JMSB
John Molson School of Business Concordia University

International Journal of Community Development & Management Studies

A Partner Publication of the Informing Science Institute InformingScience.org

IJCDMS.org

Volume 2, 2018

PRICE RELATIONS BETWEEN MALAYSIA RICE SECTOR AND SELECTED ASEAN COUNTRIES

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ABSTRACT

Aim/Purpose: This research paper attempts to assess how the Malaysia rice industry will behave if and when certain changes occur, such as the removal of policies which affect its rice import price (namely the Vietnam rice floor export price and Thailand rice pledging scheme) and which result from the ongoing region economic integration embodied in ASEAN Vision 2020.

Background: Malaysia rice farming sector compared to its ASEAN neighbors has a lower comparative advantage, this is transpiring in the lowering of the rice self-sufficiency targets and levels, moreover it is characterized as less efficiently managed compared to industrial farms. Therefore, Malaysia will continue to be a net importer of rice. It is against the background that this research was done, to anticipate how the Malaysia rice industry would behave if and when the existing trade barriers in the ASEAN rice market are removed and for the adjustment of Malaysia rice farming parameters to meet the desired state of rice self-sufficiency level.

Methodology: A system dynamics model of Malaysia rice sector with consideration of its rice import prices from ASEAN trade partners was built and tested to check if it mimics real world behavior pattern. Nevertheless, the exercise in which the model built was purposed is to foresight, the ability to anticipate how the system will behave if and when certain changes occur and a tool for policy design, it is not forecasting and it does not depend on the ability to predict.

Contribution: This study is in the line with previous related studies with the concern of the impact of trade liberalization on the global as well as ASEAN rice market. However, the beauty of the methodology applied is into taking account of non-linear relationship among variables of the system, the feedback loop mechanism, time delays, and the incorporation of all variables that are relevant to the problem endogenously. Thus, the model simulation results are driven not by

Accepting Editor: Clarence S Bayne | Received: March 20, 2018 | Revised: June 20 & July 21, 2018 | Accepted: July 23, 2018.

Cite as: Mirimo, D., & Shamsudin, M. N. (2018) Price Relations between Malaysia Rice Sector and Selected ASEAN Countries. *International Journal of Community Development & Management Studies, 2*, 131-144, Retrieved from: http://ijcdms.org/Volume02/v2p131-144Mirimo4565.pdf

	external factors, but by the internal structure of the model. The internal structure made of the feedback loos formed by the interdependency between variables.
Findings	Simulation results obtained from different Malaysia rice import price scenarios indicate a downtrend of the Malaysia rice self-sufficiency level and of less importance; the change is less than one percentage point.
Recommendations for Practitioners	Given the long run trend relationship between the rice import prices and the self-sufficiency levels, it may be advisable to policy makers to let the economic arguments for open trade with the risk of an increasing trend of import prices. It also prevails over the food security arguments, which might be involved in unintended consequences resulting from different forms of government intervention in the market.
Recommendation for Researchers	There is a need to continue to conduct test based on new scenarios and model assumptions. New research to assess the impact of selected ASEAN countries price policies on Malaysia rice industry may produce different results and recommendations. For example if we assume these selected ASEAN countries price policies are moving towards a free trade orientation, as well as the Malaysia rice industry.
Impact on Society	Food security is essential to the survival of the society. Thus, the supply of a staple commodity such as rice in Malaysia is essential to the social, political and economic stability of the society. Understanding the supply and demand conditions affecting the distribution of this product in the Country is critical for public and private policy making about the development of the economy and society. Rice commodity was conceptualized as a normal good in this study and we gained an insight on the rice consumption per capita behavior through different Malaysia rice import prices. What if the rice commodity is conceptually modeled as an inferior good, definitely rice consumption per capita behavior will change, with its associated impact on the economy and society. This study enables us to investigate the possible outcomes for various scenarios.
Future Research	For further research, this system dynamics model of Malaysia rice industry can be improved by including some variables closely related to trade such as the exchange rate between the United States dollar and ASEAN countries currency. In addition, some other variables (e.g. oil price) which can affect the rice production such as the climate change and some variables on the rice consumers side such as the changing consumer preferences (normal Vs inferior commodity), or on the rice/paddy farmers side such as poverty alleviation.
Keywords	Rice trade, Food security, Policy analysis, System Dynamics, Malaysia, ASEAN

