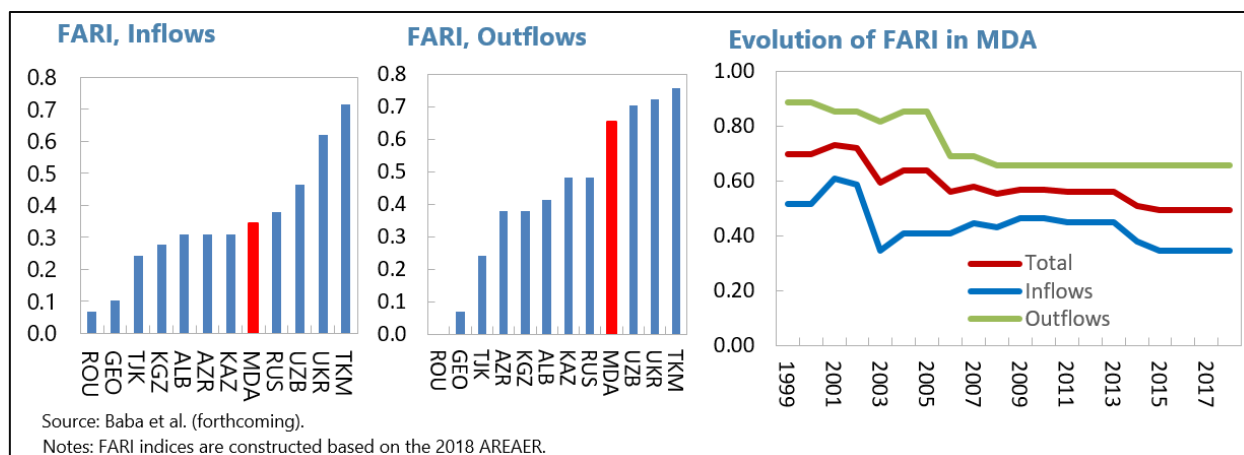
² When banks accept dollar deposits from domestic residents, they assume foreign exchange risk, and they often give dollar loans to domestic firms to reduce currency mismatches on banks’ balance sheets. Domestic firms, however, usually receive the largest part of their income in domestic currency, so they are at the risk to default on dollar debt in the event of a large depreciation.

Together with an import share of 55 percent of GDP, this makes Moldova vulnerable to sharp depreciations. On the other hand, an appreciation of the exchange rate, that is currently assessed to be moderately overvalued, weakens export competitiveness. The combination of a high degree of trade openness and dollarization levels explain why most central banks in LLMICs, even those with IT frameworks like the NBM, have some fear of floating and often use FXIs to limit excess exchange rate volatility.

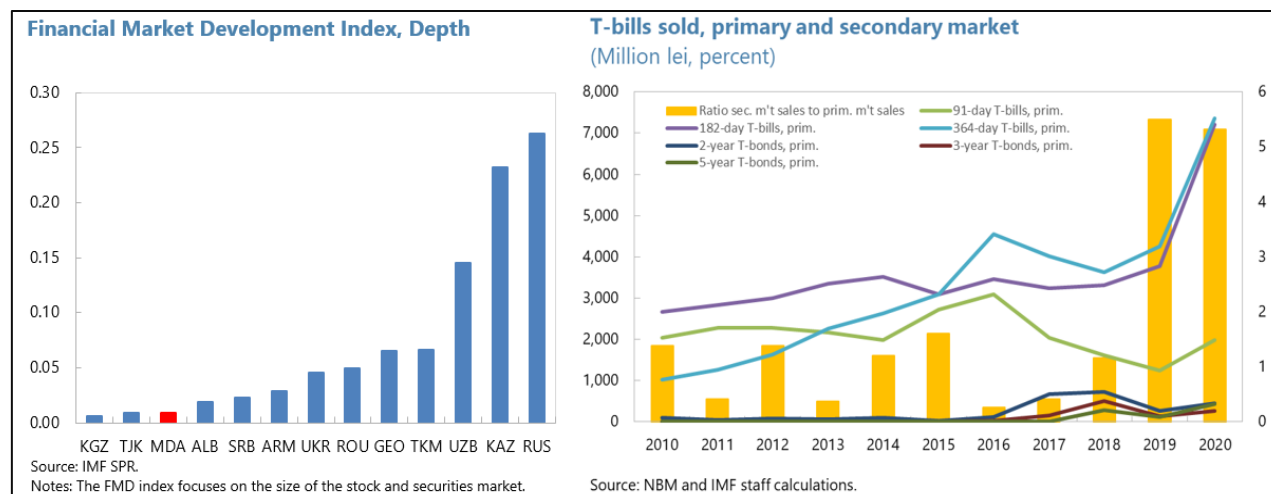
6. The NBM continues to have a sizeable footprint in the FX market and intervenes frequently, which might impair the exchange rate channel. Benchmarking it to other central banks in the peer group, NBM's footprint in 2020 seems moderate, but a comparison of the volume of NBM's interventions and interbank transactions shows that NBM's footprint was large in most months. There are only a few months with no or only minor interventions. NBM's heavy presence in the FX market suggests that the exchange rate is managed to some degree, which might reduce the effectiveness of the exchange rate channel of the MTM.



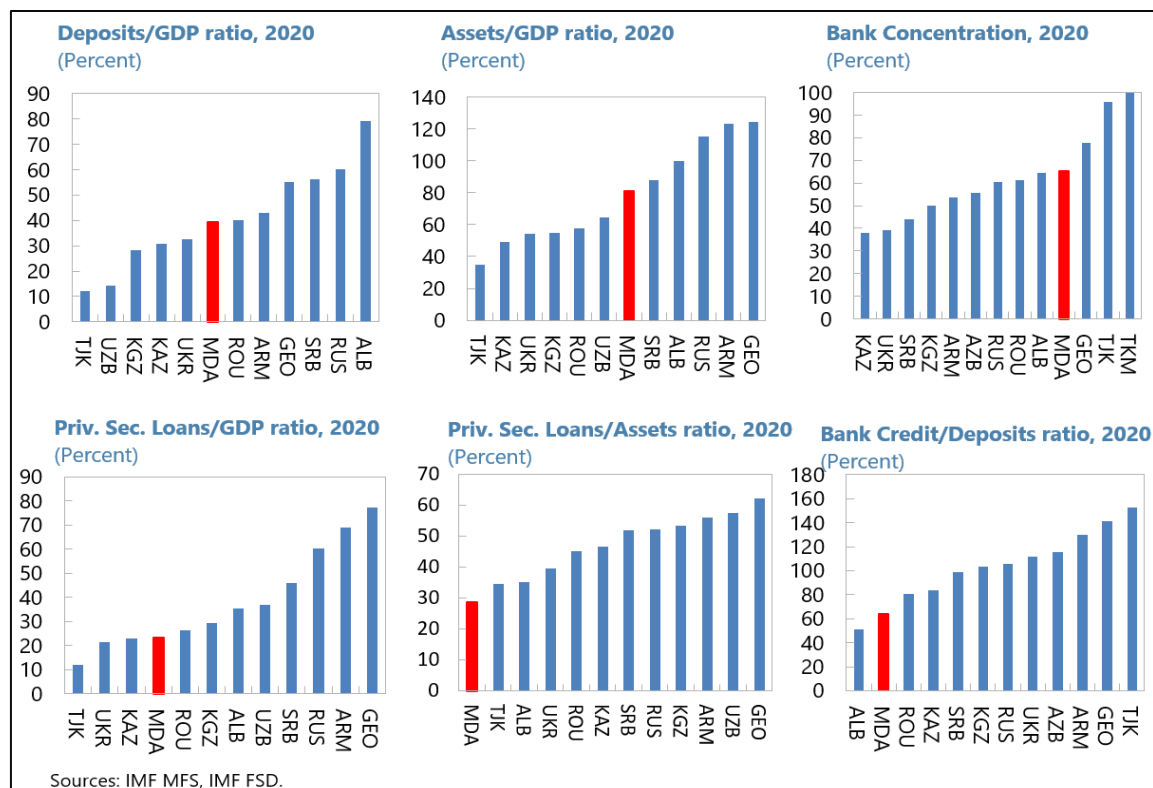
7. Despite some progress, the financial account remains restricted, potentially further impeding transmission via the exchange rate channel. Moldova's financial account remains restrictive, especially on the outflows side. The Financial Account Restrictiveness Index (FARI), based on the 2018 AREAER, indicates that restrictiveness on the inflows side is in line with peers, albeit substantially higher than in Advanced Economies. On the outflows side, the Moldova's financial account deemed very restrictive even compared to peer countries. Since capital cannot flow freely across borders, it is likely that arbitrage opportunities between returns on domestic and foreign assets cannot be eliminated in an efficient and timely way, which—together with frequent and large FXIs—might prevent the exchange rate from adjusting to policy rate changes.



