Varazdin Development and Entrepreneurship Agency and **University North**
in cooperation with
Azerbaijan State University of Economics (UNEC)
Faculty of Management University of Warsaw
Faculty of Law, Economics and Social Sciences Sale - Mohammed V University in Rabat
Polytechnic of Medimurje in Cakovec

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Editors:
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FINANCIAL SECTOR DEVELOPMENT: EFFICIENCY OF THE REGULATION AND PUBLIC TRUST

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ABSTRACT

Financial sector development, ensured by trust in the banking system, is an essential prerequisite for sustainable economic and social growth. The foregoing contributions to building a solid and reliable foundation for economic growth depend to a large extent on the efficiency of the state regulation in terms of monetary policy strategy, which has been adopted. Measuring its efficiency is one of the challenging research and practice questions of central banks. The purpose of the paper is to contribute to the methodology of indicators that allow for the measurement of the benefactions of efficient monetary policy to observed changes in public trust in the financial sector. A fundamental standpoint adopted is to view the maximization of public trust as a necessary (but not sufficient) step towards the goals that the Central banks have been tasked with within their mandates. An output-oriented data envelopment analysis method, which is widely used to measure efficiency within the banking industry, was developed and applied in order to measure the efficiency of the regulation in a central banking context. In order to get a reliable, relevant, and interpretable result, input and output variables were selected according to the Central banks' majority core strategy and objectives. Input factors are represented by Central banks' balance sheets that record assets and liabilities resulting from monetary policy instruments. While the Heritage Foundation index on monetary freedom and coefficient of economy monetization was used as outputs in a quantitative dimension. The proposed measure of monetary policy efficiency could be used as an aid to detect so-called reserves of unused capacities, and hence to provide for recommendations as to the regulations and incentives, or managerial practices, that will contribute to promoting greater trust in the financial sector and price stability that each central bank seeks to maximize given its limited amount of inputs.

Keywords: *Financial sector, Monetary policy, Central bank, Regulation, Efficiency, trust*

1. INTRODUCTION

A large and growing body of academic literature on macro and regional economic growth and sustainable development has revealed the emergence of several candidate explanations. Politics and political stability (Bakari et al., 2018), innovations (Kendiukhov, Tvaronaviciene, 2017; Eva, Marcel, 2017), investments (Lyulyov, Pimonenko, 2017; Vasylieva et al., 2017), fields of behavioral finance (Prince, 2017; Nur-Al-Ahad, Nusrat, 2019), among other things, public trust (Bilan et al., 2019; Brychko et al., 2019) are prerequisites for any widespread improvement in

