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INSTITUTIONAL ADVISORY & SOLUTIONS

A RISING PRIVATE ASSET CLASS

Core+ Real Estate Debt

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AUTHORS

Michelle (Yu) Teng, PhD, CFA, CAIA
Vice President
PGIM IAS
michelle.teng@pgim.com
+1 973 367 6947

Wenbo Zhang
Senior Associate
QMA
wenbo.zhang@qma.com
+1 919 536 2056

Jonathan P. Kohana
Senior Investment Associate
PGIM Real Estate
jonathan.kohana@pgim.com
+1 212 960 3091

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The Global Financial Crisis (GFC) disrupted the real estate (RE) debt market and triggered a retrenchment by traditional lenders such as commercial banks. Since then, this financing void has been filled by private fund vehicles – particularly within the core+ RE market – which has enabled growing institutional investor allocations to private RE debt.

CIOs managing a multi-asset portfolio with allocations to both liquid and illiquid assets need to evaluate the cash flows from each asset class to better understand their portfolio's liquidity risk. However, due to the specific cash flow pattern of core+ RE debt funds, and a lack of publicly available data, commonly used cash flow models for other private assets such as private equity (PE) are not suitable.

We present a new cash flow model for private core+ RE debt funds. Our aim is to model a fund's key cash flow dynamics using reasonable, practitioner-supplied parameter estimates. As data become available, we expect to update the parameter values. The model incorporates sensitivity to the economic environment both at fund launch and over the fund's life.

This core+ RE debt cash flow model can be integrated into a multi-asset portfolio analytics tool such as the PGIM IAS asset allocation framework OASIS™ to help CIOs evaluate the diversification and liquidity management potential that private core+ RE debt may bring to their portfolios.

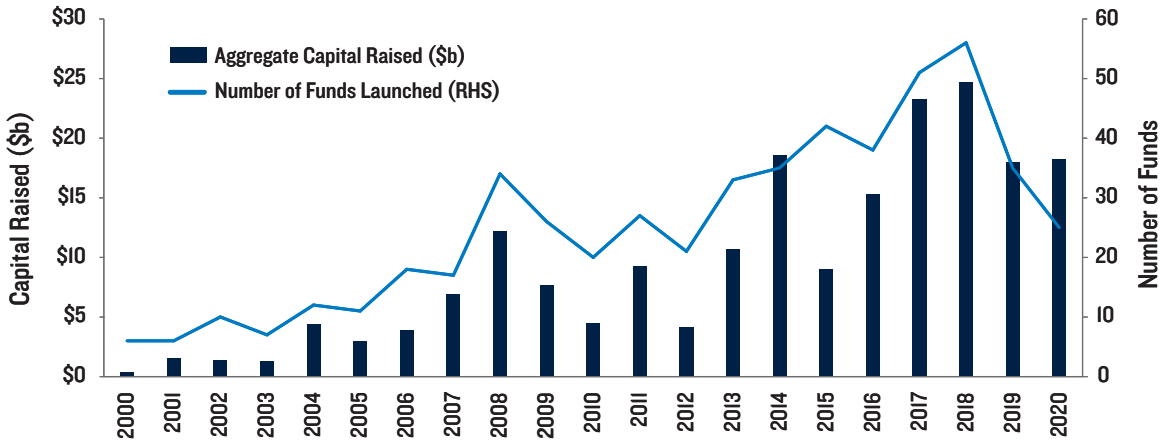
Institutional portfolios have been increasing allocations to global RE core+ debt, often via a private fund investment vehicle. Given the growing size of this market, CIOs have begun to ask how to model the cash flows and valuations for these funds. Unlike PE funds that CIOs are perhaps more familiar with, a distinguishing feature of core+ RE debt funds is the continual reinvestment of investor (*i.e.*, limited partner, or LP) capital as the underlying loans usually have a shorter maturity (2-3y, assuming no extensions) compared to the fund's life. In addition, core+ RE debt funds aim to provide a steady income stream (*i.e.*, regular interest payments, beginning almost immediately after fund inception), which can help CIOs meet periodic liquidity demands. In contrast, PE funds typically seek to provide growth and capital appreciation, with back-loaded and lumpy fund distributions. The Takahashi and Alexander (TA) model (2002) is a popular tool to model PE fund cash flows, but is not well suited for core+ RE debt funds. Not only does limited core+ RE debt fund-level data make TA parameter estimation difficult, the TA model cannot reflect the floating rate structure of core+ RE debt as well as a fund's continual reinvestment of LP capital. There is a need for a cash flow model specifically designed for core+ RE debt funds.

A core+ RE debt fund cash flow model, when integrated into a multi-asset, multi-period asset allocation tool, can help CIOs determine the optimal allocation to core+ RE debt funds by showing how this asset class performs across different economic scenarios, interacts with other liquid and illiquid assets, and how it can contribute to portfolio diversification.

Core+ RE Debt

RE debt finances the acquisition or recapitalization of commercial properties with priority claims to the properties' operational cash flows, while providing relative insulation from fluctuations in property values typically borne by equity investors. The GFC disrupted the RE debt market as commercial bank lenders retrenched due to regulatory and balance sheet pressures. Private capital sources filled this financing void, especially within the non-core (including core+) RE debt market.[1] The amount of private capital raised and the number of RE debt funds launched increased sharply post-GFC, and has continued to increase with little interruption (Figure 1). However, the recent proliferation of private RE capital strategies is not because the underlying properties are novel or that these RE loans were unavailable beforehand, but because traditional lenders have reduced their participation.

Figure 1: RE Debt Fund Capital Raising & Fund Launches



Note: Includes debt funds which target all real estate debt instruments, not solely core+ or transitional loans. A subset of the funds captured herein include CMBS in their mandates.
Source: Preqin, 31 December 2020. Provided for illustrative purposes only.

Investors are typically attracted to core+ RE debt for its scalability, current income, credit quality, low principal value volatility, reduced interest rate risk *via* floating rate structure, and portfolio diversification potential. Investors can gain exposure to core+ RE debt *via* either private fund vehicles or direct investments through separate accounts or co-investments. Both closed-end and open-end fund vehicles are available (with differences in relative prevalence depending on market geography), and we model both.

There is no standard definition of a core+ (or "transitional") real estate loan. These loans typically present more real estate credit risk compared to a **core loan** which is secured by stabilized properties operating with low vacancy. However, while **core+ loans** have more credit risk than core loans, they generally have less risk than **heavy transitional loans** that finance a property's full "transition" from one use to another during which time the property is not generating revenue. RE owners use core+ debt for a limited period while they

1 US Capital Trends, *Real Capital Analytics*, as of year-end 2020.

make property improvements through renovation or repositioning – and afterwards refinance with a long-term, fixed-rate core loan from a bank, insurer, CMBS lender, or pay off the debt through a property sale.

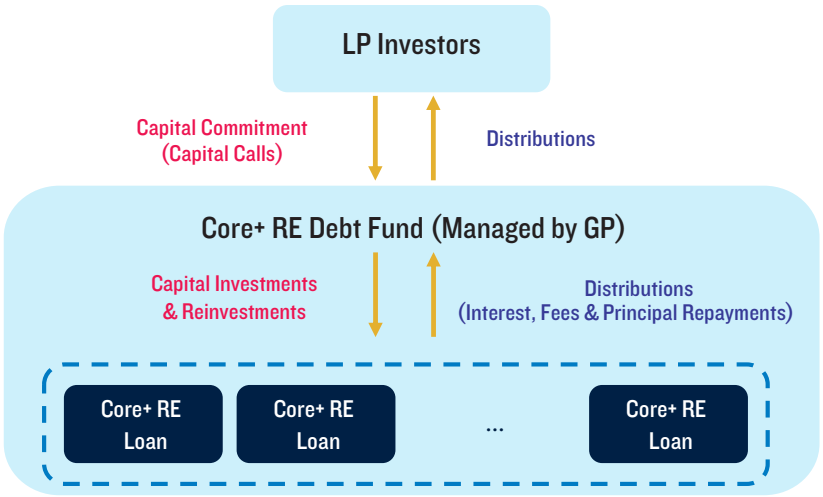
Core+ loans have "**light transitional**" characteristics as loan proceeds are often used as a bridge during property-level improvements in accordance with the owner's business plan and performance targets. These improvements are intended to increase value and grow net operating income through additional tenancy and higher rents. "Light transitional" property improvements are incremental, with only a modest and controllable negative cash flow impact. The primary function of the property does not change, and the property remains in use throughout the transition period. In contrast, "heavy transitional" loans finance a complete repositioning of an asset (*e.g.*, conversion of a warehouse into creative office space), and any subsequent growth in the asset's value is largely dependent on the success of the owner's business plan. Private capital provides financing across the risk spectrum, and for the RE debt investor the main considerations are the degree of property, market, owner, and economic risk.

Core+ loan pricing is typically tied to a floating base rate (*e.g.*, 1m Libor) and an *initial* loan term (with possible extensions). For example, a term of "3y + 1 + 1" means a three-year initial term with two possible one-year extensions. Core+ loans are largely interest-only and without principal amortization, at least during the initial term. A typical core+ loan has a loan-to-value (LTV) ratio of approximately 65% – 75%. Loan prepayment is not uncommon as the borrower's business plan may be completed earlier than expected or the borrower may be able to refinance the loan at a lower rate.[2]

Core+ RE Debt Funds

Institutional investors can invest as an LP in either a closed-end or open-end **core+ RE debt fund**. Figure 2 presents an indicative fund structure which is a portfolio of loans originated at different times and with different terms and spreads negotiated at each loan's origination.

Figure 2: Indicative Core+ RE Debt Fund Structure



Source: PGIM IAS, PGIM Real Estate. Provided for illustrative purposes only.

