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The Dynamic Simulation Model of Local Soybean Competitiveness Policy to Support the Soybean Price Stabilization

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Abstract. Fluctuations in soybean commodity prices become a crucial issue in Indonesia every year**.** In this study, it is proposed to conduct a research on the development of a dynamic simulation model for fulfilling the logistics of soybeans, which aims to look at the competitiveness of local soybeans and to support soybean price stability (case study: in Central Java Province). Researchers focus on examining the relationship between variables in the system for fulfilling soybean logistics in Central Java, namely food needs (demand), total soybean availability (supply) and soybean prices using a dynamic system framework. This study also aims to identify factors in increasing local soybean competitiveness towards meeting the needs of consumers with dynamic system simulations to increase local soybean competitiveness in the national market and stabilize soybean prices that can benefit both parties, namely producers and consumers. Based on simulation results, to look at the competitiveness of local soybeans and to support soybean price stability for the next 20 years using software powersim studio 10, the government needs to take action as follows: (1) Dummy monopoly bulog intervention in soybean import price and soybean producer prices; (2) Increasing soybean import tariffs 20%; (3) Increasing soybean local prices with predicting soybean price conditions.

1. Introduction

Fluctuations in soybean commodity prices become a crucial issue in Indonesia every year [1]. Fluctuations in food prices always make it difficult for food producers and consumers and for the economy as a whole, because the direction and development, especially the end result is difficult to predict beforehand, so that economic growth is disrupted. Therefore, almost all countries in the world always try to overcome this fluctuation through food price stabilization. Based on simple logic, food price stabilization is an effort to create a climate that encourages food distribution to benefit producers and help consumers, so that distribution management is not only based on market mechanisms that are very dynamic and dependent on various factors and policies, because the government is obliged to manage food availability as long as time.

One of the industrial commodities made from agricultural raw materials that have the ability to compete is soybean as a raw material for the processed soybean industry. Soybean has become a culture in Indonesian society in the household economy of farmers, food consumption, needs and national food trade [2]. Utilization of soybean seeds in addition to direct consumption, is also an industrial raw

material, such as fermented products such as tempeh, soy sauce, tauco, oncom, soy fresh and nonfermented products including tofu, milk, soy cheese, yuba and artificial meat.

Soybean needs increase every year, along with increasing population growth, public awareness of nutrition, which is characterized by increased consumption of soybeans per capita and the growth of the processed soybean product industry. Based on data released by BPS, the average per capita consumption of soybeans in Central Java is 10 kg / year or 0.1 quintal / year and continues to increase along with the increasing population in Central Java. The current problem is the demand for soybeans continues to increase, but cannot be matched by domestic production. To fulfill this, imports are increasing every year. Since 1975 Indonesia's position has shifted from exporting countries to importing soybeans [3]. This is because soybean demand is so fast, while production develops slowly due to low local soybean productivity [4].

In the last decade, there has been a decline in the amount of production due to soybean price problems that affect farmers' decisions in producing [5]. The government has made various efforts to increase the production and fulfillment of soybean needs since 1986. But the target of soybean production has not been achieved due to various problems [4]. Low local soybean production causes insufficient local soybeans to meet the demand of the soybean processing industry. This causes the dependence of soybean processing industries on imported soybeans [6]. Central Java contributed 13.95% of Indonesian soybean production (an average production of 123.54 thousand tons). Empirically the increase in soybean prices is caused by the element of scarcity on the supply side, or local soybean production is slower than demand [7] [8]. According to the Indonesian Ministry of Trade, more than 90% of Indonesia's soybean needs are still met from imports. Large depending on soybean consumption, especially in Java, will have an impact on dependence on imports if there is no significant increase in domestic production [9].

In this study, it is proposed to conduct a research on the development of a dynamic simulation model for fulfilling the logistics of soybeans, which aims to look at the competitiveness of local soybeans and to support soybean price stability (case study: in Central Java Province). Researchers focus on examining the relationship between variables in the system for fulfilling soybean logistics in Central Java, namely food needs (demand), total soybean availability (supply) and soybean prices using a dynamic system framework. This study also aims to identify factors in increasing local soybean competitiveness towards meeting the needs of consumers with dynamic system simulations to increase local soybean competitiveness in the national market and stabilize soybean prices that can benefit both parties, namely producers and consumers.

