MARATHON ASSET MANAGEMENT
CORNELL CFEM CAPSTONE 2025

CFEM CAPSTONE

ENHANCING TRANSPARENCY IN PRIVATE CREDIT

CONSTRUCTING AN INDEX FOR ALTERNATIVE LENDING MARKETS

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DATE: 10TH DECEMBER

AGENDA

- **Recap**
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  - Private Credit Market & BDCs
  - Project Timeline
  - Terminology Clarification
  - Dataset Coverage, Information & EDA
- **Index Construction**
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  - Index v/s CDLI Benchmark
  - Return Decomposition
- **Our Impact**
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  - Sub-Index Generation
  - Advanced Analysis
- **Case Study – First Brands Group Bankruptcy**
  - Background
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  - Exposure Concentration – Top 5 BDCs
  - Valuation Trajectory – FV/Cost Ratio
  - Valuation Dispersion – Signs of Stress
  - Identifying Vulnerable Lenders
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RECAP

MOTIVATION

- Private credit has grown rapidly to over $1.5 trillion AUM, becoming one of the fastest-expanding areas of alternative finance.
- Represents non-bank lending to private, often middle-market borrowers, offering higher yields than traditional debt.

Problem

- Market remains opaque - no standardized benchmarks or centralized performance data.
- Infrequent valuations and inconsistent disclosures hinder visibility into risk, returns, and portfolio composition.
- Investors and regulators lack tools to compare managers, track exposures, or assess market trends in real time.

Guiding Question

- How can we construct and enhance a private credit index to improve transparency in alternative lending markets?

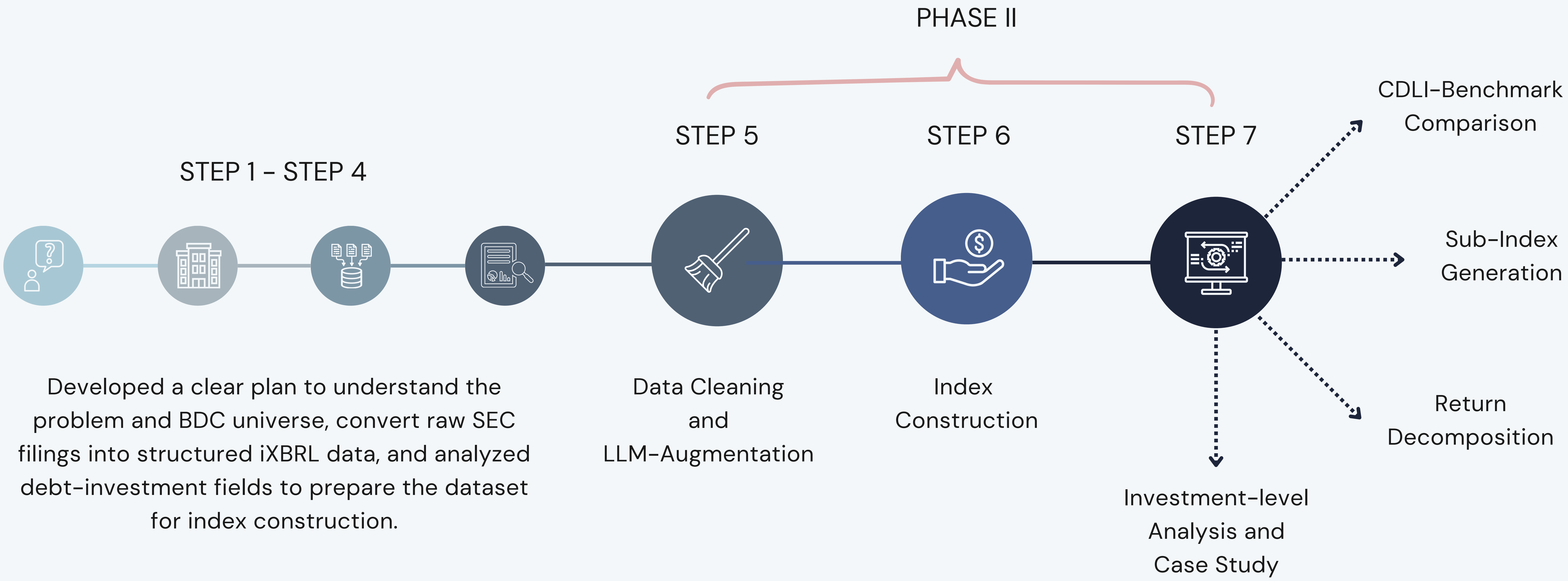
PRIVATE CREDIT MARKETS & BDCS

- **Private Credit Landscape**
  - Comprises direct lending by non-bank institutions to private, typically middle-market companies.
  - Loans are often illiquid and privately valued, limiting visibility into performance drivers.
  - Structures vary widely - from senior secured loans to mezzanine and unitranche debt - contributing to data fragmentation.
  - The lack of standardised market pricing or centralised data makes it difficult to monitor credit quality, compare lenders, or detect emerging stress.

- **Why Business Development Companies (BDCs)?**
  - BDCs serve as a public window into the private credit ecosystem.
  - Regulated under the Investment Company Act of 1940, BDCs must file 10-Q and 10-K reports with the SEC.
  - Filings contain loan-level detail: cost, fair value, rates, terms, PIK/PIC structure, sector exposure, and more.
  - This level of disclosure provides a unique, standardised dataset not available elsewhere in private credit.

- **Our Approach**
  - Build a systematic data extraction pipeline capable of processing all BDC filings since 2023, capturing loan-level terms and fair-value dynamics.
  - Construct a benchmark index that tracks the performance and dynamics of private credit portfolios over time.
  - Use this index to enhance transparency and enable comparability across managers, funds, and market cycles.

PROJECT TIMELINE



TERMINOLOGY CLARIFICATION

- **BDC - Business Development Company**: Lends money to small-to-middle market companies.

- **CIK - Central Index Key**: A unique, permanent 10-digit identifier assigned by the SEC to companies, funds, and individuals for tracking filings in EDGAR.

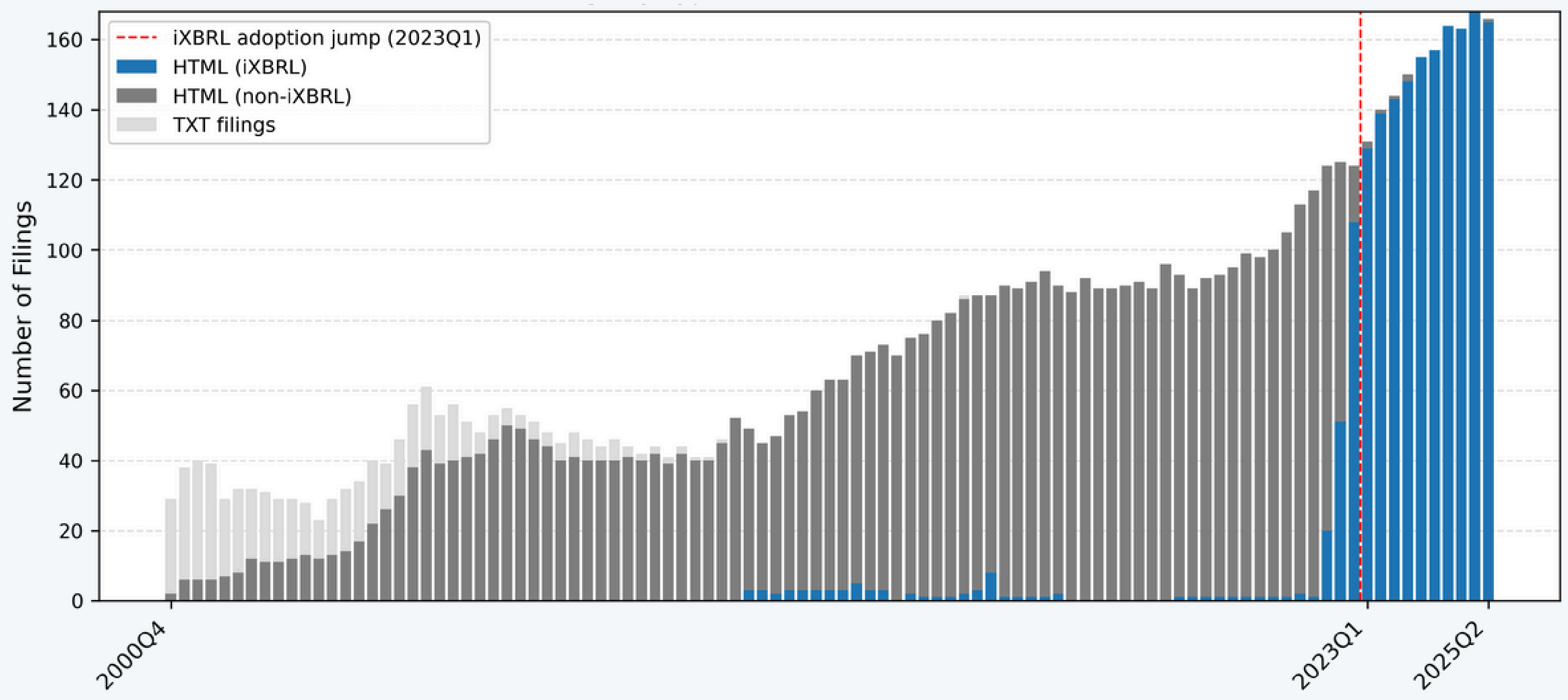
- **SOI - Schedule of Investments**: The detailed portfolio table within 10-Q/10-K filings that lists each investment, its cost, fair value, and terms.

- **Interest Rate Components**
  - **Total Interest Rate**: The borrower's all-in interest cost, composed of PIC/PIK components.
  - **PIC (Paid in Cash)**: The cash coupon portion of the interest rate.
  - **PIK (Paid in Kind)**: Interest accrued and added to the loan principal instead of being paid in cash.
  - **Spread**: The fixed premium charged above the base rate.

- **SOFR - Secured Overnight Financing Rate**: For USD floating-rate loans, the total interest rate is estimated as spread + base rate, where the base is the 3-month SOFR.

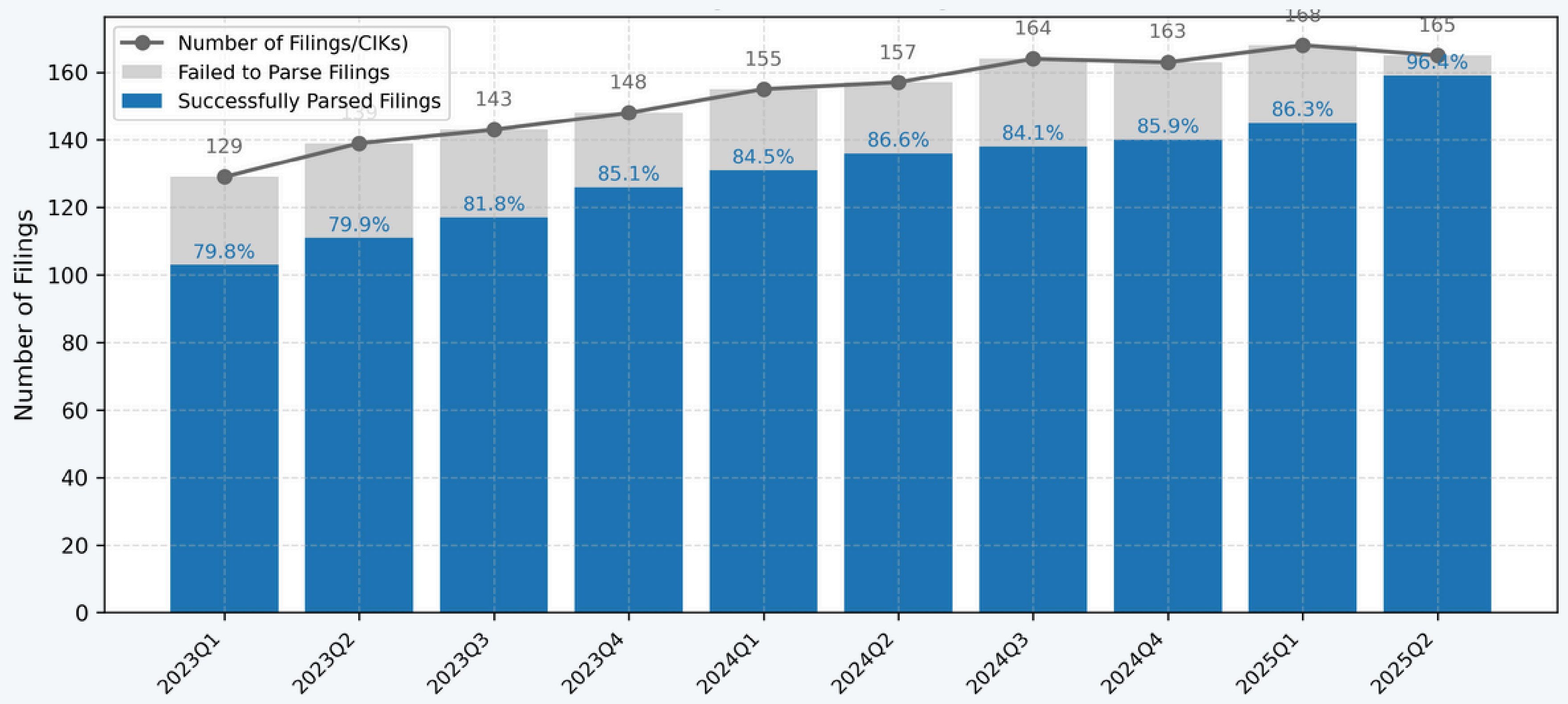
- **CDLI - Cliffwater Direct Lending Index**: A widely-used benchmark for private credit performance.

