

Gasoline Rationing Plan in Iran: A Symptomatic Solution

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Abstract

Iran is a resource-based country and these resources have brought advantages and disadvantages to the country. It seems that disadvantages are results of mismanagement of the resources and not the existence of resources. Fuel subsidy is an example of such mismanagements. While fuel subsidies are common in the Middle East, the oil-richest place of the world, Iranian domestic fuel prices are among the lowest in the world. The low fuel prices population growth, and urbanization growth have caused growth of fuel consumption and consequently growth of subsidies. Since nothing can grow forever, two years ago the government had to start a rationing plan to reduce the growth of fuel consumption due to budget and gasoline stock limitations.

In this paper we will model dynamics of the problem and answer why the government had to execute the rationing plan. Furthermore; we try to show that this solution is not a fundamental one. It is a symptomatic solution in which the ration of each car will decrease after a while. In the end, we offer two policies to limit the demand naturally, not by force of rationing plan, and try to offer a fundamental solution to manage the fuel consumption.

1- Introduction

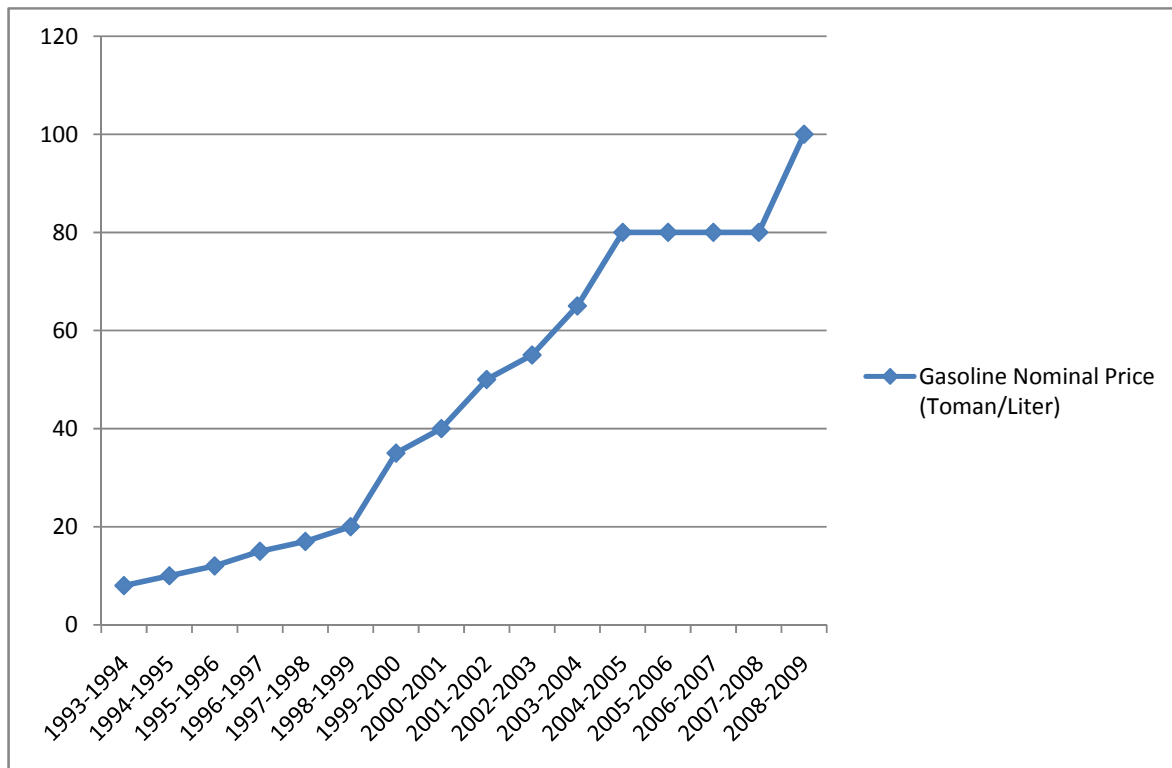
Iran is among the countries rich in natural resources especially crude oil and natural gas. It has the third largest oil reserves and also the second largest natural gas reserves in the world after Russia. These rich natural resources have brought both advantages and disadvantages to Iran. [1] (For a related discussion see [2]) The most important advantage is development of energy-consuming industries with high profit margin due to availability of inexpensive energy factors. As a matter of fact, the inexpensive energy is an important competitive advantage of domestic producers over their global competitors.

On the other hand, the most important disadvantage of these natural resources is again the low prices of energy factors especially gasoline. Every year, tens of billions of dollars are spent to import the required gasoline to meet the unnaturally huge demand of motorists. Although this money could have been spent on improvement of welfare of the society, it has caused huge budget deficit over past decades and undermined the welfare and even industrial progress of the country.

Iran's history is full of endless struggles over the increase of fuel price. Actually over the time, politicians have understood that reduction or stabilization of fuel price is a source of popularity for them. For instance, in 2004, Iran's parliament passed a law called "Stabilization of Prices". The law forced government to stabilize prices of some products including fuel, natural gas, electricity, and drinking water that were considered key factors in determination of inflation. Head of Iran's parliament called this law "the gift of parliament to the nation" at the time.

