

# Scientific Review

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Subject: Scientific contest for occupying the academic position "Associate professor" in Professional Field 3.8. Economics (Statistics, Econometrics, and Economic modelling in Bulgarian and English) at Sofia University "St. Kliment Ohridski"

## 1 ABOUT THE CONTEST

The contest was announced for the needs of the Department of Economics in the Faculty of Economics and Business Administration at Sofia University, and it is published in the official State Gazette, no. 30 of 15/04/2022. I participate in the scientific jury for the contest according to Order RD 38-272/06/06/2022 of The Rector of Sofia University "St. Clement Ohridski" (further SU).

The sole candidate for the above-mentioned contest is Andrey Andreev Vassilev, PhD.

Andrey Vassilev has submitted a set of materials including:

- CV
- Higher education diploma
- Diploma for educational and scientific degree "doctor"
- Proof of work experience in the relevant field
- Documents proving the fulfillment of the requirements under Art. 105, para. 1, item 2 of The Regulations for the terms and conditions for acquiring scientific degrees and occupying academic positions at SU "St. Kliment Ohridski"
- Medical certificate certifying mental and physical health
- Certificate of criminal record, certifying the absence of an imposed penalty "deprivation of the right to exercise a certain profession or activity"
- List of publications, and other scientific and applied results and other relevant documents related to the contest

The candidate, Dr. Andrey Vassilev, submitted a total of 34 scientific works for review, of which: five monographs (one of which is standalone); six studios; nine articles; nine scientific reports (two of which are standalone); one textbook and one teaching aid, as well as participation in various research projects. The texts of all publications are presented in electronic format. Most of the publications are in English.

It can be seen from the attached table that the candidate has a numerous significant scientific publication with a clear own contribution. There is no evidence of plagiarism and illegal use of other people's works and ideas.

№	Type of publication	<u>Standalone</u>		<u>Co-author</u>		<u>Total</u>	
		#	pp.	#	pp.	#	pp.
1	Monographs	1	146	4	394*	5	540
2	Studies			6	273	6	273
3	Articles			9	101	9	101
5	Scientific reports	2	11	7	59	9	70
6	Textbooks			2	262	2	262
7	Projects			3	**	7	**
	<b>Total</b>	<b>3</b>	<b>157</b>	<b>31</b>	<b>1089</b>	<b>34</b>	<b>1246</b>

\* According to the submitted division protocols

\*\* No division protocols

## **2 SHORT BIOGRAPHICAL NOTES**

Andrey Vassilev has a bachelor's degree in international economic relations from UNWE and a master's degree in applied mathematics (specialization in applied statistics) from the Faculty of Economics of SU "St. Kliment Ohridski". He holds the ONS "Doctor" from the Faculty of Economics and Business of the SU. The topic of the doctoral dissertation is "Mathematical models of economic phenomena in space", defended in 2008.

Dr. Vassilev has accumulated extensive experience in the field of economic research acquired in various financial and academic institutions. He held the position of "Head of Department" at the BNB and at the Agency for Economic Analyzes and Forecasts. Long-term part-time lecturer at FMI and the Faculty of Economics of SU. He has participated as a key expert and expert in a number of national and international projects. Member of Bulgarian Macroeconomic Associations since 2015.

## **3 FULFILLMENT OF THE REQUIREMENTS FOR OCCUPYING THE ACADEMIC POSITION**

From the certificate presented by the applicant, it is clear that the minimum national requirements under Art. 2b of the Law on the Development of the Academic Staff in the Republic of Bulgaria (ZRASRB) have been implemented, and in most groups the implementation significantly exceeds the requirements.