Figure 1. Filing Volume and Document Types (2001Q1-2025Q2)



- Shows the full historical set of private credit filings since 2001.
- Filings are decomposed into document types: TXT, HTML, and iXBRL formats.
- Our extraction pipeline reliably supports iXBRL only.
- Starting in **2023Q1**, **iXBRL** exceeds **90%** of all filings.
- Therefore, our analysis focuses on post-2023Q1 data to ensure consistency and quality.

Figure 2. Parsing Success Rate for iXBRL Filings (2023Q1–2025Q2)

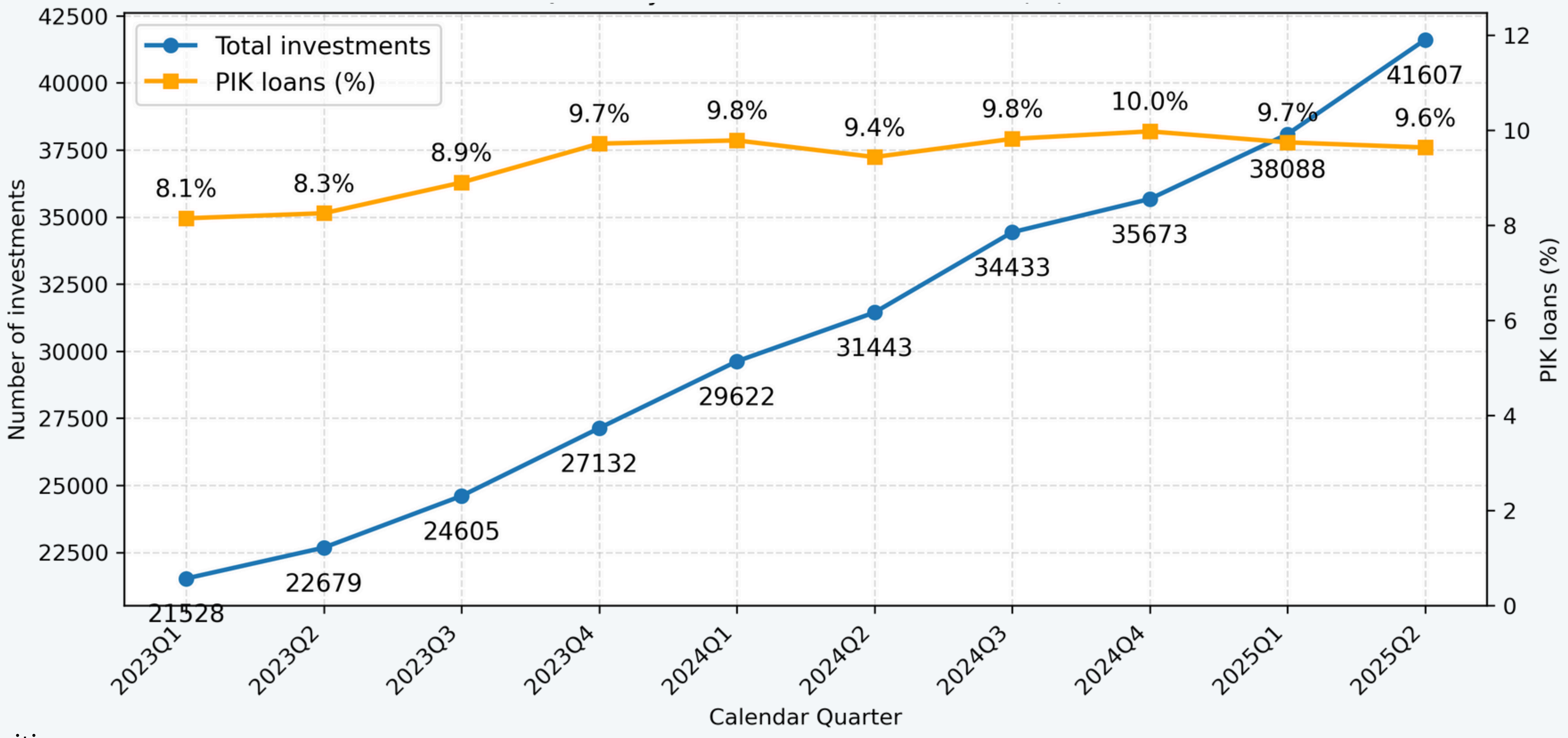


- Each bar represents the number of filings (also the number of BDCs) per quarter, showing steady growth.
- The blue portion indicates filings successfully parsed into structured SOI data.
- Parsing success is stable and gradually improving:
  - High and stable data coverage with no major missing-data bias in downstream analysis.
  - Increasing standardization in how BDCs tag and report their SOI disclosures.

DATA INFORMATION

- Total number of investments: 306,810
- Total number of PIK loans: 28,981 (9.45%)

Figure 3. Quarterly Investments vs PIK Loans (%)



App. 1.A – Currency Composition
App. 1.B – Q-Q AUM & BDC Count

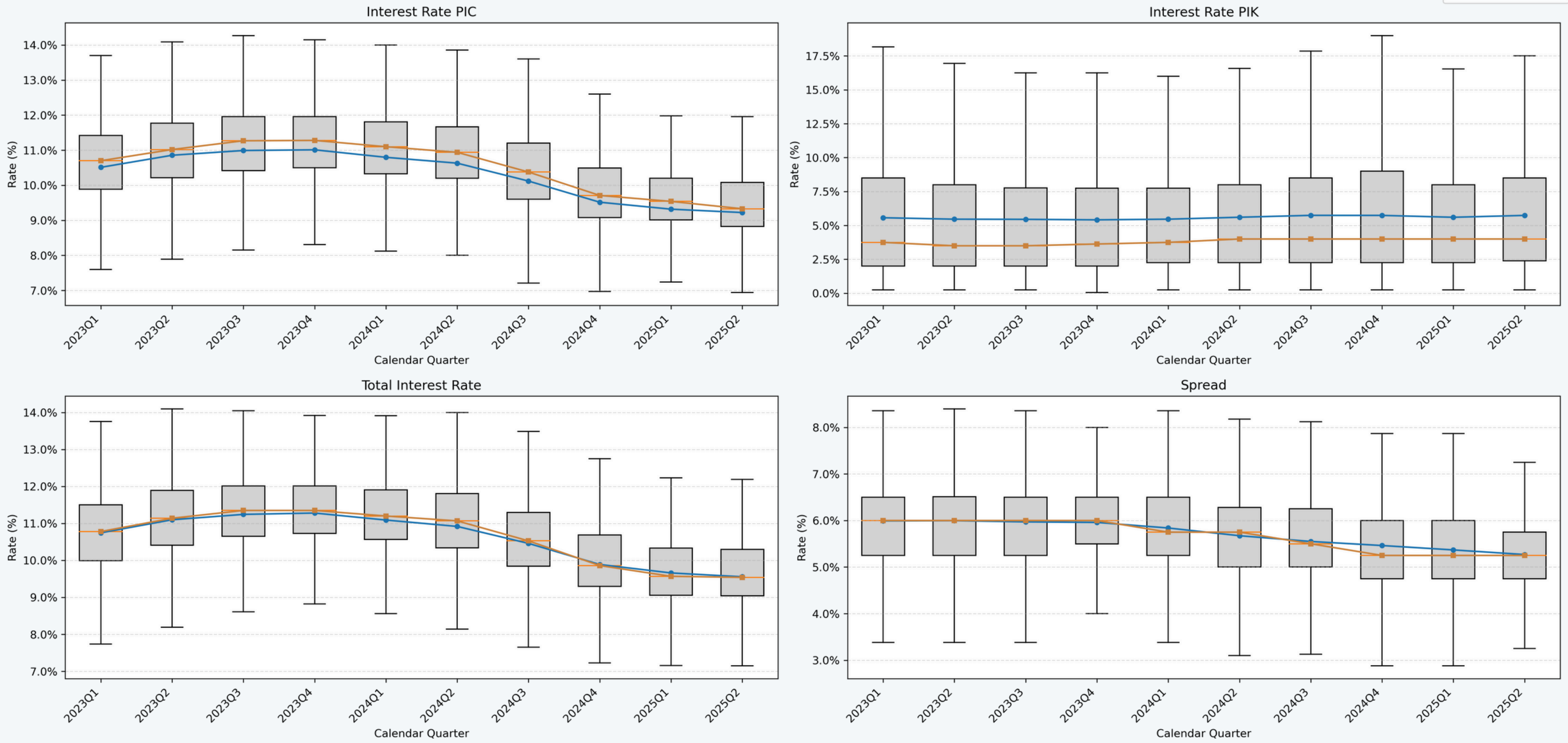


Figure 4. Rate Components Distribution Overview

- Rates peaked in mid-2023 and declined through 2024–2025, consistent with the easing cycle
- PIC drives most of the movement in total rates; PIK remains comparatively stable and less sensitive to rate cycles
- PIK Mean > Median: most loans have relatively low PIK rates, but a minority of loans carry significantly higher PIK
- Spreads show mild compression starting in 2024

Note: PIK distributions include only non-zero PIK investments; all PIC, total rate, and spread distributions use the full investment universe.

INDEX CONSTRUCTION

DATA CLEANING

Data Extraction

Automated pipeline to extract all possible iXBRL filings from 2023-2025.

Formatting

Dropped unnecessary columns , merged the useful ones with different naming schemes, and created a metadata file.

Pre-Processing

Currency change to USD using appropriate FX rates.

Changing all rates to correct decimal format to avoid confusion.

Column Misuse

Accounting for errors in filling the SEC filing.

E.g. Spread filled in IR, IR in PIC, and so on.

Missing Interest Rate Values

Imputing missing values for interest rates and filling in missing spread rates using 3M SOFR based on the reporting quarter.

Final Cleaned Data

Successfully analyzed 300K+ investments case-by-case using transparent, rule-based algorithms, ensuring high data quality without relying on opaque LLM outputs.

INDEX CONSTRUCTION

1 — Data Cleaning

Standardize fair value, cost, par amount, and interest rate fields; keep only valid positions.

2 — Reconstruct Yields (Total Rate)

Cash + PIK

OR

Spread + Base

3 — Compute Position Returns

= Δ(QoQ FV) + Cash + PIK

4 — Apply Weights

Weight each investment by its prior-quarter fair value.

5 — Aggregate Index

<u>Index Return</u>
Weighted Avg. of Position Returns

<u>Index Level</u>
Cumulative Growth from 100

Step-wise Construction of Quarterly, Flow-Based, Market Value-Weighted Measure of BDC Portfolio Performance

INDEX RESULTS

Quarter	Quarter Return	Index Value
2023Q1	1.90%	101.90
2023Q2	2.91%	104.87
2023Q3	3.13%	108.15
2023Q4	3.30%	111.72
2024Q1	2.98%	115.05
2024Q2	2.81%	118.28
2024Q3	2.61%	121.38
2024Q4	2.41%	124.30
2025Q1	2.30%	127.16
2025Q2	2.62%	130.49

Table 1. Index Returns and Index Levels

- The index demonstrates consistent positive returns across all 10 quarters shown.
- Quarterly performance ranges from 1.9% to 3.3%, with the strongest returns occurring in mid-2023.
- Momentum continues through 2024, with returns gradually moderating but remaining solidly in the 2.3–3.0% range.
- Across the full period, the index level increases from **101.9 in 2023Q1 to 130.5 in 2025Q2**, reflecting sustained income generation and stable credit conditions.
- The **smooth upward trajectory highlights the resilience of BDC portfolios** and the dominant contribution of coupon driven income to total return.

