UNCERTAINTIES DRIVE THE GREEN BONDS DANCE: TWO PIONEER MARKETS PERSPECTIVE

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WHAT REALITY URGENCY ISPIRED US?

- Understanding the impact of uncertainty factors to specific financial assets are always of great significance for guiding the investment decisions and adjust capital allocations.
  —— We need focus on the issue of uncertainties affecting the green bonds.
- There are always some different financial features for green bonds in developed and developing economies.
  —— We need simultaneously considering both the cases of two kinds of countries.
- The macro-financial factors (such as uncertainties) might play different impacts on the various states of the financial market.
  —— We need determine the different impact for different market states.

HOW WOULD WE ACHEIVE THE RESEARCH MISSION?

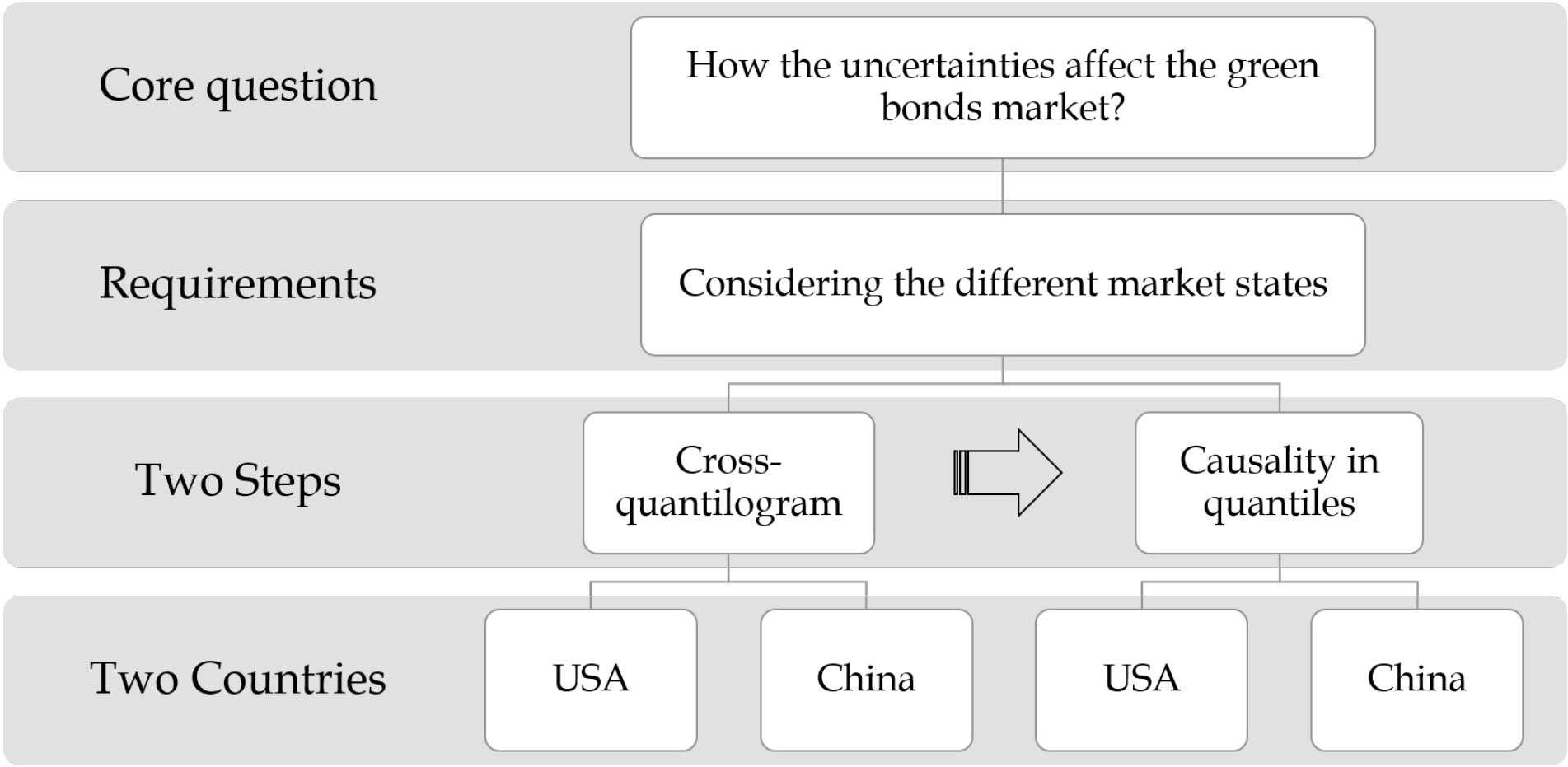


FIGURE: The research framework of this paper

THE MATHEMATICAL EQUATIONS

The main equation of Cross-quantilogram

