Discussion of

Option-Implied Spreads and Option Risk Premia

by

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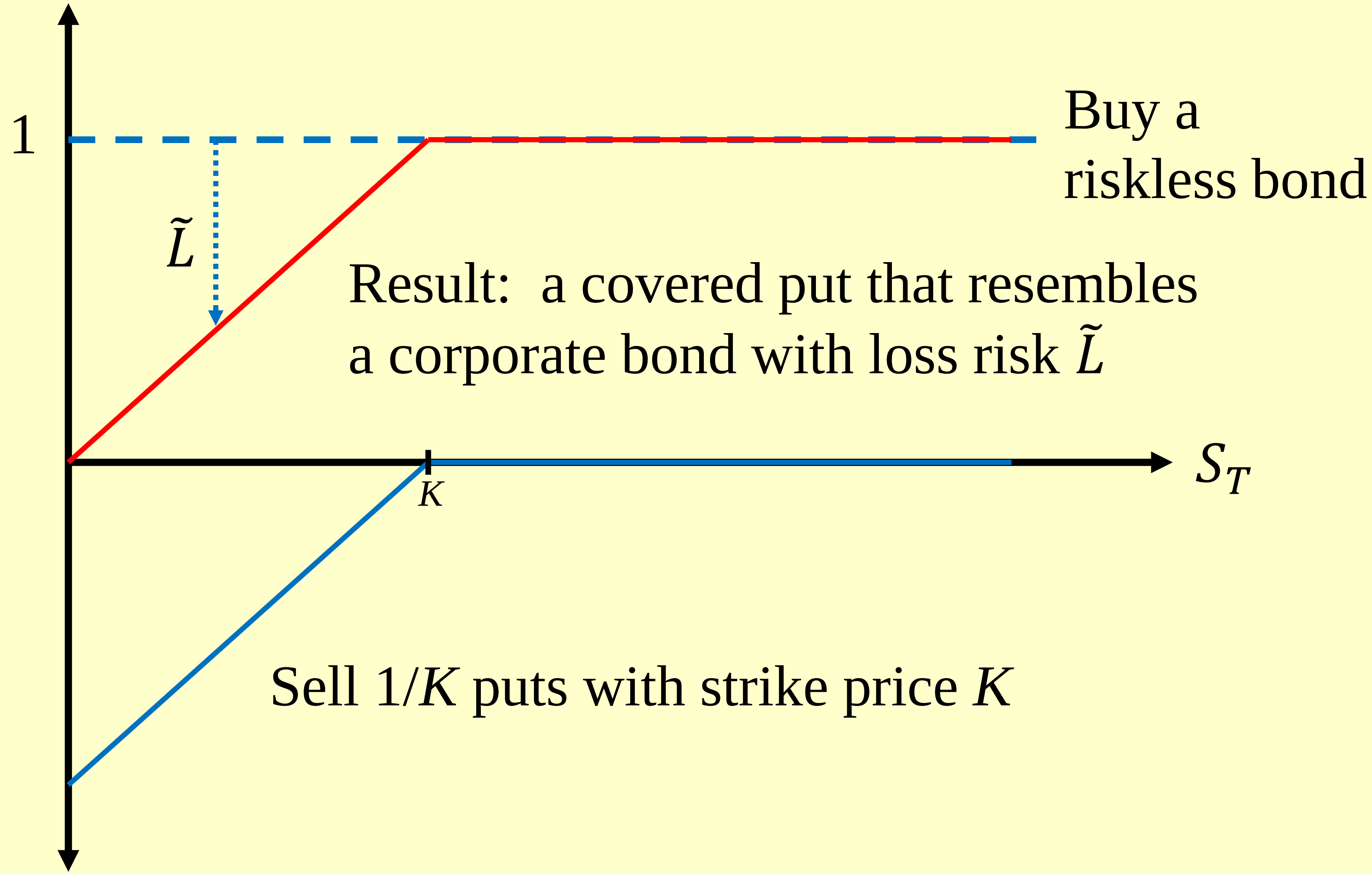
CBOE/FMA Conference on Derivatives and Volatility
November 12, 2021

Summary

1) Authors interpret writing covered puts as a corporate bond with credit risk.
2) They use (reduced-form) bond pricing models to interpret put prices
   - implied spread, normalized implied spread
3) They look at unconditional and conditional excess returns on implied bonds and puts
4) They check various models' ability to match those returns.

