An Economic Analysis of Covered Lending Markets Using Restaking

Abhimanyu Nag
University of Alberta

Dhruv Bodani
Catalysis Labs

Abhishek Kumar
Catalysis Labs

Abstract

We develop a quantitative framework for coverage markets funded by restaked capital with a two-tranche structure. First, we use tail-risk constraints based on VaR and CVaR to select a solvency-consistent allocation of shared senior capital and derive a closed-form coverage limit. Second, we design and solve a premium-splitting problem that finances expected losses while guaranteeing that junior providers earn a strictly higher APY than senior providers, with closed-form expressions for the minimal sustainable premium and tranche split. Third, we compare covered lending against standard overcollateralized and unsecured lending, showing that at equal lender APY the covered structure strictly improves lender protection under haircuts and, above a transparent strategy-yield threshold, delivers higher borrower ROE with less posted collateral.

1 Problem Statement

We study a two-tranche coverage mechanism funded by restaked capital. Our goals are: (i) select a solvency-consistent senior allocation α that caps indemnity at $C = \mathbb{T}_J + \alpha\mathbb{T}_S$ using tail risk VaR/CVaR; (ii) price the minimum sustainable premium P and split it between tranches so that junior APY exceeds senior APY; and (iii) compare covered lending (COV) against overcollateralized lending (OCL) for both lender risk and borrower economics. A case study shows a clean ROE crossover: above a yield threshold $y^\star = \frac{\gamma_{\text{ocl}} i_{\text{cov}} - \gamma i_{\text{ocl}}}{\gamma_{\text{ocl}} - \gamma}$, COV improves borrower ROE while maintaining equal lender APY and strictly better protection under haircuts.

Consider an insurance protocol that provides coverage using restaked vaults, in the spirit of recent universal staking and slashing-insurance designs [?, ?, ?]. Let the total restaked amount be $\mathbb{T}$. Out of that, let the allocation to the shared senior tranche be Δ and the remainder be allocated to junior tranches for insurance. We write

$$\mathbb{T}_S = \Delta, \qquad \mathbb{T}_J = \mathbb{T} - \Delta.$$

Losses are absorbed junior-first and then senior: if $\mathbb{T}_J$ is fully depleted, the senior tranche starts to absorb losses up to an allocated fraction. Restakers earn greater APY in the junior tranche than in the senior tranche.

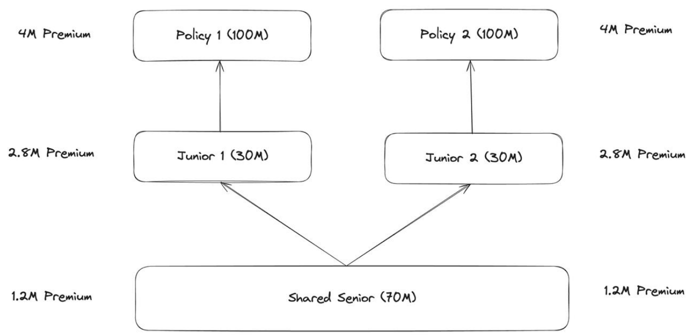

Figure 1: System overview

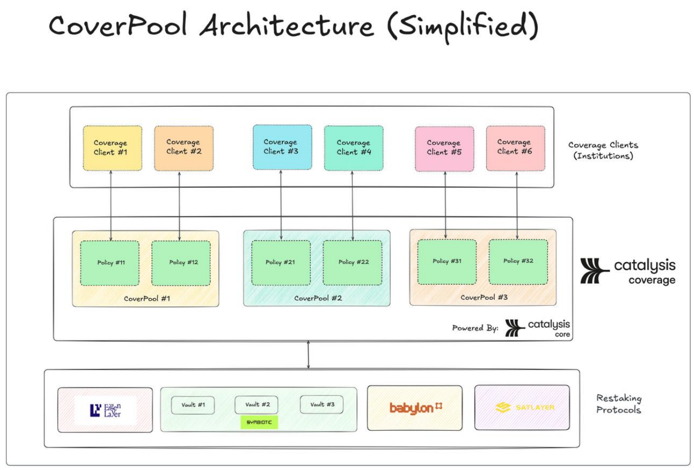

Figure 2: Tranche waterfall

Let the aggregate (random) loss be

$$\mathbb{L} = \sum_{i=1}^{n} L_i,$$

without committing to a specific parametric distribution for the summands. A client purchases coverage limit C and pays a perpetual premium P (e.g., annualized). The goal is to determine principled values of P and C from $\mathbb{L}$, and to design an incentive-compatible premium split such that junior APY exceeds senior APY.