$$\rho_{\tau}(k) = \frac{E[\Psi_{\tau_1}(y_{1,t} - q_{1,t}(\tau_1))\Psi_{\tau_2}(y_{2,t-k} - q_{2,t-k}(\tau_2))]}{\sqrt{E[\Psi^2_{\tau_1}(y_{1,t} - q_{1,t}(\tau_1))]}\sqrt{E[\Psi^2_{\tau_2}(y_{2,t-k} - q_{2,t-k}(\tau_2))]}}$$

The main equation of Causality in quantiles

$$Q_{\theta}\left\{y_t | y_{t-1}, ..., y_{t-p}, x_{t-1}, ..., x_{t-p}\right\} = Q_{\theta}\left\{y_t | y_{t-1}, ..., y_{t-p}\right\}$$

$$Q_{\theta}\left\{y_t | y_{t-1}, ..., y_{t-p}, x_{t-1}, ..., x_{t-p}\right\} \neq Q_{\theta}\left\{y_t | y_{t-1}, ..., y_{t-p}\right\}$$

THE MATHEMATICAL EQUATIONS

The main equation of Cross-quantilogram

$$\rho_{\tau}(k) = \frac{E[\Psi_{\tau_1}(y_{1,t} - q_{1,t}(\tau_1))\Psi_{\tau_2}(y_{2,t-k} - q_{2,t-k}(\tau_2))]}{\sqrt{E[\Psi^2_{\tau_1}(y_{1,t} - q_{1,t}(\tau_1))]}\sqrt{E[\Psi^2_{\tau_2}(y_{2,t-k} - q_{2,t-k}(\tau_2))]}}$$

$$y_t$$

$$x_t$$

$$y_t = (y_{1t}, y_{2t})^T$$

The main equation of Causality in quantiles

$$Q_{\theta}\left\{y_t | y_{t-1}, ..., y_{t-p}, x_{t-1}, ..., x_{t-p}\right\} = Q_{\theta}\left\{y_t | y_{t-1}, ..., y_{t-p}\right\}$$