## 4 GENERAL CHARACTERISTICS OF THE APPLICANT'S ACTIVITY

### 4.1 Assessment of teaching and learning activities

The candidate has a guaranteed teaching load at the Faculty of Economics and Business Administration as well as in Faculty of Mathematics and Informatics, where he teaches "Econometrics", "Macroeconomics I", "Macroeconomics II", "Statistical and mathematical methods", "Applied economic modeling with Python", "Applied econometrics II", "Macroeconomic modeling" and " Microeconomic Modelling". With a view to the proper conduct of the educational activity, the candidate has developed websites with educational materials for the disciplines he leads, as well as auxiliary software tools for the benefit of the students. The developed materials are at a high scientific level and convincingly demonstrate the diverse and in-depth knowledge of Dr. Vassilev in the field of macroeconomic analysis and quantitative methods in economics.

### 4.2 Evaluation of the candidate's scientific and scientific-applied activity

Unlike the mentioned reference to Dr. Vassilev's scientific publications, in which the leading criterion was the type of scientific research, in this part of the review another criterion is used - where the research was published. Given the large number of materials submitted for review (34 publications), only the more significant (according to the reviewer) studies will be considered in more detail.

#### 4.2.1 *Habilitation and monographs*

The work submitted for review is an original monographic study (Strategic models of trade under conditions of protectionism), which examines issues in the field of modeling foreign trade in the presence of strategic relationships. Situations are considered in which, on some of the markets, trade is carried out under the conditions of various forms of protectionism. It also analyzes price dynamics for such models and various formulations that summarize the proposed settings. The study is intended primarily for professionals dealing with issues of trade relations theory and economic modeling. Particularly impressive is the second chapter, in which trade takes place in the context of a game-theoretic interaction. Dynamics are introduced using an exogenous price change rule that can be recorded in discrete or continuous time. Results are shown on the existence and structure of Nash equilibria and on the types of price dynamics that arise under different parameterizations of the model. Further on in the study, a variant of the model is considered, in which the local consumer has partial protection, expressed in the possibility to purchase as a matter of priority only a certain part of the available amount of goods.

The candidate has also presented other monographic studies (outside the habilitation thesis), in which he participated within scientific teams in the development of medium- and long-term forecasts for the development of the labor market and the needs for knowledge and skills in Bulgaria. The starting point in these monographic studies is the review of existing leading practices

in modeling and forecasting labor market developments. A review of the available data on labor supply and demand was also made. An important element of the study is the description of the theoretical framework of the two main blocks of the medium-term and long-term forecasting model, as well as the various modules included in the model itself. The choice of main stances in the model is argued and a justification and presentation of the software implementation of the main two blocks in the model and the individual modules is made. The methodology of the model and its application are described, including a description of the equations and parameters contained in the empirical model and a description of the statistics used.

#### 4.2.2 Textbook

The candidate has developed (in co-authorship) a textbook "*An Introduction to Macroeconomics*" for the needs of students studying the relevant discipline. Compared to the typical introductory textbook, this one focus more on macroeconomic data and how to compile and interpret it. The structure of the textbook reflects the views of the author on various problems of macroeconomic theory and practice and is divided into three chapters. The first chapter is introductory and presents basic concepts of macroeconomics and ways of measuring macroeconomic variables, without, however, proposing theoretical constructions that bind them. The second chapter is devoted to the presentation of theoretical constructions related to the development of the economy in a short-term horizon. The textbook is oriented towards a formal but accessible presentation of the economic mechanisms operating in the short term, with an emphasis on the role of the economic, in particular the monetary, policy for counteracting various shocks. The third chapter examines the behavior of the economy over a long-term horizon. Questions from the theory of economic growth are considered. The Solow–Swan and Ramsey models widely distributed in the literature are chosen, for which discrete and continuous time variants are presented.

#### 4.2.3 Publications in referred and indexed journals

- The Stabilizing role of fiscal policy rules under the currency board arrangement (Iordanov, Iordan V., Andrey A. Vassilev (2012) The stabilizing role of fiscal policy rules under the currency board arrangement, *Comptes rendus de l'Acad bul. Sci.*, 65(11), 1499-1506)

The authors develop a dynamic model of the general equilibrium for a small open economy under a currency board arrangement and considering the specifics of the Bulgarian economy. With the help of numerical simulations, the potential to stabilize the economy through the implementation of a fiscal policy based on fiscal rules has been explored.