Dynamic system frameworks can be used to analyze models and scenarios to improve system performance because of the ability to represent physical flows and information, based on feedback control information that is continuously transformed into decisions and actions [10]. The main objective of this research is to see how to analyze and find alternative solutions quickly and as expected to see the stability of soybean prices over the next 20 years using software powersim studio 10. The results of the model scenario can be used as supporting material for government and stakeholder decisions in developing strategies for implementing increased local soybean competitiveness in the national market and stabilizing soybean prices. Thus, stakeholders can utilize the results of this simulation to make strategic decisions.

2. Basic Theory

2.1 Price Stabilization Policy

Soybean demand from year to year is increasing, but Indonesia has various problems such as the small production of soybeans, on average only reached around 40 percent so that it meets the shortage of the soybean supply through imports [11]. In 2013, the Government issued a policy of Soybean Price Stabilization Program (SHK Program) to stabilize soybean prices at the farmer level and at the craftsman level simultaneously. This is done by the government considering that since August 2012, domestic soybean prices have increased and soybean prices are difficult to control. The Ministry of Agriculture's Food Security Agency is directly involved in the formulation of SHK Program policies, from the process of drafting regulations, to the mechanism of policy implementation, including determining the purchase

price of soybeans at the farm level. The soybean price stabilization program (SHK) is a regulation on soybean purchases from farmers, soybean imports and soybean sellers to tofu and tempeh sellers. The SHK policy was issued on May 28, 2013 through the Minister of Trade Regulation No.23 / 2013 about Soybean Price Stabilization program which is the implementation of Perpres No.32 / 2013 about assignment to Perum Bulog for safeguarding soybean price and distribution. Through the soybean price stabilization program, the government is trying to regulate soybean trade through purchasing soybeans.

2.2 System Dynamics

A dynamic system is a framework that focuses on systems thinking by using a feedback loop and taking some additional structural steps and testing it through a computer simulation model [12]. The process of comparing outputs with inputs in a system, also known as a feedback system, is a general concept [13]. A statistical correlation between a pair of variables is taken from existing data in a state that these variables have a relationship with other variables in the system and all of them change simultaneously [14]. Stocks and flows are the main components of a dynamic system. A stock represents the storage of some type of information or entity (such as money or population) in the system. Flows define the rate of change in stocks and adds more than the type of information or entity to stocks, removes some to be replaced elsewhere in the system, or removes from the system. System dynamics can be used as an analytical tool to evaluate the impact of short-term and long-term policy. The final goal of the simulation model creation is validation of models and scenarios decisions. The purpose of the validation is that the model created can certainly approach the original and credible system. The credibility of the model can be expressed from the results of the verification and validation of the model. Credible models can be simulated using computer-assisted predictions to see results quickly.

3. Previous Research

By using a dynamic system framework for fulfilling food logistics to support soybean price stability in Central Java to illustrate price stability and to formulate several future policy scenarios. Research related to local soybean competitiveness and soybean price stabilization in Indonesia ever conducted by previous researchers using various methods including a system dynamics approach. The strategy to create soybean competitiveness [15] through a policy of combining soybean price increases and import tariffs of 20% will stimulate producers to increase their harvest and production areas. The research also studies and establishes factors in increasing local soybean competitiveness through policy simulations. Other studies [16] include several additional conditions such as soybean imports, sales, import volumes, import taxes, soybean import demand, dollar exchange rates, etc. The research also studies about the scenario of stabilization soybean prices to increasing farmer productivity through the implementation of policies related to import soybeans.

4. Research Steps

This research consists of four stages: data collection, analysis of existing conditions, design of computer model and perform the process simulation with scenarios. Figure 1 shows the chart of the research methodology to solve the problem. The variables involved can be identified by conducting in depth interviews and study the literature conducted in previous research.

