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Stable forecasting of tax revenues of selected countries assisted by Clustering Approach

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Tax is one of the main income of a government that utilizes in public welfare and future investment. Taxation has goals: reducing the inequalities through a policy of redistribution of income, administrating the levels of inflation as well as deflation, protecting the local industries from foreign competitions through levies, and discouraging the undesirable activities such as consumption of tobacco. Additionally, taxation provides a major portion of Gross Domestic Product (GDP), depending on the country's fiscal policy. Tax forecasting is essential towards strategizing government plans and future activities. However, tax revenue highly fluctuates due to many factors which include natural disasters, instability of political environment and government monetary policies. This study aims to find the set of best statistical forecasting models, by comparing the behavioral similarities of different tax revenues identified by clustering approach. Here, tax revenue data from 1972 to 2017 of 24 countries belonging to developing status: developed, developing and under-developed have been analyzed. Comparable and homogenize measure is obtained considering the tax revenue as a percentage of GDP. The countries with similar tax revenue are identified by using K-Means clustering. Consequently, the selected countries were clustered into five classes depending on their tax revenue as a percentage of GDP. The analysis shows that the tax revenue has similar behavior based on the similarities of countries' developing status. Tax revenues data in each cluster were analyzed to identify the best fitted time series models. It has been found that models of the types Autoregressive Moving Average (ARMA) and Autoregressive (AR) are best fitted models for the representing tax revenue of the corresponding clusters. As an example, ARMA (2,2) model was fitted to one cluster and AR (1) model was fitted for another cluster of countries. According to the type of the model and their range of parameter values, it is found that similar models can be used to represent the tax revenue data within the underlying cluster. That is, there exist cluster specific models in the sense of model type and their parameter ranges. This finding can be utilized towards forecasting tax revenue in the case of the revenue data are highly affected with a qualitative factor, for example, political instability. In summary, through the clustering approach, stable forecasting of revenue data of a given country can be performed.

Keywords: Taxation, GDP, Clustering, K-means, Time Series Analysis