- Extending a small open economy model to a multi-regional setting: domestic output determination (Iordanov, Iordan V., Andrey A. Vassilev (2014), *Comptes rendus de l'Acad bul. Sci.*, 67(12), 1621-1628.)

Results of a modification of the small open economy model of Galí and Monacelli are presented, which generalize it to the case of several regions (monetary unions). The results offer a summary representation of domestic production as a function of domestic and foreign prices and exchange rates, using an alternative index form that ostensibly ensures consistency across commodity sizes.

- Strategic trade between two regions with partial local consumer protection – General setup and Nash equilibria (Iordanov, Jordan V., Andrey A. Vassilev (2017), AIP Conference Proceedings 1910 , 020012, DOI: <https://doi.org/10.1063/1.5013949>)

In this study, the authors define a model of trade relations between two regions for the case where trading entities (consumers) compete for a commodity with limited supply and there is an element of strategic interdependence in trade. In addition, local consumers enjoy partial protection in the form of guaranteed access to part of the locally available quantity of goods. The model is formulated for the general asymmetric case where the two regions differ in parameters such as income, size of local market supply, degree of protection and transport costs. For this general model, the existence of Nash equilibria is established, and these are obtained as a function of the model parameters, creating a typology of equilibria.

#### 4.2.4 *Articles published in non-referred peer-reviewed journals*

- Price dynamics in a two-region model with strategic interaction (Iordanov, Jordan V., Stoyan V. Stoyanov, Andrey A. Vassilev (2004), Proceedings of the Spring Conference of the Union of Bulgarian Mathematicians, 144-149)

The article develops a strategic model of trade between two regions, in which, depending on the ratio between production, transport costs and financial resources, the process of changing prices when they reach equilibrium is studied. Conditions are derived for the relations between production and financial resources under which different types of Nash equilibria are obtained. The price trajectories obtained in the process of reaching equilibrium are also derived.

- A strategic model of trade between two regions with continuous-time price dynamics (Vassilev, Andrey A., Jordan V. Iordanov, Stoyan V. Stoyanov (2005), Comptes rendus de l'Acad bul. Sci. , 58(4), 361-366)

The study analyzes a trade model between two regions involving game-theoretic interactions between representative users from the respective regions. On the basis of explicit Nash equilibria, the dynamics of prices in continuous time is studied. The equilibrium points of the dynamic system are obtained, and the price behavior is illustrated graphically.

- Strategic trade with partial local consumer protection (Iordanov, Jordan V., Andrey A. Vassilev (2017), Proceedings of the 46th Spring Conference of the Union of Bulgarian Mathematicians, 181-186)

The essence of this research is the development of a strategic model of trade relations between two countries. Local consumers have preferential access to part of the available quantity of goods traded on the domestic market. Depending on the outcome of the trade, prices change to correct the mismatch between supply and demand. Using numerical simulations implemented on Python/Jupyter Notebook, it is shown that the model is capable of generating different forms of price dynamics, including degenerate states (with zero prices) and different cyclical regimes.

#### 4.2.5 *Studies published in non-referred peer-reviewed journals*

- Equilibrium Exchange Rate Determination for the Case of Bulgaria (Barber, Catherine, Andrey Vassilev (2003), AEAF Discussion Paper Series, Sofia)

This study examines the issue of determining the equilibrium exchange rate in the case of Bulgaria. A simple dynamic model was developed to calculate the equilibrium trajectory of the nominal exchange rate over a certain time horizon. Considering the specifics of Bulgaria as a country with a currency board arrangement, the lev-euro exchange rate (BGN-EUR) is modeled under the condition that the US dollar-euro (USD-EUR) exchange rate is known. In the proposed wording, the country's trading partners are divided into two groups: those trading in US dollars and those trading in euros, the latter being considered equivalent to the European Union (EU) and the former assumed to include the trading partners of Bulgaria outside the EU. The adopted concept of equilibrium calls for the current account of the balance of payments to approach zero over time, while at the same time achieving some degree of price convergence with the EU. Under these exogenously imposed requirements, the trajectory of the leva to euro exchange rate is calculated in a way that satisfies the model.