INTRODUCTION

Malaysia rice imports come mainly within the ASEAN region. In that region, Vietnam and Thailand accounted for an average of 84.46 percent of the total Malaysia rice import quantities in the decade, 2006-2015. Currently, the import duties for rice imports are 20 percent under the Common Effective Preferential Tariff Agreement (CEPT) of the ASEAN Free Trade Area (AFTA) and 40 percent under the Agreement on Agriculture (AoA) of the World Trade Organization (WTO). Padiberas National Berhad (BERNAS; a private entity, has been given the sole monopoly right from the government to import rice at duty free rates to Malaysia (Vengedasalam and MacAulay 2011). In addition, BERNAS performs certain social obligations on behalf of the Government in the rice industry. It manages and maintains the Government Rice Stockpile of 292,000 metric tons to sustain national

rice consumption of about 45 days at any point in time (Tobias et al, 2012). This is to ensure that the country has a sufficient supply of rice at all times. The stockpile serves as an emergency food security buffer as well as to stabilize rice supplies and prices in the country. In addition, BERNAS has the distinction of being the organization responsible to implement two of the 16 Entry Point Projects (EPP) as part of the National Key Economic Area (NKEA) policy for the agriculture sector. This policy has three objectives: increasing paddy production, boosting the income of farmers and achieving national food security(BERNAS 2013). The fact that Malaysia does not have a comparative advantage in the rice farming industry creates a trading situation in the region in which Malaysian rice production levels tend to be below the self-sufficiency targets. In fact, Malaysian rice farmers production is said to be less efficiently managed than industrial farms(Mailena et al, 2014). The self-sufficiency level of rice production is only 70 percent of the total that is targeted under the National Agro- Food Security policy (2011-2020). This strongly suggests that Malaysia will continue to be a net importer of rice. It is of critical importance to note that domestic food security is a function of both domestic production and imports. In a study on demand patterns of rice imports in Malaysia, expenditure elasticity was estimated to indicate how import demand (quantity) changes in response to a change in BERNAS's expenditure budget for rice imports. The estimates of expenditures elasticity suggest that Malaysia is going to import rice largely from Thailand and Vietnam(Yeong-sheng Tey and Radam 2011). Based on the above, there are at least two key reasons why policymakers in developing Asia are reluctant to move rapidly to free trade in rice. First, there is concern over the stability of domestic prices. Large sudden adjustments in prices (either up or down) for such an important commodity can lead quickly to political instability. Second, there is a strong desire for national self-sufficiency as a route to food security(Dawe 2001). In addition, both GDP per capita and trade status are correlated with the level of prices. Higher GDP per capita and higher proportions of imports in domestic consumption are both associated with higher domestic prices (McLean et al, 2013a).

In terms of rice trade status, the ASEAN country members can be divided into two blocks, the rice exporting nations such as Thailand and Vietnam which are among the world largest rice exporting countries, and the rice importing nations such as The Philippines, Indonesia and Malaysia which are among the world largest rice importing countries. However, despite their trade status, the ASEAN rice exporting and importing nations share the same concern about food security, that is, to achieve and/or to maintain their rice self-sufficiency levels by maintaining some public control over their domestic rice markets. These government concerns are not only about domestic rice production and about consumption sectors, but also about the movement of rice in and out of their countries in response to a set of trade measures: institutionalized state either trading with a market monopoly, or sometimes in competition with the private sector, or more advanced quantitative trade restrictions. In 2001, the Thai government introduced the Paddy Pledging Program which has been in use on and off since its introduction. The policy functions as a mortgage program in favor of the producers. Figure 1 is a flow chart, which shows how this rice pledging price policy affects the flow of imports and exports and prices within the region and between Malaysia and Vietnam and Thai countries. Since the guaranteed price was set much higher than the market price, the policy became too costly for the government because it ended up with very large procurements (Forssell 2009). However, the price support helped farmers increase their income and it gained support from millers who also benefited from the price support. However, the pledged prices resulted in distortions in production and caused trading problems: rice importing countries delayed their imports to await cheaper rice from other rice exporting countries (McLean and Hettel 2013a, 135). As a direct consequence of the paddy-pledging program, the government stockpile grew enormously to reach an estimated 16 million tons in warehouse by May 2015. Hence, the government administration and agents agreed to dispose of unsold rice through four channels: general auctions, government-to-government sales, direct sales and the Agricultural Futures Exchange (AFET). The paddy-pledging program ended by February 2014. However, there was news to the effect that a new Thai government proposal on-farm pledging for 2014-2015. This was to apply to the paddy main-crop of frag-

ment and glutinous rice to limit downward pressure on prices during the harvest time. However, the program has not received expected response because the intervention price set by the government to buy fragrant and glutinous paddy rice was too far below the market prices. Moreover, the government implemented a variety of measures other than the on-farm pledging scheme to support rice farmers: the income support measure (distributed $192 per hectare to 3.6 million farmers, totaling $1.2 billion), the off-farm employment assistant program (designed to help farmers affected by government imposed water restrictions), a rice insurance program subsidizing insurance rates, protecting farmers from natural disasters; and the interest subsidy program, subsidizing borrowing rates enabling traders to hold stocks. In Vietnam, the Vietnam Food Association (VFA) maintains rice export registration requirements and the Minimum Export Price (MEP) based on the Government regulation of rice exports, Ordinance 109/2010/ND-CP is an order put in place to regulate the flow and prices of rice exports(Ward 2013). The 109/2010/ND-CP decree of November 4, 2010 on rice export business was in effect since January 1, 2011. It is the governing law in force since 2014 regulating the commercial export of paddy and rice of all categories. It has three objectives and principles (Article 10): to "increase commodity rice sale and assure the interests of rice growers", "the balance of export and domestic consumption, and contribute to the valorization of domestic rice prices" and "the fulfillment of international commitments, assurance of efficient export". Article 19, entitled the "Floor export price of rice" is par excellence the policy that is considered in the current study (See figure 1). It is at the basis of the signed and registered export contracts by Vietnam rice trade partners. It is determined under the supervision of the Ministry of Finance in coordination with the Ministry of Industry and Trade, the Ministry of Agriculture and Rural Development, the provincial-level People's Committees and the Vietnam Food Association.

