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# The Performance of ARIMAX Model and Vector Autoregressive (VAR) Model in Forecasting Strategic Commodity Price in Indonesia

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## Abstract

Rice as one of the strategic commodities has an important role in the life of Indonesian society. This is cause of rice is the main food of the Indonesian nation. Therefore, the stabilization of food prices is one of the priorities of the Indonesian government's policy. It can minimize the impact of the global financial crisis such as inflation and purchasing power of the poor. The stability price can be maintained by price forecasting for several periods ahead. It can be used to set up the anticipatory action. In this research, ARIMAX model and VAR model used to forecast the rice price. This model involves several variables including consumer rice price (HKB), production (PROD), dry milled rice (GKP), harvested area (LP), and rice price in Thailand (HD). The results show that ARIMAX model can predict the rice consumer price with MAPE 0.15%. This is 15.27 % better than VAR model. The GKP variable did not significantly affect to the rice price. This is indicated by the MAPE difference between model with GKP and model without GKP is less than 0.01%.

*Keywords:* Forecasting; Arimax; Vector Autoregressive; Price; Strategic Commodity; Rice

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## 1. Introduction

Rice has an important role in the life of Indonesian society. It is considered an important food because it is the main staple food of the Indonesia. Rice consumption in Indonesia is among the highest in the world [1]. The average national rice consumption in 2010 was 139.15 kg per capita / year and corrected to 113.48 kg per capita / year 2011 compared to the consumption rate of rice in some neighboring countries (Malaysia: 80 kg / person / year, Thailand: 90 kg / person / year and Japan: 60 kg / person / year) or the average world per capita consumption of rice only 60 kg per capita / year. Therefore, the supply of rice becomes very important. Rice supply in Indonesia also has an influence on several areas, such as economic, environmental, and socio-political fields [1]. Most Indonesians want a stable supply and price of rice, available over time, distributed evenly, and provide affordable prices [2].

Seeing the importance of the need and influence of rice, the Government of Indonesia always strives to improve food security, one of which is to maintain rice supplies [1]. Sufficient rice content will also affect the price of rice on the market. The price of rice also has a very significant influence on the various areas as to which the supply of rice [3]. In addition to rice supplies, the price on the market is influenced by other things such as rice production, harvested area, rice prices in other countries, and others. For that reason, stabilizing rice prices has become one of the priorities of Indonesian government policy, as this can minimize the impact of the Indonesian financial crisis as inflation and purchasing power of the poor [4]. The stability price can be maintained by price forecasting for several periods ahead. It can be used to set up the anticipatory action [5].

The VAR forecasting model is widely used by researchers and shows success in forecasting macroeconomic and regional variables [6]. VAR was once used to build models by looking at relationships between variables by determining co integration vectors in the variables used [7] and for predicting food consumption, the Consumer Price Index (CPI), Gross Domestic Product (GDP), and investment in South Africa [8] . In addition, VAR is also used to predict macroeconomic data [9], government bond yields [10] and point and density in Euro [11].

While the ARIMAX model has not been widely used in terms of forecasting in the economic field, it proves good to predict variables that are affected by some other variables. ARIMAX proves to be good for modeling the growth of influenza disease [12], kids clothes demand forecasting [13], forecasting number of dengue fever cases [14], and forecasting number of tuberculosis patients [15].

Based on this,in this research, ARIMAX model is tried to be applied in forecasting economic data (price of rice) which have fluctuation and level of uncertainty is very high. After that, the results are compared with forecasting results using the VAR model.

## 2. Data description

The data which is used is in the form of monthly period data from 2000-2015. The variables used are retail consumer price (in units of Rupiah/kg), rice production (in tons), domestic and overseas rice procurement (in ton, net), dry paddy harvest price (Rupiah/kg), rice harvest area (in hectares), Bangkok rice price 5% (in US \$/MT, FOB). The interpolation method is used to complete the blank entries in the retail consumer price rice data. Meanwhile, triple exponential smoothing is used to complete the data of rice procurement, the price of dry grain harvest, and harvested area. Each variable has a different data pattern. The pattern of each data is shown by Fig. 1.

In this study, retail consumer price rice acts as an independent variable, while rice production, rice procurement, dry harvested paddy price, harvested area, world rice price (Bangkok 5%) act as dependent variable.

## 3. Methodology

The methodology adopted for forecasting is as follows.

### 3.1. Stationary data test

The result of the stationer test in the variant shows that the price of rice consumer (HKB) is not stationary in Box Cox variance. Plot is shown in picture 2 that the rounded value obtained from the box-plot check is 0.001 with the