INSURANCE MARKET VOLATILITY: CASE OF SEBIA[*]

Jelena Minović[1], Ivana Simeunović[2], Aleksandar Zdravković□

Abstract

This paper presents empirical analysis of volatility for insurance sector in Serbia. Generally speaking, the Serbian insurance sector is very small, undeveloped and also in the state of transition, regarding period observed in analysis (from 200□to 2009). In this analysis we applied univariate GARCH models on daily data for two stocks listed at the Belgrade Stock Exchange (www.belex.rs), Dunav Insurance Company (D□OS), and Globos Insurance Company (GLOS). □e examine volatilities of these insurance companies stocks over time. However, we found that volatility of insurance companies stocks in Serbia is infinite. In general, results of our analysis confirm that Serbia is a country with relatively low per capita income and very high volatility (risk), especially in insurance sector.

Key words: *insurance, volatility, conditional standard deviation, GARCH model.*

1. Introduction

The Serbian insurance sector is small, a fact evident from regional as well as a global comparison, and highlighted by the movement of larger firms from neighbouring countries (Croatia, Slovenia) in the Serbian market. The Serbian insurance sector is likely to remain small for the short to medium term. While many insurance companies are highlighting their ventures into emerging markets such as those in Central and Eastern Europe, these ventures are generally on a small scale, and it is the view of some that Eastern European insurance markets are not likely to experience substantial growth in the short to medium term [14].

Given the underdevelopment of insurance in Serbia, a country with relatively low per capita incomes, it is unsurprising to find the dominance of non-life segment lines, and in particular motor insurance, and compulsory insurances, such as general and Compulsory Third Party Motor Liability (CTPML) business in particular [14]. The National Bank of Serbia (NBS) is concerned at recent global financial events, and noted recently that: “Insurance companies in Serbia must be prepared to respond to the arising challenges, given the cohesive nature of the world economy and possibility of the spillover of effects in terms of rise in the price of capital, fluctuations in exchange rates of major currencies and poor performance in the securities market”. In early 2007 the life segment and the new Voluntary Pension Funds in particular, was the focus of a lot of media comment and excitement. Unlike the non-life segment, and the insurance sector as a whole, the life segment is dominated by foreign owned insurers. DDOR Novi Sad and Dunav Insurance Company, the state owned group that is the largest insurer overall, account for less than 20% of life premiums. The life segment remains tiny. The net asset value of the Voluntary Pension Funds is still less than US $20 mn. Seven companies have been granted licences to manage the new Voluntary Pension Funds [14]. Over the long term, the insurance sector should be a significant beneficiary of Serbia’s ultimate membership of the World Trade Organization (WTO) and the EU [14].

The development of insurance market itself enables us to conclude that this fact is becoming progressively important, because in today’s high-risk market circumstances, the insurer needs to determine the adequate price to its product, in order to secure financial stability, and at the same time, keep its

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[1] Jelena Minovi , Magister, Assistent, Belgrade Banking Academy, Faculty for Banking, Insurance and Finance

[2] Ivana Simeunovi , Magister, Assistent, Belgrade Banking Academy, Faculty for Banking, Insurance and Finance

[3] Aleksandar dravkovi , B.Sc, Junior Researcher, Institute of Economic Sciences

clients' trust. Therefore, it would be impossible talking about contemporary insurance without its established technical organization. This is, at the same time, the premise of modern insurance, and is based on existing and applying statistic and econometrics methods [9].

Statistics is one of the main elements of insurance. It represents the core means which help the insurance organization determine the amount of its obligation towards the client. The level of accuracy of determined obligations depends on the scope and reliability of statistic data, as well as applied methods for their processing. When the risk statistics are created, it is required to observe homogeneity risks (according to their size and nature). The goal of each statistic research is analyzing the possibilities of risk occurrence, its frequency and scope, all in order to maintain the necessary insurance fond [5].

The aim of this paper was to perform volatility modeling of Serbian insurance sector. Again, statistics and econometrics are halpfull for our analysis. For our empirical analysis we used univariate Generalized Autoregressive Conditional Heteroscedastic (GARCH) models, with EViews program. We estimated univariate GARCH models using daily data from the Belgrade stock exchange (www.belex.rs) of daily log returns for two stocks (Dunav Insurance Company, DNOS and Globos Insurance Company, GLOS). The data set covers the period from January 8, 2007. to May 4, 2009. Before we could proceed with volatility modeling, we performed an Autoregressive Moving Average (ARMA) analysis for the log returns of stocks. After testing of residuals for ARCH effects, we specified a volatility model if ARCH effects were statistically significant. When performed a joint estimation of the volatility equations, we gave discussion of results.

