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

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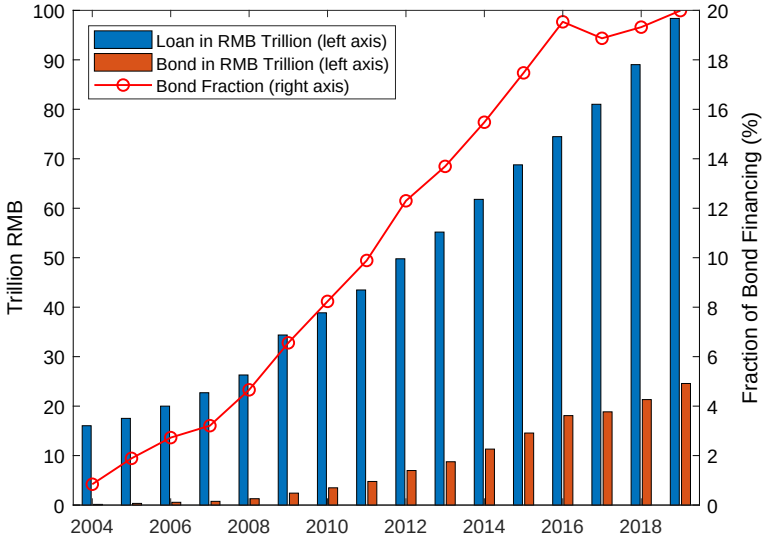
The Rise of China's Onshore Credit Market

- 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.

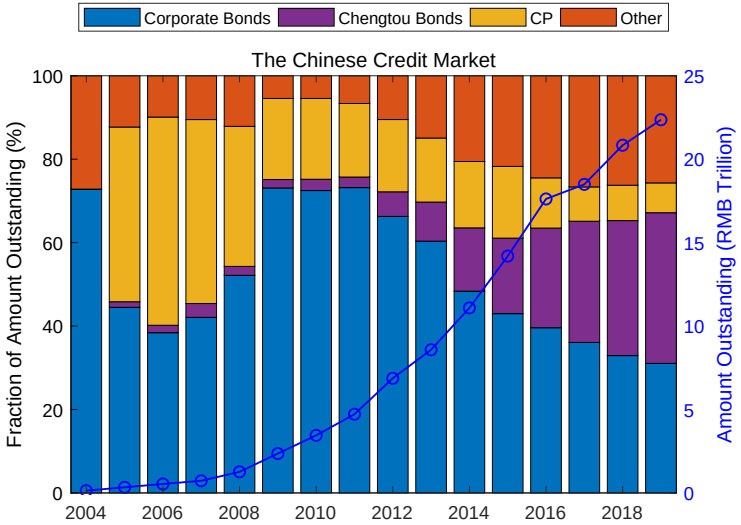
Its Significance

- 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



Compositions of China's Credit Market



Defaultable Bonds

Pricing of Defaultable Bonds

- Model the random default time with default intensity λ:
  - 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:** λ
- Assume loss given default = Loss:
  - $P = e^{-r} \times e^{-\lambda} + e^{-r} \times (1 - e^{-\lambda}) \times (1 - \text{Loss})$
  - **For small λ, 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:

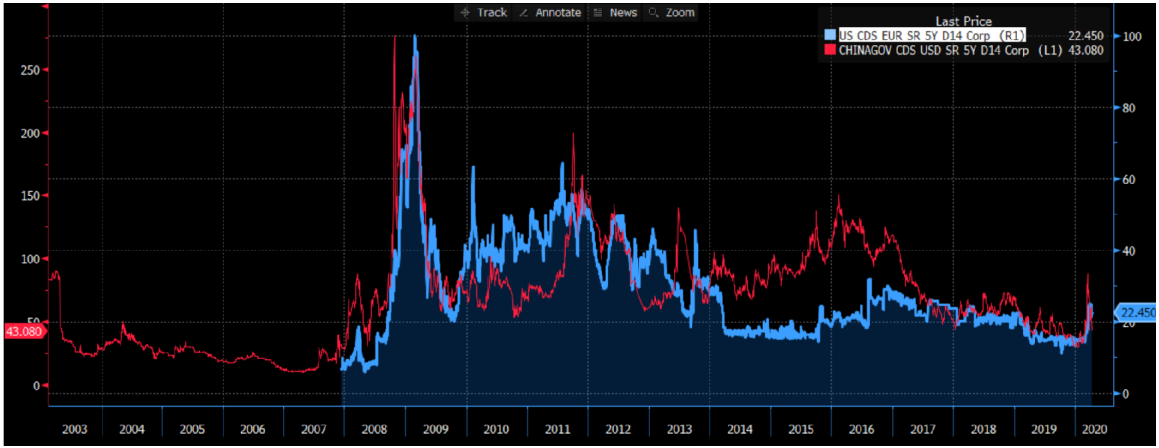
$$\text{Loss} \times \left(1 - e^{-\lambda}\right) \times e^{-r}$$