INTRODUCTION OF THE VARIABLES

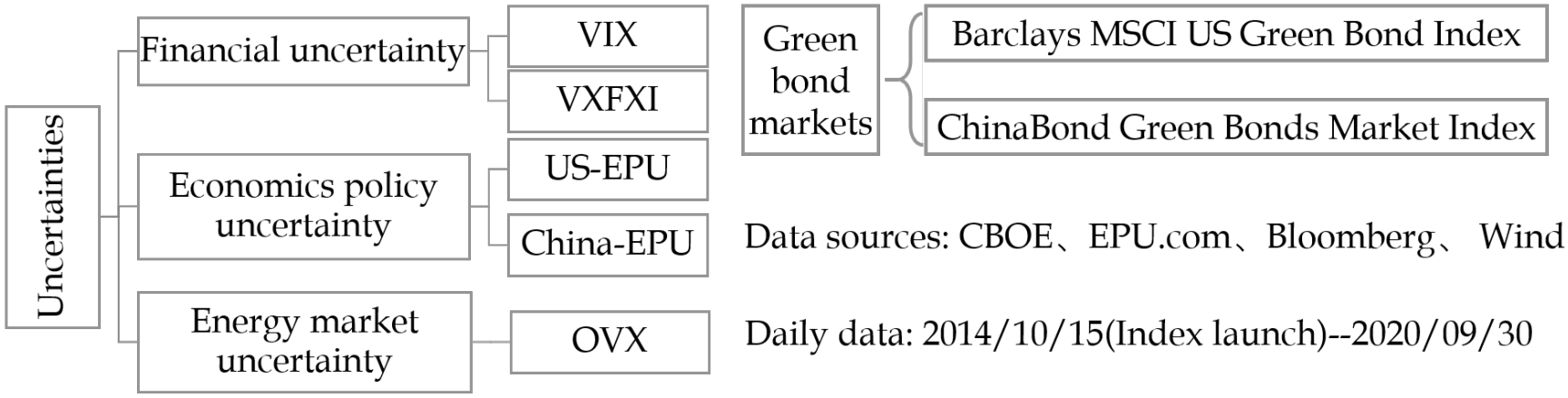