macroeconomic outcomes. Much of the literature since the global financial crisis pays particular attention to that macroeconomic performance and development requires a well-functioning financial sector. The existing literature on the financial sector development is extensive and focuses particularly on the role of systemically important banks (Buriak et al., 2015), transnational banks' influence (Fernandes, 2018), banking competition (Didenko et al., 2018), financial instruments (Tiutiunyk, 2018) for sustainable economic and social growth. Current financial systems have a complex organizational and functional structure, characterized by the public trust (Buriak et al., 2019; Savchenko, Kovács, 2017), stability, safety, reliability (Leonov et al., 2018) and a variety of risks, associated particularly with the rapid development and growth of alternative finance (Bilan et al., 2019; Rubanov et al., 2019). However, the danger signals brought on by dissemination of the financial sector negative trends and deformations through all participants and stakeholders across the economy is still an issue. And therefore, without efficient state regulation, the financial sector could be viewed as a source of financial shocks. It is widely admitted that state regulation builds a solid and reliable foundation for economic growth. Thus, there is a large number of published studies that describe changes in state regulation in the context of current changes in banking (Zarutska et al., 2018; Vasylieva et al., 2017; Islam, Khan, 2019), consumer protection (Poliakh, 2018), independence of financial supervision (Kremen et al., 2018), shadow economy (Bilan et al., 2019), reporting transparency (Vasylieva et al., 2017; Vasilyeva, Makarenko, 2017; Vasylieva et al., 2017). Measuring efficiency is one of the challenging academic and practice questions. While the overwhelming majority of research is directed toward the investigation of the efficiency of banks (Agnihotri, Gupta, 2019; Obeid, Brychko, 2017), deposit services marketing (Vasylieva, Didenko, 2016), risk management methods (Pukala et al., 2018), and tools, corporate governance (Brychko, Semenog, 2018), only a few researches have been focused on the efficiency of state regulations (Karintseva, Benetyte, 2018; Subeh, Boiko, 2017; Jiang, Wang, 2017), especially in monetary policy context (Ihaddaden, 2019; Rasche, Williams, 2007; Cecchetti et al., 2006). A relatively small number of publications on the efficiency of the state regulation in terms of monetary policy strategy, which has been adopted, related to the existence of a plurality of monetary policy objectives central banks charged with (Mester, 2003), that are also generally heterogeneous across the countries, the difficulty in the quantitative measurement of the central banking achievements, the complexity of instruments and mechanisms that central banks could use in order to pursue its goals (Ihaddaden, 2019). The purpose of the paper is to contribute to the methodology of indicators that allow for the measurement of the benefactions of efficient monetary policy to observed changes in public trust in the financial sector. The value-added of this paper compared to the existed literature lies within the determination of the maximization of public trust in the financial sector as a necessary (but not sufficient) step towards the goals that the central banks have been tasked with within their mandates as a fundamental standpoint. The rest of the paper is organized as follows. Section 2 outlines the research methodology adopted in the study. We start by presenting the theoretical framework for efficiency computations (2.1). Then, the data and empirical definitions are introduced (2.2). In this section, the DEA model is formulated (2.3), and the concept of returns to scale is defined (2.4). Section 2 also outlines calculations that should be done for the identification reserve of unused capacities (2.5). Section 3 concludes and provides directions for future research.

2. RESEARCH METHODOLOGY

2.1. Theoretical framework

Such a long-standing issue of measurement monetary policy efficiency had remained unresolved in the monetary economics and central banking literature. Concepts and suggestions aimed at addressing this question have been influenced in part by conceptualizing of what

constitutes an efficient monetary policy and in part by selecting of quantification methodologies and appraisal tools. Computation methods and models for assessing the efficiency of the state regulation in terms of monetary policy are not applied due to the nature of central banks. This is no doubt connected with the fact that the goal of the central banks' creation and activity is not deriving the maximum profit at the lowest possible risks, as in the case of commercial banks. It could be taken advantage of the diversity of existing traditional and contemporary conceptual frameworks of measuring central bank efficiency. The monetary policy efficiency can be evaluated on the perspectives of striking a balance between the money demand and supply as the principal prerequisites of price stability. The central banks could also be viewed as efficient if there is an absence of booms and busts in the financial sector. The alternative approach to recognize central bank efficiency is an empirical evaluation of the efficiency of monetary policy transmission mechanisms across its core channels. Being the followers of a goal-based approach, we consider efficient state regulation in terms of monetary policy is an achievement of the goals that the Central banks have been tasked with within their mandates. In this line, a narrow and broad-based goal approach could be used. A narrow approach is suggested that the central bank is efficient and, therefore, related monetary policy, if the stated inflation targets in the short and long term are fulfilled. This approach is due to the fact that today price stability is a primary goal not only in countries with inflation targeting. However, such a narrow approach could hardly contribute to the expanded central banks' priorities after the Global financial crisis. A broad-based approach is more appropriate to monetary policy efficiency measurement since it included the essential criteria and indicators that fairly reflect the achievement of the entire hierarchy of central bank goals established within their mandates. In this study, the broad-based goal approach has been adopted. A non-parametric approach of measuring efficiency had been widely used previously for comparative purposes as an assessment tool of commercial banks or bank branches efficiency. However, neither parametric, no non-parametric approach is not adequately reflected in the central banking context. Among the non-parametric methods, Data Envelopment Analysis (DEA) was increasingly in demand. There are several reasons related to the above DEA model dissemination among researches. First, unlike the parametric approach, DEA does not rely on assumptions about the functional form of a cost or production frontier; hence, the derived efficiency scores are more robust. Secondly, owing to the absence of a random error in the model, DEA does not shift efficiency measurement results and could overstate the actual levels of relative inefficiency. It is observed that the use of this method might be appropriate in practice during measuring the efficiency of state regulation in terms of monetary policy implementation since it enables the following estimations to be performed:

