Risk Retention Regulation of Bank Asset Securitization

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**Background: I**

- Large volume of bank asset securitization has been criticized as a major contagion factor contributing to the 2007-08 financial crisis (Diamond and Rajan, 2009; Hellwig, 2009; Stein, 2010).

![Figure 1: Issuance of ABS in US (1996-2010; $ in billions)](image-url)
Background: II

Figure 2: Securitization Process
"Risk Retention Requirement" was proposed by US and EU to regulate bank asset securitization: skin in the game.

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Figure 3: Risk Retention Requirement of US and EU

Both US and EU require more information disclosure on ABS; not on retention ratio.
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Both US and EU require more information disclosure on ABS; not on retention ratio.
Background: *III*

Figure 4: Degree of Tranche Retention of US ABS (%; IMF Estimates)
Research Question

- Whether the flat rate of risk retention requirement is soundly-founded?
  - Why 5%?

- How to theoretically rationalize the risk retention requirement?
  - Reducing asymmetric information?
  - Protecting investors?
  - Enhancing social welfare?

- Should risk retention requirement be complemented by information disclosure requirement on it?
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Reducing informational asymmetry by signalling: Leland and Pyle (1977); DeMarzo (2005).

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Model Setup

- A bank and a continuum of dispersed investors, with mean-variance utility function with ARA $\gamma$ and $\lambda$.
- At $t = 0$, B/S:
  - Liability: $D$ deposits (interest rate $r_D$) and $K$ capital (interest rate 1). No C&K.
  - Asset: riskless asset $(D + K - X)$ (rate of return $r_f$) and a continuum of risky assets indexed by $j \in [0, 1]$, each of amount $X_j$ and random time 2 rate of return $\tilde{r}_j \sim N(\hat{r}_j, \sigma^2)$. No maturity mismatch.
- ★ $\hat{r}_j$: asset quality. Representative risky asset with quality $\hat{r}$.
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- At $t = 1$, the bank securitizes $q$ proportion of its assets to meet the liquidity needs. No re-investment.

- ★ Informational asymmetry here:
  - $\hat{r}$ known only to the originating bank.
  - For investors: $\hat{r} \sim U[\underline{r}, \bar{r}]$, and $\underline{r} > r_f > 1$. Information set: $\Omega$.

- At $t = 2$, $\tilde{r}$ realizes, all uncertainties are dissolved.
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- At $t = 2$, $\tilde{r}$ realizes, all uncertainties are dissolved.
Consider investor $i$’s optimal demand $y_i$ for securitized asset,

$$\max_{y_i} E_{\hat{r}} \{ E[y_i(\tilde{r} - p)|\Omega, \hat{r}] \}$$

$$- \frac{1}{2}\lambda \cdot \{ Var_{\hat{r}}[E(y_i(\tilde{r} - p)|\Omega, \hat{r})] + E_{\hat{r}}[Var(y_i(\tilde{r} - p)|\Omega, \hat{r})] \}$$

$$= y_i \cdot [E(\hat{r}|\Omega) - p] - \frac{1}{2}\lambda y_i^2 \cdot [Var(\hat{r}|\Omega) + \sigma^2]$$

(1)

Bank chooses optimal securitization intensity $q$ to maximize its expected utility derived from end-of-period wealth,

$$\max_q Kr_f + D(r_f - r_D) + qX[p(q) - r_f] + (1 - q)X(\hat{r} - r_f) - \frac{1}{2}\gamma \sigma^2 X^2 (1 - q)^2$$

(2)
Scenario B: Complete Information as the Benchmark

Consider investor $i$’s optimal demand $y_i$ for securitized asset,

$$
\max \ E_\tilde{r} \{ E \left[ y_i(\tilde{r} - p) | \Omega, \hat{r} \right] \} \\
- \frac{1}{2} \lambda \cdot \{ \text{Var}_\tilde{r} \left[ E \left( y_i(\tilde{r} - p) | \Omega, \hat{r} \right) \right] + E_\tilde{r} \left[ \text{Var} \left( y_i(\tilde{r} - p) | \Omega, \hat{r} \right) \right] \} \\
= y_i \cdot [E(\hat{r}|\Omega) - p] - \frac{1}{2} \lambda y_i^2 \cdot \left[ \text{Var}(\hat{r}|\Omega) + \sigma^2 \right]
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$$

(2)
Definition 1

Given \( \{D, X; \hat{r}, r_D, r_f; \lambda, \gamma; \sigma^2\} \), a competitive market equilibrium is market price and securitization intensity \( \{p, q\} \), and security demand \( \{y_i\}_{i\in[0,1]} \) so that:

1. Given the information set \( \Omega \) derived from securitization intensity \( q \), security demand \( y_i \) of each investor \( i \in [0,1] \) maximizes its expected utility (1);

