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How can repurchase agreements be settled on a distributed ledger? Insights from the Helvetia pilot

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The SNB implements its monetary policy by using several instruments, including repurchase agreement (repo) transactions. The SNB conducted test repo transactions involving tokenised assets and wholesale central bank digital currency. These so-called digital repos were settled on a distributed ledger technology (DLT) infrastructure. The tests revealed that settlement of repos on a DLT-based infrastructure is feasible, and provided insights into the corresponding challenges. Specifically, integrating a DLT-based infrastructure into today's money market as in the test setup presents challenges related to market fragmentation, the need for enhanced collateral management capabilities, and the harmonisation of communication standards.

The Helvetia pilot is a joint project undertaken by commercial banks, financial infrastructure providers and the SNB. The goal of the pilot is to investigate the settlement of a range of financial transactions on a distributed ledger technology (DLT) infrastructure. The corresponding tests make use of tokenised assets and wholesale central bank digital currency (Wholesale CBDC).¹ Within the Helvetia pilot, the SNB also investigated how monetary policy operations can be conducted on DLT-based infrastructures. In doing so, the SNB issued digital SNB Bills, as was documented in a previous note by Gerosa et al. (2024). The focus of the present note is instead on the repurchase agreement (repo) test transactions conducted by the SNB in 2024—which could be referred to as *digital repos*.

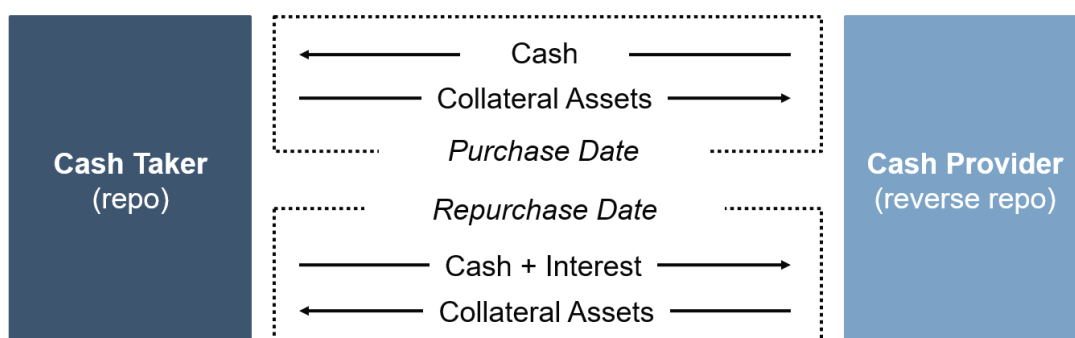
Markets based on distributed ledgers remain niches for the time being, and such tests do not constitute an indication that the SNB is planning to conduct monetary policy operations on DLT-based infrastructures.

¹ Tokenisation is the digital representation of assets on a distributed ledger, which is a system for recording and sharing data across a computer network. More information on the Helvetia pilot is available [here](#) as well as in SNB (2023) and Jordan (2024).

The repurchase agreement market in Switzerland

The SNB has conducted repos for more than 25 years.² A repo is a financial transaction in which one party (the so-called cash provider) purchases assets from another party (the cash taker) whereby both parties simultaneously agree to reverse the trade on the repurchase date. The difference between the purchase price and the repurchase price reflects the interest the cash taker is required to pay on the borrowed cash amount. The basic principle of a repo is illustrated in Chart 1.³ In economic terms, a repo represents a collateralised loan: the assets serve as collateral, and the repo specifies the loan conditions such as the term and the interest rate. From the perspective of a cash taker, the transaction is referred to as a repo. For the cash provider, it is instead called a reverse repo.

CHART 1: ILLUSTRATION OF A REPURCHASE AGREEMENT



In Switzerland, the repo market is operated via the Swiss Money Market Value Chain (SMMVC), a financial infrastructure provided by various entities of SIX Group Ltd. The structure of the SMMVC is illustrated in Chart 2. Broadly speaking, the SMMVC efficiently links the trading, administration and settlement of repos.