The setting up of the Floor export price for rice is based on two main principles: to be in conformity with domestic and world market developments, and in conformity with the announced directed paddy price and domestic purchase price of commodity rice, and business costs and profits of rice exporters (See Figure 1). Based on these policies, the ongoing trade liberalization in the ASEAN rice market is expected to bring some changes. The implementation of ASEAN Economic Community (AEC) agenda, which has been in force from 2015, will affect its member countries unevenly, where the already non-competitive domestic rice industries at the regional and global level will have to adjust to the rice-exporting nation's market peculiarities. Thus, concerns over rice trade liberalization engage the policy makers in a complex adaptive system resulting in non-linear relationships and a large number of interactions between many agents (farmers, governments, millers, wholesales, monopolists, importers, exporters, countries, consumers). The central concern to predict the following in a system of dynamic change and uncertainty: if and when the existing trade barriers in the ASEAN rice market are removed how will the Malaysia rice industry behave to adjust their rice industry parameters to meet the desired state of rice self-sufficiency.

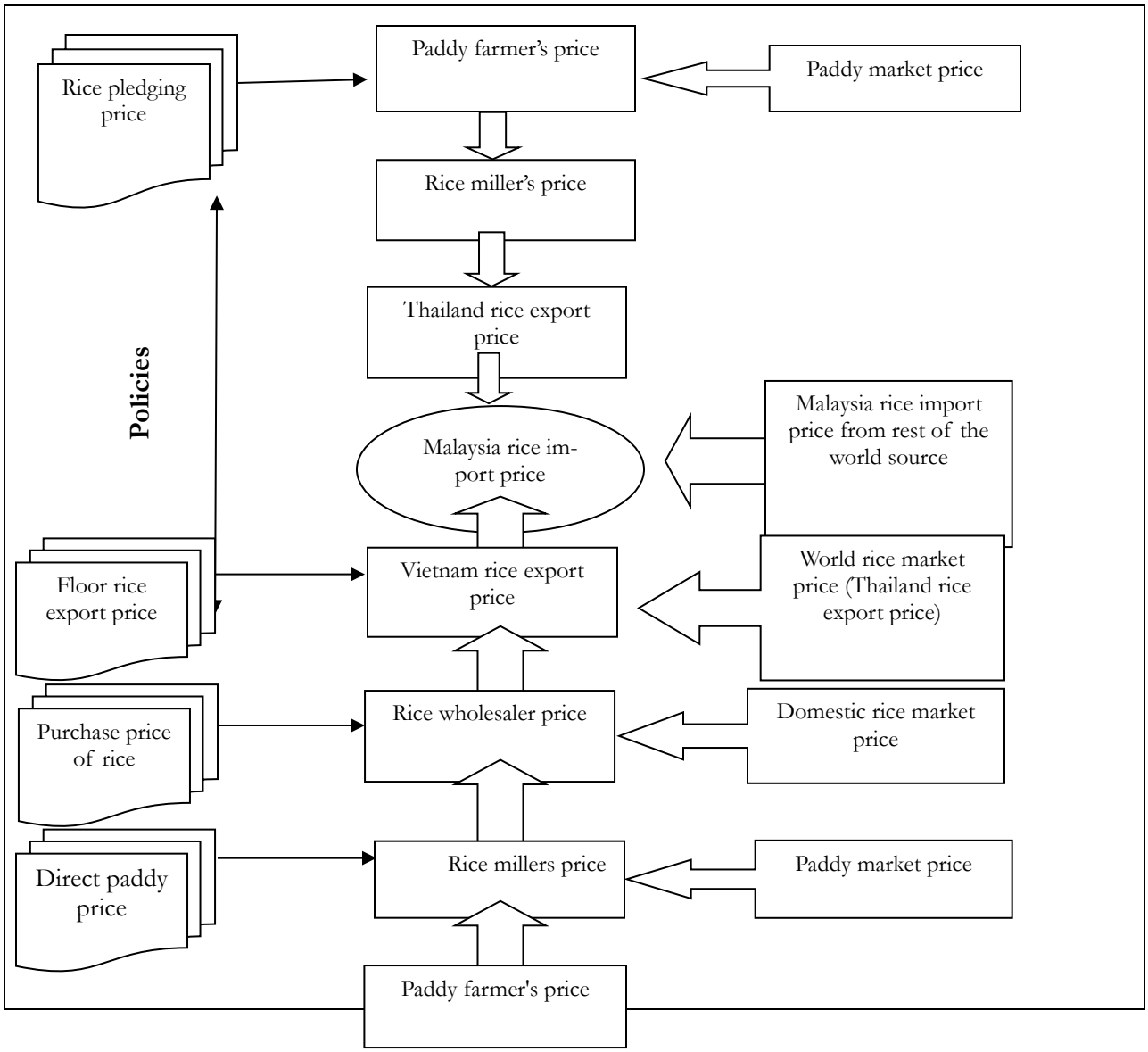

Figure 1: Summary of the Thai and Vietnam rice export price's policies on the Malaysia rice import price

