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FOREIGN CURRENCY LOAN CONVERSIONS AND CURRENCY MISMATCHES IN ROMANIA

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Abstract: *This study investigates whether different specifications of univariate GARCH models can usefully forecast volatility on the foreign exchange market. The study uses only forecasts from an asymmetric GARCH model, namely Exponential GARCH (EGARCH) for CHF/RON exchange-rate pair for the period January 2010 to February 2020. The dataset is obtained from "Investing.com" and covers the daily closing prices for the CHF/RON across the mentioned period. The data encompasses the period when hundreds of thousands of holders of Swiss franc mortgages across Romania suddenly found themselves facing higher loan repayments of up to 20 per cent when the Swiss National Bank (SNB) scrapped its policy of the minimum exchange-rate of 1.2 Swiss francs against the Euro on January 15, 2015. To reduce the burden of more currency fluctuations, Romania looked at the Hungarian experience of converting Swiss franc mortgage loans to domestic or euro denominated loans. This process will be known as loan conversion program. In this program, households had the option to choose whether they will be willing to convert their Swiss franc denominated mortgage loans to domestic currency loans or to maintain their mortgage loans in Swiss francs. Undoing CHF-denominated mortgage loans has several consequences for macroprudential and macroeconomic policy. However, a significant benefit of loan conversion for the financial system is the diminution of the exposure of the banks across Romania to systemic exchange-rate risks to their balance sheet through domestic currency depreciation. The European Central Bank (ECB) warned on several occasions that foreign currency loans represent a major risk to financial stability. This paper reaches the conclusion that the EGARCH model could be used to predict volatility of the currencies in the future.*

JEL Classification: O16, G1, G17
Key words: EGARCH, modelling and forecasting, volatility, exchange-rates, CHF/RON

1. INTRODUCTION AND OBJECTIVES

Hundreds of thousands of holders of Swiss franc mortgages across Romania suddenly found themselves facing higher loan repayments of up to 20 per cent when the Swiss National Bank (SNB) scrapped its policy of the minimum exchange-rate of 1.2 Swiss francs against the Euro on January 15, 2015. The significant increase of the Swiss franc supplemented the number of non-performing loans and rose the credit risk of bank balance sheets. To reduce the burden of more currency fluctuations, Romania looked at the Hungarian experience of converting Swiss franc mortgage loans to domestic or euro denominated loans. This process will be known as loan conversion program. In this program, households had the option to choose whether they will be willing to convert their Swiss franc denominated mortgage loans to domestic currency loans or to maintain their mortgage loans in Swiss francs (Fischer, 2019).

Undoing CHF-denominated mortgage loans has several consequences for macroprudential and macroeconomic policy. However, a significant benefit of loan conversion for the financial system is the diminution of the exposure of the banks across Romania to systemic exchange-rate risks to their balance sheet through domestic currency depreciation. The European Central Bank (ECB) warned on several occasions that foreign currency loans represent a major risk to financial stability. Reinhart et al. (2014) and Ranciere et al. (2010) emphasize that currency mismatch has been a key factor leading to crisis in emerging economies. East Asia in 1997, Mexico in 1994 and CEE in 2008 could exemplify such crisis. In other words, a large difference between the foreign currency denominated assets and foreign currency denominated liabilities indicate that exchange-rate risk could contribute to systemic risk in the banking sector. Unless borrowers of foreign currency denominated loans are able to hedge their exposure to exchange-rate risk, a great share of borrowers of foreign currency denominated loans will be unable to fulfil their financial obligations and will default after a large increase in the value of foreign currency against the

national currency. A massive increase in the number of non-performing loans could significantly influence the capital base of the banking sector and have serious implications for the economy (Fischer, 2019).

Holding a small share in the GDP of Romania (1.4 per cent) and a small share in the total loans given by the Romanian banks (4.7 per cent), CHF denominated loans do not pose systemic risk. However, a vital feature of CHF denominated loans that must be noticed is that they were primarily extended to households. The number of individuals having taken CHF-denominated loans accounts for only 2.1 per cent of the total number of individual borrowers while the share of these loans amounts to almost 10 per cent of the total volume of loans to households. Even though the share of the Romanian population who had CHF denominated loans did not seem alarmingly high, the impact of SNB's announcement to scrap the 1.2 EUR/CHF floor was devastating as the appreciation of CHF against the RON led to a massive increase in the debt service for CHF borrowers. Thus, borrowers' repayment capabilities became close to impossible. Due to the enormous pressure laid down by the Romanian population, the government felt compelled to intervene. Hence, the Ministry of Public Finance has come up with proposals to urgently modify the legal framework in order to assist with the rescheduling of loans. More specifically, the Government Emergency Ordonnance No. 46/2014 provides support to creditors and borrowers in order to ease the burden related to the unfavourable developments in the CHF exchange-rate (National Bank of Romania, 2015).