INDEX VS CDLI BENCHMARK

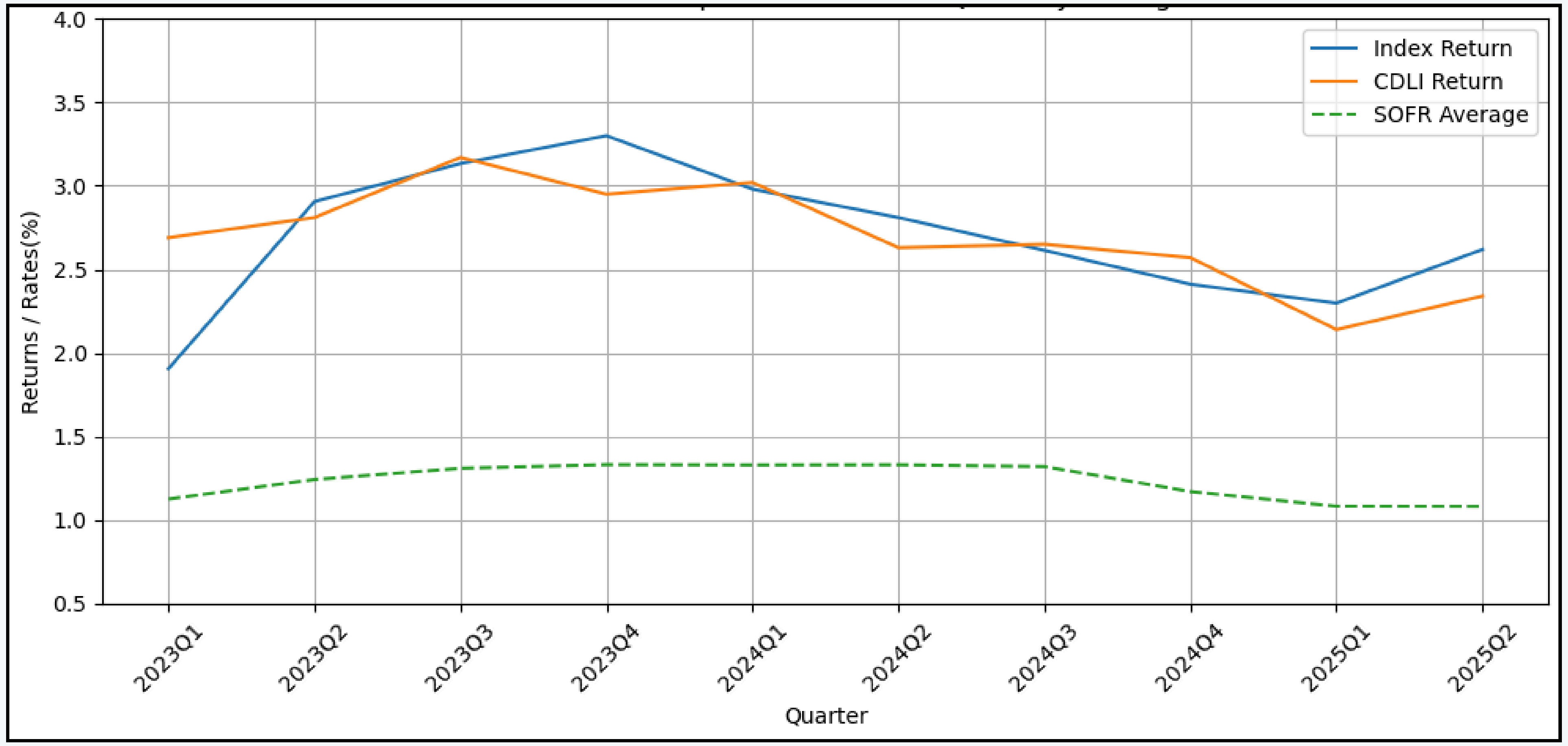


Figure 5. Index Returns Comparison with SOFR Quarterly Averages

- Our index **closely tracks the CDLI**, showing nearly identical quarter-to-quarter movements.
- Both indices peak in mid-2023 and gradually moderate through 2024 as rates stabilise.
- SOFR averages remain far lower and flatter, **underscoring the yield premium in private credit**.
- Even as SOFR declines in 2024, both credit indices remain resilient due to strong coupon income.

Ann. Return = 11.23% | Corr. = 86.95% | T.E. = 0.33%

RETURN DECOMPOSITION

- **Cash interest drives the majority of returns**, delivering a stable 2.3–2.8% each quarter.
- **PIK** adds a small, consistent uplift of **0.1–0.2%**.
- Price moves are minimal, with only brief, shallow negative quarters.
- Income fully offsets valuation noise, keeping total returns positive throughout.
- Highlights that private credit performance is overwhelmingly **yield-driven and resilient as rates normalize**.

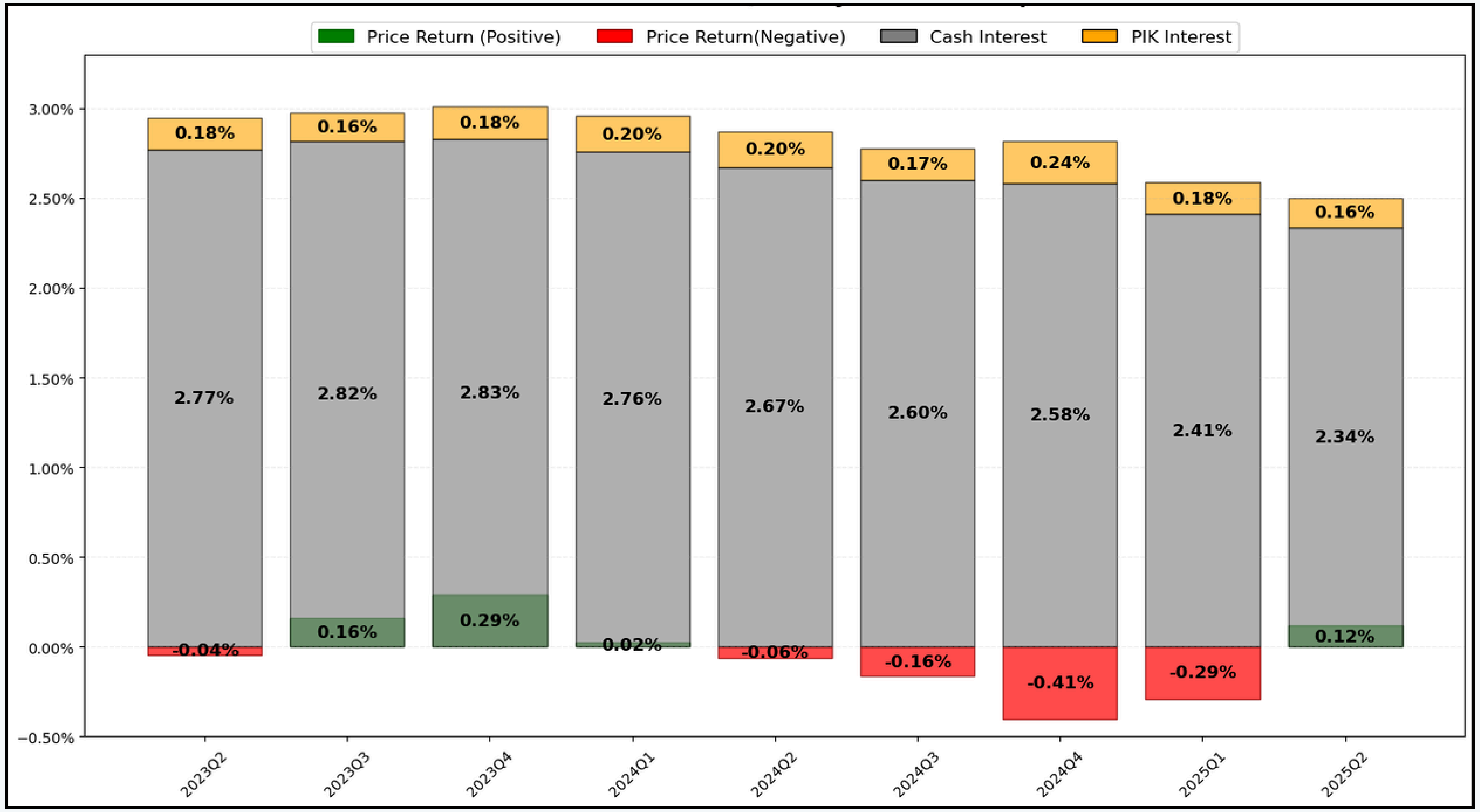
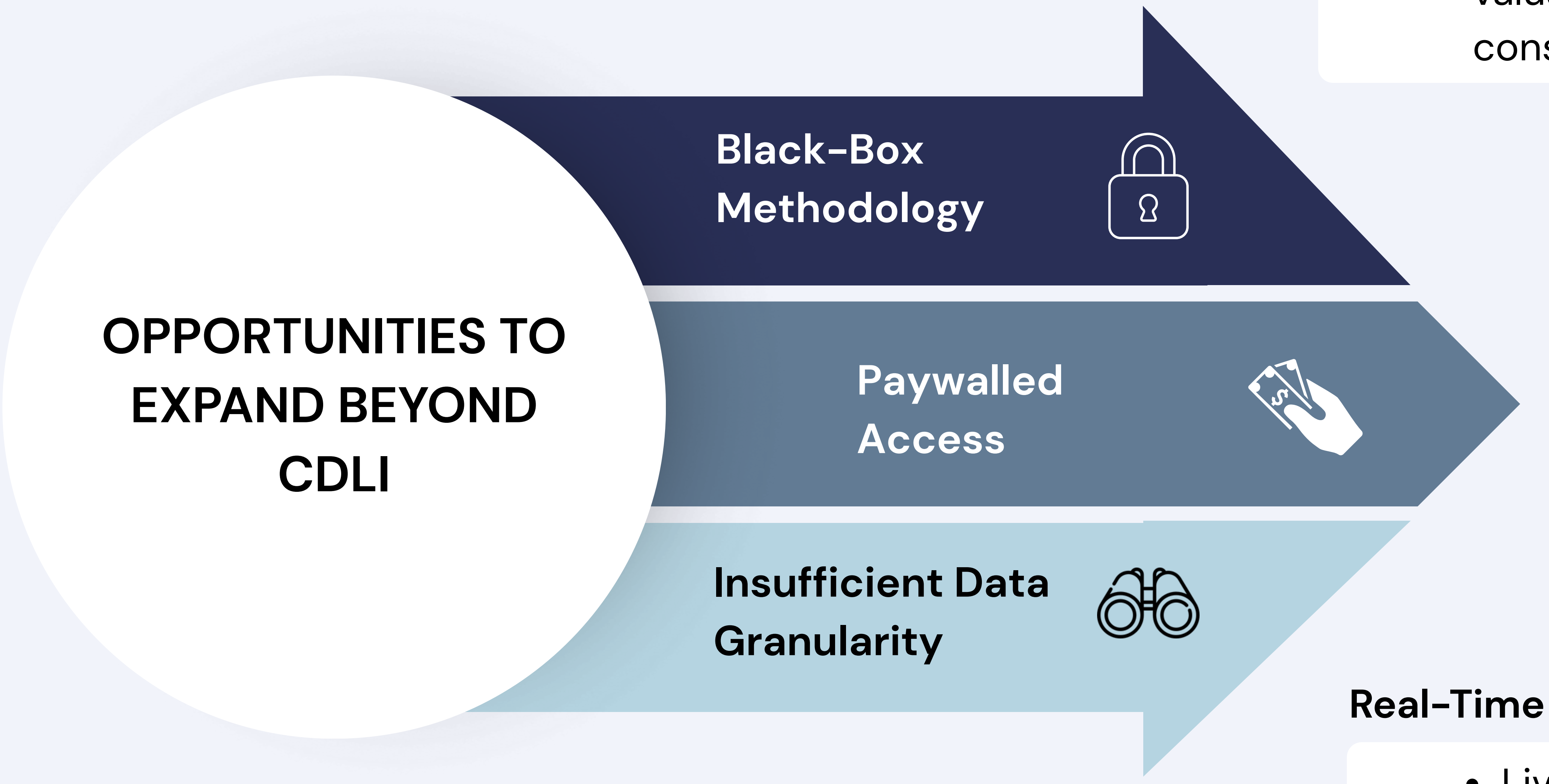


Figure 6. Market-Level BDC Index – Quarterly Return Decomposition

OUR IMPACT

IMPACT



01 Transparent & Reproducible

- Every SOI line-item extracted and processed
- Fully documented cleaning, valuation, and index-construction steps

02 Granular & Flexible Index Construction

- Sector, instrument, and custom thematic indices
- Loan-level visibility for valuation comparisons and borrower/lender tracking and analysis of PIK trends, spread changes, and FV/Cost movements.

03 Real-Time Early-Warning Capabilities

- Live extraction pipeline surfaces borrower-level stress early
- Detect markdowns, PIK increases, and other deterioration far ahead of aggregate indices like CDLI

SUB-INDEX GENERATION

BASED ON SENIORITY

LLM-Enhanced & Rule-Based Classification & Sub-Index Construction

- Used an LLM and rule-based algorithm to extract additional qualitative attributes - such as sector and seniority - from the `investment_identifier` column.

- Leveraged this augmented tagging to build a senior-loan sub-index and sector-specific sub-indices across three major sectors.

- The senior sub-index is designed to track CDLI-S, which focuses on senior and unitranche middle-market loans within BDCs and benchmarks their performance against the broader middle-market loan universe.