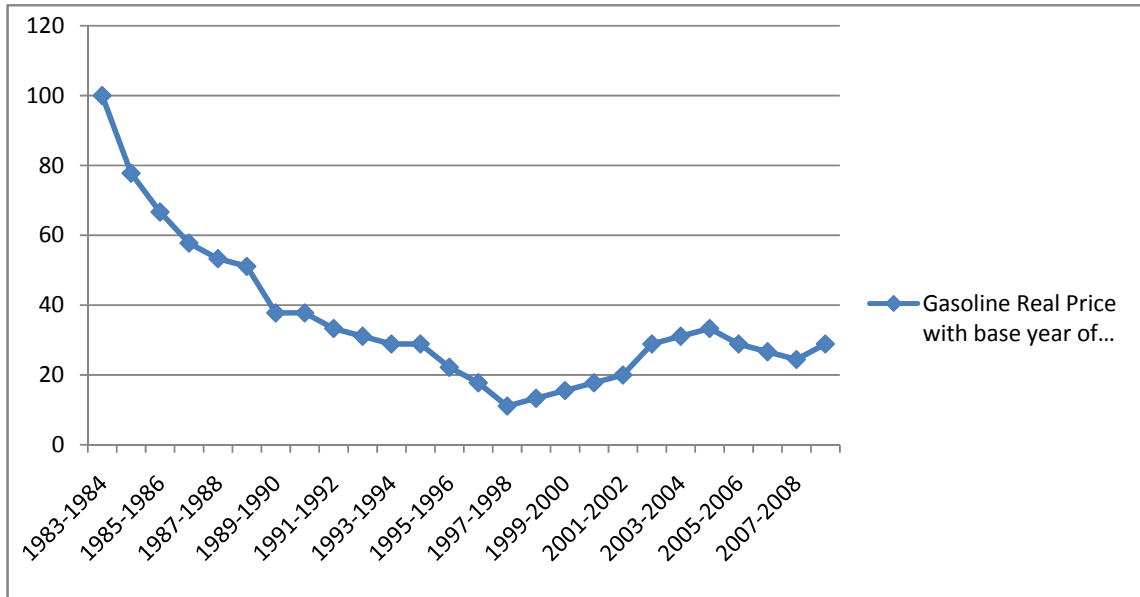
Figs 1 and 2 show the nominal and real prices of gasoline in Iran respectively.

Fig. 1: Gasoline Nominal Price in Iran in the past 15 years



Source: Iranian National Oil Company (1 Cent\$=10 Toman)

Fig. 2: Gasoline real price with base year of 1983-1984

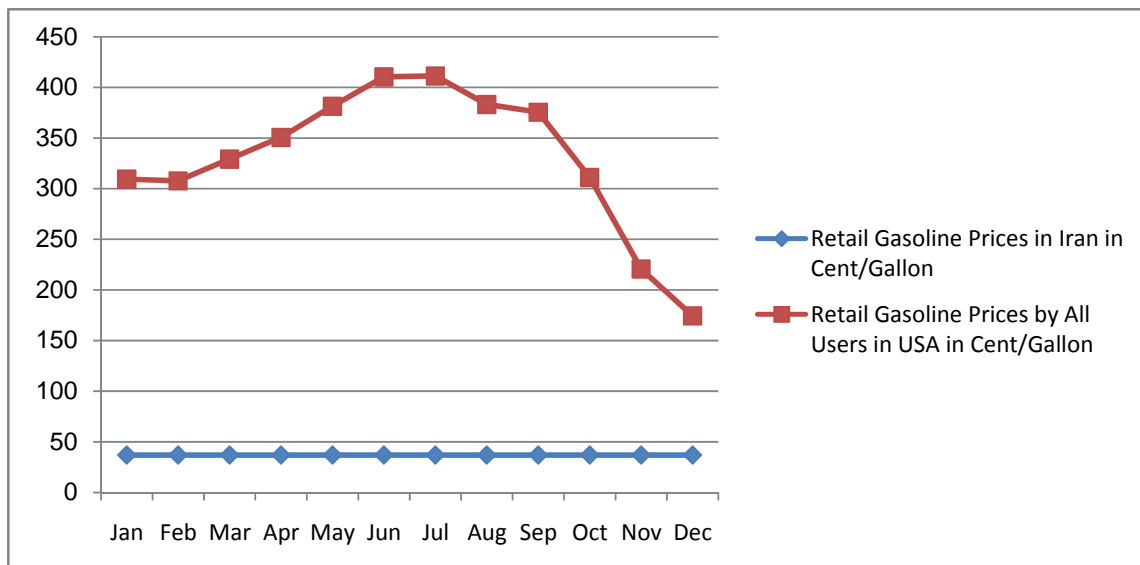


Source: Central Bank of Iran

As shown in Fig. 2, the so-called "parliament gift" decreased the real price of gasoline and eventually decreased the investment in this section and boosted importation because the domestic producers were not able to meet the growth of demand. [3]

To have a better picture of low gasoline price in Iran, Fig. 3 shows a comparison between gasoline price in Iran and USA in 2008.

Fig. 3: Gasoline Price in Iran and USA in 2008 (Cent/Gallon)



Source: Energy Information Administration (EIA)

Fig. 3 also shows another policy of Iran's government in pricing the gasoline: Fixed price policy over a year. Although the price of oil-related products such as gasoline, natural gas and electricity will naturally increase by a rise in oil price, Iran's government fixed the price of these products, even if the global prices doubled or tripled! Especially when the oil price rises, this policy has negative effects on the economy of Iran. On the other hand, when the oil price rises, the revenue of the government will rise too, but a part of this revenue is to be spent on importation of gasoline which is sold in domestic market with a price much lower than the global price. Thus it is not odd that the rise of oil income does not have the expected effect on improvement of welfare of the society of Iran. [4]

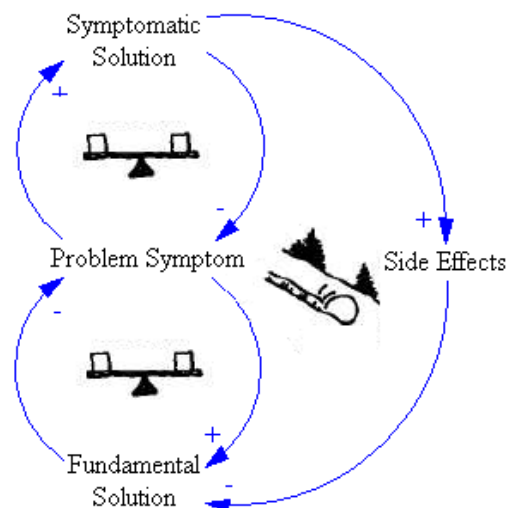
So what is the benefit of subsidies? These subsidies are a form of welfare payment that reduces the cost of living, but on the other hand, subsidies have reduced the profitability of most of industries in Iran and consequently the growth of GDP and the standard of living. The largest subsidy payment of Iran's government is on fuel, especially gasoline.