Volatility represents the process of describing the behaviour of securities or markets during phases of uncertainty and massive price fluctuations. The crucial advantages or benefits of measuring volatility within the financial markets has been studied by a substantial number of researchers (Tache and Darie, 2019a and b).

According to Emmer et al. (2013), the extensively used methodology to identify the risk of an investment is the standard deviation even though its limitations regarding the risk measurement are well known. More specifically, the absence of suitable weightings ascribed to the errors during a mentioned time interval represents one of the major drawbacks when using this methodology. As a result, the errors weightings recorded closer the present time would present the same significance as the errors weightings arising in the future. Furthermore, in 2008, Calvet and Fisher emphasized that the standard deviation used to investigate the risk of investments would offer little response on skewed data. In order to

identify the skewness within the datasets, the authors firstly singled out the outliers from the datasets as they crucially influence the mean (Tache and Darie, 2019a and b).

Most financial classical theories are built under the assumption of constant volatility regardless of the time horizon. Hence, any alteration ascribed to the volatility estimation over a mentioned time span is being regarded as white noise. In particular, traditional methodologies presume that the variance of errors does not modify regardless of the time interval at which they are determined. This course of action describes the homoskedasticity process. In contrast, Engle (2012) highlighted that the variance of errors does modify according to the time interval at which it is determined in most of the financial markets. This course of action describes the heteroskedasticity process (Tache and Darie, 2019a and b).

Since most of the financial markets highlight that variance of errors does modify according to the time interval at which it is determined, the development of the GARCH methodologies were introduced to account for this complication (Darie and Tache, 2022). Therefore, this research paper investigates the swings in the CHF/RON exchange-rate volatility during January 2010 - February 2020. This time interval was selected to monitor the Swiss franc after the SNB (Swiss National Bank) decided to drop its minimum exchange rate policy of 1.2 CHF for 1 Euro. Furthermore, this research paper examines the serious implications of the loan conversion program on the Swiss franc against Romanian Leu exchange-rate pair. Also, the asymmetric EGARCH methodology was selected to perform the analysis of data.

2. METHODOLOGY AND DATA

Within this section, the essence of the GARCH methodologies is examined by focusing on the statistical and financial characteristics. A proportion of the GARCH structure is represented by the volatility clustering and leverage effect by adding the conditional equation to the linear equation. As previously mentioned, this section focuses on only the asymmetric EGARCH methodology which attempts to determine the features of volatility. Furthermore, the maximum likelihood methodology will be used to compute the best estimates for the EGARCH model while highlighting the choice of data and the stability of the approach (Tache and Darie, 2019a and b).

The asymmetric EGARCH methodology highlights two significant advantages as compared to the symmetric GARCH methodology: 1) the ability to use log returns in order to secure a value for the conditional variance greater than 0 regardless of the parameters being negative and 2) the ability to capture the leverage effect by allowing for asymmetries. Basically, the asymmetric EGARCH methodology would reveal that negative news/shocks have a greater impact on volatility than positive news/shocks while a symmetric GARCH would reveal that both negative and positive news/shocks produce an identical response. The mathematical formula that describes best the asymmetric EGARCH for this research paper is the one of Alexander (2001) which is presented below in more detail (Tache and Darie, 2019a and b).

The asymmetric EGARCH equation used within this study is displayed below:

$$\ln(\sigma_t^2) = \omega + g(z_{t-1}) + \beta \ln \sigma_{t-1}^2$$

$$g(z_t) = \theta z_t + \gamma \left(|z_t| - \sqrt{\frac{2}{\pi}} \right)$$

$$z_t = \frac{u_t}{\sigma_t}$$

where σ_t represents the conditional variance as an asymmetric function of lagged disturbances; u_{t-1}, $g(z_t)$ is a linear asymmetric response function in z_t with slope coefficient $\theta+1$ in case z_t is positive while $g(z_t)$ is linear with $z_t$with slope coefficient θ-1 in case z_t is negative. As a result, large innovations increase the conditional variance in case $|z_t| - E|z_t| > 0$ and decrease the conditional variance in case $|z_t| - E|z_t| < 0$ only while $\theta = 0$. On the other hand, the innovation in variance $g(z_t)$ is positive in case the innovations z_t are less than $\frac{(\frac{2}{\pi})^{1/2}}{\theta-1}$. Thus, the negative returns u_t cause the innovation to the conditional variance to be positive in case θ is much less than 1 (Tache and Darie, 2019a).