The rest of the paper is organized as follows. Section 2 presents stochastic nature of insurance sector. At the beginning of the second section we present data of Dunav and Globos Insurance Companies. The rest of Section 2 presents ARMA analysis of these stocks. Section 3 presents volatility of these insurance stocks. The Section 4 concludes.

2. Stochastic nature in insurance sector

Every insurer, or insurance company, while dealing with everyday business, is faced with a fact that its future financial results will mostly be a consequence of current premium calculation. Business success or its dependence on the scope of determined premium is especially frequent in property insurance, considering rather limited possibilities of return of investment. Due to this fact, it would be needless to emphasize that every insurer who thinks appropriately of its financial stability, needs to pay great attention to both, methods of determining the premium, and creating adequate risk statistic – a ground on which the premium is built. Insurance portfolio stability is expressed in statistic values, probability that insurer's accumulated incomes will be sufficient to cover arranged payments, as well as possible deviations from expected payments. Without direct implementation of these theories, insurance business would be equal to accidental activities, with no real possibility of determining required scope of premium, as well as scope of possible risks [9], [5].

However, we can say that insurance process has stochastic nature. We proceed with empirical analysis of data from insurance sector, in order to demonstrate its stochastic aspects.

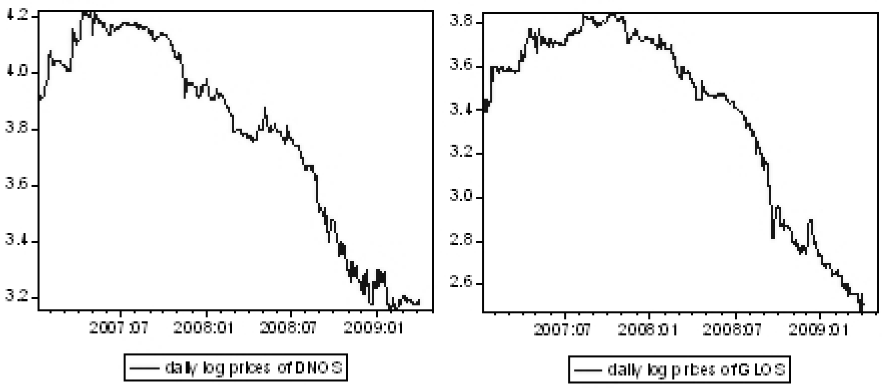
2.1. Data

Although all insurance companies in Serbia are corporations, the most of them is in the dominant ownership of one or two institutional investors (i.e. institutional investors owned more than 90% of equity in 19 from 24 active companies), and their stocks are not in the free float at the Belgrade Stock Exchange. So, we chose the insurance companies in Serbia which stocks are most frequently traded, Dunav and Globos. Our main goal is to analyze volatilities of these stocks. The data set covers the period from January 8, 2007. to May 4, 2009.

Dunav Insurance Company is the biggest and oldest insurance company in our country. It relies upon the 150-year long tradition of Serbian insurance. In spite of all the changes our society has been though during the period of one and a half century, Dunav Insurance Company has managed to remain a secure and strong support to citizens, companies and institutions. Today, this company couples its vast experience with the most up-to-date world trends in the insurance business. Its knowledge and good insight into local market conditions give to Dunav Company the crucial advantage. Its lives and business activities are entirely committed to others. Today, it is a modern company, the leader on the home insurance market and one of few insurance companies registered for all insurance classes. This company possesses a strong business network which, through continual business and information system development, reaches the top standards of the major European insurance companies. The name Dunav, as the symbol of the link between Europe and our country, was established in 1974 [16].

Globos Insurance Company is a Serbia-based company principally engaged in the insurance sector. The company's offer includes property insurance, life insurance, vehicle insurance, health insurance, transport insurance, agricultural products insurance and financial assets insurance, among others. The company has one branch office in Novi Sad and six representative offices in Backa Topola, Sombor, Sremska Mitrovica, Zrenjanin, Kragujevac and Nis. The majority stakeholder of the company is Vojvodjanska banka ad Novi Sad that owns a 83.7% stake in its capital [17].

Figure 2.1 The graphs of daily log prices of Dunav Insurance Company (D□OS) and Globos Insur□ ance Company (GLOS) stocks.



