by Prof. Dr. Maria Vidolova, SU "St. Kliment Ohridski",
on the materials presented for participation in a contest for the academic position of
**Associate Professor at Sofia University "St. Kliment Ohridski"**
Field of Higher Education: 3. "Social, economic and legal sciences"
Professional direction: 3.8. "Economics" (Application of computational methods in finance and economics /financial crises and fintech/) announced in State Gazette no. 30 of 15.04.2022.

### 1. Details about the contest

According to order № РД-38-275/06.06.2022 by the Rector of SU "St. Kliment Ohridski", I have been assigned as a member of the scientific jury of the contest for the academic position of Associate Professor at Sofia University "St. Kliment Ohridski" in the professional direction 3.8. "Economics" (Application of computational methods in finance and economics /financial crises and fintech/). The contest was announced in State Gazette no. 30 of 15.04.2022. The only candidate in the contest is As. Dr. Deyan Radev. All procedural requirements for the contest have been fulfilled: the first meeting of the jury took place on 27.06.2022 (see Protocol № 1) when the deadline for the reports and statements by the jury was set to 25.08.2022 and the date for the final meeting of the jury was set to 19.09.2022.

As. Dr. Deyan Radev fulfills the minimum national requirements according to art. 2b, par. 2 of ZRASRB for awarding scientific degrees and appointing to academic positions.

### 2. Details about the candidate

Deyan Radev hods a master degree of international economic relations from the University of Konstanz, Germany, and a doctorate in economics from Goethe University Frankfurt, Germany. In a descending chronological order, from December 2016 to February 2020, he has been an assistant professor of finance at the University of Bonn and from January 2015 to July 2018, he has been assistant professor of finance at Goethe University Frankfurt. From June 2013 to November 2016, he has been a research economist at LOEWE Research Centre SAFE in Frankfurt; from June 2013 to December 2014, he has been an economist at Research Centre ZEW Mannheim; from September 2011 to February 2012, he has been a consultant at the European Central Bank in Frankfurt. From August 2009 to May 2013, he has been a research assistant to Prof. Dr. Isabel Schnabel, Chair of Financial Economics, Johannes Gutenberg University Mainz, Germany. The scientific interests of the candidate are in the fields of Fintech and Digitalization, Financial Economics, Banking Regulations, Banking and Financial Stability, Systemic Risk, Bank Resolution, Economic and Financial Crises and Applied Econometrics, among others.

### 3. General characteristics of the scientific and applied work of the candidate

Dr. Deyan Radev takes part in the contest with 5 publications, including 2 monographies. In total, the scientific and science-related publications of the author are about 16. The candidate is an author of a habilitation work titled "Economic Crises and Financial Contagion", University Press "St. Kliment Ohridski", Sofia, 2022, with a total of 120 pages. The monography is of interest to the professional public, since in our country there has been

no attempt to build a logical theoretical frame on the subject and to apply adequate mathematical models to study volatility in stock markets. The author has set the ambitious goal to devise a comprehensive framework regarding important questions regarding financial contagion on stock exchanges, as well as its cross-border transmission among the countries in Central Europe and the emerging markets of the countries in Eastern Europe. The theoretical part analyzes the fundamental reasons related to financial interconnection that have led to the transmission of risks between Western and Central and Eastern Europe (WE and CEE) during the Subprime crisis, the default of Lehman Brothers and the Sovereign debt crisis in the euro area and how these crises are related to the workings of the internal capital markets of global banks.

Of particular value are the parts where the author presents an original methodology based on state-of-the-art accomplishments in the literature on measuring financial contagion related to the more accurate representation of the fluctuations in the stock market. In particular, these are related to the analysis of tail events as crises in themselves are tail events, which deviates from the concept of linearity at the basis of the definitions of Pearson's correlation coefficient. Using that methodology, the author manages to identify not only the changes in the level (the value of the parameters of the copula), but also in the structure (the particular mixture of copulas) of the interdependence across periods with low and high volatility in stock markets. The author outlines the most important advantage of the copula approach – the ability to derive direct estimates of tail dependence, that is, the probability of two markets to be jointly in good or bad state. This concept helps the author to test hypotheses regarding the behaviour of stock markets in times of crises. The main precondition for cross-border transmission of extreme negative events between WE and CEE markets is their sufficient level of integration.

The Switching Copula approach is further extended with modelling the dynamic tail dependence between the stock market of each CEE country and the overall WE stock market, proxied by the Stoxx600 index. This allows the author to connect tail dependence to the loan growth of the subsidiaries of global banks and helps to identify whether extreme events are an active channel of crisis transmission, and through which balance sheet and macroeconomic factors the shocks transmit to subsidiary loan growth. The study confirms the existence of financial contagion defined by Forbes & Rigobon (2002) in a broad sense – regional and national tail dependence rises during the peaks of the crises in the Wester stock markets.

The author extends the study and the existing literature by identifying a new contagion channel – through the comovement of financial markets and internal capital markets of global banks. To this end, the author uses stock market indices an balance sheet characteristics for the banks in the CEE region (the sample includes data on parent banks from Eestern Europe and their subsidiaries in 12 CEE countries) between March 2006 and March 2015. The results unequivocally prove the transmission of risk from WE to CEE. During global crises, the Subprime crisis in particular and not that much during the Sovereign debt crisis, the parent bank channel contributes more to the transmission than the macroeconomic factors.