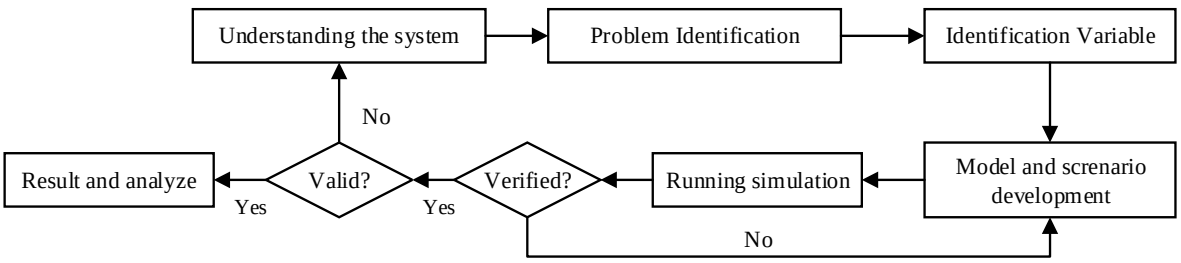

Figure 1. Research Method

4.1 Research Information and Data

This study uses secondary data from BPS and the Department of Industry and Trade Central Java Province, also related to research that has been conducted in the Central Java region.

4.2 Analysis of Existing Condition

Soybean trading system, which is dominated by importers, often has an impact on the instability of soybean prices at the community level, both producers, in this case, tofu and tempe producers, consumers or the wider people. Soybean dependence on imported products also affects domestic prices due to fluctuations in soybean prices on the international market. This condition causes soybeans to influence changes in inflation [17]. In addition to the availability of land, the availability of farmers who want to grow soybeans is also important. Farmers do not want to grow soybeans if they cannot benefit from agriculture [18]. Farmers will lose if people prefer to import soybeans because the price is cheaper. Lower selling prices will encourage farmers to use their land for cultivation of other food [19]. The establishment of government purchase prices does not help if the soybean import price is still cheaper than the soybean local prices. To overcome this problem, it is necessary to keep the soybean import price under control.

Price instability will also make farmers switch crops other than soybeans. Many factors affect price instability, one of which is price and quality competition with import soybeans [20]. Soybean local prices are influenced by soybean producer level prices, import prices and volumes, productivity and soybean local prices in the previous year. Soybean producer prices are influenced by production, import volumes, soybean consumption, dummy monopoly Bulog and soybean producer prices in the previous year. Import volumes are influenced by soybean international prices, production, consumption, population and import prices. Soybeans import price is influenced by international prices, dollar exchange rate, import tariffs, dummy monopoly Bulog and import prices of the previous year. In a systems approach, these conditions can be explained in the Causal Loop Diagram below (Fig. 2). Causal loops are made to describe the interaction or cause-effect relationships of the main variables that will be created in the model. Causal relationships in the model can be positive and negative. Figure 2 shows the CLD of this study.