In 2008, the gasoline price was \$0.1 per liter and the cost of producing a liter of gasoline in domestic refineries was estimated \$0.22, implying a subsidy of 54 percent. The average import price was \$0.48, implying a subsidy of 58 percent. [5] But the question is "why does the country having the third proved oil reserves of the world need to import gasoline?" The answer is wrong policies of policy makers who reduced the real price of gasoline over the past years (See Fig. 2) and made the industry unattractive for investors. The aftermath of those policies is that refineries are inadequate both qualitatively and quantitatively. At present, Iran having huge oil reserves, has to import gasoline due to reduced production capacity of its nine oil refineries, most of which were built before the 1979 revolution.

Maybe the amount of importation and subsidies was not huge in the past, but with growth of population and urbanization, the demand for energy factors has reached to an uncontrollable point. For instance, in 2005, gasoline import subsidies cost \$2.1 billion (1.3 percent of GDP) but in 2006, they were estimated to be \$4.4 billion (2.3 percent of GDP). The rapid rise of these costs could not be borne, so the government announced that Iran would stop importing petrol in June 2006 and would begin fuel rationing. This policy was actually preferred to rising prices policy.

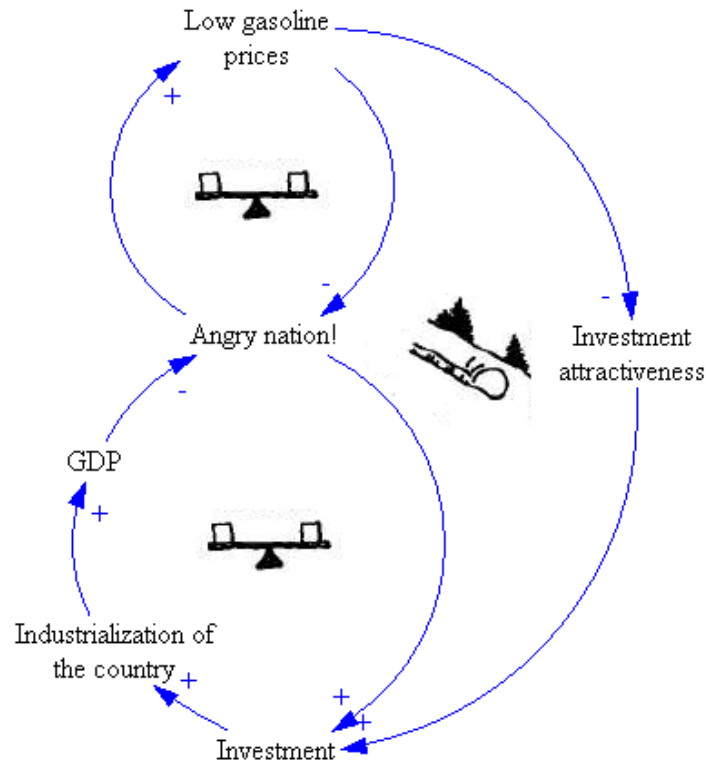
The gasoline issue is best modeled by what Peter Senge proposed in "Fifth Discipline". [6] There is a problem and you have two solutions. One is simple and immediate, "symptomatic solution", the other one, "fundamental solution", is hard and time-consuming. Although the symptomatic solution is fascinating to policy makers, it has some side effects that gradually worsen the problem. Fig. 4 shows the model.

Fig. 4: "Symptomatic" and "Fundamental" solutions



If the gasoline issue is modeled as shown in Fig. 4, we will have the model in Fig. 5.

Fig. 5: A simple model for Gasoline issue based on the model of Fig. 4



Politicians have selected the simpler way to make the nation happy. They could have invested the money in industrializing the country and therefore increasing GDP. But they have selected the simpler policy over the past decades leading to reduction of investment in new refineries which will have negative effects on the nation's standard of living. People, using inexpensive fuels, are happy in the short-term but they will be unsatisfied in the long-term because of the rationing plans and unavailability of the desired amount of gasoline.

With a brief description of the gasoline issue in Iran, we are now ready to define and model the problem. In the end, we will try to offer some solutions too, of course fundamental solutions.

2- Problem Definition

During the last few years, the rate of car production grew in Iran. With production of 370,000 cars in 2002, automakers reached the production of almost 930,000 cars in 2007. The number of all cars in use from 1999 to 2009 and their daily and yearly consumptions are shown in table 1.

Figures 6, 7, and 8 respectively show number of cars, gasoline consumption per car, and daily gasoline consumption in Iran.

Table 1- Number of cars, total daily and per car fuel consumption

Year	Number of cars	Total Gasoline consumption (m^3)	Yearly Gasoline Consumption per Car (m^3)	Daily Gasoline Consumption per Car (Liter)
1999-2000	2,945,572	11,779,302	4.0	11.0
2000-2001	3,142,572	12,242,441	3.9	10.7
2001-2002	3,389,118	13,320,996	3.9	10.8
2002-2003	3,712,964	14,267,902	3.8	10.5
2003-2004	4,178,678	15,596,651	3.7	10.2
2004-2005	4,841,653	17,217,408	3.6	9.7
2005-2006	5,601,695	18,541,784	3.3	9.1
2006-2007	6,419,116	20,508,959	3.2	8.8
2007-2008	7,335,947	22,421,991	3.1	8.4
2008-2009	7,551,120	18,720,384	2.4	6.2

