

Abstract

This study develops a Monte Carlo simulation to quantify the risk and return profile of Apollo's recently launched \$25 billion private credit portfolio. The model integrates cash flow mechanics, default probabilities, and recovery dynamics across six asset classes, each characterized by distinct repayment structures and risk-return profiles. These asset classes include senior secured loans, middle-market direct lending, unitranche loans, mezzanine debt, distressed credit, and real estate debt, tailored to diverse borrower needs and risk tolerances. The simulation produces metrics at the portfolio, asset-class, and time-series levels, offering insights into diversification, yield variation, and default risk under simulated market conditions.

Executive Summary

Key findings include a projected portfolio ROI of 20.6% over 15 years, with total profits of \$5.14 billion, driven by \$7.64 billion in interest payments and a recovery rate of 62.8% on defaulted loans. Middle-market direct lending and mezzanine loans emerged as the most profitable asset classes, contributing \$1.54 billion each to net profits. Mezzanine loans delivered a standout ROI of 62%, attributed to compounding Payment-in-Kind (PIK) interest and deferred repayments, despite a high 42% default rate. In contrast, senior secured loans offered stability with the lowest ROI of 9.1%. The analysis revealed the portfolio's breakeven point at 8 years and 11 months, with profitability following a logistic growth trajectory. These insights underscore the portfolio's potential to address growing market demand while balancing diversification and risk management. The study supports Apollo's strategy of leveraging private credit's flexibility to meet complex financing needs in an evolving market.

1. Introduction

Private credit has emerged as one of the fastest-growing segments of the financial system over the past 15 years, with growth initially concentrated in direct lending. This expansion was driven by banks' retreat from leveraged lending, prompted by tighter post-2008 regulations, and the rapid rise of private equity, which fueled demand for flexible financing solutions. As interest rates rise and private equity activity slows, private credit is diversifying into asset-based finance and real estate lending. This shift reflects a broader transition of credit assets from bank balance sheets to nonbank entities, creating opportunities for private credit funds and banks to collaborate in distributing credit risk and expanding origination capabilities.

One notable example of this evolution is the recent collaboration between Apollo Global Management and Citigroup. Announced just two months ago, the \$25 billion private credit program combines Apollo's vast capital resources with Citi's capital markets expertise to address the growing demand for non-investment grade middle-market and large corporate financing. This partnership reflects a broader trend of integrating private credit with traditional banking to meet complex funding needs.

This study examines the feasibility and sustainability of the private credit boom through the lens of Apollo's program. By analyzing its risk-return dynamics and diversification potential, the paper evaluates how large-scale private credit initiatives can balance growing market demand with the challenges of default risks and market volatility.

2. Model Description

The model begins by gathering loan-specific metrics, originating a portfolio by allocating capital across asset classes, and simulating repayment schedules and cash flows for each loan. Results are then aggregated to evaluate portfolio-level risk and performance. A Monte Carlo framework repeats this process across numerous iterations to capture variability in outcomes.

2.1 Portfolio Building

The portfolio is centered around non-investment grade Senior Secured Loans and Middle-Market Direct Lending, which provide core stability and predictable returns, while incorporating four additional asset classes designed to enhance yield and diversification. The justification and allocation percentages for each loan type are listed below.

Middle-Market Direct Lending – 35%

This allocation underscores Apollo's focus on addressing financing gaps in the underbanked middle-market segment. These loans provide high yields and customized financing solutions, representing a critical growth area in private credit.

Senior Secured Loans (Large Corporate) – 30%

Provides relative stability within the portfolio by prioritizing seniority in the capital structure and collateral backing. These loans offer predictable cash flows and mitigate risk compared to other non-investment-grade credit instruments, serving as an anchor for the portfolio.

Unitranche Loans – 10%

A hybrid structure that blends senior and junior risk, delivering higher yields for middle-market borrowers while streamlining financing and offering flexibility to meet diverse capital needs.

