Exchange rate expectations play an important role in economy of state or companies. The uncertainty in the development of exchange rate brings the risk for the future. Value at risk (VaR) is one of the most common methods used in risk measurement of exchange rate. VaR model is popular tool of risk measurement, and has developed into the standard technique of risk management in financial institutions or firms. The main idea of VaR methods is to define the highest loss over a certain period of time at a given confidence level in exchange rates. To calculate VaR, authors often combine different calculation methods to increase accuracy.

There are several methods to measure VaR for foreign exchange risk. The existing basic approach/hes for estimating VaR can be classified into three main approaches. First, tha parametric models approach assumes that returns have a normal or Gaussian distribution. Second, the non-parametric approaches that employs the empirical distribution of returns from the historical sample. Finally, the semi-parametric approach utilizes both the flexible modeling framework of parametric approaches and benefits of non-parametric approaches (Omari, Mwita, & G. Waititu, 2017) applying Extreme Value Theory and GARCH models.

The basic is parametric VaR models. The parametric VaR models use dispersion parameters and mean portfolio distribution values. According to Kuester et al. (2006), models use normal student or slanted student distributions - unable to model heavy tails. Karim, Jaffar, (2019) recommend to implement parametric approach in Value at Risk (VaR) and geometric Brownian motion model (GBM). They compared the VaR using actual historical data and the VaR that integrates Geometric Brownian Motion Model. They conclude that the VaR with historical data decreases while the VaR with GBM increases within the holding period (1 day, 5 days, 20 days, 40 days, 60 days). Using the parametric approach, the method successfully calculates the VaR of the exchange rate for different levels of confidence, but with high accuracy only for a short period of one month. Saidane (2017) highlight that VaR is the assumption of a normal probability distribution in modeling currency exchange rate changes. If the empirical probability distribution is oblique, this may lead to an overstatement or understatement of VaR and therefore proposes a new approach to VaR estimation that combines a standard latent factor model with a generalized quadratic autoregressive conditionally heteroskedastic model. If we want to include systemic risk using conditions and solve the problem with homoskedasticity Martins-Filho et al (2016) recommend applying conditional VaR (CoVaR).

The traditional nonparametric way to measure VaR for foreign exchange risk is to take the appropriate per-centile of a historical return distribution (Gregoriou, 2009). Akhtekhane and Mohammadi (2012) highlight the main advantage of the historical simulation is that historical value at risk does not have to make an assumption about the parametric form of the distribution of the risk factor returns. Historical simulations require a long time series and are unable to adapt to heteroscedasticity. Historical simulation assumes that the development is still the same model and is somewhat cyclical. It is suitable in the short term. This model does not require any assumption on the underlying probability distribution of yields, as past historical observations are used (Kresta et al., 2017).

The next approach to measure VaR is Extreme value theory. Extreme value theory is approach which to study the tail behaviour of a distribution to estimate the VaR. Gençay and Selçuk (2004) present two approaches to study the extremal events (EVT) for exchange rate. One of them is the direct modeling of the distribution of minimum or maximum realizations. The second is modeling the exceedances of a particular threshold. In calculating the appropriate model in two steps first with an average value using the GARCH model and distribution separately with EVT. They are designed for modeling heavy tails, actually black swans and structural changes. Thus, we are able to model the heteroscedasticity of the time series, but not the nonstationarity.

Chavez-Demoulin et al. (2014) have shown that the nonparametric extension of the classical Peaks-Over-Threshold method from Extreme Value Theory leads to a new method which estimating conditional risk measures applicable to both stationary and non-stationary series. Backtesting results confirm a rather precise and adapted estimation of high-quantile based risk

measures for financial time series. Kadlcakova & Komarek successfully applied (2017) Extreme Value Theory represented by GARCH model analyze the transmission of both standard crisis and bubble formation events in the examined currency markets in Central Europe.

In recent years, new GARCH models with different distribution assumptions have been developed. We have GARCH family models with different distribution assumptions. Katsiampa (2017) used various GARCH models (GARCH, EGARCH,TGARCH, APARCH, CGARCH, ACGARCH to determine cryptocurrency volatility, and CGARCH (Component GARCH) was found to be the best.

Saidane (2017) says that the assumption of a normal probability distribution in currency exchange modeling is one of the biggest imperfections in estimation (VaR). Therefore, he proposes a new approach to VaR estimation that combines a standard latent factor model with a generalized quadratic autoregressive conditional heteroscedastic (GQARCH) model with Monte-Carlo simulation. Conversely, Lonnberg, (2016) uses an iterative approach to VaR to predict VaR using extensive Monte Carlo simulations based on the asymmetric GARCH model.

Pilbeam, K., & Langeland, K. N. (2015) on the daily prices four currency pairs the euro, pound, swiss franc and yen against the dollar confirm that GARCH models perform significantly better in periods characterised by low volatility than during periods of high volatility. On the other hand, Jammazi, and Nguyen (2017) suggested to use wavelet-based extreme value theory models provide an effective and powerful tool for gauging extreme moments and improving the accuracy of portfolio’s VaR estimates.

Nowadays, the development of methods estimating the exchange rate behavior and VaR continues. Hahmiri (2017) recommended for predicting historical volatility of currency exchange effective approach rate based on [artificial neural networks](https://www.sciencedirect.com/topics/mathematics/artificial-neural-network) (ANN) than GARCH models.

Individual VaR methods are tested and compared with each other - backtesting. The reliability of the methods is compared at different levels of significance α (1,5..) and at different time horizons (daily,mouthly, yearly.)

Wang et al. (2010) examined VaR of exchange rate for Chinese Yuan using EVT and historical simulation. They found in back testing that that EVT-based VaR values underestimate the risks of exchange rates which may be caused by the continuous appreciation of Chinese Yuan.

Rufino and Guia (2011) compared Extreme VaR (EVT), the Gaussian VaR and Historical VaR for the exchnage rate of 9 countries. They conclude than extreme VaR dominate most of the exchange rate markets beating Gaussian and Historical estimates only at α = 1%.

Batten, Kinateder and Wagner (2014) used for exchange rates multifractal model (MMAR) with forecasts based on historical simulation and VaR model based on GARCH. The study found that historical simulation and GARCH produce better VaR results for the daily horizon, for 12-h. horizont is better multifractal model.

De Jesus, Ortiz, and Cabello (2013) compared historical simulation model with EVT models, in their attempt to capture VaR for exchange rates characterized by heavy or fat tails for mounth or semester. They conclude than EVT is a more precise and conservative approach estimation than conventional VaR. Historical simulation model is not good for estimating potential losses for the short position but is good for long position. Using EVT are the more precise for higher confidence levels than the two traditional models, particularly for 99.9% confidence levels. In another relevant study, Koliai (2016) ssociate the EVT with the R-vine model to carry out financial stress tests

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