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Economic policy uncertainty shocks and stock–bond correlations: Evidence from the US market

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HIGHLIGHTS

- Innovations in the policy uncertainty index impact negatively on the correlations.
- We quantify the effects of policy uncertainty shocks on stock–bond correlations.
- We adopt a novel approach to distinguishing between positive and negative shocks.
- The advent of the Euro has not changed the sign of the effects.
- Dynamic correlations are characterized by positive-type asymmetry.

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ABSTRACT

This paper examines the effects of economic policy uncertainty shocks on stock–bond correlations for the US market. We devise a general framework which distinguishes a positive shock from a negative one and nests either as its special case. The results show that innovations in the policy uncertainty index impact negatively and asymmetrically on the subsequent stock–bond correlations which are characterized by a structural break and positive-type asymmetry.

1. Introduction

Recently, a series of US studies demonstrate that economic policy uncertainty (EPU) (i) predicts future recessions if combined with financial variables (Karnizova and Li, 2014); (ii) co-moves with stock market returns and implied volatility (Antonakakis et al., 2013) and with inflation and output (Jones and Olson, 2013), (iii) impacts European aggregates more than Euro-area policy uncertainty (Colombo, 2013), and (iv) spills over to influence other developed countries (Klößner and Sekkel, 2014). These findings greatly enrich our understanding of the importance of US policy uncertainty in terms of its economic and financial effects both domestically and internationally.

In this study, we explore another interesting yet untouched question: How do EPU shocks drive the co-movements between stock and bond markets? Our study is related to, but different from, Antonakakis et al. (2013) and Jones and Olson (2013), and it has three distinct features. First, we focus on changes in, rather than levels of, the EPU index because the former is a more accurate measure of policy uncertainty shocks than the latter and so better serves our research purposes.

Second, we take policy uncertainty shocks as exogenously predetermined and examine what effects they may have on subsequent stock–bond correlations. Innovations in the EPU index should be perceived by investors as policy-induced shocks. When the shocks are positive, investors, being risk averse, tend to sell in the relatively riskier stock market and buy in the relatively safer

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bond market, known as flight to quality, leading to a decline in the correlations. When the shocks are negative, however, there may be two possibilities. (i) Flight *from* quality occurs with decreased uncertainty, resulting in, too, a reduction in the correlations. If this is true, then it is the absolute changes in the EPU index that matter and will impact negatively on the correlations. (ii) There is no flight from quality: decreased uncertainty improves economic environment and outlook, which raises investors' demand for *both* stocks and bonds, thereby pushing up their correlations. If this is true, then a positive (negative) EPU shock will cause a fall (rise) in the correlations—i.e., the effect of EPU shocks on the correlations is negative. In fact, Connolly et al. (2005) document a negative effect of uncertainty (measured by implied volatility) on the future stock–bond correlation, regardless of whether uncertainty shocks are positive or negative. Based on their findings, we hypothesize that innovations in the EPU index also have a negative effect on the subsequent stock–bond correlations, and devise a general framework to test this conjecture. The framework nests positive and negative uncertainty shocks as two special cases by imposing relevant restrictions, and lets data ascertain if such restrictions should be accepted or rejected. It enables us to shed light on whether the correlations respond to the absolute or the raw EPU shock, and whether the responses are asymmetric to a positive and a negative EPU shock.

Third, we employ two types of the Asymmetric Dynamic Conditional Correlation (ADCC) model for incorporating EPU innovations (hence indicated as ADCCX throughout this paper) and allow for structural change, induced possibly by the advent of the Euro (see, e.g., Cappiello et al., 2006). These are to ensure the robustness of our test results.

The rest of the paper proceeds as follows. Section 2 focuses on data and methodology, Section 3 reports empirical results, and Section 4 concludes.