2 Model

2.1 Tranche structure and coverage

We model coverage with a hard limit C and a two-tranche capital stack. The junior tranche absorbs first losses up to $\mathbb{T}_J$. The senior tranche is shared protocol-wide and only a fraction $\alpha \in [0, 1]$ of its notional is committed to a given policy. Hence

$$C = \mathbb{T}_J + \alpha\, \mathbb{T}_S, \qquad 0 \le \alpha \le 1.$$

The indemnity function for realized loss ℓ is $I(\ell) = \min\{\ell, C\}$. The tranche-level losses are

$$L_J(\ell) = \min\{\ell, \mathbb{T}_J\},$$
$$L_S(\ell) = \min\{(\ell - \mathbb{T}_J)^+ , \alpha\, \mathbb{T}_S\}.$$

Thus $I(\ell) = L_J(\ell) + L_S(\ell)$ and is capped at C.

2.2 Expected loss and tail risk

Let $F_{\mathbb{L}}$ be the CDF of $\mathbb{L}$. The expected indemnity and expected tranche losses are

$$\mathrm{EL}(C) = \mathbb{E}\big[\min\{\mathbb{L}, C\}\big] = \int_0^C \big(1 - F_{\mathbb{L}}(x)\big)\, dx, \tag{1}$$

$$\mathrm{EL}_J = \mathbb{E}\big[\min\{\mathbb{L}, \mathbb{T}_J\}\big] = \int_0^{\mathbb{T}_J} \big(1 - F_{\mathbb{L}}(x)\big)\, dx, \tag{2}$$

$$\mathrm{EL}_S(\alpha) = \mathbb{E}\big[\min\{(\mathbb{L} - \mathbb{T}_J)^+ , \alpha\, \mathbb{T}_S\}\big] \tag{3}$$

$$= \int_{\mathbb{T}_J}^{\mathbb{T}_J + \alpha \mathbb{T}_S} \big(1 - F_{\mathbb{L}}(x)\big)\, dx. \tag{4}$$

A solvency standard is imposed at tail probability $\varepsilon \in (0, 1)$. Two common choices, following the coherent risk-measure literature [**?**, **?**], are

$$\mathrm{VaR}_{1-\varepsilon}(\mathbb{L}) \le C \qquad \text{or} \qquad \mathrm{CVaR}_{1-\varepsilon}(\mathbb{L}) \le C,$$

with the latter being convex in C and more robust.

2.3 Choosing the senior allocation α via tail constraint

Given $\mathbb{T}_J$, $\mathbb{T}_S$, and a tail confidence $1-\varepsilon$, choose the smallest α that satisfies solvency. Under a CVaR constraint this is

$$\alpha^* \;=\; \min\left\{1,\; \max\left\{0,\; \frac{\mathrm{CVaR}_{1-\varepsilon}(\mathbb{L}) - \mathbb{T}_J}{\mathbb{T}_S}\right\}\right\}. \tag{5}$$

Then $C^* = \mathbb{T}_J + \alpha^* \mathbb{T}_S$. If VaR is used, replace CVaR by VaR in (5).

3 Premium design and optimization

3.1 Premium components and tranche split

Let $s_J, s_S \ge 0$ with $s_J + s_S = 1$ denote the premium split between junior and senior providers. Let the protocol promise target APYs r_J and r_S (per unit time) on the respective total restaked amounts $\mathbb{T}_J$ and $\mathbb{T}_S$. Ex-ante, junior and senior APYs (net of expected losses) are

$$\mathrm{APY}_J = \frac{s_J P - \mathrm{EL}_J}{\mathbb{T}_J}, \qquad\qquad \mathrm{APY}_S = \frac{s_S P - \mathrm{EL}_S(\alpha)}{\mathbb{T}_S}. \tag{6}$$

Here, senior APY is quoted per the total senior base $\mathbb{T}_S$. If instead one quotes per-dollar at risk for a given policy, divide by $\alpha \mathbb{T}_S$. An incentive-compatible (IC) design requires $\mathrm{APY}_J \ge \mathrm{APY}_S + \delta$ for some margin $\delta > 0$.