8. The interbank market collapsed after the banking fraud and securities markets are shallow, possibly reducing transmission via the interest rate channel. Moldova's interbank market in local currency has been largely inactive and has completely dried up after the banking crisis. Lingering trust issues and reliable provision of liquidity by the NBM discourage banks from borrowing from each other. Even compared to its peer group, Moldova's stock and securities markets are extremely shallow. The size of the primary and secondary T-Bill markets increased over the last two years but remain small compared to peers. Shallow financial markets weaken arbitrage, and thereby potentially the interest rate channel.

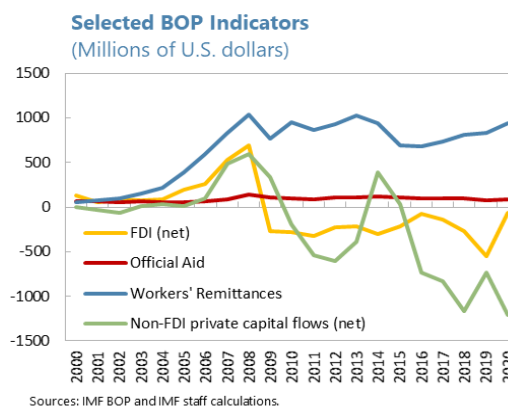


9. Subdued financial intermediation by banks might reduce the strength of the credit channel. Cross-country comparison shows that despite Moldova being in the middle range of peer countries in terms of banks capitalization, lending indicators are particularly low in Moldova, hinting to some frictions in the lending process. One important factor here might be high remittances inflows which tend to increase deposits, which is often, however, not matched by an equivalent growth in credit. (See Box 1.) Bank concentration is also at the higher end. These characteristics are likely to harm the credit channel, but might also reduce the effectiveness of the interest rate channel.



Box 1. Remittances and Monetary Transmission

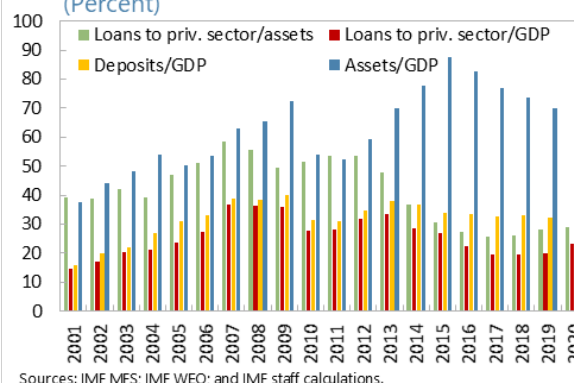
While beneficial to the individual recipients, the macroeconomic consequences of remittance inflows are ambiguous. Workers' remittance inflows into Moldova strongly increased in the 2000s and are by far the largest external inflow. A vast literature argues that remittances grow the tax base, enlarge fiscal space, and improve debt sustainability, but at the same time discourage fiscal discipline, erode the quality of institutions, and increase business cycle volatility. Furthermore, remittance inflows may complicate monetary policy through several channels that seem also to be operative in Moldova (Barajas et al., 2018).



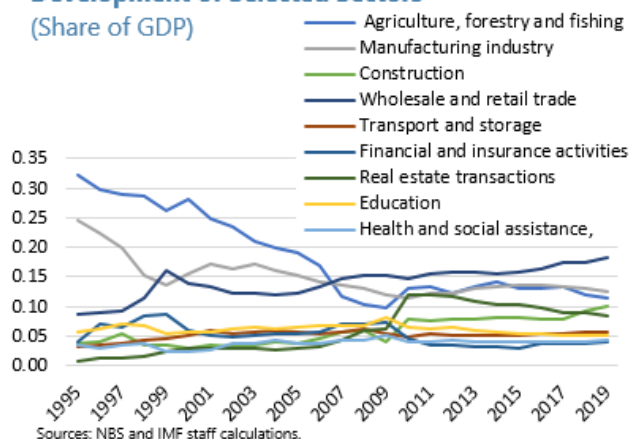
Box 1. Remittances and Monetary Transmission (continued)

Persistent remittance inflows can cause Dutch-Disease-like effects, appreciating the real exchange rate and weakening the competitiveness of the tradable sector, which might drive frequent and non-coordinated FX purchases. Barajas et al. (2012) document that countries with a large share of remittances experience symptoms that are similar to those of countries with vast natural resources. Remittance inflows allow for higher spending on both tradable and non-tradable goods, but since prices for tradables are set internationally, only non-tradable sector prices increase, expanding non-tradable supply and shifting resources from tradable to non-tradable production. The resulting increase in tradable sector wages can erode the sector's competitiveness, causing an increase in the real effective exchange rate (REER). The coincidence of an increase in remittance inflows, an expansion of the non-tradable sector, and an appreciation of the REER suggests that remittances tend to diminish competitiveness, which in turn might be associated with more prevalent FXIs and a weaker exchange rate channel.

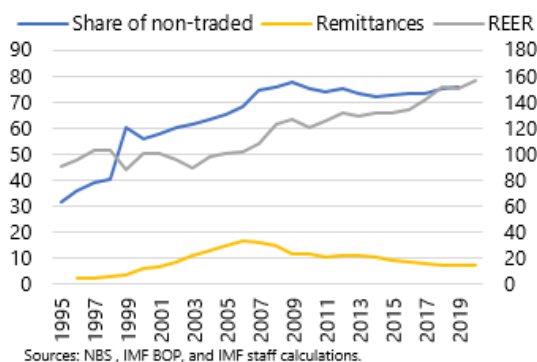
Selected Bank Indicators for Moldova
(Percent)



Development of Selected Sectors
(Share of GDP)

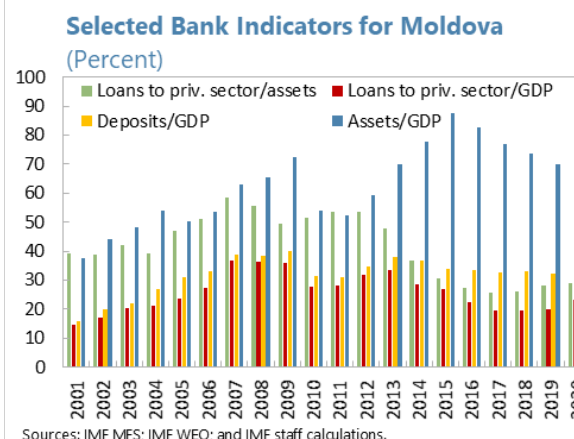


Share of Non-tradable Sector, Remittances and REER
(Percent of GDP, Index)

