Research in International Business and Finance 40 (2017) 217–230

Contents lists available at ScienceDirect

Research in International Business and Finance

journal homepage: www.elsevier.com/locate/ribaf

True or spurious long memory in European non-EMU currencies

Thomas Walther[a,*], Tony Klein[a], Hien Pham Thu[b], Krzysztof Piontek[c]

[a] *Faculty of Business and Economics, Technische Universität Dresden, 01062 Dresden, Germany*
[b] *School of Business and Economics, Humboldt-Universität zu Berlin, 10099 Berlin, Germany*
[c] *Department of Financial Investments and Risk Management, Wrocław University of Economics, 53-345 Wrocław, Poland*

ARTICLE INFO

Article history:
Received 9 January 2017
Accepted 26 January 2017
Available online 16 February 2017

JEL classification:
C22
C51
C53
C58

Keywords:
Conditional variance
Foreign exchange
GARCH
Spurious long memory
Value-at-Risk

ABSTRACT

We examine the Croatian Kuna, the Czech Koruna, the Hungarian Forint, the Polish Złoty, the Romanian Leu, and the Swedish Krona whether their Euro exchange rates volatility exhibits true or spurious long memory. Recent research reveals long memory in foreign exchange rate volatility and we confirm this finding for these currency pairs by examining the long memory behavior of squared residuals by means of the V/S test. However, by using the ICSS approach we also find structural breaks in the unconditional variance. Literature suggests that structural breaks might lead to spurious long memory behavior. In a refined test strategy, we distinguish true from spurious long memory for the six exchange rates. Our findings suggest that Czech Koruna and Hungarian Forint only feature spurious long memory, while the rest of the series have both structural breaks and true long memory. Lastly, we demonstrate how to extend existing models to jointly model both properties yielding superior fit and better Value-at-Risk forecasts. The results of our work help to avoid misspecification and provide a better understanding of the properties of the foreign exchange rate volatility.

1. Introduction

Since the collapse of Bretton Woods in 1973, currencies of most economies are floating exchange rates which create the need for currency risk management for cross country transactions. In recent research the main impact factors such as interest rate, inflation, or the trade level of the country have been widely investigated (i.a. Anderson et al., 2003; Taylor and Taylor, 2004; Engel and West, 2005). This study concentrates on volatility-driven foreign exchange forecasts since volatility is a crucial component indicating the stability of a currency and related trade volume (Yang and Gu, 2016). Further, exchange rate volatility has a vital impact on risk management strategies for investors with trades affected to foreign currencies.

The property of long memory of a financial time series refers to long lasting, i.e. slowly decaying, autocorrelation effects in conditional returns or volatility (Baillie, 1996). In time discrete modeling, this effect can be depicted by fractional differencing (Hosking, 1981). Many types of financial time series are reported to attribute long memory in their variance; e.g. individual stocks, stock indices, commodities, and foreign exchange rates (i.a. Baillie et al., 1996; Bollerslev and Mikkelsen, 1996; Chkili et al., 2014).

* Corresponding author.
E-mail address: thomas.walther@tu-dresden.de (T. Walther).

http://dx.doi.org/10.1016/j.ribaf.2017.01.003
0275-5319/

However, it is proven that sudden structural changes can falsely imitate the behavior of long memory (Granger and Terasvirta, 1999; Diebold and Inoue, 2001; Granger and Hyung, 2004). Mikosch and Starica (1999) examine the case of switching between two volatility processes and show that it leads to spurious long memory in variance. In fact, several studies separately examine either long memory or structural breaks. Engel and Hamilton (1990) find long swings in the currencies of Germany, France, and U.K. against the U.S. Dollar. This finding is supported by other studies, revealing regime switches or structural breaks in foreign exchange rates (Bollen et al., 2000; Rapach and Strauss, 2008). Focusing on long memory, various authors suggest its existence in the returns or the volatility of exchange rates (Cheung, 1993; Bollerslev and Mikkelsen, 1996; Souza et al., 2008). Moreover, some literature copes with spurious long memory in variance (Yalama and Celik, 2013; Charfeddine, 2014, 2016; Shi and Ho, 2015).

