State policies on self-sufficiency in agricultural section of Iran

J. Parvizian*, A. Karimi-Tabar

* Assistant Professor, Isfahan University of Technology, Isfahan, 84156, Iran.
Tel: (98) 311 391 2550, Email: japa@cc.iut.ac.ir

Master of System Dynamics, Organization of Budgeting and Planning,
Hamedan, Iran.

Abstract

A system dynamics approach is presented in this paper to study the long-term effects of Iranian State policies to support agriculture and gain self-sufficiency (SS) of products. Policies such as controlled exchange rate and fixed prices have important effects on production and export of foods. These policies are taken to support consumers and producers against high prices, to increase the SS index and the nutrition rate. In the model presented here, the aim is to measure variables like export, ICOR index, the ratio of investment to surplus, and SS index against counter policies such as equilibrium prices and floating exchange rates in long term. It is shown that recommended policies to activate the whole economy are equally effective in this special section.

Key words: Self-sufficiency, agriculture, exchange rate, system dynamics, Iran.

1. Introduction

In the last three decades, agricultural products formed about 70 percent of Iranian non-oil export. The volume of export is determined by many factors such as the annual rainfall, ecological diversity, and state policies on export and import. This paper is essentially about the effects of state policies to protect agriculture on the export/import balance of agricultural products. Mainly with aims like increasing production, gaining self-sufficiency, and weakening the dependency on the export of oil, the government has implemented policies such as fixed or guaranteed price policy, and fixed exchange rate policy. However, fixed prices at a level lower than the equilibrium price to support consumers, cause the demand for food grows faster than production. In addition, to supply imported foods with subsidized prices has severe effects on production, while still 43 percent of the populations live in villages, and 20 percent of active population work in agriculture.

Bach and Saeed [1992] studied the food self-sufficiency in Vietnam using system dynamics. Their model has three sections: population, food production and soil ecology. For them the available land is a key factor in the model. Policies such as population control, land and water management and a combination of policies are examined. This study shows that short-run policies to increase food production to a level planned by the state are detrimental to maintaining food adequacy in the long run. The self-sufficiency ratio, in this study, compares actual food per capita with a fixed target. They conclude that their observations can be generalized to all centrally planned economies.

In the present paper, agriculture is studied as one section of the whole national economy. Therefore, the interactions of this with other sections, such as import/export

balance and relative price play important roles in the constructed model. Also, policies such as fixed or market price, and control of exchange rate are taken into account. So, the self-sufficiency index indicates the ability of the economy to domestically answer the demand for food.
It is shown by Kiani [1999] that the unrealistic exchange rate is one of the most important barriers against the export of foods and increasing domestic price index can only worsen the export by making internal supply more profitable.
Using econometrics models, Hoseini [1996], shows that state financial policies worked as direct taxation on food exporters. These policies undermine production and export of agricultural products. Though providing subsidized machineries, fertilizers, and pesticides could make the production profitable, the productivity per acre has not improved due to the fixed price policy and more subsidization on consumption.

A system dynamics model is presented to study the long-term effects of fixed price and exchange rate policies on the overall self-sufficiency on food. First, the model assumes that the present policies continue to be applied. Then effects of two counter policies of floated price and exchange rate are examined in the model. It is shown that these two policies, implemented together, can increase the self sufficiency index while keeping the nutrition index at an acceptable level.

2. Exchange Rate Effects

Lower exchange rates can increase the volume of export and decrease the commercial price of agricultural products. This, with the elasticity of demand, determines the net income of agricultural exports. Lower exchange rates and domestic elasticity of demand for import may have different effects on imports than on exports. The volume of import decreases in all cases but when there is no demand [Zareei, 1998].

3. Fixed Prices Effects

Fixed or ceiling price policy has several drawbacks such as [Adeli, 1990]:

- The policy is limited to some commodities. This may increase the incentives to produce other products.
- In inflation conditions, fixed prices can increase consumption, and destabilize the market through reducing the productivity.
- Low profits in production can divert investments towards service section [Asgari, 1989].
- Subsidization, thus resulted, effects poor and rich, with different incomes equally.

4. Self-sufficiency

Self-sufficiency, a concept form classic theories, is adopted here to imply the financial balance between export and import. To enable the model to consist this variable, some key concepts are defined as:
Incremental Capital Output Ratio (ICOR) index: This index indicates the performance of the investment in agriculture. ICOR is defined as [MosaNejad, 1993]:

ICOR Index=Investment during the phase / (Surplus at the end of the phase – Surplus at the beginning of the phase)

The phase length is taken as 5 years. This index for developed countries is between 1.0 and 2. The average for Iran for the last three decades is 1.4

ITS: This index shows the fraction of surplus of agriculture that is invested in agriculture. This never exceeded 11 percent with the average of 4.9 percent in Iran.

Self-sufficiency Index (SSI): This factor indicates the capability of the section to export. One way to define this is:

SSI=1-(Net agricultural import / demand for agricultural products)

Normal nutrition index (NNCR): This factor is defined as:

NNCR= Consumption of products / Normal Consumption

The higher this factor, the higher is the food security. Ceiling price policy can increase this factor by keeping prices lower than the equilibrium prices. On the other hand, this policy may diminish motivations to produce. Therefore, the SSI will decrease.