A **closed-end core+ RE debt fund** has a finite lifetime. Until the closing of the fundraising period, the fund permits LPs to make a fixed capital commitment. Then, the fund manager (or general partner, GP) makes a series of capital calls to these investors to originate core+ loans. GPs typically call capital as investments are identified so as not to hold cash within the fund which could dilute returns. Once a loan is originated, it pays regular monthly interest based on a spread over the base rate (usually a floating rate, with a floor depending on market conditions) negotiated at loan origination. Interest received from loans in the fund is distributed to investors, often quarterly.

Early in the fund's life, the GP reinvests principal repayments from matured loans into new loans, resulting in cash flow movement *within* the fund as opposed to distributions to investors (unless the GP is unable to reinvest within a reasonable period). Only later in the fund's life, as the vehicle winds down, does the GP distribute principal repayments back to investors.

In contrast, an **open-end core+ RE debt fund** tends to be "evergreen" and does not have a defined lifetime. The benefits of this structure are twofold: For the investor, it allows for a hypothetically perpetual exposure to both the asset class and the GP without

2 Appendix A1 provides a comparison of core *vs.* core+ RE debt characteristics. Also, for a detailed discussion of core RE debt see B. McDonnell, J. Brady, and J. Kohana "Commercial Mortgage Loans: An Alternative Asset in LDI Portfolios?" PGIM Real Estate, May 2020.

fluctuations in exposure inherent to closed-end funds; and for the GP, overall, it maintains a permanent capital base (see footnote 15) while avoiding the time and expense of regularly launching new vehicles. The GP accepts a series of new capital commitments from existing and new LPs, usually at monthly or quarterly intervals. An open-end fund allows for redemptions, which may be granted immediately or with a delay depending on market conditions. The GP invests new capital commitments and principal repayments, net of redemptions, in new loans.

Cash Flow Model

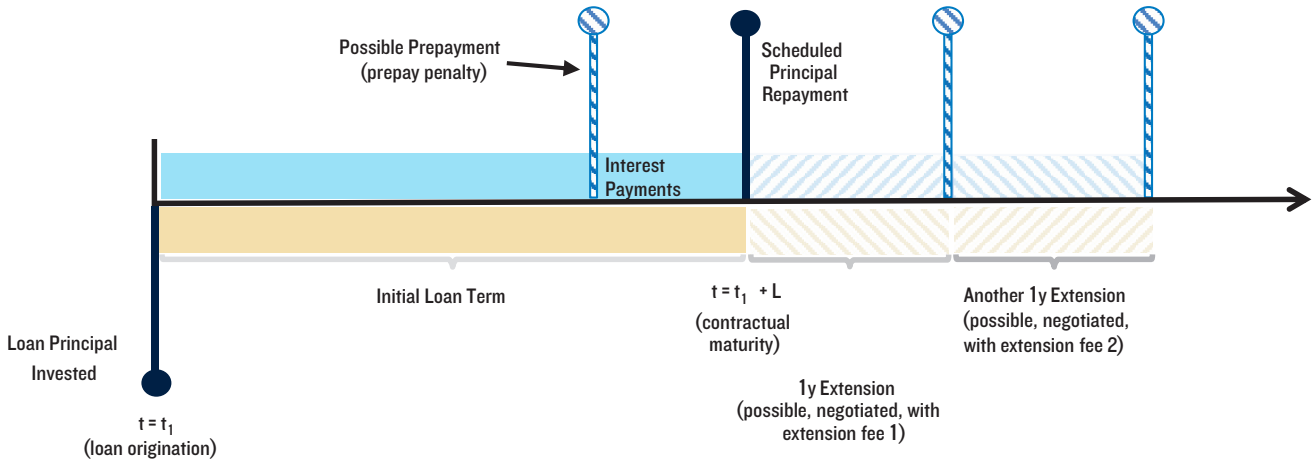
We take a bottom-up approach to modeling core+ RE debt fund cash flows. First, we model loan-level cash flows including the initial loan commitment, interest payments, extension fees, prepayment fees, and principal repayment which are tracked throughout the loan's life. Loan-level activities are the same irrespective of whether the core+ RE loan is in a closed-end or an open-end fund. We then aggregate loan-level cash flows to derive a fund's cash flows. In other words, at each period, fund-level cash flow is the sum of loan-level cash flows, and the fund's value is the sum of all current outstanding loan commitment amounts (AMT). We assume non-defaulted loans are held at cost.[3]

The pace of new loan originations, pricing, extensions, loan quality (*e.g.*, covenants, delinquency rates, and loss given default (LGD)), and reinvestment are all salient variables for a core+ RE debt fund. The model captures these variables using a set of loan-level and fund-level parameters whose values are conditional on the general state of the economy. Inputs into the model include a time series of both the state of the economy (*i.e.*, "good" or "bad") and the base rate (*e.g.*, 1m Libor).[4]

Loan-Level Model

Figure 3 shows an indicative timeline of loan-level activities. At loan origination, the borrower (equity investor, or property owner) uses the loan's proceeds to either purchase or refinance real estate and fund its transition. The loan immediately starts paying regular interest based on the agreed rate at loan initiation (base rate + spread) until loan maturity, at which time the loan may be extended at the borrower's request and cost. If the loan is extended, a fee (often 25bp) is levied on the loan commitment amount. The model assumes a core+ loan can be extended for up to two 1y periods. While amortization might be included as a condition of loan extension, the model assumes no amortization. Prepayments (*i.e.*, full, no partial, repayment of the loan before initial maturity) are allowed with a penalty following a hard lock-out period.

Figure 3: Indicative Timeline of Loan-Level Activities



Note: Shaded areas represent potential actions. Source: PGIM IAS, PGIM Real Estate. Provided for illustrative purposes only.

The model captures four loan-level activities (*i.e.*, origination, credit risk changes, extension, and prepayment). Due to the scarcity of publicly available data, model parameters are high-level *assumptions* informed, in part, by PGIM Real Estate's experience along with

3 Closed-end funds often value non-defaulted loans at cost. Open-end funds often mark loans to market at regular intervals due to the ongoing inflows/outflows of investor capital. For modeling purposes, the model assumes all non-defaulted loans are held at cost, regardless of the vehicle.

4 We define a "bad" economy when the monthly moving average (6m, backward-looking) of the S&P 500 index cumulative total return experiences a drawdown of -15% or more. We use 1m Libor from the Federal Reserve Bank of St. Louis (FRED) as the base rate.

any available data. Parameter values are also conditional on the general state of the economy (*i.e.*, "good" versus "bad"), as informed by PGIM's experience and data. These parameters may be customized by CIOs to reflect their own experience and for stress testing.

The pricing of core+ RE debt, expressed through an all-in yield equal to the base rate plus a credit spread, is dependent on both macroeconomic risk and asset-level risk reflecting property cash flows, the nature of the property's transition, location (local demographic and economic trends), and borrower quality. Like all credit assets, core+ RE debt will price at a wider spread as perceived risk increases, and *vice versa*. Pricing is further dependent on the prevailing conditions of other large credit markets, including core RE debt and public corporate credit, as well as US Treasuries. These assets reflect a continuum of risk from zero default risk Treasuries to corporate credits which price at a spread to Treasuries because corporate cash flows are inherently riskier than Treasury cash flows. Due to its more limited liquidity and greater underwriting and monitoring costs, core RE debt typically prices at a spread over comparably rated corporate bonds. In turn, due to its greater asset-level risk, core+ RE debt requires a yield premium over core RE debt.

The model assumes that the loan spread is set at origination based on a pre-defined **pricing curve** which, in turn, depends on the floating base rate and the economy. Figure 4a shows the pricing curves for a good and a bad economy. For example, a loan originated in a good economy at a 2% base rate has an assumed spread of 3.25%, for an all-in yield of 5.25% (loan is priced at par). As the base rate at origination decreases, the spread increases. In other words, loans are usually originated at a wider spread in a lower base rate environment, and *vice versa*. This empirical negative relationship stems from lower base rates generally reflecting a weaker economy in which investors demand additional compensation for more economic risk through wider spreads, while higher base rates generally reflect a stronger economy with lower property plan execution risk. This negative relationship between base rates and spreads limits variation in all-in yields, and helps lenders cover the fixed costs of loan origination and monitoring across economic cycles.

For a given base rate the model assumes the spread at origination in a bad economy is approximately 25bp/y higher compared to a good economy. We note that in past bad economy periods, the widening of spreads attracted opportunistic investors which pushed spreads back to good economy levels before the economy technically became "good." This occurred in both the GFC and recent pandemic, during which the government and Federal Reserve provided fiscal and monetary stimulus. However, given the historical variability in financial market performance in recessions, the model assumes the 25bp/y yield premium lasts for the duration of the bad economy period.

Figure 4b presents other loan origination parameter assumptions. In a good economy, since core+ loans often have a 3y initial term, the model assigns a 75% probability that a new loan has a 3y term. However, in a bad economy the model assigns a slightly *higher* 80% probability of a 3y initial term since a property's business plan will likely take longer to complete in this environment. The model assumes a base rate floor of 100bp/y and 25bp/y at origination for a good and bad economy, respectively, but no base rate cap.