Mezzanine Debt – 10%

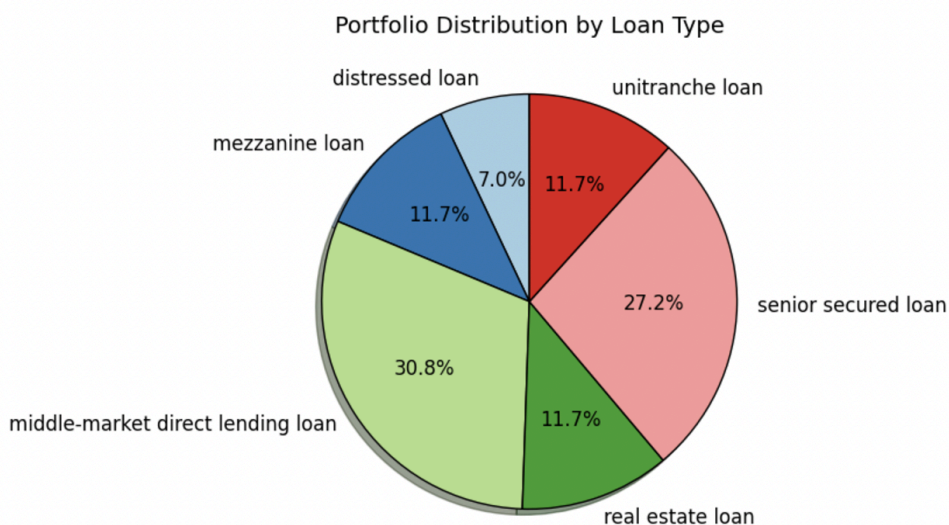
Adds high-yield potential and equity-like upside, complementing the portfolio's senior debt-heavy structure. Provides subordinated risk for enhanced returns, albeit with increased risk exposure.

Distressed & Special Situations – 5%

An opportunistic allocation targeting complex, high-return opportunities, relying on expertise to invest selectively in distressed credit scenarios and maximize upside.

Real Estate & Infrastructure Debt – 10%

Provides diversification with stable, long-term returns backed by real assets, targeting riskier real estate for higher yields and growth potential.



2.2 Loan Parameters

Next, we extrapolate recent metrics for each asset class from Bloomberg Terminal, including expected yield (mean and standard deviation), term structure, repayment modality, and default risk. The figures are derived from a combination of bond ETFs and tranche loan data, selected as proxies to approximate the characteristics of the loans in our portfolio. Yields are based on the all-in yield or weighted average yield-to-maturity (YTM) of the proxies, adjusted for specific loan features like cash-to-PIK ratios. Yield standard deviations are derived from the variability in loan spreads observed across short-term and longer-term maturities. Default rates are derived by allocating a portion of the loan's spread to

default risk and dividing it by one minus the expected recovery rate, adjusted for collateral and enforcement assumptions.

	mean_yield	std_yield	term_length	repayment_structure	interest_type	default_rate
Senior Secured Loans (BB)	6.31%	0.17%	(3, 6)	amortizing	floating	2.04%
Middle-Market Direct Lending	7.79%	0.39%	(4, 8)	amortizing_balloon	[fixed, floating]	3.47%
Unitranche Loans	9.11%	0.39%	(4, 6)	bullet	floating	4.73%
Mezzanine Debt	15.00%	0.09%	(7, 10)	bullet_with_PIK	fixed	6.88%
Distressed and Special Situations	16.69%	1.27%	(2, 5)	[PIK, bullet]	fixed	9.80%
Real Estate and Infrastructure Debt	7.61%	1.17%	(5, 11)	interest_with_balloon	floating	1.78%

2.2 Loan Origination

To populate the portfolio, capital is allocated across loan types each quarter for the first five years, adhering to the portfolio's target composition. Individual loans are generated with principals ranging from 0.4% to 0.6% of total capital. Key parameters, such as interest rate, repayment structure, and default risk, are assigned using normal distributions, while variable attributes like fixed or floating interest rates and repayment modalities are randomly determined. The final dataset typically includes around 285 loans, capturing all relevant details such as loan type, principal, interest rate, and origination period. This results in a well-defined portfolio, prepared for detailed analysis and scenario modeling.

2.3 Repayment Simulation

The next step is to define the cash flow schedule for each loan type. The following repayment functions simulate the financial mechanics of each loan, incorporating variations in amortization schedules, default probabilities, and recovery scenarios to accurately represent the distinct repayment structures across asset classes.

Middle-Market Direct Lending

Middle-market direct lending loans use an amortizing-balloon repayment structure, where a portion of the principal is deferred to the final payment (40%), and fixed quarterly payments cover interest and part of the non-balloon principal. The floating interest rate is recalculated each quarter based on a normal distribution reflecting the loan's yield parameters. The loan principal (P) is secured by collateral, valued as the remaining principal divided by the loan-to-value (LTV) ratio. The collateral depreciates over time, while a haircut and enforcement costs reduce its recovery value in the event of default.