- Set CDS so that the two legs have the same present value:

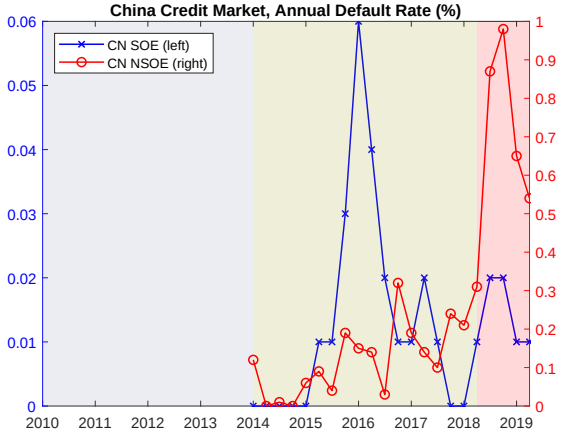
$$\text{CDS} = \frac{\left(1 - e^{-\lambda}\right) \times \text{Loss}}{e^{-\lambda}} \approx \lambda \times \text{Loss},$$

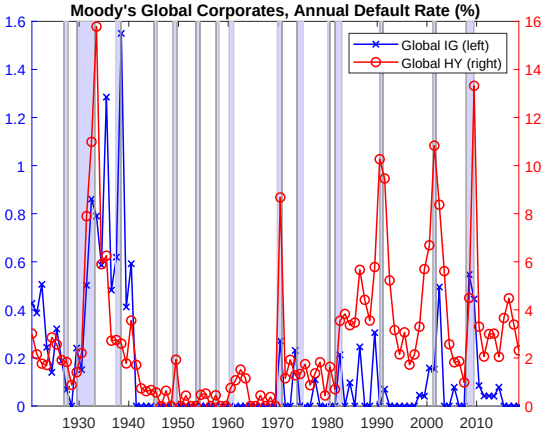
where the approximation works well for small λ.

5YR CDS, China and US



One-Year Default Rates



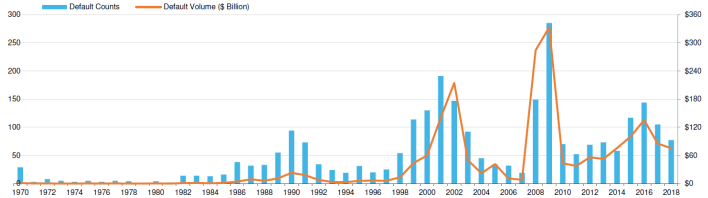


Default Counts and Volume

Senior Unsecured Bond Recovery Rates for Financial Institution Defaults in 2008[1]