2. Data and methodology

According to Baker et al. (2012), an EPU index is a good proxy for economic policy uncertainty. We thus consider the weekly US news index (converted from the daily index from http://www.policyuncertainty.com/) as a measure of weekly economic policy uncertainty. Weekly stock and bond market returns are calculated as log differences of the S&P 500 Index (from http://www.wind.com.cn/) and the US 10 years government bond index (from DataStream) using Friday-to-Friday closing prices.[3] The sample period spans from January 4, 1985 to October 31, 2014, with 1557 observations.

We first fit an ARMA(1,1) model to each return series:

$$\begin{aligned} & r_{it} = c_i + \varphi_i r_{it-1} + z_{it} + \kappa_i z_{it-1}, \quad (i = 1, 2) \\ & (Z_t \mid \Omega_{t-1}) \sim N[0, H_t] \end{aligned} \tag{1}$$

where r_{it} ($i = 1, 2$, similarly hereinafter) are the return rates of, respectively, the stock and bond markets at time t, $Z_t = [z_{1t}, z_{2t}]$, and Ω_{t-1} the information set. The covariance matrix H_t can be modelled as:

$$H_t = D_t R_t D_t \tag{2}$$

where $D_t = \operatorname{diag}(H_t) = \operatorname{diag}\left(\sqrt{h_{1t}}, \sqrt{h_{2t}}\right)$ and $R_t = (\operatorname{diag}(Q_t))^{-1} Q_t (\operatorname{diag}(Q_t))^{-1}$. D_t is the diagonal matrix of conditional standard deviations. R_t is the conditional correlation matrix of ε_{1t} and ε_{2t}, with $\varepsilon_{it} = z_{it}/\sqrt{h_{it}}$ being the two standardized residuals. To obtain conditional variances h_{1t} and h_{2t}, we estimate GARCH(1,1):

$$h_{it} = \omega_i + \delta_i z_{it-1}^2 + \theta_i h_{it-1}, \quad (i = 1, 2). \tag{3}$$

The element $\rho_{12t} = q_{12t}/\sqrt{q_{11t} q_{22t}}$ in R_t is the correlation coefficient between ε_{1t} and ε_{2t}, where q_{12t}, q_{11t} and q_{22t} are the elements of Q_t.

The two ADCCX models we employ to estimate Q_t are specified as follows:

$$\begin{aligned} Q_t &= (\overline{Q} - A'\overline{Q}A - B'\overline{Q}B) + A'e_{t-1}e'_{t-1}A + B'Q_{t-1}B \\ &\quad + \eta^+ \Delta\xi^+_{t-1} + \eta^- \Delta\xi^-_{t-1} \end{aligned} \tag{4}$$

$$\begin{aligned} Q_t &= (\overline{Q} - A'\overline{Q}A - B'\overline{Q}B - G'\overline{N}G) + A'\varepsilon_{t-1}\varepsilon'_{t-1}A \\ &\quad + B'Q_{t-1}B + G'n_{t-1}n'_{t-1}G + \eta^+ \Delta\xi^+_{t-1} + \eta^- \Delta\xi^-_{t-1}. \end{aligned} \tag{5}$$

