Economic policy uncertainty in Europe and safe heaven currencies

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Abstract:

European investors had traditionally considered the German mark and the Swiss franc as safe currencies. From their asset universe, however, the German mark disappeared after the Euro was introduced in circulation in 1999, which has made them search for alternative safe assets, especially in turbulent times, such as the European sovereign debt crisis of 2010. This study estimates the dynamic conditional correlations from the VAR-DCC-GARCH models between the EPU indexes, developed by Baker et al. (2012), and the real effective exchange rates of the five major currencies to find safe currencies for European investors. The estimated correlations indicate that the Japanese yen and the US dollar could serve as such currencies even in the recent financial crisis.

Keywords

International Diversification, European Sovereign Debt Crisis, Dynamic Conditional Correlation,

1 Introduction

The European debt crisis that erupted during the global financial crisis of the 2000s has heightened concerns about safe assets. Among European currencies, the German mark and the Swiss franc had been traditionally viewed as safe. Since the introduction of Euro as a circulating currency, however, the German mark had vanished from the asset universe and the Swiss franc has not been large enough in volume to absorb the unsatisfied demand for safe currencies within Europe. European investors have searched for other currencies beyond the European continent, such as the British pound, the Japanese yen and the US dollar, more eagerly than before.

The modern portfolio theory, pioneered by Markovitz (1952), recommends that assets are diversified between less correlated asset classes, which efficiently reduces the risk of portfolio with its expected return unchanged. In international diversification, the choice of currencies in the portfolio partially determines its risk and, therefore, the quantitative assessments of the dynamic behaviors of correlations are of great value.

The dynamics of correlations between currencies is driven by multiple potential factors. One of the factors is economic policy uncertainty. Some empirical studies, such as Baker et al. (2016), show that the effects of economic policy uncertainty on economic variables are not negligible. Other studies, such as Blcilar et al. (2015), Krol (2014), and Martin and Urrea (2011), empirically analyze how economic policy uncertainty affects foreign exchange rates, finding that their lasting impacts are statistically significant in the markets over a long period of time.

This study analyzes the effects of shocks to the Global, European and US EPU indexes on the major currencies – the British pound, the Euro, the Japanese yen, the Swiss franc and the US dollar – and estimates the dynamic correlation coefficients over time, using the vector autoregression – dynamic conditional correlation – generalized autoregressive conditional heteroskedasticity (VAR-DCC-GARCH) models, developed by Engle (2002). In recent years, the EPU indexes, developed by Baker et al. (2012), have been widely used to measure the degree of uncertainty possibly caused by sovereigns. In this study, we estimate dynamic conditional correlation between the EPU indexes and the foreign exchange rate with the VAR-DCC-GARCH models, which allow us to track the dynamics of the correlations in the sample period.

The paper is constructed as follows. The next section describes the bivariate VAR-DCC-GARCH model applied in this study. The third section explains the data used in the analysis. The fourth section presents the results from the estimation of the VAR-DCC-GARCH models in the sample period from January 1999 to July 2017. We also plot the estimated dynamic correlation coefficients between the EPU indexes and the real effective exchange rates, describing their changing patters over time. The last section concludes.

2 The VAR-DCC-GARCH Model

This study considers a VAR-DCC-GARCH model of two variables $y_t=[y_{1,t}, y_{2,t}]'$, where $y_{1,t}$ is the real exchange rate at time t and $y_{2,t}$ is the European EPU index. We first assume the first-order VAR model in the form of

$$y_t=\alpha+\beta y_{t-1}+e_t \quad (1)$$

where α is a vector of constants, β is a vector of fixed coefficients and e_t, is a vector of random errors. The VAR model represents the conditional means of the variables.

The random errors are assumed to follow the multivariate normal distribution with the time-variant covariance matrix

$$e_t \Omega_{t-1} \sim N(0, \Sigma_t) \quad (2)$$

$$\Sigma_t = D_t \rho_t D_t \quad (3)$$

where $\Sigma_t=[\sigma_{ij,t}]$ is the 2×2 time-variant covariance matrix, $D_t=diag\{\sigma_{ii,t}^{1/2}\}$ is the diagonal matrix, and $\rho_t=[\rho_{ij}]$ is the conditional correlation matrix. The variances $\sigma_{11}$and σ_{22}follow the GARCH processes

$$\sigma_{ii,t}=\gamma_i+\varphi_i e_{i,t-1}^2+\psi_i \sigma_{ii,t-1} \quad (4)$$

where γ_i, ϕ_i and ψ_i are fixed coefficients. We formulate the evolution of ρ_t as the DCC model developed by Engle (2002)

$$Q_t=(1-\theta_1-\theta_2)\bar{Q}+\theta_1 Q_{t-1}+\theta_2 \eta_{t-1}\eta_{t-1}' \quad (5)$$

$$\rho_t = j_t Q_t j_t \quad (6)$$

where $\eta_t=[\eta_{1t}, \eta_{2t}]'$ is a vector of the marginally standardized errors $\eta_{it}=e_{it}/\sqrt{\sigma_{ii,t}}$, $\bar{Q}$ is the unconditional covariance matrix of η_t, $J_t=diag\{\rho_{ii,t}^{1/2}\}$ is the diagonal matrix, θ_1 and θ_2 are fixed coefficients.