METHODOLOGY

The system-thinking concept is defined by Peter Stroh as the ability to understand the interconnectedness between the elements of a system in such a way as to achieve a desired purpose. The Iceberg diagram (Figure 2), one of the system thinking tools, is applied to the current study to distinguish problem symptoms from root causes, to distinguish four levels of insights: the event, patterns, structure and mental model levels, with some specific questions to inform(Stroh 2009). It enables the researcher to understand a non-linear complex adaptive system structures by an understanding of the underlying possible causal links. The rice self-sufficiency level which is the metric of many Asian nations food security achievement, is a computed variable from other variables, thus to get a full grasp of relationships among variables which are making and surrounding it, we resorted to building a causal loop diagram. This tool enables us to better understand the system structures, which cause the

patterns of behavior, and to comprehend the complexity of the interaction and potential causality between the elements. The diagram was later translated to a formal mathematical model in the form of a stock-flow diagram and equations (See Appendix: List of Equations), with the help of the modeling software Vensim. The basic elements of a system dynamics model are stocks and flows. The stock and flow diagram has the same purpose as the causal loop diagram, they are both intended to show relationships among variables of a dynamic system structure, however unlike the causal loop diagram, a stock and flow diagram distinguishes between types of variables.

MALAYSIA RICE INDUSTRY STOCK AND FLOW DIAGRAM

The Malaysia rice industry Stock and Flow Diagram (Figure 2) is made of four (4) stocks or levels, namely the rice stock, the domestic market rice price, the population and the gross domestic product (GDP). The rice stock variable reflects at best the closed system nature of the rice commodity distribution throughout the whole structure. It starts with an initial value and is thereafter changed only by flows in and out of it. The rice supply constitutes its inflow, whereas the rice consumption its outflow. The rice supply in Malaysia is originating from two different sources, the domestic rice production and the rice import (See Figure 1). Rice production consists of the paddy production multiply by the paddy rice conversion rate. The paddy production consists of the potential paddy production multiplied by the post-harvest "loss" percentage. The potential paddy production results from the paddy productivity multiplied by the paddy area harvested. The rice import comes from the "desired rice import", an information flow variable, which in turn is derived from both the rice demand and stock status. The desired rice import from stock is adjusted by two time steps, the "Time to adjust stock" and the "Desired coverage time of rice stock". The "Desired coverage time of the rice stock" is defined as the average time our rice stock is intended to last, whereas the "Time to adjust stock" is defined as the average time of replenishing rice stock by either a new crop season harvest or the acquisition of an import order into the wholesaler stock. From the desired rice import information which is sent to Malaysia rice trade partners, Thailand and Vietnam, the information flow is treated through two main mechanisms, the Fraction of Desired rice import and the Rice export allocation policy either from Vietnam or Thailand. The fraction of desired rice import allocated either to Vietnam or Thailand is based mainly on their export price quotations, for we have considered the rice commodity in the current study as an homogeneous product, the different rice types, varieties and qualities on which rice is traded globally are replaced by either the Thai 5 % broken, Vietnam 5% broken or Pakistan 25% broken price quotations. Briefly, the mechanism stipulates that the fraction of desired rice import towards either Thailand or Vietnam is varying between these two countries with their export price quotations. The mechanism proves its capacity to explain the trade behavior in the past fourteen years (2000-2013) in the model validation. The rice export policy allocation maintained by Vietnam or Thailand is basically null because for most of time these countries were fulfilling any import request by Malaysia, but at the height of the food crisis in 2008, Vietnam discontinued its export. That is, it refused to fulfill any import demand no matter where it came from. Therefore it is through price mechanism that in the current study, we will assess the impact of removing the selected ASEAN countries price policies, namely the Vietnam rice floor export price and the on and off Thailand rice pledging program. The outflow of the rice stock is the rice consumption, which is computed from the rice demand multiply by the stock availability. The stock availability is a product of division between two variables, the rice stock over the desired rice stock. The desired rice stock is defined as the product of multiplication between two variables, the rice demand and the desired coverage time of the rice stock. The Malaysia population and GDP are both stocks in our model; they start with the initial value and were simply modeled to be driven by their growth rates. The Malaysia population affects directly the rice demand in the model, whereas the GDP along with the population were used to define the GDP per capita. The GDP per capita is also affecting the rice demand through the per capita rice consumption. This is in line with the literature concerning the factors influencing the increase of rice demand, mainly from the high population growth and the rice status as

