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Financial crises, exchange rate linkages and uncovered interest parity: Evidence from G7 markets[☆]

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A B S T R A C T

This paper examines the dynamic linkages among major exchange rates during the Global Financial Crisis and Eurozone Sovereign Debt Crisis. We extend the previous literature on volatility spillover linkages among the currencies by taking into account the uncovered interest-rate parity hypothesis for 2004–2015. The results indicate that the Canadian Dollar and Great British Pound were affected mainly by the US Dollar across the two crises due to strong financial and economic ties among the three economies, while the Japanese Yen shows evidence of a safe-haven currency. We also provide evidence of varying vulnerability of currencies to both crises, implying increased portfolio diversification benefits, since holding a portfolio with diverse currencies is less subject to systematic risk. These results show that the policy makers need to adopt a stricter form of monetary policy coordination among central banks, since the different vulnerability of currencies across turbulent periods reveals possible non-cooperative monetary policies.

1. Introduction

The role of monetary policy in stabilising the economy during turmoil periods is crucial. Specifically, in today's liberalised open economies, with increasing capital mobility, the pursuit of greater efficiency in economic policies is harder than ever. In addition to increasing globalisation, two major crises occurred during the last decade, namely, the Global Financial Crisis (GFC) of 2008–2009 and the Eurozone Sovereign Debt Crisis (ESDC), which became evident when several eurozone countries were unable to refinance their government debt from the end of 2009 onwards. As the manipulation of interest rates by central banks exerts a major influence (among other factors) on exchange rates, the investigation of the currencies' behavior during turmoil periods, considering the interest rates, is an important issue. To do so, we include the uncovered interest-rate parity (UIP) condition in the investigation of the dynamic linkages among currencies. This procedure will establish a significant link between the transmission of macroeconomic and monetary policies across turbulent periods.

There is an extensive body of literature that empirically investigates the long-run form of the UIP. For example, Beyaert et al. (2007) find evidence in support of the UIP within a Markov-switching VAR framework, especially in the case of Spain–UK, after the entrance of Spain into the EU. Tang (2011) investigates the existence of UIP on a sample of ASEAN-5 countries within a Fully Modified OLS (FMOLS) framework. Cover and Mallick (2012) provide evidence against the UIP in response to an unexpected monetary policy tightening for the UK. More recently, Bhatti (2014) supports the existence of a long-run version of unrestricted UIP for six countries of the Commonwealth of Independent States (CIS).

There is an equally large body of literature on the volatility spillover linkages among exchange rates. Past studies have either focused on earlier periods (e.g., Nikkinen et al., 2006; Antonakakis, 2012) or used high-frequency data to capture intraday volatility (e.g., Kitamura, 2010) and the effects of political and risk news, including earlier financial crises (Renaldo and Soderlind, 2010). Dimitriou and Kenourgios (2013) investigate the interdependence of USD exchange rates expressed in major currencies during 2004–2011 by focusing on different phases of the GFC and the ESDC. Using a dynamic conditional correlation (DCC) model in a multivariate FIAPARCH-DCC specification, they provide empirical evidence of decreasing exchange rates' correlations during the turmoil periods, suggesting differing vulnerability among currencies. The most stable periods for all currencies are the early phases of the GFC. De Bock and de Carvalho Filho (2015) find

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that currency markets exhibit recurrent patterns during risk-off episodes identified by the VIX, as the Japanese yen (JPY), Swiss franc (CHF), and USD appreciate against other G-10 and emerging market currencies. Dua and Tuteja (2016) test for contagion in stock and currency markets of China, Eurozone, India, Japan, and the US during GFC and ESDC. The results show significant contagion as well as flight to quality effects both across and within asset classes. In addition, the behaviour of Euro (EUR) and JPY exchange rates is markedly different from that of the Yuan and Rupee exchange rates. Finally, the JPY shows evidence of a safe-haven currency across several phases of the two crises.

Motivated by the previous work on the UIP and the linkages among exchange rates, we empirically investigate the time-varying linkages among currencies during turmoil periods for the G7 countries, namely: US, Canada, France, Germany, Italy, Japan, UK, in addition to the European Union, which is also represented within the G7. Given that France, Germany, and Italy share a joint monetary policy since the adoption of the Euro as a common currency, we focus on the following four main currencies: the Canadian dollar (CAD), EUR, JPY, and British pound (GBP), all denominated in USD.

Our study contributes to the existing literature by taking the UIP hypothesis and asymmetries into account in the empirical investigation of the exchange rates' dynamic linkages during the GFC and ESDC. Specifically, our econometric analysis is implemented in two steps. In the first step, we estimate an Error Correction Model (ECM) format of the UIP hypothesis. The UIP is a key international financial relation that is used consistently in the fields of international finance and open-economy macroeconomics for both model construction and empirical work (see, for instance, Lothian and Wu (2011), and Bekaert et al. (2007)). According to the UIP hypothesis, the difference between interest rates in two currencies will equal the rate of change of the exchange rate under the assumptions of capital mobility and perfect capital substitutability among foreign and domestic assets.