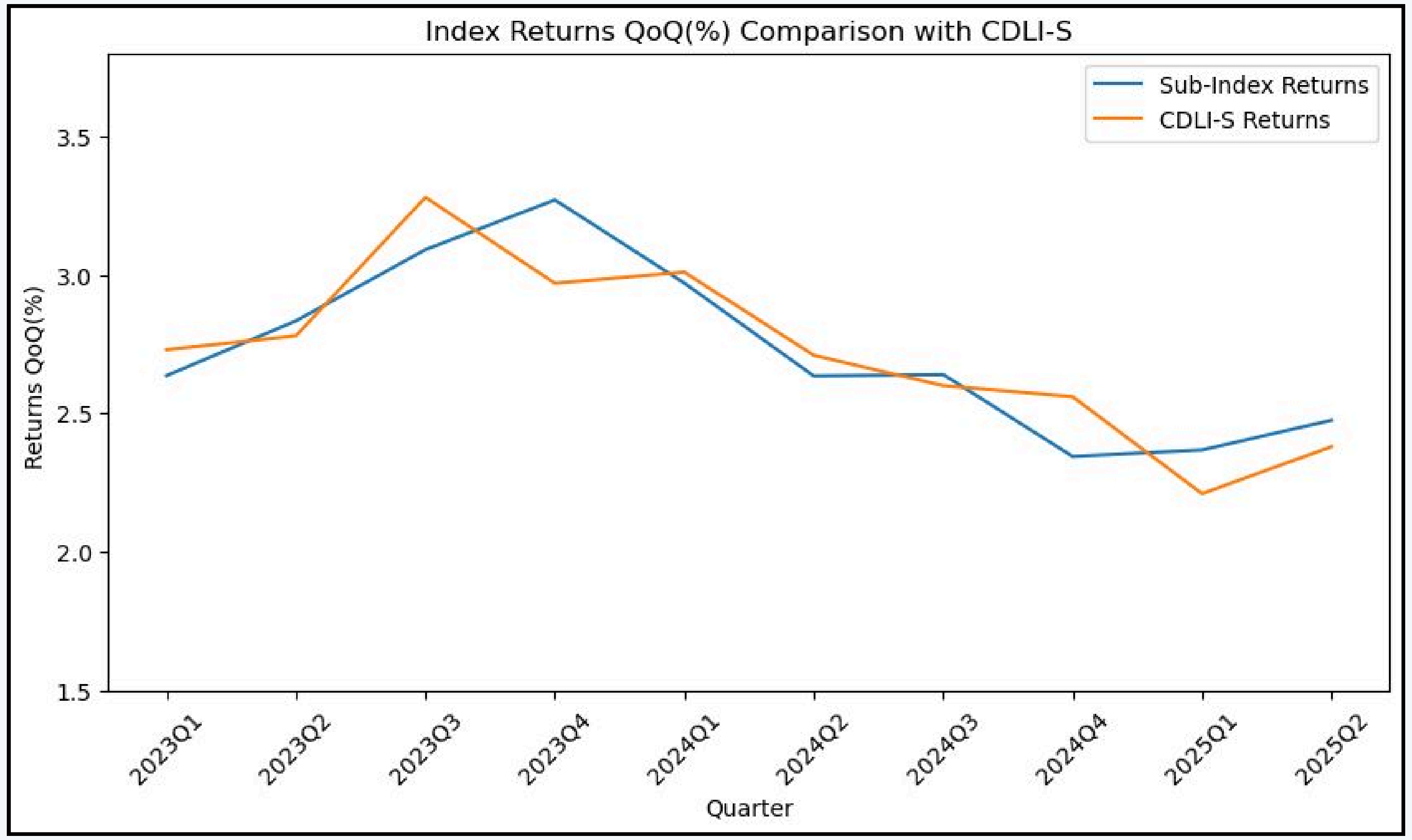


Figure 7. Index Returns QoQ(%) Comparison with CDLI-S

Corr. = 87.5% | T.E. = 0.32%

SUB-INDEX GENERATION

BASED ON SECTOR

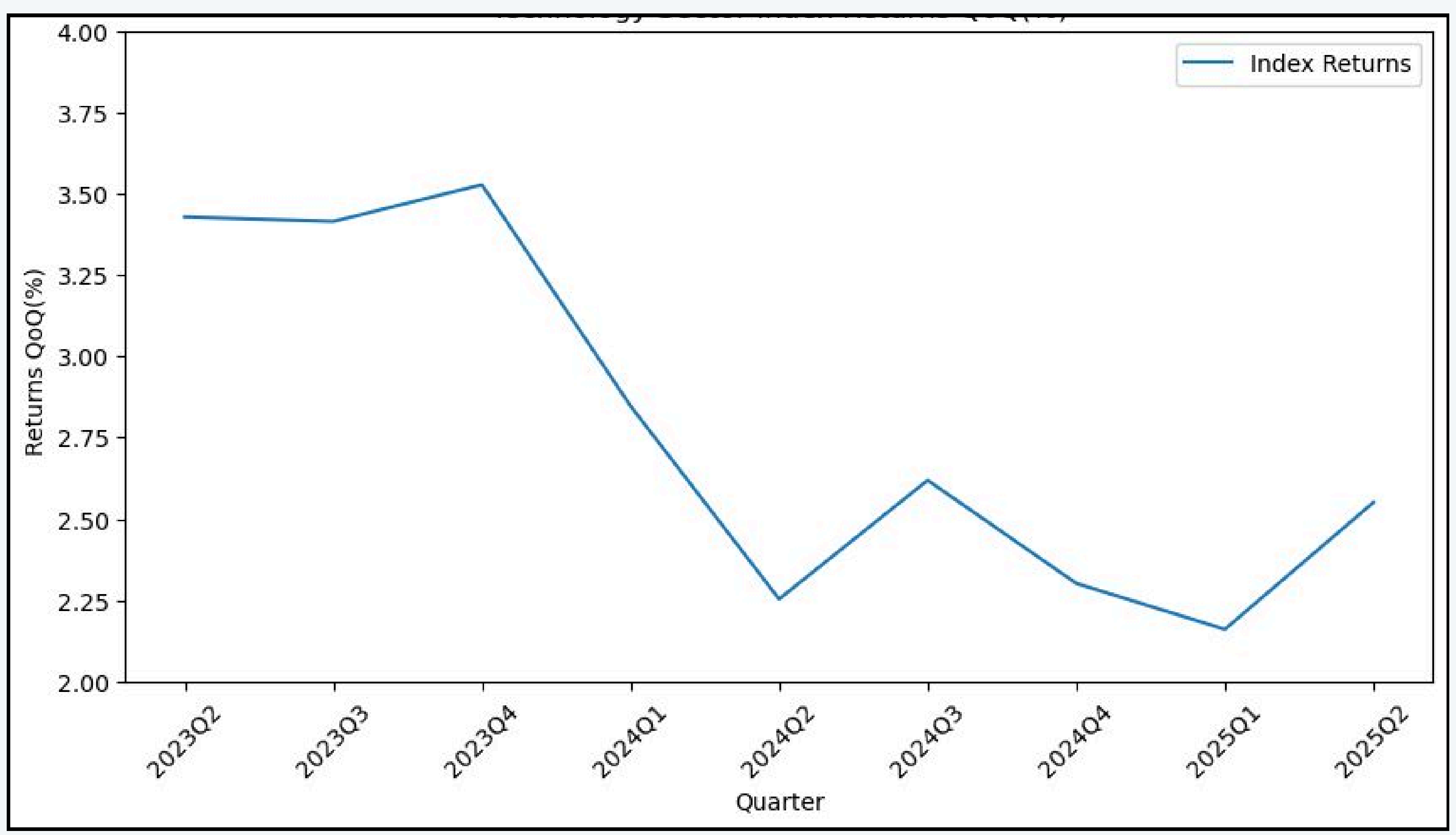


Figure 8. Technology Sector Index Returns QoQ (%)

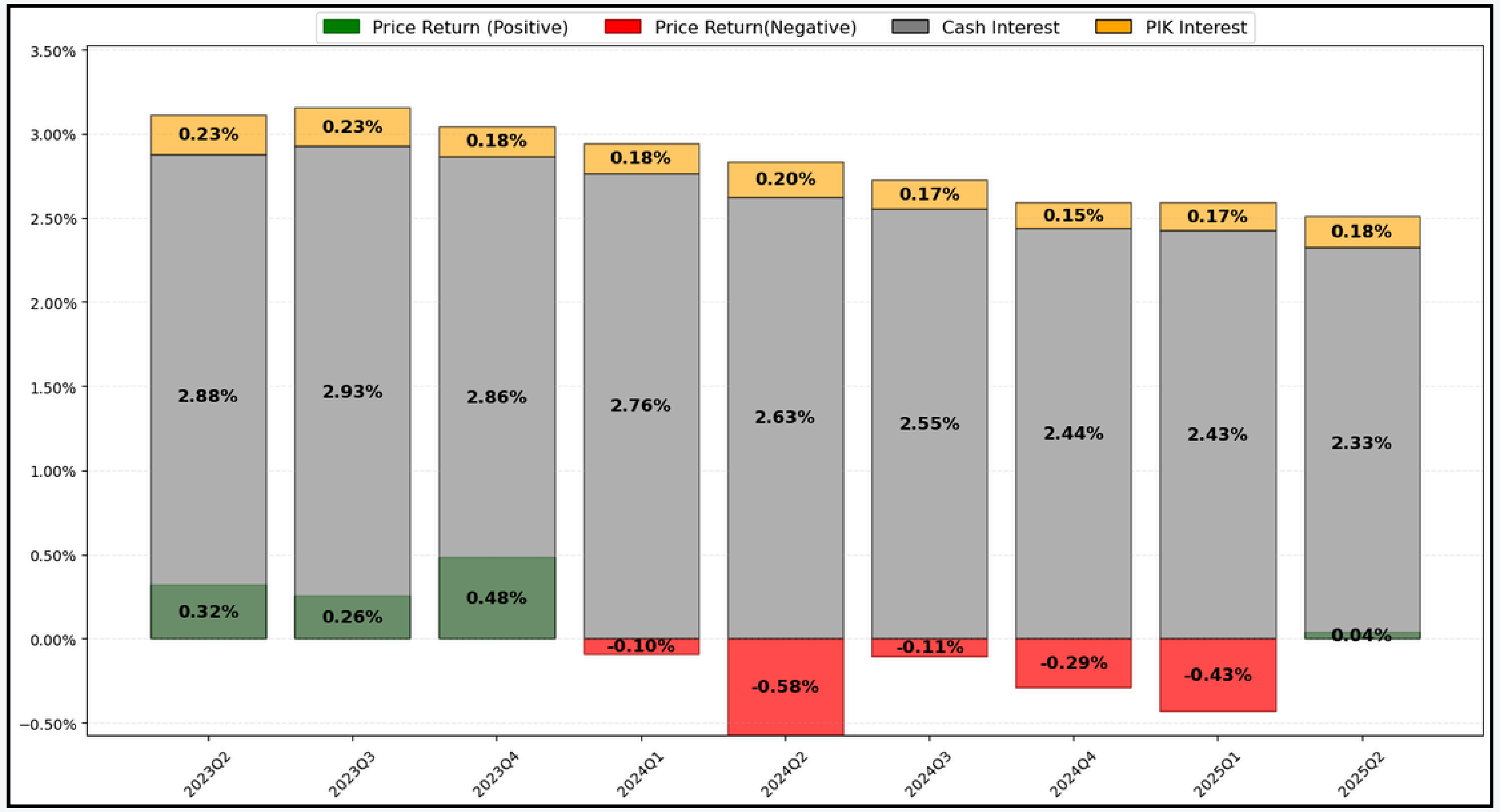


Figure 9. Technology Sector - Quarterly Return Decomposition

Using the extracted sector information, we generated sub-indices for the Top 3 sectors with largest coverage - Technology, Health Care, and Financials & Insurance.

ADVANCED ANALYSIS

BASED ON GOOD/BAD PIK LOANS

Figure 10. Quarterly Trend of Bad PIK

Bad PIK investments refer to loans that began with no PIK feature but later added one as credit conditions deteriorated.