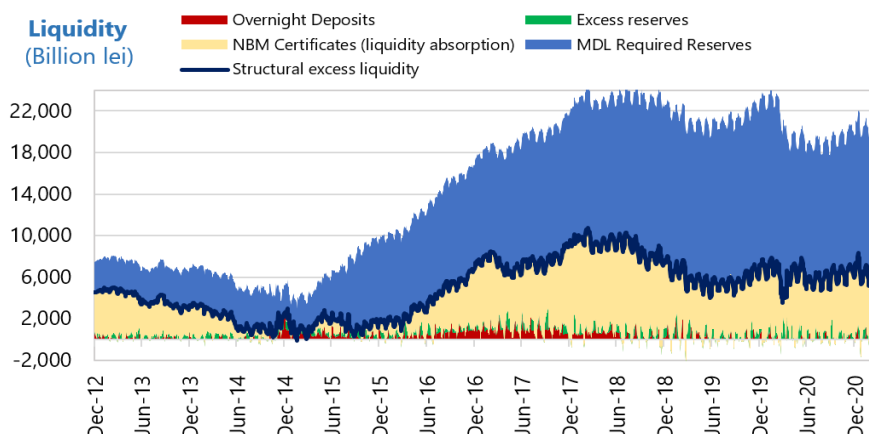


Box 1. Remittances and Monetary Transmission (concluded)

Remittances can also weaken the credit channel by curbing institutional quality and bank intermediation. Abdih et al. (2012) suggest that high remittance inflows are associated with a weak institutional environment, which might undermine the development of financial markets. Furthermore, remittances provide a stable inflow that is not sensitive to interest rates, narrowing the scope of monetary policy. Finally, while remittances increase bank deposits, they are often not matched by a one-to-one increase in credit to the private sector, generating excessive liquidity on banks' balance sheets, in turn reducing in the interbank market. In Moldova, the deposit-to-GDP ratio increased in the early 2000s and remained relatively stable since then, while loans indicators have been going down since the early 2010s. While the banking fraud was responsible for a large part of the decrease in credit to the private sector, high remittances inflows might have contributed to this development.

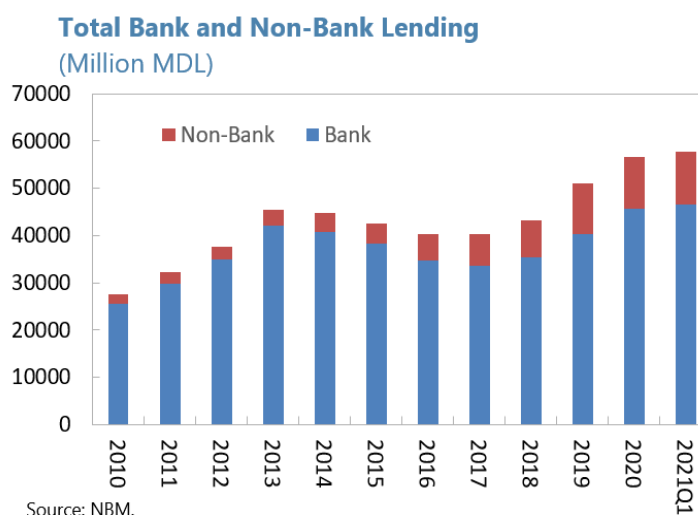


10. There is an excess liquidity overhang as a legacy of the 2014 banking fraud, which might deter banks from passing on policy rate changes to market rates and loan supply. All frictions and challenges mentioned so far pose difficulties and monetary policy trade-offs for most LLMICs, but there are also idiosyncratic factors in Moldova potentially harming transmission through the interest rate and credit channels. One important friction is the excess liquidity that the NBM injected into the financial system in the aftermath of the 2014 banking fraud, which has only partially been mopped up by increases in RRs. Excess liquidity continues to impair interbank lending and the pass-through of policy rate changes to changes in bank rates and loan supply. As credit to the economy continues to increase, liquidity slowly comes down, but a normalization of the liquidity situation is still a long way to go.



11. Regulatory arbitrage resulted in growth of externally funded non-bank credit organizations.

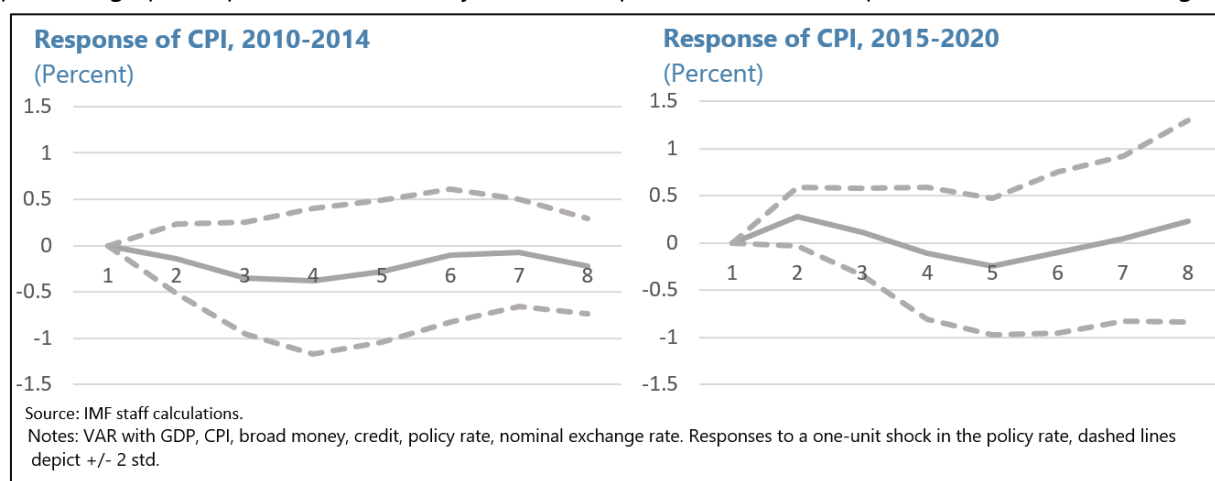
The non-bank financial sector started growing in the aftermath of the banking crisis, coinciding with a stricter regulation of the banking sector, while the non-banking sector remained largely underregulated, giving rise to regulatory arbitrage and predatory-lending practices. With non-banks predominantly being funded from abroad, domestic monetary policy can only marginally influence non-banks' lending conditions, again potentially reducing the scope of monetary policy.³



B. Empirical Analysis of the Monetary Transmission Mechanism

Overall Transmission

12. The effectiveness of the transmission of policy rate changes to inflation has weakened after the banking fraud. The empirical part of this paper starts by analyzing the general strength of the monetary transmission mechanism.⁴ Vector autoregression (VAR) allows to identify monetary policy shocks and to estimate the response of inflation to these shocks. The sample period, 2010–2020, is split into two subperiods to account for the clear structural break after the banking fraud became public. Although statistically insignificant, it appears that in the first subperiod, 2010–14, transmission to inflation was swift and solid: In response to an increase in the policy rate by one percentage point, prices decreased by around 0.4 percent after three quarters. After the banking



³ An additional factor that is beyond the scope of the NBM are regulated energy prices.

⁴ Details on data and methodology can be found in the technical annex.

fraud, the response of inflation weakened considerably, showing only a peak decrease of 0.2 percent after five quarters. In the following analysis, the focus will be on the effectiveness of different transmission channels to determine which channels are most impaired and what frictions are likely to be responsible.

Interest Rate Channel

13. For the interest rate channel, short-term transmission from the policy rate to market rates weakened after the banking fraud, while long-term transmission remains solid. The first channel to be analyzed is the interest rate channel, with a focus on its first leg (i.e., the transmission of the policy rate to deposit and lending rates, the money market rate, and the T-bill rate). First, Granger causality analysis indicates that direction of causation is correct: The policy rate affects money market, T-Bill, deposit, and lending rates, but not vice versa. Money market rates affect lending and deposit rates, but not vice versa. This suggests that there is reliable pass-through from the policy rate to market rates. Second, autoregressive distributive lag (ADL) regression analysis allows to estimate the size of the pass-through from the policy rate to market rates. The estimates provided in the table provide the short run and long run change of a given market rate in response to a one percentage point change in the policy rate. For example, between 2010 and 2014 a change in the policy rate by 100 basis points led to a change of the deposit rate by 6 basis points in the following month, and to a long-term change of 4 basis points. Short term pass-through to the lending rate was higher with 24 basis points. Short-term pass-through to money market and T-Bill rates was higher, with 48 and 60 basis points, respectively.⁵ After 2014, short-term pass-through from policy rate changes to market interest rates

Pairwise Granger Causality Tests

Null Hypothesis:	Probability
Money market rate does not Granger Cause deposit rate	0.02
Deposit rate does not Granger Cause money market rate	0.42
Policy rate does not Granger Cause deposit rate	0.00
Deposit rate does not Granger Cause Policy rate	0.53
Money market rate does not Granger Cause lending rate	0.24
Lending rate does not Granger Cause Money market rate	0.09
Policy rate does not Granger Cause lending rate	0.00
Lending rate does not Granger Cause Policy rate	0.60
Policy rate does not Granger Cause Money market rate	0.00
Money market rate does not Granger Cause Policy rate	0.60
Policy rate does not Granger Cause T-Bill rate	0.00
T-bill rate does not Granger Cause policy rate	0.85

Source: IMF staff calculations.

