Financial Strategy Model for Social Health Insurance in Indonesia using Simulation

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Abstract. Social Health Insurance (SHI) in Indonesia is still facing many obstacles, especially the financial aspects from 2014 to 2017 due to the SHI financial losses that has received more attention from the public and the government in Indonesia. Therefore, this study intends to provide financial strategy recommendations that will get a stability revenue over cost. Dynamic system simulation approaches are used to obtain optimal financial strategies that take into account variable costs and income decisions. The parameter of the load variable is medical costs while the income variable is obtained from the participant premium rate factor. The data come from 2016 and 2017 related data to membership, especially PBPU (Participants Not Wage Recipients). Then, the equation used to find the right strategy is Income ≥ Expenditures. In conducting simulations, scenarios are designed to reduce the level of financial losses that occur in SHI. The scenario of this research is a scenario that changes the parameters of premium rates and benefit costs. The combination of medical cost and premium scenarios is a recommendation from the SHI financial strategy because it gets optimal results so that financial SHI does not occur in a losses. In addition, the results of this study can contribute to the resolution of BPJS Health financial problems in Indonesia which continue to experience a losses.

1. Introduction

Insurance is a component of social justice and social security. Insurance is an instrument in the economic sector as one of the main components of financial markets [1]. So, health insurance is insurance in the social form that guarantees medical care. Health insurance has three schemes namely Commercial Health Insurance, Public Health Insurance, and Social Health Insurance (SHI). The ongoing health insurance in Indonesia is Social Health Insurance. This insurance was initiated by the government as a public health insurance program handled by BPJS Kesehatan (Social assurance agency on Health) [2].

Social health insurance differs from other types of insurance because of the form of financing and management of health services based on risk of unification [3].

Based on three types of insurance, many countries are currently implementing health sector reform by setting good health insurance premiums [4]. In this case, the Palmucci and Dague (2015) study proved correct because in Indonesia there was a financial losses problem in 2015 on health insurance so the government continued to make improvements. Furthermore, in 2016, the government established a policy by increasing premiums as the best premium arrangement solution so that health insurance continued. In this case, Retnaningsih (2017) and Simanjuntak (2016) agree with government policies because losses occur because participant premiums are lower than the health costs incurred so that...
premium increases make sense. In fact, according to Mas’udin, 2017, premiums paid by participants are not comparable to the services provided in relation to health facilities and available medical personnel. In accordance with the problems described earlier, it is necessary to review the financial losses of Social Health Insurance in Indonesia so that strategies for solving problems use dynamic systems. Dynamic systems are usually used to simulate, model, and describe dynamic systems. Therefore, this research is very necessary because it provides an important contribution so that the constraints of SHI Indonesia's managers are quickly resolved especially in the financial aspects.

2. Framework

The framework in this research use to develop the system dynamic model about SHI in Indonesia. The proposed model framework is obtained from valid literature and framework. The framework will be shown in the following Figure 1.

![Figure 1. Framework](image)

In making a conceptual model it is necessary to go through three steps, namely to arrange the Input Output Diagram, identify variables, and build the Causal Loop Diagram. This stage becomes an important part because it is used as a reference for preparing the Stock Flow Diagram model. Afterward, parameter estimation is needed to process data from the system. Parameter value in the research is get from collecting data. The collecting data is from SHI managers, especially in Indonesia, namely BPJS. Data obtained from BPJS is total participant SHI such as Individual participants, Paid Workers participants - government employee (PPU-PN), Paid Workers participants - company employee (PPU-BU), and Dues Assistance Recipients participants (PBI). Moreover, the research need budget data from annual financial statements that have been audited. The data is take in 2016 and 2017. Data that has been obtained is then analyzed to find the right strategy recommendations for financing SHI. Data are shown in Table 1 below.