5. The Model

The dynamic model taken to study the problem has five main sections: I) Population and income, II) Demand, III) Price, IV) Investment and production capacity, V) Export, import and exchange rate. The model is shown in figure 1.

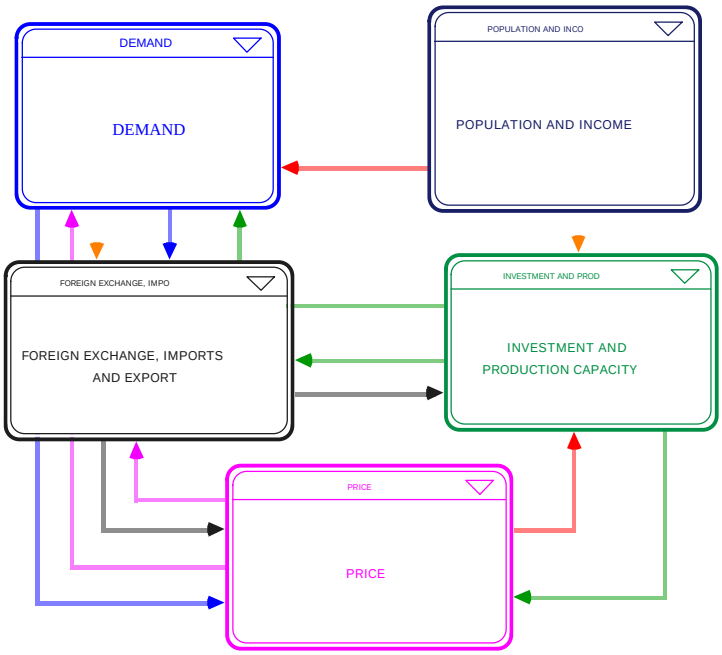

Figure 1, The dynamic model contains five section.

The purpose of this model is to study the effects of prices of agricultural products when determined at the equilibrium point and floating exchange rate on the export, import and self-sufficiency of the agricultural section. Per capita income is taken to indicate the consumption. National income is an exogenous variable with a moderate growth rate.
In the demand section, the main variable is food consumption level (FPC). Per capita income (PCI) and relative price affect this level form other sections. With increased per capita income the effect of consumer costs share (FPCR), therefore the effect of income on consumption (IFC) decreases. The consumption rate of agricultural products (FPCG) slows down, so the consumption and consequently the effect of consumer costs, (FPCR). The demand section is shown in figure 2.

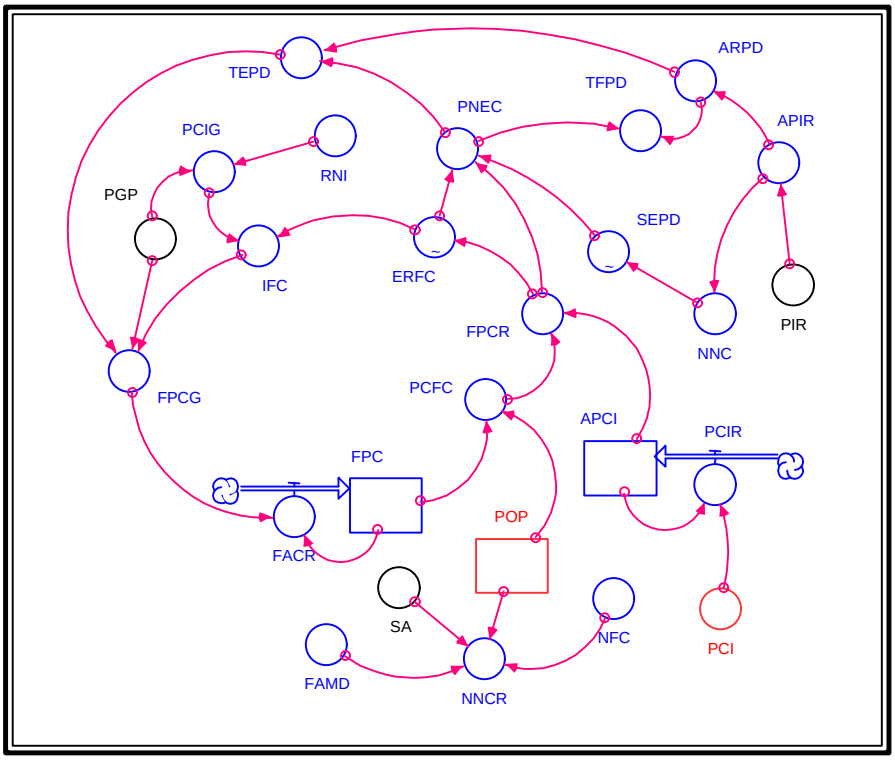

Figure 2, Demand section.

Price elasticity factor, (PNEC), is given as a combination of substitutive effect of price changes (SEPD) and the effect of income (ERFC*FPCR), in which ERFC is the income elasticity of demand. An increase in this factor results in increasing the relative prices (PIR), and decreasing the consumption (FPC). The latter effect increases FPCR. Eventually, increased FPCR has positive effect on price elasticity factor.