Notes: Monthly data from 2010M1 until 2020M12.

Effect of 1 Percent Policy Rate Change on Change In ...

		2010-14	2015-2020	2010-2020
Lending rate	ST	0.24	0.02	0.08
	LT	0.06	0.27	0.24
Deposit rate	ST	0.06	0.06	0.07
	LT	0.04	0.61	0.52
Money m't rate	ST	0.48		
	LT	1.01		
Tbill rate	ST	0.60***	0.04	0.21**
	LT	1.05	1.28	1.24

Source: IMF staff calculations.

Notes: * 0.01 < p ≤ 0.05, ** 0.001 < p ≤ 0.01, *** p ≤ 0.001.

Short term effect: $\hat{\gamma}$, Long term effect: $(\hat{\gamma} + \delta + \varepsilon)/(1 - \hat{\alpha} - \hat{\beta})$.

Money m't rate data is only available for 2010M1 to 2015M4.

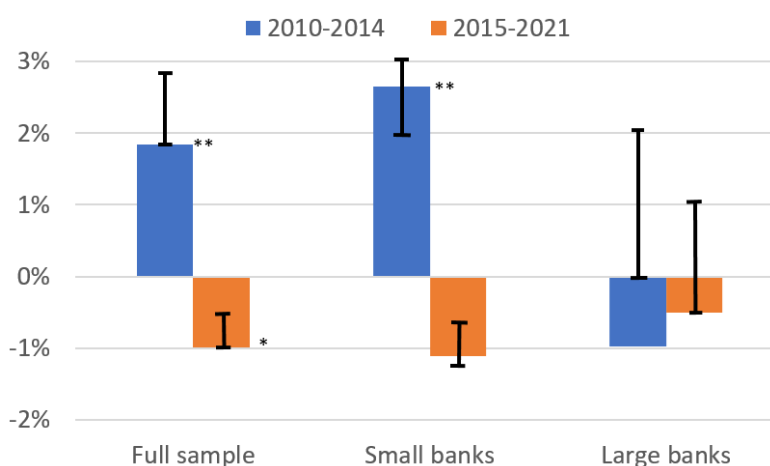
⁵ The fact that the interest rate channel was effective in Moldova prior to 2014, even though financial markets in general and the secondary securities market in particular were not very deep, is in line with recent evidence by Bulíř and Viček (2021). They find that the interest channel in LLMICs can be active when agents trade in "close-asset alternatives" with similar maturities, and arbitrage opportunities between different maturities are of secondary importance.

remained low, but long-term transmission improved. Note that results for the lending and deposit rate are statistically insignificant and very sensitive to the sample period analyzed.⁶ Short-term pass-through to T-Bill rates has weakened considerably, while long-run transmission remained intact. Improvement in long-term transmission could be linked to slowly deepening financial markets. A possible cause for the persistent low short-term transmission might be the excess liquidity injected into the system, which, apart from diminishing the interbank market, means that banks are less compelled to immediately pass on interest rate changes.

Credit Channel

14. The bank lending channel was operative before the banking fraud but broke down after the crisis, likely caused by the injection of excess liquidity. Next, the credit, or bank lending, channel is analyzed which is defined as the effect of a change in the policy rate on banks' loans supply. A change in the policy rate constitutes a funding shock to liquidity-constrained banks, forcing them to adjust credit supply. While policy rate changes also bring about a change in demand, this effect is considered to be part of the second leg of the interest rate channel. Since demand and supply effects are difficult to disentangle in aggregate data, the method used in this paper relies on bank-level data on lending and liquidity. If the bank lending channel is active, liquidity constraints should be amplified during periods of tight monetary policy and vice versa, which would be indicated by a positive sum of coefficients on the interaction term of policy rate changes and a liquidity indicator and its lags. The analysis shows that this is the case for the first subperiod. Additional evidence for a stable bank lending channel in the first subperiod is the fact that the results are mainly driven by small banks that are most likely to be liquidity constrained. In the second subperiod, there is no evidence for an active bank lending channel, reflected by the negative sum of coefficients. The inactive bank lending channel is likely the

Sum of Coefficients on the Interaction Term



Source: NBM and IMF staff calculations.

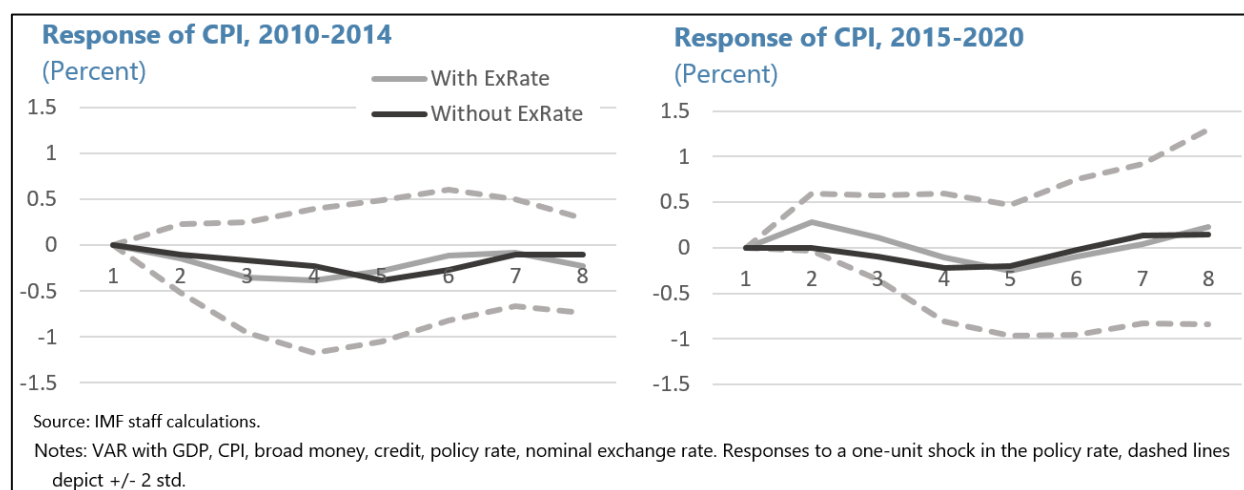
Notes: * $p \leq 0.1$, ** $p \leq 0.05$, *** $p \leq 0.01$. Whiskers indicate min and max of reasonable specifications of $\Delta \log(L_{it}) = \sum_{j=1}^5 \alpha_{tj} \Delta \log(L_{it-j}) + \text{time}_t + \beta B_{it-1} + \gamma Y_t + \sum_{j=0}^5 [\delta_{tj} \Delta \log M_{t-j} + \eta_{tj} B_{it-1} \Delta \log M_{t-j} + \theta_{tj} Y_t \Delta \log M_{t-j}] + \varepsilon_{it}$, following Kashyap and Stein (2000).

⁶ The analysis for 2009-2014 generates more significant results, which suggest a serious deterioration in short term pass-through to market rates, while long-term transmission remained intact.

result of the injection of liquidity and efforts to clean up the banking sector in the aftermath of the banking fraud.