3 Data

Baker et al. (2016) develop the monthly country-level EPU indexes for the United States and other major countries, the European-wide and Global indexes. The indexes draw on newspaper articles and for the US index, other sources, such as tax codes and economic forecast disagreements. The European EPU index is constructed from ten newspapers published in five European countries – France, Germany, Italy, Spain and the United Kingdom. For each country, they select two major newspapers in its native language and count the number of newspaper articles that contain the triple of key words - (1) ‘economic’ or ‘economy’, (2) ‘uncertain’ or ‘uncertainty’, and (3) other policy-relevant terms. The newspaper-level series are standardized to unit standard deviations and averaged across all the ten newspapers to construct the European index. Technical details are explained in Baker et al. (2016), and the data sets are downloaded from their web site.

For the real effective exchange rates, we use the monthly broad indexes released by the Bank for International Settlements (BIS), which are calculated as geometric weighted averages of bilateral exchange rates and adjusted by relative consumer price indexes (CPI). The weights vary over time. Technical details are explained in Klau and Fung (2006). The data series are downloaded from the web site of the BIS.

For the real bilateral exchange rates, the monthly averages of daily noon buying rates in New York City for cable transfers payable in foreign currencies are adjusted by relative CPI. The data sets of the exchange rates and the CPIs are obtained from the web site of the Federal Reserve Bank of St. Louis.

The sample covers 247 months from January 1997 to July 2017. The real effective and bilateral exchange rates are converted into monthly returns by taking log difference.

Table 1 shows the descriptive statistics of the variables as well as the Phillips-Perron (PP) and augmented Dickey-Fuller (ADF) statistics for unit roots. We primarily use the PP test, not the widely used ADF test, since the PP test is a non-parametric test that allows for serial correlation and heteroskedasticity in the error terms; the DCC-GARCH model assumes that the error terms are heteroskedastic. The PP statistics indicate that the monthly returns of the real exchange rates are all stationary at the 1% significance level. The European EPU index is also stationary at the 1% significance level (the ADF test cannot rejects the null hypothesis of a unit root).

4 Results

The VAR-DCC-GARCH model is estimated in three steps. We first estimate the VAR models (1) by maximizing the log likelihood function. Table 2 reports the estimated coefficients and their standard errors as well as the adjusted R^2s and the Breusch-Pagan (BP) statistics for normality. For most of the variables, their own lags are statistically significant while the lags of the other variables are not. The adjusted R^2s are relatively high for the EPU indexes. In all cases, the BP tests cannot reject the null hypothesis of normality.

We then estimate the GARCH models from the VAR residuals $\hat{e}_t = y_t - \hat{\alpha} - \hat{\beta} y_{t-1}$, where $\hat{\alpha}$ and

Table 1: Descriptive statistics

	Euro	Japanese Yen	Swiss Franc	British Pound	US Dollar	European EPU
Mean	−0.049	−0.206	0.039	−0.117	−0.007	4.852
Standard Deviation	1.497	2.368	1.366	1.593	1.197	0.447
Minimum	−5.136	−6.812	−8.181	−6.601	−3.637	3.865
Maximum	5.176	10.664	7.447	4.359	5.464	6.071
Skewness	0.206	0.376	0.291	−0.813	0.264	0.131
Kurtosis	0.688	1.802	9.144	2.338	1.440	−0.639
PP statistics	−162.001**	−164.171**	−207.977**	−199.274**	−135.488**	−55.952**
ADF Statistics	−5.056**	−5.961**	−6.094**	−5.333**	−5.735**	−3.028

