The Rise of China’s Onshore Credit Market

- From 2008 through 2018, domestic debt securities issued by China’s non-financial companies increased by $2.795 trillion, from a negligible level in 2008 to $3 trillion in 2018, second only to the US.

- As China further opens up its financial system, this onshore credit market has the potential of becoming a key component of the global fixed-income market, offering international investors exposure to the real China.

- If the rapid growth of China’s economy has been the story of our age for the past three decades, then, moving forward, the maturation of China’s financial markets and their integration into the global markets can very well be the story of the coming decade.
Its Significance

- China’s financial system has long been dominated by large state-owned banks. Firms in China rely on bank loans as a major source of debt financing. Prior to 2008, market-based debt accounts for less than 5% of the total debt financing.

- For non-financial firms in China, the emergence of the credit market has opened a cheaper and more efficient form of debt financing and lessened the dominance of banks in extending credit. By 2018, the market-based debt accounts for 16% of the total debt financing of non-financial firms in China.

- For the fast growing asset-management industry in China, it has expanded the investment frontier by offering an entirely new asset class – between the lower yielding and lower risk government bonds and the higher yielding and higher risk equity market.
Debt Financing by Non-Financial Firms in China, Bond vs Loan

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Class 19: Chinese Credit Market 中国信用债市场

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Compositions of China’s Credit Market

The Chinese Credit Market

- Corporate Bonds
- Chengtou Bonds
- CP
- Other

Fraction of Amount Outstanding (%)

Amount Outstanding (RMB Trillion)
Defaultable Bonds
Pricing of Defaultable Bonds

- Model the random default time with default intensity $\lambda$:
  - One-year survival probability: $e^{-\lambda}$
  - **One-year default probability**: $1 - e^{-\lambda} \approx \lambda$

- Assume zero recovery (100% loss given default):
  - Price: $P = e^{-r} \times e^{-\lambda} = e^{-(r+\lambda)}$, where $r$ is the riskfree rate.
  - Yield: $r + \lambda$
  - **Credit Spread**: $\lambda$

- Assume loss given default = Loss:
  - $P = e^{-r} \times e^{-\lambda} + e^{-r} \times (1 - e^{-\lambda}) \times (1 - \text{Loss})$
  - **For small $\lambda$, the credit spread is approximately**: $\lambda \times \text{Loss}$. 
Credit Default Swap

- The present value of the annuity:
  \[ \text{CDS} \times e^{-\lambda} \times e^{-r} \]

- The present value of the insurance:
  \[ \text{Loss} \times (1 - e^{-\lambda}) \times e^{-r} \]

- Set CDS so that the two legs have the same present value:
  \[ \text{CDS} = \frac{(1 - e^{-\lambda}) \times \text{Loss}}{e^{-\lambda}} \approx \lambda \times \text{Loss}, \]

where the approximation works well for small \( \lambda \).
5YR CDS, China and US
One-Year Default Rates

China Credit Market, Annual Default Rate (%)

Moody’s Global Corporates, Annual Default Rate (%)

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### Default Counts and Volume

#### Senior Unsecured Bond Recovery Rates for Financial Institution Defaults in 2008

<table>
<thead>
<tr>
<th>Company</th>
<th>Domain</th>
<th>Default Volume ($M)</th>
<th>Sr. Unsecured Bond Recovery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lehman Brothers Holdings, Inc.</td>
<td>United States</td>
<td>120,164</td>
<td>9.3%</td>
</tr>
<tr>
<td>Kaupthing Bank hf</td>
<td>Iceland</td>
<td>20,063</td>
<td>4.0%</td>
</tr>
<tr>
<td>Glitnir banki hf</td>
<td>Iceland</td>
<td>18,773</td>
<td>3.0%</td>
</tr>
<tr>
<td>GMAC LLC</td>
<td>United States</td>
<td>17,190</td>
<td>69.9%</td>
</tr>
<tr>
<td>Washington Mutual Bank</td>
<td>United States</td>
<td>13,600</td>
<td>26.5%</td>
</tr>
<tr>
<td>Residential Capital, LLC</td>
<td>United States</td>
<td>12,315</td>
<td>51.7%</td>
</tr>
<tr>
<td>Landsbanki Islands hf</td>
<td>Iceland</td>
<td>12,161</td>
<td>3.0%</td>
</tr>
<tr>
<td>Washington Mutual, Inc.</td>
<td>United States</td>
<td>5,746</td>
<td>57.0%</td>
</tr>
<tr>
<td>GMAC of Canada Ltd</td>
<td>Canada</td>
<td>265</td>
<td>70.7%</td>
</tr>
<tr>
<td>Downey Financial Corp.</td>
<td>United States</td>
<td>200</td>
<td>0.5%</td>
</tr>
<tr>
<td>Fremont General Corporation</td>
<td>United States</td>
<td>166</td>
<td>46.0%</td>
</tr>
<tr>
<td>Luminent Mortgage Capital, Inc.</td>
<td>United States</td>
<td>131</td>
<td>27.3%</td>
</tr>
<tr>
<td>Triad Financial Corporation</td>
<td>United States</td>
<td>89</td>
<td>76.5%</td>
</tr>
<tr>
<td>Franklin Bank Corp.</td>
<td>United States</td>
<td>80</td>
<td>0.0%</td>
</tr>
<tr>
<td>GMAC International Finance B.V.</td>
<td>Netherlands</td>
<td>51</td>
<td>85.5%</td>
</tr>
</tbody>
</table>