Figure 4a: Loan Origination Spread *vs.* Base Rate Curve Assumptions

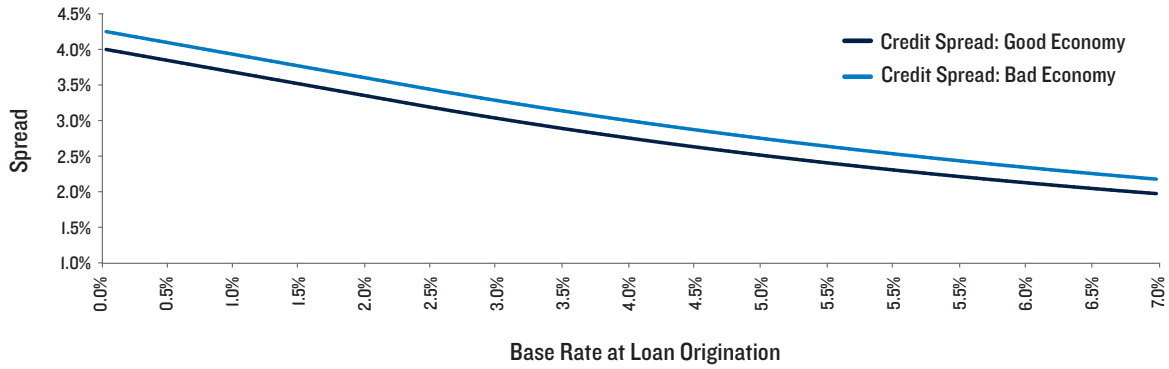


Figure 4b: Loan Origination Parameter Assumptions

Parameter		Good Economy	Bad Economy
Term (X)	Pr(X=2) Pr(X=3)	25% 75%	20% 80%
Delinquency Rate		0.8%	0.8%
Loss Given Default (LGD)		2.4%	2.4%
Base Rate Floor		100bp	25bp

Source: PGIM IAS, PGIM Real Estate. Provided for illustrative purposes only.

The probability of a loan becoming delinquent (*i.e.*, missing an interest payment) and its principal loss given default (LGD), as a percentage of the loan amount, are assumed not to change with the economy at loan origination. In other words, the model assumes loans originated in a bad economy have the same level of credit risk (0.8% delinquency probability and 2.4% LGD) as loans originated in a good economy, which reflects the assumption that during a bad economy, loan structures typically become more lender-friendly to account for added risk, including lower LTV ratios. In contrast, during a good economy, loan structures become more borrower-friendly. The rationale is that better loan structures in a bad economy compensate for the risk of poor economic environments on business plan execution, whereas the strong environment in a good economy masks the higher structural risk of loans originated during these periods.

What happens to a loan's credit risk as the economy changes? For loans originated during a bad economy, the model assumes credit risk is unaffected if the economy were to subsequently improve – in other words, the credit performance of the loan remains strong and stable. In contrast, for loans originated in a good economy, the model assumes that if the economy subsequently deteriorates, credit risk increases due to the higher structural risk associated with loans originated in borrower-friendly environments. Specifically, the **delinquency rate** and **LGD** for a loan originated in a good economy change with the economy, which the model captures by applying a multiplier to the values at origination (Figure 5). For example, if a loan is originated in a good economy and has never been delinquent, then a shift to a bad economy changes its delinquency rate and LGD from 0.8% and 2.4%, respectively, to 8% and 24%. In other words, a move from a good to a bad economy increases the delinquency rate of a loan originated in a good economy by a factor of 10.[5] If the economy were then to return to a good state and the loan had not become delinquent, then its delinquency probability and LGD return close to their original values.[6]

The modeling of credit risk is asymmetric, depending on the state of the economy at loan origination. In the model, for a loan originated in a bad economy, its credit risk metrics remain unchanged even if the economy improves. In contrast, a loan originated in a good economy suffers a deterioration in its credit metrics if the economic state worsens – even worse compared to a loan originated in a bad economy.

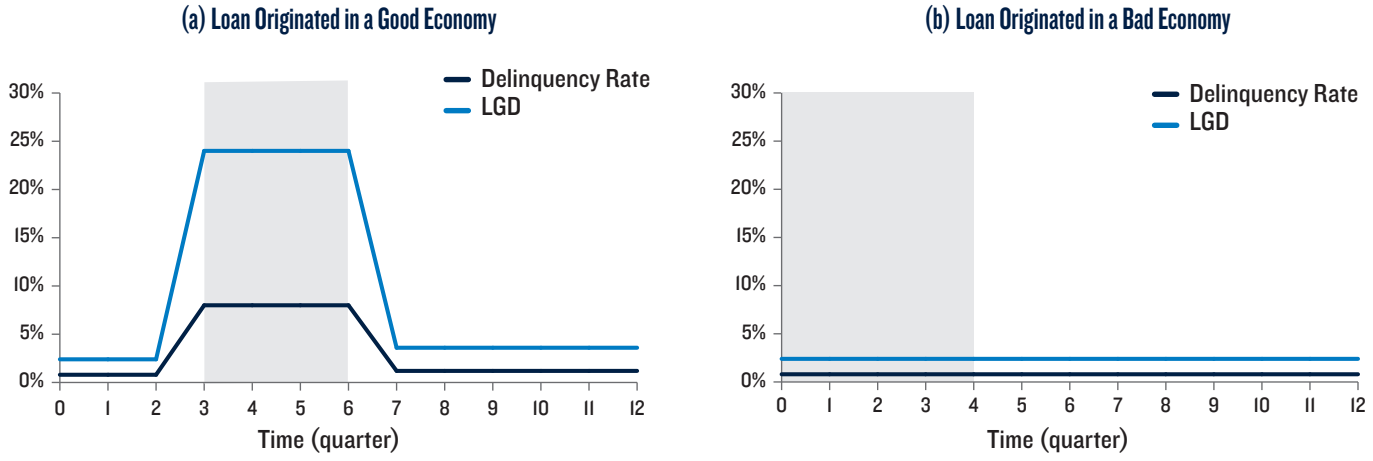
Figure 6 illustrates how credit risk for a loan originated in a good or bad economy changes with the economic environment.

Figure 5: Indicative Loan Reevaluation Parameters – Loans Originated in a Good Economy

Loan Parameter	Shift Back to Good Economy	Shift to Bad Economy
Delinquency Rate (multiplier to original value)	× 0.15	× 10
LGD (multiplier to original value)	× 0.15	× 10

Source: PGIM IAS, PGIM Real Estate. Provided for illustrative purposes only.

Figure 6: Credit Risk Over Time – Illustrative Examples



Note: Bad economy period is shaded in grey. Source: PGIM IAS, PGIM Real Estate. Provided for illustrative purposes only.

5 The change in the delinquency rate from a good to a bad economy, and *vice versa*, mirrors the change in delinquency rates as reported in "Delinquency Rate on Commercial Real Estate Loans (Excluding Farmland), Booked in Domestic Offices, All Commercial Banks, Percent, Quarterly, Seasonally Adjusted" dataset, produced by the Federal Reserve Bank of St. Louis, between January 2016 - January 2020 (good) and January 2008 - January 2012 (bad).

6 When the state of economy switches back to a good economy, we assume a slightly higher 0.15 multiplier, instead of 0.1, to bring the delinquency and LGD not quite back to their original values to reflect that the bad economy will have some long-lasting impact on credit risk.

If a loan becomes delinquent, the model assumes it *remains delinquent for three consecutive months*, after which the loan either remains delinquent, defaults, or becomes current with past missed interest payments fully accrued and paid. If the loan becomes delinquent at scheduled maturity, the loan is assumed to extend. If a loan remains delinquent after two 1y extensions, the model assumes it defaults.

A newly delinquent loan, even if it subsequently becomes current, acquires a "taint" of delinquency in the model, *i.e.*, its forward delinquency probability is adjusted higher after its initial delinquency event to reflect its historical experience. For such a loan, the subsequent delinquency rate increases by a constant factor depending on the economy (*i.e.*, 10% higher if good and 25% higher if bad). For example, a never-delinquent loan originated in a bad economy has a 0.8% delinquency probability (Figure 4b). If the loan were to become delinquent during a bad economy quarter, then in the *next quarter*, if the economy remains bad, the loan's delinquency probability will be 0.8% × 1.25 = 1% (*vs.* if the economy returns to good next quarter, the delinquency probability will be 0.8% × 1.1 = 0.88%).[7] This delinquency taint adjustment decays if no further delinquency occurs.[8]

Typically, a core+ RE loan can extend after the initial term at the borrower's request and cost. The model assumes a loan can extend only twice, and each 1y extension comes with a 25bp one-time fee (applied to the full loan amount, which is income for the RE fund). An extended loan is modeled to have a higher delinquency rate and LGD with the assumption that the borrower did not successfully execute the business plan during the initial term. For example, if a loan was originated in a good economy and has never been delinquent, then upon extension the loan's delinquency rate and LGD adjust upward, respectively, to 0.8% × 1.5 = 1.2% and 2.4% × 1.5 = 3.6% (Figure 7). The probability of extension depends on the economic state at the loan's initial maturity, and the model treats extension as more likely in a bad economy when business plan execution risk is elevated.

Figure 7: Indicative Loan Extension Parameters

Extension		Good Economy	Bad Economy
Extension Probability		25%	80%
Extension Fee		25bp	25bp
Extension Penalty (multiplier to original value)	Delinquency Rate	× 1.5	× 1.5
	LGD	× 1.5	× 1.5

Source: PGIM IAS, PGIM Real Estate. Provided for illustrative purposes only.

While **prepayments** are generally allowed any time with a penalty following a hard lock-out window, for simplicity the model allows for prepayment (full, no partial) 1y prior to maturity, with a higher prepayment probability in a good economy (Figure 8). The **prepay penalty amount** equals 1y of interest, *i.e.*, ((base rate at the end of year (X-1), subject to a floor) + spread) × loan amount.[9] While in reality the duration of the period during which a loan would be subject to prepay penalties varies across economic environments (*e.g.*, typically a shorter window during a good economy reflecting greater structural risk to lenders) the model assumes a fixed prepay penalty (1y of interest).

Figure 8: Indicative Loan Prepayment Parameters

Prepayment	Good Economy	Bad Economy
Time of Prepayment	1y prior to maturity	1y prior to maturity
Expected Loan Prepayment Probability	25%	3%

Source: PGIM IAS, PGIM Real Estate. Provided for illustrative purposes only.

