An Investigation into Iran's Auto Industry and Analyzing the Effects of Importation on its Growth: A System Dynamics Approach

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Abstract:

Nowadays Iran is going to become one of the major auto producers in the Middle East. Although Iranian car industry is reaching near 1,000,000 annual productions, the quality of the products is not comparable with global standards. Iranian auto industry, passing a period of maturation, is now in a situation, in which domestic car producers are supported by strict governmental laws, and import is severely limited. Thus there are not sufficient requirements to form a competitive market. In this paper, we will present a system dynamics model which maps condition of Iran's auto industry in the recent years. The model is then used to provide insights for the current status of the industry, as well as testing some policies for simulating the auto industry's growth.

Keywords: Demand for Domestic Products, Quality of Domestic Products, Quality to Price Ratio, Tariff

Introduction:

Auto industry which was started up by two production lines at the two strands of the Atlantic Ocean in 1896, today, after 150 years has reached an annual production of 50,500,000 cars and involves nearly 100,000,000 employees.

In fact, nowadays, automobile is a commodity which plays a great role in everyday life, based on its major application in transportation and trade. Moreover, it even has significant effects on some social and cultural aspects of people's life.

Iran's auto industry which started from the 1959 has passed the first states of a new born auto industry (assembling the imported parts) and before the revolution, some of the car factories were upgraded to factories with the ability of design and production of spare parts. After the revolution, due to the shortage of qualified engineers and closure of car factories, we had a great downfall in auto production. The car industry tried to survive but, because of the war it faced another shock and auto production experienced another slump. In addition, by the first 15 years until 1993 it was mainly producing some outmoded cars (with the out of date technology of 20 years before).

After the war, while the Iranian car factories were using just 20 percent of their production capacity (from 1989 to 1995) by importing 164,000 autos (cost 2,000,000,000 dollars) we had a reduction in demand for domestic cars. It is worth mentioning that before 1990 imports were in a reasonable limit, hence there could be observed a gradual increase in demand for domestic production. But during the years 1991 to 1993 by the irregular importation of cars, we had a sharp fall in demand for domestic cars. In 1991 the government passed a law for supporting the auto industry and in the year 2000 the domestic car industry reached an annual production of 265,000 cars which evinced a 23 percent growth in production in comparison with the year 1999.

Iran's auto industry, experiencing a lot of ups and downs after the war, has started to grow but during these post-war years because of the monopoly it could not improve much. In 90s, Iranian car factories just had simple assembly lines and they had no unit for designing autos and no R&D section, but progressively they are moving toward a mature industry.

Our concern today is that by the monopoly which apparently acts in favor of domestic producers we might think that we are protecting our car companies, but unfortunately this has caused deterioration in the quality of Iranian cars and as there is no choice left for the Iranian customer except buying domestic cars, no obstacles exist for domestic producers. In fact, when we prohibit the importation of cars or put a high tariff for them, there would not be any threats for the domestic producers and thus we would not have a competitive market.

Problem Definition:

Regarding the undeniable effects of Auto industry on the economy of a country, Iran's auto industry has many concerns for improvement. These days by the evidence of statistics, Iran is going to become one of the most significant car producers in the Middle East, and the Iranian car factories

are going to export their products to many other countries like Azerbaijan, Turkmenistan, Venezuela, etc. Although the production capacity is increasing with a desirable rate, nowadays the most important concern for Iran's Auto industry is the quality of the products. The quality of the production will become more important if we consider that Iranians are trying to join WTO and also have moved toward a more open economy during recent years. As a matter of fact, if they don't consider quality improvement, they will lose their market share in a competitive market.

Here, we are going to develop a system dynamics model to simulate the situation of Iran's auto industry and address the reasons of the problem which was mentioned. As we explained in the introduction, in Iran, importation of cars is being done with a high level of tariff which reduces the competitiveness of the market.

Before we go through our dynamic hypothesis, it's better to mention the most important variables which we are going to develop our model based on them.

- *Quality to Price ratio (for Domestic Products and Imported Products):*
  To understand why we took into account this variable, first of all we study the customer's behavior. For choosing a car the most important issue is the price they pay and the quality they achieve, so what is going to be determinant for choosing a car is the ratio of quality to price.

- *Demand for Domestic Products (Demand for Imported Products)*:
  In a competitive market, it is really important to know the portion of domestic products which is used in the country, because the capital of the companies will be determined by their sales.

- *Quality of Domestic Products :*
  In fact, our main concentration is on the quality of the domestic autos.