Table 2: The VAR models

	REER	Euro	Japanese Yen	Swiss Franc	British Pound	US Dollar
	Constant	−0.747	1.274	−0.182	0.781	0.402
		(1.08)	(1.68)	(1.016)	(1.173)	(0.834)
	REERt-1	0.208**	0.286**	0.028	0.118	0.352**
REER		(0.066)	(0.065)	(0.068)	(0.067)	(0.064)
	EPUt-1	0.148	−0.291	0.046	−0.183	−0.085
		(0.222)	(0.345)	(0.209)	(0.241)	(0.171)
	Adjusted R Squared	0.037	0.074	−0.008	0.009	0.114
	BP Statistic	1.484	0.736	0.904	2.179	1.794
	Constant	0.74**	0.741**	0.742**	0.723**	0.742**
		(0.173)	(0.174)	(0.175)	(0.175)	(0.175)
	REERt-1	0.016	0.004	0.006	0.005	0.006
EPU		(0.011)	(0.007)	(0.012)	(0.01)	(0.013)
	EPUt-1	0.848**	0.848**	0.848**	0.852**	0.848**
		(0.036)	(0.036)	(0.036)	(0.036)	(0.036)
	Adjusted R Squared	0.722	0.72	0.72	0.72	0.72
	BP Statistic	1.971	0.993	1.822	0.039	0.977

Table 3: The DCC-GARCH models

REER		Euro	Japanese Yen	Swiss Franc	British Pound	US Dollar
	γ	0.006	0.569	0.751	0.239	0.223
		(0.033)	(1.450)	(0.411)	(0.135)	(0.797)
REER GARCH	ϕ	0.000	0.051	0.195	0.122*	0.060
		(0.015)	(0.073)	(0.124)	(0.057)	(0.129)
	ψ	0.997**	0.837*	0.389*	0.782**	0.764
		(0.001)	(0.338)	(0.153)	(0.098)	(0.756)
	γ	0.055	0.055	0.055	0.055	0.055
		(0.047)	(0.047)	(0.047)	(0.056)	(0.047)
EPU GARCH	ϕ	0.000	0.000	0.000	0.000	0.000
		(0.006)	(0.006)	(0.006)	(0.007)	(0.007)
	ψ	0.000	0.000	0.000	0.000	0.000
		(0.908)	(0.901)	(0.898)	(1.071)	(0.902)
	θ_1	0.000	0.021	0.020	0.000	0.000
DCC		0.000	(0.015)	(0.03)	(0.000)	(0.000)
	θ_2	0.934**	0.952**	0.925**	0.922**	0.931**
		(0.325)	(0.022)	(0.052)	(0.162)	(0.263)

$\hat{\beta}$ are the estimated coefficients. We finally estimate the DCC model by using the standardized residuals $\hat{\eta}_t = \hat{e}/\hat{\sigma}_t$, where $\hat{o}_t$ is the predicted value of the GARCH models. Table 3 summarizes the results from the DCC-GARC models.

Figures 1-3 plots the estimated dynamic conditional correlation coefficients between the real effective exchange rates of the five currencies and the EPU indexes. Over the sample period, the Japanese yen and the Swiss franc are positively correlated with all the EUP indexes, which indicates that these currencies can serve as safe haven regardless of the origins of the EPU shocks. In particular, the Japanese yen highly appreciated in response to the shocks during the global financial crisis of 2008. The figures also show that the US dollar is positively correlated with the EPU indexes over the sample period. Surprisingly, it positively reacted the US EPU shock even during the global financial crisis of 2008. The correlation between the EPU indexes and the two European currencies – the Euro and the British pound – are negligibly small. Although weak correlation does not necessarily invalidate currencies as safe haven, these two Europen currencies are inferior to the Japanese yen, the Swiss franc and the US dollar in this respect.

5 Concluding Remarks

Controlling the risk of the internationally diversified portfolio, it is of great value to find safe haven currencies, which are less correlated with other currencies and external shocks. In Europe, the German mark and the Swiss franc have been considered as such currencies. The demand for safety, however, have not been satisfied since the German mark stopped circulating after the Euro became an official medium of exchange in 1999. This has makes European investors more eager to search for alternative currencies, especially in

Figure 1: The dynamic conditional correlation between the real exchange rates and the Global EPU index