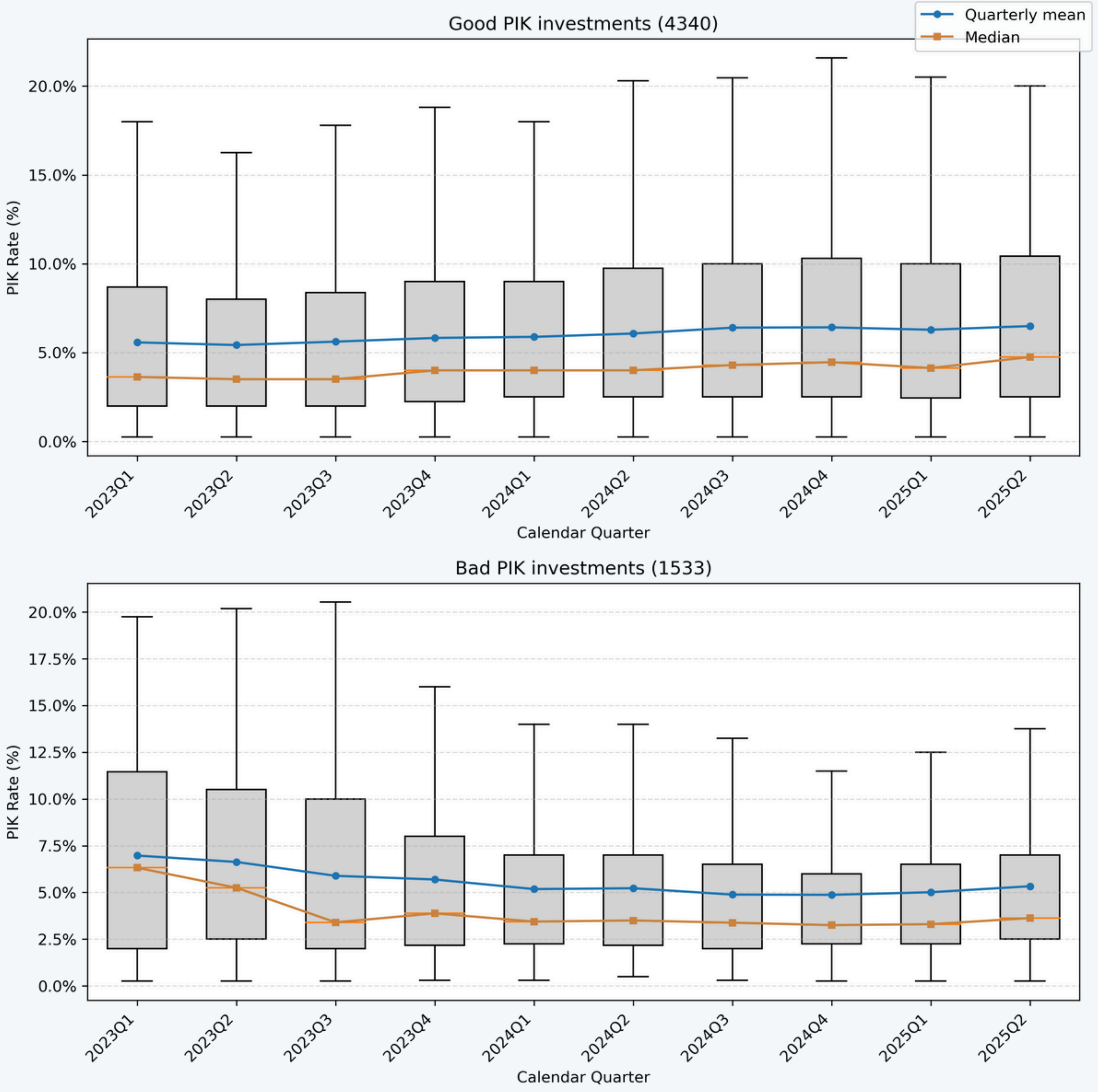


Figure 11. PIK Distribution Comparison: Good v/s Bad PIK Investments

CASE STUDY

FIRST BRANDS GROUP

CASE STUDY

BACKGROUND

First Brands Group + Add to myFT

First Brands files for bankruptcy, threatening multibillion-dollar losses

Collapse of US auto parts maker that borrowed billions in private markets has unnerved Wall Street

First Brands, owned by Malaysian-born businessman Patrick James, makes Michelin-branded windscreen wipers in Europe and Carter fuel pumps in the US © Bryan Terry/The Oklahoman/USA Today Network/Reuters

- First Brands filed for Chapter 11 **bankruptcy** in **September 2025** after revealing US$10B+ in liabilities and significant off-balance-sheet financing exposure.
- Broad lender exposure → significant impact across private credit and BDCs.
- Demonstrates the need for systematic monitoring tools that detect early credit deterioration.
- **Why our dataset and analytics matter?**
  - Consistent extraction of SOI data enables cross-BDC comparability.
  - Improved transparency on loan terms and valuations helps identify anomalies early, before they escalate into major losses.

Source: First Brands files for bankruptcy, threatening multibillion-dollar losses

CASE STUDY

BDC EXPOSURE DYNAMICS TO FIRST BRANDS GROUP

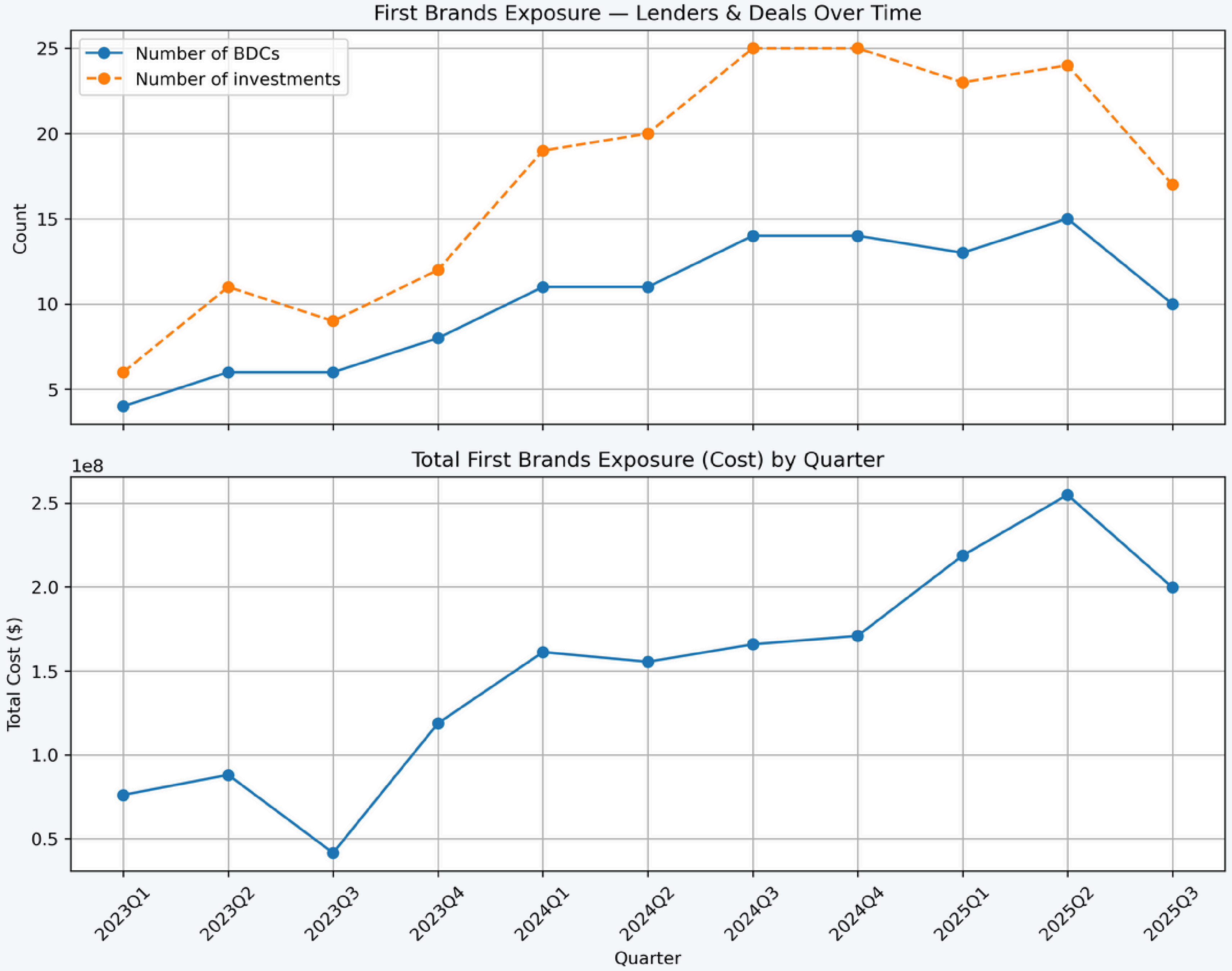


Figure 12.

- Number of exposed BDCs increased from 4 to 15 (~10% of BDC universe) by 2025Q2.

- Loan positions grew from 6 (2023Q1) to 25 (2024Q4).
- Total cost exposure expanded from ~$70M to $250M+ by 2025Q2.

- Confirms the news narrative: First Brands had become a market-wide borrower in private credit, not an isolated exposure.

- Increasing exposure + increasing lender participation = rising systemic vulnerability.

- First Brands did not involve PIK interest, which highlights the added value of valuation markdowns as an early warning signals.

CASE STUDY

EXPOSURE CONCENTRATION: TOP-5 BDCS

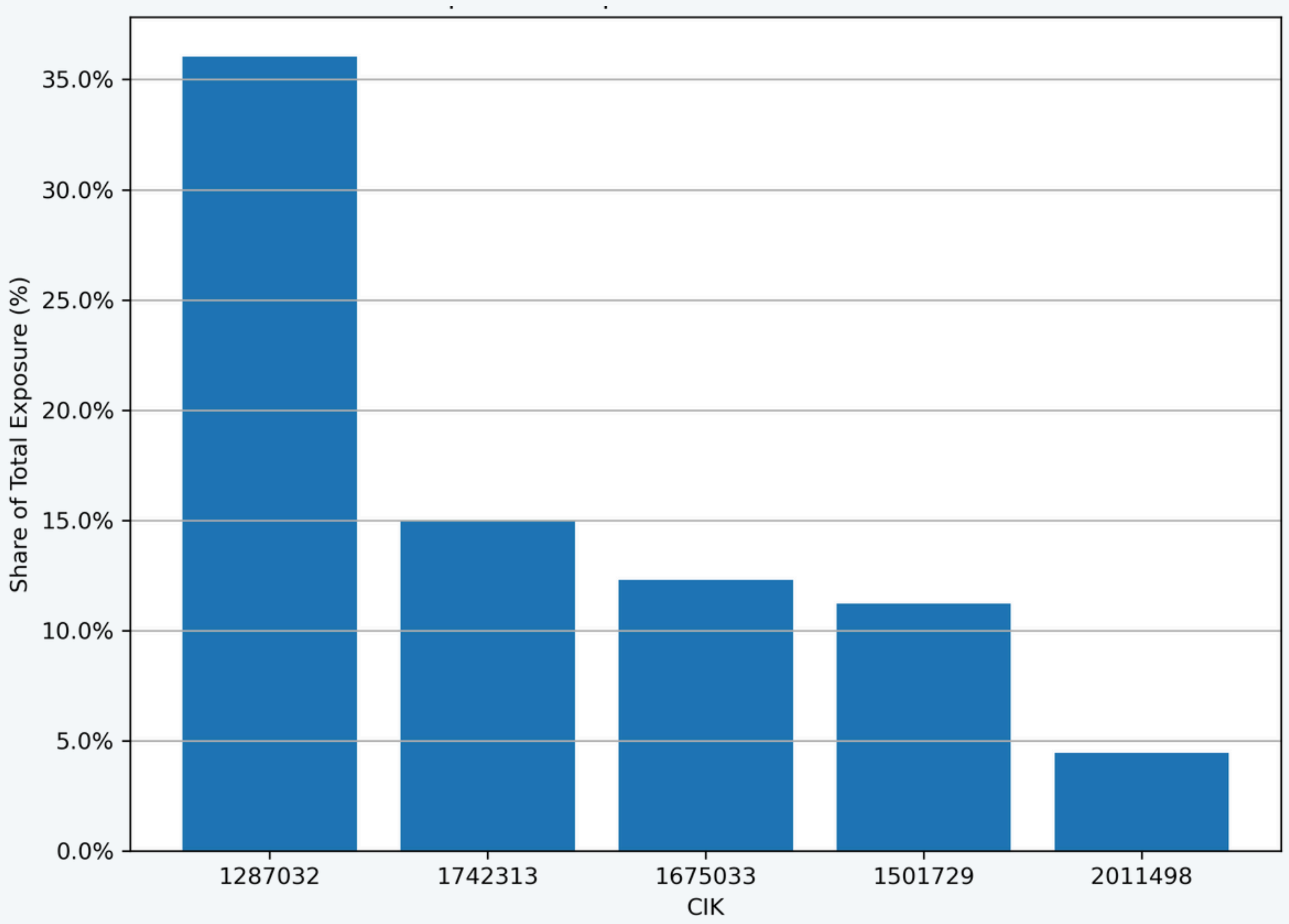


Figure 13. Top 5 BDC Exposure Share to First Brands

CIK	BDC	Shares	Public
1287032	Prospect Capital Corp	36%	V
1742313	Monroe Capital Income Plus Corp	15%	
1675033	Great Elm Capital Corp	12%	V
1501729	FS Specialty Lending Fund	11%	
2011498	AGL Private Credit Income Fund	4%	
Total		78%	

- Top 5 BDCs collectively hold ~80% of the exposure.
- Largest holder alone holds 36%.
- Bankruptcy losses will disproportionately hit a few lenders.
- For public BDCs, this concentrated exposure translated directly into NAV volatility and stock price pressure.