- The efficiency of state regulation in terms of achieving the goals set by central banks within their mandates that is measured by the distance from central bank under evaluation to the efficiency frontier;
- Efficient frontier, which constitutes the "best practice" central banks;
- A (small) subset of efficient central banks closest in the balance sheet characteristics to the central bank under evaluation, in other terms, an efficiency reference peer group;
- Reserve of unused capacity, which could also be considered as the degree of inefficiency in the use of inputs;
- Efficient targets for each inefficient central bank, which is derived by a projection of inefficient central banks to the efficient frontier.

2.2. Data and empirical definitions

In order to get a reliable, relevant, and interpretable result, input and output variables were selected according to the Central banks' majority core strategy and objectives. Given the imbalances that have taken place in the global and national financial markets over the last

decades, many central banks, in particular the National bank of Ukraine and Central Bank of the Republic of Azerbaijan, have responded by transforming their strategy and expanded core functions. This has triggered most countries, in accordance with the national legislative framework, for a radical redefinition and regularization of the hierarchical subordination of central banks' objectives. Additional goals, along with the primary goal of the central banks in achievement and retention of the price stability in the country were proclaimed: to promote the stability of the banking/financial system (for instance, Azerbaijan, Armenia, Belarus, Czech Republic, Georgia, Poland, Israel, Germany, Norway, USA, Sweden, Ukraine), maximum employment (for instance, Australia, ECB, Israel, USA, Sweden), the sustainability of the economic growth and/or supporting the government's economic policies (for instance, Australia, Georgia, Israel, Switzerland, Sweden, Turkey, Hungary, Czech Republic), to organize and ensure operation of centralized interbank and other unlicensed payment systems (for instance, Azerbaijan, Armenia, Belarus, Germany, USA, Japan, Sweden), etc. Meeting the goals, that central banks" was mandated, or approximation to corresponding quantitative criteria for their assessment creates the necessary level of public trust in the central bank (institutional level) and the financial sector (systemic level) as a whole, which is a prerequisite for economic growth. For this reason, maximizing public trust in the financial sector is a unifying characteristic of the efficient state regulation in terms of achieving the goals set by central banks within their mandates. The Heritage Foundation index on monetary freedom (y1) and coefficient of economy monetization (y2) were used as output parameters of the model that, respectively, characterize price stability, reliability, and stability of the financial system in a quantitative dimension. The justification for using the Heritage Foundation index on monetary freedom as a proxy is based on similar contemporary studies such as (Mckinley, Banaian, 2005), (Ihaddaden, 2019). The Monetary Freedom Index is part of the Index of Economic Freedom, developed and annually published by the Heritage Foundation, which is used to evaluate the Regulatory Efficiency of various government activities. The monetary freedom index demonstrates the ability of the central bank to control inflation and to ensure price stability. It combines a measure of inflation with an assessment of various government activities that distort prices and, in quantitative terms consists of two components (The Heritage Foundation, 2020):

1. The weighted average inflation rate for the most recent three years;
2. A qualitative judgment about the extent of government manipulation of prices through direct controls or subsidies.

Thus, the monetary freedom index is defined by the formula:

$$\text{Monetary Freedom}_i = 100 - \alpha \sqrt{\text{Weighted Avg. Inflation}_i} - \text{PC penalty}_i,$$

Where: Weighted Avg. Inflationi is the weighted average inflation rate for the most recent three years in the country i; α represents a coefficient that stabilizes the variance of scores; PC penalty – the penalty is an assigned value of 0–20 penalty points based on the extent of price controls; Monetary Freedomi is the Heritage Foundation index on monetary freedom. The base score for the Heritage Foundation index on monetary freedom that serves as the primary input into an equation is the weighted average inflation rate for the most recent three years. It is calculated as follows:

$$\text{Weighted Avg. Inflation}_i = \theta_1 \text{Inflation}_{it} + \theta_2 \text{Inflation}_{it-1} + \theta_3 \text{Inflation}_{it-2}$$