2. Given market price \( p \), securitization intensity \( q \) maximizes the bank’s expected utility (2);

3. Security market clears: \( \int_0^1 y_i \, di = qX \).
Proposition 1

When asset quality is observable to both the originating bank and investors, the bank would like to securitize a constant proportion of its assets of any quality \( \hat{r} \in [r, \bar{r}] \):

\[
p_B = \hat{r} - \lambda \sigma^2 X \cdot \frac{\gamma}{\gamma + 2\lambda}, \quad q_B = \frac{\gamma}{\gamma + 2\lambda}
\]  

(3)
Scenario $U$: Unregulated Equilibrium with Asymmetric Information

- Information set: $\Omega_U = \{ q > 0 \}$.
- **Assumption A:** $\gamma < \frac{\bar{r} - r}{2\sigma^2 X}$.
- Define $\eta^2 \equiv \text{Var}(\hat{r}) = \frac{(\bar{r} - r)^2}{12}$. 
Proposition 2

Under Assumptions A, the unregulated competitive market equilibrium is:

\[ p_U = \begin{cases} 
    r + \gamma \sigma^2 X - \lambda q_U X \cdot (\eta_U^2 + \sigma^2), & \text{if } r < \hat{r} < \hat{r}_U \\
    0, & \text{if } \hat{r}_U < \hat{r} < \bar{r}
\end{cases} \]

If \( \gamma < 2\lambda(1 + \frac{1}{3}\gamma^2\sigma^2X^2) \),

\[ q_U = \begin{cases} 
    \frac{r + 2\gamma \sigma^2 X - \hat{r}}{2\lambda X \cdot (\eta_U^2 + \sigma^2) + \gamma \sigma^2 X}, & \text{if } r < \hat{r} < \hat{r}_U \\
    0, & \text{if } \hat{r}_U < \hat{r} < \bar{r}
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    1, & \text{if } r < \hat{r} < r + \gamma \sigma^2 X - 2\lambda X(\eta_U^2 + \sigma^2) \\
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    0, & \text{if } \hat{r}_U < \hat{r} < \bar{r}
\end{cases} \]

where \( \eta_U^2 \equiv \frac{1}{3}\gamma^2\sigma^4X^2 \), \( \hat{r}_U \equiv r + 2\gamma \sigma^2 X \).
Distortion $I$ of Informational Asymmetry

Figure 6: Comparing Securitization Intensity

Securitization Level Distortion: $LD \equiv AS_U = \bar{r} - \hat{r}_U$.  

$\hat{r}_U$
Distortion II of Informational Asymmetry

Figure 7: Comparing Market Valuation

- **Securitization Structural Distortion:**

  \[ SD \equiv \int_{2}^{\hat{r}_U} q_U X \cdot [\hat{r} - E(\hat{r}|\Omega_U)] d\hat{r}, \quad E(\hat{r}|\Omega_U) = \frac{r + \hat{r}_U}{2}. \]
Competitive Market Equilibrium of Scenarios $R$

- Risk retention requirement: $q = \bar{q}$, and not disclosed to investors.
- Information set: $\Omega_R = \{q_R = \bar{q} > 0\}$,

**Proposition 3**

*Under Assumption A, the competitive market equilibrium of scenario $R$ is:*

$$p_R = \begin{cases} r + \frac{1}{2} \gamma \sigma^2 X (2 - \bar{q}) - 2 \lambda \bar{q} X \cdot (\sigma^2 + \eta_R^2), & \text{if } r < \hat{r} < \hat{r}_R, \ 0 < \bar{q} < \bar{q}_R \\ 0, & \text{if otherwise} \end{cases}$$

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where $\bar{q}_R = \frac{2\gamma}{\gamma + 2\lambda}$ is the upper bound of $\bar{q}$ for $\hat{r}_R > r$ to hold, and

$$\eta_R^2 = \frac{1}{2\lambda^2 \bar{q}^2 X^2} \left\{ 3 + \lambda \bar{q} X^2 \sigma^2 [\gamma (2 - \bar{q}) - 2 \lambda \bar{q}] - \sqrt{9 + 6 \lambda \bar{q} X^2 \sigma^2 [\gamma (2 - \bar{q}) - 2 \lambda \bar{q}]} \right\}$$

$$\hat{r}_R = r + \frac{1}{\lambda \bar{q} X} \cdot \left\{ \sqrt{9 + 6 \lambda \bar{q} X^2 \sigma^2 \cdot [\gamma (2 - \bar{q}) - 2 \lambda \bar{q}]} - 3 \right\}$$
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Sub-optimality of Flat-Rate Retention Ratio

Optimal $\bar{q}^*$ that maximizes expected social welfare is implicitly determined by

$$\sqrt{9 + 6\lambda\bar{q}X^2\sigma^2 \cdot [\gamma(2 - \bar{q}) - 2\lambda\bar{q}] \cdot [6 + \lambda\bar{q}^2\sigma^2X^2(\gamma + 4\lambda)]}$$

$$= 18 - 3\lambda\bar{q}^2\gamma\sigma^2X^2 + 12\lambda\bar{q}\gamma\sigma^2X^2$$

$$+ 2\gamma\bar{q}^2(\lambda\sigma^2X^2)^2 \cdot [\gamma(2 - \bar{q})(1 - 2\bar{q}) - 4\lambda\bar{q}(1 - \bar{q})]$$

Proposition 4

Given volatility of risky asset return $\sigma^2$ and loan value $X$, there is no optimal flat rate of retention ratio requirement for all markets with securitizers and investors of different risk attitudes.
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Competitive Market Equilibrium of Scenarios $D$

- $q_D$ acts as a noiseless signal of asset quality.
- Information set: $\Omega_D = \{q_D\}$.