Numerous empirical evidences suggested that the price series (log values) of both stocks of insurance companies are not stationary and are stationary when they are first differenced. Augmented Dickey Fuller Tests reveal that price series of DNOS and GLOS stocks contain a unit root [8]. Therefore, the first difference of the logarithm of DNOS and GLOS prices, the continuously compounded rate of return as calculated below, had applied in the estimation process.

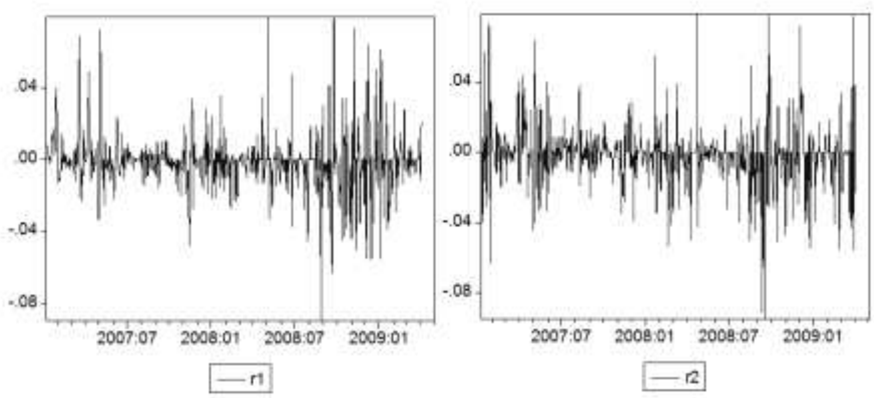
$$\textit{D□OS daily continuous return} \quad r_{1,t} \quad \log \; P_{1,t} / P_{1,t-1}$$

$$\textit{GLOS daily continuous return} \quad r_{2,t} \quad \log \; P_{2,t} / P_{2,t-1}$$

where $r_{1,t}$ and $P_{1,t}$ represent the daily continuous return and daily closing price of DNOS at time t respectively, and $P_{1,t□1}$ is the daily closing price of DNOS at time t - 1. Similarly, $r_{2,t}$ and $P_{2,t}$ represent the daily continuous return and daily closing price of GLOS at time t, and $P_{2,t□1}$ is the daily closing price of GLOS at one period prior [8]. Figure 2.2 presents log returns of these stocks.

We observe from Figure 2.2 that the log returns of DNOS and GLOS stocks evidence the well known the volatility clustering effect. It is tendency for volatility in financial markets to appear in bunches. Thus large returns (of either sign) are expected to follow large returns, and small returns (of either sign) to follow small returns [2].

Figure 2.2.The graphs of daily log returns of Dunav Insurance Company (D□OS, r_1) and Globos Insurance Company (GLOS, r_2) stocks



Our analysis contains specification of a mean equation by testing for serial dependence in the data and building an ARMA model for the log return series to remove any linear dependence. Then, it contains testing for ARCH effects in residuals (Subsection 2.2). The analysis contains specification of a volatility model if ARCH effects are statistically significant and joint estimation of the mean and volatility (GARCH) equations. Finally, it contains diagnostic checking of the fitted models (Section 3) [10].

2.2. ARMA modeling

We perform an Autoregressive Moving Average (ARMA) analysis for the log returns in order to obtain a residual series which is free of serial correlation. We have tested several combination ARMA(p,q). We specify and estimate ARMA models which minimize the information criteria (Akaike, AIC and Schwarz, SIC). Akaike's criterion suggests ARMA(2,2) model, and Schwarz's criterion suggest ARMA(1,1) model for log return of DNOS stock. We know that SIC correctly identifies an ARMA model, whereas AIC tends to overfit the model [1]. Then, according SIC criterion we choose ARMA(1,1) process for log return of DNOS stock. So, we infer that right model for log price of DNOS stock is ARIMA(, ,). Akaike's criterion suggest ARMA(,) model, and Schwarz's criterion suggest ARMA(2,2) model for log return of GLOS stock. Similar as previous, according SIC criterion we choose ARMA(2,2) process for log return of GLOS stock. It can conclude that right model for log price of GLOS stock is ARIMA(2,1,2).