In the price sector, the price is determined at the equilibrium point of demand and supply. Two scenarios are adopted for relative prices. In the first scenario, the government intervenes in fixing the relative price of products at the average level of 0.7, while in the second scenario, the relative price in equilibrium condition, is determined endogenously.

As shown in figure 3, in determining the relative prices (PIR), the supply (from investment sector) and producing capacity affect prices. The effect of income is taken into account by IFC. Export (XA) and exchange rate are also considered.

Two cycles are important in determining the relative prices. In the first one, food consumption (FPC) has positive effect on demand (DA), so on the ratio of demand to supply. This influences the effect of demand to supply ratio on price (EADSR). Therefore, the relative price decreases so does the consumption.
In the second cycle, more consumption results in more import (M), hence higher exchange rate and higher prices. This performs as a balancing cycle.

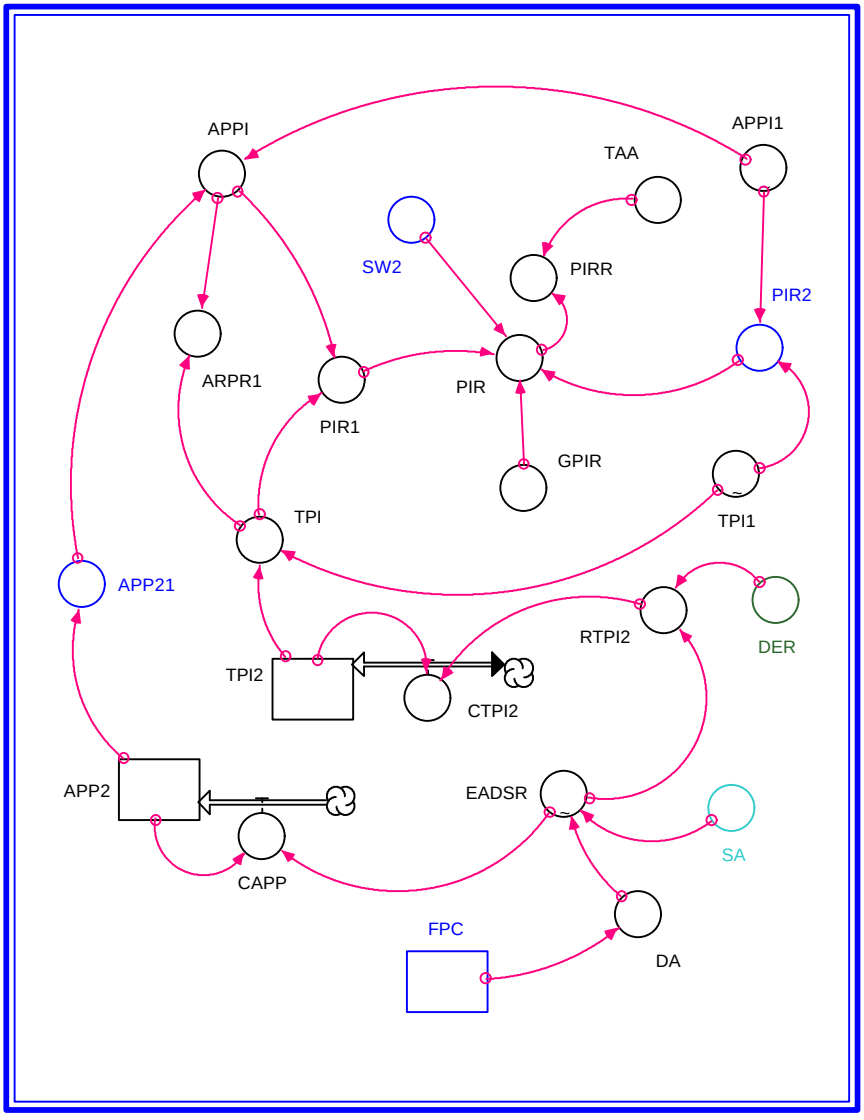

Figure 3, Price sector.

In the investment and production capacity sector, the national income (NI) influences

the investment opportunities (IA) and production (YA). The investment is also affected by the relative prices (PIR). Investment influences the capital (KA), therefore, the production. This eventually reduces the relative price, so investment opportunities.
More production capacities increases the productivity (EPS), so the production. Therefore, this is a positive cycle. For production until 1999, the real values are used. For coming years, it is assumed that:

$$YA_s = YA_0 \times [1 + DYA(S - 1999)]$$

In which S indicates the year, and YA_0 shows the production in year 1999. DYA, endogenously determined in the model, is the real production rate.
The effects of net import and exchange rate are also considered. The production section is shown in figure 4.

