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PORTFOLIO OPTIMIZATION USING THE GO-GARCH MODEL: EVIDENCE FROM PFTS

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Financial intermediaries are essential participants in the investment process. They play an important role in the investment market, acting as intermediaries in the accumulation and redistribution of temporarily free funds. To perform the mission of capital protection and enhancement, financial intermediaries should continually improve the efficiency of their activities in the securities market and work on improvement of analytical instruments used in management process.

Risk exposure prevention requires intense diversification of the investment portfolio. Improving the asset allocation efficiency for financial intermediaries through diversification can not only significantly reduce the investment risk, the probability and amount of loss on the stock market, but also create conditions for improved financial results.

The purpose of the thesis is to use a mathematical model to minimize risk for a given portfolio. In this study we examine the portfolio consisted of four stocks, included in PFTS Index (on 16th of August list of the PFTS Index contains nine stocks [1]). We calculate the optimal weights using Sharpe ratio (Sharpe, 1966) [2]. The estimation of portfolio assets' conditional covariance is conducted by means of generalized orthogonal GARCH model (Van der Weide, R., 2002) [3] with multivariate normal and normal-inverse Gaussian distributions for errors. Comparing optimal portfolios with naïve portfolio with all weights equal we demonstrate that implementation of multivariate GARCH together with normal-inverse Gaussian distribution for errors enables to reduce the portfolio risk substantially.

For the sake of visibility we present kernel estimates of portfolio returns with normal errors and of raw assets' returns. Evidently, that both Gaussian and normal-inverse Gaussian portfolios provide smaller portfolio variance than raw assets and naïve portfolio. Moreover the tails of portfolio distributions are much lighter for the estimated portfolios.

Table 1 presents the estimation of portfolio risk via portfolio returns' standard deviation and VaR.

Source: own work

"norm" stands for GO-GARCH portfolio with Gaussian errors,

"nig" stands for GO-GARCH portfolio with normal-inverse Gaussian errors,

"sd" stands for portfolio returns' standard deviation,
"VaR" stands for Value-at-Risk.

Tab. 1: **Portfolio risk estimation**

	sd	VaR
norm	0.0114	-0.0252
nig	0.0119	-0.0252
PFTS	0.0149	-0.0262
naive	0.0153	-0.0274

Here we choose 95% level of confidence for VaR as suggested in Riskmetrics [4]. Naïve portfolio demonstrates the poorest results. Index portfolio performs slightly better. Evidently, that the using of GO-GARCH allows to reduce substantially the risk of portfolio estimated by standard deviation and VaR.

We also compare average returns of GO-GARCH portfolios, naïve portfolio and index in Table 2. The returns are multiplied by 1000 for the sake of convenience.

Tab. 2: **Average returns of the portfolios**

	Average return*1000
norm	-0.600
nig	-0.541
PFTS	-1.678
naive	-0.851

Source: own work.

The returns are multiplied by 1000.

GO-GARCH portfolios provide better returns, than naïve and index portfolios. Moreover, they allow investors taking lower risk.

The purpose of this study was to present a methodological and an empirical approach to portfolio optimization. We used dynamic covariance to calculate optimal weights. The dynamic covariances are estimated via GO-GARCH model with Gaussian and normal-inverse Gaussian innovations. The comparison of risk estimated by 95% VaR and returns' standard deviation showed that GO-GARCH portfolios outperform both naïve and index portfolios. Moreover GO-GARCH with normal-inverse Gaussian errors resulted in portfolio with considerably thinner tails due to the fact that this distribution enables to capture returns' heavy tails.

As for the returns GO-GARCH with both distributions ensure higher average returns.

The best performance is demonstrated by normal-inverse Gaussian portfolio with the highest average return and the risk, which is the same according to VaR and slightly higher according to standard deviation as in Gaussian GO-GARCH. To sum up, using normal-inverse Gaussian errors, which implement skewness in modeling volatility, does allow increasing the performance of asset allocation process and to surpass both naïve and index portfolio.

References

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FINANCING RENEWABLE ENERGY PROJECTS IN TURKEY

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Introduction

Rapid increase of population and industrialization in the 20th century resulted in a huge energy demand across the world. According to the United States Energy Information Administration (EIA), total world consumption of marketed energy is projected to increase by 49% from 2007 to 2035 in International Energy Outlook 2010 reference case.

Energy is the most important input of economic sustainability but it is not possible to provide sustainable development without protecting the environment and taking economic conditions into account (Fig. 1).

Energy is considered to be a significant factor in economic development and prime agent in generation of wealth.

Much of the world's energy, however, is currently produced and consumed in ways that could not be sustained if technology were to remain constant and if overall consumption were to increase substantially. Electricity supply infrastructures in many developing countries are being rapidly expanded as policy makers and investors around the world increasingly recognize the pivotal role of electricity in improving living standards and sustaining economic growth. The renewable energy sources have become more important than ever due to the increase in oil and natural gas prices by 500% in the last 15 years and corresponding political situation of the world.