a normal good, a positive relationship between the per capita consumption and both the income and price (McLean, Hardy, and Hettel 2013b, 48; (John) Yeong-Sheng Tey et al. 2008). The domestic market rice price is a stock variable. It results from the "Indicated rice price" with a lag effect, the difference between the indicated rice price and the initial value of the stock given for the "change in price". For any change in price; the government has the leverage to either let the difference affected the domestic rice market or to stabilize and to absorb the price difference. All this mechanism is performed at a time scale, which is the "Time to adjust price". The "Indicated rice price" equal to the weighted price "Indicated price from supply source" about the stock availability. As for the rice consumption, the system dynamic recognized the effect of commodity availability to its consumption and price levels. The "Indicated price from supply source" is a weighted price of different prices such as the production cost (paddy famers harvest price) standing for the domestic price of rice production, Thai rice export price (5% broken), Vietnam rice export price (5% broken) and Pakistan rice export price (25% broken) (the FAO GIEWS website provide only two price quotations for Pakistan, the Pakistan rice export price (25% broken) and the Pakistan rice export price (Basmati)),as the third Malaysia rice trade partners standing for Rest of the world import source, to the ratio of their quantity over the total supply. It is important to mention that relationships between the stock availability and rice consumption, the stock availability and the Indicated rice price, the domestic rice market price (specifically the trend of price) and the rice consumption per capita, the GDP per capita and the rice consumption per capita, and at last the Malaysia Fraction of rice import from either Vietnam or Thailand, were all modeled with the help of table functions, also known as Lookup functions, which are graph relationship between two different variables, an arbitrary nonlinear relationship to express causal relationship between variables.

VALIDITY OF THE MALAYSIA RICE INDUSTRY MODEL

System dynamics model validation is the process of establishing confidence in the usefulness of a model with respect to its intended purpose. It means validity of the internal structure of the model, not its output behavior. The accuracy of the model estimation and predictive behavior is also evaluated, but only if and after we already have sufficient confidence in the structure of the model. Thus the general logical order of validation is first to test the validity of the structure, and then start testing the behavior accuracy, only if the structure of the model is perceived adequate. Structure tests assess the validity of the model equations individually, by directly comparing them against available knowledge. There is no simulation involved. Error checking test and dimension test fall in this category. Moreover, the extreme condition test is also part of the structure test as it involves evaluating the model equations under extreme conditions and assessing the plausibility of the resulting values against knowledge of what would happen under similar condition in real life. The error checking and the dimensional tests are built-in applications of the Vensim software. The results of these tests on the Malaysia rice industry model reported no problem. The extreme condition tests were performed on two parameters of the Malaysia rice industry model: the post-harvest "Loss" percentage with respect to the "potential paddy production" and the "paddy production" variables, and the "normal rice consumption per capita". The results of the extreme condition test indicate that the model is robust. Moreover, the test suggests that the model behavior is plausible and consistent with real life situations. Behavior sensitivity test were also applied. These tests consist to determine those parameters to which the model is sensitive, and ask if the real system would exhibit similar high sensitivity to the corresponding parameters in the real world. In particular, best and worst scenarios were tested over two parameters, the GDP and the Population growth rates to check the Malaysia rice industry model sensibility to these two uncertain variables. Results of these tests were in accordance with the theory and model assumptions. In addition, the model behavior test can be performed with some statistical tools. To do this, we require two sets of data, the real world and model-generated data. Some of these tests are presented below.