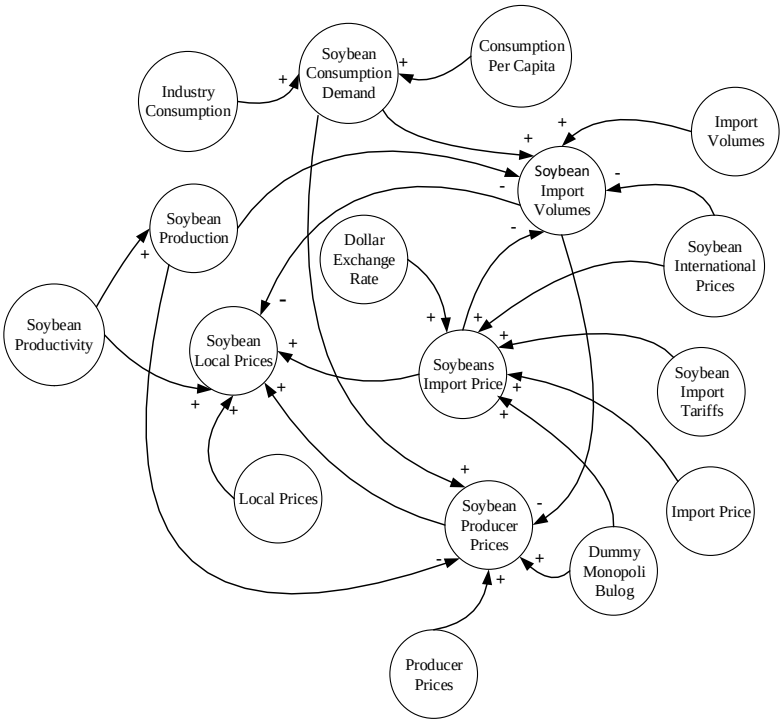

Figure 2. Causal Loop Diagram

4.3 System Dynamics Model

Data modeling is carried out to verify and validate the relationships between variables (model formulation) to suit the model with the actual system. Based on a causal loop diagram, a dynamic model of local soybean competitiveness can be developed to support soybean price stability to the stock flow diagram. It can be seen in the Figure 3 base model of local soybean competitiveness to support soybean price stability using software powersim studio 10 explained as follows (Fig. 3):