Source: Iranian Fuel Conservation Company

Fig. 6: The number of cars in use during the study periods

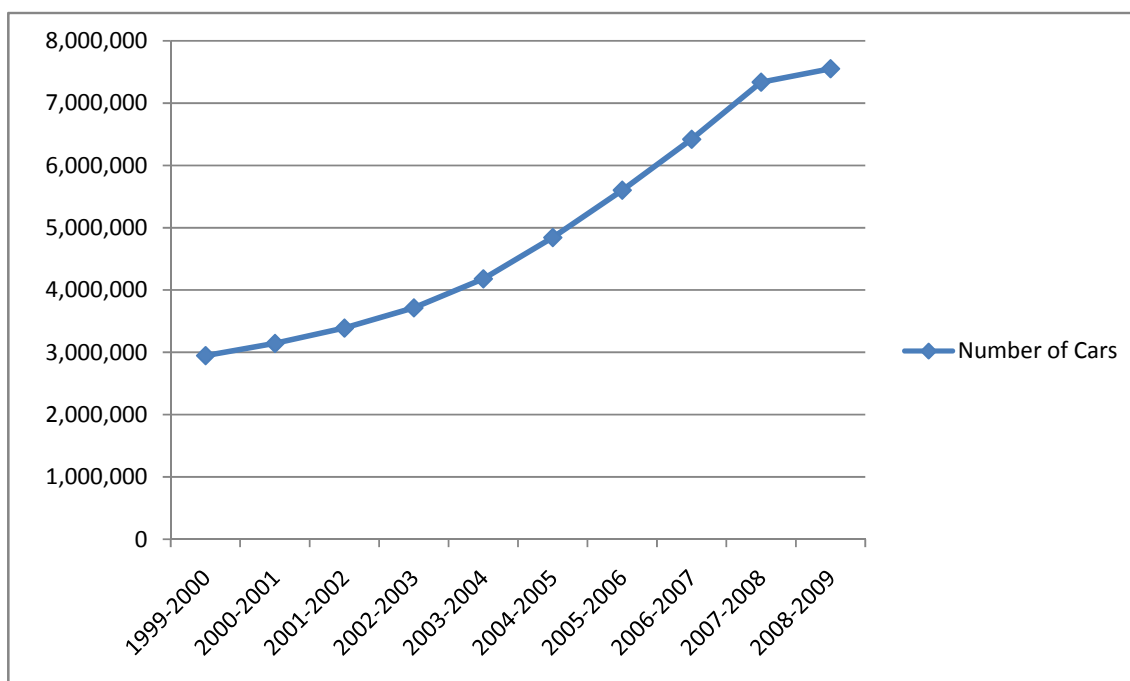


Fig. 7: Yearly and daily consumption of each car during the study periods

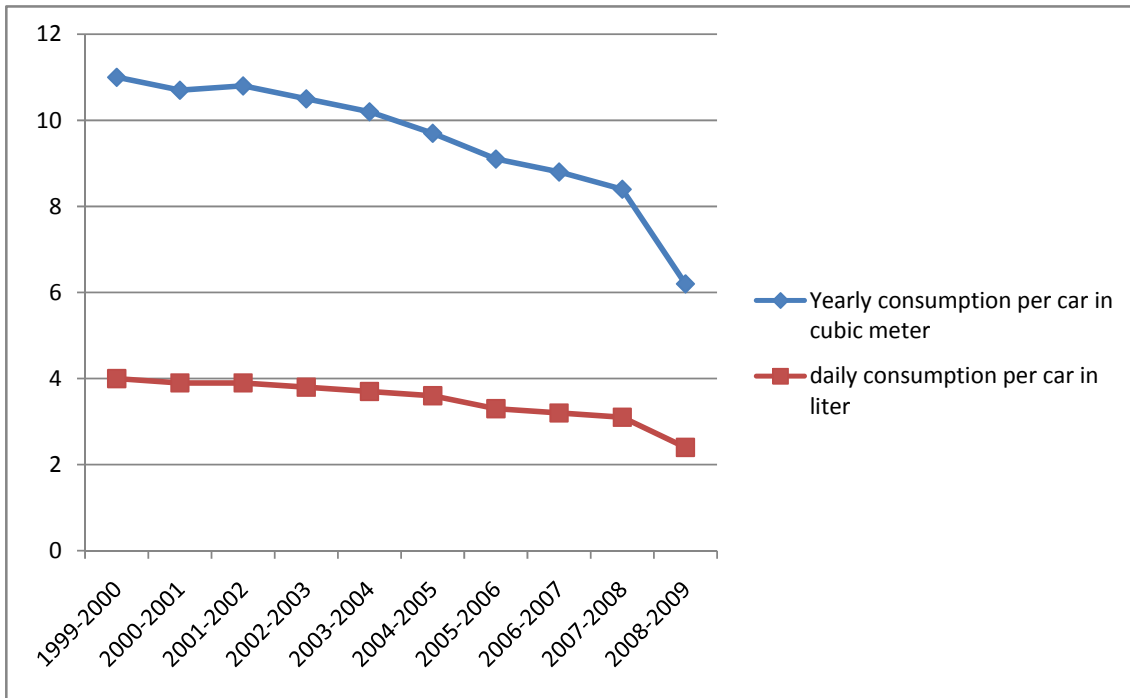
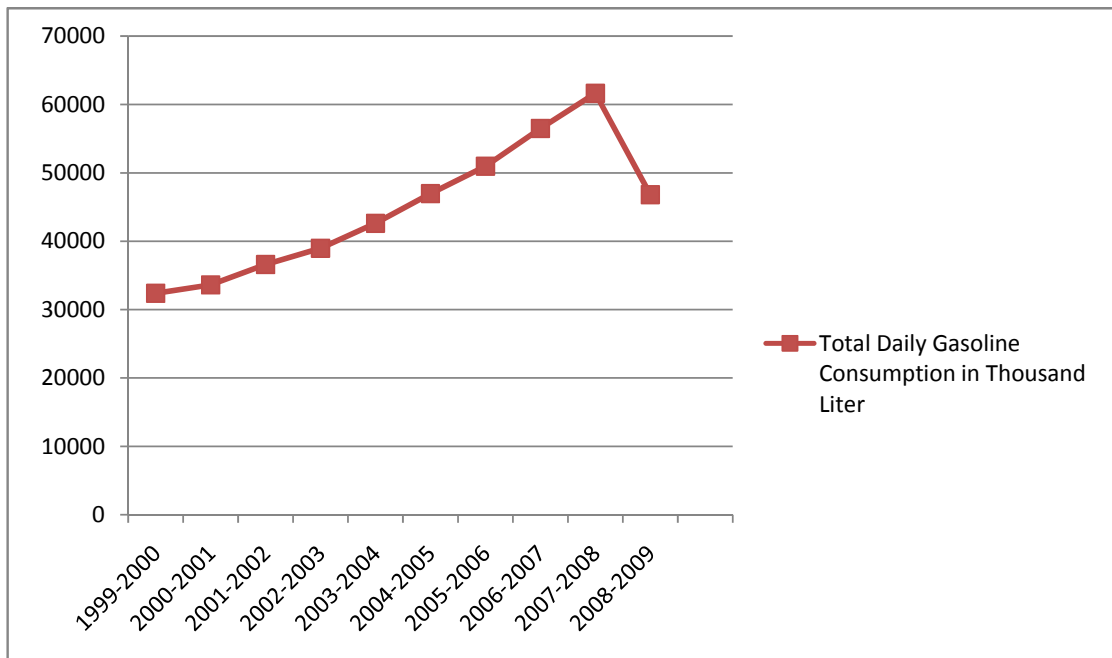