Covered puts



Covered puts

- Payoff: $1 - \tilde{L}\,1(\tilde{S}_T < K)$
- Price: $e^{-y\tau} = e^{-r\tau} E_t^*[1 - \tilde{L}\,1(\tilde{S}_T < K)]$, where $Prob_t^*\left(\tilde{S}_T < K\right) \equiv 1 - e^{-\lambda^* \tau}$
- If credit risk and $\bar{L}^* \equiv E_t^*[\tilde{L} | \tilde{S}_T < K]$ are small, then $y \approx r + \lambda^* \bar{L}^*$.
  – Implied spread (IS): $\lambda^* \bar{L}^*$
  – Normalized implied spread (NIS): $\bar{L}^*$
- **Problems**:
  – $\lambda^* \tau$ and $\bar{L}^*$ are not small for ATM and ITM puts.
  – $\bar{L}^*$ is exogenous in reduced-form corporate bond models. That's not true here.

A more exact approach

(Bates and Craine, JMCB 1999)

Put price:

$$P = e^{-r\tau} E_t^*\left[\max\left(K - \tilde{S}_T, 0\right)\right]$$

$$= e^{-r\tau} \underbrace{E_t^*\left[K - \tilde{S}_T \middle| \tilde{S}_T < K\right]}_{\text{RN expected shortfall}} \underbrace{Prob_t^*[\tilde{S}_T < K]}_{\text{RN tail probability}}$$

So $\frac{e^{r\tau}P}{K} = E_t^*\left[1 - \frac{\tilde{S}_T}{K} \middle| \tilde{S}_T < K\right] \; Prob_t^*\left[\tilde{S}_T < K\right]$

$= \qquad \bar{L}_t^* \qquad e^{rT} P_K$

Compute NIS ($= \bar{L}_t^*$) $= \frac{P/K}{P_K}$, rather than $\frac{\ln(1 - e^{r\tau}P/K)}{\ln(1 - e^{r\tau}P_K)}$

Option returns

- The paper notes that IS and NIS are highly correlated with IV.

$$Corr(IV, IS) \quad = \ .92$$
$$Corr(IV, NIS) = \ .84$$

- The paper then compares returns R^{IB} on implied bonds with returns R^{Put} on puts, using info content of IS and NIS.
- Results:
  - IS & NIS can't predict $R^{Put} - R^f$
  - IS & NIS ***can*** predict $R^{IB} - R^f$

Returns R^{IB} on implied bonds

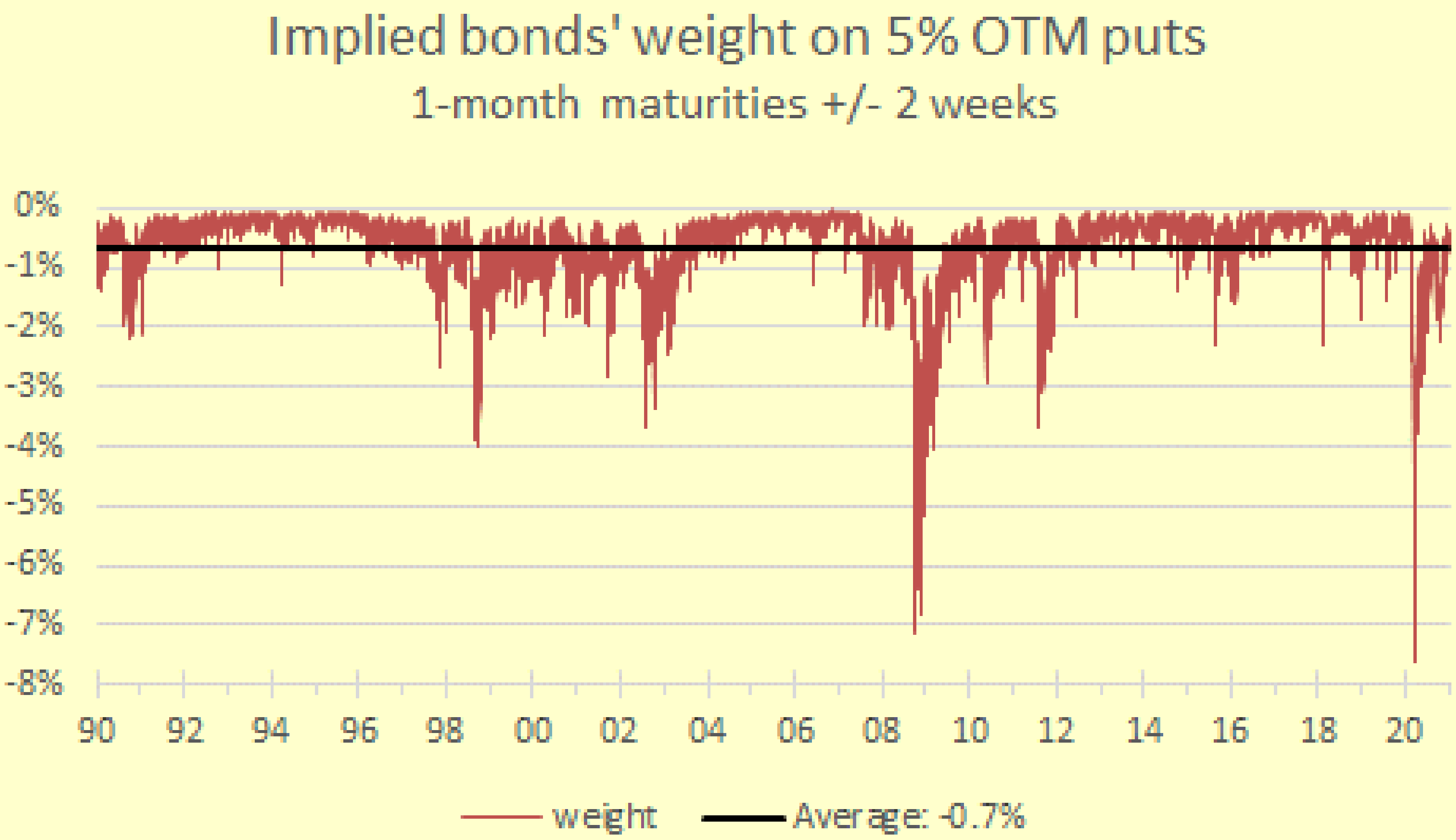
Implied bonds are a portfolio of riskless bonds and puts:

$$R_{t+1}^{IB} - R_t^f = \left(1 - \omega_t^{put}\right)\left(R_{t+1}^Z - R_t^f\right) + \omega_t^{put}\left(R_{t+1}^{put} - R_t^f\right)$$

$$\approx \omega_t^{put}\left(R_{t+1}^{put} - R_t^f\right) \text{ for } \omega_t^{put} = -\frac{e^{r\tau}P_t}{1 - e^{r\tau}P_t}$$

R^{IB} is a dynamically levered put position

- Short puts more heavily in higher-volatility periods (2008-9 financial crisis; 2020 pandemic)



$$Corr\left[\omega_t^{put}, IV_t\right] = -89\%$$

Time-varying weights create spurious predictability

- $R_{t+1}^{IB} - R_t^f \equiv xy \approx \bar{x}\bar{y} + (x - \bar{x})\bar{y} + \bar{x}(\mathrm{y} - \bar{y})$
- $Cov\left[\omega_t^{put}(R_{t+1}^{put} - R_t^f), I_t\right]$

$$\approx \boxed{Cov\left[\omega_t^{put}, I_t\right]} Avg\left(R_{t+1}^{put} - R_t^f\right)$$

"predictable"

$$+ Avg(\omega_t^{put})\ Cov\left[R_{t+1}^{put} - R_t^f, I_t\right]$$

Not predictable

- Any good proxy I_t for ω_t^{put} (IS, IV_t, ω_t^{put} itself) will generate apparent predictability for R_{t+1}^{IB}

How much "predictability"?

- **Suggestion**: regress $R^{IB}_{t+1} - R_{ft}$ on ω^{put}_t
- If $\text{Cov}\left(R^{put}_{t+1} - R_{ft}, \omega^{put}_t\right) = 0$, should get a slope estimate of $Avg(R^{put}_{t+1} - R_{ft})$

- Resulting $R^2 = \rho^2 = \dfrac{\frac{\sigma^2_\omega}{\bar{\omega}^2}}{\frac{\sigma^2_\omega}{\bar{\omega}^2} + \frac{1}{sr^2_{put}}}$

1990-2020	$\boldsymbol{\bar{\omega}}$	$\boldsymbol{\sigma_\omega}$	$\boldsymbol{sr_{put}}$	$\boldsymbol{R^2}$
5% OTM puts	-0.7%	0.7%	-0.46?	17%
ATM puts	-1.9%	0.9%	-0.27	2%