- **Trading** takes place on CO:RE, an electronic trading platform provided by SIX Repo Ltd. (SIX Repo).
- **Administration** is carried out by the Triparty Agent (TPA) of SIX SIS Ltd (SIS). This involves among other things the coordination of the settlement process, the margining of collateral and the execution of corporate actions. Some administrative actions, such as the margining of collateral are actually executed over the entire lifecycle of a transaction.
- **Settlement** happens on a delivery-versus-payment (DvP) basis⁴ using the central securities depository (CSD) of SIS for the collateral settlement and the payment

² The SNB repo operations are detailed [here](#) and are further discussed in Tschudin and Moser (2024).

³ Note that for simplicity, we omit the details on processes that happen during the term of the repo transaction such as margining or substitution of collateral.

⁴ DvP settlement represents the transfer of assets and cash in a way that ensures that delivery of assets occurs if and only if the corresponding delivery of the cash occurs. DvP processes reduce settlement risk—that is, the risk that one counterparty successfully completes its transfer of assets or cash, while the other counterparty fails on its committed transfer.

system Swiss Interbank Clearing (SIC) operated by SIX Interbank Clearing Ltd. for the cash settlement.

CHART 2: STRUCTURE OF TODAY'S SWISS MONEY MARKET VALUE CHAIN



The repo test transactions in the Helvetia pilot

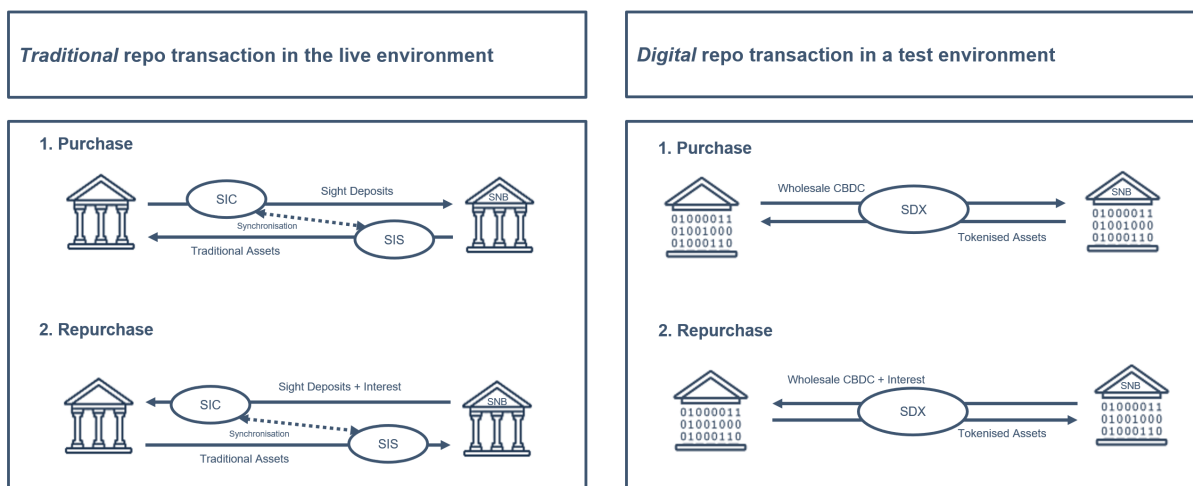
The Helvetia pilot enabled the SNB to evaluate how a repo transaction can be settled on a DLT-based infrastructure using tokenised assets and Wholesale CBDC. The DLT-based infrastructure was provided by SIX Digital Exchange (SDX). The conducted test transactions were a first attempt to explore the operational challenges related to a digital repo—that is, a repo that is settled on a distributed ledger but still adheres to the SMMVC for trading and administration.

A repo transaction involves a complex sequence of steps, not all of which could be tested. The test transactions included the most essential steps. A particular focus was placed on the settlement process. Note that all process steps of the relevant transactions were executed in the test environments of the involved infrastructures. On the basis of the SMMVC structure illustrated in Chart 2, the test transactions can be described as follows.

- **Trading**—As with any traditional repo, trading was initiated on the trading platform CO:RE. Specifically, an order was sent from a commercial bank to the SNB or another commercial bank, which accepted it and concluded the trade.
- **Administration**—After the trade was concluded on CO:RE, the SIX TPA handled the communication for the DvP settlement.
- **Settlement**—Finally, the settlement involved only one infrastructure (SDX) rather than the two infrastructures (SIS and SIC) needed for a traditional repo. Chart 3 illustrates how traditional and digital repos differ. Unlike today's SMMVC setup, a digital repo does not need the synchronisation of systems to ensure DvP settlement. In fact, the transfer of cash and assets can occur simultaneously, a situation often referred to as atomic settlement.⁵

⁵ Atomic settlement differs from instant settlement, which refers to the immediate settlement after trading (see Lee et al., 2022 for details).