CASE STUDY

VALUATION TRAJECTORY: FV/COST RATIO

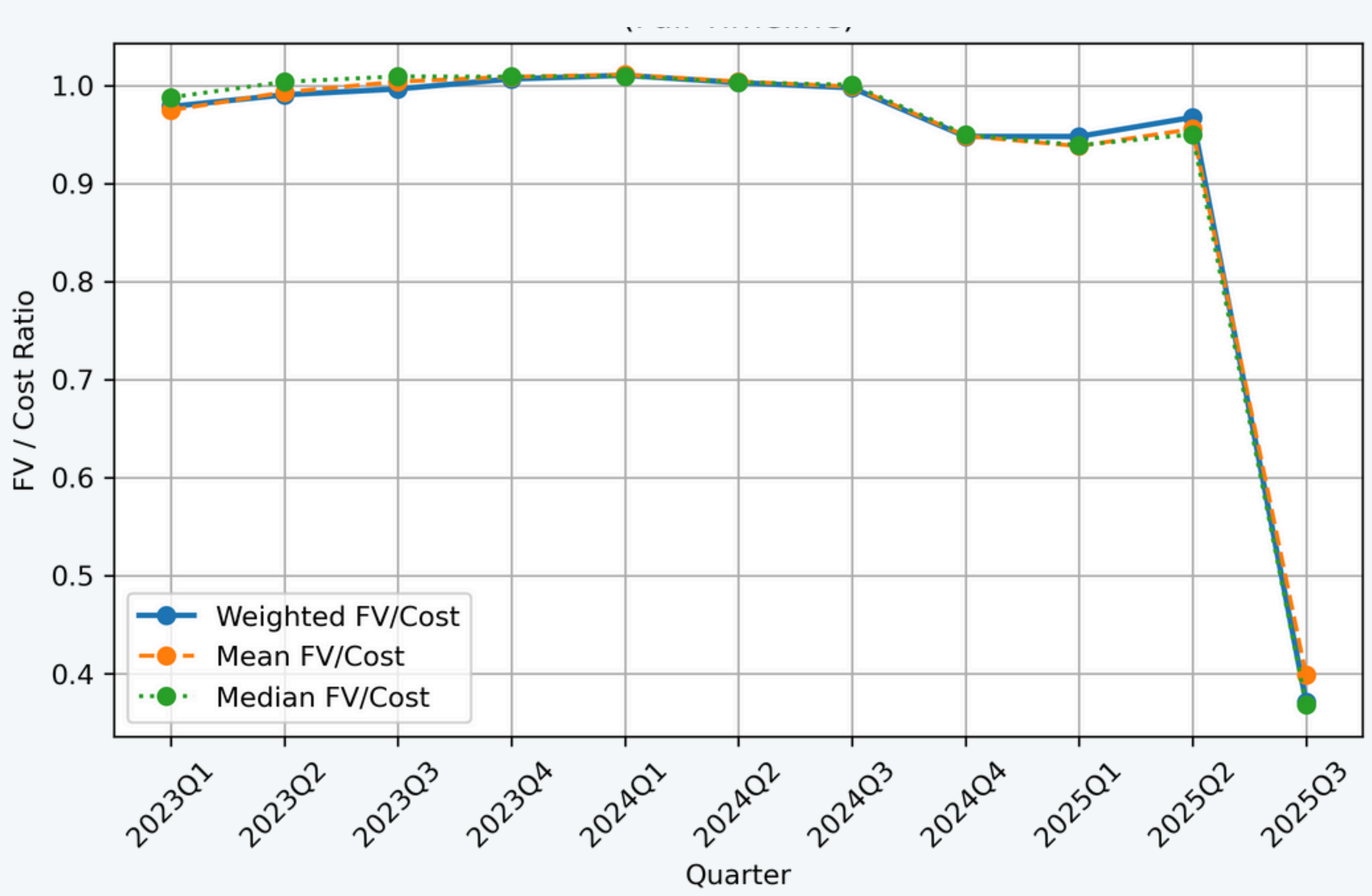


Figure 14. FV/Cost Ratio (Full Timeline)

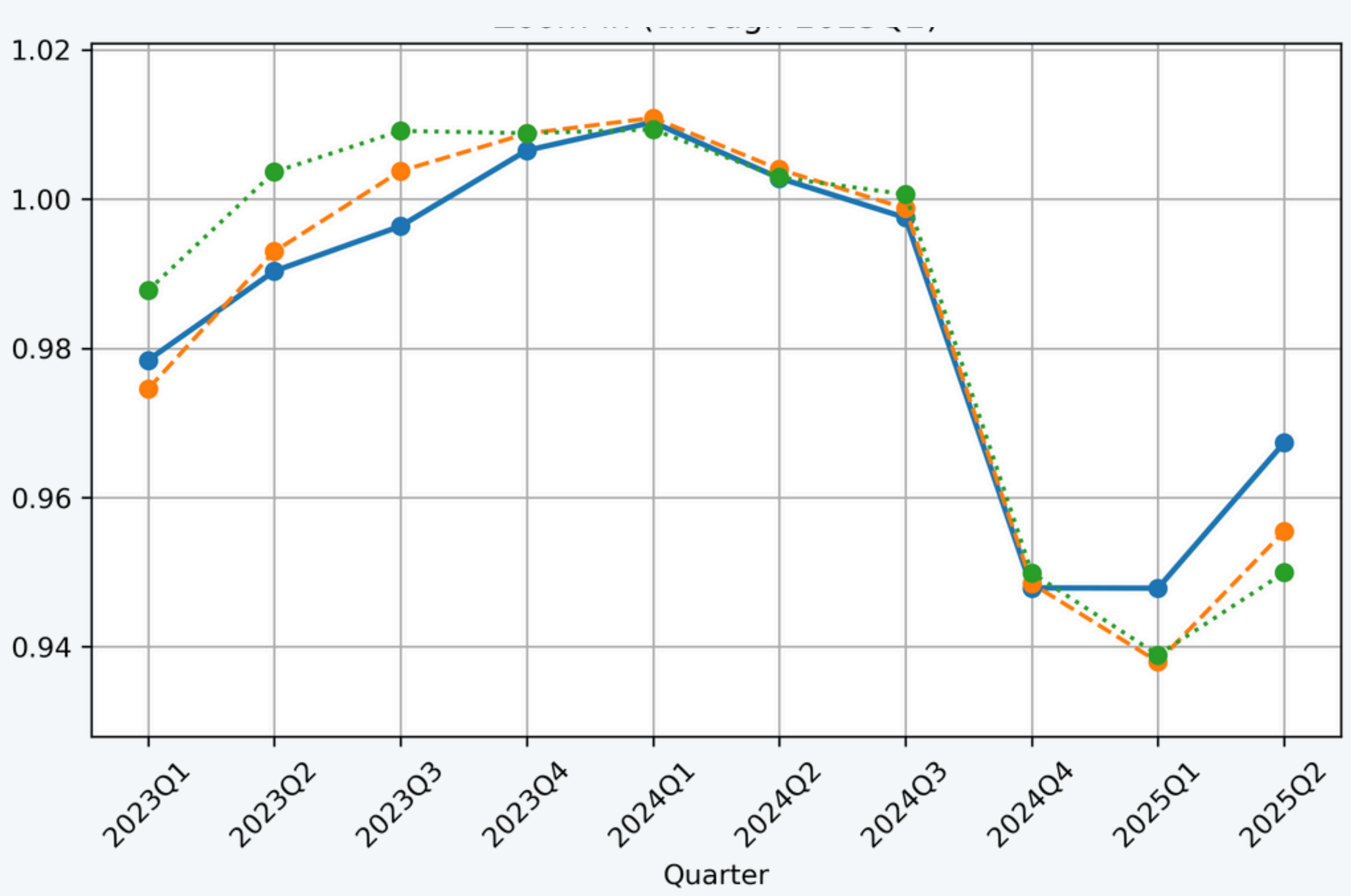


Figure 15. FV/Cost Ratio (~2025Q2)

- Stage 1 – Stable Valuation (2023–2024Q2): FV/Cost 0.99~1.01, signaling industry consensus that the loan was performing.
- Stage 2 – Early Warning (2024Q3–2024Q4): FV/Cost ~0.95, indicating the start of valuation stress well before bankruptcy.
- Stage 3 – Major Impairment (2025Q3): FV/Cost ~0.35, bankruptcy or restructuring event fully priced in.

CASE STUDY

VALUATION DISPERSION: SIGNS OF STRESS

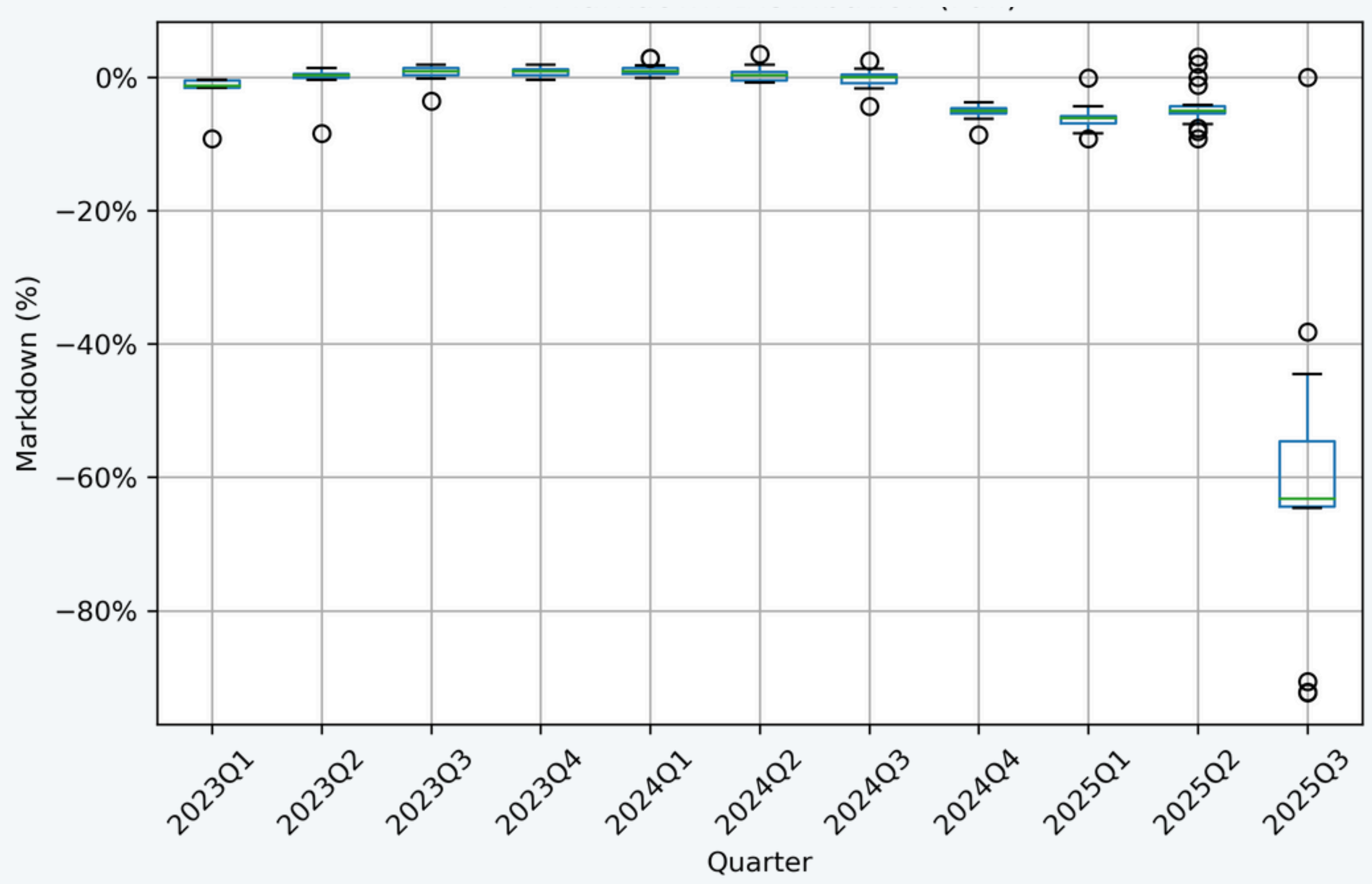


Figure 16. FV Markdown (Full)