Fund-Level Model – Closed-End Funds

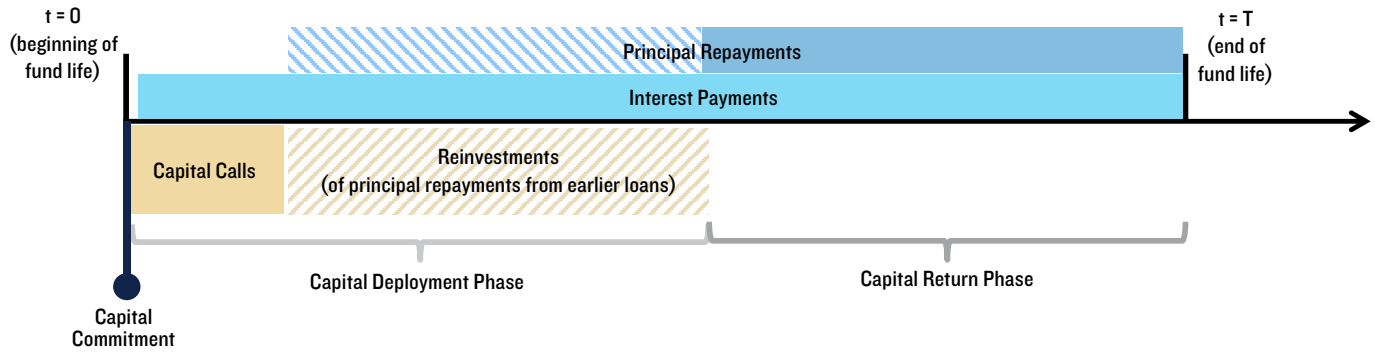
Figure 9 is an indicative timeline of fund-level activities for a **closed-end fund**. LPs make a one-time capital commitment at the beginning of the fund's life, and the GP then makes capital calls during the fund's investment period. The GP has full discretion on the timing of capital calls and is assumed to make calls more quickly in a good economy. The model assumes a call occurs at each loan origination so the fund never holds uninvested cash.

7 In contrast, a never-delinquent loan originated in a good economy has a 0.8% delinquency rate and then has an 8% delinquency rate when the economy shifts to bad (Figures 4b & 5). If the loan were to become delinquent during a bad economy, then in the next quarter, if the economy remains bad, the delinquency probability would be 8% × 1.25 = 10% (*vs.* if the economy becomes good, the delinquency probability would be 8% × 1.1 = 8.8%).

8 We assume the "taint" adjustment factor decays exponentially with a half-life of 6m.

9 For fixed rate loans, the prepay penalty is often referred to as "yield maintenance."

Figure 9: Indicative Timeline of Fund-Level Activities (Closed-End Fund)



Note: Shaded areas represent potential actions. Source: PGIM IAS, PGIM Real Estate. Provided for illustrative purposes only.

LP investors receive loan interest payments throughout the fund's life. The GP reinvests principal repayments into new loans during the fund's **capital deployment phase**. Reinvestment pacing is at the GP's discretion subject to any pre-defined **annual turnover ceiling**. The end of the capital deployment phase marks the beginning of the **capital return phase** when all principal repayments flow back to investors.

The GP's investment activities are conditional on the economy (Figure 10). A GP makes capital calls sooner, and reinvestments occur more quickly, in a good economy. During capital deployment, the **reinvestment amount** equals a reinvestment ratio multiplied by the cumulative principal paid back from all matured loans, capped by the maximum reinvestment amount determined by the annual turnover ceiling. This ceiling, in turn, controls the reinvestment pace which determines the maximum amount of principal repayments reinvested each year in new loans as a percentage of the initial capital commitment (**maximum reinvestment amount = annual turnover ceiling × capital commitment**). In a good economy, the annual turnover ceiling is higher, increasing reinvestments.

For example, assume a fund with a $1,000m commitment receives $300m of principal repayments in a year. If this is a good economy year, the maximum reinvestment amount would be $500m (= $1,000m × 50%), so the GP can reinvest the full $300m into new loans. If this is a bad economy year, the maximum reinvestment amount would be $200m (= $1,000m × 20%), so the GP reinvests only $200m and returns the remaining $100m to LPs.

In a bad economy, the model extends the capital deployment phase by 1y to provide the GP more time to invest, and reinvestment is subject to a lower annual turnover ceiling.[10]

Figure 10: GP Capital Deployment Assumptions

GP Investment Activity	Good Economy	Bad Economy
Pace of Capital Call (# of Years)	1y	3y
Length of Capital Deployment Phase	3y	4y
Reinvestment Ratio	100%	100%
Annual Turnover Ceiling	50%	20%

Source: PGIM IAS, PGIM Real Estate. Provided for illustrative purposes only.

Fund-Level Model – Open-End Funds

An open-end fund allows LPs to make new capital commitments and redemption requests at any time, but the model only allows them to occur at quarter-end. The GP first uses any new commitments and loan payoffs to fulfill redemption requests. If this is insufficient to meet all redemptions, the requests are filled *pro rata* based on the requested redemption amount from each requesting LP.

10 We note that the duration of the capital deployment phase and reinvestment ceiling are not contractually stipulated in fund documents but rather are commercial assumptions reflecting a hypothetical investing environment across economic scenarios. Specifically, in a bad economy the GP will typically require more time to fully invest the fund's capital given lower deal flow, and there may be fewer repayments as well.

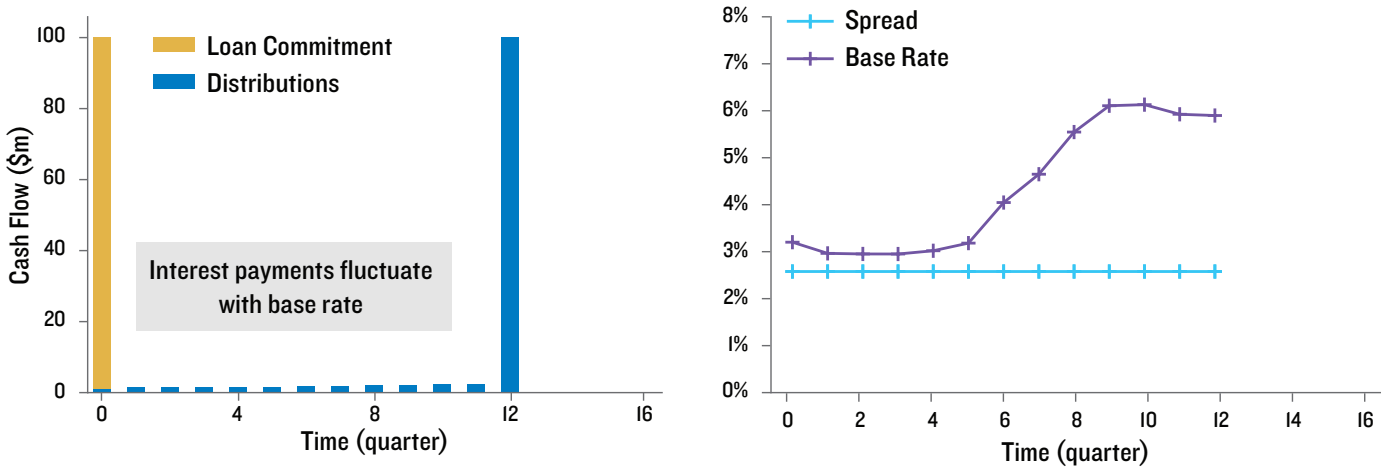
An open-end fund expects a positive (negative) **net fund capital flow** (*i.e.*, capital commitments – redemptions) in a good (bad) economy. Specifically, in a good economy, the model assumes a fund experiences a *capital inflow* of 8%/y, on average, of the fund's initial capital commitment (2%/q with 25bp/q volatility), and in a bad economy, the fund experiences a *capital outflow* of -6%/y, on average, (-1.5%/q with 25bp/q volatility). For example, a fund with an initial commitment of $1,000m will expect a $20m ($1,000 × 8% ÷ 4) quarterly capital inflow in a good economy. The GP endeavors to deploy new commitments immediately by originating new loans and fulfilling redemption requests and does not return capital to LPs unless there is a net capital outflow or a surplus of cash on the fund's balance sheet which cannot be quickly reinvested.

Putting It All Together – Model Outputs

Loan-Level Cash Flows

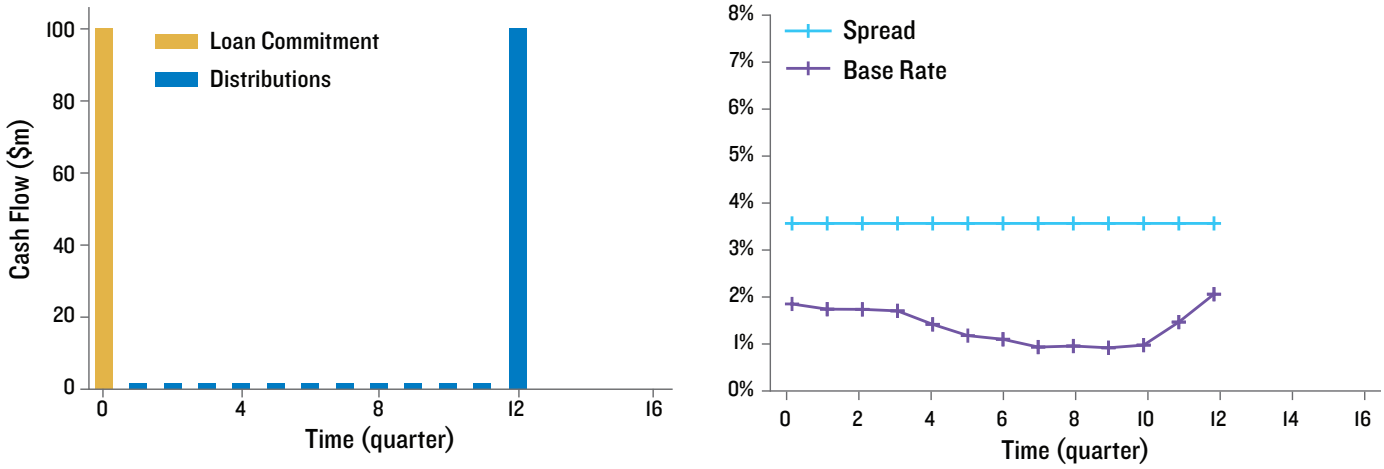
To illustrate the *loan-level* model, assume each loan has a $100m initial principal amount and 3y term.[11] (However, when illustrating *fund-level* cash flows, principal amounts and terms across individual loans in the fund will vary.[12]) To highlight the impact of economic conditions on loan-level cash flows, we provide several loan examples (Loans A, B, C and D which differ according to the economic environment at origination and borrower behavior).