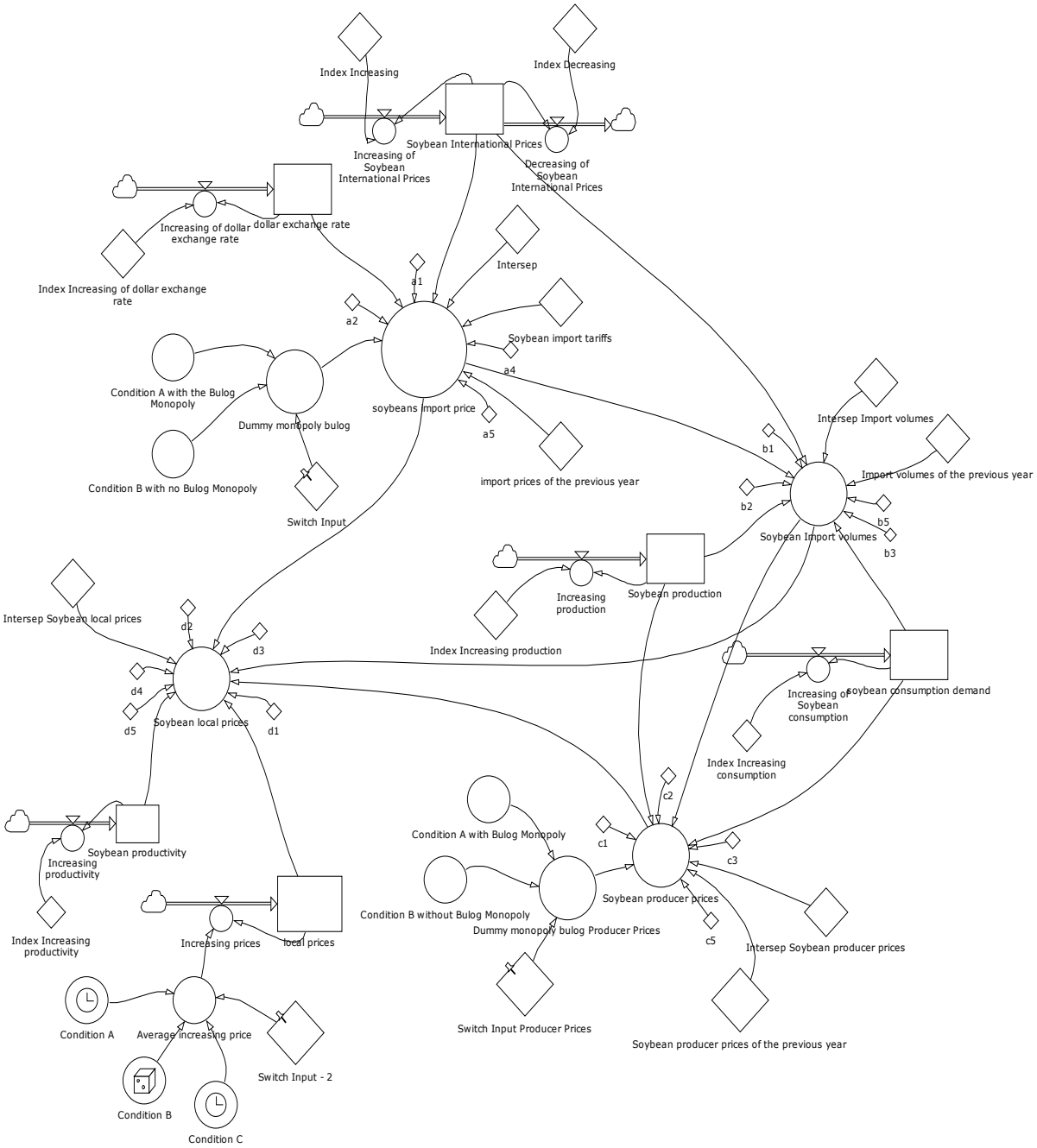

Figure 3. Causal Loop Diagram

4.4 Model Simulations

The base model is a basic model that will later be developed for analysis. The initial step is to identify related variables that affect the main system. Model simulations are carried out to obtain the results and behavior of the system during the simulation period. The simulation is run by entering the values of the

input parameters and changing the structure of the model if necessary. The simulation period used for the model is from 2018 to 2038. To see the competitiveness of local soybeans and to support soybean price stability in the next 20 years, the following scenarios are carried out: (1) The scenario without dummy monopoly Bulog intervention; (2) Scenarios of with dummy monopoly bulog intervention on soybeans import price and soybean producer prices; (3) Scenarios for increasing soybean import tariffs 20%; (4) Scenario of increasing soybean local prices.

4.4.1 Result of Model Simulation

The simulation process is done using software powersim studio 10. The data used came from secondary data from BPS and the Department of Industry and Trade Central Java Province, also related to research that has been conducted in the Central Java region.

4.4.1.1 Scenario without dummy monopoly bulog intervention.

The variable without dummy monopoly Bulog has an effect on lower import prices and more import volumes. If the soybean import price is cheap, it will disadvantage farmers because local soybeans are valued cheaply, so they cannot cover farming costs. This also shows that without the monopoly on soybean trade by Bulog, the effect on soybean local price has decreased from the previous year. Increasing soybean import volume will reduce the soybean local price. If Bulog does not monopolize soybeans, the soybean import price is getting lower. As a result, many soybean processing industries use soybean import. This resulted in sluggish local soybean production.