### Table 1. Actual Data

| Variable | 2016               | 2017               |
|----------|--------------------|--------------------|
| Incomes  | 74,167,034,000,000 | 74,748,969,000,000 |
| Expenses | 70,893,773,000,000 | 85,002,634,000,000 |

3. Method

The steps in the research taken include build model, create Causal Loop Diagram, and create Stock Flow Diagram. In the step of build model, there are several steps taken to design the model with dynamic
system simulation methods including create Causal Loop Diagram, create Stock Flow Diagram, build verification and validation model, and contrive scenarios. The stages in making a simulation model in this study are used to model Social Health Insurance (SHI) in Indonesia. Modeling income and expenditure as an indicator of the financial condition of the SHI, as well as other supporting variables. So the simulation results can help in getting a stable optimal financial between SHI costs and income.

In building a simulation model with a dynamic system approach, the first step that needs to be done is to formulate a model in accordance with the existing conditions of the financial condition of Social Health Insurance (SHI) in Indonesia. The Causal Loop Diagram (CLD) concept is needed to identify and connect between variables that affect financial SHI based on the BPJS Health system, references relating to SHI, and related data. After building CLD, the next step is to build a Stock Flow Diagram (SFD). SFD concept is data modeling that aims to determine behavior patterns and relationships between variables. From this stage, you can find out the compatibility of the model with the behavior in actual conditions.

In the search for solutions so that SHI finance does not loss, the income received is greater or equal to the expenses borne. SHI income obtained from income of participant premium and others (investment, grants, etc.). Whereas, expenses are obtained from benefit costs (claim cost, capitation cost, an non capitation cost) and others (investment, technical reserves, etc.). Participant premium income is obtained from monthly contributions paid by participants. Then for the stock of funds obtained from the previous stock + (income-expense). Additional fees required are processed from difference of income and expense. The main of Social Health Insurance model in Indonesia is shown in Figure 2.

The model verification phase is used to ensure that the implementation carried out on the tool does not occur with errors. Based on the understanding of verification, the verification process on Stella's tool is carried out by running the model that has been made. Then, the model validation process is to ascertain whether the output of the model's behavior is real, accurate, and acceptable. The validation phase will be done by matching the data that has been obtained so that the conditions are truly accurate.

The equation used for validation is shown in Equation 1.

\[ E = \frac{|S - A|}{A} \]  

(1)

where,

A = Actual data
S = Simulation data
E = Error variance between actual data and simulation data, where if E <0.1, then the model is valid.

The result of validation are shown in Table 2 below.

| Variable | Simulation (S) | Actual (A) | Error (E) |
|----------|----------------|------------|-----------|
| Income   | 77,450,135,984,849 | 74,617,819,000,000 | 0.03795765 |
| Expense  | 92,818,238,814,679  | 92,817,560,000,000 | 0.00000731 |

After conducting the verification and validation process on the basic model so that the simulation results are said to be valid with the original data, then the next step is to do the scenario design phase. The scenario that is done is the parameter scenario. This scenario will change the parameters of important variables that are likely to be pessimistic, optimistic, and on average. The scenario created aims to reduce the level of financial losses that occur in Social Health Insurance in Indonesia from several influencing factors. The following is explained about the scenarios that have been designed including:

a. Scenario 1 – Pessimistic
   Make changes to the value of the variables that influence the increase in the losses level.

b. Scenario 2 – Optimistic
   Make changes to the value of the variables that influence the decrease in the losses level.

c. Scenario 3 – Most Likely
   Make changes to the value of the variable that affects the losses number that has no change.
Figure 2. The Social Health Insurance sub-model of Indonesia

4. Result and Discussion

The model simulation process is carried out to determine the existing behavior in the observation system, namely the Social Health Insurance (SHI) system in Indonesia. From the simulation process, simulation results will be obtained which can be analyzed the results of the income and expenditure curves. The result of simulation model built shown in Table 3.

| Table 3. Simulation Results |
|----------------------------|
| Years | Fund Inventory | Incomes  | Expenses   | Additional Funds |
|-------|----------------|----------|------------|------------------|
| 2016  | -9,069,216,000,000.00 | 69,879,557,573,128.00 | 73,899,962,000,000.00 | 4,020,404,426,872.00 |
| 2017  | -13,089,620,426,872.00 | 77,450,135,984,849.00 | 92,818,238,814,679.00 | 15,368,102,829,830.00 |
| 2018  | -28,457,723,256,702.00 | 86,330,671,667,771.00 | 117,290,573,734,845.00 | 30,959,902,067,074.00 |
| 2019  | -59,417,625,323,776.00 | 96,971,473,996,720.00 | 148,979,495,598,227.00 | 52,008,021,601,507.00 |
| 2020  | -111,425,646,925,283.00 | 110,132,083,574,703.00 | 190,047,921,028,909.00 | 79,915,133,454,206.00 |