Casual Loop Diagram & Dynamic Hypothesis:

In this part, first we depict the loops which are detected in analyzing Iran's auto industry and after that we will go through our dynamic hypothesis.

As the population of a country increases, demand for products will increase. This is more serious in countries which have young population. So by the increase in the demand for car, the producers put more effort on:

1-Increasing the production capacity in use (percentage of total capacity which is in use, which is a short term policy)

2-Increasing their total production capacity (long term policy)

As production capacity in use increases, the quality may decrease (like what we see in limits to growth Archetype), because they have lots of orders to fulfill which may end to a delay in delivery or a lower quality. (We can interpret the delay in delivery as a reduction in quality) By reduction of the quality of the products, the desirability of those products will decrease as well as the demand. This is shown in Fig.1.
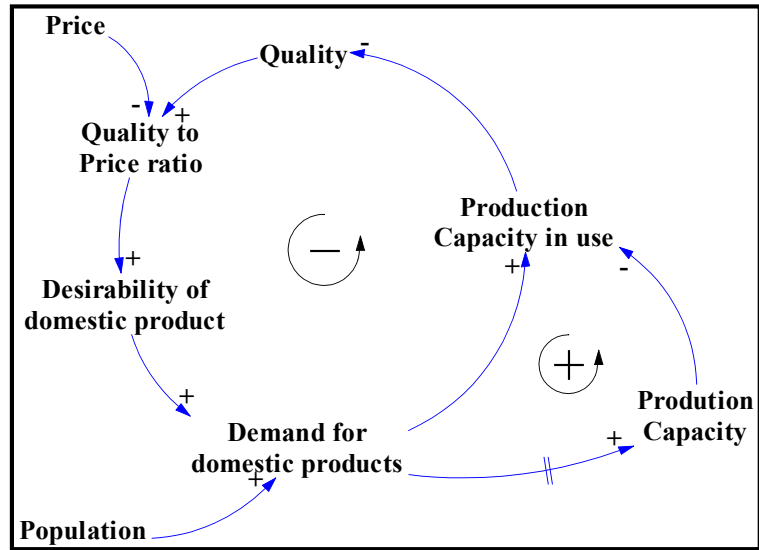

Fig.1

Thus, by the loop illustrated we deduce that the quality of the products will decrease as the population increases. On the other hand, when demand for the domestic products increases, the revenue of the company will increase which will cause an increase in the capital of the company. Quality change can be performed by investing on R&D part of the company. Thus, as the capital of the company increases, the R&D budget will increase, which can result in a change in the quality. This loop can be observed in Fig.2.
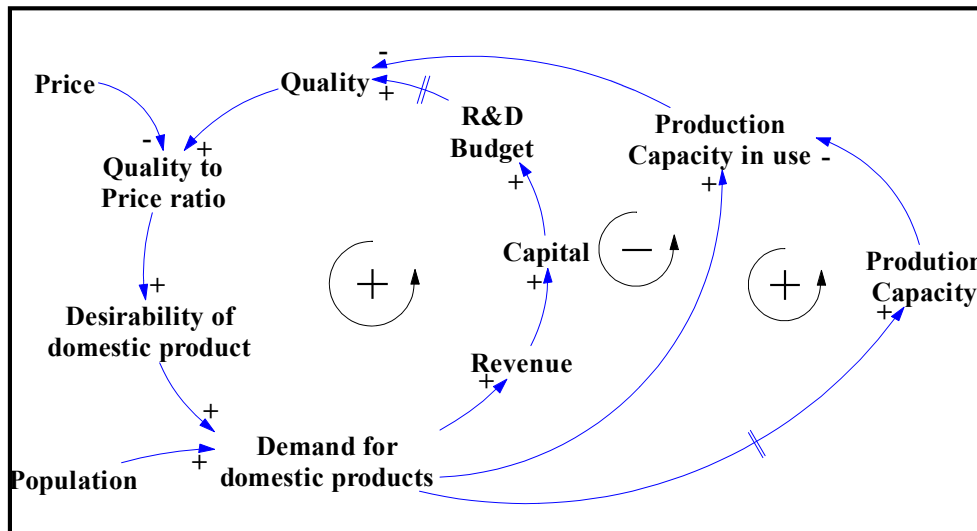

Fig.2

Merely, the demand for a product won't be created only with regard to its desirability. It also depends on the desirability of other competitors. Thus, when customers want to decide between some products, they compare the desirability of those products which is based on quality to price ratio. For analyzing Iran's auto industry, we should notice that domestic products are not competitors for each other, because the domestic products are not in the same range of price.