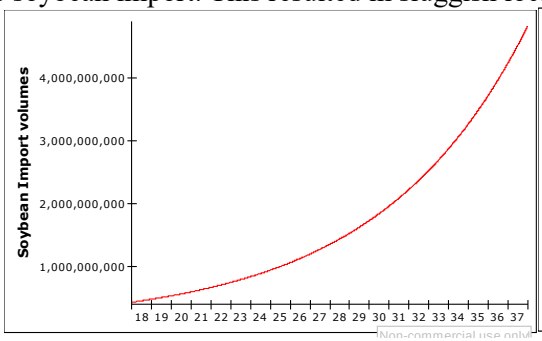

Figure 4. Soybean Import Volume

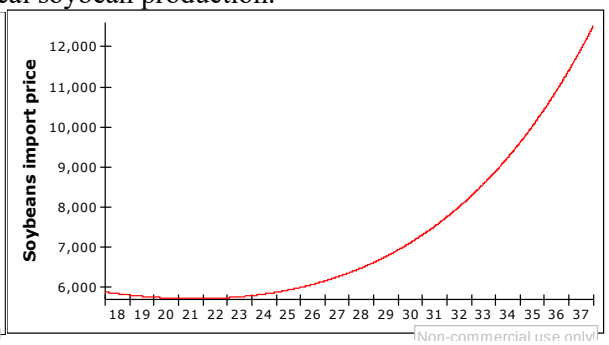

Figure 5. Soybeans Import Price

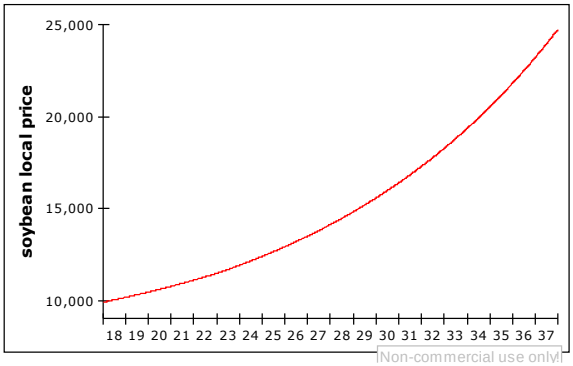

Figure 6. Soybean Local Price

4.4.1.2 Scenarios of with dummy monopoly bulog intervention on soybeans import price and soybean producer prices.

The variable dummy monopoly Bulog has an effect on increasing soybean local price, decreasing import volumes and increasing import prices. This shows that the monopoly Bulog causes the soybean local price to increase. Bulog has a role in stabilizing domestic soybean prices, through the procurement, storage and distribution of soybeans. The aim is to ensure the availability of soybean, especially for the

tofu and tempeh industry, especially for Kopti members. If Bulog manages soybeans, a quota policy can be implemented, so that import volumes can be controlled.

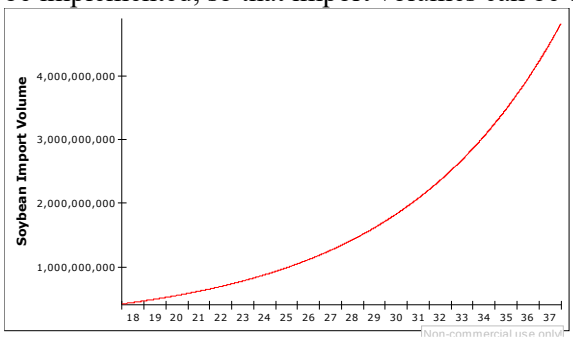

Figure 7. Soybean Import Volume

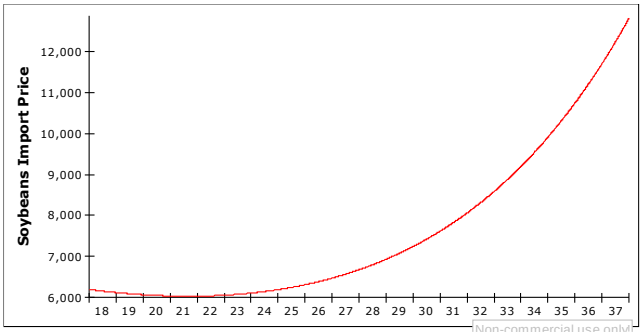

Figure 8. Soybeans Import Price

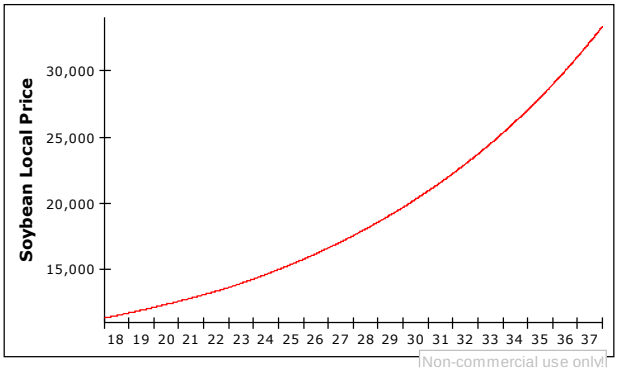

Figure 9. Soybean Local Price

4.4.1.3 Scenarios for increasing soybean import tariffs 20% and dummy monopoly Bulog intervention.

The government is currently implementing an import tariff policy 0.5% for soybean commodity to prevent the amount of import soybeans and effort to increase domestic soybean production. By raising import tariffs 20%, so there is an increase in the soybean import prices. This shows that the increase in the soybean import prices will stimulate an increase in the soybean local price, so farmers are interested in planting soybeans again, the implication of this is an increase in soybean production. This is consistent with observations at the industry level that soybean local price provisions are based on market mechanisms by following soybean import prices with soybean local price slightly above import prices.