CHART 3: DIFFERENCE IN SETTLEMENT IN TODAY'S SYSTEMS VERSUS ON SDX



The project team first tested monetary policy transactions through liquidity-providing repos. In these transactions, the SNB acted as a cash provider of Wholesale CBDC and accepted tokenised assets as collateral. To maintain a simple test setup, the test transactions were intraday repos, with purchase and repurchase occurring on the same day. The collateral used was part of the SNB General Collateral basket, which defines the eligible collateral for repos with the SNB. The involvement of the SNB makes this a monetary policy transaction, which—if conducted in live systems—increases the amount of central bank money in the financial system. The team then tested repos between commercial banks (so-called interbank repos) with the setup otherwise left unchanged.

Insights obtained from the repo test transactions

As with the issuance of digital SNB Bills, the repo test transactions helped to understand the challenges associated with implementing monetary policy and ensuring a functioning interbank repo market on a DLT-based infrastructure. Upholding reliable market standards and focusing on one centralised marketplace contributes to a liquid and efficient market, in turn ensuring effective monetary policy implementation. On this basis, the repo test transactions were designed so that trading and administration remained within today's SMMVC—a setup that specifically contributes to maintaining a liquid and efficient market.

In the process of integrating SDX as an additional CSD into the SMMVC to test a new way of settling repos, the SNB and its project partners gained several new insights.

First, the project provided insights into the risk of market fragmentation, even when trading and administration remain within today's SMMVC. This risk arises from the potentially different preferences of market participants regarding the settlement of cash and collateral in their repo transactions. Chart 4 depicts the possible preferences, distinguishing between SIC balances and Wholesale CBDC on the cash side, and between traditional and tokenised assets on the collateral side. Integrating SDX as an additional CSD in today's SMMVC would open up a wide range of new possibilities for settling repo transactions, which could lead to market

fragmentation. This risk could be addressed with a settlement-agnostic SMMVC, for which the project team engaged in a high-level conceptual analysis with the involved infrastructure providers.

CHART 4: RANGE OF POSSIBLE PREFERENCES FOR CASH AND COLLATERAL WITH TRADITIONAL AND DLT-BASED INFRASTRUCTURES FOR SETTLEMENT

		Cash Provider Preference			
		SIC Balances & Traditional Assets	SIC Balances & Tokenised Assets	Wholesale CBDC & Traditional Assets	Wholesale CBDC & Tokenised Assets
Cash Taker Preference	SIC Balances & Traditional Assets	Today's SMMVC			
	SIC Balances & Tokenised Assets				
	Wholesale CBDC & Traditional Assets				
	Wholesale CBDC & Tokenised Assets				Test repo in Helvetia pilot

Second, allowing market participants to settle repos using different CSDs requires enhanced capabilities on the part of the TPA, such as a holistic collateral management across CSDs and a routing logic that allows the TPA to select the relevant infrastructure for administrating and settling repos. Ensuring that the TPA can fully execute its tasks across all CSDs reduces the operational burden on market participants and supports an efficient repo market.

Third, the tests revealed that a harmonisation of the communication standards used by the involved systems is desirable to achieve straight-through processing and to ensure that infrastructures are integrated seamlessly to maximize efficiency. However, this alone may not be sufficient to unlock the full efficiency gains promised by new DLT technologies. For example, in the test setup, the instant settlement of transactions, i.e. immediate settlement after trading, might be impossible to achieve because of the need for system interaction and the specific way interoperability between infrastructures was set up.

Conclusion

The Helvetia pilot, including the discussed repo test transactions, allowed the SNB to gain a better understanding of DLT-based infrastructures and the potential ways of integrating them into today's infrastructure landscape should it become necessary in the future. The tests with digital repos revealed that such an integration presents several challenges, including market fragmentation, the need for enhanced collateral management capabilities, and the harmonisation of communication standards.

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