However, these two assumptions are strong. We relax them by embedding the UIP condition in the form of an ECM. In this way, although the UIP may not strictly hold at every time point in the sample period, we allow for a dynamic convergence to a steady state, consistent with the UIP, with a convergence speed determined by the data. Moreover, the estimated residuals are conditional on the information that an investor will most likely consider and include not only past observations of exchange rates but also past observations of interest rates. By using a standard hypothesis, such as the UIP, we achieve flexibility and robustness.

In the second step, we try to capture possible asymmetries in the correlation dynamics among currencies by employing an asymmetric dynamic conditional correlation (A-DCC) model based on the standardised residuals of the ECM derived from the first step. The ECM long-run equilibrium is consisted with the UIP hypothesis. Thus, we can investigate the dynamic patterns of correlation changes among each pair of currencies across the GFC and ESDC. Finally, we check the robustness of our central results by applying the generalised method of moments (GMM) procedure.

The results show that CAD, EUR, and GBP currencies are substantially influenced by the USD during the GFC, while the JPY remains less affected. During the ESDC, we find increasing linkages and, thus, a contagion effect for CAD, JPY, and GBP. On the other hand, the decreasing linkages among several pairs of currencies across the two crises suggest a varying vulnerability of the currencies to shocks, with crucial implications for the effectiveness of portfolio diversification and the cooperation of central banks.

The layout of the present paper is as follows. In Section 2 we state the econometric framework, along with the identification of the crises' length. Section 3 presents the dataset and provides a preliminary analysis. The empirical results are presented and discussed in Section 4, while Section 5 reports the concluding remarks.

2. Estimation framework

2.1. The UIP hypothesis adjusted into an ECM - A-DCC process

The model adopted in this study is specified to allow for two-stage estimation of the conditional covariance matrix. Firstly, to disentangle the effects of risk premia and systematic exchange rate forecast errors, we encompass the UIP hypothesis into an Error Correction Model (ECM) format, as follows[1]:

$$\Delta^2 s_{w,t} = c_w - a_w(\Delta s_{w,t-1} - b_w spreadL_{w,t}) + \varepsilon_{w,t},\ w = 1,\ldots, W \quad (1)$$

where c_w is the risk premium for the $w = 1,\ldots W$ exchange rate (w may be CAD, EUR, JPY, or GBP, denominated in USD), which will be positive if investors require an excess return on a currency to compensate for the risk of holding it. Moreover, $spreadL_{w,t} = i_{w,t-1} - i^*_{t-1}$, where $i_{w,t}$ is the return for the w domestic 10-year bond index and i^*_t is the return for the foreign 10-year bond index (i.e., the US). The changes in the logarithmic exchange rates are denoted by Δs_t. Finally, $\varepsilon_{w,t}$ is the exchange-rate forecast error. Under the usual assumptions of rational expectations, exchange-rate forecast errors will be uncorrelated.[2]

In Eq. (1) the standard UIP condition is embedded in an error correction format. The method employed to estimate Eq. (1) is the quasi-maximum likelihood (QML), which generates consistent standard errors robust to non-normality. Subsequently, the residuals obtained from Eq. (1) are exploited to estimate the parameters of the conditional correlations adopting the A-DCC model.[3] This model captures asymmetries better than do other members of GARCH family models, allows for series-specific news impact, permits conditional asymmetries in correlation dynamics, and accounts for heteroscedasticity directly by estimating correlation coefficients using the standardised residuals (see Cappiello et al. (2006), for an extensive analysis of this model's advantages).

We assume that the stochastic process $\{\varepsilon_t\}$, $t = 1,.,T$ is a realisation of a Data Generating Process (DGP), whose conditional variance matrix and conditional distribution are H_t and $p(\varepsilon_t|\Omega_{t-1})$, respectively, where Ω_{t-1} is the information available at the end of period t-1. The conditional covariance time-varying matrix H_t obeys the system of equations

$$H_t = E[\varepsilon_t\varepsilon_t'] = D_t Cor_t D_t \quad (2)$$

where D_t is the $k\ x\ k$ diagonal matrix of time-varying standard deviations, $\sqrt{h_{it}}$ is the ith element on the diagonal, Cor_t is the time-varying conditional correlation matrix, and z_t is a $N\ x\ 1$ random vector with elements the standardised innovations $z_{i,t} = \varepsilon_{i,t}/h^{1/2}_{ii,t}$. The evolution of correlations in the standard DCC model (Engle, 2002) is specified as follows:

$$Q_t = (1 - a - b)\overline{Cor} + a z_{t-1}z'_{t-1} + bQ_{t-1} \quad (3)$$

where $\overline{Cor} = E[z_t z_t']$ and α and b are non-negative scalars, satisfying $a+b < 1$. A drawback of the DCC model (Eq. (3)) is that it does not allow for either asset-specific news or asymmetries. The standard DCC model can be extended to the asymmetric generalised DCC model (AG-DCC), using the following form:

[1] The ECM is a theoretically-driven approach useful for estimating both short-term and long-term effects among currencies and spreads. The 10-year bond index is a metric of the long-term interest rate.

[2] However, from the seminal study of Fisher (1930), it is recognised that there are conditions under which these errors might be systematic over time. One situation in which this may occur is when investors anticipate changes in the underlying process generating the return distribution. A second situation is that of a monetary shock, in the form of a sudden shift in monetary regime.

[3] The A-DCC model was developed by Cappiello et al. (2006), who generalised the DCC-GARCH model of Engle (2002).