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Assessment Summary

- BA Labs supports the proposed deployment of Spark Protocol onto Polygon zkEVM
- Initial supported assets will include DAI, ETH, and wstETH, with parameters listed below in the Protocol Parameters section
- Operating on an external domain introduces novel technical and solvency risk factors that should be considered by Spark and Maker governance

Overview

Spark Protocol is a fork of the Aave v3 protocol. In addition to the standard features of Aave v3, Spark has a close integration with the core Maker protocol to facilitate deep liquidity and low, stable DAI borrowing rates. Currently, Spark is only deployed on Ethereum mainnet. However, Spark is expected to deploy on Gnosis Chain soon. Additionally, Polygon has proposed to deploy an instance of Spark on the Polygon zkEVM L2 network.

Deploying on Polygon zkEVM could create significant opportunities for growth of Spark Protocol, and increase existing synergies between Maker and Polygon. There is relatively little competition in the lending protocol space on Polygon zkEVM, which could allow Spark to more easily gain market share.

In the future, it may be possible for Maker itself to deploy DAI liquidity into the protocol. However, doing this on an external domain brings increasing complexity and technical risk, and is not the focus of this analysis. More research, development work, and an additional assessment should be undertaken before Maker deploys liquidity into the proposed zkEVM Spark deployment.

This assessment covers the deployment of Spark Protocol onto Polygon zkEVM, including review of risk factors and possible mitigations, as well as proposed parameters for the initial protocol deployment.

Qualitative Risk

This section covers fundamental and non quantitative risk factors for the proposed deployment.

Polygon zkEVM Risk Profile

Polygon zkEVM is a zk rollup. It posts compressed data to Ethereum with validity proofs of valid state transitions to provide a similar level of economic security to running programs on Ethereum L1 itself. However, the underlying zk tech is relatively new and unproven, which implies a higher risk of technical faults and bugs. These faults could range from downtime all the way to invalid state transitions causing loss of funds.

Per Vitalik’s description of types of zkRollups, and the Polygon dev teams’ previous statements, not all parts of the current implementation of Polygon zkEVM are fully equivalent to Ethereum (type 3 zkEVM). While the Polygon team is planning to push towards full equivalence over time (type 2 or type 1 zkEVM), at present there may be differences that require special handling for applications.

Transactions are currently selected for L2 block inclusion by a single, centralized sequencer. This creates increased risk of downtime (no transactions can be processed if sequencer infrastructure experiences a fault or interruption in service), as well as transaction censorship (sequencer could refuse to include certain transactions). While censorship is unlikely due to Polygon team reputation and incentives, downtime has occurred across several other rollups such as Base and Arbitrum and may occur on Polygon zkEVM as well. Each of these risks can be problematic for lending markets, which rely on prompt execution of certain transactions such as oracle updates, liquidation transactions, and user operations to top up collateral or repay debt when their position nears the liquidation threshold. Use of a centralized prover also increases risk of downtime or unavailability. During the mainnet beta phase, users may not be able to force transaction inclusion via L1, which would typically be a key fallback mechanism in case of infrastructure failure.

Overall, Polygon zkEVM has a strong security architecture and has long term advantages over alternative L1s by benefiting from Ethereum security. But the novelty of the underlying zk tech introduces additional risk in the short term until it has proven resilient, based on time without incidents and total value secured. The chain level risk is considered acceptably low for deployment, but specific factors such as potential for downtime (estimated to be higher than for Gnosis Chain, based on historical outages on single sequencer L2s) should be considered when selecting protocol parameters.

zkEVM Bridge Risk Profile

The zkEVM bridge uses validity proofs to ensure that any bridging transactions are valid. This provides arguably much higher security versus multisig validated bridges, as the validity of bridge messages to and from zkEVM are secured by cryptography, bridge code, and underlying Ethereum consensus, rather than honest majority assumptions of a small, centralized validator set.

However, zk rollup technology is fairly new, with Polygon zkEVM only going live on mainnet within the past year. This means there is an elevated risk of technical faults that could potentially allow funds to be stolen from the bridge escrow, invalid messages to be accepted by the bridge contract, or service interruptions.

Unlike optimistic rollups, which have a long delay (typically 1 week) to allow invalid messages to be challenged, zk rollups can bridge funds back to Ethereum quickly as the validity of bridge messages is assured via cryptography. This means zkEVM liquidity and asset prices should be closely coupled with Ethereum mainnet under normal conditions, when the bridge is operable. The main constraint on time for bridge messages to go through is how frequently the zk rollup posts batches of data back to L1. In the case of Polygon zkEVM, bridging between L1 and L2 typically takes under 15 minutes (generally between 5-10 minutes). On the other hand, the delay period for optimistic rollup bridges gives teams an opportunity to address any technical issues before funds are lost, which may not be available for zk rollup teams like Polygon zkEVM.