As identified by Tache and Darie (2019a and b), the GARCH methodologies repeatedly use daily or intradaily datasets in order to spot the effects of volatility clustering as they cease to be significantly visible over a long-time horizon. Also, the maximum likelihood methodology estimates the asymmetric EGARCH parameters using the mean and variance

that change according to the time period. The formula used to maximize the asymmetric EGARCH parameters is shown below:

$$\ln L(\theta) = -\frac{1}{2}\sum_{t=1}^{T}(\ln(\sigma_t^2) + (\frac{u_t}{\sigma_2})^2)$$

where the parameters of conditional variance equation are represented by θ.

For univariate GARCH methodologies, a small number of convergence issues might arise as changes in the dataset trigger changes in the coefficient estimates. Nonetheless, the estimation of parameters can only be severely influenced by faults in the generation of data. As a result, the estimated parameters should not significantly modify as new observations appear.

In order to avoid this possible problem, approximately 10 years of daily data was collected. More specifically, a total of 2633 daily observation from the time interval January 2010 – February 2020 was gathered to ensure the suitability of the methodology.

3. EMPIRICAL RESULTS AND ANALYSIS

Correlation represents a process that measures the extent to which at least two variables oscillate together. The autocorrelation process describes the correlation between two time series, except that same time series is used twice: once in its original form and once lagged over one or more time periods. Traders or technical analysts assess the value of a security by investigating its past behaviour. More specifically, autocorrelation is used to forecast how well the past prices of a security anticipate its future price. Therefore, the autocorrelation process is very useful for this research paper as it supports the use of the GARCH methodologies. The formula used to identify the autocorrelation in observations is the Q test (also known as Box-Pierce test) which is presented below:

$$Q = n\sum_{k=1}^{h} r_k^2$$

where Q represents the Box-Pierce statistic, n represents the total number of observations, m is the number of parameters and h represents the maximum lag considered.

Normally, the Q test is described as follows:

H_0: Prices do not have any significant historic dependence

H_1: Prices do have significant historic dependence

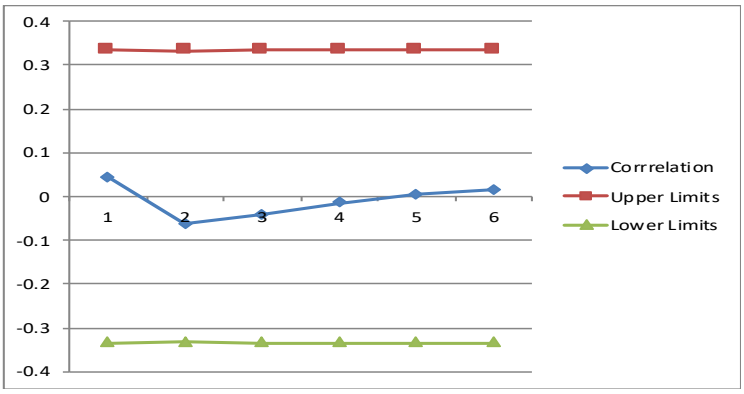

Fig 1. *CHF/RON Autocorrelation for the period January 2010 to February 2020 (elaborated by the author)*

As illustrated above, figure 1 displays that autocorrelation is present in the returns of CHF/RON exchange-rate for the time interval January 2010 – February 2020. Nonetheless, the evidence provided by the Q test confirmed the H_1 hypothesis. Primarily, in order to arrive at this conclusion, the result of the Q test was compared to the value of Chi-squared (Tache and Darie, 2019a and b). The determination of this outcome is shown below:

$$Q = 2633 \sum_{k=1}^{6} r_k^2 = 21.39$$

Upon comparison, it has been shown that the result provided by the Q test (21.39) is greater than the critical value of Chi-square (12.6) for a 95 per cent confidence interval. Therefore, the historic returns do have an impact on the current returns (Tache and Darie, 2019a and b).