Senior Secured Loans (Large Corporate)

Senior secured loans follow an amortizing repayment structure with fixed payments covering interest and principal. Each period, the floating interest rate is sampled from a normal distribution. The collateral and recovery logic remains consistent with the previous framework.

Unitranche Loans

Unitranche loans follow a bullet repayment structure, where the entire principal is repaid at the end of the loan term, and quarterly payments cover only interest. The floating interest rate adjusts each quarter, and the collateral value and recovery logic remain the same. However, recovery is split between first-out (70%) and last-out lenders, with losses distributed accordingly.

Mezzanine Debt

Mezzanine loans also follow a bullet repayment structure. However, interest is divided into cash (60%) and payment-in-kind (PIK) components. The PIK interest is added to the outstanding principal each quarter, increasing the total balance over time. Defaults are simulated quarterly, but the recovery is calculated as 20% of the remaining principal at default due to the higher risk and subordinated position of this loan type.

Distressed and Special Situations

Distressed loans are modeled randomly with two repayment structures: PIK (Payment-in-Kind) or bullet. For PIK loans, accrued interest is added to the principal each quarter, while bullet loans have deferred and ramp-up periods during which interest accrues and payments gradually increase. Recoveries are calculated separately for the secured and unsecured portions of the loan. Secured recoveries depend on the collateral value, adjusted for haircuts and enforcement costs, while unsecured recoveries are based on a low fixed recovery rate (10%).

Real Estate and Infrastructure Debt

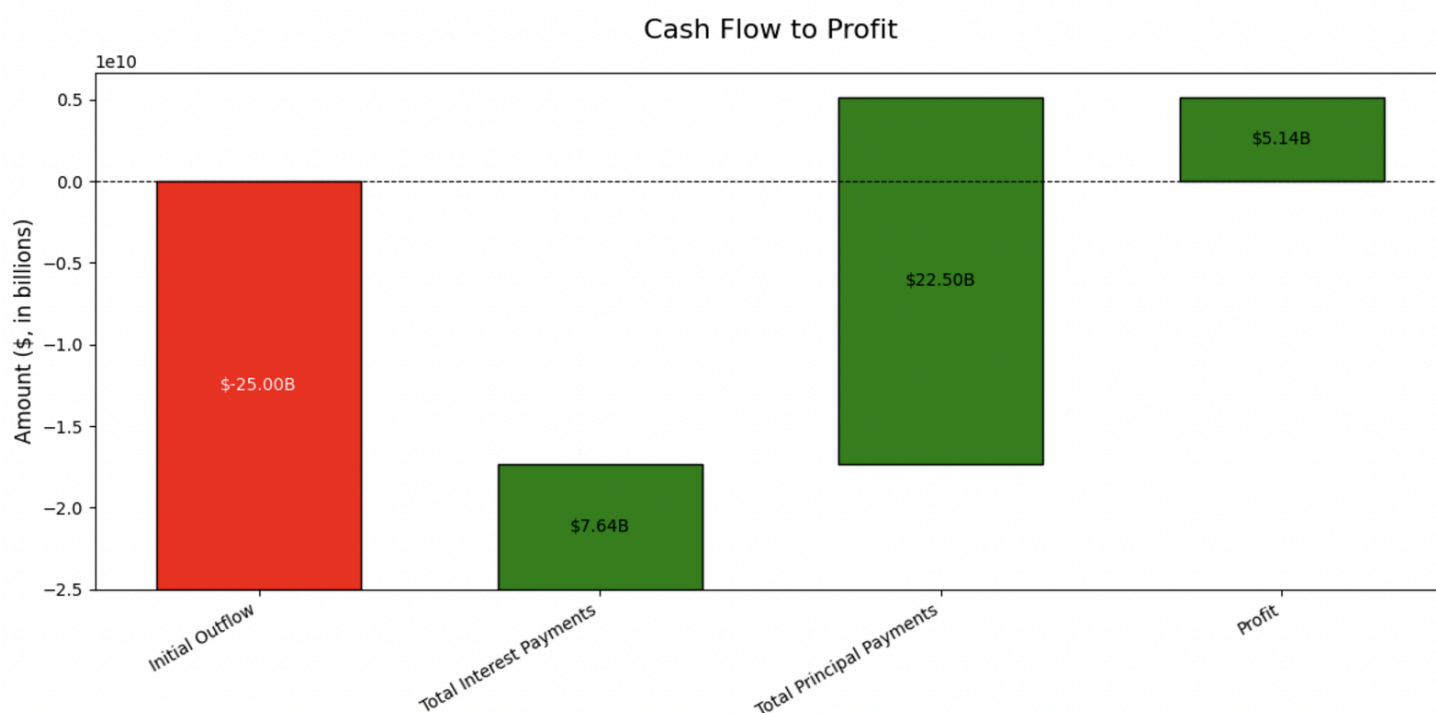
Real estate loans follow an interest-plus-amortizing-balloon repayment structure, where a portion of the principal is amortized over the term, and the remaining balloon principal is repaid in the final quarter. Interest payments are calculated quarterly based on a floating interest rate. Defaults are modeled quarterly, and recovery is based on the depreciated collateral value, adjusted for haircuts and enforcement costs, similar to other loan types.

