BOOTSTRAP METHOD IN EXCHANGE RATE FORECASTING.

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1. Introduction

The literature contains various models that can be employed when studying exchange rates. One of these consists in considering the exchange rate as the price of an asset, placing emphasis on the role of expectations. This approach, as is the case in other asset markets, explains the expectations of the agents and discounts the set of exogenous monetary and real factors that are expected. However, in the short-term, it is non-expected factors and events that are the main cause of large variations in the exchange rate. Models constructed on the basis of this approach allow us to test the efficiency hypothesis in the foreign exchange markets. This implies that the rate of expected return from speculation in the forward rates is zero; that is to say, the expected value of the future spot rate conditioned by the available information at a given moment is equal to the actual forward rate. The rejection of this efficiency hypothesis leads to an alternative hypothesis which consists in considering the economic agents who intervene in this markets as being risk adverse, and thus these agents demand a premium. This implies the need to measure market risk by way of its volatility, that is to say, to measure the conditional variance of the unforeseeable events.

This paper has a dual objective. First, to detect the existence, or not, of risk premia for the foreign exchange market; secondly, to study the forecasting capacity of the proposed model and to analyse to the future evolution of the exchange rate.

The paper is organised as follows. In Section 2 we present the series being studied and propose the risk premia model using ARCH models to specify the volatility of the market. In Section 3 we propose a bootstrap method to obtain prediction intervals and present various measures over the fit of these predictions.

2. The ARCH-M model

In this Section, we present the set of analysed data and the ARCH-M model that we will use to estimate the risk premia. We have a weekly sample over the period 5 January 1983 to 10 January 1996 of the peseta/dollar (Pta/$USA) and peseta/deutschmark (Pta/DM) exchange spot and forward to one month. The variable we study is the difference between the logarithm of spot rate ($S_t$) (to 1 month) and the logarithm of forward rate ($F_t$) in a moment $t$ (to 1 month):

$$y_t = \ln\left(\frac{S_{t-4}}{F_t}\right)$$

We analyse the empirical regularities of this series for both types of exchange rate and carry out a Box-Jenkins analysis of the identified series, selecting, in both cases, an MA(3) model. Subsequently, we study the residuals and test the possible ARCH effects. In this stage, we find that in both exchange rates a high order ARCH model is required, so that a more parsimonious representation arises corresponding to the GARCH(1,1) model. Therefore, we propose an MA(3)-GARCH(1,1) model and introduce the conditional variance as a possible regressive variable in the mean of the process in order to detect the existence, or otherwise, of risk premium. The ARCH-M model proposed and analysed takes the following form:
\[ y_t = \mu + \delta \sigma_t^2 + \sum_{i=1}^{3} \vartheta_i \xi_{t-i} + \xi_t \]

\[ \xi_t | I_{t-1} \sim F(0, \sigma_t^2) \]

\[ \sigma_t^2 = \omega + \alpha \xi_{t-1}^2 + \beta \sigma_{t-1}^2 \]

where F is a distribution whose mean is zero and the variance is \( \sigma_t^2 \). The model is estimated under the hypothesis of normal and t-Student conditional distribution whose degree of freedom is considered as another parameter to estimate in the models. The results show that there is no risk premium for the exchange rates considered.

3. Bootstrap forecast intervals

In this Section we propose a bootstrap method in order to obtain forecast intervals in ARCH models. The method is designed to mimic the distribution of the forward values, conditional on all previous values of the series. We will only resample ahead conditional on the estimates of the model parameters, since the ARCH models are ‘ad hoc’ methods for measuring shifts in the variance over time.

The bootstrap consists of constructing the empirical distribution of the estimated standardized residuals. We resample from this distribution in order to obtain the forward errors and calculate the forward values of the series from T to T+s (where T is the sample size and s is the horizon of prediction). The problem lies in constructing the conditional mean and conditional variance, that is to say, we need to replicate both equations of the model. If we obtain B forward values of the series, then we will approximate the bootstrap conditional distribution of \( y_{T+s} \). This will be a good approximation of the real conditional distribution we are seeking to estimate. We calculate the forecast intervals, taking the adequate quantiles of the empirical distribution obtained with B resamples. One advantage of the method is that it does not need to demand any assumption from the error conditional distribution. Moreover, the forecast intervals are obtained more easily than in the standard parametric techniques and the empirical results are similar when the parametric assumptions are verified.

References