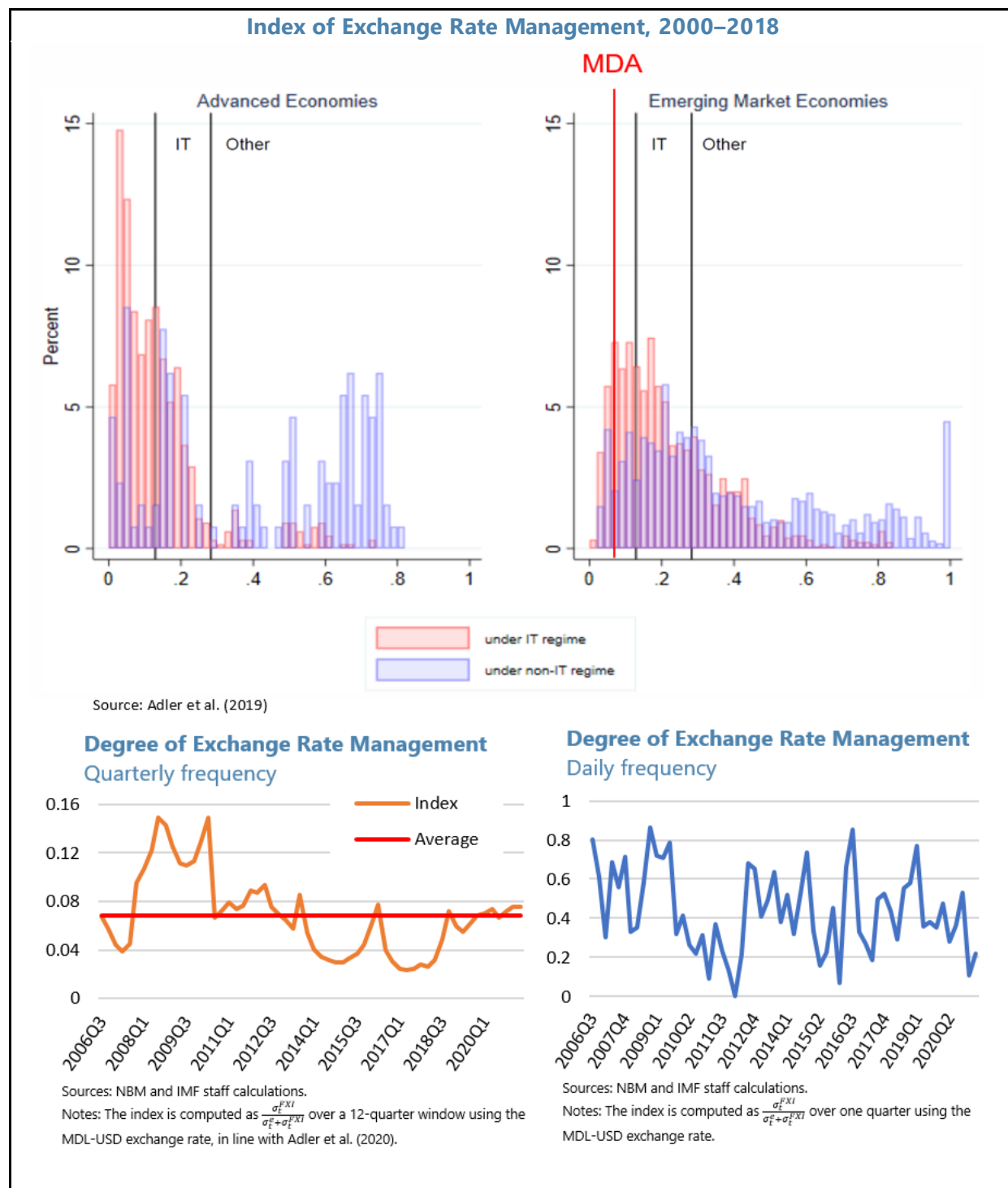
Exchange Rate Channel

15. Transmission via the exchange rate channel remains weak in light of low capital mobility and exchange rate management. The remaining channel to be analyzed is the exchange rate channel. Its role in overall monetary policy transmission is isolated by comparing the response of CPI to a monetary policy shock with and without including the exchange rate in the VAR. For both subperiods, the difference in impulse responses with and without the exchange rate are not substantially different, hinting at a generally weak transmission through the exchange rate channel, which reflects Moldova's restricted capital account. There are, however, important differences between the two subperiods. In the first subperiod, the response of CPI would be weaker and slower without the exchange rate, showing that the exchange rate channel was active, albeit with only a small impact. After 2015, the response of CPI would have been stronger without the exchange rate channel, suggesting that the exchange rate is effectively undermining transmission of the policy rate. In the following, the role of FXIs in damaging the exchange rate channel is analyzed.



16. The degree of exchange rate management in the medium term is moderate, but it is much higher at high frequencies, potentially harming warranted adjustments in the exchange rate. As mentioned in the beginning, there are features of the Moldovan economy that might justify a degree of exchange rate management to reduce excess exchange rate volatility. This should, however, not prevent warranted macroeconomic adjustments via the exchange rate, a trade-off that needs to be carefully evaluated and managed. To analyze whether NBM's FXIs take out too much of the exchange rate volatility, a simple index of exchange rate management at quarterly frequency is constructed. Cross-country comparisons indicate that Moldova's level of exchange rate management is moderate at quarterly frequency and is well in line with IT emerging economies. Constructing the same index with daily data, however, shows that the degree of exchange rate management is much stronger at higher frequencies compared to the lower frequency index. Part of this high-frequency

management is warranted and desirable, as it reduces excess volatility, but it might also reflect some over-management of lower frequency movements.



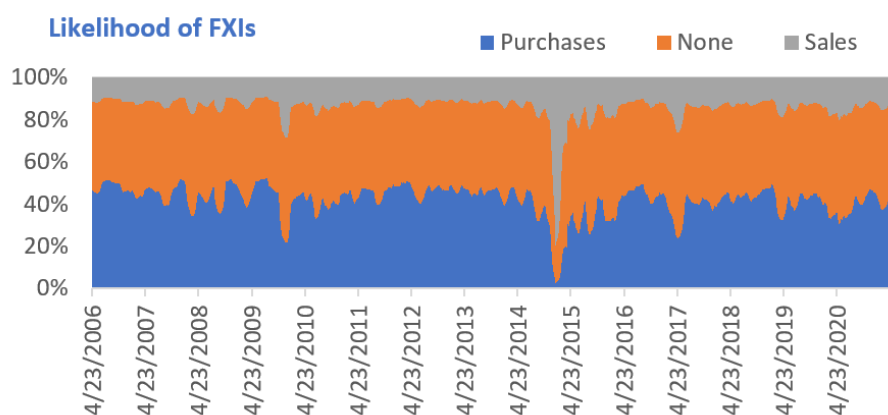
17. Exchange rate volatility is a more important driver of FXIs than low-frequency developments.

The next analysis investigates to what degree FXIs are driven by concerns about exchange rate volatility versus efforts to affect the

medium- and long-run level of the exchange rate. The latter would be in stark contradiction of NBM's commitment of a freely floating exchange rate. The analysis suggests that exchange rate deviations from its

medium-term level play only a minor role for FXIs, while exchange rate volatility is the dominant driving force for most of the time. This confirms the previous findings that the NBM does not seem to attempt to manipulate the medium and long run development of the exchange rate, but rather reacts to high-frequency movements. Using the regressors to estimate the time-variant likelihood of interventions shows

that, on average over the whole sample, the likelihood of purchases is about 40 percent, the likelihood of no intervention 45 percent, and the likelihood of sales 15 percent for a given week. In crisis times, the likelihood of FX sales increases.