Thus, here we assume that imported cars are in the same range of price, competing with domestic products. In fact, their price can be affected by the policies of government, which ordain some tariffs on the imported products. As the demand for imported cars increases, the importers will import cars with a better quality in that price range, which will affect the quality to price ratio for imported cars. Subsequently it will increase the desirability of imported cars and demand for those kinds of products will increase. The mentioned loop can be seen in Fig.3.
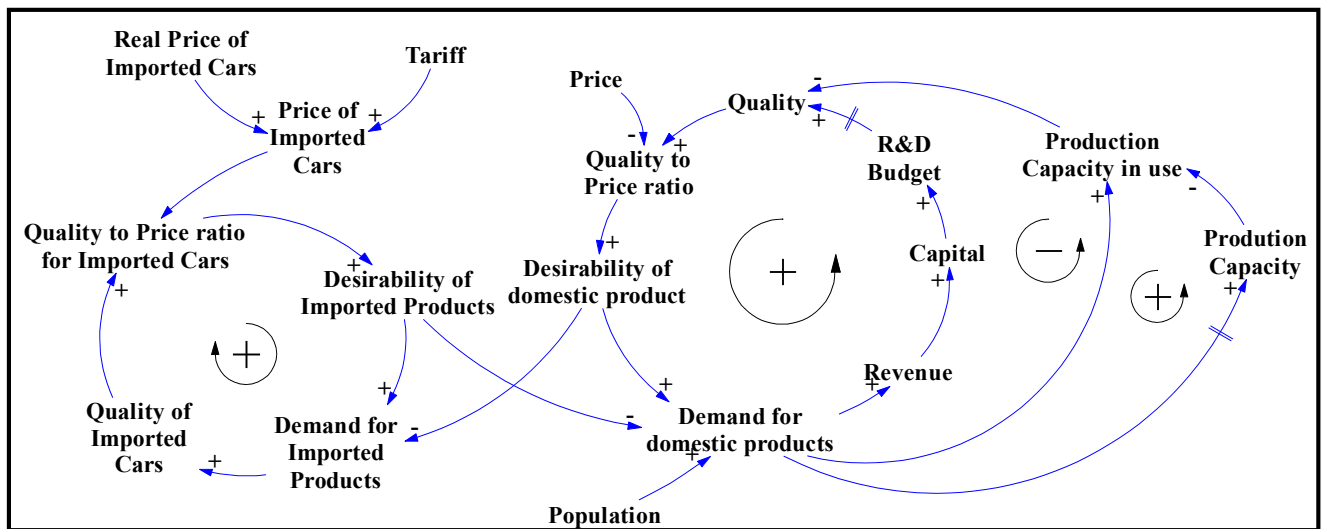

Fig.3

Regarding what we have depicted until now, we can state our dynamic hypothesis as below:

In Iran's auto industry, because of high level of tariff, the desirability of imported cars is not comparable with domestic ones, so most of the customers buy domestic products. As demand for domestic products increases, the production capacity in use will increase which cause the company to work with higher effort to fulfill the demand. It can decrease the quality of products because of higher demands compared to production capacity (explained in fig.1). This downfall of quality can be adjusted by investing on R&D, but in uncompetitive atmosphere it cannot be effective.

On the other hand, for decreasing such a pressure for production, companies increase production capacity which will be effective after some delay, so it can not deter the downfall in quality immediately.

Following the above mentioned we will develop the flow diagram and discuss the effects of importation on the development of auto industry as a policy to change the current situation.

Flow Diagram and Model Description:

In this part we are going to develop a stock-flow diagram. In our model, first we consider the situation in which imported cars are not competitors for domestic products, so most of the demand must be satisfied by domestic production.

As we stated in the previous section, we have four loops in our model:

Loop 1, 2: when demand for domestic products increases, the quality will decrease. Also as demand increases, there will be some plans for increasing the production capacity which will take place after a delay time. The stock flow diagram of these 2 loops is shown in Fig.4.

Production capacity in use can be used as an indicator for producers to increase the total production capacity. This is done by means of a look up. (f3)

Total Demand will increase as population increases, so it is a function of time. Here because of the absence of competition even if the desirability of domestic products decreases, demand does not decrease that much because the customers have not any other choice.

Fig.4

Loop 3: As we mentioned before, when demand increases for products, companies' revenue will increase, which can affect quality of the products. "*R&D coefficient*" determines how much of the capital will be invested on R&D. Also we should notice that the domestic producer's goal will be

attaining the quality of imported productions. "*Budget needed for 1% improvement*" shows how much money should be spent in order to have 1% increase in the quality gap between domestic productions and imported ones.