- A small open economy model with a currency board feature – the case of Bulgaria (Iordanov, Jordan V., Andrey A. Vassilev (2008), Bulgarian National Bank Discussion Paper DP/63/2008)

The study basically presents an initial variant of a dynamic stochastic general equilibrium model for a small open economy operating under a currency board arrangement. The used specification and calibration of the model are tailored to the case of the Bulgarian economy. The model solution is commented, the results of several simulation scenarios are described, and directions for extending and improving the model are identified.

- Multi-agent systems and their applications in macroeconomic and financial modeling (Vassilev, Andrey, Georgi Deyanov, Svilen Pachejiev (2013), BNB Discussion Papers DP/92/2013)

This research presents the methodology and principles for developing multi-agent systems – computer models of interactions between multiple autonomous entities – with an emphasis on their use in economics and finance. The characteristics of multi-agent systems are described, which

make them particularly suitable for modeling situations with heterogeneous types of agents and non-standard microeconomic characteristics of the actors and the interactions between them. The necessary conditions for the successful use of models based on multi-agent systems are reviewed and the main drawbacks of multi-agent systems are discussed. A review of selected applications of multi-agent systems in macroeconomics and finance was made with a view to the possibilities of using their results in the formulation and implementation of macroeconomic policy. Some technical aspects of the development of multi-agent systems, such as possible software platforms for their implementation and the necessary qualification of the team of specialists developing a multi-agent system, have also been considered.

- Relationship between inflation, potential output, and structural unemployment in Bulgaria (Kasabov, Daniel, Petra Kotseva, Andrey Vassilev, Mihail Yanchev (2017), Bulgarian National Bank Discussion Paper DP/104/2017)

The study evaluates the dependence on the type of Phillips curve for the Bulgarian economy in a formulation that takes into account the simultaneous interaction between inflation, potential output, and unemployment. Using a phase-space representation model estimated by Bayesian methods with quarterly data from 1999 to 2015, the authors estimate the cyclical development of unemployment and output and identify the main drivers of inflation over the period. Compared to other methods, such as one-dimensional filtering or production function approaches, this methodology allows the combination of information from different time series and enables a structural interpretation of the results in terms of the main shocks.

## **5 ASSESSMENT OF SCIENTIFIC AND SCIENTIFIC-APPLIED CONTRIBUTIONS**

After familiarizing with the scientific output of the candidate, the following scientific and scientific-applied contributions can be ascertained:

### **5.1 Regarding the habilitation work**

The habilitation offers a detailed and well-systematized classification of the models with full and partial protection of internal users, thereby building a unified framework for the analysis of the questions posed for trade relations with a strategic element. The study also offers unpublished summaries of the tasks under consideration, such as adding a stochastic element, introducing more than two regions in the trade, and different options for describing the supply-side economy that allow price dynamics to be derived from microeconomic foundations.

### **5.2 Regarding studies, articles, and scientific reports**

The materials submitted for review show the candidate's purposeful and systematic work in several directions, fully covering the subject of the contest and the specific needs of the Faculty of Economics and Business Administration at SU. The relatively long period during which the research is conducted (spanning nearly two decades) convincingly shows the scientific growth of

the candidate and the deepening of his scientific research. Scientific and scientific-applied contributions can be considered in several directions:

- Macroeconomic modeling

A significant part of the publications falls in this direction, which is logical and expected given the candidate's preparation and theoretical and practical experience. Among the more significant contributing moments in this direction, one can point out the modeling of fiscal policy in the conditions of a currency board, which allows to assess the reaction of the economy to various shocks. In another study, these ideas are further developed, and fiscal policy is described using fiscal rules. Contributions also include studies investigating the behavior of a small open economy operating under a currency union. The studies dedicated to the labor market in Bulgaria deserve special attention. These studies developed a framework for forecasting labor supply and demand. A framework is built on a modular principle, which allows the consideration of a variety of information, including exogenously set parameters of development such as demographic dynamics and projected trajectories of deviation from potential output and capital in the economy. The model allows the preparation of forecasts in the medium and long term and in various breakdowns, including labor supply by age and educational levels, employment structure by economic activities, structural disparities by educational levels at the regional level and by economic activities, duration of registration as an unemployed person, job search by economic activities and occupations and by economic activities and gender.