In this work, we focus on countries of the European Union which have not implemented the Euro. Some of them are candidates for joining the European Monetary Union (EMU). This approach limits the data period as early as the general introduction of the Euro in 11 countries in 1999. The examined countries are trading within the European Single Market, hence exchange rates play a vital role for importing and exporting non-EMU countries. Additionally, we also address countries that are candidates for implementation and examine the impact of EU convergence criteria on the properties of exchange rates. Up to now, literature analyzing volatility of Central and Eastern European foreign exchange rates is scarce. Its importance for the individual countries, investors seeking for diversification, and firms—importing and exporting—seems to be neglected, albeit the fact that EUR, USD, JPY, and GBP are much more liquid and do have different characteristics. Murinde and Poshakwale (2001) examine the volatility of Eastern and Central European currencies by means of various volatility models. Kočenda and Valachy (2006) analyze the foreign exchange rates volatility of the Visegard countries. Their findings suggest that changing to a free floating regime increases the volatility compared to a fixed regime. Frömmel (2010) uses a Markov-Regime-Switching volatility model to analyze the currencies of Czech Republic, Hungary, Poland, Romania, and Slovakia. Będowska-Sójka and Kliber (2010) investigate various volatility models and its usage for the Polish Złoty. Horobet et al. (2016) use a Hodrick–Prescott filter to examine volatility for Croatia, Czech Republic, Hungary, Poland, Romania, Russia, Serbia, and Turkey. Klein et al. (2016) show that long memory can be found in the variance of the Polish Złoty against the Euro.

The contribution of this work to existing literature is at least twofold: Firstly, we advance the technique of identifying spurious long memory in variance. Existing tests are only suited to deal with long memory on a return basis. Secondly, we examine the long memory behavior of foreign exchange rates volatility of currencies which are not part of the EMU. Lastly and most importantly, we demonstrate how to jointly model long memory and structural breaks in conditional variance and show its applicability in a Value-at-Risk prediction analysis.

The remainder is structured as follows: Section 2 introduces the conditional volatility models. In Section 3 the data is described and test results for structural breaks, long memory, and spurious long memory are presented. Section 4 analyzes the results of the parameter estimation and Value-at-Risk forecasts of the conditional variance models. Section 5 concludes.

2. Methodology

Throughout this paper and especially for the models defined in the subsequent sections, we set for all $t = 1, \ldots, T$:

$$\begin{aligned} y_t &= \mu_t + \varepsilon_t, \\ \varepsilon_t &= z_t \sqrt{h_t} \quad \text{with}\, z_t \sim \mathrm{t}_\nu(0,1)\,\text{i.i.d.}, \\ \mu_t &= \mathbb{E}[y_t | \mathcal{F}_{t-1}], \\ h_t &= \mathbb{V}[y_t | \mathcal{F}_{t-1}], \end{aligned} \tag{1}$$

where μ_t denotes the conditional mean structure modeled by an Autoregressive Integrated Moving Average (ARIMA) model of the return series $\{y_t\}_{t=0}^{T}$, h_t denotes the conditional variance at time t, and $\mathcal{F}_{t-1}$ refers to the sigma-algebra generated by the past of the time series up to time $t-1$. The random variable z_t stems from a centered and standardized Student's t-distribution with ν degrees-of-freedom as in Bollerslev (1987).

For the following models, the definition given in (1) holds while we further specify the conditional variance structure. We introduce volatility models to capture the effect of long memory and structural breaks separately and then jointly. As we only present three alternative long memory models with variance shift, it should be noted that several other models exist (Ben Nasr et al., 2010; Klç, 2011; Belkhouja, 2011; Shi and Ho, 2015).[1]

[1] For reasons of robustness, we also test a Markov-Regime-Switching variant of FIGARCH. The results remain the same and are available upon request.