Loop4: In this loop we model the behavior of the importers who import autos with better quality as the demand for imported products increases. Also this loop will affect the behavior of the customers because they will compare the desirability of domestic and imported products to decide. Also the surplus of demand for imported products will be forced to buy domestic productions. (Demand for Imported Products-Imported Products in Use) These 2 loops are shown in Fig.5. To obtain a compatible model with Iran's current situation of auto industry, we will set a high tariff on importation.
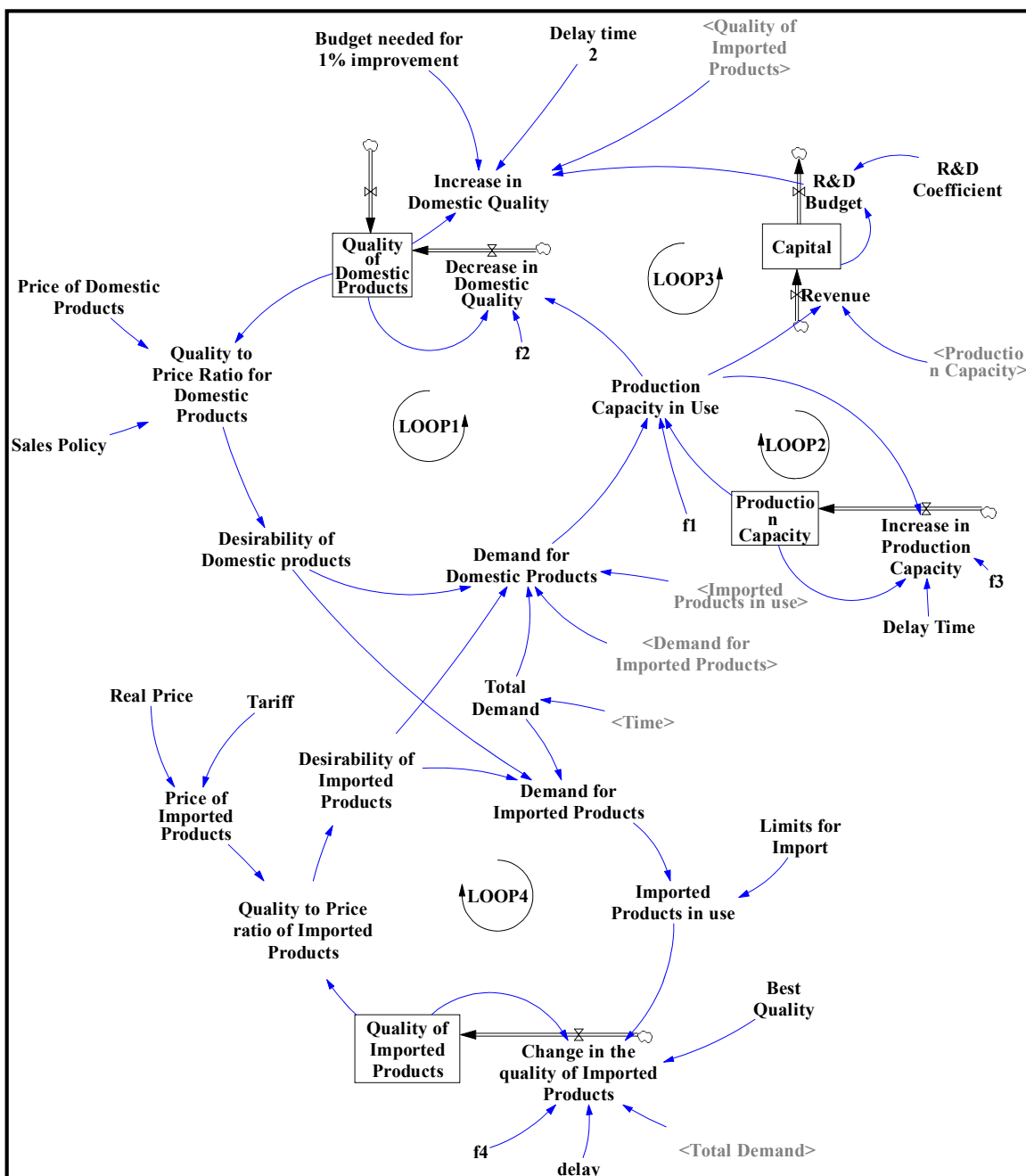
Fig.5

Simulation & Results:

After simulating the model, the behaviors of the "*Quality of Domestic Products*" and "*Production Capacity*" are as follows:

Quality of Domestic Products

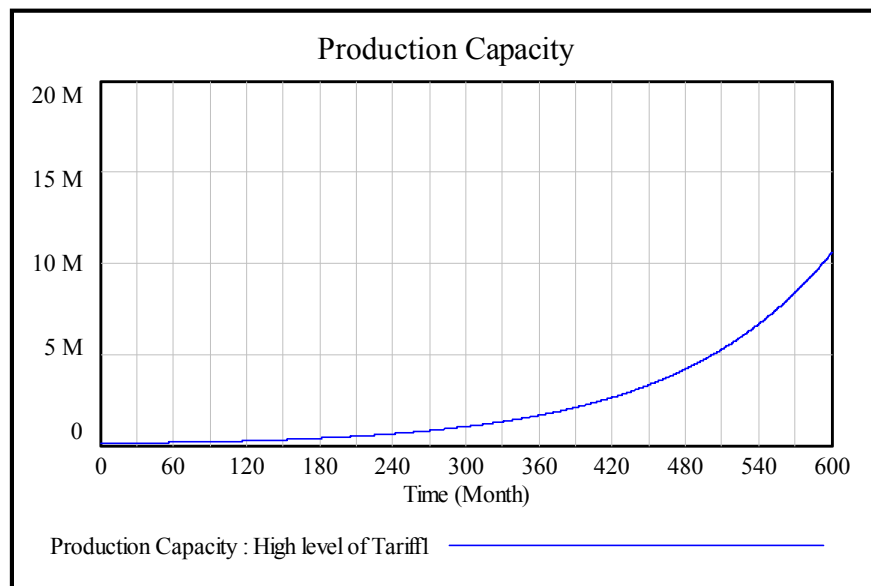Fig.6
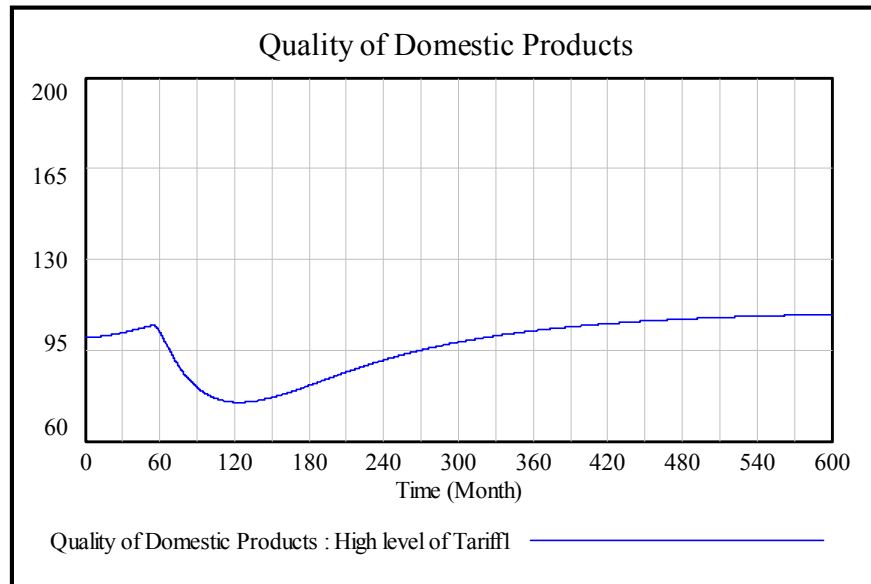
Production Capacity

Fig.7

As we can see in these graphs, when demand for products is less than production capacity, producers invest on R&D so their product's quality will increase, but as their quality increases, demand for their products will increase either. When demand increases the "*Production Capacity in Use*" will increase which brings about a decrease in quality. If demand approaches production capacity, it will cause an increase in "*Production Capacity*" which will take place with a delay.

After this delay the surplus of the demand will be fulfilled but increase in the level of quality occurs with a slow slope which is caused by the low level of quality of imported cars. Despite that we can see an exponential increase in demand for domestic cars.

Policy design:

As we mentioned before, Iran's government tries to support the domestic producers by ordaining high tariff on the imported products. The previous section shows the results of such a policy. Also we should notice that putting a limitation on the imports can be considered as an effective policy, because if there is some limitation on importing products, the surplus of demand for imported products will be forced to choose domestic products. We observe that there are two ways for controlling the market share of imported products. One is "*Tariff*" and the other one is "*Limits for Import*".

