

Chapter 36

Analysis Results for the Effectiveness of Monetary Policies With Fuzzy Logic

Hasan Dinçer

Istanbul Medipol University, Turkey

Serhat Yüksel

Istanbul Medipol University, Turkey

ABSTRACT

This chapter aims to examine the effectiveness of central bank policies in E7 economies. For this purpose, five different monetary policy instruments (required reserve ratio, rediscount rate, open market operations, standing facilities, and asset purchase program) are defined as the criteria. On the other side, E7 countries are selected as the alternatives. In the analysis process, fuzzy DEMATEL approach is used to weight the criteria whereas fuzzy TOPSIS and fuzzy VIKOR methods are considered to rank E7 economies. The findings show that open market operations are the most important criterion. However, changing required reserve ratio does not have any powerful impact on the market. Therefore, it is recommended that E7 countries should prefer open market operations instead of required reserve ratio in order to influence the market in an effective manner. Additionally, it is defined that Indonesia has the best performance in the E7 economies while Brazil takes place on the last rank.

GENERAL INFORMATION ABOUT THE ANALYSIS

In this first analysis, effectiveness of the monetary policies in the central banks of E7 countries is measured. For this purpose, five different monetary policies are selected as the criteria. These are Required Reserve Ratio (C1), Rediscount Rate (C2), Open Market Operations (C3), Standing Facilities (C4), Asset Purchase Programs (C5). In addition to this situation, Brazil (A1), Russia (A2), India (A3), China (A4), Mexico (A5), Indonesia (A6), Turkey (A7) are selected as the alternatives. Fuzzy DEMATEL approach

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is used to weight the dimensions. On the other side, alternatives are ranked by using fuzzy TOPSIS and fuzzy VIKOR. The details of this analysis are given in the following subtitles.

IDENTIFYING THE WEIGHTS OF CRITERIA

Step 1: Define the multicriteria decision making problem: The effective use of monetary policy instruments is discussed for the emerging countries. A set of criteria is determined to measure the performance of the economies. So, 5 Monetary policy instruments are defined as Required Reserve Ratio (C1), Rediscount Rate (C2), Open Market Operations (C3), Standing Facilities (C4), Asset Purchase Programs (C5) are listed to evaluate the central bank success in the emerging economies. For this purpose, Brazil (A1), Russia (A2), India (A3), China (A4), Mexico (A5), Indonesia (A6), Turkey (A7) that are called E7 economies are selected as a set of the alternatives.

Step 2: Provide the evaluations of decision makers: 5 Decision makers that are experts in the field of financial markets in emerging economies are appointed to provide their linguistic evaluations for the criteria and alternatives. Linguistic evaluations are converted into the fuzzy numbers to compute the performance results of criteria and alternatives. By considering the evaluations, weights and ranking results are computed with the proposed multi criteria decision making model (Dinçer and Hacıoğlu, 2017; Dinçer et al., 2016). Table 1 and 2 define the linguistic scales and fuzzy numbers for criteria and alternatives respectively.

Table 1. Linguistic variables of the impact-relationship degrees

Influence Level	Triangular Fuzzy Numbers		
No (N)	0	0	0.25
Low (L)	0	0.25	0.5
Medium (M)	0.25	0.5	0.75
High (H)	0.5	0.75	1
Very High (VH))	0.75	1	1

Source: Dinçer (2018)

Table 2. Linguistic scales for rating of alternatives

Definition	Triangular Fuzzy Numbers		
Worst (W)	0	0	2.5
Poor (P)	0	2.5	5
Fair (F)	2.5	5	7.5
Good (G)	5	7.5	10
Best (B)	7.5	10	10

Source: Dinçer et. al. (2018)

However, Tables 3-8 illustrate the linguistic opinions of each decision maker on the criteria and their fuzzy numbers for the impact-relationship of criteria respectively.

Table 9-16 represent the linguistic evaluations and fuzzy numbers of alternatives for the decision matrix.

Step 3: Weight the criteria: Monetary policy instruments defined as a set of criteria are weighted by using fuzzy DEMATEL. First, the averaged fuzzy values of decision makers evaluations have been computed to construct the initial direct-relation matrix by the equations (1) and (2). Table 17 defines the averaged results of the direct-relations matrix.

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