3.2 Optimization for minimal premium subject to APY targets

We determine the smallest premium that finances expected losses and meets target APYs r_J, r_S:

$$\min_{P,\, s_J \in [0,1]} P \tag{7}$$

$$\text{s.t. } \frac{s_J P - \mathrm{EL}_J}{\mathbb{T}_J} \geq r_J, \qquad \frac{(1-s_J)P - \mathrm{EL}_S(\alpha)}{\mathbb{T}_S} \geq r_S. \tag{8}$$

Proposition 1 (Closed-form solution for (8))**.** *Assume* $\mathbb{T}_J, \mathbb{T}_S > 0$ *and* $\mathrm{EL}_J, \mathrm{EL}_S(\alpha)$ *finite. The optimal premium and split are*

$$P^* = \mathrm{EL}_J + \mathrm{EL}_S(\alpha) + r_J \mathbb{T}_J + r_S \mathbb{T}_S, \tag{9}$$

$$s_J^* = \frac{\mathrm{EL}_J + r_J \mathbb{T}_J}{\mathrm{EL}_J + \mathrm{EL}_S(\alpha) + r_J \mathbb{T}_J + r_S \mathbb{T}_S}, \qquad s_S^* = 1 - s_J^*. \tag{10}$$

Moreover, the resulting ex-ante APYs equal the targets: $\mathrm{APY}_J = r_J$ *and* $\mathrm{APY}_S = r_S$*.*

Proof. The constraints in (8) yield $P \geq (\mathrm{EL}_J + r_J \mathbb{T}_J)/s_J$ and $P \geq (\mathrm{EL}_S(\alpha) + r_S \mathbb{T}_S)/(1-s_J)$. Minimizing P over $s_J \in (0,1)$ is achieved when the two lower bounds are equal, which gives s_J^* as in (10). Substituting back gives $P^* = \mathrm{EL}_J + \mathrm{EL}_S(\alpha) + r_J \mathbb{T}_J + r_S \mathbb{T}_S$. Plugging P^*, s_J^* into (6) yields $\mathrm{APY}_J = r_J$ and $\mathrm{APY}_S = r_S$. □

3.3 Ensuring incentive compatibility (junior APY > senior APY)

By design, choosing $r_J \geq r_S + \delta$ with $\delta > 0$ ensures

$$\mathrm{APY}_J - \mathrm{APY}_S = r_J - r_S \geq \delta.$$

A risk-weighted rule ties targets to tranche risk:

$$r_J = r_0 + \kappa\, \rho_J, \qquad r_S = r_0 + \kappa\, \rho_S, \qquad \rho_J > \rho_S,\ \kappa > 0, \tag{11}$$

where r_0 is a baseline yield (e.g., restaking rewards) and $\rho_\cdot$ are risk weights (e.g., based on loss waterfall position, volatility, or marginal contribution to CVaR). Then $r_J > r_S$ holds structurally. If only a fraction α of senior notional is put at risk for a policy, the realized per-dollar APY for senior over its total base $\mathbb{T}_S$ becomes α-scaled relative to a risk-only target; equation (11) can absorb this via $\rho_S \propto \alpha$.

3.4 Solvency and pricing in one program

Combining solvency and pricing yields the following convex program if CVaR is used:

$$\min_{\alpha,\, P,\, s_J \in [0,1]} P \tag{12}$$

$$\text{s.t. } 0 \leq \alpha \leq 1, \quad C = \mathbb{T}_J + \alpha \mathbb{T}_S, \tag{13}$$

$$\mathrm{CVaR}_{1-\varepsilon}(\mathbb{L}) \leq C, \tag{14}$$

$$\frac{s_J P - \mathrm{EL}_J}{\mathbb{T}_J} \geq r_J, \quad \frac{(1-s_J)P - \mathrm{EL}_S(\alpha)}{\mathbb{T}_S} \geq r_S. \tag{15}$$

The solution has the closed forms (5) and (9)–(10).

