



European exchange rate volatility dynamics: an empirical investigation

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Abstract

The hourly and daily dummy variables in the conditional variance functions of the two European currencies, the British pound and the euro are estimated. The conditional variance functions are specified as GARCH models to capture the time-dependent conditional heteroskedasticity at both the hourly and daily recorded data. The estimated dummy variables give remarkably similar and distinct characteristics of the volatility dynamics embodied in the two currencies. Some discussion of the possible sources of the observed volatility dynamics in the two currencies is provided. A comparison between GARCH, FIGARCH and SV models is also provided. The estimated hourly and daily dummy variables suggests that euro is considerably more volatile when compared to British pound, a result with important implications for the economic policy making in the two regions.

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1. Introduction

As the debate intensifies on Britain's joining Europe's new single currency, the task of economists is manifold. A rational evaluation of the gains and losses to be made following the decision to join has to be produced. An economic perspective to the problem could definitely lead to a better resolution than relying on cultural or sentimental perspectives. Within this economic perspective lies many dimensions which

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need to be addressed and one such dimension is the volatility of the British pound and the euro. Volatility is definitely an important financial phenomenon which needs to be addressed. Questions such as: which of the two currencies is more volatile, do the currencies follow the same intra- and inter-daily volatility patterns, does the volatility in the two currencies depict the underlying volatility in their economic fundamentals, etc., need to be answered. Answers to these questions are important in determining the relative trade and financial position of a country.

The foreign exchange market is the world's biggest financial market; in operation 24 h a day, 7 days a week, it is the closest analogue to the concept of a continuous time global market place. This particular study will specifically focus on just one aspect of trading in the foreign exchange market, i.e. the volatility of exchange rates and that too the focus would be on just two currencies: the euro and the British pound (BP). An enormous amount of research on the volatility of exchange rates has been done in the past decade or so. However, research along this dimension, i.e. exclusively providing an insight into the BP and euro argument is still pending. Considering the importance of this issue, some research on the volatility of BP and euro is conducted making use of the high frequency data. After identifying the hourly volatility patterns embodied in the two currencies the research is subsequently extended to a daily basis. The objective is to get a thorough analysis of the two currencies from a volatility dimension within the economic perspective.

Even though there is widespread agreement among the researchers that exchange rates are well described as martingales, the returns are not independently distributed over time because of 'volatility clustering'. It was this observation by [Mandelbrot \(1963\)](#) and [Fama \(1965\)](#) that periods of large absolute changes tend to cluster together, followed by periods of relatively small absolute changes that generated a huge amount of research on the volatility of financial market returns. The main econometric tool used in the paper is the well-known Generalised Autoregressive Conditional Heteroskedasticity (GARCH) model ([Bollerslev, 1986](#)) together with some of its recently developed extensions. The basic insight behind GARCH is that the second moment of the distribution of exchange rates is serially correlated. The rigorous treatment of the exchange rates using the fascinating tools of GARCH modelling would certainly make this research a valuable addition to the existing literature on the volatility of exchange rates and hopefully would pave the way for analysing Europe's new currency along this dimension. A comparison between GARCH and some of its recently developed versions and an alternative modelling technique is also provided using both the high and low frequency data, an exercise often found to be missing in the literature when comparing the superiority of different variance specifications.

The paper is organized as follows. Section 2 discusses the data and some preliminary testing. Section 3 estimates the hourly and daily volatility patterns embodied in the two currencies, i.e. the hourly and daily dummy variables in the conditional variance formulation of the two currencies and reviews some of the reasons documented in the literature on the observed volatility dynamics of exchange rates; their applicability to the volatility dynamics exhibited by euro and BP is also examined. Section 4 compares the GARCH with some of its recently developed extensions and an alternative modelling technique known as the stochastic volatility model. Section 5 concludes.

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