Where: θ_1, θ_2, θ_3 represent three numbers that sum to 1 and are exponentially smaller in sequence (in this case, values of 0.665, 0.245, and 0.090, respectively); Inflation is the absolute

value of the annual inflation rate in the country i during year t as measured by the Consumer Price Index. The extent of price controls, as the second component of the monetary freedom index, is formed based on information on the status and implementation of the reform process in the country in the year under study and the second half of the previous calendar year. It is then assessed as a penalty deduction of up to 20 points from the base score. The banking system stability can be measured in terms of its ability to withstand various external and internal shocks (sustainability of the system), mitigate their adverse effects (resilience of the system), and, maintain public trust (reliability of the system) in case banking system deviates from the equilibrium. Therefore, the quantitative indicator of the stability of the banking system measuring is the coefficient of economy monetization, as it describes the financial situation of the economy, reflects public trust in the national monetary unit as well as the policies of monetary authorities. Indicators that describe compliance by commercial banks with economic standards and financial sustainability indicators, in particular, those developed by the International Monetary Fund under the Financial Sector Stability Assessment Programme, have no support or justification provided due to they are the result of regulatory actions by central banks and not the purpose of their activities. Quantitatively, the coefficient of economy monetization is calculated as the ratio of the monetary aggregate M2 as a percentage to GDP. Thus, the deepening and diversification of the financial system, increasing its size and liquidity, thereby determining its stability, is ensured by an increase in the level of economy monetization. The model inputs are represented by the components of Central banks' balance sheets that record assets and liabilities resulting from the use of a set of monetary policy instruments and methods. Accordingly, securities (x1), reserves (x2), foreign assets (x3), and refinancing operations (x4) are used as input parameters of the model. The turbulence and distortions created by the global financial crisis have provoked the central banks of many countries to instruments and mechanisms of unconventional, at least in the contemporary context, monetary policy including quantitative easing, credit mitigation, and term lending to achieve monetary policy goals and addressing financial system stability issues. Therefore, changes in the size and composition of central banks' balance sheets since 2008 have been an indicator of monetary policy stance (Curdia, Woodford, 2011). Confronted with risks and grave negative consequences of the financial crisis, many central banks have implemented one or several actions of the stabilization program such as term lending and other modalities of liquidity provision to give funding reassurance, direct lending operations for the non-bank private sector, purchasing medium and long-dated public sector securities on a large scale, offering explicit verbal guidance on the evolution of policy in the future (ECB, 2015). All these actions that represent instruments and mechanisms of monetary policy lead to increasing the size of the central bank's balance sheet and/or modifying its composition. The only monetary policy instrument that does not lead to a direct change in the size or / composition of the central banks' balance sheet is the short-term interest rate and, accordingly, does not provide information on the monetary policy position.

2.3. DEA model formulation

In this paper, the data envelopment analysis model was developed and applied in order to measure the efficiency of the regulation in a central banking context. Since the main task of the efficient government regulation in terms of monetary policy implementation is to maximize the level of public trust in the financial sector of the economy, expressed in the achieved goals, the modification of the model is oriented to output parameters (output-oriented). Thus, the achievement of maximization of output parameters at given resources will be considered efficient state regulation with zero reserves. Therefore, for central banks with inefficient government regulation in terms of monetary policy implementation, recommendations will be given for proportionally increasing the output parameters by φ times with unchanged input

parameters. In order to calculate the measure of the government regulation efficiency in terms of the implementation of monetary policy of the central bank, it is necessary to solve the following problem of linear programming:

$$E_{sr}^{mp} = (\varphi_i)$$

Where: E_{sr}^{mp} is the government regulation efficiency in terms of the implementation of monetary policy of the central bank; φ_i represents a coefficient that determines how many times a central bank can increase output when using inputs in a technically efficient configuration. The main provisions of the model are the following assumptions. Let there be N central banks that use K input parameters to produce M output parameters. For the i-th central bank, these data are expressed by vectors xi and yi, respectively. Matrix input parameters X (K×N matrix) and output parameters Y (M×N matrix) contain information about N central banks. In general terms, the objective function is defined as:

$$F = (\varphi_1, \varphi_2, \dots, \varphi_N) \to max$$

Furthermore, the system of basic limitations is as follows:

$$\sum_{i=1}^{N} \lambda_i \cdot y_{mi} - \varphi_i \cdot y_{mi}^{*} \geq 0, m = 1, \dots, M$$

$$x_{ki}^{*} - \sum_{j=1}^{N} \lambda_i \cdot x_{ki} \geq 0, k = 1, \dots, K$$

$$\lambda_j \geq 0, j = 1, \dots N$$

Where: λ_i is a vector of the weights (intensity variables) of the i-th central bank to be determined by the above programming problem (in the simulation process, all possible combinations λi, for which there is a solution, are sorted out in order to select only those values φ_i at which E_{sr}^{mp} = max); i is a sequential central bank number (i ϵ [1; N], N – observations (number of central banks whose primary goal is to ensure price stability and promote the stability of the banking system); x_{ki}, x_{ki}^{*} is observed amount of input of the k-th type of the i-th central bank (k ϵ [1; 4]); y_{mi}, y_{mi}^{*} is observed amount of output of the m-th type for the i-th central bank (m ϵ [1; 2]); E_{sr}^{mp} is the efficiency score to be calculated. Thus, the level of government regulation efficiency in terms of monetary policy is not determined as a single integral indicator, but by generalizing (in the corresponding mathematical configuration) the values of the relevant parameters (hierarchy of central bank goals) that form it. The system of purpose function restrictions for each i-th central bank having M + K + 1 constraint and, for a given task with four input parameters (x1, x2, x3, and x4) and two output parameters (y1 and y2), is the following:

$$\begin{cases} -\varphi_i \cdot y_{1i} + (y_{11} \cdot \lambda_1 + y_{12} \cdot \lambda_2 + \dots + y_{1N} \cdot \lambda_N) \geq 0 \\ -\varphi_i \cdot y_{2i} + (y_{21} \cdot \lambda_1 + y_{22} \cdot \lambda_2 + \dots + y_{2N} \cdot \lambda_N) \geq 0 \\ x_{1i} - (x_{11} \cdot \lambda_1 + x_{12} \cdot \lambda_2 + \dots + x_{1N} \cdot \lambda_N) \geq 0 \\ x_{2i} - (x_{21} \cdot \lambda_1 + x_{22} \cdot \lambda_2 + \dots + x_{2N} \cdot \lambda_N) \geq 0 \\ x_{3i} - (x_{31} \cdot \lambda_1 + x_{32} \cdot \lambda_2 + \dots + x_{3N} \cdot \lambda_N) \geq 0 \\ x_{4i} - (x_{41} \cdot \lambda_1 + x_{42} \cdot \lambda_2 + \dots x_{4N} \cdot \lambda_N) \geq 0 \\ \lambda_j \geq 0 \end{cases}$$

Finding a solution using the linear programming method is that it overcomes all possible combinations of λ_i for which there is a solution. The next step is to select only the value φ_i at which the goal function reaches its maximum. Thus, each output parameter of the central bank is scaled by the same factor φ_i until the limit of efficiency of the given central bank reaches a correspondingly determined limit of efficiency by Farrell. The defined measure of the efficiency with output-oriented DEA model determines the proportion (number of percentages) by which central bank management could increase the outputs in order to achieve the highest level of the government regulation efficiency with zero reserves in relation to other central banks that exist, real or hypothetical, and function optimally. The calculated value of the indicator E_{sr}^{mp} varies between one and positive infinity. An efficiency score equals one means that the central bank is efficient and thus located on the frontier. However, there are cases when the value of efficiency is less than one and means that even with the efficient use of input parameters across the various monetary policy instruments, the level of public trust in the financial sector is less than potentially possible. This indicates that public trust in the financial sector can be increased due to growth in the productive activity of central banks without any changes in the level of the input parameters used.