The residuals obtained from ARMA models for both series are not normally distributed according to coefficients of skewness, kurtosis and Jarque-Bera (JB) normality tests. However, even if the distribution of the residuals is not normal, the estimates are still consistent under quasi-maximum likelihood (QML) assumptions [15]. Obviously, the residuals have to be tested for the absence of autocorrelation. With the Ljung-Box (Q) test, we test whether the residuals behave like a white noise process [11]. There are the significant Q-statistics for squared residuals across many lag lengths for DNOS and GLOS stocks and we infer the presence of ARCH effects. On the other hand, the Lagrange multiplier (LM) test shows strong ARCH effects for these stocks with test statistic $F = 4.881$, $p = 0.0002$ for DNOS and $F = 9.292$ with the p-value of which is zero for GLOS.

3. Volatility of Serbian insurance market

Volatility plays an important role in controlling and forecasting risks in various financial operations. For a univariate return series, volatility is often represented in terms of conditional standard deviations. The autoregressive conditional heteroscedasticity (ARCH) model and the generalized ARCH (GARCH) model are useful and important in describing the time-varying variances of economic data in the univariate case [12], [6]. For detail about theoretical and empirical modeling univariate GARCH processes you can see references [6] and [7].

We consider univariate time series models in order to examine volatility of Serbian insurance companies. We estimate the univariate GARCH models with EViews program, Version 4.1 using daily data from Belgrade stock exchange for two daily log returns of stocks (Dunav Insurance Company, DNOS and Globos Insurance Company, GLOS). The data set covers the period from January 8, 2007. to May 4, 2009.

We find that coefficients for ARMA processes for DNOS and GLOS are significant at the 5% level. Then, coefficients for GARCH process for DNOS are highly significant at the 1% level and for GLOS are significant, too at the 5% level. From Equation (3.2) we observe that sum of the ARCH and GARCH parameters close to unity, for example $a_{ii}\quad b_{ii}\quad 1$. This suggests the persistence of ARCH effects in the DNOS datasets and, hence, implies that current information remains important for forecasts of conditional variances at all horizons [13]. This special type of GARCH model is termed as Integrated GARCH (IGARCH). In order to examine IGARCH process, we apply Wald test. The first, we formulate the null hypothesis: the sum of the ARCH and GARCH coefficients is very close to one. According to results of Wald test (F = 1.009, p = 0.316; p > 5%) the null hypothesis is not rejected. Hence, we can conclude that log returns of DNOS follows IGARCH process.

A joint estimation of the ARMA(1,1)-IGARCH(1,1) model for DNOS gives

$$r_t \quad \underset{0.0007}{-0.0027} \quad \underset{0.0028}{0.9842}\, r_{t-1} \underset{0.0099}{-1.0103} \quad {}_{t-1} \quad {}_t\,, \tag{3.1}$$

$$ {}^2_t \quad \underset{2.29\,10^{-6}}{6.17\;10^{-6}} \quad \underset{0.0657}{0.2334} \quad {}^2_{t-1} \quad \underset{0.0444}{0.8032} \quad {}^2_{t-1}. \tag{3.2}$$

A joint estimation of the ARMA(2,2)-IGARCH(1,1) model for GLOS gives

$$r_t \quad \underset{0.0006}{-0.0010} \underset{0.1184}{-1.2301}\, r_{t-1} \underset{0.1254}{-0.3350}\, r_{t-2} \quad \underset{0.1143}{1.1632} \quad {}_{t-1} \quad \underset{0.1292}{0.2972} \quad {}_{t-2} \quad {}_t\,, \tag{3.3}$$

$$ {}^2_t \quad \underset{8.73\,10^{-6}}{1.78\;10^{-5}} \quad \underset{0.0402}{0.1260} \quad {}^2_{t-1} \quad \underset{0.0558}{0.8307} \quad {}^2_{t-1}. \tag{3.4}$$

It is interesting to note empirical regularity in Equations (3.2) and (3.4) that the estimates of ARCH terms are small and positive, with the estimates of GARCH terms much larger. Again, in equation (3.4) we see that the sum of the ARCH and GARCH coefficients is between 0.9 and 1, for GLOS stock. These parameter values imply that the time-varying volatility is highly persistent [3]. According to results of Wald test (F = 1.872, p = 0.172; p > 5%) the null hypothesis about the sum of the ARCH and GARCH coefficients close to unity is not rejected. Hence, we can conclude that log returns of GLOS follows IGARCH process. We know that if residuals follows an IGARCH process, then the its unconditional variance is infinite, so neither residuals nor squared of residuals satisfies the definition of a covariance-stationary process [4].