In other words, the current value of CHF/RON exchange-rate is influenced by its past value. Therefore, the presence of autocorrelation within the residuals of the mentioned exchange-rate pair might drive the future actions of the traders and investors. More specifically, after considering the results provided by the autocorrelation measure, they could speculate the direction and the trend of the Swiss franc against the Romanian Leu. In this case, the volatility of the CHF/RON significantly increased after the devastating

announcement of the Swiss National Bank (SNB) to eliminate its policy of 1.2 Swiss francs for 1 Euro on January 15, 2015.

The results determined by the asymmetric EGARCH methodology and the maximum likelihood using Excel Solver are presented in Table 1.

Caption for the table Table 1.

CHFRON	EGARCH
Jan 2010 – Feb 2020	
w	**-0.10819**
a	-
b	**0.98983**
a+b	-
q	**0.09116**
g	**-0.01107**
l	**-**
LT Vol	**7.73%**
LogLikelyhoodFunction	**12278.22**

Note: $\ln(\sigma_t^2) = \omega + g(z_{t-1}) + \beta \ln \sigma_{t-1}^2$; $g(z_t) = \theta z_t + \gamma(|z_t| - \sqrt{\frac{2}{\pi}})$ - parameter estimation

As illustrated in Table 1, the variables encompassed in the EGARCH methodology, the maximized value of the LLF (log likelihood function) and long-term volatility for the Swiss franc against the Romanian leu during the time horizon January 2010 – February 2020 was presented. Note that firstly, the estimates provided by the asymmetric EGARCH are compared with the estimated provided by the unconditional volatility. While the unconditional volatility of 11.66 per cent remains constant throughout the period, the asymmetric EGARCH methodology shows a long-term volatility of 7.73 per cent.

The value of the coefficient β exhibits significant persistence over a long-time horizon while ω shows the sensitivity of this approach to the historical dataset. Also, γ represents a key parameter from the equation and its negative value established that

negative news influences the estimates of volatility more than positive news. The Swiss franc remained a stable currency after the removal of the currency cap against the Euro. Similar events can occur although the market did not record high volatility in the recent past. However, the mostly affected countries were the CEE countries such as Hungary, Romania and Poland (Darie and Tache, 2022).

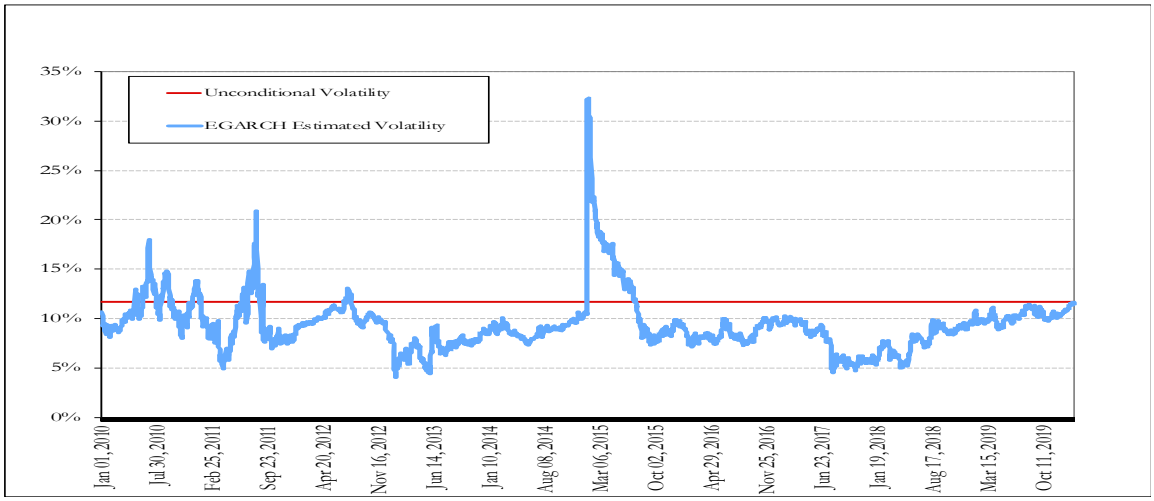

Fig 2. *Comparison between EGARCH Estimated Volatility versus Unconditional Volatility for the CHF/RON exchange-rate from January 2010 to February 2020 (elaborated by the authors)*

