Implementation of Backpropagation Artificial Neural Network Algorithm for Turkey Currency Crisis Detection Based on Financial Pressure Index

Sugiyanto¹, Isnandar Slamet², Etik Zukhronah³, Alvina Aulia Rahma⁴, Ihsan Fathoni Amri⁵

ABSTRACT

The currency crises that hit Turkey in 1994, 2001, and 2018 caused the depreciation of the Turkish lira and caused severe adverse effects, especially in the economic sector. In response to these events, this study aims to develop a predictive model capable of identifying future currency crises to help mitigate potential losses. The purpose of this study is to build an early warning model for currency crises in Turkey based on macroeconomic indicators using the Multilayer Perceptron Backpropagation (MLPBP) approach, optimized with the SGD, ADAM, NADAM, and AdaBound algorithms. The independent variables consist of 11 macroeconomic indicators from January 1990 to December 2022, while the response variable is the perfect signal value determined through the Financial Stress Index (FPI). The analysis reveals that the best performing model is the MLPBP optimized with NADAM, achieving an accuracy of 97.29% on the validation data and 93.33% on the test data. The detection results show that no currency crisis is expected to occur in Türkiye from January 2023 to December 2024. This study highlights the importance and potential of machine learning approaches, particularly neural network models, in improving early detection and prevention of currency crises.

Keywords: Currency Crisis, Macroeconomic Indicators, Multilayer Perceptron Backpropagation (MLPBP), Financial Pressure Index (FPI), Early Crisis Detection.

¹ Department of Statistics, Sebelas Maret University, Indonesia. Email: <u>sugiyanto61@staff.uns.ac.id</u> (correspondence author)

² Department of Statistics, Sebelas Maret University, Indonesia. Email: <u>isnandarslamet@staff.uns.ac.id</u>

³ Department of Statistics, Sebelas Maret University, Indonesia. Email: <u>etikzukhronah@staff.uns.ac.id</u>

⁴ Department of Statistics, Sebelas Maret University, Indonesia. Email: <u>alvinaauliarahma@student.uns.ac.id</u>

⁵ Department of Data Science, Muhammadiyah Semarang University, Indonesia.

E-mail: ihsanfathoni@unimus.ac.id