Fig. 8: Total Daily Gasoline Consumption (Thousand Liter)



The table 1 shows that the number of cars is rising. However, the trend of daily and per car consumption has decreased for the studied period. Maybe the reasons are technology improvement of automakers, increase of the dual-fuel system cars (CNG cars), improvement of public transportation and also scrapping the old cars. Until two years ago this drop in

consumption per car was due to natural mechanisms that led to consumption reduction. But the last year drop is due to gasoline rationing plan. With the rationing program, each car is allowed to use a limited volume of low- priced gasoline (for example 100 liters/month).

In the following section, we will try to model the situation that led the country to rationing plan and then we will examine the effects of different scenarios and policies.

3- Model Description

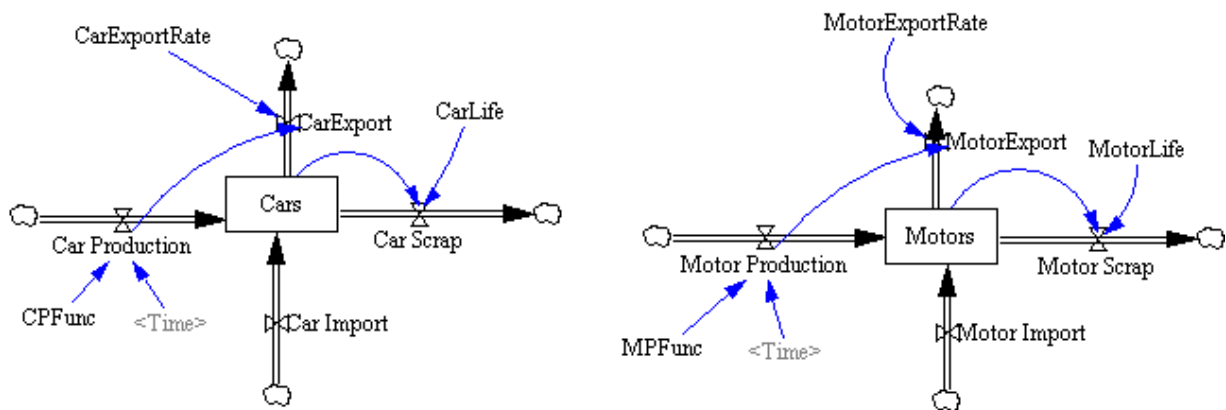
Important variables considered in this paper are: car and motorcycle production, car importation and exportation, fuel smuggling, government’s budget for subsidizing fuel, inventory capacity for gasoline, political resistance, population and the number of trips, public transportation capacity and attractiveness, scrap rate, technology improvements and finally the average gasoline consumption of each vehicle.

The whole model is shown in Fig. 9. The main parts of the model are:

1- Car and Motorcycle Stocks: Iran has two major car producers with production of almost 900,000 cars a year; hence it is the first car producer in the Middle East. In Iran, motorcycles are produced too.

Cars and motorcycles have their own average life. So after a delay, they are scrapped. The stocks of cars and motorcycles also have another input that is import. Actually there was no import since two years ago when Iran started to import cars with tariff of 100%! In order to support domestic industries, the import of cars was forbidden for about 10 years. Another output is export that has been active since about three years ago when Iran's market almost reached the saturation point. Fig. 10 shows these two stocks.

Fig. 10: Car and Motorcycle production stocks



2- The gasoline stock is the most important stock of the model. It shows the gasoline available for consumption. Inputs are gasoline produced in domestic petrochemical plants and also gasoline imported. Outputs are gasoline consumption and gasoline smuggling. Due to the significant difference between the gasoline price in Iran and neighborhood countries, smuggling was a very important dynamics. But after rationing plan and using Gasoline Smart Card, Iran's government was successful to limit smuggling. Fig. 11 shows the gasoline stock.