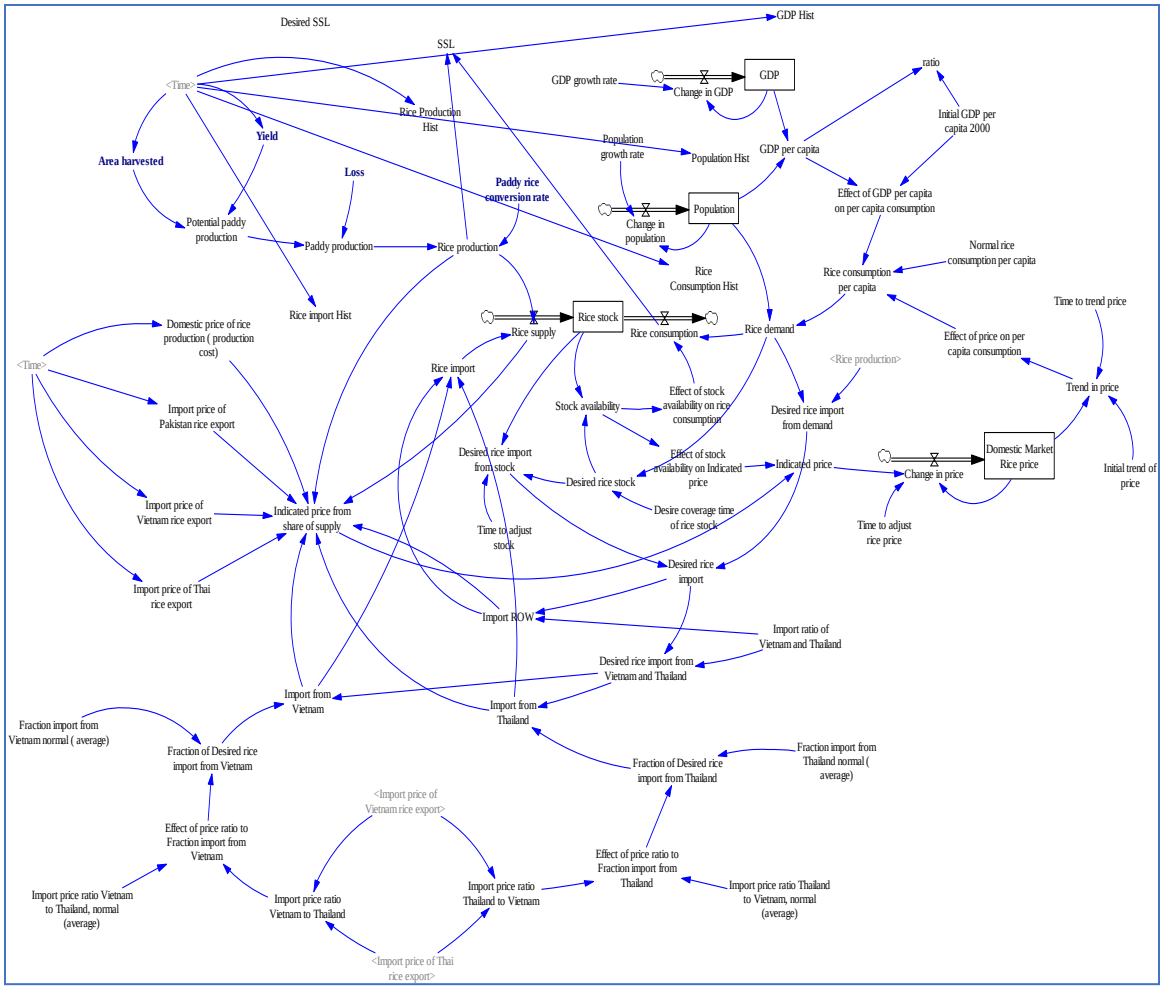

Figure 2: Malaysia rice industry Stock and Flow Diagram

STATISTICAL TESTS

Statistical tests such as the Mean Squared Error (MSE), the Root Mean Squared Percent Error (RMSPE), and the Theil inequality statistics ($\boldsymbol{U^C}$, $\boldsymbol{U^M}$ and $\boldsymbol{U^S}$) are used to assess the model ability to reproduce the behavior of a real system. The validation process using the statistical test involves comparing the performance of the model against the real historical data available. The mean square error (MSE) and the root mean square error (RMSE) provide measures of the average error between the simulated and actual series and weight large errors much heavier than small ones. Both measure the error in the same units as the variable itself. The Theil statistics helps to characterize the sources of error, to decompose the error by dividing the MSE into three components: bias, unequal variation, and unequal co-variation. Bias arises when the model output and data have different means. Unequal variation indicates that the variances of the two series differ. Unequal co-variation means the model and data are imperfectly correlated, that is, they differ point by point.

The Theil statistics are defined as:

$U^M = \frac{(\bar{X}-\bar{Y})^2}{\delta^2}$ the bias of proportion

$U^S = \frac{(S_X-S_Y)^2}{\delta^2}$ the variance proportion

$U^C = \frac{2(1-r) S_X S_Y}{\delta^2}$ the covariance proportion

There are three acceptable situations, which indicate unsystematic (random) error of the simulating model:

i) U^C is close to 1 and both U^M and U^S are close to 0;

ii) U^S is close to 1, both U^M and U^C are close to 0, and additionally $Y_t = k$ = constant, $X_t = k + \varepsilon_t$, where $\frac{1}{n}\sum_{t=1}^{n} \varepsilon_t = 0$;

iii) U^M=0, $U^S = \alpha$, $U^C = 1 - \alpha$

There are other variants of the values of the triple (U^M ,U^S, U^C) that test to determine whether the simulation model has a systematic error (Sterman 2000, 874–79). The Theil Statistics results shown below (Table 1) are based on the comparison between the actual/historical data and the simulated data from the model for variables such as the Malaysia GDP and rice production and consumption variables. The results show that the majority of errors are located in the $\boldsymbol{U}^C$, while $\boldsymbol{U}^M$ and $\boldsymbol{U}^S$ are small. A large $\boldsymbol{U}^C$ is an indication that the majority of the error is unsystematic with respect to the purpose of the model, and hence the model should not be faulted for failing to match the random component of the data. The Theil statistics results for the Malaysia population and rice import variables show that the errors are concentrated in $\boldsymbol{U}^C$ and $\boldsymbol{U}^S$, with very small proportion in $\boldsymbol{U}^M$. Therefore, in summary, the majority of the error is small and non-systematic: not causally related to the purpose of the model.