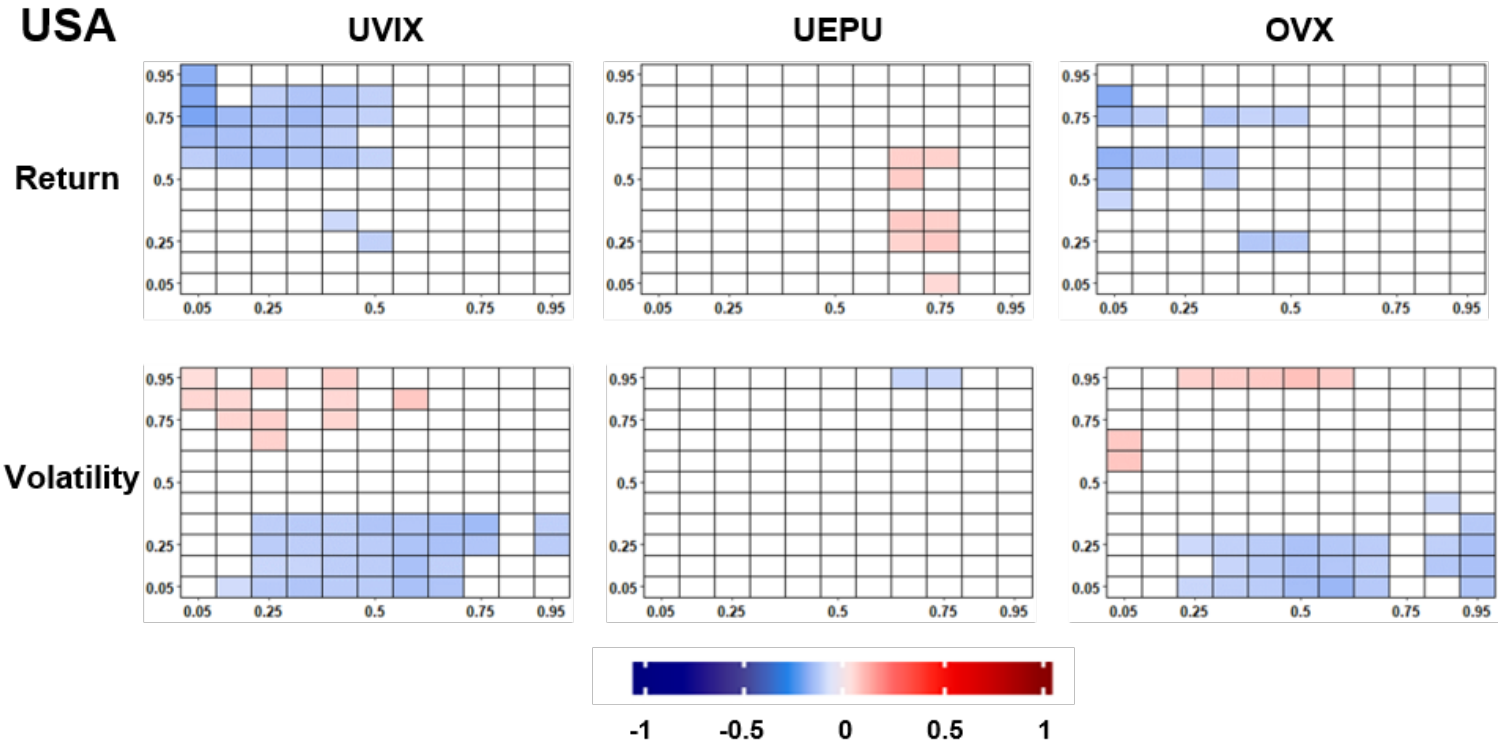
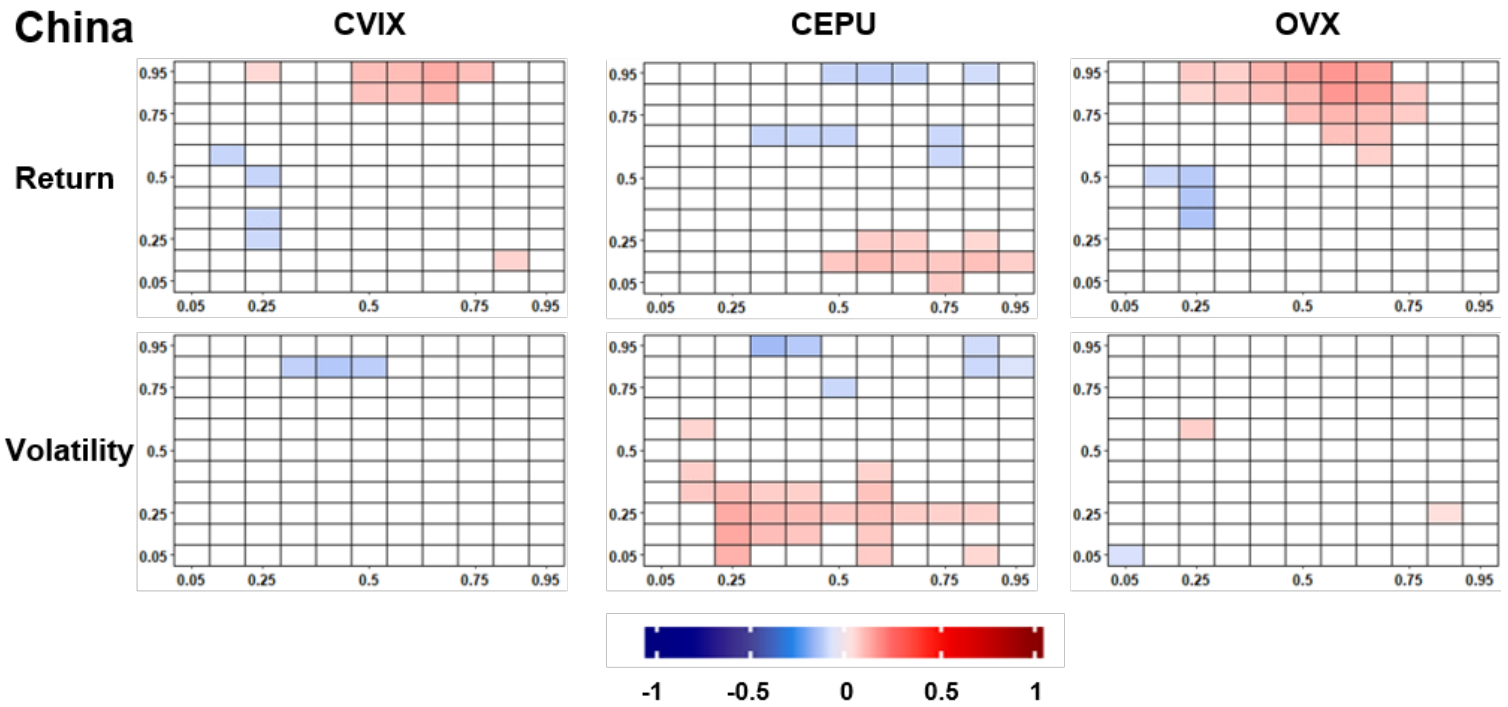