As illustrated in Figure 1, the volatility estimates of the asymmetric EGARCH (7.73%) are superior to the volatility estimates of unconditional volatility (11.66%). In other terms, the lower the percentage of volatility, the better. Moreover, Figure 2 displays that between January 2010 and February 2020, significant swings related to the volatility estimates occurred after the removal of the currency cap of the Swiss franc against the Euro. However, the Romanian population started embracing the Swiss franc at the end of 2015 when the OTP bank began offering and endorsing the CHF denominated loans – an exotic currency loan for Romania at that time - as they required the lowest interest rate compared to Lei denominated loans and Euro denominated loans (Ziarul Financiar, 2016). Shortly afterwards, the concept of CHF denominated loans was embraced by other several bank such as Volksbank Bank, Piraeus Bank, Bancpost, Raiffaisen Bank and Banca Romaneasca (Asociatia Pro Consumatori, 2019). The main benefits of the CHF denominated loans at that time was the

fact that these loans required the lowest interest and they were much easier to obtain. Thus, the Romanian population with modest income was eligible for the CHF denominated loans although they did not meet the requirements for the Lei or Euro denominated loans. The Governor of the National Bank of Romania warned the Romanian population that applying for an exotic currency loan may involve a severe currency risk (Curs de Guvernare, 2015).

The average exchange-rate price for the CHF/RON pair between 2006 and 2015 has massively increased by 48 per cent (Ziarul Financiar, 2016). As presented in figure 2, from January 2010 to September 2011, the volatility of the Swiss franc was strongly fluctuating as investor were buying up massive amounts of the Swiss franc which was being considered a safer foreign exchange currency. Therefore, in September 2011, the Swiss National Bank pegged its Swiss franc to Euro as the exporters and service providers found it difficult to make profits. Having the Swiss franc pegged to Euro, discouraged the extensive buying of Swiss francs and stabilized the Swiss economy (CNBC, 2015). Thus, between September 2011 to December 2014, the volatility of the CHF/RON considerably declined to a much lower level without any massive swings. However, in 15th January 2015, the Swiss National Bank scrapped its three-year-old peg of 1.20 Swiss franc to Euro. Figure 2 illustrates the massive rise in the volatility of the CHF/RON as the Swiss stunned the markets with the unexpected announcement. The persistence in volatility lasted until October 2015. Afterwards, the behaviour of the volatility of the CHF/RON continued at approximately the same level during its peg to Euro period. This assumption is enforced by the statement of the Swiss National Bank which concluded that the minimum exchange-rate is no longer necessary as the Euro depreciated significantly against the US dollar and this, in turn, has caused the Swiss franc to decline against the US dollar. Furthermore, a growing number of analysts were expecting the European Central Bank to announce an extensive government bond-buying programme at the next meeting as in December 2014, the eurozone slid into deflation. This event would have devaluated the Swiss franc even more. (CNBC, 2015).

4. CONCLUSION

The Swiss franc amazingly transformed its label from an exotic foreign currency into a safe haven currency. The evolution in the value of the Swiss franc against the Romanian Leu between 2006 to 2020 is astonishing due to the demand created for it since 2006 in several

CEE states such as Poland, Hungary and Romania as the population in these countries borrowed heavily using the Swiss currency denomination. All the CHF denominated assets approximately double its value during the mentioned time period. Unfortunately, around 10 per cent of the Romanian population got seduced by the low interest and the low eligibility requirement to take up a loan. Although the National Bank of Romania advised the population to be cautions when applying for a CHF denominated loan due the currency risk, several households and individuals found themselves struggling honouring their financial payments. Therefore, the Romanian government felt compelled to intervene. Hence, the Ministry of Public Finance has come up with proposals to urgently modify the legal framework (Government Emergency Ordinance No. 46/2014) in order to assist with the rescheduling of loans. More specifically, the Government Emergency Ordonnance No. 46/2014 provides support to creditors and borrowers in order to ease the burden related to the unfavourable developments in the CHF exchange-rate.

According to Darie and Tache (2022), the EGARCH model provides the best univariate forecasting GARCH model when forecasting exchange-rate volatility. The estimations for the CHF/RON exchange-rate pair obtained from the EGARCH model for the period January 2010 to February 2020 show a pattern that matches the news or events that influence or affect the two currencies. Hence, this paper reaches the conclusion that the EGARCH model could be used to predict volatility of the currencies in the future.

CONFLICTS OF INTEREST AND PLAGIARISM: The authors declare no conflict of interest and plagiarism.

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