Table 1: Theil Statistics results

Variables	Theil Statistics		
	$\boldsymbol{U^M}$	$\boldsymbol{U^S}$	$\boldsymbol{U^C}$
Malaysia Population	0.008131	0.568319	0.42355
Malaysia GDP	0.007971	0.034484	0.957546
Rice production	0.050959	0.027438	0.921603
Rice consumption	0.025073	0.239181	0.735746
Rice import	0.034099	0.436276	0.529625

RESULTS AND DISCUSSION

DESCRIPTION OF THE SCENARIOS

For this study, statistics for the period 2000-2014 for the variables Malaysia population, gross domestic production (GDP in Ringgit), paddy planted Area, paddy average yield and rice production were obtained from the Malaysia Department of Statistics. Malaysia rice consumption and rice imports were generated from the Malaysia Agriculture Department. The rice production cost in Malaysia was replaced by the Farm gate price, which is generated in Malaysia Local Currency (1 Malaysian Ringgit is 0.25 USD) from the International Rice Research Institute (IRRI). The Thai rice export price (5% broken), Vietnam rice export price (5% broken) and Pakistan rice export price (25% broken) were generated by the Global Information and Early Warning System maintained (GIEWS) by the Food and Agriculture Organization (FAO) website. To achieve the objectives of this study, five price scenarios (2014-2025) including the base line scenario were designed over the Thai rice export price (5% broken), Vietnam rice export price (5% broken) and Pakistan rice export price (25% broken). The

base line scenario was drawn from the World Bank commodities price forecast (nominal US dollars) data of Thai rice export price (5% broken) for the period of 2014 to 2025. The remaining export prices of Vietnam (5% broken) and Pakistan (25% broken) were deduced from the Thai rice export price (5% broken) World Bank price commodities forecast with respect to their past relationships (2000 to 2014), as expressed by the regression coefficients. Here it is worth mentioning that the assumption is that, as it was observed in the past decades, Thailand will maintain its leading position as either the price leader or the first/major rice exporting country in the ASEAN region as well as in the whole world. This is demonstrated below in Figure 3. It should be noted to convert these rice export prices forecasts for the period 2014 to 2025 from the US Dollars to their respective local currencies (Thai Baht, Viet Nam Dong and Pakistan Rupee), then from these domestic currencies to Malaysia local currency (Ringgit), an average of the previous four years (2010 to 2014) exchange rates statistics were used. The remaining scenarios were designed to assess various trends in relation to the base line scenario, specifically either a trend up of 20 and 40 percent or a trend down of 10 and 30 percent of rice export prices.

Figure 3: Malaysia import price of Thai rice export (RM/ton), from 2000 to 2025

SCENARIOS RESULTS

Baseline Scenario

The simulation results for the base line scenario show that for key variables in the Malaysia rice industry, the rice production, consumption and import, are increasing in volume throughout the simulation period (2013 to 2025) as shown in Table 2. In contrast, the rice self-sufficiency level (SSL) is facing a decreasing trend because the gap between the rice consumption and production is widening over the simulation time. Specifically the paddy area harvested is projected to slightly increase from 674,332 to 684,720 hectares, and the paddy yield from 3.9 to 4.55 tons per hectare and per year. These are solely growth engines for the rice production, which in turn is projected to increase from 1,685,226.625 tons/year in 2013 to 2,026,839.625 tons/year in 2025. The Malaysia population and GDP growth rates were set at their average value for the past fourteen years (2000-2013), thus the population with a growth rate of 1.98 percent from 2013 to 2025 is projected to reach 37,974,036 of inhabitants in 2025 from 29,947,600 of inhabitants in 2013, while the Gross Domestic Product (GDP) with a 8.15 percent of growth rate is projected to reach 2,617,349.5 million of ringgit (RM) in 2025 from 986,237 million of ringgit (RM) in 2013. The rice consumption simulation result will be 3,450,475.25 tons/year in 2025 compared to 2,567,313.75 tons/year in 2013. Malaysia rice import is

projected to be at 1,444,328.25 tons/year in 2025 from 915,504.3 tons/year in 2013. The last major model generated result of the Malaysia rice industry is the Rice Self Sufficiency Level. In 2013, it was at 65.64 percent and it is projected to decline at 58.74 percent by 2025.

Table 2: Simulation results of the Base run scenario

Time (Year)	Selected Variables Runs	Rice consumption (tons)	Rice import (tons)	Rice production (tons)	SSL (%)
2013	Base run	2567313.75	915504.3125	1685226.625	65.642
2014		2629451.75	839475.3125	1759064	66.899
2015		2681418.25	912901.0625	1780912.875	66.417
2016		2744652.5	930655.25	1826432.125	66.545
2017		2810538	939588.4375	1883295.75	67.008
2018		2879240.25	1080200	1819898.75	63.208
2019		2955667.5	1112614.25	1868146.625	63.206
2020		3041690	1142091.75	1925910	63.317
2021		3131414.75	1185010.625	1973835.75	63.033
2022		3226513.25	1246623.625	2009183.125	62.271
2023		3313708.25	1290592.25	2043744.75	61.675
2024		3381837.5	1393963.25	2008554.75	59.392
2025		3450475.25	1444328.25	2026839.625	58.741

Alternative Scenarios Results

The simulation results (Figure 4) for the period 2013 to 2025 expressed the following relationships, ceteris paribus, holding the Malaysia rice production volume at its base line projection and varying the rice import prices of Malaysia, the increase of export prices of Thailand, Vietnam and Pakistan by 20 and 40 percentages induced a decrease of the rice self-sufficiency level by 0.374 and 0.85 percentage points, and the decrease of export prices of Thailand, Vietnam and Pakistan by 10 and 30 percentages induced an increase of the rice self-sufficiency level by 0.116 and 0.19 percentage points.