Now we will examine three different scenarios by means of this model:

    1- When there is high level of tariff for importing cars (High Level of Tariff)

    2- When there is no tariff for importing cars (No Tariff)

    3- When there is no tariff for importing cars, but importing is limited (Limited Import with no
       Tariff)

The behavior of "*Quality of Domestic Products*" and "*Demand for Domestic Products*" and "*Quality of Imported Products*" are shown in Fig.8, Fig.9, and Fig.10.
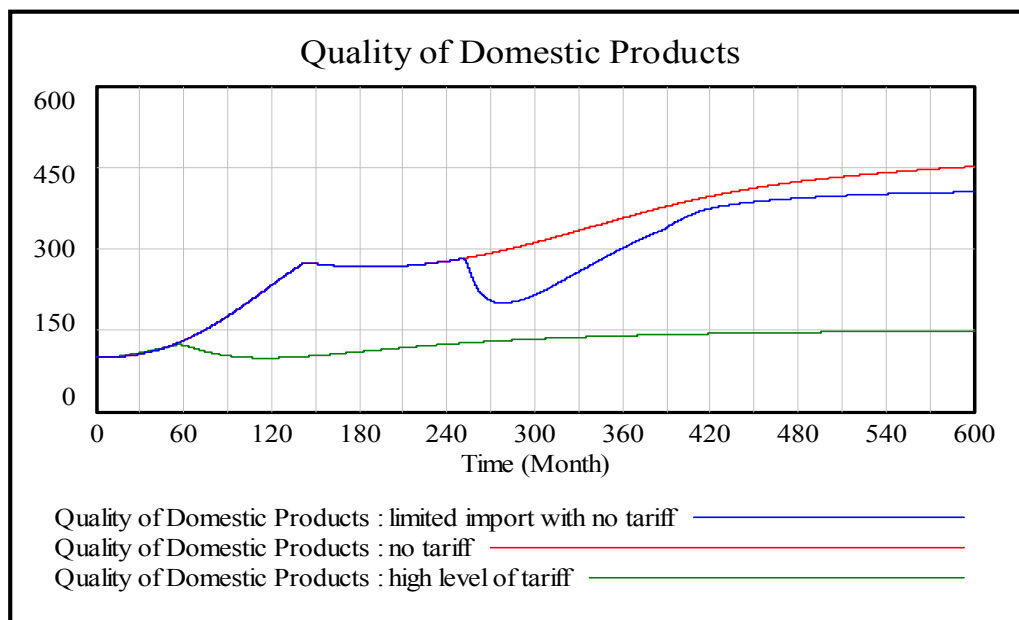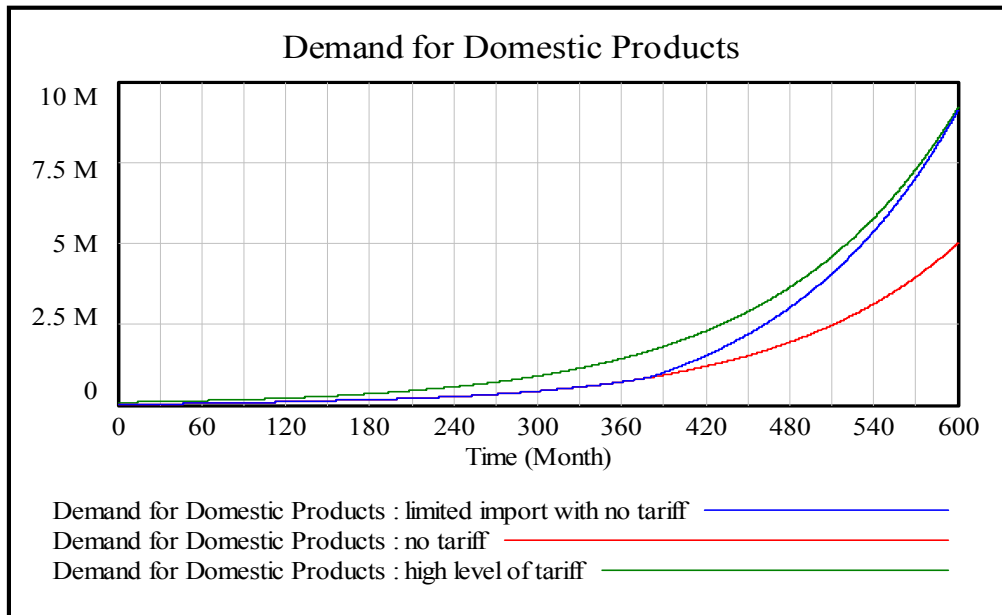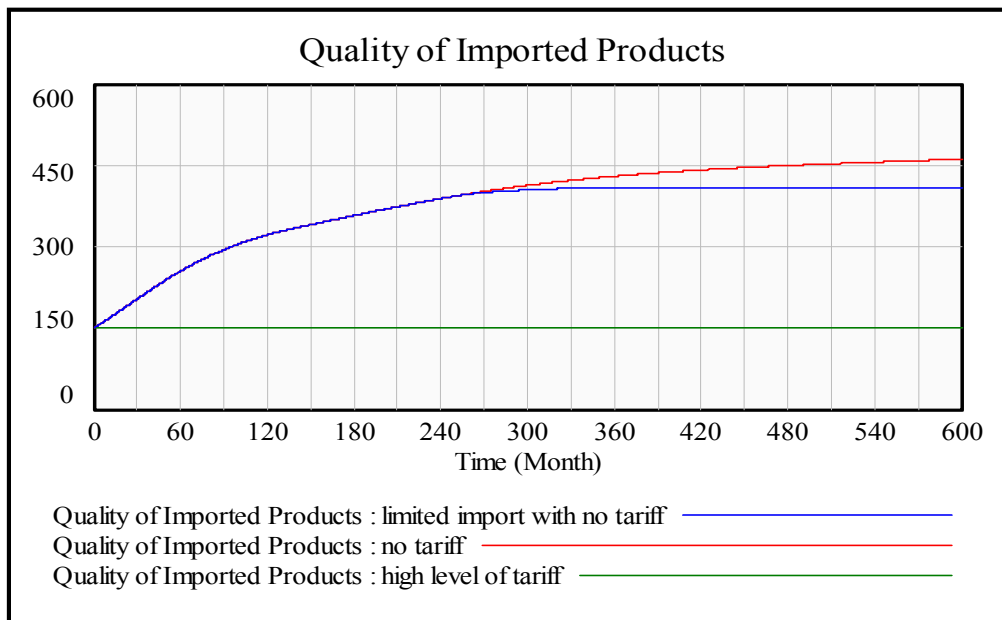