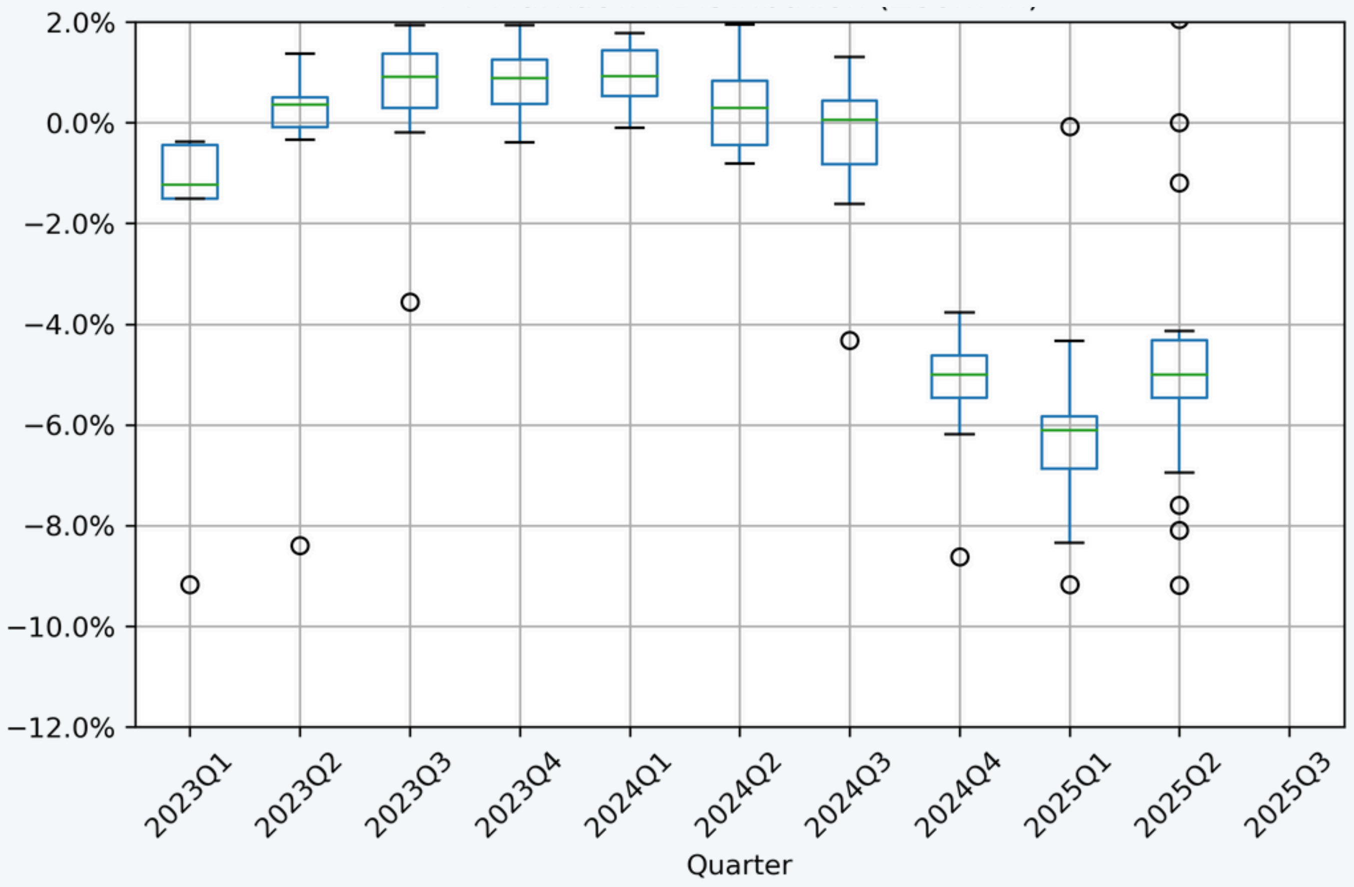


Figure 17. FV Markdown (Zoom-In)

- 2023Q1–2024Q3: extremely tight markdown distribution → lenders broadly agreed on valuation.
- 2024Q4–2025Q2: dispersion widens meaningfully → Some BDCs start markdowns early.
- 2025Q3: markdowns range from –10% to –90%, matching media commentary on valuation divergence.
  - Differences in internal valuation models; different recovery rate assumptions; differences in lien position (1st vs 2nd lien), etc.
- Dispersion itself is a leading indicator of credit stress.

CASE STUDY

IDENTIFYING VULNERABLE LENDERS (PER-BDC VALUATION TRAJECTORIES)

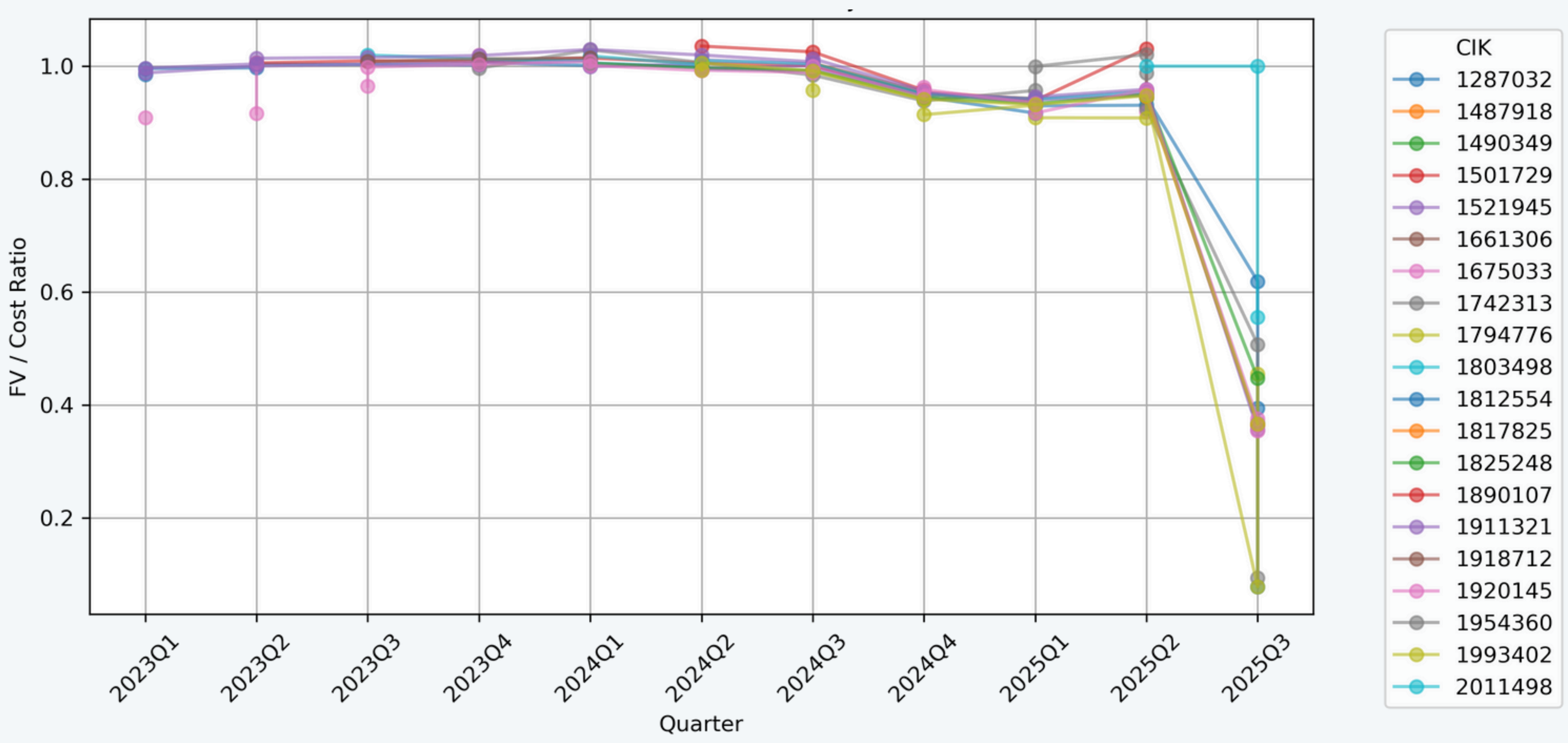


Figure 18. Per-BDC FV/Cost Markdown Trajectories

Heterogeneity in credit-risk management across lenders:

- Some BDCs began gradual markdowns as early as 2024 Q4 → more conservative internal valuation.
- All BDCs markdown in 2025Q3, but severity varies dramatically.
- 5 BDCs exited their positions before 2025Q2 (e.g. Ares, Blue Owl)
- The chart allows us to pinpoint:
  - Which BDCs mark conservatively vs aggressively?
  - Which lenders systematically lag the market signal?
  - Underscores the need to examine each BDC's internal valuation model and assumptions.

DEVELOP A HIGHER-FREQUENCY PRIVATE CREDIT INDEX WITH LOWER REPORTING LAG (NOWCASTING)

DESMOOTH RETURNS USING EXPANDED DATA

FUTURE SCOPE

BUILD SECTOR, INDUSTRY, MARKET-SIZE, AND YIELD SUB-INDICES AND OTHERS TO TRACK CDLI-V/CDLI-P/CDLI-UMM/CDLI-LMM

INCREASE DATA COVERAGE FOR A STRONGER SIGNAL

App. 4. - CDLI Sub-Indices

CONCLUSION

- **Greater Data Accessibility**
  - Expanded access to Private Credit data through quarterly SEC Schedule of Investments (iXBRL format).
  - Streamlined and normalized the dataset by addressing formatting errors, currency mismatches, and basis-point deviations.
  - Monthly filings available as well which allow for more frequent and timely index updates.

- **Enhanced Market Transparency**
  - The newly constructed index significantly improves visibility into Private Credit performance and return dynamics.

- **Improved Portfolio Insights**
  - Private Credit delivers steady returns with low volatility, supporting its role as a stable component in diversified portfolios.

- **Customizable Sub-Indexes**
  - Ability to build sector or loan-type sub-indexes enables more informed investment analysis and benchmarking.

- **Streamlined Case Study Analysis**
  - Case studies (e.g., First Brand's Case) can now be executed with greater accuracy and efficiency due to improved data structure and accessibility.

Our project establishes a strong and scalable foundation for future research and product development in Private Credit analytics. With improved data accessibility, enhanced transparency, and new analytical capabilities, we are now positioned to drive more informed investment decisions and unlock deeper insights into the Private Credit market.

THANK YOU

APPENDIX

APP. 1.A - CURRENCY COMPOSITION

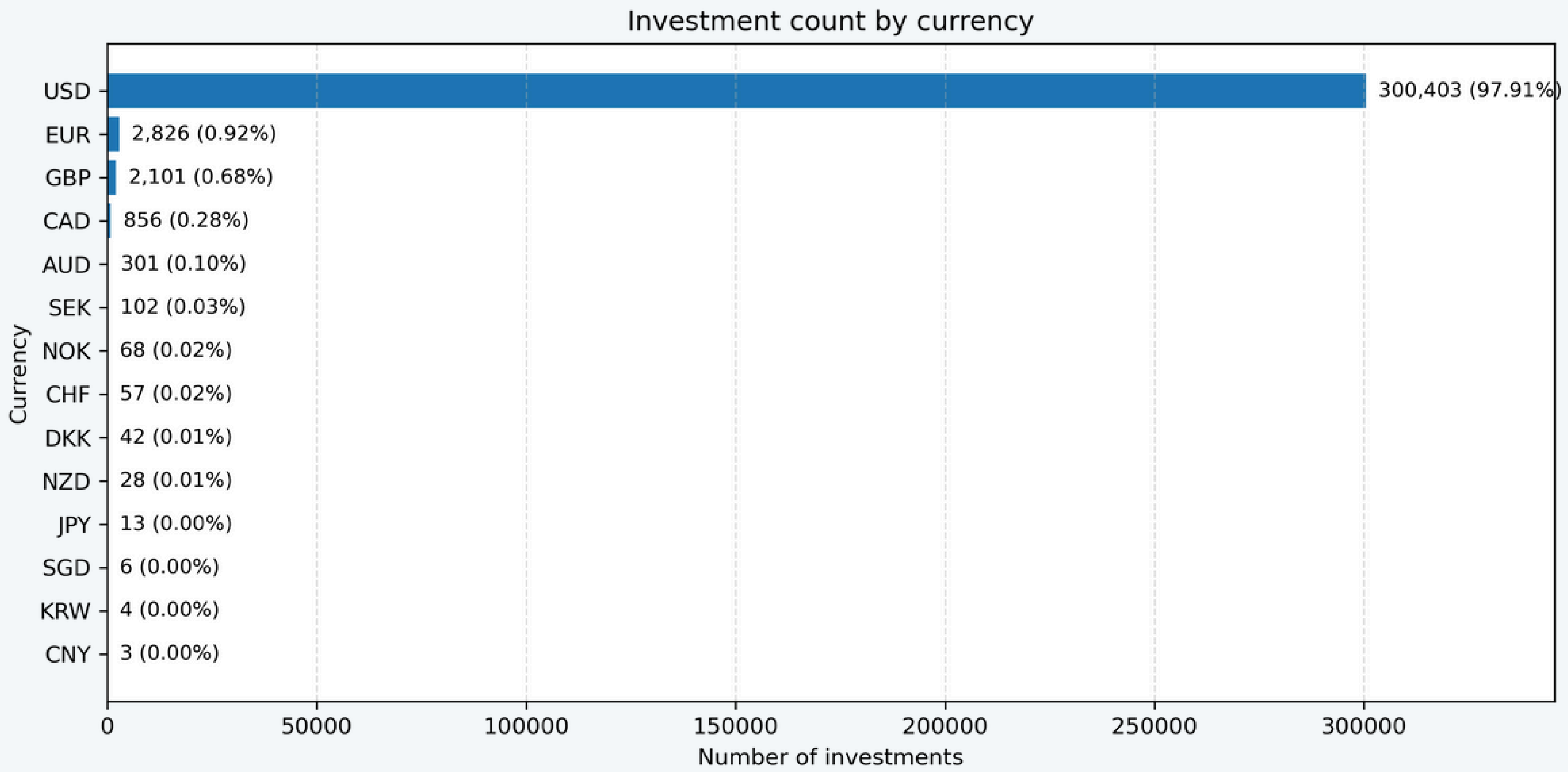


Figure A1.ii Currency Distribution (All Investments)