2.4. Model modification according to the scale effect

The DEA model allows to determine both long-term and short-term government regulation efficiency in the context of monetary policy implementation. By restricting the weights in the programming problem, two different efficiency measures could be obtained and interpreted with different scale assumptions: CRS-model (constant returns to scale) and VRS-model (variable returns to scale). CRS-model will be referred to as long-run efficiency. It was developed by Charnes, Cooper, and Rhodes (Charnes et al., 1978) and became one of the most widely used DEA models in a banking industry context. The algorithm of the CRS model corresponds to the solution of the problem in general terms described above. In this case, any comparisons between central banks of different sizes are allowed, as a constant return to scale is considered. In other words, the operating size of the central banks does not have an impact on the efficiency of the monetary policy they implement. This implies that in the long term, the central bank size is mostly irrelevant, and so the central bank can raise any combination of input and output parameters. Depending on the scale of production, the VRS model or the variable returns to scale model was developed by Banker, Charnes, and Cooper (Banker et al., 1984) and aimed to determine short-term efficiency. VRS model is used when the operating scale of the central bank plays an essential role in its goals achieving. In contrast to the previous model, in this case, the presence of the optimal value of the central bank is assumed. That is, a central bank of precisely this size can theoretically be more efficient in its activities aimed at increasing public trust in the financial sector than small or medium-sized central banks. Thus, the output-oriented VRS model evaluates the government regulation efficiency in terms of monetary policy implementtation of an ith central bank in comparison to other central banks that can be compared to it in terms of scale in the short term. Therefore, model estimation determines the pure technical efficiency of the central bank. For allowing variable returns to scale, it is necessary to add the convexity condition for the weights λi, i.e., to include in the described above model, the restriction imposes variable return to scale assumption on the reference technology:

$$\sum \lambda_i = 1$$

Thus, this constraint ensures that the central bank is only compared against central banks of a similar size.

2.5. Reserve of unused capacities

The Reserve of unused capacities could be viewed as an ability of the central bank to improve the efficiency of government regulation in terms of monetary policy implementation. However, the reserve of unused capacities and government regulation efficiency are inversely dependent. Therefore, the reserve of unused capacities of the central bank can be considered as lost opportunities for monetary policy implementation. Thus, the larger reserve of unused capacities the central bank has, the more inefficient it is. Mathematically, the method of finding a reserve would have the following expression:

$$\theta_i = E_{sr}^{mp} - 1$$

Approaching its expected value to 0 indicates the approximation of the public trust in the financial sector to its optimum. Other values reserve of unused capacities could be interpreted as the generalized characteristics of the shortfall in public trust in the financial sector as a result of irrational use of the monetary policy instruments and mechanisms.

3. CONCLUSION

Financial sector development, ensured by trust in the banking system, is an essential prerequisite for sustainable economic and social growth. The foregoing contributions to building a solid and reliable foundation for economic growth depend to a large extent on the efficiency of the state regulation in terms of monetary policy strategy, which has been adopted. Measuring its efficiency is one of the challenging research and practice questions of central banks. The existence of a plurality of monetary policy objectives central banks charged with, that are also generally heterogeneous across the countries, the difficulty in the quantitative measurement of the central banking achievements, the complexity of instruments and mechanisms that central banks could use in order to pursue its goals makes the application of the standard techniques pose challenges. An output-oriented data envelopment analysis method, which is widely used to measure efficiency within the banking industry, was developed and applied in order to measure the efficiency of government regulation in a central banking context. In order to get a reliable, relevant, and interpretable result, input and output variables were selected according to the Central banks' majority core strategy and objectives. Input factors are represented by the components of Central banks' balance sheets that record assets and liabilities resulting from the use of a set of monetary policy instruments and methods. While the Heritage Foundation index on monetary freedom and coefficient of economy monetization characterize price stability, reliability, and stability of the financial system in a quantitative dimension and, therefore, was used as outputs in the model. The proposed measure of monetary policy efficiency could be used as an aid to detect so-called reserves of unused capacities, and hence to provide for recommendations as to the regulations and incentives, or managerial practices, that will contribute to promoting greater trust in the financial sector and price stability that each central bank seeks to maximize given its limited amount of inputs.

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