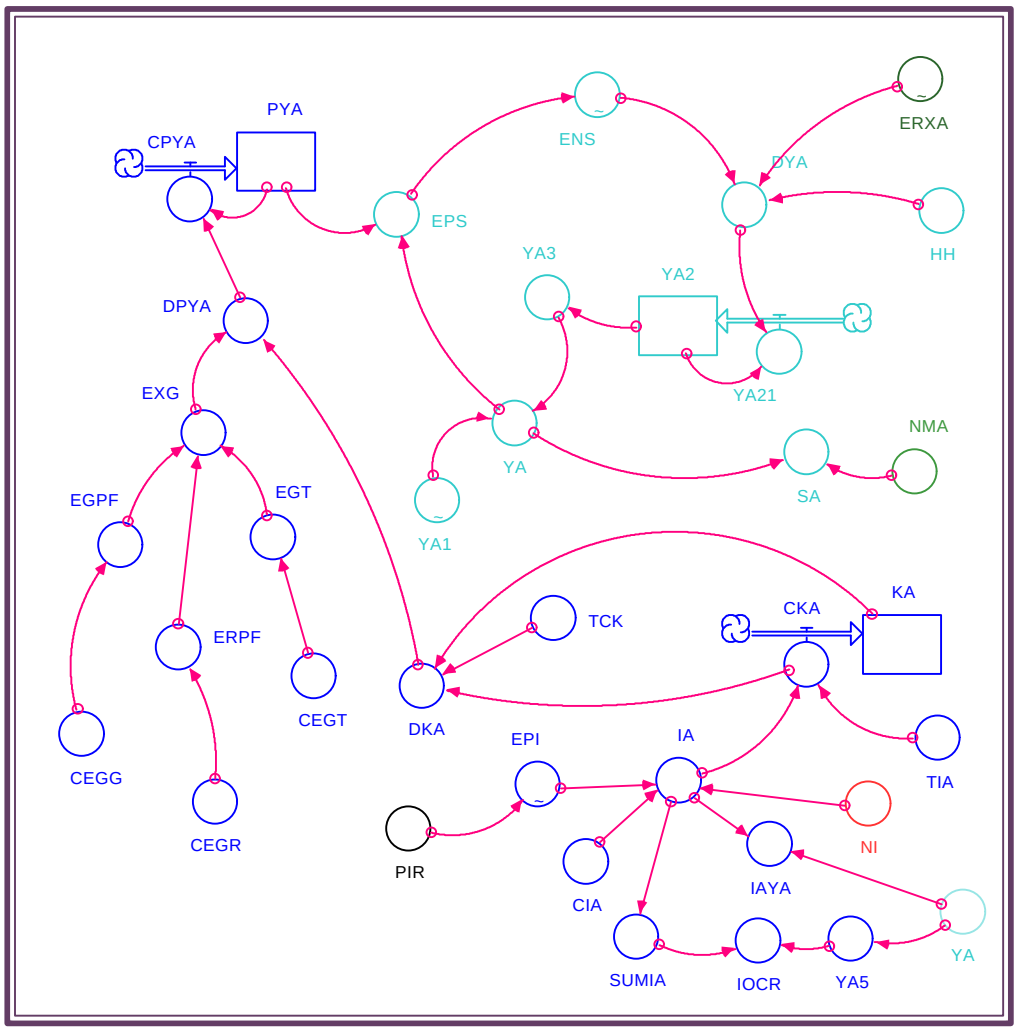

Figure 4, Investment and production capacity sector.

The net import (NMA) affects the relative prices and investment through the supply (SA). The real values of import and export are determined in the corresponding section. In the present model, the real values of net import are used up to the year 1999. For the

period of 1999-2030 the import is taken as equal to 80 percent of the difference between production and demand.
Two scenarios are used for the exchange rate. In the first, the government intervenes to determine the rate, in the other the government is neutral. This section is shown in figure 5.