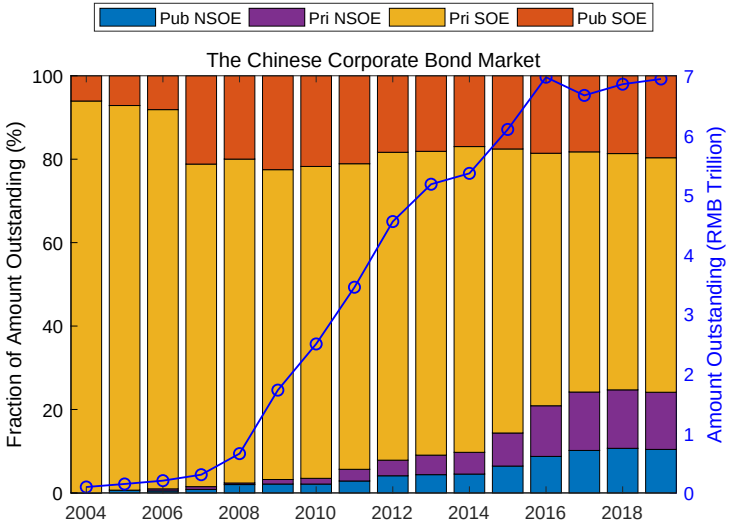
Company	Domain	Default Volume ($Mil)	Sr. Unsecured Bond Recovery
Lehman Brothers Holdings, Inc.	United States	120,164	9.3%
Kaupthing Bank hf	Iceland	20,063	4.0%
Glitnir banki hf	Iceland	18,773	3.0%
GMAC LLC	United States	17,190	69.9%
Washington Mutual Bank	United States	13,600	26.5%
Residential Capital, LLC	United States	12,315	51.7%
Landsbanki Islands hf	Iceland	12,161	3.0%
Washington Mutual, Inc.	United States	5,746	57.0%
GMAC of Canada Ltd	Canada	265	70.7%
Downey Financial Corp.	United States	200	0.5%
Fremont General Corporation	United States	166	46.0%
Luminent Mortgage Capital, Inc.	United States	131	27.3%
Triad Financial Corporation	United States	89	76.5%
Franklin Bank Corp.	United States	80	0.0%
GMAC International Finance B.V.	Netherlands	51	85.5%
Average	35.4%	Median	27.3%

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

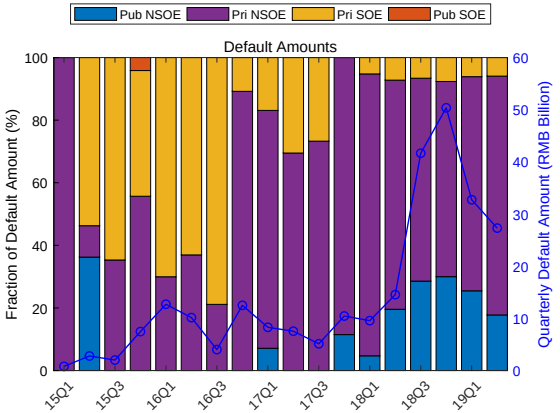


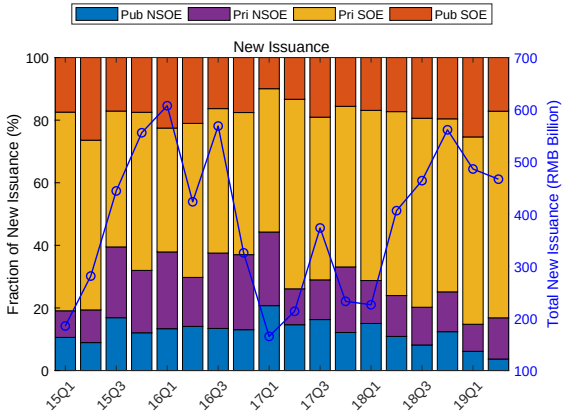
Source: Moody's Investors Service

China's Corporate Bonds

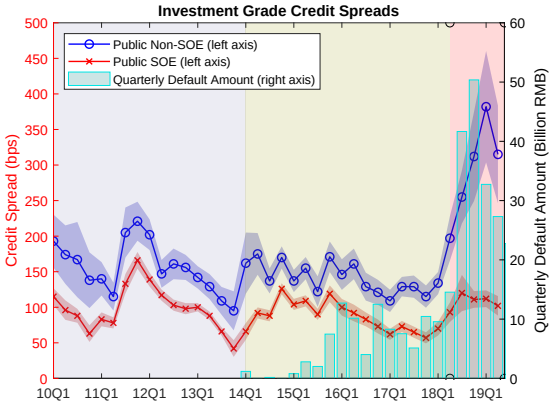


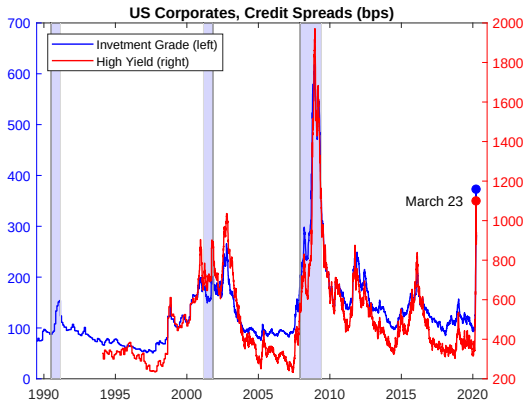
Default and New Issuance of Corporate Bonds