Figure I1: Loan A – Originated in a Good Economy (no extension, no prepayment)



Source: PGIM IAS, PGIM Real Estate. Provided for illustrative purposes only.

Figure I2: Loan B – Originated in a Bad Economy (no extension, no prepayment)



Source: PGIM IAS, PGIM Real Estate. Provided for illustrative purposes only.

11 The model assumes loans do not carry future funding commitments and are fully funded at origination.
12 In a fund, the model assumes the loan amount ranges from 12m to 60m with an average of 30m.

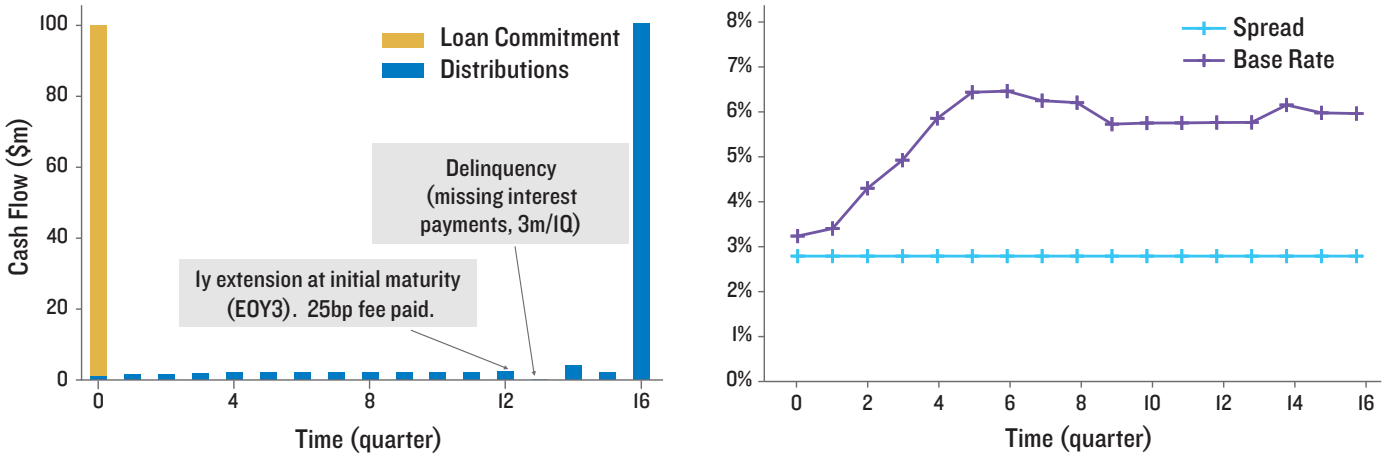
Loan A originates in a good economy (Figure 11). Interest paid fluctuates as the base rate changes over the loan's life. Loan A does not extend or prepay and is never delinquent. The loan matures on schedule after 3y.

Loan B (Figure 12) originates in a bad economy with a lower base rate compared to Loan A. Correspondingly, Loan B has a wider spread at origination. Loan B does not extend or prepay.

Like Loan A, Loan C originates in a good economy but experiences a one-time 1y extension at the end of its initial 3y term resulting in a 25bp fee on the principal amount (Figure 13). Due to this extension, the loan's delinquency rate and LGD increase to 0.8% × 1.5 = 1.2% and 2.4% × 1.5 = 3.6%, respectively. In the following quarter (Q13), Loan C becomes delinquent and pays no interest. The loan then becomes current (Q14) and makes up its accrued, missed interest payments. Loan C, although "delinquency tainted," does not extend again and repays in full at the end of year 4.

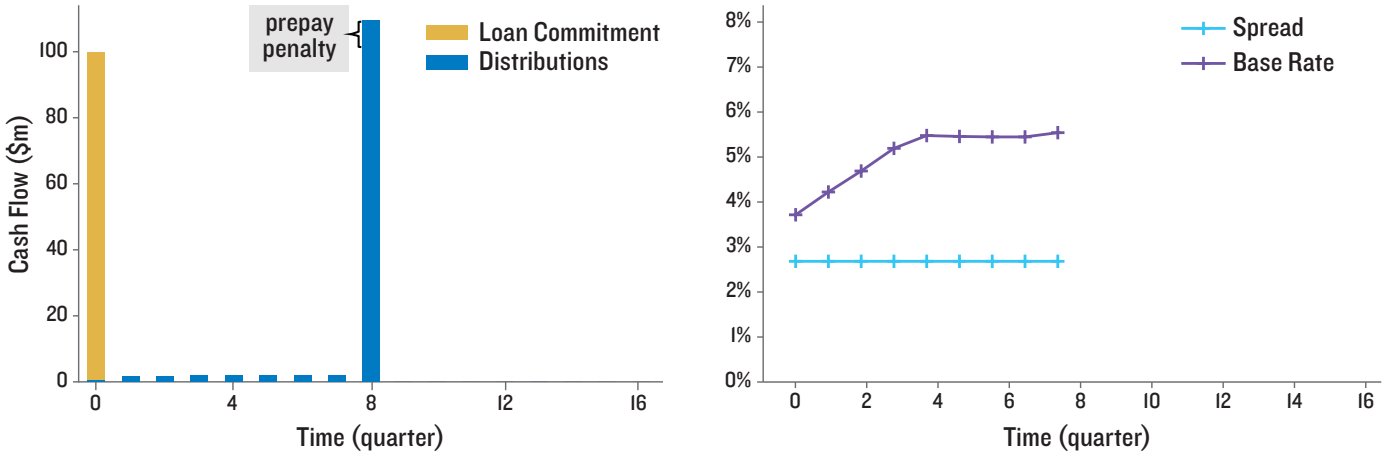
Lastly, Loan D is a 3y loan that originates in a good economy and prepays after 2y (Figure 14). The loan pays a prepay penalty equal to one year of interest.

Figure 13: Loan C – Originated in a Good Economy (1y extension, no prepayment)



Source: PGIM IAS, PGIM Real Estate. Provided for illustrative purposes only.

Figure 14: Loan D – Originated in a Good Economy (no extension, prepayment at EOY 2)



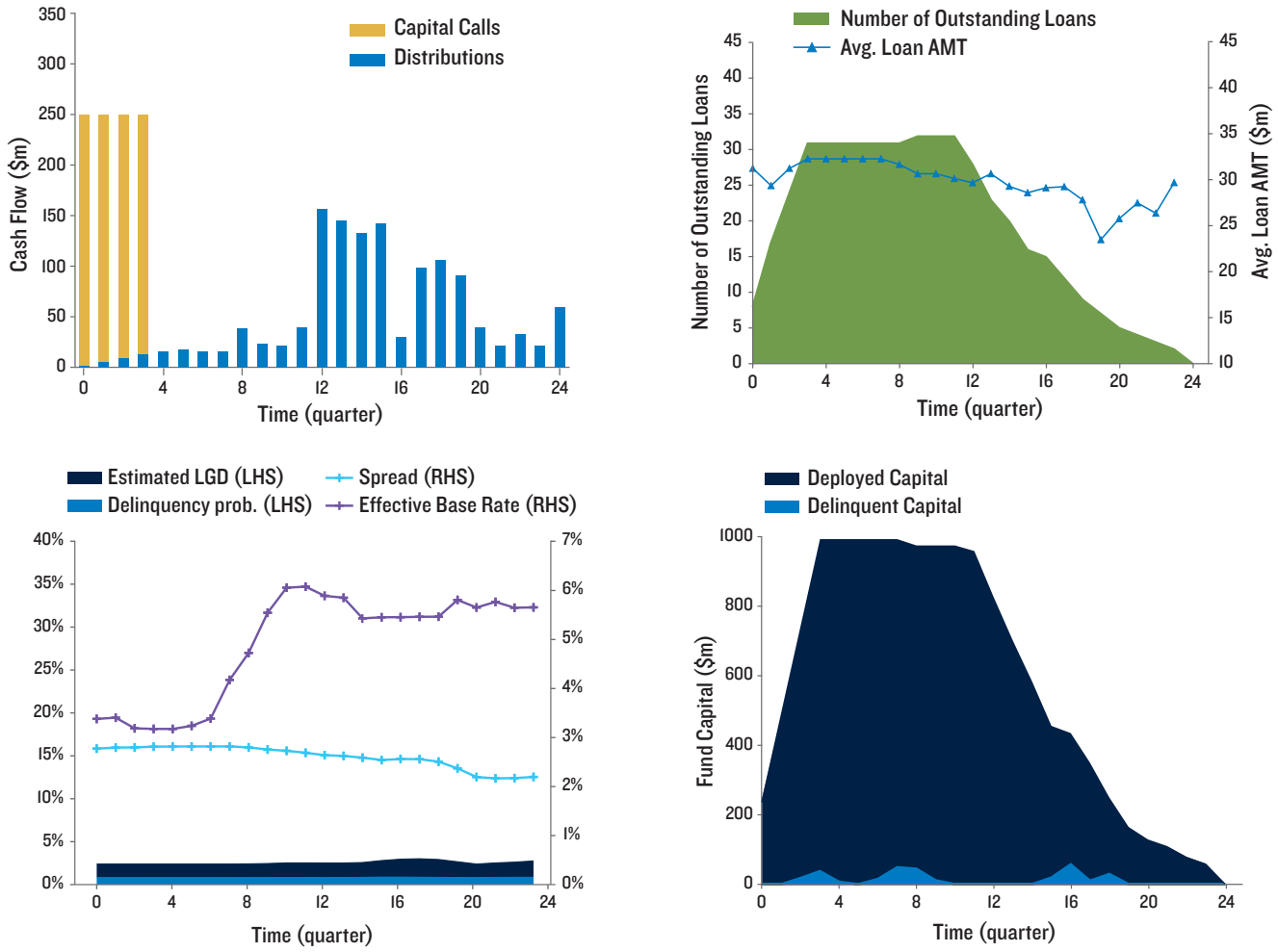
Source: PGIM IAS, PGIM Real Estate. Provided for illustrative purposes only.