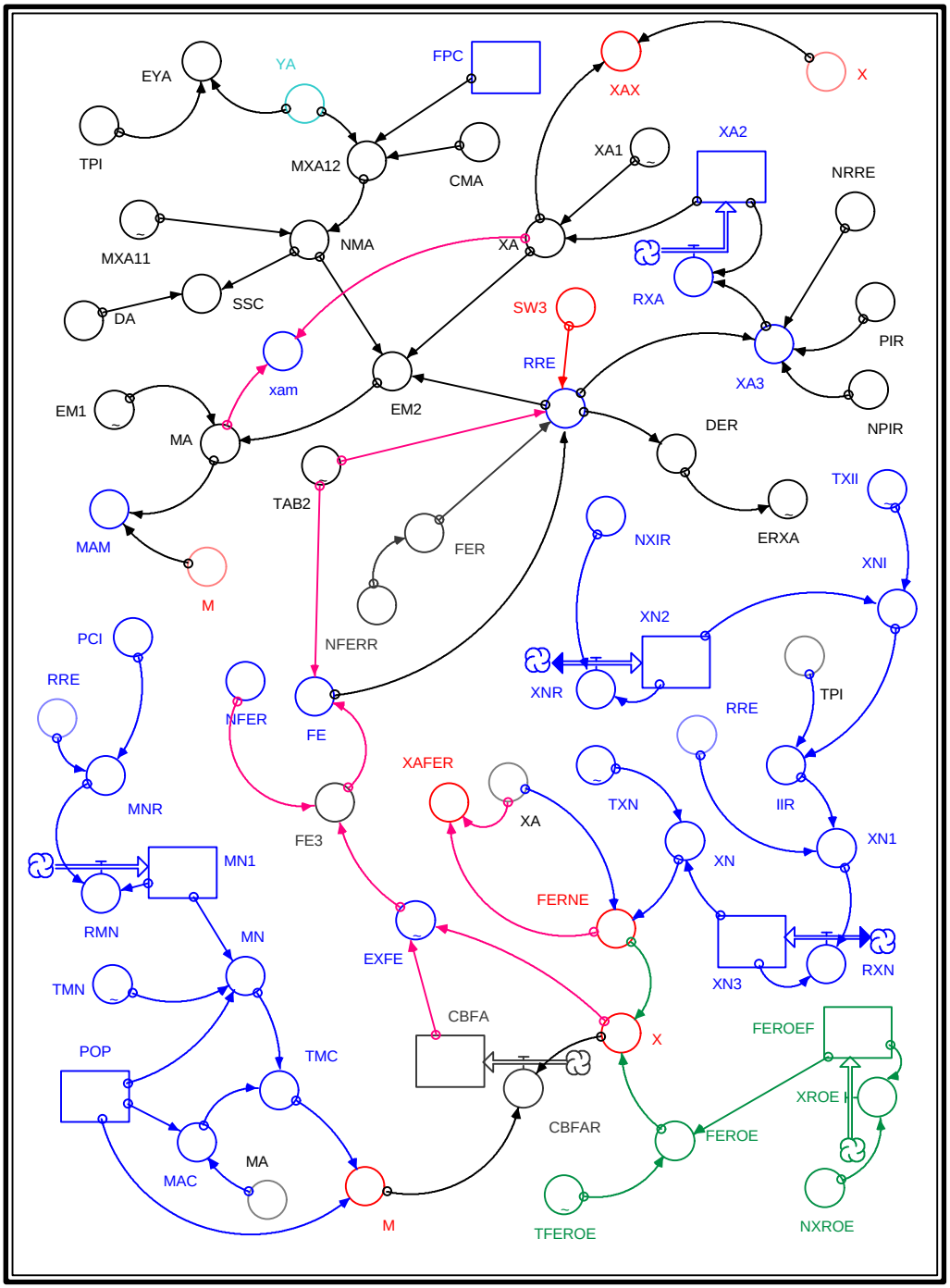

Figure 5, Foreign exchange, import end export section.

There are three cycles in which import and export of agricultural products are involved.

In the first balancing cycle, the exchange rate (FER) affects the export of agricultural products (XA) and exports (X) in general. The foreign currency possessed by the central bank, (CBFA), and therefore, the value of national currency increases. In the second cycle, the exchange rate is affected by other exports. In the third cycle, devaluation of the national currency increases the total prices index (TPI). This results in less export and more devaluation.
In the model, it is assumed that the exogenous variable of oil export grows by 1 percent annually. Also, non-agricultural import is estimated by regression. Econometrics methods were used to relate the agricultural export to relative price and exchange rate. Software ithink is used to establish the model.

6. Running the model for the current situation

In this section, the model is evaluated assuming that the current policies continue. Results show that the normal nutrition index is increasing steadily. This shows that current policies can support poor people. However, as shown in figure 6, the gap between production and supply increases from 0.42 percent at the beginning to 13 percent by the year 2030.

The self-sufficiency changes from 1.0 to 0.92 at the end of the running period. This is obviously against the predefined government's target. In fact, the adopted policies encourage more consumption and less production. In addition, fixed exchange rate works in favor of more import. As shown in figure 7 during the period of 1972-2030, the import is always higher than export.
With some fluctuation, ICOR index declines steadily. This could be the result of unused capacities that have no financial justification to be used. With a slight improvement until 2017, ITS begins to decrease form this year.

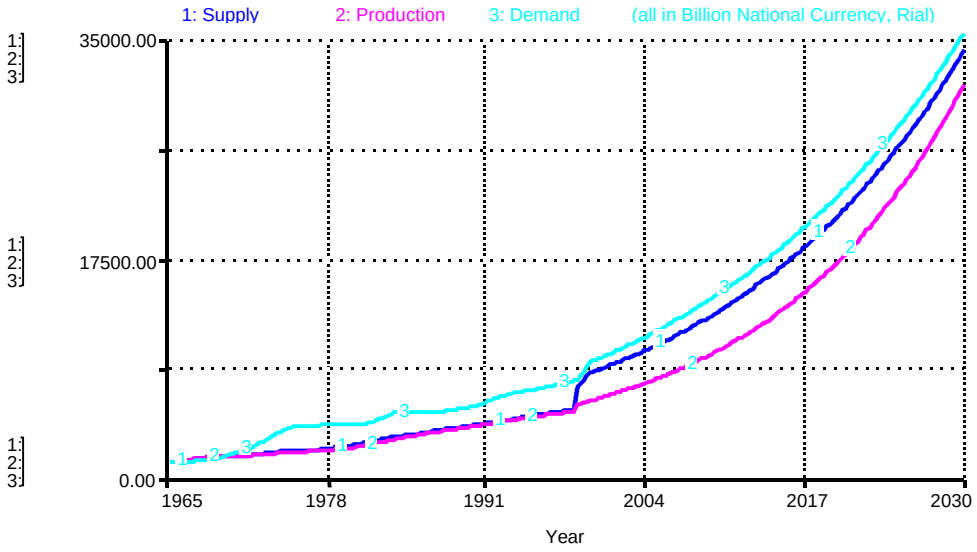

Figure 6, Demand, Supply, and Production if the current policies continue.