4 Implementation notes

4.1 Computing expected loss and CVaR

Without a parametric distribution, estimate EL_J and $\mathrm{EL}_S(\alpha)$ via Monte Carlo samples $\{\ell^{(k)}\}_{k=1}^{K}$ of $\mathbb{L}$:

$$\widehat{\mathrm{EL}}_J = \frac{1}{K}\sum_{k=1}^{K}\min\{\ell^{(k)}, \mathbb{T}_J\},$$
$$\widehat{\mathrm{EL}}_S(\alpha) = \frac{1}{K}\sum_{k=1}^{K}\min\{\big(\ell^{(k)} - \mathbb{T}_J\big)^+,\, \alpha\,\mathbb{T}_S\}.$$

A standard representation of CVaR for a random variable X at confidence $\beta \in (0,1)$ is [**?**, **?**]

$$\mathrm{CVaR}_\beta(X) = \min_{t\in\mathbb{R}}\ t + \frac{1}{1-\beta}\,\mathbb{E}\big[\,(X-t)^+\,\big],$$

which admits a sample-average convex approximation.

4.2 Premium quoting recipe

Given $\mathbb{T}_J, \mathbb{T}_S, \varepsilon$ and a loss sampler for $\mathbb{L}$:

1. Compute α^* from (5); set $C^* = \mathbb{T}_J + \alpha^*\mathbb{T}_S$.
2. Estimate EL_J and $\mathrm{EL}_S(\alpha^*)$ using (1) or Monte Carlo.
3. Choose target APYs $r_J > r_S$ (e.g., via (11) with chosen r_0, κ).
4. Quote premium P^* via (9) and allocate split s_J^*, s_S^* via (10).
5. Verify IC: $\mathrm{APY}_J - \mathrm{APY}_S = r_J - r_S > 0$. Adjust δ via $r_J - r_S$ if a margin is required.

Remark. *Using* CVaR *yields convexity and stable tail protection while* VaR *can underestimate tail risk for heavy-tailed* $\mathbb{L}$. *Additionally, if there is baseline staking yield* r_0 *on* $\mathbb{T}$*, net APYs add* r_0 *to both tranches; IC is preserved by setting* $r_J - r_S$ *sufficiently large. Finally if policy demand depends on* P *and* C*, a welfare-optimal choice would maximize expected surplus (or protocol utility) subject to solvency; the pricing formulas above furnish the minimum feasible* P *given* C*.*

5 Covered lending versus alternatives

We compare three modes for a loan of notional Q: (i) Overcollateralized lending (OCL) with collateral ratio $\gamma_{\mathrm{ocl}} = 1.50$ and borrower rate $i_{\mathrm{ocl}} = 6\%$; (ii) Unsecured lending (USC) with $\gamma_{\mathrm{usc}} = 0$, rate 12–20%; (iii) Covered lending (COV) with actual collateral $\gamma \in [0.80, 1.20]$, additional coverage fraction c (as a fraction of Q), borrower *all-in* rate i_{cov}, and lender coupon $i_\ell = 6\%$. This mirrors emerging practices where lending markets underwrite bad-debt events via dedicated insurance vaults funded from protocol yield [?, ?]. In the worked example, $\gamma = 1.10$, $c = 0.40$, $i_{\text{cov}} = 10\%$, loan $Q = 100\,\text{M}$. The lender receives 6% (\$6 M); the remaining spread $i_{\text{cov}} - 0.06 = 4\%$ funds the insurance premium, so $P = (i_{\text{cov}} - 0.06)Q = 4\,\text{M}$. Numerically in this example, P also equals $10\% \cdot cQ$. The borrower does not pay a premium on top of i_{cov}.

We model a conservative liquidation haircut (difference between collateral and loan value) $h \in [0, 1)$ applied to collateral at default, and assume coverage pays in cash up to cQ without haircut. The lender must be money-good on principal plus coupon $Q(1 + i_\ell)$.

5.1 Lender risk parity and dominance

Proposition 2 (Risk parity and haircut dominance)**.** *Let OCL have collateral ratio γ_{ocl} and coupon i. Let COV have actual collateral γ, coverage c, and the same coupon i to the lender. If for all haircuts $h \in [0, \bar{h}]$ we have*

$$\gamma(1 - h) + c \;\geq\; \gamma_{\text{ocl}}(1 - h), \tag{16}$$

then the lender's loss under COV is almost-surely no worse than under OCL, and strictly better for any $h > 0$ whenever equality holds at $h = 0$ with $c > 0$.