Fig.8

Fig.9

Fig.10

As we can see in these graphs(Fig.8, Fig.9, Fig.10), the best quality will be achieved when there is no tariff and no limit on importation, but in this scenario the demand for domestic products will be lesser than other two scenarios. Also we can notice that when there is limitation on the amount of importation, the quality will not increase as much as when there is no tariff, but the demand for domestic products will be in a higher level.

In countries like Iran which have had high level of tariff on imported products, there are some arguments about rapid change in tariff or smoothed change in tariff. In Fig.11, Fig.12 and Fig.13, the effects of these two different policies are shown.
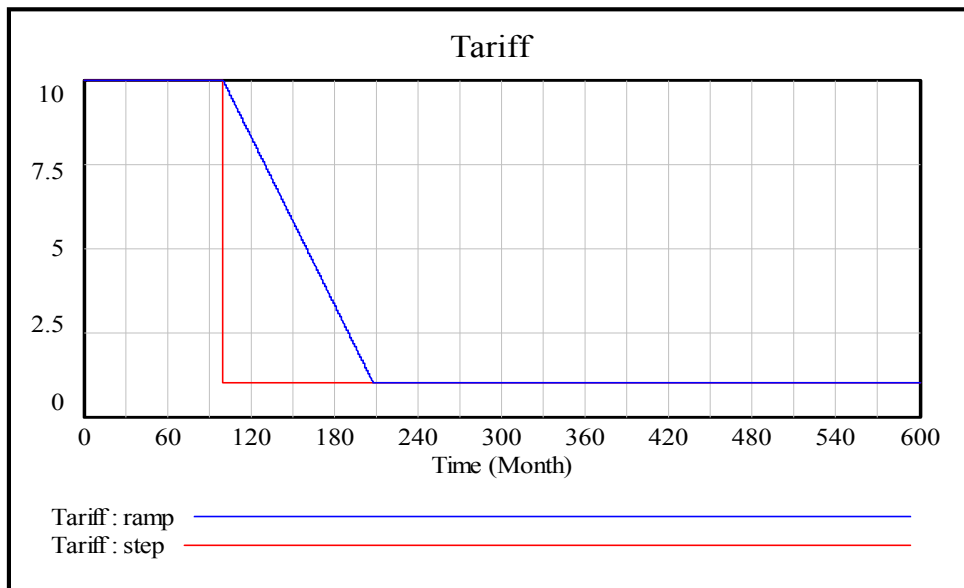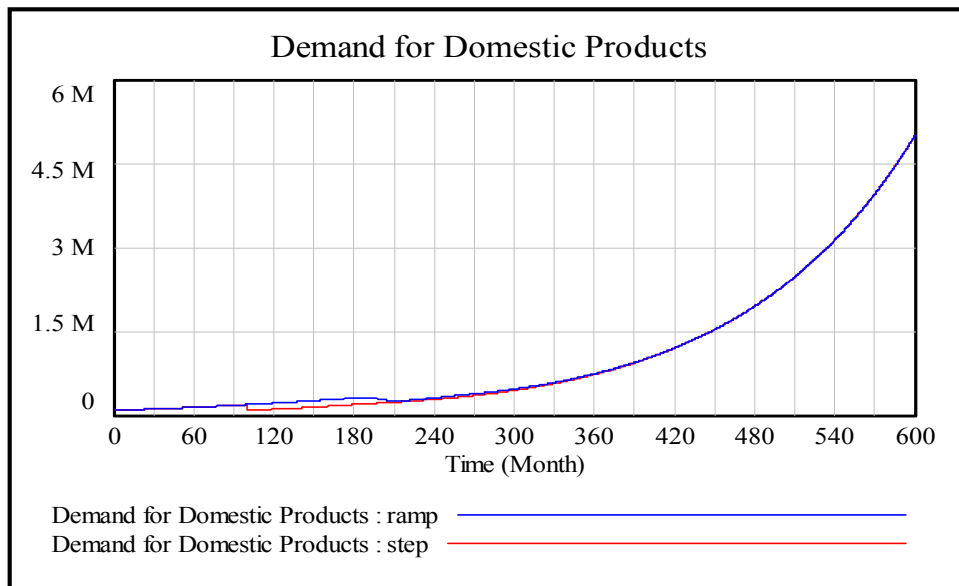
Tariff