2.3 Portfolio Simulation

After defining the repayment structure for each loan type at an individual level, the next step is to simulate the repayment schedule for the entire loan portfolio by dynamically applying the appropriate function for each loan type. Using a Monte Carlo approach, the portfolio is simulated 1,000 times, with loans initialized based on the process described above. This process tracks loan performance and calculates aggregate metrics at the portfolio, loan-type, and quarterly levels. The following section presents the conclusions derived from these simulations.

3. Conclusions

The simulation of the portfolio yielded total profits of \$5.14 billion over a 15-year horizon, corresponding to an ROI of 20.6%. These profits were generated through \$7.64 billion in interest payments and the recovery of \$22.5 billion of the initial \$25 billion principal investment.



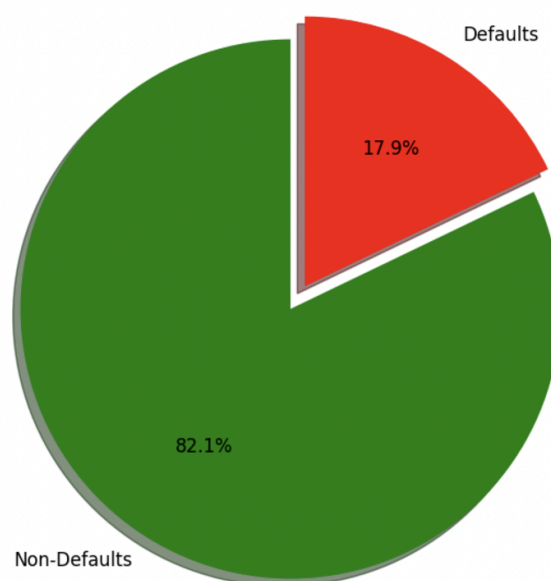
Despite these returns, the portfolio experienced a 17.9% default rate across an average of 285 loans, resulting in \$1.48 billion in losses. However, recoveries from defaults amounted to \$2.50 billion, offsetting 62.8% of the potential incurred losses.

Across asset types, Middle-Market Direct Lending and Mezzanine Loans emerged as the most profitable asset classes, each contributing \$1.54 billion in net profits. However, these loan types differed significantly in their portfolio allocations, with mezzanine loans accounting for only 10%, while middle-market loans represented 30% of the total portfolio.