Proof. Under OCL, the recoverable protection after haircut is $\gamma_{\text{ocl}}Q(1 - h)$. Under COV it is $\gamma Q(1 - h) + cQ$. Condition (16) implies COV's protection dominates OCL's pointwise in h, hence the lender shortfall random variable under COV is bounded above by that under OCL. If $c > 0$, then for any $h > 0$, $\gamma(1 - h) + c > \gamma(1 - h) \geq \gamma_{\text{ocl}}(1 - h)$ when equality holds at $h = 0$, so dominance is strict for $h > 0$. $\square$

With $\gamma = 1.10$, $c = 0.40$, $\gamma_{\text{ocl}} = 1.50$, the left-hand side equals $1.10(1-h)+0.40 = 1.50 - 1.10h$ and the OCL right-hand side equals $1.50(1 - h) = 1.50 - 1.50h$. Thus $1.50 - 1.10h \geq 1.50 - 1.50h$ for all h, with strict inequality for $h > 0$. Therefore, COV strictly dominates OCL in recovered protection after any haircut while paying the same lender APY of 6%.

Proposition 3 (Dominance at equal lender APY)**.** *Suppose the lender coupon under both OCL and COV equals $i_\ell = 6\%$. If condition (16) holds for all haircuts $h \in [0, \bar{h}]$, then for any default state the lender payoff under COV is almost-surely at least the OCL payoff, and strictly greater whenever $h > 0$. Hence at equal APY, COV exhibits weakly lower loss tail than OCL and strictly lower for any positive haircut.*

Proof. At default, the maximum cash available to repay lender under OCL is $Q \min\{\gamma_{\text{ocl}}(1-h),\, 1 + i_\ell\}$. Under COV it is $Q \min\{\gamma(1 - h) + c,\, 1 + i_\ell\}$. By (16), $\gamma(1 - h) + c \geq \gamma_{\text{ocl}}(1 - h)$ pointwise in h, so the COV minimum is no smaller. If $h > 0$ and OCL binds on protection (not coupon), then $\gamma(1 - h) + c > \gamma_{\text{ocl}}(1 - h)$ yields a strictly larger minimum. Thus payoffs are dominated; at equal coupons/APY this implies strictly better risk for COV. $\square$

5.2 Borrower ROE comparison

Let the borrower's investment yield be y on Q. Define equity-at-risk as posted collateral, ignoring time value and rehypothecation. Then

$$\mathrm{ROE}_{\mathrm{ocl}} = \frac{(y - i_{\mathrm{ocl}})Q}{\gamma_{\mathrm{ocl}}Q} = \frac{y - i_{\mathrm{ocl}}}{\gamma_{\mathrm{ocl}}}, \qquad \mathrm{ROE}_{\mathrm{cov}} = \frac{(y - i_{\mathrm{cov}})Q}{\gamma Q} = \frac{y - i_{\mathrm{cov}}}{\gamma}.$$

Proposition 4 (ROE superiority condition)**.** *Covered lending yields higher ROE than OCL iff*

$$y \; > \; y^\star \; := \; \frac{\gamma_{\mathrm{ocl}}\, i_{\mathrm{cov}} - \gamma\, i_{\mathrm{ocl}}}{\gamma_{\mathrm{ocl}} - \gamma}. \tag{17}$$

Proof. From $\frac{y - i_{\mathrm{cov}}}{\gamma} > \frac{y - i_{\mathrm{ocl}}}{\gamma_{\mathrm{ocl}}}$, rearrange to $y(\gamma_{\mathrm{ocl}} - \gamma) > \gamma_{\mathrm{ocl}} i_{\mathrm{cov}} - \gamma i_{\mathrm{ocl}}$, which yields (17). □

For example, with $\gamma_{\mathrm{ocl}} = 1.50$, $\gamma = 1.10$, $i_{\mathrm{ocl}} = 6\%$, $i_{\mathrm{cov}} = 10\%$, we obtain $y^\star = (1.5 \cdot 0.10 - 1.1 \cdot 0.06)/(1.5 - 1.1) = 0.084/0.4 = 21\%$. Hence for strategies with $y > 21\%$ (e.g., leveraged or recursive positions), covered lending strictly improves ROE while keeping lender APY at 6% and reducing tail risk per Proposition 2.

