

Model\_Predictability

Intra-European Fellowships  
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PEOPLE

MARIE CURIE ACTIONS

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Call: FP7-PEOPLE-2010-RG**

Final Report:  
Volatility Forecasting Evaluation Framework

**Model\_Predictability**

ATHENS UNIVERSITY OF ECONOMICS AND BUSINESS  
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The project proposes an enhanced volatility forecasting evaluation framework which combines the state-of-the-art findings in financial and statistical literature with the assumption that the forecast errors are non-normally distributed.

We developed the appropriate framework for defining realized (intra-day) volatility as the quantity for appropriate measuring integrated volatility and simulated data generated realized volatility series from an ARFIMA-GARCH framework assuming that the forecast errors are conditionally leptokurtotic or/and asymmetrically distributed.

We estimated a set of models for forecasting realized volatility under the assumptions that the innovations are i) symmetrically, ii) leptokurtically, and ii) leptokurtically and asymmetrically distributed. We computed the forecast errors from the estimated models and investigated whether the data-generated model achieves the lowest value of the standardized prediction error criterion (SPEC); the sum of the squared standardized forecast errors. The data-generated model does have the lowest value of the SPEC criterion under a model specification with i) symmetric distribution, i.e.  $z_t \sim N(0,1)$ , ii) leptokurtic distribution, i.e.  $z_t \sim t(0,1;\nu)$  and  $z_t \sim Ged(0,1;\nu)$  as well as iii) leptokurtic and asymmetric distribution, i.e.  $z_t \sim skT(0,1;\nu, g)$ . The SPEC loss function picks the data-generated model as the most accurate for one-point-in-time-ahead realized volatility forecasts. Thus, the usage of the SPEC as a predictability criterion is not limited to models with normally distributed residuals. The sum of the squared standardized forecast errors is an accurate criterion for evaluating predictability for realized volatility models with leptokurtically and asymmetrically distributed residuals as well.

In the sequel, the models were applied in estimating and forecasting the realized volatility of the major European Union's stock market indices (FTSE100, DAX30, CAC40) and the exchange rates of Euro to the Great Britain Pound, the United States Dollar and the Japanese Yen. Each one of the models was re-estimated for each trading day, based on a rolling sample of constant size of 1000 trading days. The predictability of the estimated models was evaluated according to the SPEC criterion; i.e. we investigate which model achieves the lowest value of the SPEC loss function. In general, the ARFIMA(1,d,1)-GARCH(1,1) model achieves the lowest value of the sum of the squared standardized forecast errors for the vast majority of the cases. For the 6 realized volatility series and the 4 distributional assumptions, in total 24 cases, there were just two exceptions; the HAR-RV-

GARCH(1,1) model for the Euro/Pound rate under the normal distribution and the ARFIMA(0,d,1)-GARCH(1,1) model for the DAX30 index under the Student  $t$  distribution.

The project benefits fellow's career by offering him an opportunity to continue his research in the field of evaluating model's forecasting accuracy and strengthening his professional affiliation. The fellowship has transferred researcher's knowledge previously acquired to the host institution. The Marie Curie Fellowship gave the opportunity to the academic staff of both University of Portsmouth and Athens University of Economics and Business for joining and advancing research efforts as well as for developing a skilled academic network. The fellowship gave the opportunity to the researcher to develop strong research collaborations with researchers in academia as well as in industry. With the completion of the project the fellow has the perspective to obtain a stable, promising long term position.

### **Dissemination activities**

The Marie Curie researcher, Stavros Degiannakis, has successfully accomplished the project, delivered the three deliverables, and submitted papers in international journals that have been produced during the fellowship. The Community support of the Marie Curie Action is being acknowledged in publications and presentations.

### **Deliverables:**

Degiannakis, S. and Livada, A. (2012). Theory and simulations - Forecast errors loss function, 1<sup>st</sup> Deliverable, Project Volatility Forecasting Evaluation Framework, funded under the Marie Curie European Re-integration Grant, PERG08-GA-2010-276904.