Tariff : ramp
Tariff : step

Fig.11

Demand for Domestic Products

Demand for Domestic Products : ramp
Demand for Domestic Products : step

Fig.12

Quality of Domestic Products

Quality of Domestic Products : ramp
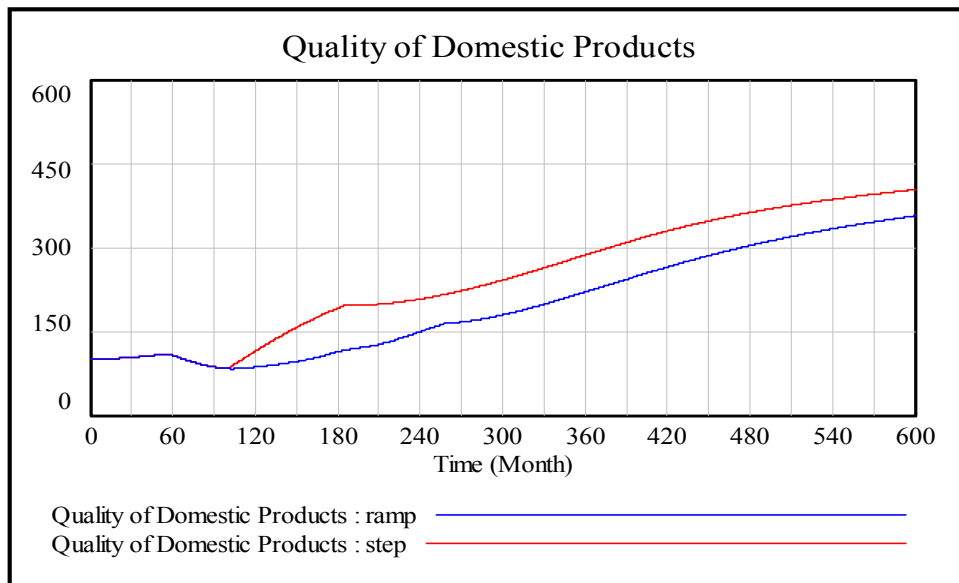Quality of Domestic Products : step

Fig.13

Conclusion:

As we mentioned in this paper, the quality of the products of Iran's auto industry is decreasing because of lack of competition in domestic market. We have shown this reduction in quality and increase in production capacity as it happens in reality. This problem takes place because of high level of tariff on imported products which has been decided by the government for supporting domestic industry. For having a more competitive market there are different policies which influence "*Quality of Domestic Products*" and also "*Demand for Domestic Products*". There is two policy design point in our model: 1-Limits for Import, 2-Tariff. For those countries like Iran that have had high level of tariff, reduction of tariff can be an effective way for increasing the quality of domestic products. For deterring the reduction in demand for domestic products it is a good policy to put some limitation for importing. Also we depicted that for those countries, which have ordained high level of tariff on imported products, rapid change in tariff will be more effective than linear reduction in the quality change, and there is not a marked difference in demand for domestic products.

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