The threshold $y^\star = 21\%$ is the *crossover* strategy yield on the borrowed notional Q where the borrower's ROE under covered lending (COV) overtakes overcollateralized lending (OCL). Below 21%, OCL can have slightly higher ROE because it avoids the coverage premium and has a lower coupon; above 21%, COV wins because it requires much less equity ($\gamma = 1.10$ vs $\gamma_{\mathrm{ocl}} = 1.50$), so every dollar of strategy profit is divided by a smaller equity base. Importantly, at the *same* lender APY (6%), COV is at least as safe for lenders as OCL and strictly safer under haircuts (Propositions 2–3).

Two refinements push the crossover even lower in practice: (i) *freed collateral* under COV can earn external yield, which offsets COV's premium and lowers the required strategy yield (Section 5.3); and (ii) if venues recognize coverage as collateral (weight ϕ), the posted collateral falls further, mechanically improving ROE and reducing the threshold (Figure 5). These make the case that covered lending is the superior design for both parties over a broad range of realistic yields.

5.3 Borrower cost with freed collateral returns

Covered lending typically reduces posted collateral relative to OCL. The difference

$$F \; = \; (\gamma_{\mathrm{ocl}} - \gamma)\, Q$$

is *freed capital* the borrower can deploy elsewhere. If this capital earns an external net yield r_f (annualized, risk- and fee-adjusted), it offsets part of the covered loan's explicit cost (coupon plus premium). The annual dollar P&L difference of COV versus OCL is

$$\Delta\mathrm{PNL}_{\mathrm{COV-OCL}} \; = \; -\big(i_{\mathrm{cov}} - i_{\mathrm{ocl}}\big)\, Q \; + \; r_f\, F. \tag{18}$$

Thus COV is cheaper (higher P&L) than OCL whenever

$$r_f \; > \; r_f^\star \; := \; \frac{i_{\mathrm{cov}} - i_{\mathrm{ocl}}}{\gamma_{\mathrm{ocl}} - \gamma}. \tag{19}$$

With $Q = 100\,\text{M}$, $i_{\text{cov}} = 10\%$, $i_{\text{ocl}} = 6\%$, $\gamma_{\text{ocl}} = 1.50$, $\gamma = 1.10$: the incremental cash outlay relative to OCL is $(i_{\text{cov}} - i_{\text{ocl}})Q = (0.10 - 0.06) \cdot 100 = 4\,\text{M}$; freed capital is $(1.50 - 1.10) \cdot 100 = 40\,\text{M}$, hence $r_f^\star = 4/40 = 10\%$. If the borrower can earn $r_f > 10\%$ on the freed \$40 M, the covered structure is cheaper than OCL on a cash basis.

When evaluating a strategy on the borrowed notional Q, the break-even gross yield that covers the borrower's all-in rate, net of the freed-capital earnings, is

$$y_{\text{req}} \;=\; i_{\text{cov}} - r_f\,(\gamma_{\text{ocl}} - \gamma). \tag{20}$$

Using the same numbers and taking $r_f = 10\%$ gives $y_{\text{req}} = 0.10 - 0.10 \cdot 0.40 = 10\% - 4\% = 6\%$.

In some venues, posted collateral (or a portion of it) may earn a baseline yield r_c while locked (e.g., liquid staking). If only the *excess* posted collateral over principal, $E = (\gamma - 1)Q$, earns r_c, an alternative break-even on the loan notional is

$$y_{\text{req}}^{(c)} \;=\; i_{\text{cov}} - r_c\,(\gamma - 1). \tag{21}$$

This lens is distinct from (20): (20) values capital freed *versus OCL*, while (21) values yield on the excess posted collateral *within COV*.

A more faithful comparison should: (i) use *risk-adjusted* expected yields $\tilde{r}_f, \tilde{r}_c$ that reflect liquidity, lockups, and drawdown risk; (ii) account for correlation between strategy returns and default/coverage states (e.g., credit stress may also depress r_f); (iii) align timing (continuous accrual vs discrete premiums/coupons) via NPV; and (iv) incorporate coverage recognition ϕ if venues count coverage toward collateral, which increases freed capital to $F_\phi = \big(\gamma_{\text{ocl}} - \gamma_{\text{eff}}\big)Q$ and lowers the required yields (cf. Figure 5). These refinements tighten the decision boundary around (19) and (20) while preserving the qualitative conclusion: freed collateral yield materially offsets the borrower's all-in cost under covered lending.