Fig. 9: The model of Fuel Consumption in Iran

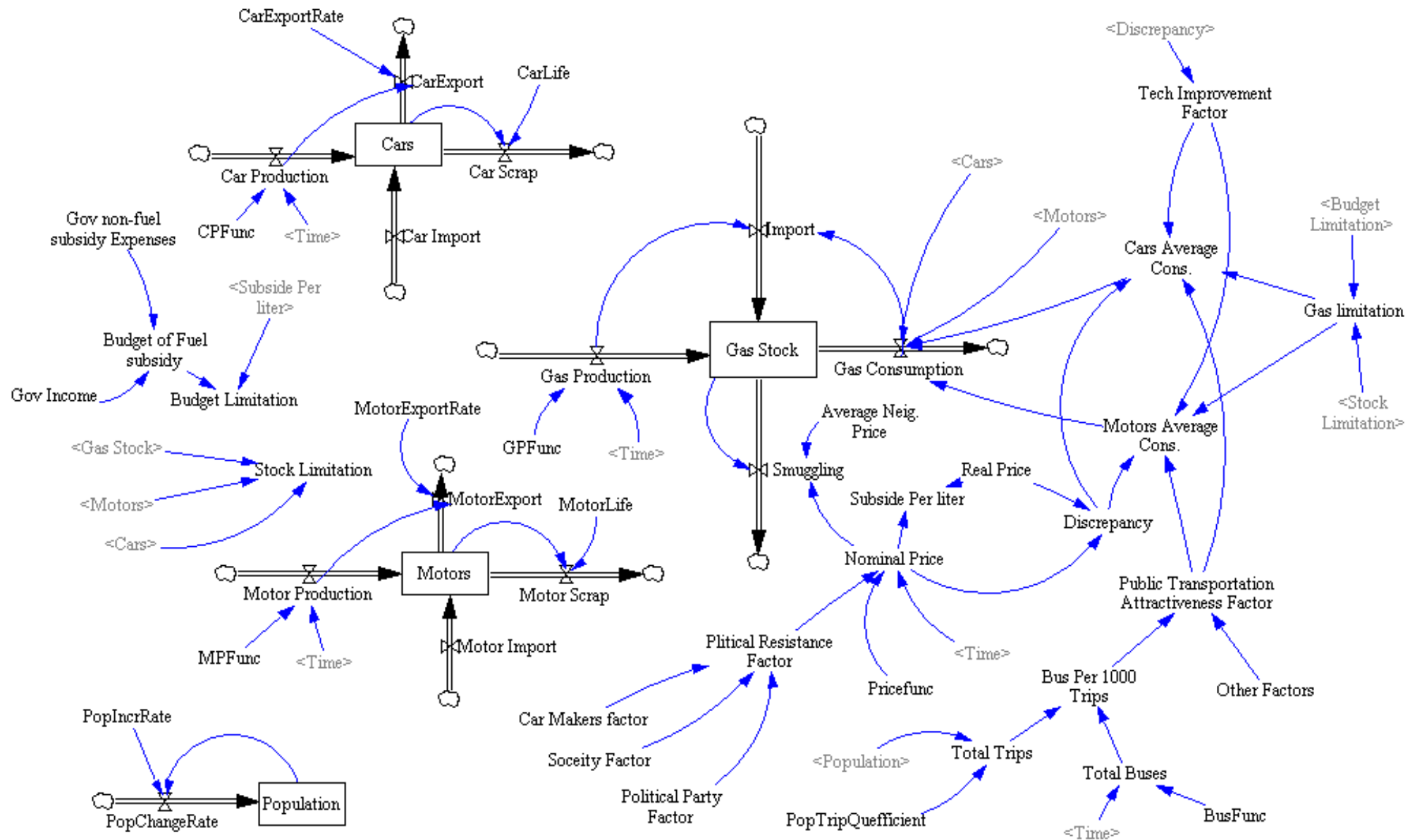
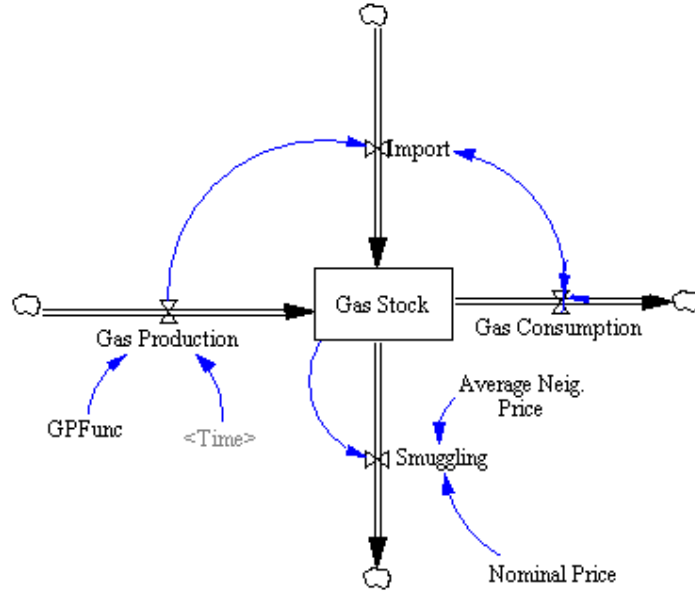


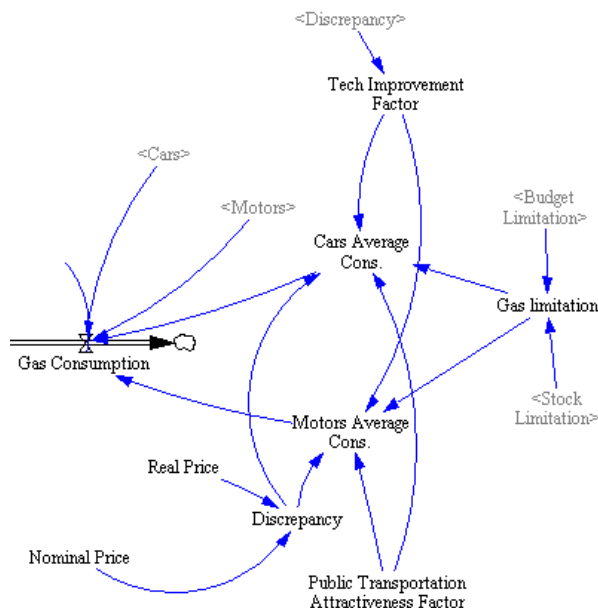
Fig. 11: Gasoline Stock



3- Gasoline consumption is a function of number of cars and motorcycles and their average consumption. (Fig. 12) The average consumption is a function of the discrepancy between real and nominal gasoline prices, total trips and Public Transportation Attractiveness Factor, and technology improvement. The rules of relationship are as below:

- 1- The more the Discrepancy (the cheaper the gasoline compared to its real price), the more the consumption and the less the technological improvement.
- 2- The more the Total Trip, The more the average consumption.
- 3- The more the Public Transportation Attractiveness Factor, The less the Average Consumption.
- 4- The more the improvement of technology, the less the average gasoline consumption.

Fig. 12: Average consumption of vehicles dynamics

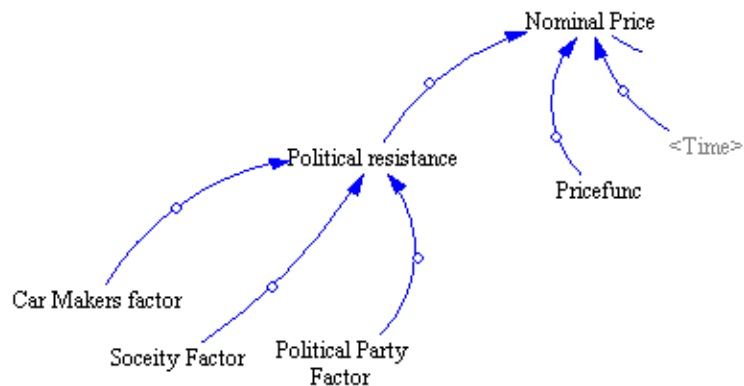


What makes the discrepancy between the real price and nominal price? There are three sources of political resistance over the price increase.