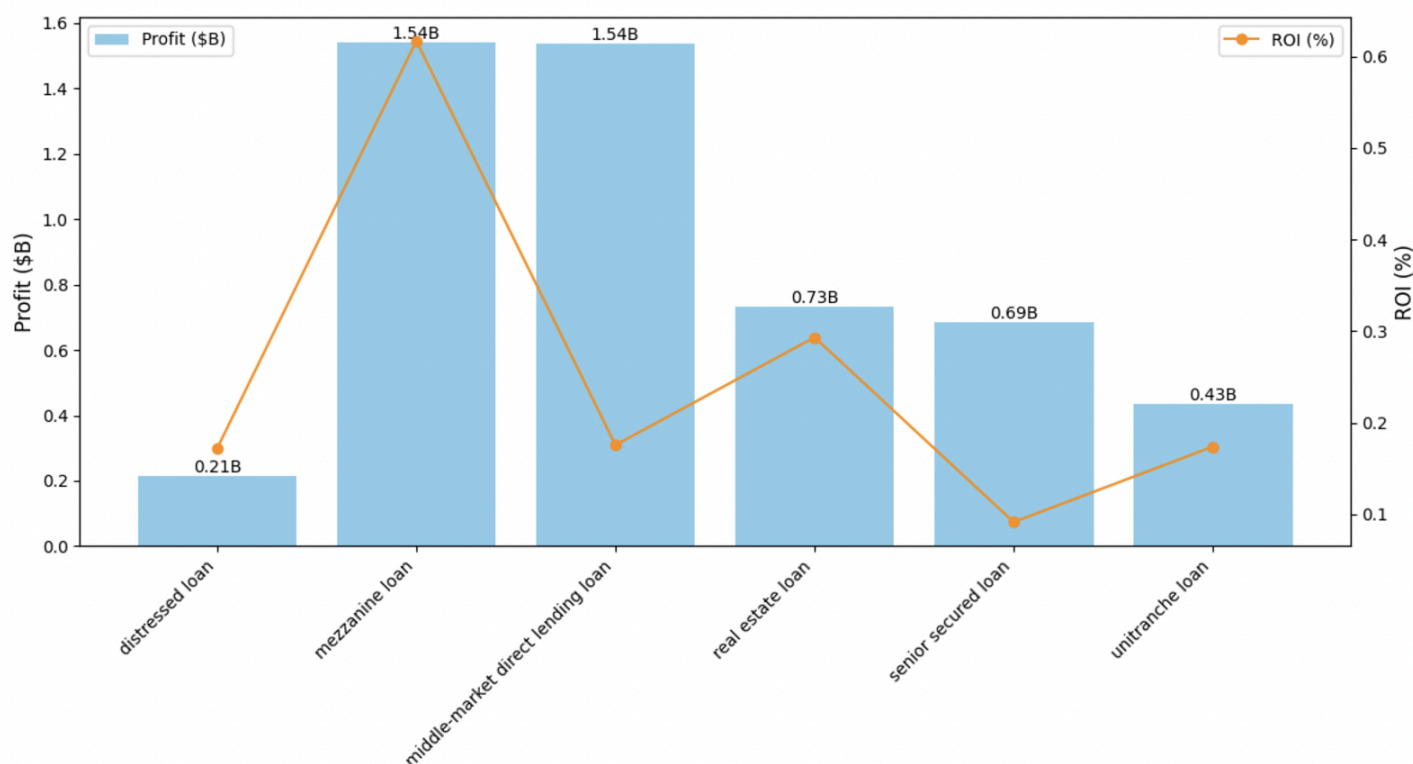
Mezzanine loans demonstrated a remarkably high ROI of 62%, which significantly exceeded that of other asset types. This performance can be attributed to the compounding effect of Payment-in-Kind (PIK) interest, where deferred interest accrues to the outstanding principal, and bullet repayment structures, which defer large principal repayments until maturity. Despite a 42% default rate, the high profitability of individual mezzanine loans offset their elevated risk profile.

Senior secured loans exhibited the lowest ROI of 9.1%, likely due to their lower-risk profile and conservative interest rate structures. While these loans provided stability to the portfolio, their contributions to overall profitability were comparatively limited.