Thus, DNOS stock follows ARMA(1,1)-IGARCH(1,1) model, and GLOS stock follow ARMA(2,2)-IGARCH(1,1) model. The fitted models can be checked by using the standardized residual and its squared process. The Ljung-Box statistics (Table 3.4) of standardized residuals and those of its squared show that models are adequate for describing the heteroscedasticity of the data.

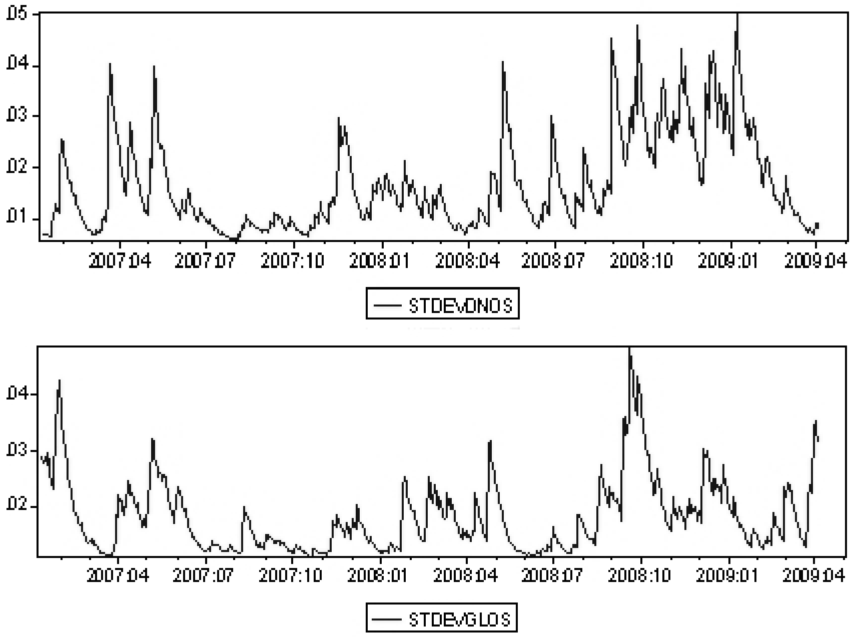
We apply the ARCH test on the standardized residuals to see if there are any ARCH effects left. Both the F-statistic and the LM-statistic are very insignificant, suggesting no ARCH effect up to order 5 or 10 for both series DNOS and GLOS stocks (see Table 3.4).

Table 3.4. The Ljung-Box statistics and ARCH-LM test of order 5 and 10.

	The Ljung-Box Statistics		**ARCH-LM(5) test**		**ARCH-LM(10) test**	
series	**Q(36)**	**Q^2(36)**	**F-stat**	**Obs*R^2**	**F-stat**	**Obs*R^2**
DNOS	37.648 (0.306)	33.990 (0.468)	0.3278 (0.8963)	1.6513 (0.8950)	0.4831 (0.9013)	4.8838 (0.8988)
GLOS	27.111 (0.713)	21.971 (0.908)	0.1880 (0.9671)	0.9482 (0.9666)	0.599198 (0.8150)	6.044808 (0.8115)

On Figure 3.1 we plot the conditional standard deviations for DNOS and GLOS stocks.

Figure □1. The conditional standard deviations for D□OS (termed as STDEVD□OS) and GLOS (termed as STDEVGLOS) stocks, respectively



In addition to visual inspection Figure 3.1 tell us conditional standard deviations series exhibit significant changes over time for both stocks. Therefore, these volatilities are very unstable over time.

Conclusion

This paper presents empirical analysis of volatility in Serbian insurance market. For empirical analysis we had to perform univariate GARCH analysis using daily data listed at the Belgrade stock exchange of daily log returns for (Dunav Insurance Company, DNOS), and (Globos Insurance Company, GLOS) stocks. It has been observed that conditional standard deviations exhibit significant changes over time for both stocks. Especially, volatilities of Dunav and Globos insurance companies stocks satisfy Integrated GARCH process. This suggests that the time-varying volatilities are highly persistent. In another words, we infer that unconditional volatility of insurance companies stocks in Serbia is infinite. As we said before, the Serbian insurance sector is very small, and undeveloped. Main finding of this paper is that volatility of insurance sector is unstable and persistent - which means that Serbia is a country with relatively low per capita income and very high risk in insurance sector. In this observed period from 2007 to 2009 we can say that Serbian insurance market is in transition, with property of high volatility (risk). We hope that Serbia will become member of the World Trade Organization (WTO) and the EU, as soon as possible. In that case, we expect that the Serbian insurance market could get a significant benefit.

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