**Proposition 5**

The equilibrium asset price and securitization intensity in the market with asymmetric information and information disclosure regulation are:

$$p_D = \hat{r} - \lambda \sigma^2 q_D X$$  \hspace{1cm} (5)

and $q_D$ is the inverse function of $\hat{r}(q_D)$, where

$$\hat{r}(q_D) = \gamma \sigma^2 X \cdot (q_D - \ln q_D) + 2 \lambda \sigma^2 X q_D + r - \gamma \sigma^2 X (1 - \ln \frac{\gamma}{\gamma + 2\lambda})$$  \hspace{1cm} (6)
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(6)
Comprehensive Comparisons

**Figure 8:** Comprehensively Comparing Securitization Intensity

**Figure 9:** Comprehensively Comparing Market Valuation
Corrected Distortions by $R$ and $D$ Regulation

**Proposition 6**

*Risk retention regulation is effective in correcting structural distortion resulted from asset opaqueness; information disclosure regulation is effective in correcting both structural and level distortions.*

- $R$ regulation corrects structural distortion: 
  \[ \int_{r}^{\hat{r}_R} q_X[r - E(\hat{r}|\Omega_R)]dr = 0, \]
  where \( E(\hat{r}|\Omega_R) = \frac{r + \hat{r}_R}{2} \);

- $D$ regulation corrects structural distortion: 
  \[ \int_{r}^{\hat{r}} q_DX(r - r)dr = 0; \]

- $D$ regulation corrects level distortion: 
  \( AS_D = 0. \)
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- $R$ regulation corrects structural distortion: $\int_{\hat{\gamma}}^{\hat{\gamma}} qX[r - E(\hat{r} | \Omega_R)]dr = 0$, where $E(\hat{r} | \Omega_R) = \frac{r + \hat{\gamma}}{2}$;
- $D$ regulation corrects structural distortion: $\int_{\hat{\gamma}}^{\bar{r}} qDX(r - r)dr = 0$;
- $D$ regulation corrects level distortion: $AS_D = 0$. 
New Distortions of $R$ and $D$ Regulation

Proposition 7

*The level distortion resulted from informational asymmetry is aggravated by risk retention regulation: $\hat{r}_R < \hat{r}_U$."

- Intuition: $\Omega_R = \{q_R = \bar{q} > 0\}$ has less effective information content than $\Omega_U = \{q_U > 0\}$.

- ★ New distortion of $R$ Regulation: Securitization Level Distortion is aggravated.

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Evaluating Welfare Effects of \( R \) and \( D \) Regulation

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<th>(Correcting) Structural Distortion</th>
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<td>Unregulated Scenario</td>
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<td>( - )</td>
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Figure 10: Welfare Effects of \( R \) and \( D \) Regulation

**Proposition 8**

*Risk retention regulation tends to increase expected social welfare when the bank is more risk averse (i.e. \( \gamma \) is relatively large); information disclosure regulation tends to dominate risk retention regulation when investors are more risk averse (i.e. \( \lambda \) is relatively large).*
A Numerical Example

Let $\sigma^2 = 1$, $X = 1$.

Bolded line: $\overline{q}^* = 0.95$ in Figure 9, and $\overline{q}^* = 0.5$ in Figure 10.

Figure 11: $\overline{q}^* = 0.95$ but Market Breaks Down

Figure 12: $\overline{q}^* = 0.5$ and No Market Breakdown
A Numerical Example (Continued)

Figure 13: $\bar{q}^*$ and Risk Attitude of Investors

Figure 14: $\bar{q}^*$ and Risk Attitude of the Bank
**A Numerical Example (Continued)**

**Figure 15: When R Regulation Improves Social Welfare**

- *R* Regulation improves social welfare upon the unregulated case when \( \gamma \) is relatively large.
A Numerical Example (Continued)

Figure 16: When $D$ Regulation Improves Upon $R$ Regulation

- $D$ Regulation can complement $R$ Regulation when $\lambda$ is relatively large.
Conclusion: Back to the Questions

- **Whether the flat rate of risk retention requirement is soundly-founded?**
  - It is impossible for a flat rate retention ratio requirement to be optimal for all markets.

- **How to theoretically rationalize the risk retention requirement?**
  - Reducing asymmetric information? Only information disclosure requirement can.
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  - Enhancing social welfare? Neither.

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Future Directions

- Modelling securitization process, especially tranching.
  - Form of retention.
- Risk retention regulation and double-sided moral hazard.
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Thank You!