Corporate Credit Spreads, China vs US

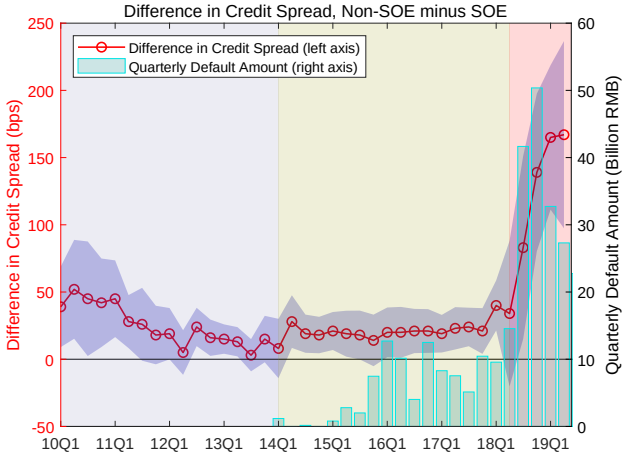




Market Segmentation and Price Discovery

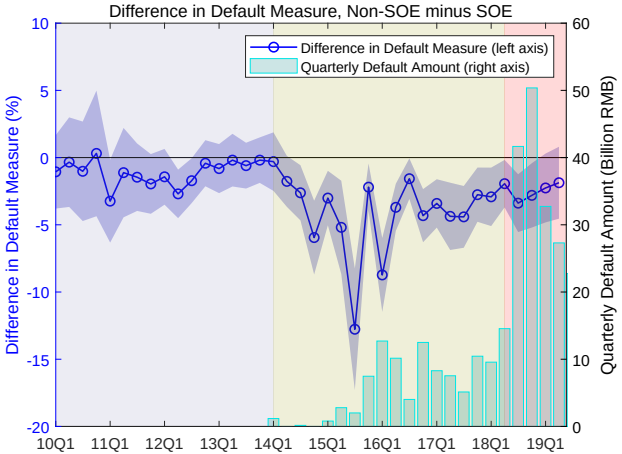
- Price discovery: The link between credit spreads and credit quality is generally weak in China's bond market. Prior to the first default in 2014, credit spreads in China are uninformative about credit quality above and beyond credit ratings.
- Segmentation: Since the credit tightening of 2017-18, the 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.

Severe Segmentation amidst Record-High Defaults in Chinese Corp Bonds



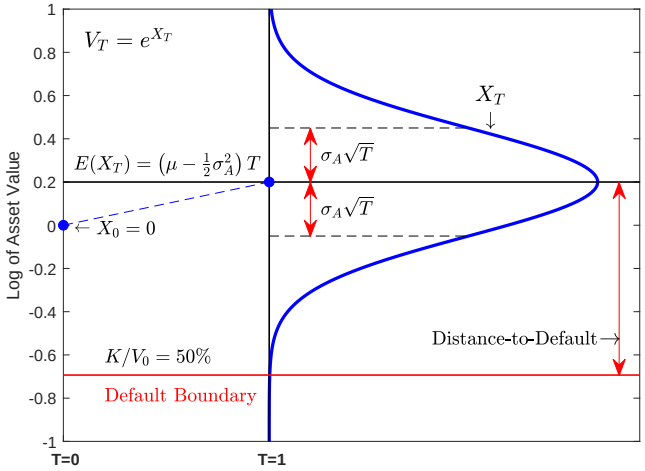
- Credit spreads for non-SOE bonds are over 150 basis points higher than their SOE counterparts in 2019.
- This is after controlling for credit ratings and other bond and firm characteristics.