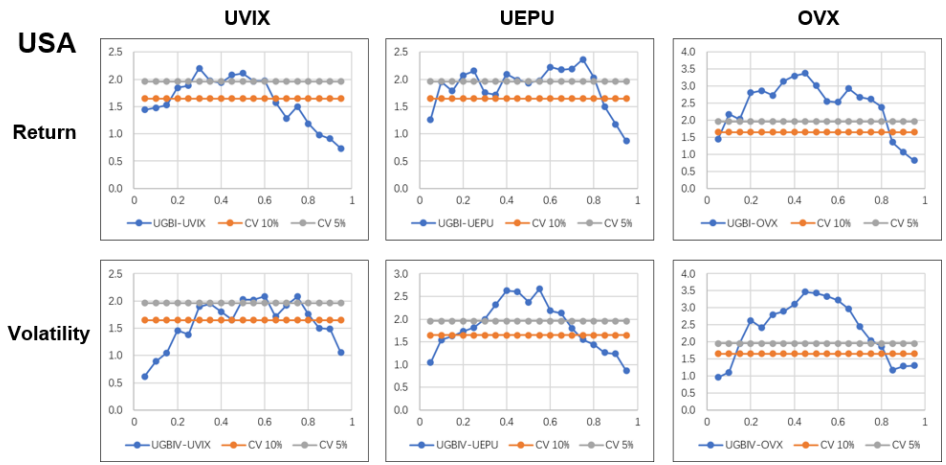
FIGURE: The main variables

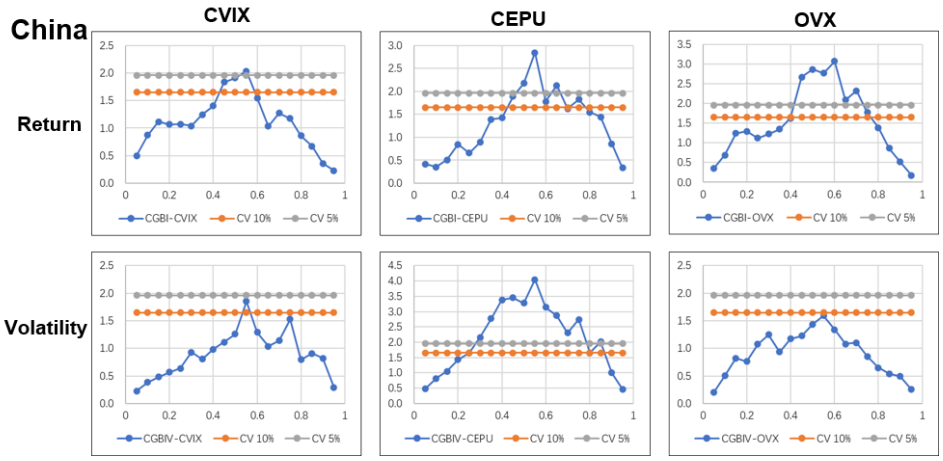


- UVIX and OVX would negatively affect the green bonds return in the bearish market, while UEPU positively affects it when green bonds in a bullish market.
- UEPU will hardly affect the volatility of green bonds, but UVIX and OVX will. Especially in a state of low uncertainty, these two uncertainties will always negatively affect the volatility of green bonds. In other words, when the uncertainty of the financial and energy markets decreases, the volatility of the green bond market will also decrease.



- Green bonds may also move in the opposite direction of CVIX and OVX in bear markets, but they are more likely to be affected to increase returns in other conditions. While, CEPU would not only positively affect green bonds in bullish market, but also produce negative effects when the CEPU is bullish.
- China's green bond market volatility will hardly be affected by CVIX and OVX, but CEPU will have a very strong impact. Except for a few extreme bullish situations, CEPU has always been an important driver of China's green bond volatility





- OVX would always play the most causal impact on USA green bonds than the other uncertainties (for both return and volatility).
- The causal relationship between green bonds and uncertainties would be various under different conditions, and this features is basically consistent with the previous results.

- CEPU would always play the most causal impact on Chinese green bonds than the other uncertainties (especially for volatility).
- The asymmetric characteristics for the bull market and the bear market are smaller than that of the US, which is consistent with the previous results from the cross-quantilogram approach.

What do we conclude from the estimation

1. Uncertainties indeed have impact on green bonds in China and the United States, but there are some differences for three uncertainty indicators and two countries (*Heterogeneities*).
2. The USA green bonds are more susceptible to the negative impact of financial and oil market uncertainties, reflecting the *effective integration* of the US green bond market with the general financial market but cannot effectively hedge the risks of oil.
3. China's green bonds are rarely affected by CVIX and OVX. This reflects the fact that China's green bond market has not been effectively integrated with the general financial market and this market is still *mainly promoted by the government* so that sensitive to economic policy uncertainties.