Over the time, Iranians have believed that while Iran has the third proved oil reserves of the world; it is their right to consume low price fuel! This belief, Society Factor of Resistance, has created a source of popularity for politicians too! As a matter of fact, if any politician tries to increase the gasoline price, he may lose his popularity. So politicians try to keep prices as low as possible.

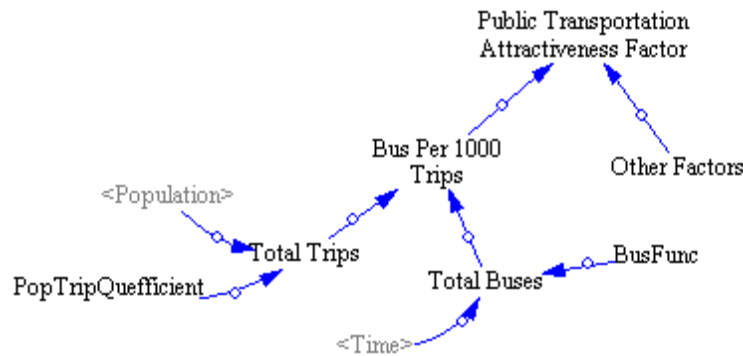
Another source of resistance comes from car manufacturers! Any price increase will affect the demand for personal cars especially when the average gasoline consumption of cars is high. Fig. 13 shows the dynamics related to political resistance.

Fig. 13: Political Resistance dynamics



And finally "what makes the Public Transportation Attractiveness Factor?" The model we offered is shown in Fig. 14.

Fig. 14: Public transportation attractiveness dynamics

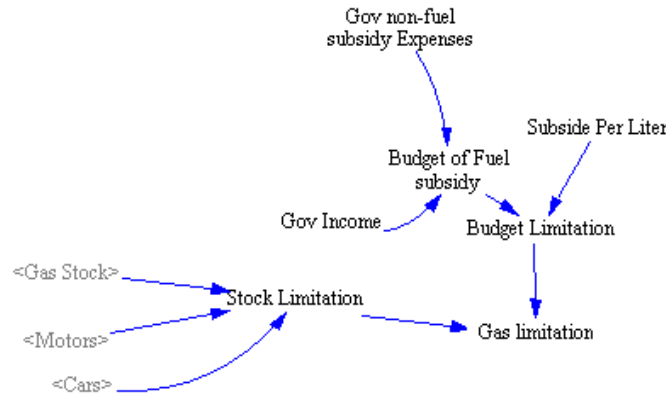


The total trips is a function of population and if the Buses per 1000 Trips are attractive enough, people are more eager to use public transportation, and subsequently the "Public Transportation attractiveness factor" will also be higher.

And the last part (Fig. 15) is the Limitation part. The resources, budget ,and gasoline reserves are limited and can't grow for ever as consumption grows. So the dynamics of limitations restrict the average consumption of each car. We will see in results of the model that these limitations led the country to execute the "Rationing Plan".

Having this model in mind, we are ready to simulate different scenarios and policies.

Fig. 15: Limitations dynamics



4- Simulation And Results

Two different scenarios are considered for simulation:

- 1- In the first scenario, the gasoline price is constant but the real price rises leading to a larger discrepancy between nominal and real prices.
- 2- In the second scenario, the model undergoes the gasoline rationing plan as a solution and results are examined.

4-1: First Scenario Simulation and Results

This scenario was conducted with assumptions below:

- 1- After $t=30$ the real price rises but nominal price remains constant. It means that the discrepancy is rising so it is obvious that consumption will rise too.
- 2- Because government spends substantially on subsidies, little money is left for public transportation improvement and extension of new plants (investment). So we ignore the effects of public transportation improvement and also assume that the gasoline production is constant over the period of simulation. Finally because the nominal price is below the real price, auto makers don't find it necessary to improve their technology. Hence, technology improvement is assumed to be constant too.

The results are shown in the figures 16 and 17.