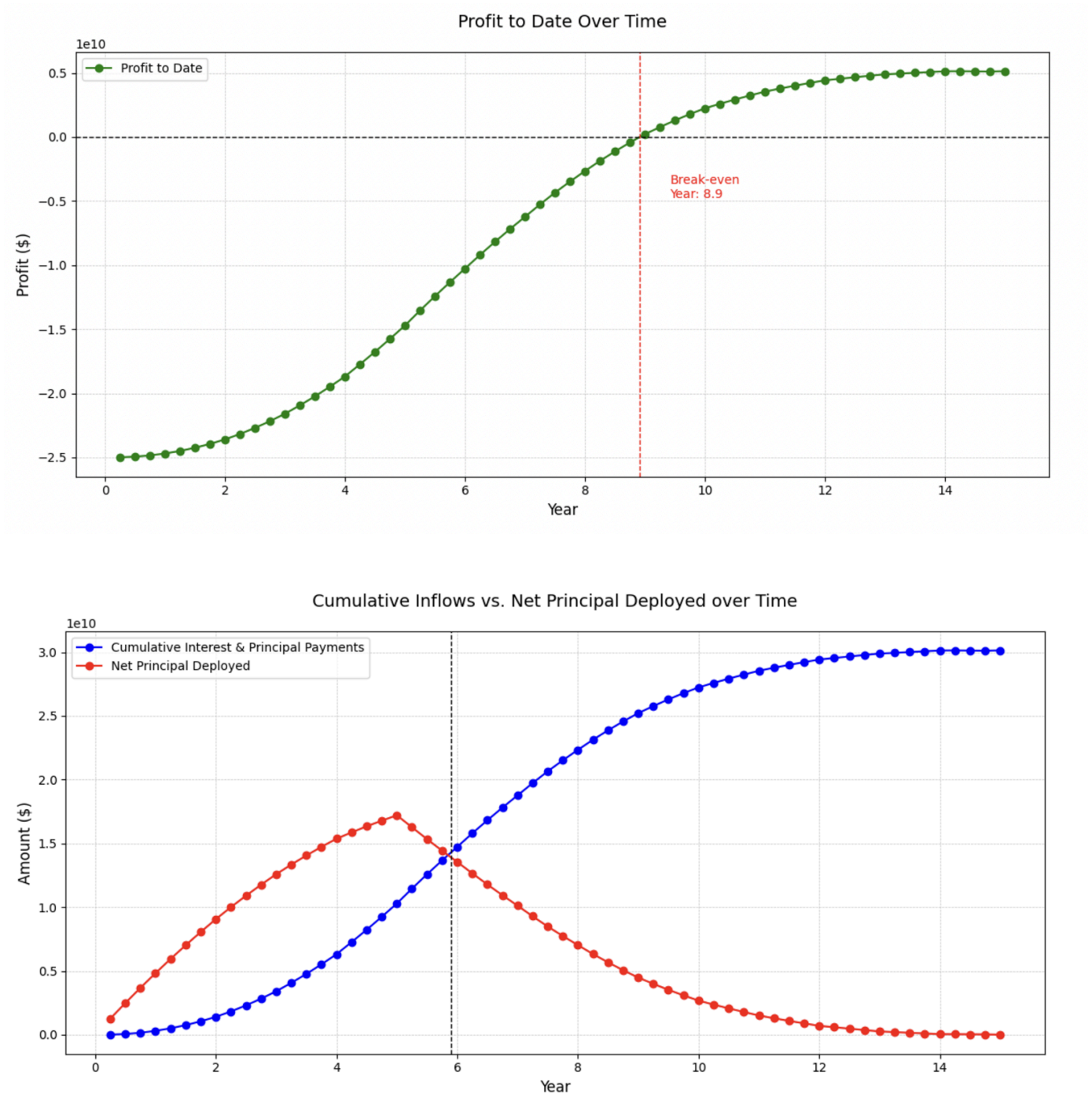
Loan Defaults as Proportion of Total Loans