- Modeling commercial relationships

Research in this direction consistently builds and complicates different models, characterized by the presence of a strategic (game-theoretic) element, and foreign trade is carried out in conditions as close as possible to reality and considering the presence of protectionism. An important piece of contribution is the research that focuses on price dynamics and consumer protection.

- Gaps of the spatial economy

Research in this direction has resulted in the construction of different variants of a model in which the decisions of a given economic subject for consumption and savings are supplemented with decisions for moving in space. The latter are motivated by the possibility of obtaining different incomes in different points of space but considering the existence of barriers to moving in the form of transaction costs of moving (e.g., transport costs) as well as habit formation in relation to the current location .

- Creation of technical tools and software for the needs of economic analysis and training

The candidate's research and achievements in this direction focus on the development of multi-agent systems - computer models of interactions between multiple autonomous entities - with an



emphasis on their use in economics and finance. The application of multi-agent systems to situations with heterogeneous types of agents or non-standard microeconomic characteristics of the actors and the interactions between them is commented. Contributory moments are also found in the consideration of questions from the theory of reaction networks, including mathematical properties of different types of reaction networks, options for their numerical simulation and for estimating their parameters based on a sample of data.

### 5.3 Citations

The candidate has attached a list of the citations of the publications in which he was an author or co-author. Included in the list are 17 established citations to 6 different publications. The specified evidentiary material meets the requirements laid down in the law on the development of the academic staff and the regulations for its application.

## 6 CRITICAL REMARKS AND RECOMMENDATIONS

I have no critical remarks about the materials submitted for review. I recommend that Dr. Vassilev continue his research in the field of macroeconomic modeling, focusing on the changes that will occur after Bulgaria joins the Eurozone.

## 7 PERSONAL IMPRESSIONS

I have known the candidate for nearly 20 years and have an excellent opinion of his research efforts. Dr. Vassilev has very deep knowledge in the field of quantitative methods of macroeconomic analysis and macroeconomic modeling. On a personal level, Andrey is extremely honest and well-intentioned towards both colleagues and students.

## 8 CONCLUSION

The documents and materials presented by the only candidate, Dr. Andrey Vassilev, meet the minimum requirements of the Law on the Development of the Academic Staff in the Republic of Bulgaria (ZRASRB), the Regulations for the Implementation of ZRASRB and the corresponding Regulations of SU "St. Kliment Ohridski".

The only candidate in this scientific contest has submitted a sufficient number of scientific works published after he obtained a PhD degree. A number of scientific and scientific-applied contributions can be found in the candidate's publications, which are described in items 5.1 and 5.2. The candidate's theoretical studies have a certain practical applicability, and a significant part of them are directly aimed at improving the teaching activity. Dr. Vassilev's scientific and teaching qualifications are at a high level. The results achieved by the candidate in the educational and research activities correspond to the specific requirements of the Faculty of Economics and Business Administration.

After getting acquainted with the materials and scientific works presented in the competition and after a thorough consideration of their significance and the scientific and scientific-applied contributions contained in them, I strongly support the candidate for acquiring this scientific degree and recommend that the scientific jury prepare a report-proposal to The Faculty Council of the Faculty of Economics and Business Administration of the SU for the election of Dr. Andrey Andreev Vassilev to the academic position of "associate professor" in professional direction 3.8 Economics (Statistics, econometrics and economic modeling - in Bulgarian). and English).

25/08/2022

Prof. (Assoc.) Victor Yotzov, PhD