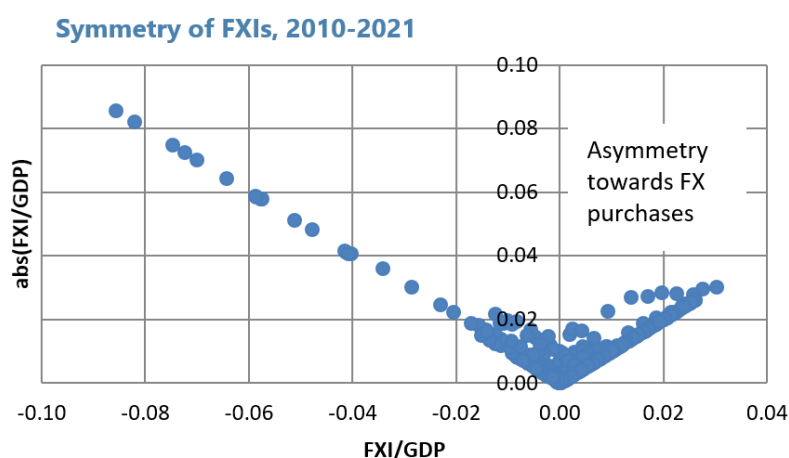


Source: IMF staff calculations.

Notes: Ordered logit model following Poghosyan (2020).

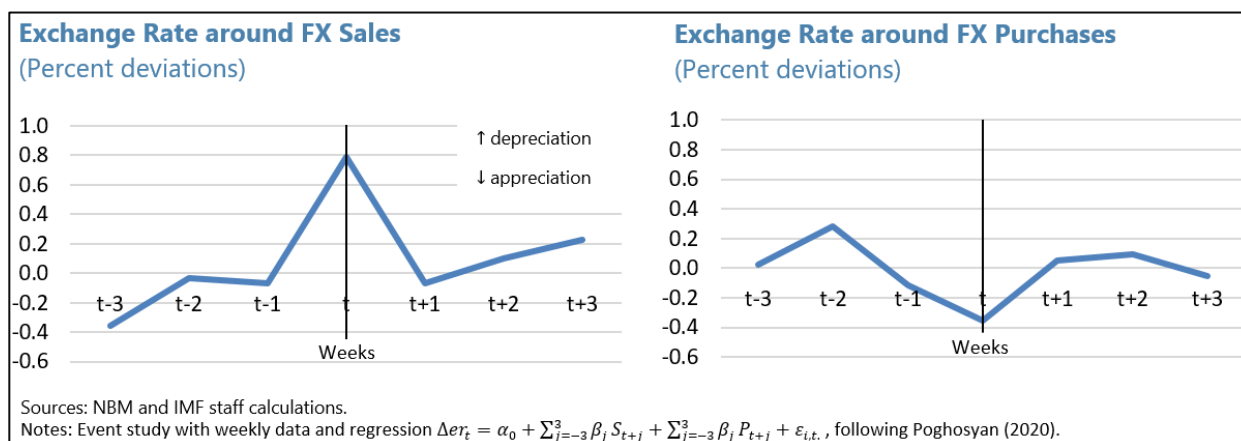
18. NBM's FXIs are tilted towards purchases ("one-sided leaning-against-the-wind"), except for few large sales, standing in the way of two-way flexibility of the exchange rate.

Weekly intervention data shows that NBM purchases much more often than it sells, while the average purchase volume is smaller than the average sale volume. This suggests that NBM tolerates more volatility on the depreciation side than on the appreciation side, but only to the point where a large depreciation looms that would threaten partially



Sources: NBM and IMF staff calculations.

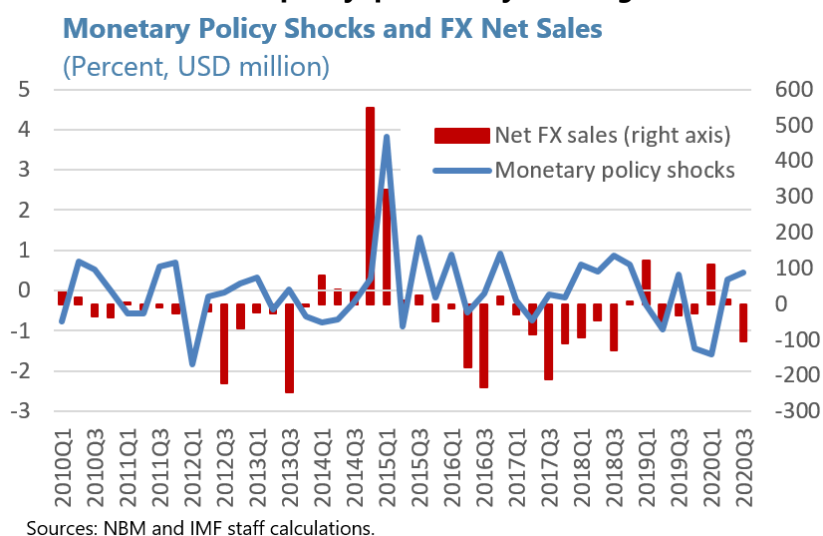
Note: Weekly data.



dollarized balance sheets. An event-window analysis around the time of the intervention shows that FXIs are effective in changing the path of the exchange rate into the desired direction. The analysis averages over the evolution of the exchange rate over a period three weeks before and three weeks after an intervention. FX purchases happen in weeks after the exchange rate appreciates relative to the average by about 0.3 percent. Starting from the week of the purchase, the difference comes down and becomes not different from zero. FX sales, in contrast, occur in weeks after exchange rate depreciates relative to average by about 0.8 percent. After the intervention, the difference comes down, being not different from zero. Here the asymmetry of NBM's FXIs becomes apparent in that it requires a smaller appreciation to prompt an intervention than the average depreciation that leads to an intervention. Starting from the week of the sale, the difference relative to normal periods comes down and becomes not different from zero. This suggests that FXIs are successful in influencing the exchange rate, at least in the very short term. Continuing one-sided interventions can be expected to have more permanent effect. This "one-sided leaning-against-the-wind" strategy might reflect NBM's preference for higher reserve adequacy and the assessment that the currency is moderately overvalued. It bears, however, the danger of preventing the exchange rate from appreciating when monetary policy is tightened, thereby blunting interest rate policy.

19. FXIs are not always aligned with interest rate policy, potentially harming transmission of policy rate changes.

FXIs that are well coordinated with interest rate policy should foster appreciation (depreciation) in times of policy rate increases (decreases), or at least not stem against exchange rate adjustments by pushing in the opposite direction. The plot below shows that this was the case for the crisis years of 2015/16 when a sharp increase

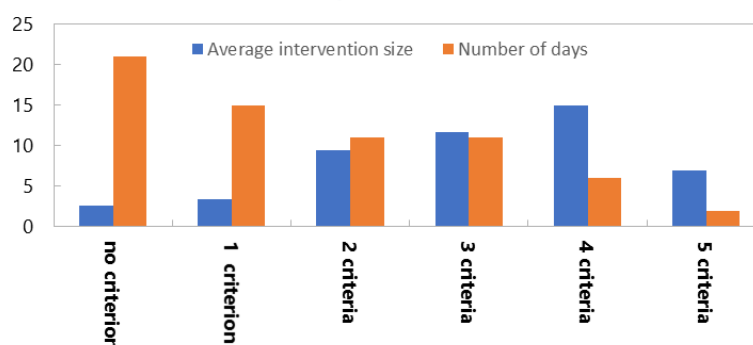


in the policy rate was accompanied by large FX sales, stemming against depreciation, and thereby fostering monetary tightening. However, for most part of the period from 2010–2020, FXIs were not coordinated with interest rate policy, and sometimes even actively countering it. For example, in 2017/18 NBM was increasing policy rates while at the same time purchasing FX, thereby preventing an appreciation of the exchange rate. Here, the tightening effect of policy rate changes on inflation might have been impaired by inflationary pressures caused by FXIs not allowing the exchange rate to appreciate (sufficiently) as well as additional liquidity brought about by only partially sterilized FXIs. Hence, FXIs actively stemming against exchange rate adjustments in response to changes in the policy rate weaken the exchange rate channel of monetary transmission, or even work against the other monetary transmission channels, and thereby seriously reduce the effect of policy rate changes on inflation, in line with the VAR analysis.