5.4 Uncollateralized lending (USC) is trivially expensive

Unsecured loans set $\gamma_{\text{usc}} = 0$, providing no recoveries at default. To compensate for both expected losses and tail risk, market coupons i_{usc} must embed the full loss cost plus a risk premium, which empirically places USC rates in the 12–20%+ range for comparable credit. Relative to OCL or COV at equal lender APY, USC is strictly riskier (no haircut protection or coverage), so the borrower coupon must be materially higher to clear, making USC trivially more expensive than covered structures that deliver lender safety with lower posted capital.

5.5 AAVE collateral inclusion and capital efficiency

If a venue like AAVE [?] recognizes coverage toward collateral with weight $\phi \in [0, 1]$, the posted collateral needed to achieve a target protection level Θ solves $\gamma + \phi c = \Theta$. For fixed c, this reduces γ to $\gamma_{\text{eff}} = \Theta - \phi c$. Replacing γ by γ_{eff} in (17) lowers $y^\star$ to

$$y^\star(\phi) = \frac{\gamma_{\text{ocl}} i_{\text{cov}} - \gamma_{\text{eff}} i_{\text{ocl}}}{\gamma_{\text{ocl}} - \gamma_{\text{eff}}} \quad \text{with} \quad \frac{dy^\star}{d\phi} < 0.$$

If $\phi = 0.5$ and $\Theta = 1.50$, with $c = 0.40$ we get $\gamma_{\text{eff}} = 1.30$. Then $y^\star = (1.5 \cdot 0.10 - 1.3 \cdot 0.06)/(1.5 - 1.3) = (0.15 - 0.078)/0.2 = 36\%$. If recognition is stronger (e.g., $\phi \approx 1$) and the same tail target Θ is enforced using more coverage and less posted collateral, γ_{eff} falls and $y^\star$ declines accordingly, improving borrower capital efficiency while preserving or improving lender safety via (16).

6 Conclusion

Covered lending (COV) is the superior design relative to overcollateralized lending (OCL) at the same lender coupon/APY. For lenders, Propositions 2–3 show that COV offers pointwise greater protection after haircut and hence weakly dominates OCL in every default state, with strict improvement whenever haircuts are nonzero. For borrowers, Proposition 4 establishes a clear ROE crossover: when the strategy yield exceeds $y^\star = \frac{\gamma_{\text{ocl}} i_{\text{cov}} - \gamma i_{\text{ocl}}}{\gamma_{\text{ocl}} - \gamma}$, COV delivers strictly higher ROE by requiring materially less posted collateral; in our example, $y^\star = 21\%$.

Two practical effects further tilt the economics toward COV. First, freed collateral under COV can be productively deployed, offsetting coupon and premium and lowering the effective yield required to break even (Section 5.3). Second, if venues recognize coverage as collateral with weight ϕ, the required posted collateral falls to $\gamma_{\text{eff}} = \Theta - \phi c$, reducing $y^\star$ and improving ROE (Figure 5). By contrast, uncollateralized lending (USC) bears zero recoveries and must price in full loss and tail risk, resulting in trivially higher borrower coupons (typically 12–20%+).

In sum, across realistic DeFi yield ranges and market venues, covered lending maintains or improves lender safety while enabling higher borrower ROE with less capital tied up. This combination of superior risk for lenders and superior capital efficiency for borrowers makes covered lending the preferred structure.