Bridge risk is considered acceptably low for the purposes of deployment, but risk of bridge downtime means that local zkEVM liquidity should be considered when selecting Spark protocol parameters for deployment.

Spark DAI Rate Model

Similar to the Spark Gnosis Chain deployment, sDAI is not planned to be listed on the Polygon zkEVM deployment. This is due to liquidity constraints; sDAI would need independent liquidity pools as it cannot be wrapped/unwrapped on L2. For this reason, any users wanting to borrow volatile assets against stablecoins would need to supply into the regular DAI market, which introduces additional safety constraints for the DAI interest rate model.

If zkEVM Spark accepts the standard borrowable DAI market as collateral, this would require an increasing borrow rate slope at high utilizations to incentivize additional suppliers or debt repayments. This ensures that the market does not remain at 100% borrow utilization for long periods which would prevent atomic liquidations, but involves a tradeoff versus the mainnet Spark Protocol where a key feature is the assurance of stable borrowing rates regardless of market utilization. Alternatively, Spark could maintain a constant DAI borrow rate across the entire utilization spectrum, but disallow the DAI market as collateral.

The initial recommendation is to adopt a modified DAI rate model for Spark on zkEVM similar to the Gnosis Chain deployment, that includes an increasing borrow rate at high utilization. This will allow for DAI to be usable as collateral, and also improve flexibility and liquidity conditions for DAI suppliers who are expected to be 3rd party users rather than a Maker D3M. This should cause minimal impact on user experience, as utilization will typically be below the levels where rates would escalate.

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Source: Data: Spark on Polygon zkEVM

Note that the chart above shows 5% borrow rate (equal to current effective DSR), but if a similar rate spread is applied as on mainnet, the borrow rate would be 0.5% higher. It is expected this spread will not be applied on zkEVM because pre-farming is only taking place on mainnet.

Liquidity and Asset Risk

This section discusses market and liquidity risk factors and process for determining appropriate asset specific parameters.

Parameter Tradeoff Space

As mentioned above, the delays for using the zkEVM bridge along with possibility of service interruption mean that zkEVM local liquidity is an important limiting constraint for parameter selection. Polygon zkEVM has much more limited DEX TVL versus mainnet, and even somewhat more limited than Gnosis Chain, so while parameters can be loosely modeled on the mainnet Spark deployment, additional margins of safety should be applied to avoid situations where local liquidity on zkEVM is exhausted. Increases in borrow and supply caps should be counterbalanced by reductions in LTV and liquidation threshold, or vice versa.

Because reductions in liquidation threshold can cause poor user experience, it is recommended to set these parameters relatively lower at launch, to allow for more rapid growth in supply and borrow caps to meet demand. Liquidation threshold and LTV parameters can then be raised over time if it becomes clear that higher values are safe.

Oracle Deviation

Oracle networks aggregate price data from a range of highly liquid markets including centralized exchanges and top decentralized exchanges. However, because Polygon zkEVM is somewhat remote from primary liquidity venues, there may be cases where prices deviate from the broader market and values reported by Spark's oracles. This may make it more difficult for participants to liquidate unsafe positions, as the price offered for liquidated collateral is based on the oracle price plus a fixed penalty rather than the prevailing market rate on zkEVM.

If price divergence increases above the liquidation penalty, it will no longer be profitable to perform liquidations and this could allow for further market moves to push positions into insolvency. Even if divergence is initially not greater than the flat incentive for liquidations, the disposal of collateral into relatively thin zkEVM DEX liquidity pools may itself cause this deviation to increase to unsafe levels.

Primary methods to mitigate this risk include limiting total supply and borrow caps for assets based on locally available liquidity, and increasing the liquidation penalty to offer a greater tolerance for oracle vs zkEVM market price deviations. The need for a higher liquidation penalty is somewhat counterbalanced by the lower gas costs on zkEVM, which implies a lower fixed cost required to perform liquidations.

At any one point in time, it will only be profitable to liquidate positions until the marginal market impact exceeds the liquidation penalty; after this amount of volume, DEX liquidity will need to be replenished from cross chain or stat arbs (traders who hold inventory of assets on multiple domains to take advantage of price discrepancies) before it becomes profitable to atomically liquidate positions. Given up to 15 minute timeline to transfer funds across the zkEVM<>Ethereum bridge, we can estimate hourly throughput (assuming the bridge is operational) by selecting the marginal market impact corresponding to a collateral asset's liquidation penalty, and then calculating 4-6 times the token quantity volume at the given market impact level. This offers a reasonable estimate of total liquidation throughput based on bridge latency and liquidation penalty, but may be over or underestimated depending on overall competition in the liquidator space, and participation levels of stat arbs. If the native bridge becomes unavailable for a period of time this will also impact how much liquidation throughput is possible.