Measures of Credit Quality Paint an Opposite Picture



- 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, $dV_t = \mu\, V_t\, dt + \sigma_A\, V_t\, dZ_t$



Distance-to-Default (DD)

$$\frac{\left(\mu - \frac{1}{2}\sigma_A^2\right) T - \ln(K/V_0)}{\sigma_A \sqrt{T}}$$

- Asset volatility: σ_A
- Firm leverage: K/V_0
- Asset growth: μ

Model Calibration

- For a fixed horizon T, we estimate the firm's asset value V_t and volatility σ_A via

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

  where E_t is the firm's equity value and σ_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 σ_E: estimated using daily stock returns within the quarter.
  - Riskfree rate r: one-year bank deposit rate.

Default Measure

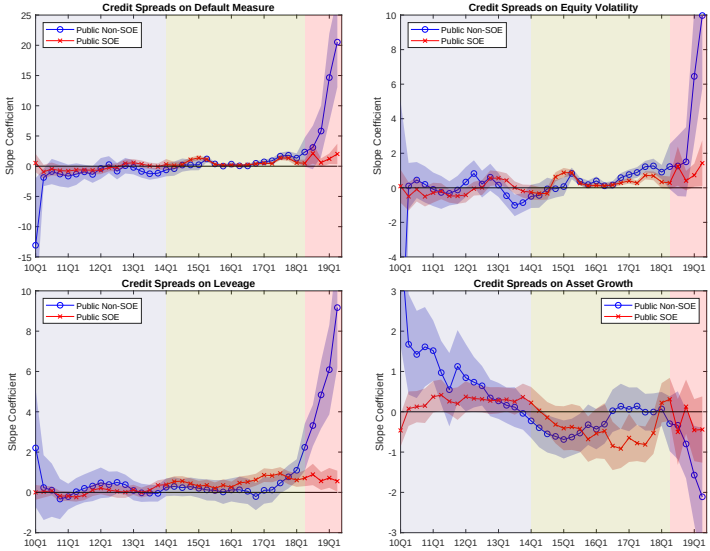
- The inverse of Merton's distance to default (DD) to measure the firm's default risk:

$$\mathrm{DM}_t = \mathrm{DD}_t^{-1} \quad \text{and} \quad \mathrm{DD}_t = \frac{\left(\mu - \frac{1}{2}\sigma_A^2\right) T - \ln\left(K/V_0\right)}{\sigma_A \sqrt{T}}$$

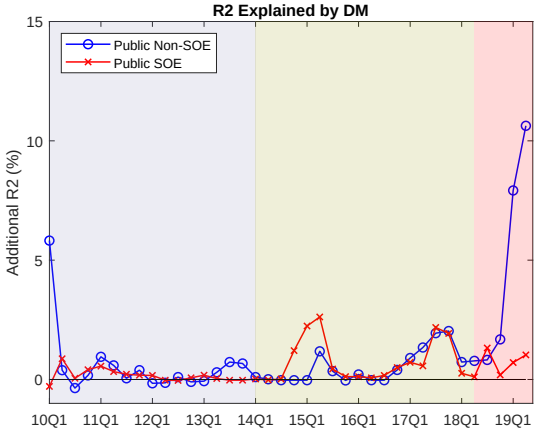
  where the asset growth μ is estimated using the average growth rate of the asset value over the past three years.

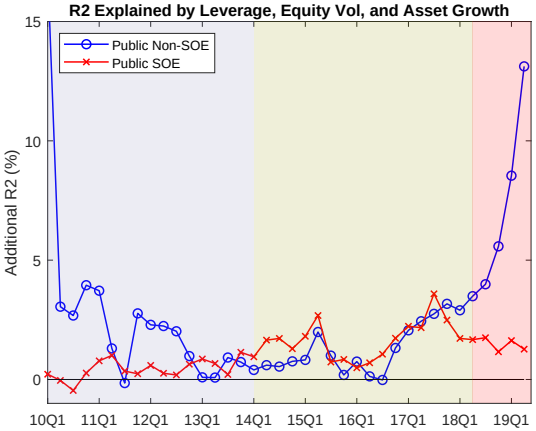
- Issuers with higher DM are of lower credit quality and more likely to default. Our default measure is similar in spirit to:
  - Merton's probability of default $N(-\mathrm{DD})$: Its reliance on normal distribution predicts low levels of defaults and flattens out the cross-issuer variation in DD.
  - 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



Additional R2 Explained





Main Takeaways