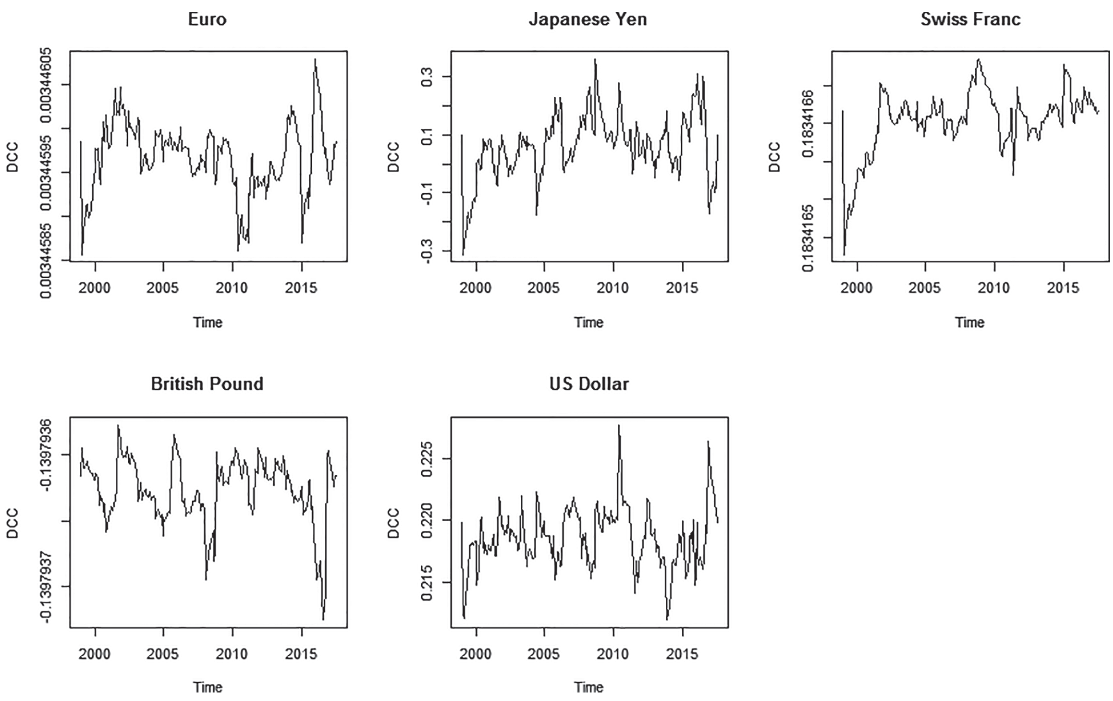
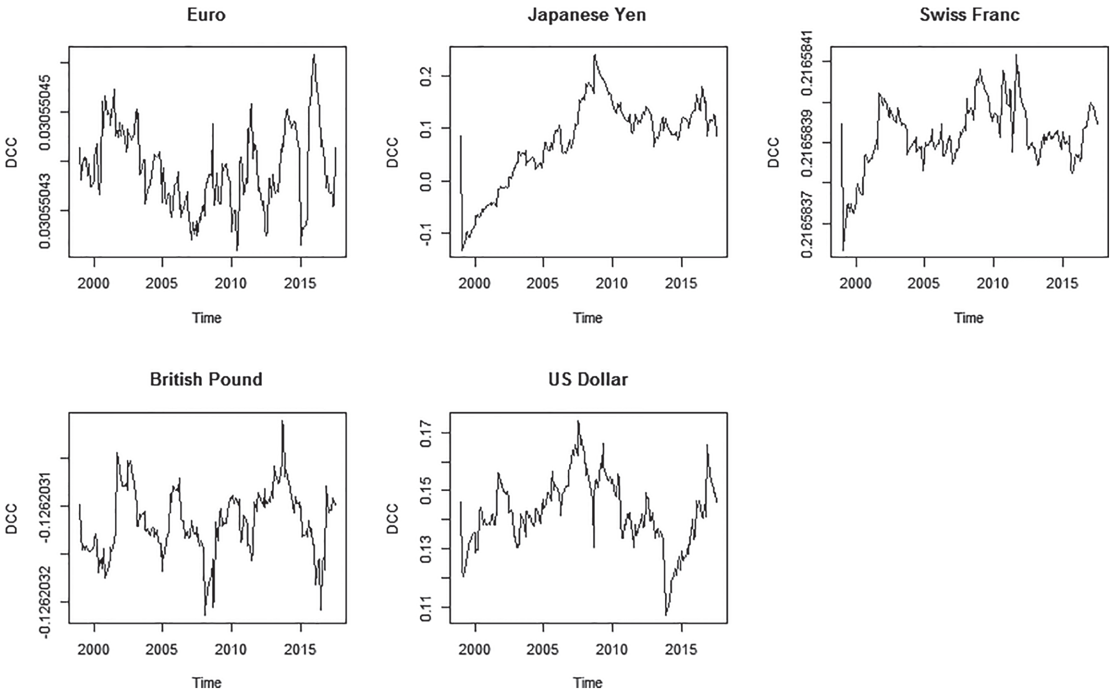


Figure 2:



turbulent times, such as the recent European severing crisis.

This study has analyzed one aspect of the currency choice for European investors, estimating the dynamic conditional correlations between the EPU indexes and the real effective exchange rates of the five major currencies. We find that the Japanese yen and the US dollar can serve as safe currencies for European investors more effectively and efficiently than the traditional escape, the Swiss franc

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