R^2 in paper: 4%

R^{IB} as a dynamic put trading strategy

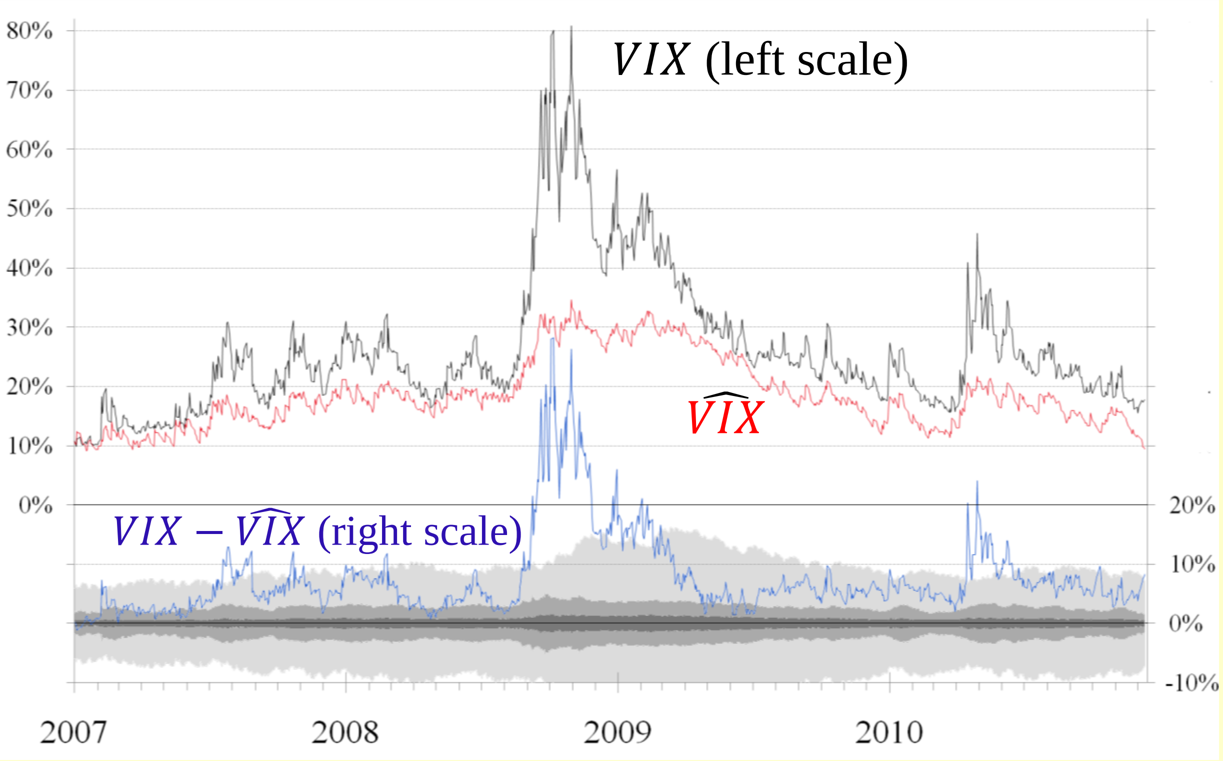
- Heavier put selling in high volatility periods:
  - Get higher excess returns (because more levered), generating “predictability” from leverage proxies if expected excess put returns don’t change (as found here)
  - Get higher volatility (because more levered)
- Strategy does ***not*** improve investment performance over 1990-2020, as measured by Sharpe ratio

	Short puts	Implied bonds
ST OTM	0.46	0.32
ST ATM	0.27	0.26

- Goetzmann et al (RFS, 2007) for alternate performance measures

R^{IB} as a dynamic put trading strategy

- The gap between objective and risk-neutral measures of volatility underpinning option risk premia is especially pronounced during high-volatility periods
  - Regressions: VIX is a biased predictor of future volatility, and is ***more*** biased when high
  - Bates (JFE, 2012): VIX was especially overpriced during 2008-9 financial crisis



BUT – not an exploitable trading opportunity, according to results in this paper

Other comments

- Based on Merton (1974), default risk on corporate bonds is categorized by distance to default.
- **Implication**: should measure moneyness *K/S* in SD units, rather than in percentages
  - Local IV (Carr & Wu, JF 2020)
  - ATM IV
  - Maturity-specific VIX

Model evaluation

- Paper then looks at various affine models' ability to match predictive regression results, using simulated data.
- Past approaches have focused more on matching option **prices** (under RN distribution) than option returns.
- Not easy. If $p(S_t, Y_t, t)$ for state variable(s) Y_t, then

$$E_t\left[\frac{\Delta P}{P}\right] - R_t^f = E_t\left[\frac{\Delta P}{P}\right] - E_t^*\left[\frac{\Delta P}{P}\right]$$

$$\approx \frac{SP_S}{P}\left[E_t\left(\frac{\Delta S}{S}\right) - R_t^f\right] + \frac{P_Y}{P}\left[E_t(\Delta Y) - \mathrm{E}_t^*(\Delta Y)\right] + (E_t - E_t^*)(SOT)$$

- **equity premium** **Y risk premium** **jump risk premium**
- Even more difficult with R_{t+1}^{IB}. Have to also match the variation in leverage/IV levels.

Conclusions

- The implied-bond approach of this paper is of some interest as an aggressive put trading strategy.
- The approach is otherwise not particularly useful.
  - IS and NIS contain little information that is not already in IV.
  - IS and NIS have no info content for put returns.
  - Returns on implied bonds are just noisy versions of put returns. The approach adds noise rather than clarity to the central issue:

    why is selling stock index puts so profitable?