Fund-Level Cash Flows – Closed-End Funds

We illustrate fund-level cash flows and credit metrics (calculated as a loan-AMT weighted average across all loans in the fund) for three individual funds (Funds I, II and III) that experience different economic dynamics. The capital commitment for each fund is $1,000m. While GPs may employ fund-level leverage to try to boost returns – typically through term-matched debt facilities provided by banks or the securitized market *via* CLOs – we model fund performance on an unlevered basis.[13]

Fund I (Figure 15) launches in a good economy and never experiences a bad economy. Capital calls occur quickly as the GP actively invests during the good economy. The GP also diligently reinvests principal repayments during the capital deployment phase. Loan-level delinquency rates and credit losses stay low throughout, and so do delinquent capital amounts. During the capital return phase (*i.e.*, after Q12), distributions, represented by the blue bars, are high and somewhat stable. The fund-level spread (*i.e.*, the weighted average spread of all outstanding loans which are originated at different times) tracks, with a lag, the evolution of the base rate and any new originations. Fund I's average spread decreases as the base rate rises.

Figure 15: Fund I – Good Economy Throughout Fund's Life

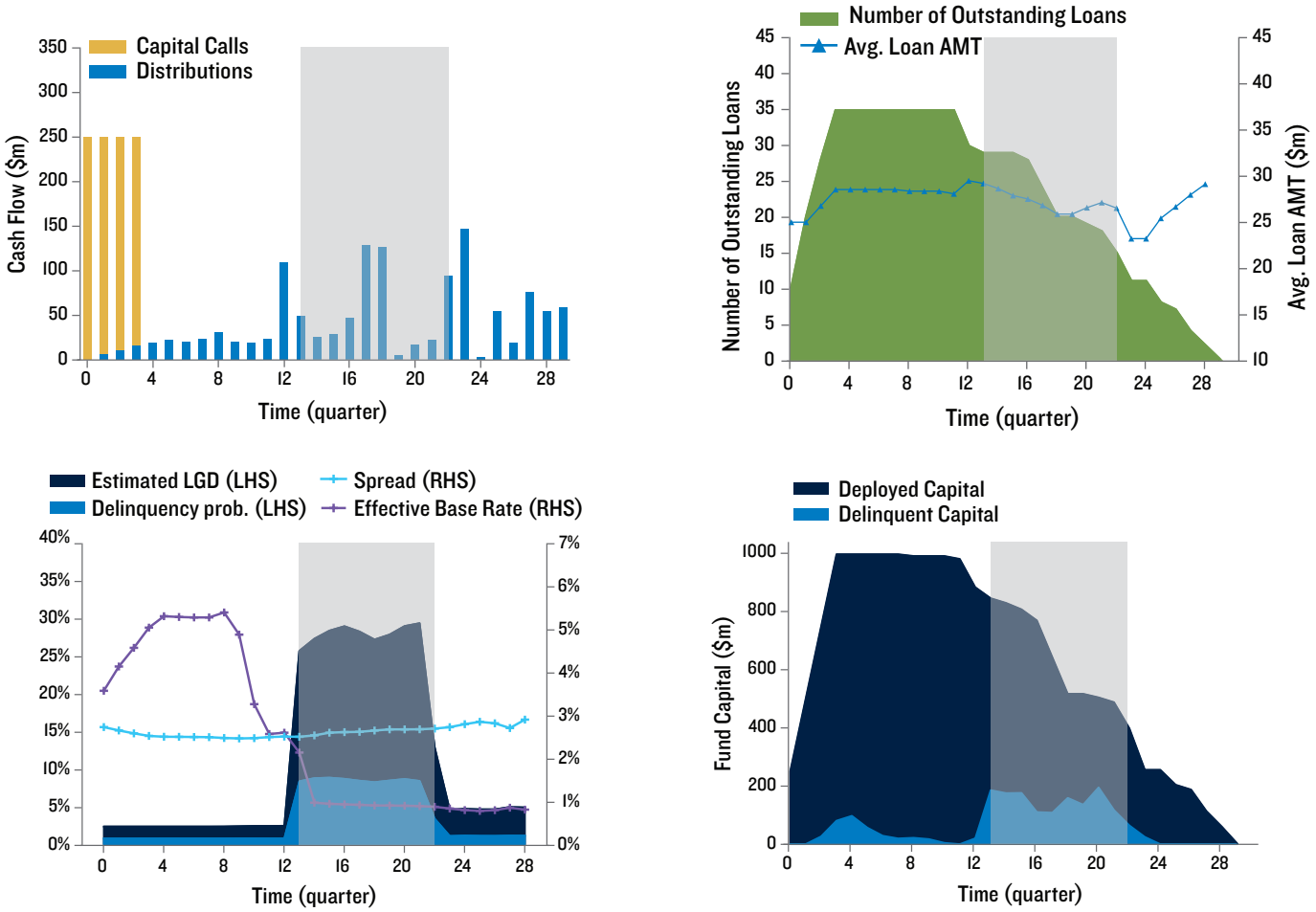


Fund I	
Annualized IRR	8.2%/y
Fund Life	6.0y
Loan-AMT-weighted avg. spread	2.7%
Loan-AMT-weighted avg. effective base rate	4.7%

Source: PGIM IAS, PGIM Real Estate. Provided for illustrative purposes only.

13 For modeling purposes, we have elected to emphasize loan-level performance and not make assumptions regarding fund-level leverage taken on each asset (and their corresponding advance rates, pricings, performance covenants and re-margin risk) given the wide variability in terms.

Figure 16: Fund II – Economic Regime Shifts during Fund's Life



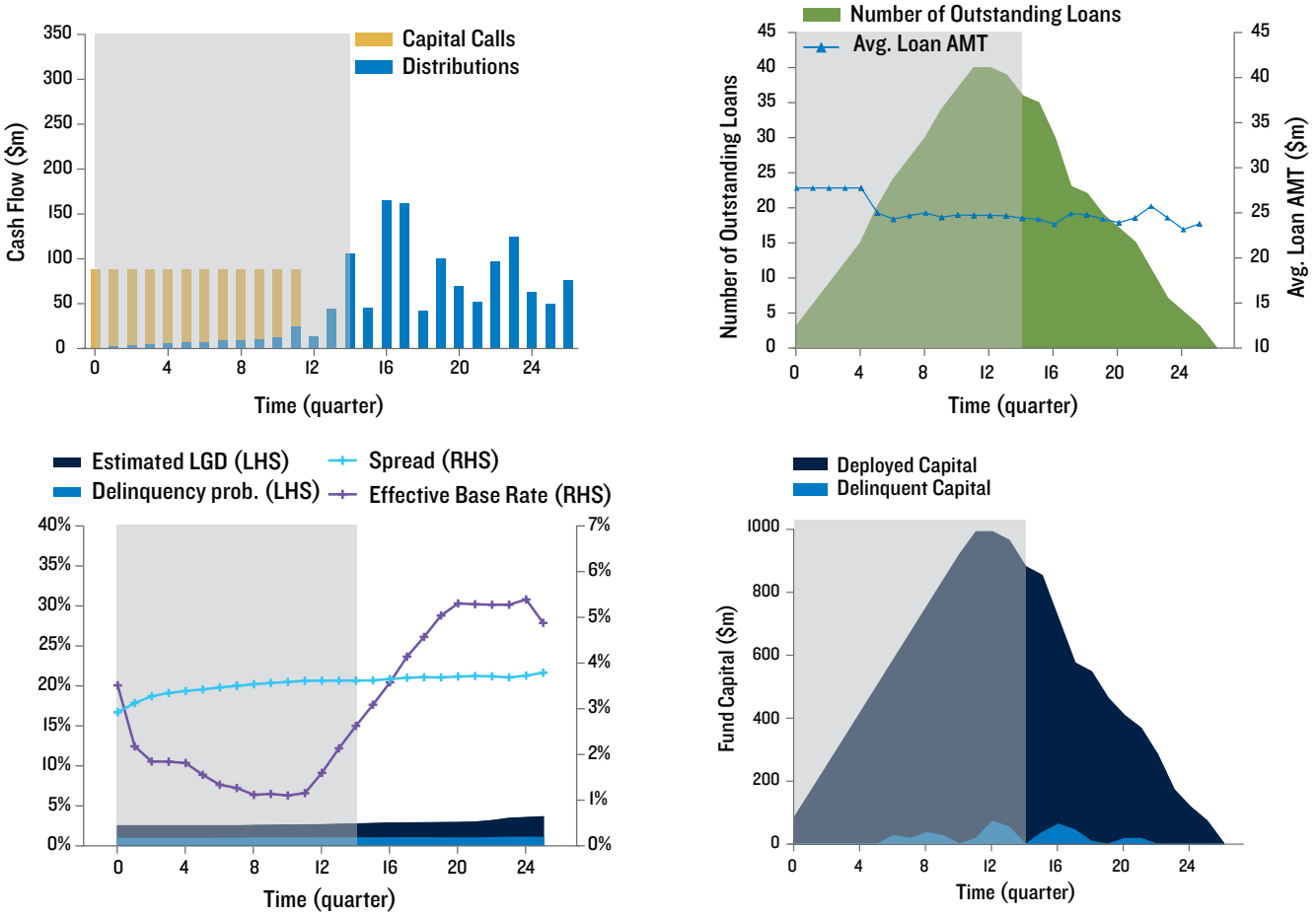
Fund II	
Annualized IRR	6.1%/y
Fund Life	7.3y
Loan-AMT-weighted avg. spread	2.6%
Loan-AMT-weighted avg. effective base rate	3.1%

Note: Bad economy period is shaded in grey. Source: PGIM IAS, PGIM Real Estate. Provided for illustrative purposes only.