**Average**: 35.4%  **Median**: 27.3%

1. Based on 30-day post-default market prices.

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![Graph](chart.png)
China's Corporate Bonds

The Chinese Corporate Bond Market

<table>
<thead>
<tr>
<th>Year</th>
<th>Amount Outstanding (RMB Trillion)</th>
<th>Fraction of Amount Outstanding (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2006</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>2008</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>2010</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>2012</td>
<td>80</td>
<td>80</td>
</tr>
<tr>
<td>2014</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>2016</td>
<td>1.5</td>
<td>1.5</td>
</tr>
<tr>
<td>2018</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

Legend:
- Pub NSOE
- Pri NSOE
- Pri SOE
- Pub SOE
Default and New Issuance of Corporate Bonds

**Default Amounts**
- **Quarterly Default Amount (RMB Billion)**
- **Fraction of Default Amount (%)**
  - Pub NSOE
  - Pri NSOE
  - Pri SOE
  - Pub SOE

**New Issuance**
- **Total New Issuance (RMB Billion)**
- **Fraction of New Issuance (%)**
  - Pub NSOE
  - Pri NSOE
  - Pri SOE
  - Pub SOE
Corporate Credit Spreads, China vs US

Investment Grade Credit Spreads

- Public Non-SOE (left axis)
- Public SOE (left axis)
- Quarterly Default Amount (right axis)

US Corporates, Credit Spreads (bps)

- Investment Grade (left)
- High Yield (right)

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Market Segmentation and Price Discovery

- Price discovery: The link between credit spreads and credit quality is generally weak in China’s bond market. Prior to the first default in 2014, credit spreads in China are uninformative about credit quality above and beyond credit ratings.

- Segmentation: Since the credit tightening of 2017-18, the non-SOEs see their credit spreads exploding to over 100 bps above than their SOEs counterparts. By contrast, according to our default measures, the non-SOE issuers are in fact healthier than their SOEs counterparts.

- Segmentation on price discovery:
  - The unprecedented credit risk forces investors to price non-SOE bonds with more differentiation, making the non-SOE credit spreads markedly more informative.
  - As investors seek safety in SOE bonds under the perception of government support, the information content of SOE credit spreads remains limited.
Credit spreads for non-SOE bonds are over 150 basis points higher than their SOE counterparts in 2019.

This is after controlling for credit ratings and other bond and firm characteristics.
The non-SOE issuers are stronger than their SOE counterparts in credit quality.

Default measure: the inverse of Merton’s distance to default.

Issuers with higher DM more likely to default.
Merton’s Model of Default, \( dV_t = \mu V_t \, dt + \sigma_A V_t \, dZ_t \)

\[
V_T = e^{X_T}
\]

\[
E(X_T) = (\mu - \frac{1}{2} \sigma_A^2) \, T
\]

\[
\frac{(\mu - \frac{1}{2} \sigma_A^2) \, T - \ln(K/V_0)}{\sigma_A \sqrt{T}}
\]

- Asset volatility: \( \sigma_A \)
- Firm leverage: \( K/V_0 \)
- Asset growth: \( \mu \)
Model Calibration

- For a fixed horizon $T$, we estimate the firm’s asset value $V_t$ and volatility $\sigma_A$ via

$$E_t = V_t N(d_1) - e^r T KN(d_2) \quad \text{and} \quad \sigma_E = \frac{V_t}{E_t} \frac{\partial E_t}{\partial A_t} \sigma_A,$$

where $E_t$ is the firm’s equity value and $\sigma_E$ is the equity volatility, and

$$d_2 = \frac{\ln(V_t/K) + (r - \sigma_A^2/2) T}{\sigma_A \sqrt{T}} \quad \text{and} \quad d_1 = d_2 + \sigma_A \sqrt{T}.$$

- Quarterly calibration using quarterly-updated model inputs:
  - Default Boundary $K$: current liabilities plus one half of long-term debt.
  - Equity Value $E_t$: the total market cap by quarter end.
  - Equity volatility $\sigma_E$: estimated using daily stock returns within the quarter.
  - Riskfree rate $r$: one-year bank deposit rate.
Default Measure

- The inverse of Merton’s distance to default (DD) to measure the firm’s default risk:

\[
DM_t = DD_t^{-1} \quad \text{and} \quad DD_t = \frac{\left(\mu - \frac{1}{2} \sigma_A^2\right) T - \ln \left(\frac{K}{V_0}\right)}{\sigma_A \sqrt{T}}
\]

where the asset growth \( \mu \) is estimated using the average growth rate of the asset value over the past three years.

- Issuers with higher DM are of lower credit quality and more likely to default. Our default measure is similar in spirit to:
  - Merton’s probability of default \( N(-DD) \): Its reliance on normal distribution predicts low levels of defaults and flattens out the cross-issuer variation in DD.
  - Moody’s KMV EDF (expected default frequency): This construction of empirical distribution requires a large database of historical defaults, infeasible for the Chinese market.
Explaining Credit Spreads using DM and its Three Components

Credit Spreads on Default Measure

Credit Spreads on Equity Volatility

Credit Spreads on Leverage

Credit Spreads on Asset Growth
## Additional R2 Explained

**R2 Explained by DM**

<table>
<thead>
<tr>
<th>Quarter</th>
<th>Additional R2 (%)</th>
<th>Public Non-SOE</th>
<th>Public SOE</th>
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<tbody>
<tr>
<td>10Q1</td>
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**R2 Explained by Leverage, Equity Vol, and Asset Growth**

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