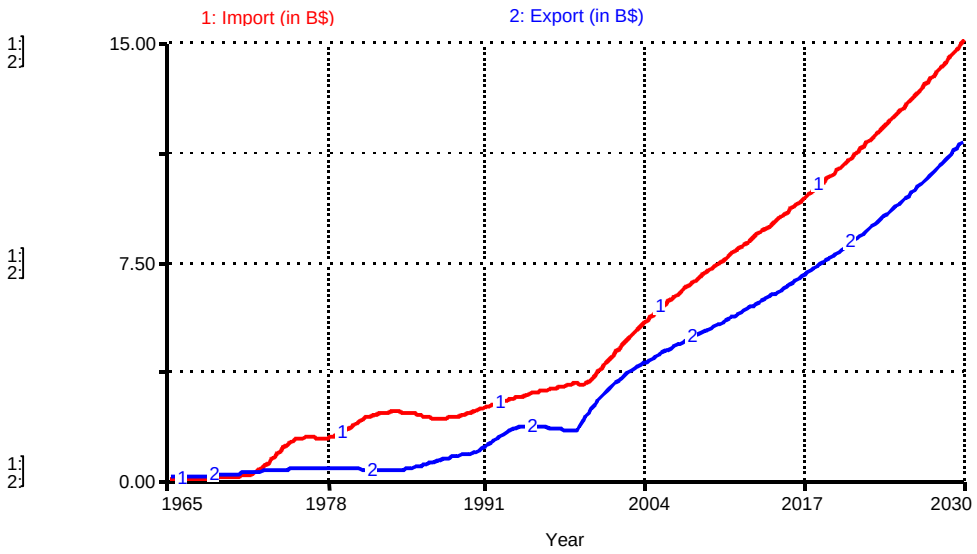

Figure 7, Agricultural export is always lower than import for 1972-2030.

7. Implementing Policies

In this section, three counter-policies are examined in the model. Theses policies are:

1- There is no fixed price for agricultural products; therefore it is expected that the relative price will increase.
2- The exchange rate follows the general economic balances so that the governing policy is a floating exchange rate.
3- Above policies are taken simultaneously.

7.1. No-Fixed Prices Policy

The current policy to fix the price of agricultural products undermines the motives to produce, encourages more consumption, therefore more dependency on import. If such policy is removed from the model, one can expect that the levels of demand and supply determine the price. The price index is taken as a direct function of two variables: the ratio of demand to supply, and exchange rate changes. As expected, higher relative prices result in more profit and less demand. As shown in figure 8, the SSI is increased form 0.92 in the initial condition to 1.12 and the normal nutrition index to 3.02 in comparison to 3.67 in the initial model.

However, the increase thus resulted in SSI stems originally from decrease in demand. In fact, the positive change in production with this policy is very slight. This is because higher prices of agricultural products influence greatly the relative prices.

Therefore, producing factors, such as investment and productivity, will not enhance. Decreased demand also affects negatively the import. However, as the model predicts, by the end of the running period, the export of products exceeds the import, as shown in figure 9.

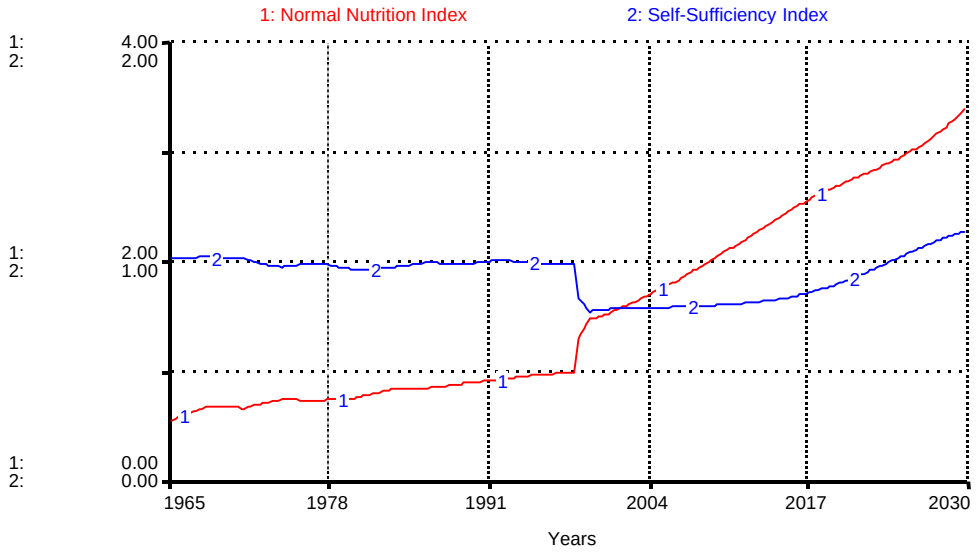

Figure 8, The Self-Sufficiency and Normal Nutrition Indices with no-fixed price policy.