Asset Specific Analysis

Liquidity available on Polygon zkEVM is fairly weak across relevant pairs. The two primary DEX operating on zkEVM are Balancer and Quickswap. Balancer offers standard v2 style pools including "weighted" (typical xyk liquidity) and "stableswap" (optimized for stablecoins and liquid staked tokens), and the vast majority of liquidity is in LST pools including wstETH and rETH. Quickswap uses a concentrated liquidity protocol similar to Uniswap v3, and has a built-in integration with liquidity manager Gamma Strategies to offer an optional simplified user experience. Quickswap offers the primary ETH<>USDC and USDC<>DAI pools on zkEVM.

Overall, DEX TVL is significantly lower than the liquidity present on Gnosis Chain, and the gap may widen as Gnosis is expected to deploy treasury funds as liquidity and use their AURA tokens to drive incentives, while Polygon may lack similar resources to pursue a liquidity boosting strategy. However, the availability of Uniswap v3 style concentrated liquidity and GMX style perpetuals on zkEVM (via Quickswap) offers some advantages for volatile pairs like ETHUSD, and this is demonstrated by relatively strong performance on slippage metrics.

Based on aggregator data, it seems that most ETHUSD trades are routed through the Quickswap GMX style perpetual swap feature. While this offers healthy market depth with relatively low TVL, liquidity could become exhausted more easily and unpredictably in cases of severe market volatility or if OI limits are reached.

wstETH<>ETH Liquidity

Balancer holds roughly $1.9 million in TVL for the wstETH/ETH pool, and an additional $1.4 million in rETH/ETH plus $1 million in wstETH/rETH liquidity; rETH liquidity could be used for multihop wstETH/ETH trades, or for eventual listing of rETH on zkEVM Spark.

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Source: Data: Spark on Polygon zkEVM

We can see liquidity has marginally improved over the past month, with it now possible to swap up to ~600 wstETH for ETH with manageable slippage (up from ~400 wstETH at the beginning of September).

To avoid market manipulation attacks, wstETH borrow caps could be set well below this liquidity threshold. Additionally, LTV/LT for wstETH collateral will be held below mainnet Spark protocol values to ensure large positions can be liquidated over time without reaching insolvency, and liquidation penalty should be relatively higher to speed up liquidations even in a case where zkEVM market prices diverge from oracle prices. It also makes sense to curtail ETH correlated efficiency mode somewhat, similar to Spark on Gnosis Chain, to provide greater margin of safety for liquidations.

Overall we see liquidity is healthy for wstETH on zkEVM, but drops off at a relatively lower size vs Gnosis Chain (600-700 wstETH on zkEVM, vs 1,200-1,500 wstETH or higher on Gnosis).

ETH<>USD Liquidity

A majority of aggregator swaps on ETHUSD are routed through the Quickswap perp. Because there are strict limits on open interest and exposures, this means liquidity falls off discontinuously when this liquidity is exhausted. We see swaps are fairly efficient for size up to 200 ETH, and then liquidity falls almost to zero beyond this point.

We plan to mainly ignore Quickswap perpetual liquidity in our analysis, due to low resiliency and the likelihood that liquidity will not be available during significant market moves. Presence of the perpetual may even reduce effective liquidity available on zkEVM due to the possibility of positions being liquidated.

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Source: Data: Spark on Polygon zkEVM

If we discount Quickswap perps and focus only on regular DEX pools, we see that marginal market impact on ETHUSD swaps reaches around 5% with roughly 80 ETH trade sizes. This is similar levels of liquidity at this size to Gnosis Chain, but because Quickswap DEX uses Uniswap v3 style concentrated liquidity rather than Balancer weighted pool (xyk liquidity), the slippage increases much faster at higher swap sizes. Similar to wstETH, liquidity for ETH has improved somewhat over the past month.

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Source: Data: Spark on Polygon zkEVM

Risk Backstop Exposure

Similar to discussion on the Gnosis Chain deployment, deploying Spark to zkEVM may create expectations among users that any technical or insolvency losses incurred by Spark would be covered by the protocol. As Spark is a part of the Maker ecosystem, and currently does not have a token or significant capitalization, users may also assume that Spark liabilities would in turn be covered by the core Maker protocol. In addition to financial exposure, Maker and Spark could also face reputational damage if something went wrong.

To avoid any confusion or possible misunderstandings, Maker and Spark can make the amount and nature of any protocol backstopping explicit as part of the deployment process. This clarity should also help mitigate reputational damage that could arise from protocol faults and unmet user expectations. This can be further discussed by the Maker community, Polygon, and Spark protocol as part of the deployment process.