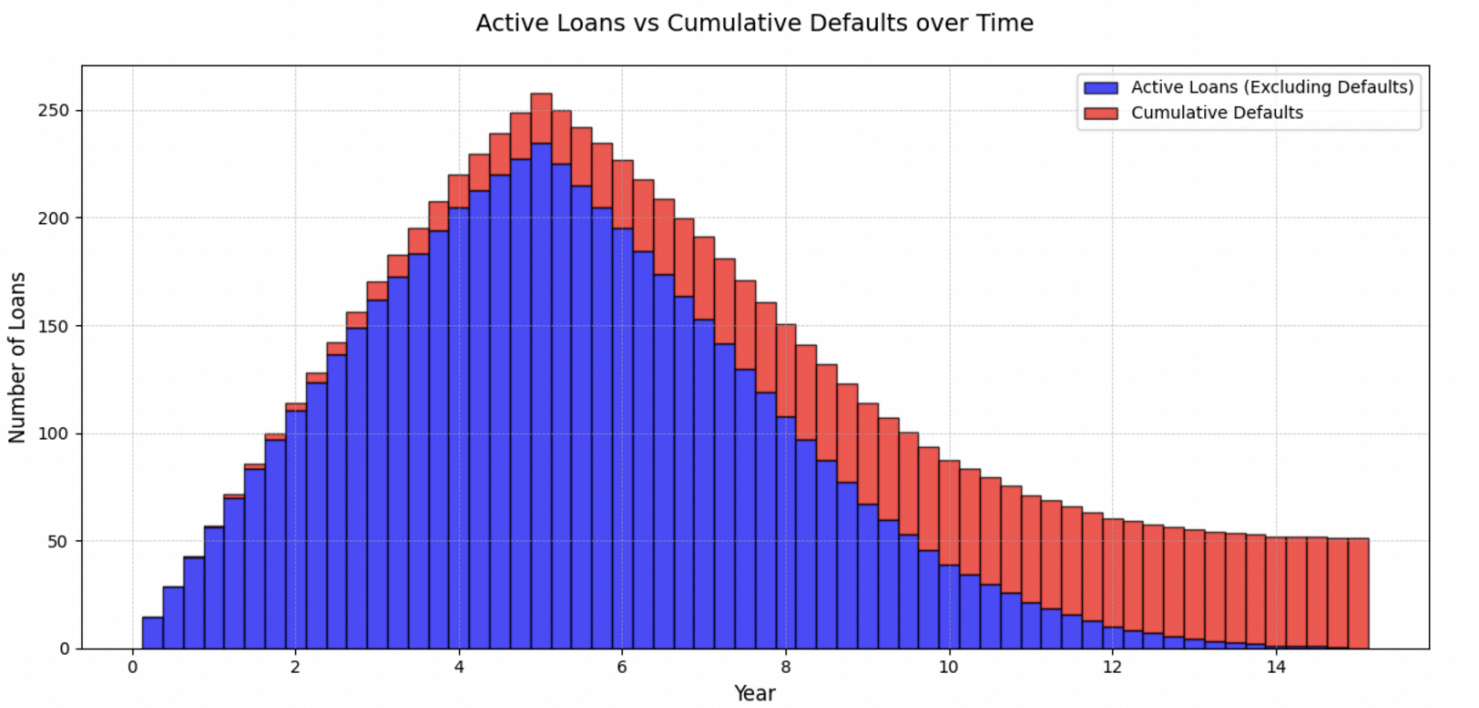
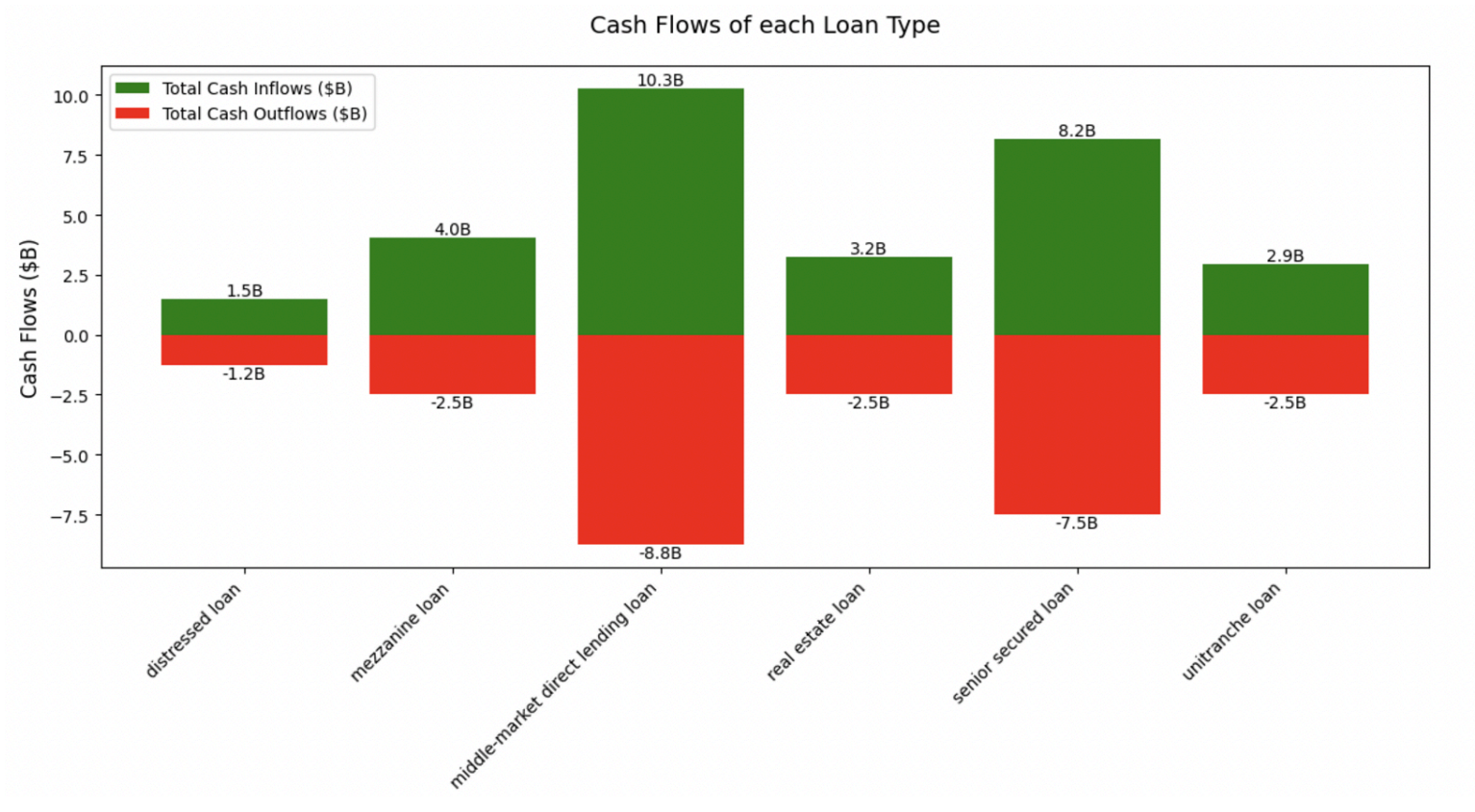
Profit and ROI for each Loan Type