Fund II (Figure 16) launches during a good economy, and like Fund I, all capital commitments are called quickly. During the capital return phase Fund II experiences 2.5y of a bad economy (shaded region), which significantly reduces distributions (compared to Fund I) due to delinquencies, higher LGD, and a greater number of loans that extend. Since more loans extend during the capital return phase, Fund II has a longer life than Fund I.

Fund III (Figure 17) launches in a bad economy during which the GP calls all committed capital. Fund III's capital deployment is significantly slower compared to Funds I & II. Initial capital calls are made over 3y (*vs.* 1y for the other two funds). However, the capital return phase occurs entirely during a good economy, with low delinquency rates, LGDs, and extension rates. Therefore, during the capital return phase, capital distributions are relatively high and stable compared to Fund II. Also, note that Fund III's delinquency and LGD rates are low during the bad economic period since these loans were originated in this economy and are assumed to include more structural protection compared to loans originated in a good economy and which subsequently experience a bad economy (Figures 4b & 5).

Figure 17: Fund III – Fund Is Launched during a Bad Economy



Fund III	
Annualized IRR	6.5%/y
Fund Life	6.6y
Loan-AMT-weighted avg. spread	3.6%
Loan-AMT-weighted avg. effective base rate	2.6%

Note: Bad economy period is shaded in grey. Source: PGIM IAS, PGIM Real Estate. Provided for illustrative purposes only.

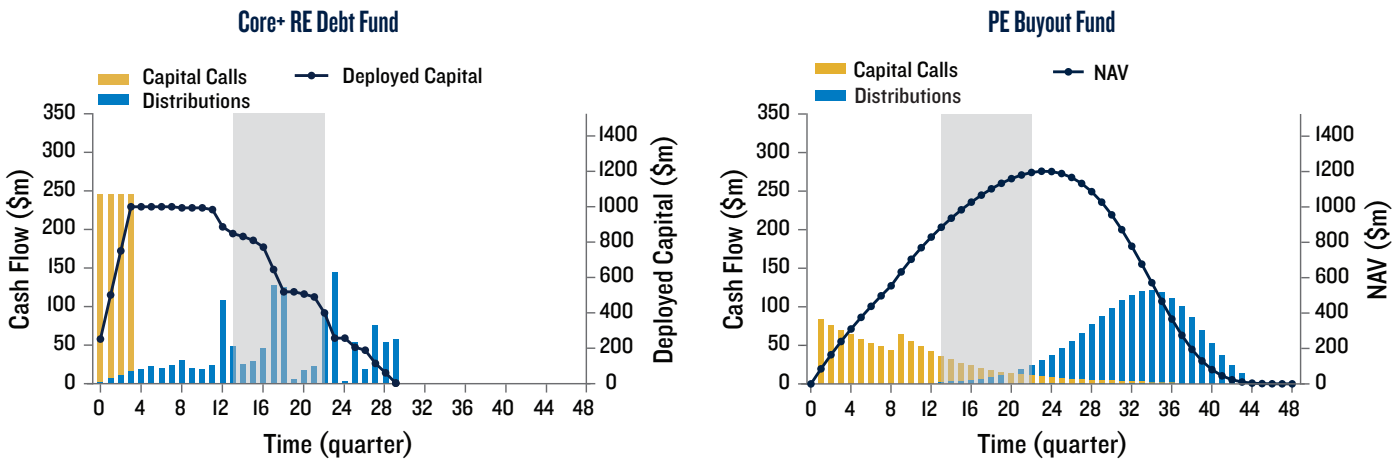
Comparing Cash Flow Patterns: Closed-End Core+ RE Debt Fund *vs.* PE Buyout Fund

PE buyout funds are well established in institutional portfolios, and many investors have experience with their cash flow pattern. In this section we compare the cash flow patterns of closed-end core+ RE debt and PE buyout funds which may help CIOs assess the potential diversification benefits within their private multi-asset portfolios. Figure 18 shows the annual cash flows and valuation of a core+ RE debt fund alongside a representative PE buyout fund as modeled in OASIS.[14] We assume these two hypothetical funds have the same vintage year and $1,000m capital commitments.

Capital calls for the RE debt fund tend to concentrate at the beginning of the fund's life while the PE fund has persistent but variable capital calls over several years before tapering off. Correspondingly, the RE fund's value rises quickly, levels off, then declines gradually once the fund enters its capital return phase (assuming no impairments). In contrast, the PE fund's NAV ramps up slowly, then begins to decline, exhibiting a hump-shaped pattern. The RE fund's distributions start immediately following receipt of interest income, then increase once the fund enters its capital return phase. In contrast, the PE fund's distribution curve also takes a hump-shape akin to its NAV curve, but commences much later. Lastly, the RE debt fund has a shorter life than the PE fund given the nature of the underlying assets.

14 J. Shen, *et al.* "Building a Better Portfolio: Balancing Performance and Liquidity," PGIM IAS & GIC EIS, April 2020; J. Shen *et al.* "Asset Allocation and Private Market Investing," *Journal of Portfolio Management*, 2021; J. Shen, *et al.* "Harnessing the Potential of Private Assets: A Framework for Institutional Portfolio Construction," PGIM IAS & GIC EIS, June 2021.

Figure 18: Private Assets Comparison – Cash Flows



Note: Bad economy period is shaded in grey. Source: PGIM IAS, PGIM Real Estate, Burgiss. Provided for illustrative purposes only.

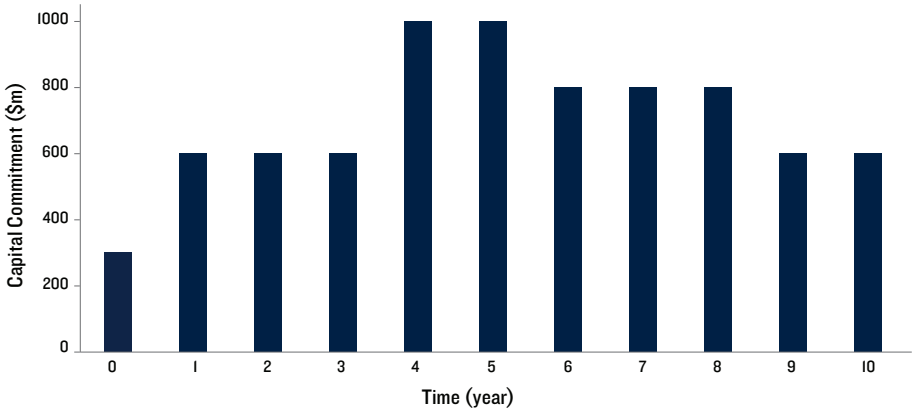
The cash flow patterns of the two funds differ significantly. This is not surprising as PE is a growth asset seeking capital gains, not regular income. In contrast, core+ RE asset strives to be income-generating with limited prospects for capital appreciation. These differences in cash flows highlight the diversification and liquidity risk management potential offered by these illiquid private assets.

A Portfolio of Closed-End Core+ RE Debt Funds

An investor may invest in several closed-end core+ RE debt funds over time to achieve vintage or GP diversification and to provide steady income over prolonged periods. We assume the investor starts with no core+ RE funds, then follows the commitment schedule shown in Figure 19 as the investor increases RE exposure to achieve a relatively stable exposure (*i.e.*, volume of deployed capital) over time.

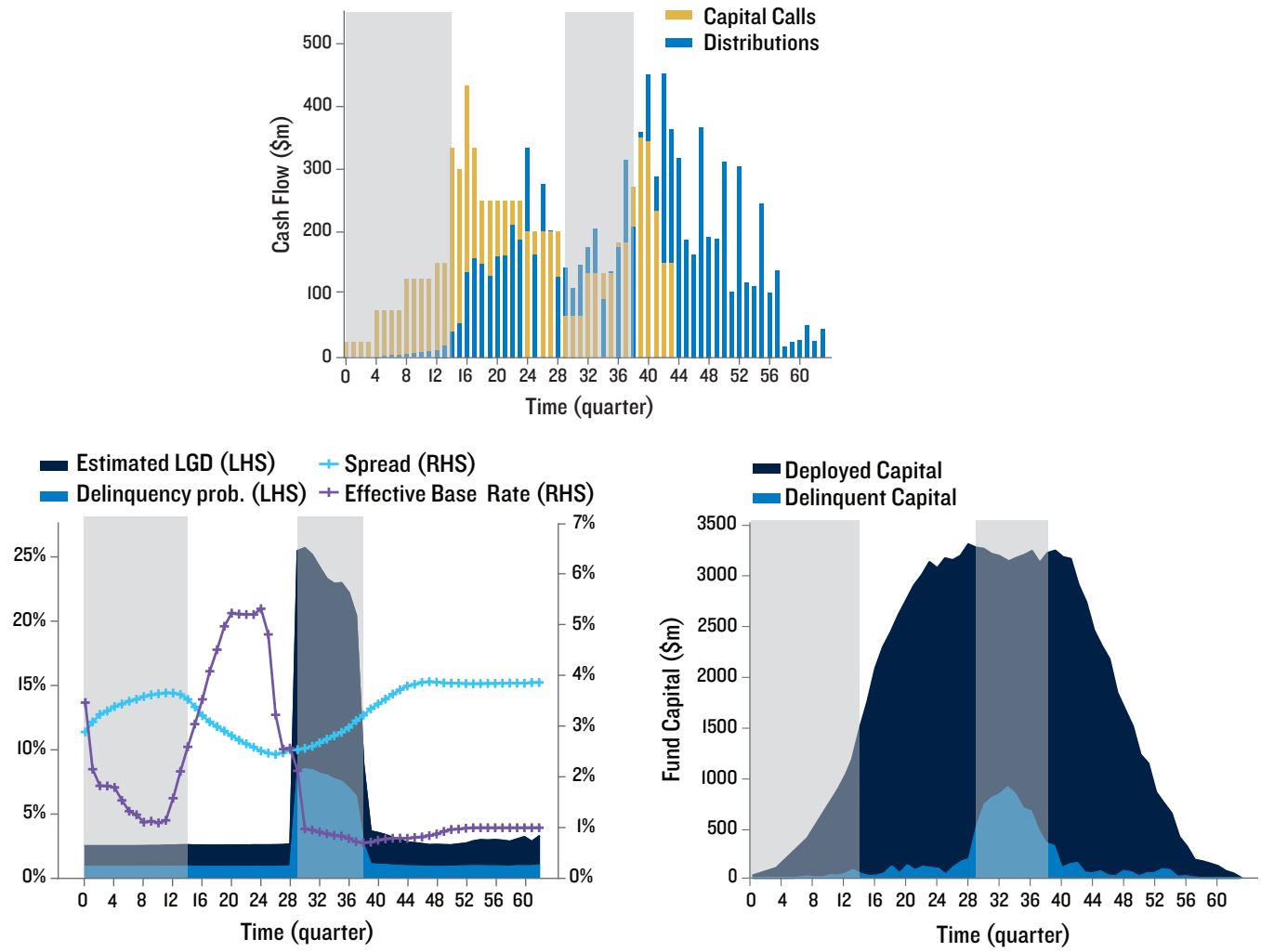
With this commitment pacing strategy, the investor's total deployed capital stays relatively stable over almost 6y (Figure 20), highlighting that a portfolio of core+ RE debt funds may provide stable income (*i.e.*, distributions) over an extended period. Notably, even though the portfolio's overall distributions are adversely affected during a bad economic period (*i.e.*, Q29 through Q38), RE debt funds still continue to provide income during this period, helping to cushion any reduced distributions from other illiquid private assets in the investor's portfolio.