Protocol Parameters

The following parameters are proposed based on current market and liquidity conditions present on Polygon zkEVM. Note that risk parameters and limits are somewhat more conservative than equivalent assets on the mainnet Spark Protocol to account for limited liquidity and greater cross chain tail risks. Compared to the proposal for Gnosis Chain deployment, certain caps are recommended to be lower due to limited onchain liquidity: DAI borrow cap, ETH borrow cap, and wstETH supply cap.

DAI

- Collateral: Yes
- LTV: 70%
- LT: 75%
- Liquidation penalty: 10% (vs 5% on mainnet)
- LTV: 70%
- LT: 75%
- Liquidation penalty: 10% (vs 5% on mainnet)
- Isolation mode: No
- Isolated debt ceiling: n/a
- Isolated debt ceiling: n/a
- Efficiency mode: No
- Borrowable: Yes
- Base borrow rate: Base DSR
- Optimal borrow rate: Base DSR
- Max borrow rate: Base DSR + 50%
- Optimal Utilization: 90%
- Reserve factor: 0%
- Base borrow rate: Base DSR

- Optimal borrow rate: Base DSR
- Max borrow rate: Base DSR + 50%
- Optimal Utilization: 90%
- Reserve factor: 0%
- Supply cap: 10,000,000 DAI
- Borrow cap: 7,000,000 DAI

ETH

- Collateral: Yes
- LTV: 70% (vs 80% on Mainnet)
- LT: 75% (vs 82.5% on Mainnet)
- Liquidation penalty: 10% (vs 5% on mainnet)
- LTV: 70% (vs 80% on Mainnet)
- LT: 75% (vs 82.5% on Mainnet)
- Liquidation penalty: 10% (vs 5% on mainnet)
- Isolation mode: No
- Isolated debt ceiling: n/a
- Isolated debt ceiling: n/a
- Efficiency mode: ETH
- Borrowable: Yes
- Base borrow rate: 1%
- Optimal borrow rate: 4%
- Max borrow rate: 104%
- Optimal Utilization: 80%
- Reserve factor: 10%
- Base borrow rate: 1%
- Optimal borrow rate: 4%
- Max borrow rate: 104%
- Optimal Utilization: 80%
- Reserve factor: 10%
- Supply cap: 5,000 ETH
- Borrow cap: 2,000 ETH

wstETH

- Collateral: Yes
- LTV: 65% (vs 68.5% on Mainnet)
- LT: 72.5% (vs 79.5% on Mainnet)
- Liquidation penalty: 10% (vs 7% on Mainnet)
- LTV: 65% (vs 68.5% on Mainnet)

- LT: 72.5% (vs 79.5% on Mainnet)
- Liquidation penalty: 10% (vs 7% on Mainnet)
- Isolation mode: No
- Isolated debt ceiling: n/a
- Isolated debt ceiling: n/a
- Efficiency mode: ETH
- Borrowable: Yes
- Base borrow rate: 1%
- Optimal borrow rate: 4%
- Max borrow rate: 104%
- Optimal Utilization: 45%
- Reserve factor: 30%
- Base borrow rate: 1%
- Optimal borrow rate: 4%
- Max borrow rate: 104%
- Optimal Utilization: 45%
- Reserve factor: 30%
- Supply cap: 3,000 wstETH
- Borrow cap: 100 wstETH

ETH Efficiency Mode

- LTV: 85% (vs 90% on Mainnet)
- LT: 90% (vs 93% on Mainnet)
- Liquidation penalty: 3% (vs 1% on Mainnet)

Guarded Launch

Given novel risk factors involved in the Spark on Polygon zkEVM deployment, it may be prudent to ramp up maximum potential exposure with lower initial supply caps. This would limit maximum user losses in case something goes wrong. Phoenix Labs may propose lower caps for a guarded launch at their discretion based on potential risks. As liquidity improves and usage grows, parameters can be adjusted to allow for higher exposures and better capital efficiency.

References

Spark Protocol and Deployment Proposal

- Spark Lend on Polygon zkEVM

Polygon zkEVM and Bridge Details

- The different types of ZK-EVMs
- zkEVM and EVM Equivalence FAQs | Polygon Wiki
- Polygon zkEVM Risk Disclosures | Polygon Wiki
- Polygon Bridge: Bridge Assets from Ethereum to Polygon zkEVM

Asset Data Sources

- https://app.xy.finance/

- https://quickswap.exchange/#/
- https://perps-analytics.quickswap.exchange/
- https://quickswap.exchange/#/analytics/v3/pairs
- Balancer
- https://zkevm.polygonscan.com/
- Data: Spark on Polygon zkEVM