

Loan servicers' incentives and optimal CDOs¹

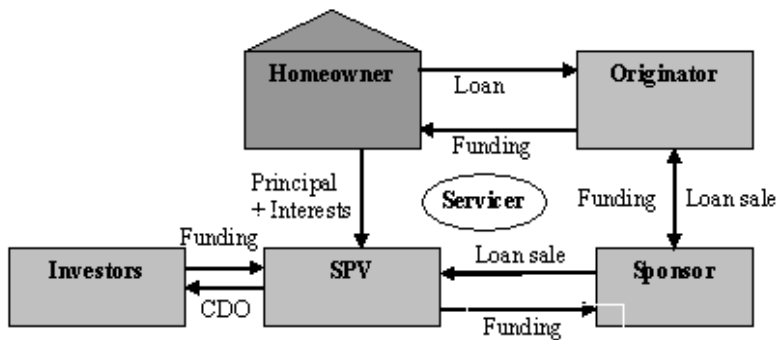
Henri Pagès
Banque de France, Research Department

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¹The views expressed here are personal and do not necessarily reflect those of the Bank of France or the Eurosystem



- Unprecedented tide of foreclosures in subprime mortgage has focused attention on servicers' decision to terminate loans
 - In times of adverse macro shocks, rate of foreclosures may be too high: Bolton & Rosenthal (2002), Kroszner (2003), Piskorski & Tchisty (2008) → "Renegotiation-failure hypothesis" Foote, Gerardi, Goette & Willen (2009)
 - Negative externalities may depress collateral prices and exacerbate crisis: Campbell et al (2009)
- Which contractual arrangement minimizes renegotiation frictions induced by securitization under two specific assumptions:
 - "Foreclosure bias:" Opportunities of private benefit diversion by servicers down the road
 - "Markovian contagion:" New foreclosures expose pool of outstanding loans to higher intensity of loss

Motivation

Continuous servicing in ABS transactions

- Securitization can induce foreclosure bias: 20% (Moody's), 30% (Fitch, 2003):
 - Servicers may not fully internalize costs and benefits of renegotiation (Piskorski et al, 2009)
 - P & S agreement may legally restrain servicers' ability to renegotiate (Bolton & Scharfstein, 1996)
 - Inefficiency of mass modification plans (Foote et al, 2009)
- Securitization gives significant room for moral hazard on the part of servicers (SEC's Federal Register, 2005)
 - Administration (master trust, prefunding period, revolving period, ...): Asset substitution is possible within certain limits
 - Complex organization (master servicer, primary servicers, special servicers, ...): Role is not restricted to collection and remittance of payments and becomes critical with large fraction of delinquent assets

Motivation

Relation with literature

- Dynamic moral hazard: DeMarzo and Sannikov (2006), Sannikov (2008), Biais et al.(2009)...
- Role of servicing: Ashcraft & Schuermann (2008), Piskorski et al (2009), Adelino et al (2009), Foote et al (2009)
- CRT on bank's incentives to monitor: Innes (1990), Chiesa (2008), Duffie (2008)
- Security design and tranching: DeMarzo (2005), Franke & Krahen (2006)
 - With adverse selection, tranching can demonstrate to investors confidence in low default losses
 - Signaling equilibrium linked to information intensity of tranches

Continuous servicing

Key assumptions

- Static portfolio (I defaultable unit loans), yielding μ per unit time
- Default in Markovian setting (no recovery): Loss intensities depend on default count $N_t = \sum_j N_t^j$ (Karlin & Taylor, 1975):

Individual intensity: $\alpha^j(t) = \alpha_i$, where size $i = I - N_t$

Aggregate intensity: $\lambda_i = i\alpha_i$, $P(N_{t+dt} = N_t + 1 \mid N_t) = \lambda_i dt$

- Continuous moral hazard on the part of the servicer:
 - With diligent servicing ($e_t = 1$), individual loss intensity is α_i
 - When shirking ($e_t = 0$), it is $\alpha'_i = \alpha_i (1 + \epsilon)$, with private benefit B per loan
 - Foreclosure bias: $\Delta\alpha_i = \epsilon\alpha_i$ (*unit level*) or $\Delta\lambda_i = \epsilon\lambda_i$ (*aggregate level*)
- Only diligent servicing is viable:

$$\frac{\mu + B}{\alpha'_i} < 1 < \frac{\mu}{\alpha_i} \Rightarrow b_i \equiv \frac{B}{\Delta\alpha_i} = \frac{B}{\epsilon\alpha_i} < 1$$