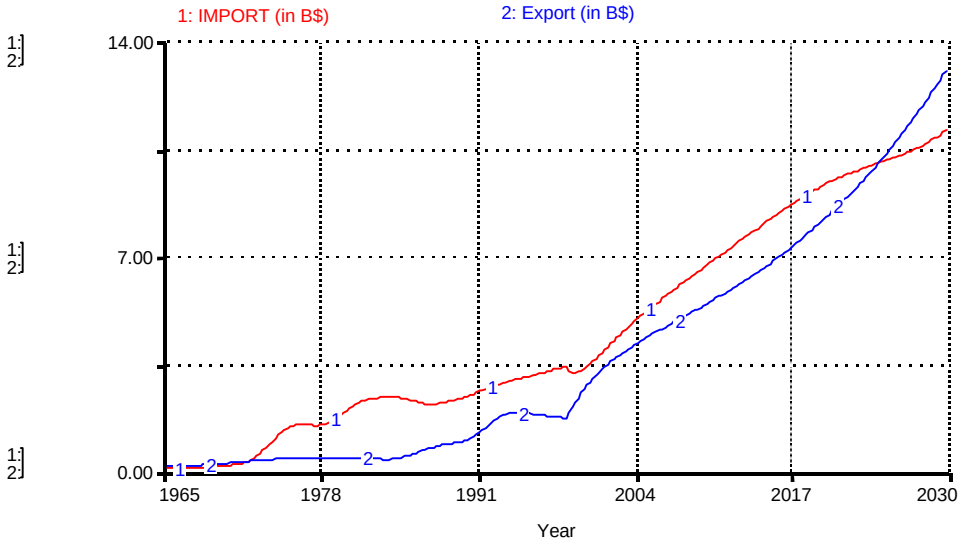

Figure 9, Export exceeds Import with no-fixed price policy

7.2. Floating Exchange Rate Policy

In countries with limited resources to influence international prices, devaluation of national currency may increase the export by using the unused capacities, creating new capacities and shifting the production resources to produce goods for export instead of producing to replace imported goods. This, however, increases the export level only if it causes more foreign investment, higher national deposit rate, and better performance of investment.

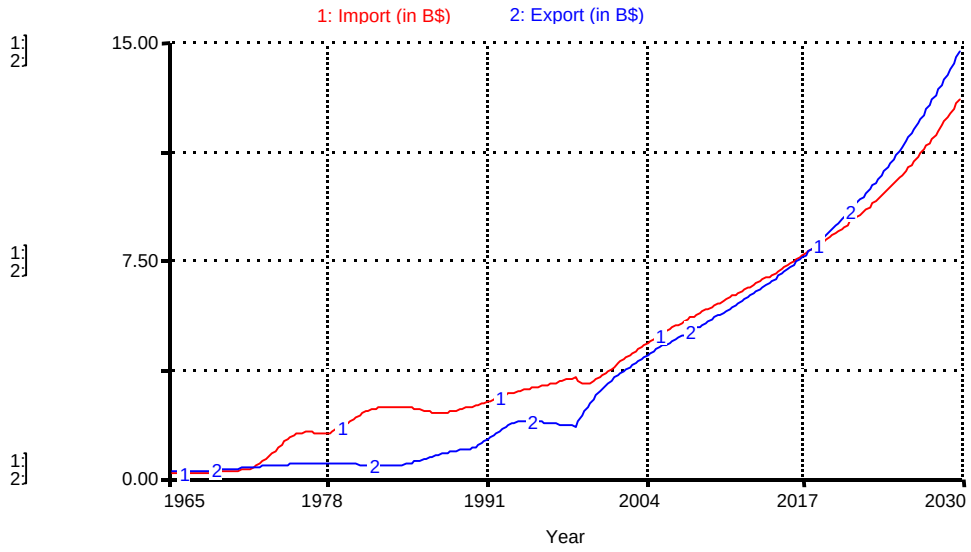

Figure 10, Export exceeds Import with Floating exchange rate policy.

For more than 20 years, the government has taken the policy to apply the predetermined fixed exchange rates to save the national currency. The effects of the counter policy of devaluation by floating the exchange rate are examined by the model. The results show that SSI will increase from 0.92 to 1.01 due to reduction in demand. The 8.9 percent increase thus resulted is lower than the 18 percent gained by no fixed price policy. The nutrition index increases by 20 percent. In addition, as shown in figure 10, by the end of the running period the export exceeds the import. However, the change in production is still insignificant. The essential goods are still imported by the government and provided to people for subsidized prices. This is the cause of the increased normal nutrition index.

This policy has also negative influences on investment in the agricultural section when relative prices are steady. This can be because of the increased inflation that reduces the relative prices.

7.3. Combined policies

As seen in previous sections no-fixed price policy and floating exchange rate policy influence the relative prices conversely. If both policies were implemented together, the resultant effect on the relative price would be unknown. Figures 11 and 12 show that the relative prices have encouraging effects on investment and production. In the model, investment in agriculture, (IA), is a function of national income, (NI), multiplied by the common tendency to invest (CIA). The relative prices affect the investment through EPI coefficient.

With constant CIA, the increase in investment is due to increase in relative prices. This also reduces the gap between the demand and the production by reducing the demand. The counter effects of these policies on import and export are reflected in SSI. This index increases significantly to 1.12, in comparison to 0.92 of the original model.

Higher price means lower demand, hence lower, though still acceptable nutrition index.