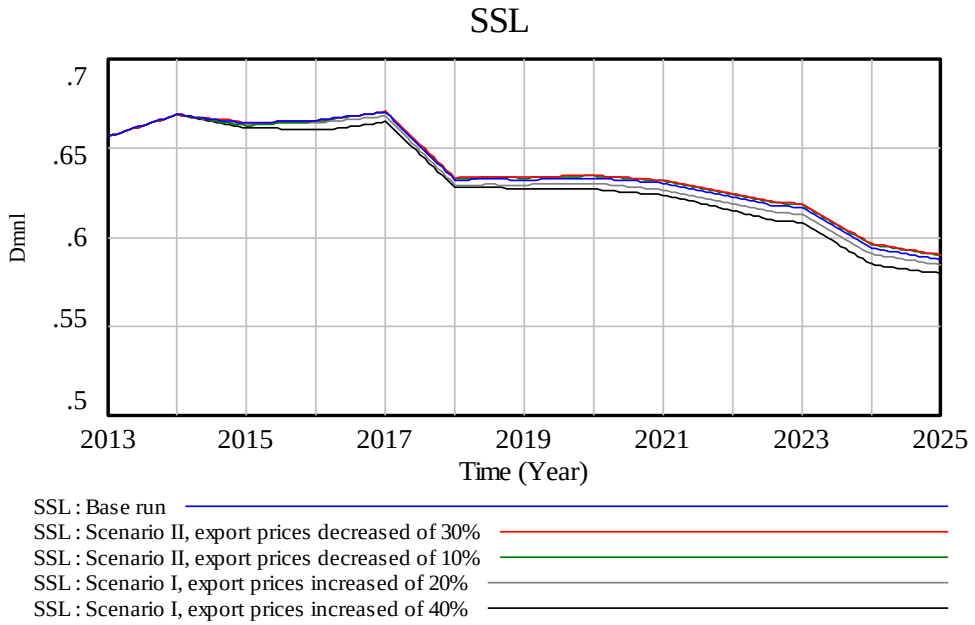

Figure 4: Simulated Malaysia rice self-sufficiency (SSL) under all five (5) scenarios for the period 2013-2025

CONCLUSION

In all scenarios results including the base line scenario, the Malaysia rice self-sufficiency is facing a downtrend. No matter whatever scenarios the impact of removing the Vietnam rice floor export price and the on and off Thailand rice pledging program on the Malaysia rice industry is of little importance. Whether there is an increase or decrease in the level of desired rice self-sufficiency target, the magnitude is less than one percentage. A market dynamism model result of an increasing Malaysia rice import prices as the result of change in selected ASEAN countries price policy parameters generates a decrease in the rice self-sufficiency level compared to the base line projection. The decrease in the self-sufficiency level is a result of the excess of the increase in per capita rice consumption, rice consumption and import quantities, over the base line projection levels, while at the same time the rice production was kept at its base line projection level. On the other hand, a market dynamism model result of a decreasing Malaysia rice import prices, as the result of change in the selected ASEAN countries price policy parameters, generates an increase in the rice self-sufficiency level compared to the base line projection. However, this increase is a result of the decrease in the per capita rice consumption, rice consumption and import quantities compared to our projected base line levels, while at the same time the rice production was kept to its base line level. Thus, speaking strictly from the perspective of food security expressed in terms of the level of rice self-sufficiency stock, a market dynamic system-thinking model that shows a decrease in the Malaysian rice import prices over the long run strongly suggests that there will be amelioration in food security. However, this will be achieved at the cost of a decrease in the per capita rice consumption, and the total rice consumption and imports. Speaking in terms of the economic benefits, an increase over the long term in the Malaysia rice import prices will benefit the Malaysia rice industry; due to the increases in the per capita rice consumption and total rice consumption; as well as increases in imports to replace local demand-baseline-supply gaps. However, this gain is at the cost of the national food security indicator.

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APPENDIX

LIST OF ABBREVIATIONS

AEC: ASEAN ECONOMIC COMMUNITY
AFET: AGRICULTURE FUTURES EXCHANGE OF THAILAND
AFTA: ASEAN FREE TRADE AREA
AOA: AGREEMENT ON AGRICULTURE
ASEAN: ASSOCIATION OF EAST ASIAN NATIONS
BERNAS: PADIBERAS NATIONAL BERHAD
CEPT: COMMON EFFECTIVE PREFERENTIAL TARIFF

EPP: ENTRY POINT PROJECTS (IN THE NKEA)
FAO: FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
FAO GIEWS: FAO GLOBAL INFORMATION AND EARLY WARNING SYSTEM
MEP: MINIMUM EXPORT PRICE
MSE: MEAN SQUARE ERROR
NKEA: NATIONAL KEY ECONOMIC AREA
RMSE: ROOT MEAN SQUARE ERROR
SSL: SELF SUFFICIENCY LEVEL
VFA: VIETNAM FOOD ASSOCIATION
WTO: WORLD TRADE ORGANIZATION

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