7 Graphs

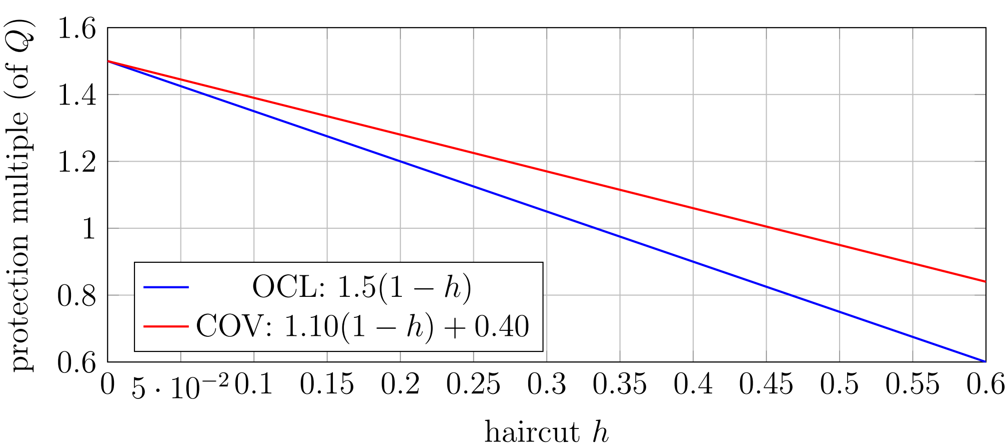

Figure 3: Recovered protection vs haircut. COV strictly dominates OCL for any $h > 0$.

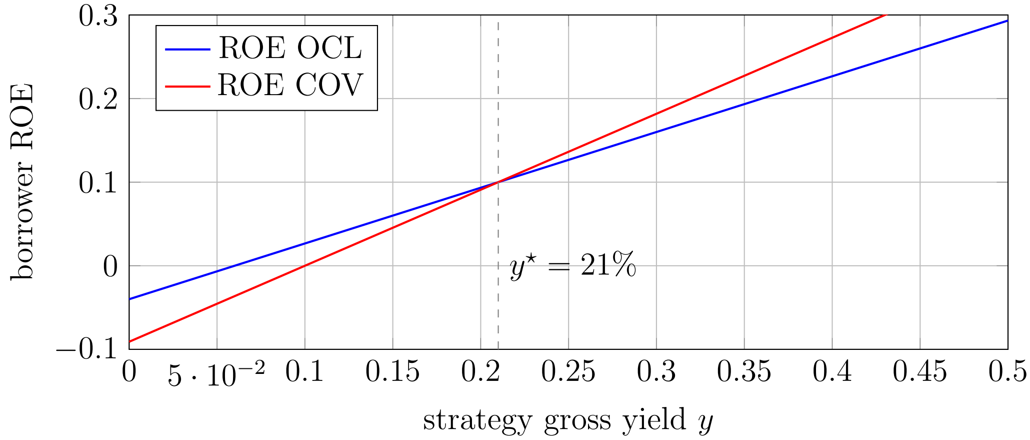

Figure 4: Borrower ROE comparison. COV outperforms for $y > 21\%$ in this example.

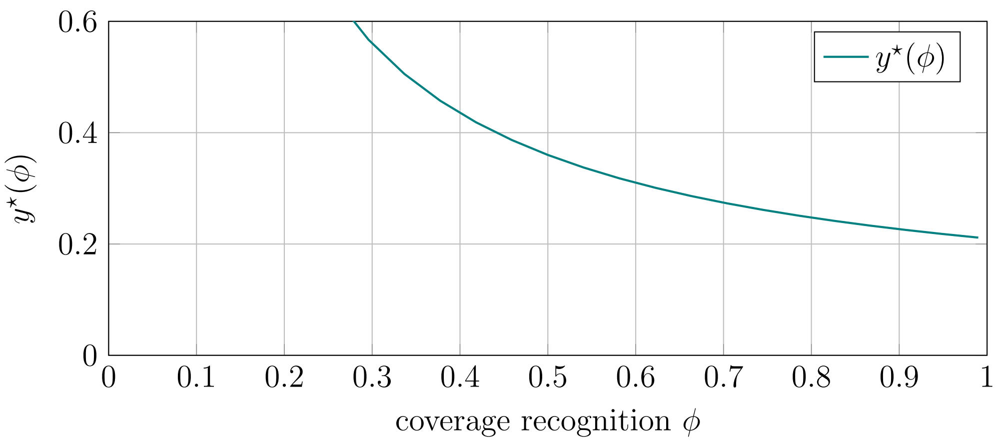

Figure 5: Threshold $y^\star$ vs coverage recognition ϕ when target protection $\Theta = 1.50$. Higher recognition lowers the required strategy yield for ROE superiority.