The portfolio reached its break-even point after 8 years and 11 months, representing the time required for cumulative inflows (principal and interest) to exceed the initial capital outlay. The profit growth trajectory followed a logistic growth function, characterized by three distinct phases. In the initial phase, growth was slow, dominated by significant capital deployment and limited inflows during the early years. This was followed by an accelerated growth phase, where profit accumulation increased exponentially as inflows from interest payments and principal repayments grew. Finally, the curve entered a saturation phase, characterized by a flattening trajectory in later years as the portfolio approached a steady state due to loan maturities and reduced compounding effects.



Additionally, the portfolio’s cumulative inflows surpassed the net principal deployed just before the sixth year, marking a pivotal point in its profitability trajectory.



	loan_type	total_loans	total_defaults	default_rate	total_interest_payments	total_principal_payments	total_cash_inflows	total_cash_outflows	total_default_loss	total_recovery_amount	profit	roi
	distressed loan	20.000	5.060	0.253000	2.346853e+08	1.230255e+09	1.464941e+09	1.250000e+09	9.666069e+07	2.613419e+08	2.149407e+08	0.171953
	mezzanine loan	33.295	13.991	0.420176	1.710049e+09	2.331837e+09	4.041886e+09	2.500000e+09	1.046556e+09	2.616390e+08	1.541886e+09	0.616754
	middle-market direct lending loan	87.849	15.373	0.174908	2.813616e+09	7.472084e+09	1.028570e+10	8.750000e+09	1.956891e+08	1.082227e+09	1.535700e+09	0.175509
	real estate loan	33.436	4.166	0.124585	9.540446e+08	2.278778e+09	3.232822e+09	2.500000e+09	2.889269e+07	1.923295e+08	7.328224e+08	0.293129
	senior secured loan	77.518	6.034	0.077841	1.013205e+09	7.171824e+09	8.185029e+09	7.500000e+09	7.132837e+03	3.256788e+08	6.850289e+08	0.091337
	unitranche loan	33.284	6.335	0.190379	9.146029e+08	2.019698e+09	2.934301e+09	2.500000e+09	1.136783e+08	3.666235e+08	4.343011e+08	0.173720

Results for each unique loan type

References

- [1] Faridi, F., Spivey, J., & Kwek, J.-H. (2024, September 24). *The next era of private credit*. McKinsey & Company.
<https://www.mckinsey.com/industries/private-capital/our-insights/the-next-era-of-private-credit#/>
- [2] Gillespie, T., & Basak, S. (2024, September 26). *Citigroup, Apollo team up in private credit push (C, APO)*. Bloomberg.com.
<https://www.bloomberg.com/news/articles/2024-09-26/citigroup-apollo-join-forces-in-25-billion-private-credit-push>