20. Since 2020, FXIs are guided by a formal intervention strategy to increase two-way exchange-rate flexibility, which has been broadly followed. In 2020, NBM adopted a FXI strategy

to foster two-way exchange-rate flexibility.⁷ The strategy specifies several intervention criteria specifying disorderly market conditions and excess exchange rate volatility. If at least one of these criteria is fulfilled, the NBM can justify an intervention in the FX market. The evaluation of daily intervention data suggests that the strategy was broadly followed. There were some days when no intervention criterion was satisfied, and yet NBM decided to intervene, albeit with very small volumes.⁸ But most interventions happened on days when at least one criterion was satisfied. As expected, the more intervention criteria were fulfilled, the larger the average intervention size, since the number of fulfilled criteria proxies the degree of market turmoil.

Number of Intervention Days When X Intervention Criteria Were Fulfilled and Average Intervention Size
(Number, Million USD equivalent)



Source: NBM and IMF staff calculations.

Note: Period under consideration is Jan 1 2020 - August 26 2021.

⁷ The strategy has been developed with the IMF's MCM department.

⁸ NBM reports that some of these interventions happened preemptively (i.e., to prevent an expected future market turbulence).

Box 2. International Experience with FXIs in IT Frameworks

Many LLMICs with IT regimes use FXIs to curb excess exchange rate volatility. As illustrated in Section A, many LLMICs have high levels of dollarization (often in the presence of currency and/or maturity mismatches) and trade openness, making excess exchange rate movements costly. At the same time, many of these countries have adopted IT, which, in theory, requires a fully floating exchange rate. The following two examples illustrate how FXIs can coincide with an IT regime in practice:

Peru's FXI strategy was broadly successful in guarding its highly dollarized economy from exchange-rate-related financial risk, while reducing dollarization over time. In 2002, the Central Reserve Bank of Peru (CRBP) adopted a hybrid framework that combines IT with a managed float and a long-term national de-dollarization strategy. This framework shields the originally highly dollarized economy from excessive exchange rate swings using sterilized FXIs, and reduced dollarization (coming down to 26 and 35 percent of loan and deposit dollarization, respectively, at the beginning of 2021, from over 60 and 70 percent, respectively at the beginning of the 1990s).¹ Lower dollarization levels allowed to gradually reduce the size and frequency of FXIs, which are supposed to strike a balance between smoothing exchange rate volatility to limit detrimental balance-sheet effects and allowing for sufficient volatility to incentivize agents to internalize exchange rate risk and the cost of dollarization. Still, interventions came at the cost of more constrained financial development (e.g., low credit-to-GDP ratio and limited FX hedging instruments).

- Ukraine's recent IT framework has been combined with a FXI strategy from the start.** The National Bank of Ukraine (NBU) adopted IT only in 2016 (later than many other countries in the region), so building up credibility for the new framework is crucial. Since the NBU faces many of the same economic challenges as the NBM (high remittances, high shares of food and energy in CPI, relatively high dollarization), the Ukrainian example is particularly instructive for Moldova. From the beginning, the IT regime has been complemented by a FXI strategy that specifies three objectives justifying (fully sterilized) FXIs: (i) accumulating international reserves; (ii) smoothing out excess exchange rate volatility; and (iii) supporting the transmission of the policy rate "when it is not efficient enough". That is, the NBU specifies FXIs as an additional monetary policy instrument that may be used to support the transmission of the policy rate.³

International experience shows that IT systems can coexist with limited use of FXIs if their scope is narrowly defined and targeted to country characteristics, but it can entail considerable costs in terms of hindering market development and undermining central bank credibility. Recent research shows that the use of FXIs is only warranted if there are currency mismatches and FX markets are shallow.² In this context, countries with high levels of dollarization might want to intervene to ensure financial stability during the transition phase to lower dollarization levels. However, as FXIs can encourage moral hazard by protecting market participants from exchange rate fluctuations, disincentivizing hedging or addressing currency mismatches, their use should be limited. FXIs also pose the risk to undermine the credibility of the policy rate as the main monetary policy tool, which is particularly relevant for central banks that have moved recently to an IT framework. Establishing a credible FXI strategy is crucial to minimize this risk.

¹ Armas et al. (2015) cite four main risks of financial dollarization for monetary policy: (i) balance sheet effects of large exchange rate depreciations; (ii) high exchange rate pass-through to prices; (iii) high exchange rate volatility; (iv) high pass-through of foreign to domestic interest rates.

² See Grui and Lepushynskyi (2016).

³ See Adrian et. al. (2020) and Basu et al. (2020).

C. Policy Recommendations

21. It is crucial to strengthen the IT framework's credibility and policy consistency. Staff emphasizes that the policy rate should always be NBM's primary instrument to achieve its inflation target. If additional instruments are used, be it RRs for liquidity management or FXIs to counter disorderly FX market conditions, they need to be coordinated with the policy rate, so as not to undermine the credibility and effectiveness of the IT regime. NBM should improve its communication with the public, both with regards to the general outlook and objectives as well as to the instruments used to achieve them. Thereby the development of well-anchored inflation expectations is fostered, which will ultimately improve the MTM.

22. Going forward, NBM's presence in the FX market should be gradually reduced to facilitate external adjustment and improve transmission through the exchange rate channel.

The empirical analysis has shown that there are three factors associated with large and frequent FXIs that potentially harm monetary transmission, especially in periods of monetary tightening. First, persistent and one-sided FXIs might prevent the exchange rate from appreciating when the policy rate is hiked, reducing the tightening effect of policy rate changes on inflation. Second, at the same time, the increase in liquidity associated with FX purchases might put further upward pressure on inflation. Third, the conflicting signal from FX purchases when interest rate policy is tightened poses the danger of blurring NBM's messaging and undermines the credibility of the IT regime. Staff assesses that the new FXI strategy is an integral part of following an exchange rate strategy that is consistent with the IT regime. The Covid-crisis-induced FX market volatility, and consequent FXIs, complicate the assessment of the FXI strategy's success in reducing NBM's footprint in the FX market. However, the most recent data suggests that NBM seems to be continuing the positive trend from the beginning of 2020 in reducing its footprint in the FX market. Going forward, there should be an evaluation as to whether the parameterization of the strategy could be improved, with the objective of gradually improving exchange rate flexibility. Staff also assesses that NBM should communicate the main objectives of the strategy to banks, so banks can make informed risk-pricing decisions. At the same time, it is important to foster development of the FX market, which should further improve the pricing of exchange rate risks, and in particular the development of hedging instruments. Given that the capital account is still less open than in peer countries, limiting the ability of the exchange rate to act as a shock absorber, a review of FX market liberalization policies should identify and eliminate potential obstacles. Finally, there should be a national de-dollarization strategy to limit balance sheet exposure to exchange rate shocks and. (See Box 2.)

23. Facilitating financial market development and reducing excess liquidity is essential to foster transmission via the interest rate and credit channels. To foster lending to households and small and medium enterprises without compromising financial stability, reforms in both bank and non-bank financial sector should be advanced. It is crucial to safeguard progress in reforming the banking sector and continued progress in financial sector reforms. To eliminate opportunities of regulatory arbitrage of non-bank financial institutions (NBFIs) and ensure financial stability, it is important to strengthen regulation and supervision. Thereby, it is crucial to address risks and increase consumer protection without depriving NBFIs' customers of access to lending. The

forthcoming transfer of supervision from NCFM to NBM allows leveraging NBM's expertise in this area. A strategy to foster financial inclusion and capital market development should be an important pillar in broadening the financial sector's customer base, and thereby widening NBM's scope of action. As credit to the economy grows and excess liquidity is reduced to more normal levels, a normalization of RRs to reduce banks' funding costs should follow. With reduced excess liquidity, it is also important to move away from the passive full-allotment system and towards a proactive liquidity forecasting and management system. In that regard, also the strengthening of the budgetary liquidity and debt management procedures and promoting development of domestic securities should be priorities.