Degiannakis, S. and Livada, A. (2013). Application of the simulation findings in developing the enhanced forecasting evaluation framework, 2<sup>nd</sup> Deliverable, Project Volatility Forecasting Evaluation Framework, funded under the Marie Curie European Re-integration Grant, PERG08-GA-2010-276904.

Degiannakis, S. and Livada, A. (2014). Application of the enhanced forecasting evaluation framework, 3<sup>rd</sup> Deliverable, Project Volatility Forecasting Evaluation Framework, funded under the Marie Curie European Re-integration Grant, PERG08-GA-2010-276904.

### **Papers published in international journals:**

Degiannakis, S. and Livada, A. (2013). Realized Volatility or Price Range: Evidence from a discrete simulation of the continuous time diffusion process, *Economic Modelling*, 30, 212-216.

Degiannakis, S. and Kiohos, A. (2014). Multivariate modelling of 10-day-ahead VaR and dynamic correlation for worldwide real estate and stock indices, *Journal of Economic Studies*, 41(2), 216-232.

Degiannakis, S., Duffy, D. and Filis, G. (2014). Business Cycle Synchronisation in EU: A time-varying approach, *Scottish Journal of Political Economy*, 61(4), 348-370.

#### **Books under preparation:**

Degiannakis, S. and C. Floros. (2015) Modelling and Forecasting High Frequency Financial Data", Palgrave - MacMillan Ltd., Hampshire, forthcoming.

#### **Papers under review (submitted in international journals):**

Degiannakis, S. and A., Livada. Evaluate Realized Volatility Predictions from Models with Leptokurtically and Asymmetrically Distributed Forecast Errors, under revision.

Degiannakis, S. and C. Floros. Intra-Day Realized Volatility for European and USA Stock Indices, under revision.

Degiannakis, S., T. Angelidis and G. Filis. Oil price shocks and volatility do predict stock market regimes, under revision.

Degiannakis, S., A. Andrikopoulos, T. Angelidis, and C. Floros. Return dispersion, stock market liquidity and aggregate economic activity, under revision.

Degiannakis, S., A. Livada, D. Duffy and G. Filis The effects of fiscal policy on EU business cycle synchronisation, under revision.

#### **Conferences**

Degiannakis, S., G. Filis and H. Hassani. "Forecasting implied volatility indices: A novel approach". Winter Conference of the Multinational Finance Society, Athens, Greece, 14-16 December, 2014.

Degiannakis, S., A. Andrikopoulos, T. Angelidis, and C. Floros. "Dispersed returns, illiquid stocks and the dynamics of the business cycle ", 5th Conference of the Financial Engineering and Banking Society (FEBS), Athens, 19-20 December, 2014.

Degiannakis, S., A. Andrikopoulos, T. Angelidis, and C. Floros. "Return dispersion, stock market liquidity and aggregate economic activity", Winter Conference of the Multinational Finance Society, Athens, Greece, 14-16 December, 2014.

Degiannakis, S., G. Filis and T. Angelidis “Oil Price Shocks and Volatility can Predict Stock Market Regimes”, 21st Multinational Finance Annual Conference, Prague, Czech Republic, June 29 - July 2, 2014.

Degiannakis, S., G. Filis and C. Floros. “Oil Prices and Industrial Sector Indices”, 20th Multinational Finance Annual Conference, 30 June-2 July 2013, Izmir, Turkey.

Degiannakis, S. and A. Kiohos. “Modelling Multi-period Value at Risk for Two Financial Markets: Global Evidence”. 4th International Conference on International Business, 16-18 May 2013, Thessaloniki, Greece.

Degiannakis, S., with G. Filis and K. Renatas. “Oil price shocks on stock market volatility in Europe”, 2nd International Conference of the Financial Engineering and Banking Society, 7-8 June, 2012, ESCP Europe London Campus.

Degiannakis, S., G. Filis and C. Floros. “The time-varying relationship between oil and stock prices: Evidence from 10 European industrial sector indices”, 1st International Symposium on Business Economics & Financial Applications, 1-2 June, 2012, Kefalonia, Greece.