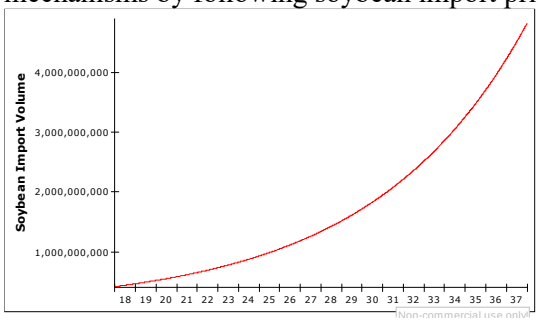

Figure 10. Soybean Import Volume

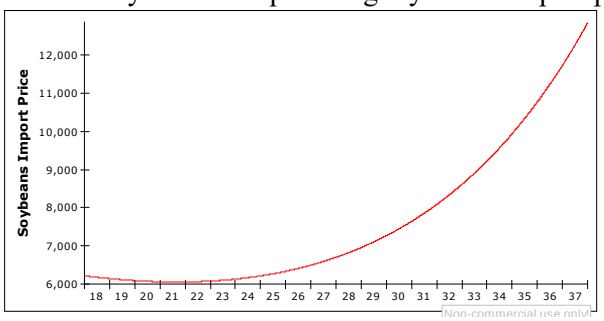

Figure 11. Soybeans Import Price

4.4.1.4 Scenario of increasing soybean local prices.

By raising the soybean local prices properly, it is estimated that farmers will benefit properly and consumers buy at affordable prices. If the government tries to increase local soybean production and farmer income, it is necessary to have a policy to determine the soybean base price that benefits farmers.

Predict soybean prices with 2 conditions: (1) Condition B: Soybean prices have increased randomly to normal distribution with a mean of 8.1% per year and a standard deviation of 1% per year; (2) Condition C: The average price increase in the form of a cycle with a price increase of 8.1% per year and a change of 5% per year in 5 years.

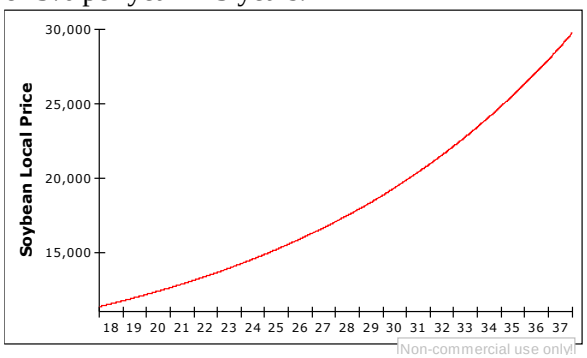

Figure 12. Soybeans Import Price Condition B

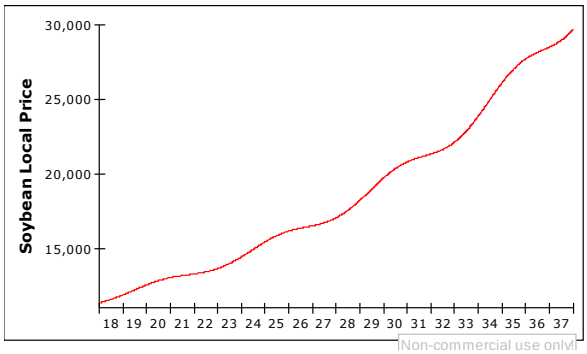

Figure 13. Soybeans Import Price Condition C

5. Conclusions

Based on simulation results, to look at the competitiveness of local soybeans and to support soybean price stability for the next 20 years, the government needs to take action as follows:

1. Dummy monopoly bulog intervention on soybeans import price and soybean producer prices. The variable dummy monopoly Bulog has an effect on increasing soybean local price, decreasing import volumes and increasing import prices.
2. Increasing soybean import tariffs 20%. This shows that the increase in the soybean import prices will stimulate an increase in the soybean local price, so farmers are interested in planting soybeans again, the implication of this is an increase in soybean production.
3. Increasing soybean local prices with predicting soybean price conditions. By raising the soybean local prices properly, it is estimated that farmers will benefit properly and consumers buy at affordable prices.

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