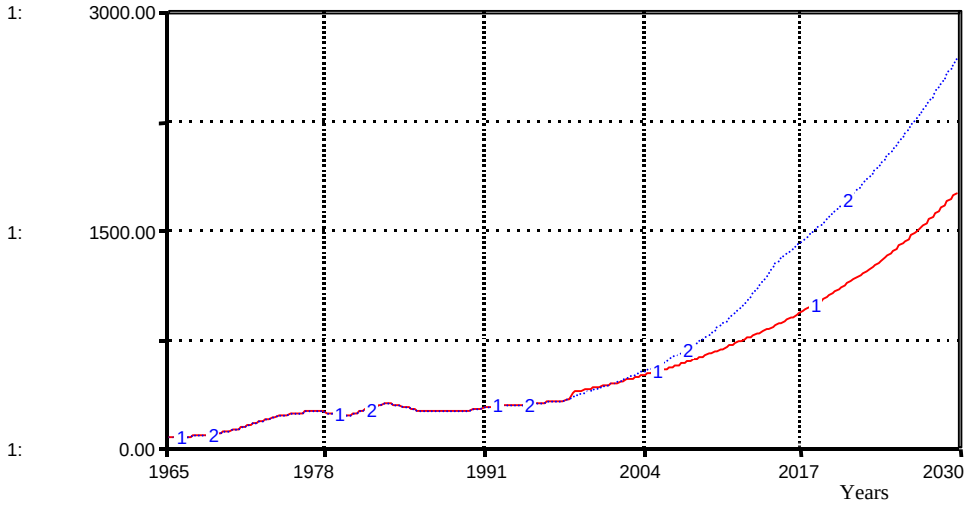

Figure 11, Investment in agriculture 1) if the current policies continue, 2) applying no-fixed price and floating exchange rate policies. The investment in year 1980 is assumed 100 billion Rials.

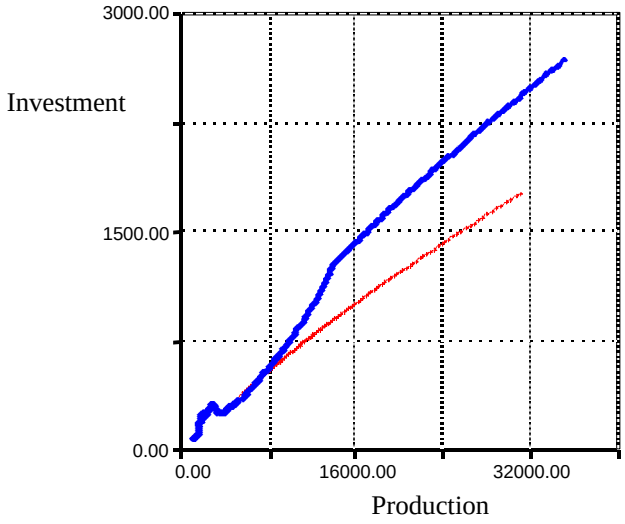

Figure 12, Investment/Production relationship if the current policies continue (lower line) and if both new policies are applied (upper line).

8. Conclusions

Floating prices for agricultural products can motivate the investment in agriculture. However, this may cause inflation affecting the general prices. Poor class suffer and the nutrition index lowers. Only increase in the production and decrease in the demand can reduce the existing gap between them, and have positive effects on self-sufficiency index.

Floating exchange rate policy, with the immediate consequence of devaluation of national currency, increases the export to import ratio, hence the SSI. In addition, this can increase prices in general. This cause the relative price of agricultural products to decrease since the market is very sensitive to imported goods and it is assumed that the fixed price policy still exists. Reduced relative price results in less production, and more import. Therefore, the effect of this policy on SSI depends on other variables.
When both floated exchange rate and prices policies are implemented together, the self-sufficiency index will improve as well as the nutrition index. This combined policy increases also the ratio of investment to surplus in agriculture and with an initial rise, ICOR index is improved by the end of the period.
In summary, recommended policies to activate the whole economy are equally effective in agriculture. However, in oil-dependent economies like Iran, no study is complete unless the trend of oil price is also considered in the model. To complete this study, the model can be extended to include factors like the long-term capacities of exporting oil and the net income ensued. Moreover, reducing the domestic demand by birth control plans is another important tool that can be added to the model in future research.

References

1. Adeli, M. [1990] "Exchange rate and economic reform", Published by Institute of financial and banking studies, Central Bank of Iran.
2. Asgari, A. [1989], "Price and pricing Methods and policies", Published by Institute of business researches, Tehran.
3. Bach, N.L., and Saeed, K. [1992]., "*Food self-sufficiency in Vietnam: a search for a viable solution*" System Dynamics Review, 8 No. 2: pp.129-148.
4. Hoseini, M., [1995] "*Exchange rate policy effects on agricultural products in the last decade*" MSc thesis, Tehran University.
5. Kiani, H. H., and Nikeghbali, H. [1999] "Unbalanced exchange rate effects on export of food" Journal of Economic Research, No. 65, pp. 52-79.
6. MosaNejad, M., [1993] "Optimum distribution of resources to gain self-sufficiency", 1st ed. Published by Ministry of Finance.
7. Zareei, A. M., [1998] "*Evaluation of supportive policies in self-sufficiency in agricultural products*" MSc thesis, Beheshti University.

Back to the Top