Annex I. Technical Annex

A. VAR Analysis of the Transmission of the Policy Rate to Inflation

1. The VAR analyses on pages 10 and 13 use quarterly data from 2010Q1 through 2020Q3 of the policy rate, GDP, CPI, broad money, credit to the economy, and the nominal MDL-USD exchange rate.
2. Vector Autoregressions (VARs) describe the dynamics of a set of variables imposing minimal structure on the data. They are dynamic systems of equations where the current value of each variable depends on its past values as well as contemporaneous and past values of all other variables in the system, as captured by

$$Y_t = A_1 Y_{t-1} + \dots + A_p Y_{t-p} + u_t,$$

where Y_t is an $n \times 1$ vector of variables at time t , A_1, \dots, A_p are $n \times n$ coefficient matrices, and u_t is an $n \times 1$ vector of residuals with a variance-covariance matrix $E[u_t u_t'] = \Omega$. Estimating this reduced-form system of equations yields residuals u_t and allows forecasting the variables of interest, but it does not provide an estimate of the response of the system to an isolated shock in one of the variables, since reduced-form shocks affect more than one variable. Thus, additional structure is needed to identify structural shocks to one variable in isolation, i.e. to derive shocks with an economic interpretation as e.g. shocks to the policy rate. To that end, the reduced-form system of equations is rearranged in the following way

$$Y_t = B_0 Y_t + B_1 Y_{t-1} + \dots + B_p Y_{t-p} + \varepsilon_t,$$

where, B_0, B_1, \dots, B_p are $n \times n$ coefficient matrices with $A_0 = (I - B_0)^{-1}$ and $A_i = A_0 B_i$ for $i = 1, \dots, p$, and ε_t is a vector of structural shocks with a variance-covariance matrix $E[\varepsilon_t \varepsilon_t'] = I$. It therefore holds that residuals and structural shocks are related in the following way: $u_t = A_0 \varepsilon_t$, and $\Omega = A_0 A_0'$. That is, if matrix A_0 is known, structural shocks can be backed out from residuals. $n(n+1)/2$ additional restrictions required to uniquely identify A_0 . This paper uses Cholesky ordering, assuming that monetary policy shock affects variables in the following order: exchange rate, interest rate, broad money, CPI, GDP. Under these assumptions, impulse responses to identified monetary policy shocks can then be derived from $Y_t = [I - A(L)]^{-1} A_0 \varepsilon_t$.

B. Interest Rate Pass-through / ADL and Granger Causality Analysis

3. The interest rate channel analyses on page 11 use monthly data of the policy rate, deposit rate, lending rate, money market rate, and T-Bill rate from 2010M1 to 2020M12.
4. The pairwise Granger causality analysis uses two lags and is conducted for each of the relevant pairs of variables. The table on page 11 shows probabilities for the joint hypothesis

$$\beta_1 = \beta_2 = \dots = \beta_k = 0,$$

where the coefficients come from the following bivariate regressions

$$y_t = \alpha_0 + \alpha_1 y_{t-1} + \dots + \alpha_k y_{t-k} + \beta_1 x_{t-1} + \dots + \beta_k x_{t-k} + \varepsilon_t$$

$$x_t = \alpha_0 + \alpha_1 x_{t-1} + \dots + \alpha_k x_{t-k} + \beta_1 y_{t-1} + \dots + \beta_k y_{t-k} + u_t.$$

For example, in the first row of the Granger analysis table on page 11, the hypothesis that the deposit rate does not Granger cause the policy rate cannot be rejected, but the hypothesis that the deposit rate does not Granger cause the policy rate can be rejected. These results suggest that Granger causality runs one-way from the money market rate to the deposit rate and not the other way.

5. An Autoregressive Distributive Lag (ADL) model (see e.g. Mishra et al., 2010) is then estimated for every relevant pair of variables of interest

$$\Delta x_t = \alpha \Delta x_{t-1} + \beta \Delta x_{t-2} + \gamma \Delta y_t + \delta \Delta y_{t-1} + \varepsilon \Delta y_{t-2} + \eta_t.$$

The short term-effect is given by the estimate of coefficient, $\hat{\gamma}$, and the long-run effect is given by the ratio of the following estimated coefficients: $(\hat{\gamma} + \delta + \varepsilon)/(1 - \hat{\alpha} - \beta)$.

C. Credit Channel Analysis

6. The credit channel analysis on page 12 uses monthly bank-level data from 2010M1 to 2021M1 on lending volumes and liquid-assets-to-total-assets ratio for 11 banks (balanced panel).

7. The advantage of a microeconometric approach, relative to a macroeconometric one, is that it allows to isolate the effect of a monetary policy shock on credit supply by analyzing the effects of (excess) liquidity at the bank level. To this end, the following pooled regressions are estimated

$$\begin{aligned} \Delta \log(L_{it}) = & \sum_{i=1}^5 \alpha_{tj} \Delta \log(L_{it-i}) + time_t + \beta B_{it-1} + \gamma Y_t \\ & + \sum_{j=0}^5 [\delta_{tj} \Delta \log M_{t-j} + \eta_{tj} B_{it-1} \Delta \log M_{t-j} + \theta_{tj} Y_t \Delta \log M_{t-j}] + \varepsilon_{it} \end{aligned}$$

where L_{it} is lending volume, B_{it-1} is the ratio of liquid assets to total assets (capturing (excess) liquidity and balance sheet strength), M_t is the policy rate, and Y_t is a business cycle indicator (see Kashyap and Stein, 2000). The idea is that an expansionary monetary policy shock should lead to a reduction of credit-constrained banks if the bank lending channel is active. This would be reflected by a positive sum of coefficients on the first interaction term and its lags.

D. FXI Analyses

8. The FXI analyses on pages 13-16 use weekly data of NBM FX sales and purchases as well as the nominal MDL-USD exchange rate. It is aggregated from daily data.

9. The index to capture the degree of exchange rate management is computed as $\sigma_t^{FXI} / (\sigma_t^{FXI} + \sigma_t^E)$, where σ_t^{FXI} is the standard deviation of FXIs and σ_t^E is the standard deviation of the exchange rate. For the index at quarterly frequency, weekly data are aggregated to quarterly frequency and then a 12-quarter rolling window is used to compute the standard deviation of FXIs and the exchange rate. For the index at daily frequency, the standard deviation of daily data over one quarter is computed for both FXIs and the exchange rate.

10. An ordered logit model is estimated to assess the determinants of FXIs (see e.g. Poghosyan, 2020). Two variables drive the probability to intervene in the exchange market: er_t is the percentage deviation of the exchange rate at time t from its average in a 12-week rolling window centered around period t . vol_t is a proxy for volatility that measures the standard deviation of the exchange rate in a 12-week moving window centered around period t . The empirical specification takes the following form

$$y_t^* = \alpha + \beta er_t + \gamma vol_t + \varepsilon_t$$

with

$$P(y_t = \text{"FX purchase"}) = P(y_t^* \leq \kappa_1)$$

$$P(y_t = \text{"No intervention"}) = P(\kappa_1 \leq y_t^* \leq \kappa_2)$$

$$P(y_t = \text{"FX sale"}) = P(\kappa_2 \leq y_t^*),$$

where κ_1 and κ_2 are the cut-off values of y_t^* associated with probabilities of purchases, no intervention, and sales, respectively.

11. The empirical specification of the event-window analysis is as follows (see e.g. Poghosyan, 2020):

$$\Delta er_t = \alpha_0 + \sum_{j=-3}^3 \beta_j S_{t+j} + \sum_{j=-3}^3 \gamma_j P_{t+j} + \varepsilon_{i,t}$$

where er is the logarithmic difference of the MDL/USD exchange rate times 100, S is a dummy variable that takes the value 1 in periods of FX sales, and P is a dummy variable that takes the value 1 in periods of FX purchases.

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