Figure 19: RE Debt Fund Commitment Pacing Strategy



Source: PGIM IAS, PGIM Real Estate. Provided for illustrative purposes only.

Figure 20: A Portfolio of Closed-End Core+ RE Debt Funds



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Fund-Level Cash Flows – Open-End Fund

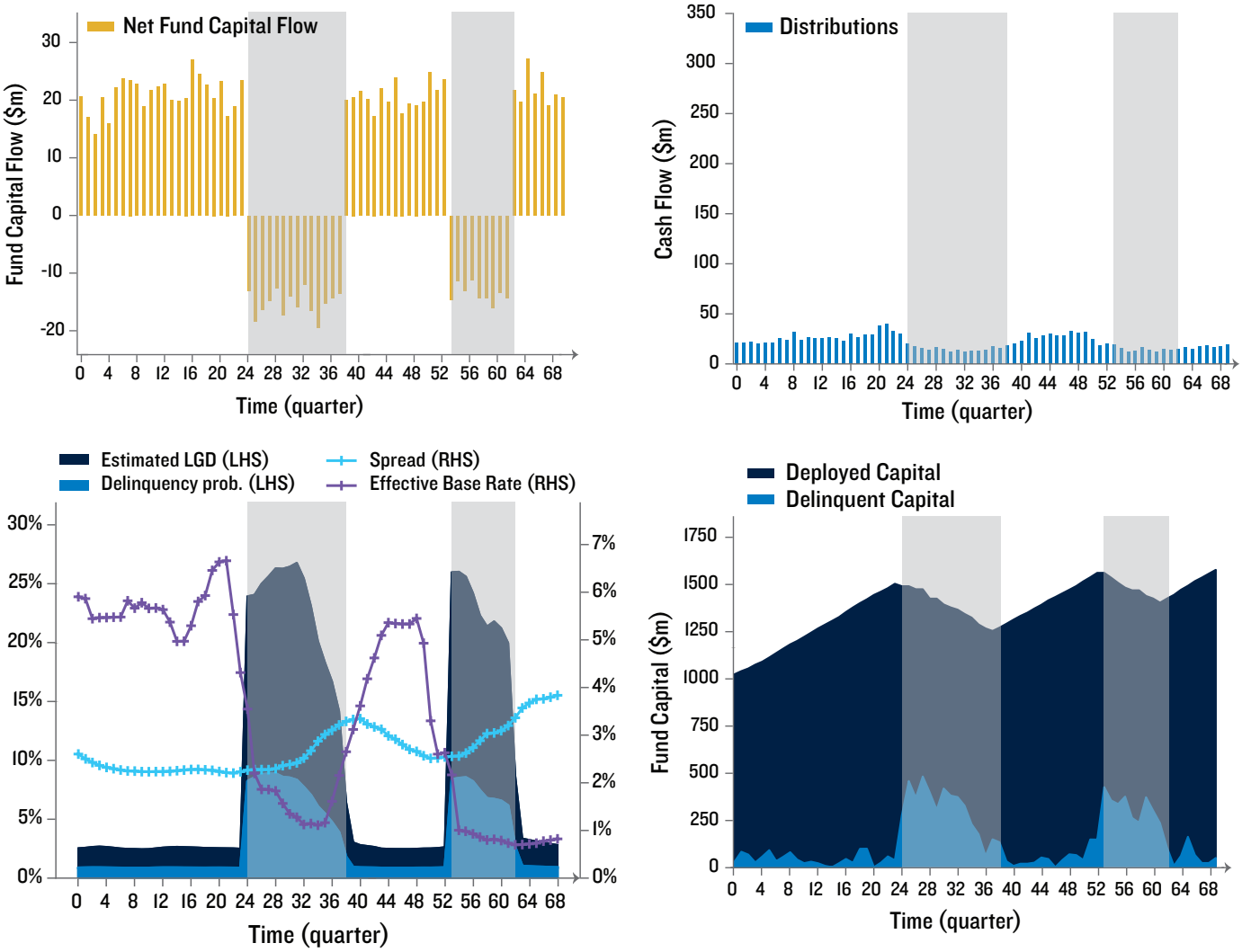
An investor may choose an open-end core+ RE debt fund which does not have a fixed term but provides opportunities to redeem. Figure 21 illustrates the cash flows and credit risk for a hypothetical open-end fund. The fund has an initial capital deployment of $1,000m, and in a good economy the fund expects $20m/q net capital inflows ($80m/y = $1,000 × 8%/y) while in a bad economy it expects $15m/q of net capital outflows ($60m/y = $1,000 × 6%/y).

Distributions to LPs from an open-end fund consist of regular interest payments as the GP reinvests all principal repayments and any new investor commitments, net of redemption requests. Fund distributions are generally stable over the economic cycle and the fund's spread tracks the base rate with a lag. In a good economy, deployed capital increases as the fund tends to see net inflows while the converse occurs during a bad economy.

Overall, an open-end fund serves as permanent capital for the GP.[15] This feature helps limit vintage risk inherent to finite-lived vehicles and allows for potentially perpetual exposure to the RE asset class with significantly less NAV fluctuation inherent to closed-end funds. From a cash flow perspective, an open-end fund's capital deployment schedule and regular interest distributions are like those of a closed-end fund. However, the return of principal is at the LP's, not the GP's, discretion. Therefore, an investor's "in-the-ground" invested capital may be more stable over time with an open-end fund.

15 Some open-end core+ RE debt funds offer enhanced liquidity through redemption rights – redemptions can occur after a defined lock-up period during which the GP has certainty of access to the investor's capital.

Figure 21: An Open-End Core+ RE Debt Fund: Net Capital Flows & Distributions



Note: Bad economy period is shaded in grey. Source: PGIM IAS, PGIM Real Estate. Provided for illustrative purposes only.

Conclusion

We have developed a core+ RE debt fund cash flow model by taking a bottom-up, loan-level approach, and then aggregating loan-level cash flows to estimate fund-level cash flows.

The model is flexible and customizable on an investor-by-investor basis. The model uses empirical market and debt fund data to assign values to loan-level and fund-level parameters which can be adjusted to reflect an investor's own experience and expectations. Our aim is to model the key cash flow dynamics of a core+ RE debt fund using reasonable, practitioner-supplied parameter estimates. As data become available, we expect to update the parameter values. The model offers an analytical solution for the cash flows from a core+ RE debt fund incorporating sensitivity to the economic environment both at fund launch and over the fund's life.

The new core+ RE debt cash flow model can be integrated into a multi-asset portfolio analytics tool to help CIOs examine the impact of their allocations to core+ RE debt, either through closed-end or open-end funds, on their portfolio's liquidity properties. PGIM IAS' asset allocation framework, OASIS, can help CIOs with *liquid* and *illiquid* assets measure their portfolio's liquidity risk (*i.e.*, whether the portfolio can generate enough cash from pre-defined liquidity sources to meet various liquidity demands). As such, this core+ RE debt model can be used in OASIS to help CIOs better understand the tradeoff between performance and liquidity risk.

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APPENDIX

AI. Comparison of Core+ and Core Debt

	Core+ RE Debt	Core RE Debt
Characteristics of Underlying Property	Secured by properties undergoing some level of transition/renovation/repositioning to increase tenancy and rents and therefore property value upon completion	Secured by high cash-flowing properties which are essentially operating near or at their maximum economic potential – high tenancy, market rents, etc.
Loan Structure	Floating rate with typical terms of 2+1+1, 3+1+1 (most common) or 4+1+1	Fixed rate and longer in term (5-10y, sometimes extending to 20y+)
Base Rate	1m Libor	10y Treasury
Amortization	Interest only (may include amortization during extension period(s))	Includes amortization
LTV	~65%-75%	~50%-60%
Type of Properties	Office buildings, multifamily housing, industrial warehouses, hotels, specialty properties, and retail properties	Office buildings, multifamily housing, industrial warehouses, hotels, specialty properties, and retail properties

Source: PGIM IAS, PGIM Real Estate. Provided for illustrative purposes only.

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