Eq. (4) is based on Li's (2011) ADCC model, and will be indicated as LADCCX. Eq. (5) is built upon Sheppard's (2002) ADCC model, and will be labelled as SADCCX. In the two equations, $\bar{Q} = \begin{pmatrix} 1 & \bar{\rho}_{12} \\ \bar{\rho}_{12} & 1 \end{pmatrix}$ is theunconditional correlation matrix, $A = \begin{pmatrix} \alpha_1 & 0 \\ 0 & \alpha_2 \end{pmatrix}$, $B = \begin{pmatrix} \beta_1 & 0 \\ 0 & \beta_2 \end{pmatrix}$, $e_t = \begin{pmatrix} \varepsilon_{1t} + \gamma_1 \\ \varepsilon_{2t} + \gamma_2 \end{pmatrix}$ (γ_1 and γ_2 capture the asymmetric effects of non-EPU shocks ε_{1t} and ε_{2t}, if any, on correlations), $\varepsilon_t = \begin{pmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{pmatrix}$, $G = \begin{pmatrix} g_1 & 0 \\ 0 & g_2 \end{pmatrix}$ ($g_i \geq 0$, playing the same role as γ_i), $\overline{N} = T^{-1} \sum_{t=1}^{T} n_t n'_t$ (T is the sample size, and $n_t = I(\varepsilon_t > 0)_\circ \varepsilon_t$ referred to as positive-type asymmetry, or $n_t = I(\varepsilon_t < 0)_\circ \varepsilon_t$ referred to as negative-type asymmetry), $\Delta\xi_t = 100 \times (\ln \xi_t - \ln \xi_{t-1})$ (ξ denotes the EPU index), $\Delta\xi^+_t = I(\Delta\xi_t > 0)^\circ \Delta\xi_t$ and $\Delta\xi^-_t = I(\Delta\xi_t < 0)^\circ \Delta\xi_t$ ("$\circ$" denotes the Hadamard product). Note, (4) and (5) embrace the standard DCC model of Engle and Sheppard (2001) augmented with $\Delta\xi_t$, where $\gamma_1 = \gamma_2 = 0$ or $g_1 = g_2 = 0$.

Of particular note is $\eta^+ \Delta\xi^+_{t-1} + \eta^- \Delta\xi^-_{t-1}$. If $\eta^- = -\eta^+ (= -\eta)$, then $\eta^+ \Delta\xi^+_{t-1} + \eta^- \Delta\xi^-_{t-1} = \eta(\Delta\xi^+_{t-1} - \Delta\xi^-_{t-1}) = \eta |\Delta\xi_{t-1}|$: $\rho_{12,t}$ would respond to the absolute changes in EPU and, with $\eta < 0$, both positive and negative EPU shocks would lower $\rho_{12,t}$. If $\eta^- = \eta^+ (=\eta)$, then $\eta^+ \Delta\xi^+_{t-1} + \eta^- \Delta\xi^-_{t-1} = \eta(\Delta\xi^+_{t-1} + \Delta\xi^-_{t-1}) = \eta \Delta\xi_{t-1}$: with $\eta < 0$, a positive EPU shock would lower $\rho_{12,t}$ while a negative shock would raise $\rho_{12,t}$. Thus, we regard $\eta^+ \Delta\xi^+_{t-1} + \eta^- \Delta\xi^-_{t-1}$ without restrictions on η^+ and η^- as a general case which nests the two special cases $\eta |\Delta\xi_{t-1}|$ and $\eta \Delta\xi_{t-1}$. This device allows us to test the restrictions $\eta^- = -\eta^+$ and $\eta^- = \eta^+$ respectively against the general case, and reveal the sign of the relation between uncertainty shocks and future stock–bond correlations.[4]

3. Empirical results

Fig. 1 presents the time-series plot of weekly percentage changes in the EPU index. We can see that EPU innovations are highly volatile: the maximum and minimum values equal, respectively, 195.70% and −155.71%. The standard deviation can be calculated as 38.07%.

Table 1 summarizes initial estimation results, but we only discuss the most relevant ones. In Panel A, the insignificant Ljung–Box statistics of ε_{it} and ε^2_{it} indicate the employed ARMA(1,1) and GARCH(1,1) models do a good job in ensuring ε_{it} are white noise. In Panel B pertaining to the LADCCX model, row (a) corresponds to the general model where η^+ and η^- are freely estimated, and (b) and (c) to the special cases where the restrictions $\eta^- = \eta^+$ and $\eta^- = -\eta^+$ respectively are imposed.

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[3] Results based on Thursday-to-Thursday returns are qualitatively similar, suggesting that the end-of-week effects are not an issue.

[4] We thank an anonymous referee for suggesting the possibility of asymmetric responses of $\rho_{12,t}$ to uncertainty shocks, which inspires us to conceive this device.