In hi study, the author manages to overcome some of the constraints in previous research, namely the focus on linear correlation and not on tail dependence, the lack of evaluation of how symmetric the market reaction is in good and bad times and in the tails of

the distribution, the exogenous determination of crisis periods and last but not least, the relatively sparse application of copula methods on data from CEE.

Dr. D. Radev accomplishes the set scientific and applied goal of the study related to extreme value theory and tail dependence between the stock markets of WE and CEE. The author extends the switching copula methodology to arrive not only at qualitative, but also at quantitative conclusions about the type of dependence. Last but not least, the use of Markov chains allows the endogenization of crisis periods, as opposed to setting arbitrarily fixed dates as in previous studies.

The results of this in-depth study are important in the context of the ongoing economic and political integration within the EU, as well as of early warning systems in the EU.

Of particular interest among the works submitted for the context is the study on systemic risk, the transmission of financial shocks from one financial system to another and to the real economy, as well as the macroeconomic effects of the introduction of the digital euro in the euro area.

The publications submitted for the contest are a testament for the breadth of scientific interests of the candidate and his ability to undertake quantitative and qualitative research across disciplines. The latter is undeniable proof for his academic skills and readiness to apply methods from different research fields. All presented publications prove an in-depth knowledge of the research methods in the professional direction of the contest: they are based on an excellent knowledge about the specifics of the financial sector and represent a good illustration of the evolution in the academic career of the candidate. The scientific publications of the candidate contain in places original author opinions and elaborations, which is particularly valuable in the chosen professional direction.

## 4. Main scientific and applied contributions

The scientific contributions of the candidate could be attributed to the following fields:

- In the theoretical part of the presented works, the author presents a comprehensive theoretical analysis of the specialized literature on the subject of the cross-border contagion against the backdrop of the heavily regulated institutional environment of international banking. The author has compiled a review of the literature on systemic risk, its causes and measurement based on multivariate probabilities of default of banks and sovereigns, the channels of transmission of financial and economic crises across national borders, as well as the application of multivariate copulas for identification of financial contagion across stock markets. Based on that, the author manages to identify a number of testable hypotheses for the identification of new channels of transmission of financial crises through the internal capital markets of global banks.

- An important contribution is the application of copula theory for the analysis of contagion between WE and CEE during the subprime crisis based on tail dependence, as well as the introduction of several new measures that help the analysis of the asymmetry in intermarket dependence.

- Based on an in-depth theoretical analysis of the national and internation banking regulations and the existing institutional environment, the author forms suggestions for innovations regarding the capturing of the effect of liquidity requirements on the transmission of idiosyncratic shocks across borders, as well as capturing the influence of

various currency regimes on the transmission of shocks from abroad and the need for the introduction of digital form of payments given the increase in level of innovations in the European financial system and the financial inclusion of vulnerable groups in the euro area.

### 4. Основни научни и научно-приложни приноси

The applied contributions of the candidate could be summarized as follows:

- The author applies multivariate copulas to identify financial contation between WE and CEE stock markets introducing dynamic version of the used methodology, which allows the derivation of time series of tail dependence indicators. The author manages to prove the application of the derived indicators for the identification of a new channel of transmission of shocks by global banks to the economies in CEE. Furthermore, the author analyzes the activity of that channel during the global financial crisis and the sovereign debt crisis in the euro area and derives policy implications for changes in international banking regulations based on the results.

- Using multivariate probabilities and credit default swaps, Dr. Radev derives a large number of systemic risk indicators for the euro area. These reflect bivariate, trivariate and multivariate conditional and unconditional probabilities of default, as well as a family of measures of changes of conditional probabilities of default, which, following technical assessment, are in daily use by the European Central Bank. The latter could be used to improve the methodology for determining the size of the future rescue packages of banks and sovereigns.

- It should be noted that the author successfully defines an empirical model for the identification of the effect of negative capital and liquidity shocks at the parent bank level on the lending of their foreign subsidiaries (based on an empirical study of parent banks from the OECD and their subsidiaries around the globe). The results of the empirical tests on the contagion channels show that parent capital shocks are more important than parent liquidity shocks for the lending of their foreign subsidiaries.

- Of interest is also the study on the effect of different currency regimes like currency boards and dollarization. The study again includes OECD parents and foreign subsidiaries around the world. The author identifies a link between liquidity regulations and the transmission of negative shocks, as well as a link of that effect to the currency regime of the foreign subsidiary, which in some cases renders the liquidity regulations ineffective to prevent transmission of shocks from abroad.

## Conclusion

Dr. Deyan Radev takes part in the contest for the academic title "Associate Professor" if sufficient in volume and quantity scientific production. The professional and teaching experience of the candidate and the mentioned above scientific and applied contributions fulfill the requirements for the academic position "Associate Professor" at SU "St. Kliment Ohridski". I express my positive evaluation regarding the quality of the scientific studies of the candidate. The submitted publications for review contain original scientific and applied contributions

All these facts provide me with arguments to confidently support the awarding of the academic position "Associate Professor" in professional direction: 3.8. "Economics" (Application of computational methods in finance and economics /financial crises and fintech/) to As. Dr. Deyan Radev.


Sofia, 19.08.2022 г.                                                    Prof. M. Vidolova