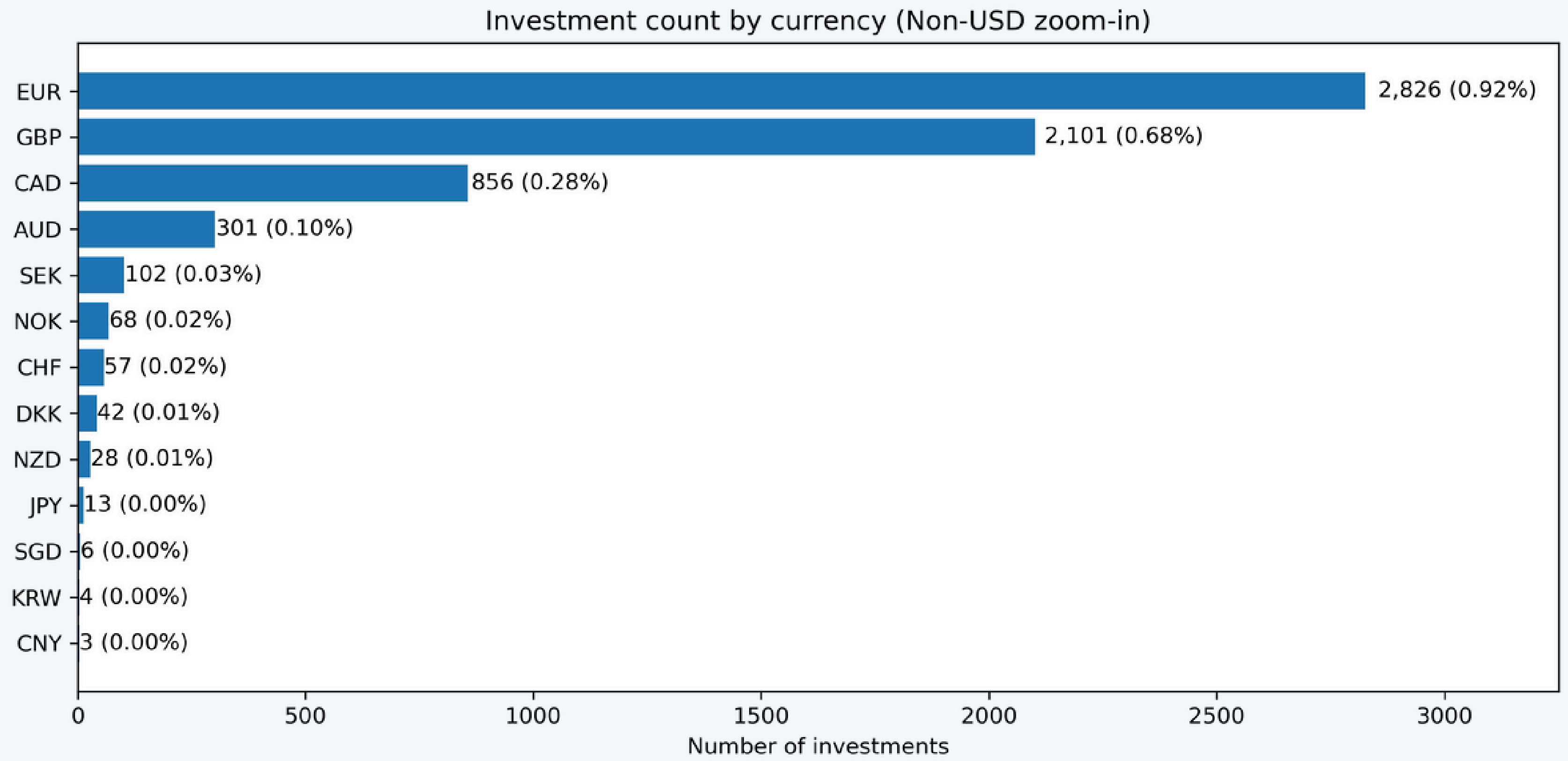


Figure 1A.i Currency Distribution (Excluding USD)

- USD dominates the portfolio's currency exposure (97.91%).
- Non-USD currencies each represent less than 1% of total positions.
- The distribution shows that currency risk is minimal at the aggregate level.

- Displays the relative shares of only non-USD currencies.
- The largest non-USD exposures are still extremely small (each <1%).
- Confirms that international or FX-related effects have negligible impact on portfolio-level analysis.

APP. 1.B - Q-Q AUM & BDC COUNT

QUARTER	AUM (IN)	UNIQUE CIK (IN)	UNIQUE CIK (OUT)	AUM (OUT)
2023Q1	591110.73	96	1	174.5
2023Q2	3776.26	9	1	15.05
2023Q3	12046.39	16	2	3236.88
2023Q4	1167.55	8	1	600.202
2024Q1	891.96	6	2	3666.45
2024Q2	2495.88	7	0	0
2024Q3	2323.47	3	5	6562.13
2024Q4	4544.08	8	1	4725.176
2025Q1	2077.46	5	1	149.97
2025Q2	5898.98	15	159	540865.78

Note: AUM reported in Million Dollar denomination.

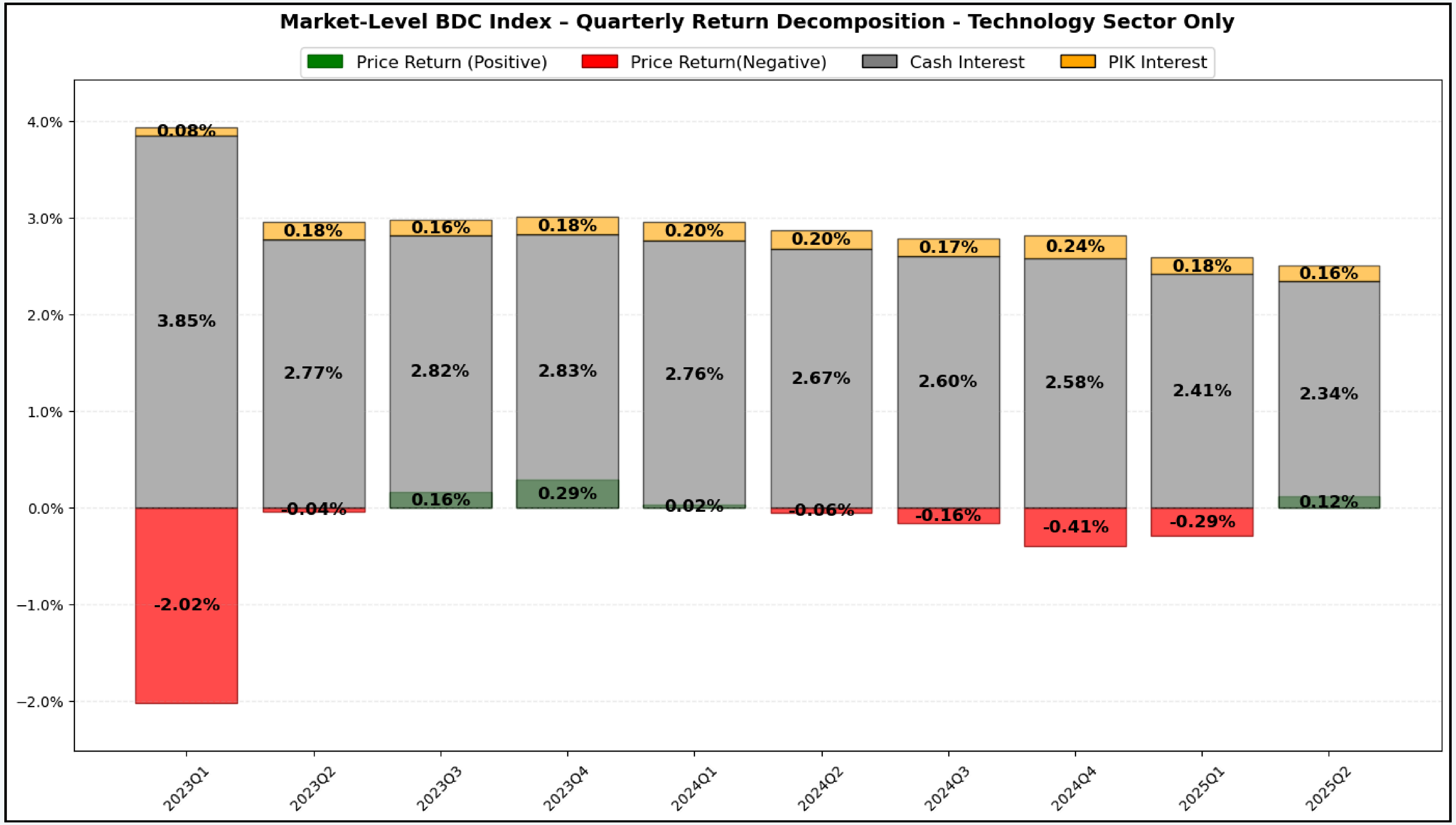
APP. 2.A. - RETURN DECOMPOSITION

TOTAL RETURN	=	INCOME	+	UNREALIZED GAINS (LOSSES)	+	REALIZED GAINS (LOSSES)
		Interest Payments Dividends Price Discounts		Δ in Loan Values (Mark-to-market)		Default Recoveries

- Total returns of the index are divided into the three major components that investors use to assess performance for credit-driven securities:
  - **Income Return:** Includes contractual interest payments and, to a lesser degree, price discounts direct lenders might receive when they originate loans. It also includes dividend payments and other sources of income as reported on BDC income statements.
  - **Unrealized Gains (Losses):** Includes changes in loan values as determined by valuation agents. These are generally a reflection of movement in overall market spreads or changes in the assessment of specific loan credit risk, akin to a loan loss reserve.
  - **Realized Gains (Losses):** Includes losses predominantly and are the product of loan-specific defaults and recoveries, which result in a write-down of loan principal.

Source: Cliffwater Direct Lending Index Methdology

APP. 2.B. - RETURN DECOMPOSITION



APP. 3. - DATASET COVERAGE

SENIORITY FLAG	NUMBER OF ROWS	ROW SHARE
CLASSIFIED BY SENIORITY RULES	200457	65%
UNCLASSIFIED	112427	35%

INSTRUMENT SENIORITY	NUMBER OF ROWS	ROW SHARE
CLO STRUCTURED EQUITY	136	0.04%
UNKNOWN	11247	36%
SENIOR SECURED (1L)	153394	49%
SENIOR SECURED (2L)	7274	2.30%
SENIOR SECURED (UNSPEC.)	31235	9.90%
SENIOR UNSECURED	1008	0.32%
SUBORD. MEZZANINE	3385	1.10%
UNITRANCHE	4025	1.20%

APP. 3. - DATASET COVERAGE

SECTOR CLASSIFICATION	NUMBER OF ROWS	ROW SHARE
TECHNOLOGY	54904	17.50%
HEALTHCARE	39145	13%
FINANCE & INSURANCE	26281	8%

INDUSTRY CLASS	NUMBER OF ROWS	ROW SHARE
CLASSIFIED	175	65%
UNCLASSIFIED	112427	35%

APP. 4. - CDLI SUB-INDICES

- **CDLI-Senior (CDLI-S)**
  - The CDLI-S is comprised primarily (95%+) of senior and unitranche loans held within BDCs and was created to address the comparative performance of senior middle market loans against the entire universe of middle market loans represented by CDLI.
- **CDLI-Venture (CDLI-V)**
  - The CDLI-V is comprised primarily of venture-backed loans held within BDCs and was created to investigate the comparative performance of this less common type of lending against the entire universe of middle market loans represented by CDLI.
- **CDLI-Perpetual (CDLI-P)**
  - CDLI-P focuses on perpetually structured, non-traded BDCs that have no planned liquidity event. These vehicles offer limited quarterly redemptions (typically capped at ~5%). The sub-index enables us to compare the performance of this growing perpetual-life BDC segment with the broader middle-market loan universe, as captured by CDLI.
- **CDLI-Upper Middle Market (CDLI-UMM)**
  - CDLI-UMM is comprised primarily of loans held in BDCs who focus on lending to borrowers in the upper middle market, which we generally define as borrowers averaging $100 million in annual EBITDA and greater.
- **CDLI-Lower Middle Market (CDLI-LMM)**
  - CDLI-LMM is comprised primarily of loans held in BDCs who focus on lending to borrowers in the lower middle market, which we generally define as borrowers averaging less than $40 million in annual EBITDA.

Source: Cliffwater Direct Lending Index Methdology