The factors that have an important influence on income and expenditure are premium costs and medical costs. Then do a trial to change the value related to premium tariff initialization. The financial condition is losses, the government is recommended to provide policies by imposing an increase in
premium costs on the previous costs [5]. This policy is based on financial losses that occur because participant premiums are lower than health costs incurred [6]. Then, the trial scenario uses this speculation, namely to increase the premium rate set by the government. Change in value increase by increasing 20% of the previous rate so that the premium rate is higher than the current Social Health Insurance rate. The following are the SHI premium rates in Indonesia shown in Table 4.

| Class level in the PBPU segment | Premium Rate Government Determination |
|---------------------------------|--------------------------------------|
| Class I                         | 80,000                               |
| Class II                        | 51,000                               |
| Class III                       | 30,000                               |

Based on Table 4 above, the scenario taken is an increase in premium rates by raising 20% of the previous premium rate. The results obtained from this scenario are shown in Figure 3.

The results obtained from this simulation process scenario are that from 2016 to 2020, a new deficit will occur in 2019 and the following year. The results obtained are in accordance with the results of other researchers who explain that premiums are increased so the financial losses is easily overcome. However, the results obtained by raising premium rates have not overcome the losses but only delay the occurrence of losses. The premium increase scenario is combination of an optimistic and pessimistic scenario.

The next step is to reduce benefit costs. It can be seen that spending has increased every year so this speculation is the reason for making a scenario. Change the value by reducing 20% of the initial benefit cost. The results obtained from the scenario reduce the value of the medical cost variable shown in Figure 5.

![Result Scenario 1](image-url)
Based on the simulation results from the scenario shown in Figure 4, the results obtained are similar to scenario 1. The financial condition will experience a loss in 2019. The strategy to reduce the benefit cost is very appropriate if the conditions only want to delay so that the financial does not lose. This scenario is also a combination of optimistic and pessimistic scenarios.

Then, the next scenario is to combine influential factors. In this scenario, the premium increase will be collaborated with a decrease in medical costs by giving the same variable value to the previous scenario. The results obtained from the third scenario are shown in Figure 5 below.
The simulation results from the third scenario provide the best strategy from the previous scenario. In the third scenario, finance has never experienced an increase in losses until 2020. However, additional funds that must be provided by the government are still needed. The increase in the losses did not occur due to excessive funds from previous years. So, if there are financial problems, it does not have a significant effect. Scenarios that reduce losses are called optimistic scenarios.

5. Conclusion
The financial indicator of Social Health Insurance (SHI) influencing the level of losses is income and expenditure. In making a dynamic system simulation model, this model has been said to be valid and in accordance with the real system because the output is the same as the original data. This system simulation model can be a reference for determining financially relevant SHI policies and can be a reference for conducting SHI financial simulations whose main indicators are income and expenditure. The factors that influence the main indicators are premium rates and benefit costs.

The scenario made to provide recommendations with improving the system is a parameter scenario. Parameter scenarios include optimistic, most likely, and pessimistic scenarios. The results obtained from the scenario are a combination of scenarios with an increase in premiums and reducing medical costs as a good recommendation strategy. From the results of this scenario, in 2016 until 2020 years there will be no losses. A good combination between the two will provide good recommendations so that there are no financial constraints on SHI. If the arrangement to increase premiums is too high it has violated government regulations. Similarly, the benefit costs are limited too much, so SHI participants will be reduced to using SHI so that they are in arrears in payments and detrimental to SHI finances. This condition has not been supported by the current situation which may be caused by the Indonesian people who have become SHI participants but do not make payments so that the income contribution is not on target. In this study, participant factors are still not included in the scenario process. For future research, it is necessary to examine the influence of participant factors, premium factors, and medical cost factors on financial problems that are losses at SHI in Indonesia.

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