Continuous servicing

Key assumptions

- Under Markovian contagion, higher tranches are exposed to higher individual intensity of loss (Laurent et al., 2007):

$$\alpha_I \leq \alpha_{I-1} \leq \dots \leq \alpha_1$$

- Loans need servicing, and are worth nothing if managed outside the servicer-borrower relationship (exogenous liquidation value of 0)
- No commitment problem on the part of investors
- All agents are risk neutral
- Interest rate is normalized to zero
- Servicer is more impatient than investors ($r \geq 0$)

- Optimal control of servicer relies on two instruments:
 - Payments to servicers: $\delta_t \geq 0$
 - Unpredictable and stochastic liquidation τ
 - Liquidation triggered with probability $1 - \theta$ when default occurs
 - Pre-default intensity of $M_t = 1_{\{t \geq \tau\}}$ is $(1 - \theta) \lambda_i (1 + (1 - e_t)\epsilon)$
- History summarized by two state variables:
 - Default count $N_t \in \{0, 1, \dots, I\}$
 - Continuation utility

$$u(t) = 1_{\{t \leq \tau\}} E \left[\int_t^\tau e^{-r(s-t)} (\delta_s + (1 - e_s)B(I - N_s)) ds \mid \mathcal{F}_t \right]$$

- In line with literature on dynamic moral hazard, size of the pool $i = I - N_t$ and continuation utility u_t are sufficient statistics for the optimal contract:
 - Former summarizes extent of losses
 - Latter summarizes history of losses (track record of performance)

Continuous servicing

Compensation: Carrot and stick policy

- Optimal compensation relies on promise of payments after good performance:

- Incentive compatibility constraint defines “penalty” when loss occurs

$$\Delta u_i \equiv u_i(t_-) - u_{i-1}(t) \geq b_i \equiv \frac{B}{\Delta \alpha_i} = \frac{B}{\epsilon \alpha_i} \quad (\text{ICC})$$

- Penalty also defines limited liability constraint

$$u_i(t) \geq b_i \quad (\text{LLC})$$

- Promise-keeping constraint governs continuation payoff between defaulting states

$$\dot{u}_i + \delta_t - \lambda_i \Delta u_i = r u_i \quad (\text{PKC})$$

- Define social surplus as $S_i(u) = u + v_i(u) - I$

$$\delta_t (dS_i/du) = 0 \quad (\text{CSC})$$

- Bliss: $\delta_t > 0 \Rightarrow \partial v_i / \partial u = -1$ (Max social surplus)
- Probation: $\partial v_i / \partial u > -1 \Rightarrow \delta_t = 0$ (agency pb)

Continuous servicing

Compensation: Carrot and stick policy

- Under bliss, social welfare is maximized and bank's utility should not increase further:

$$u_i(t) = \gamma_i > b_i$$

is target utility in state i (highest performance level)

- When $\dot{u}_t = 0$, promise-keeping equation yields both “servicing” and “rent-preserving” fees

$$\delta_t = iB/\epsilon + r\gamma_i$$

- Probation: $u_i(t) < \gamma_i$ (below target), it is cheaper to compensate the bank with higher utility (promise of future payments) than to make immediate payment: $\delta_t = 0$, and $u_i(t) \uparrow$ until target is reached

Continuous servicing

Investors' payoff as a function of servicers' performance

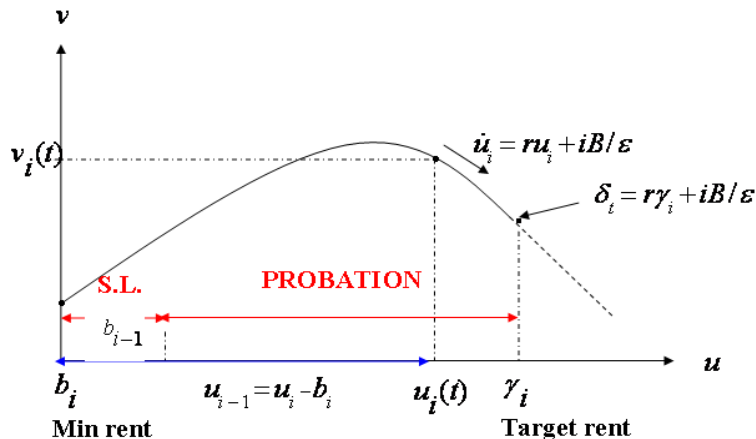


Figure: Current state: $i_t = i$

Implementation

Overview

- Optimal contract determines agent's performance record $u(t)$ as a function of fees δ_t and liquidation policy τ , given history of losses, as

$$u(t) = \mathbf{1}_{\{t \leq \tau\}} E \left[\int_t^\tau e^{-r(s-t)} \delta_s ds \mid \mathcal{F}_t \right]$$

- Using reverse engineering, optimal fees δ and liquidation policy τ can be recovered from $u(t)$ through

$$\begin{aligned} \delta_t &= \left(\frac{iB}{\epsilon} + r\gamma_i \right) \mathbf{1}_{\{u(t)=\gamma_i\}} \\ \tau &= \inf \{t : u_t = 0\} \end{aligned}$$

- Intuition: Trust (SIV) manages *liquidity buffer* $u(t)$ with two roles:
 - *Limited insurance*: buffer serves as collateral for protection underwritten by sponsor on behalf of servicer
 - *Performance-based compensation*: buffer ties sponsor's compensation to servicer's performance, as reflected in current balance

Implementation

Insurance role

- Benchmark: Individual loss intensity $\alpha_E < \alpha_M < \alpha_S$ is constant in equity, mezzanine and senior *tranches of losses*
- Penalties charged after a loss $b_i = B/(\epsilon\alpha_i)$ are constant within tranches, so are proportional to number of defaults in the tranche
- But CDOs are based on loan portfolios rather than individual loans, and commit the investor to reimbursing losses within a specific tranche
- Thus, penalties can be imposed by requiring servicers to extend protection in the form of a portfolio of CDOs, weighted by b_i , using liquidity buffer as collateral (insurance role)
- The risks borne by the servicer are those she can control:
 - High in the beginning (weight $b_E = B/(\epsilon\alpha_E)$), as it is difficult to disentangle a diligent servicer from a careless one
 - Low in the end (weight $b_S = B/\epsilon\alpha_S$), as large foreclosure bias makes servicer eager to apply her best collecting skills

Implementation

Long term risk sharing

- Optimal retention rate matches incidence of contagion risk (declining risk shares):
 - Different from one-size-fits-all 5% retention rate
 - Consistent with interpretation of “information intensity” of securities in adverse selection context
- Difference with margin account
 - Margin account: Broker asks investor to post new collateral as prices drop
 - Here, margin calls b_i are known in advance and triggered as losses unfold
- CDOs are an ideal way to make non-standard, unfrequently traded loans more transparent: Losses are revealed to investors as they occur and act as a trigger mechanism to make “margin calls” b_i
- Since CDOs are “bets” on losses in specific tranches, their prices can be used to compute margin calls b_i at the time of issuance

Implementation

Performance-based compensation role

- Trust pays fees, maintaining balance between cap γ_i and floor b_i
 - $b_i < u_t < \gamma_i$: Servicing fee (Bi/ϵ) and interests (r) accrue on balance (not remitted), according to $\dot{u} = Bi/\epsilon + ru$
 - $u_t = \gamma_i$: Excess cash triggers payment to the sponsor
 - $u_t = u_{t-} - b_i$: Balance serves as collateral to CDOs' protection leg
 - $u_t < b_i$: Overdrafts trigger stochastic liquidation
- By construction, balance u_t reflects *market value of performance* as in optimal contract
- SIV always stands in for low-performing servicer when stochastic liquidation is triggered:
 - replenishes balance if pool is kept afloat (probability θ): Shortfall is $b_i - u$
 - seizes balance if pool is liquidated (probability $1 - \theta$): Liability vis-a-vis outstanding buyers of CDOs is $\sum_{j \geq i} b_j$
- If sponsor waives CDO premium flows to the benefit of trust, the latter breaks even

Implications for regulation

Why is optimal scheme not found in practice?

- Commitment problem: Solvency regulation
 - Sponsor has incentive to provide more credit enhancement than necessary, shifting losses to depositors (Chiesa, 2008)
 - Allocation of tranches is of particular relevance for supervisors (Franke & Krahn, 2007)
- Performance measurement problem: Liquidity regulation
 - Buffer balance reflects servicers' performance, removing uncertainty about underlying quality of servicing
 - Drawing down sponsor's liquidity position does not leave the institution exposed to the "repeated" liquidity shock conundrum (Goodhart, 2008)
 - No need to rely on proprietary quantitative risk model or expert judgement by regulators
- High fees problem: Contingent capital insurance
 - Banks should not be compensated for the protection they extend
 - Waived CDO premium flows can be viewed as regulatory charge prepaid for contingent support received from the trust

- Servicers help support deteriorating performance:
 - Incentive alignment not attained by standard debt or FLP retention
 - Optimal risk sharing requires more “skin in the game”
- Regulation has a role to play: Compensation, capital requirements, securitization and liquidity are regulated under separate “global frameworks” but linked under optimal contract
- Securitization has a role to play:
 - Tranching can demonstrate commitment of effort for (rather than confidence in) low default losses to investors
 - Consistent with separating functions in production: sponsoring activities (with servicing) vs. activities related to distribution of tranches
- Liquidity management has a role to play
 - Allows investors to see through the quality of servicing
 - Does not provide transparency about the system's risk exposure