Fig. 16: First Scenario Simulation and Results

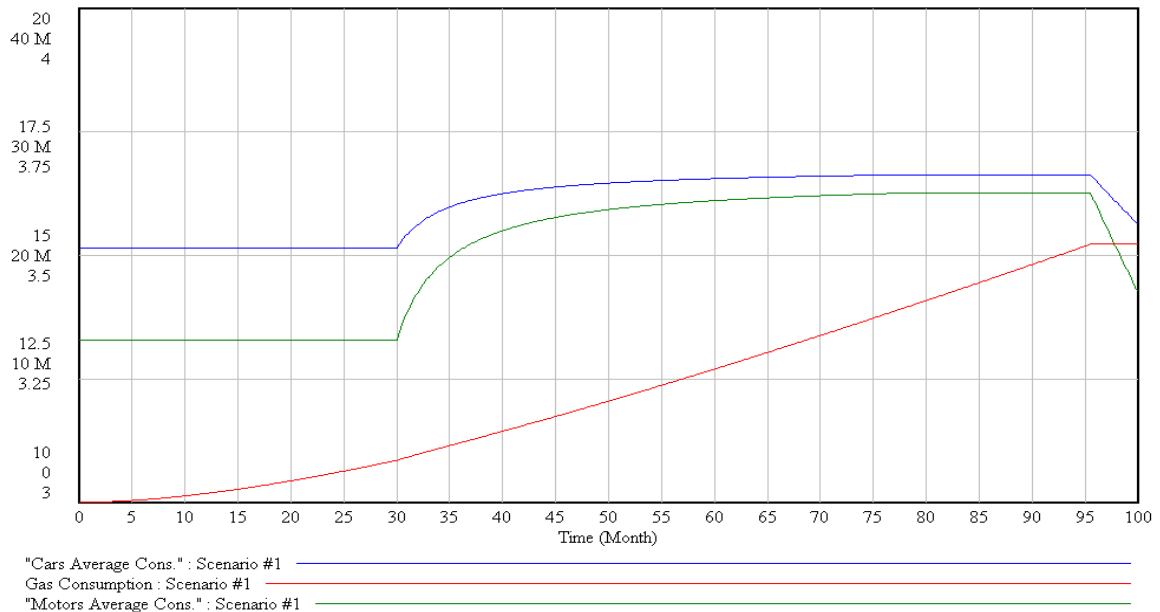
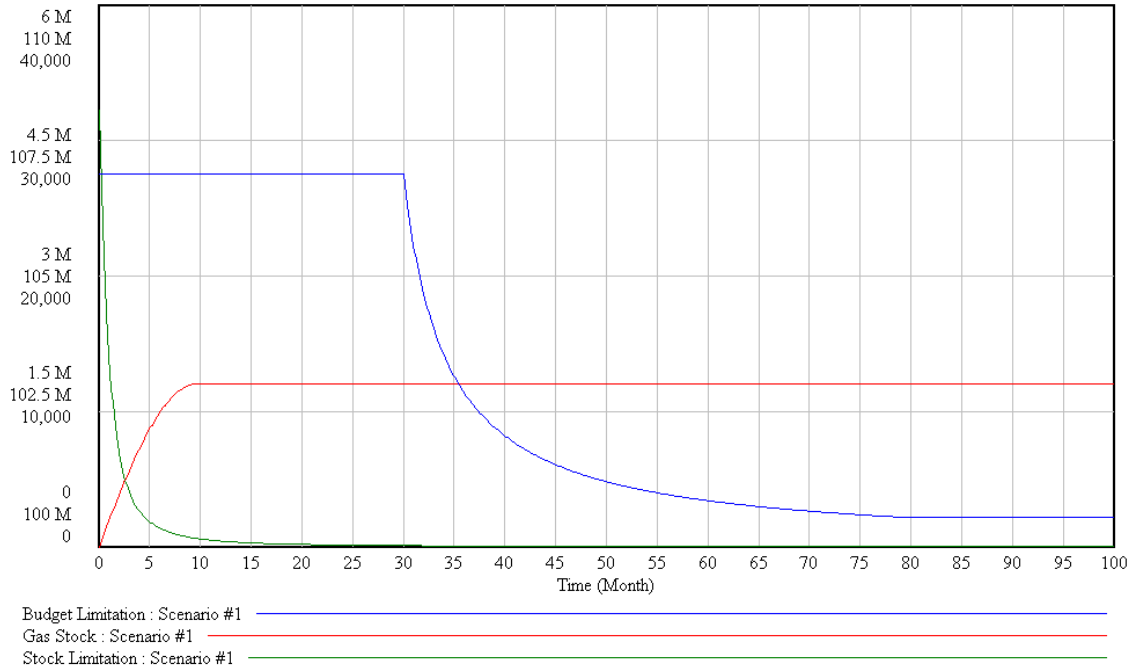


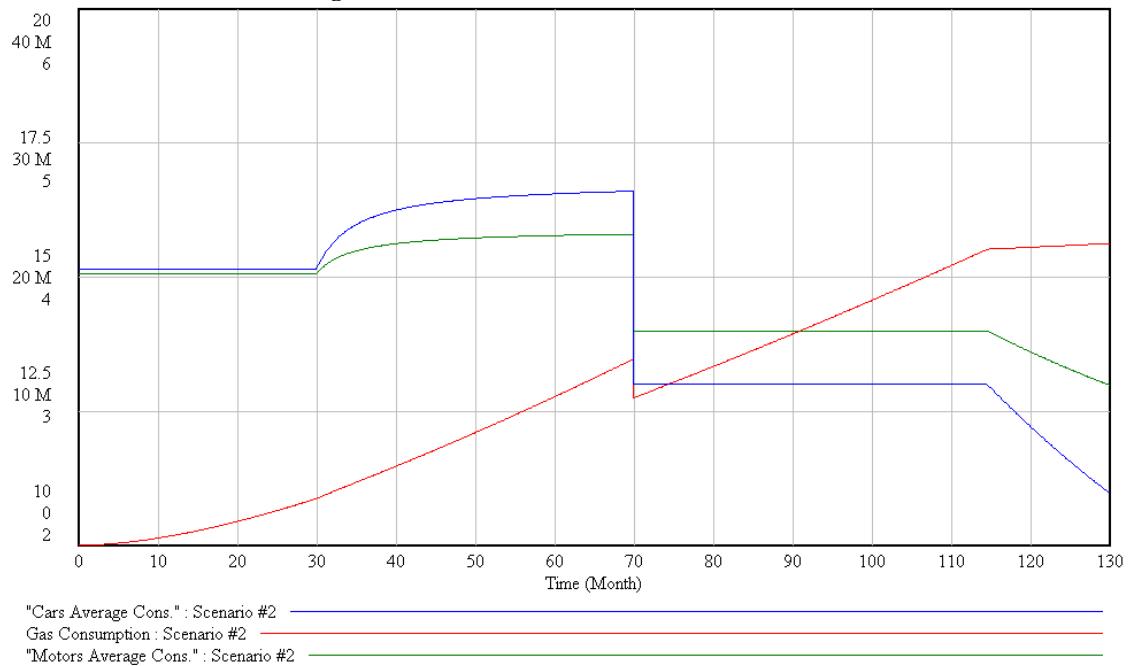
Fig. 17: First Scenario Simulation and Results



4-2: Second Scenario Simulation and Results

In this scenario we execute rationing plan because we know that in the near future there will not be enough gasoline available to use. Before this to hapen, we manage the consumption using rationing plan. For example in $t=70$ all vehicles are forced to reduce their consumption to a lower level. The result of this scenario is shown in the Fig. 18.

Fig. 18: Second Scenario Simulation and Results



As figure shows with limiting the demand but assuming other factors constant, we were successful to postpone the gasoline shortage but again we will encounter the gasoline shortage (at a time between $t=110$ and $t=120$ in the figure). At this point the title of the paper seems reasonable because we faced lack of enough gasoline even with executing rationing plan. Actually, with rationing plan the government has used a symptomatic solution and not a fundamental one. This scenario and its prediction are what happened in the real world in Iran. In fact after a year of implementing the rationing plan with 120 liter/month, limitations show themselves and ration of each car is reduced to 100 liter/month by the government. All the results above lead us to find a fundamental solution. So policies aimed to offer such solutions.

5-Policies

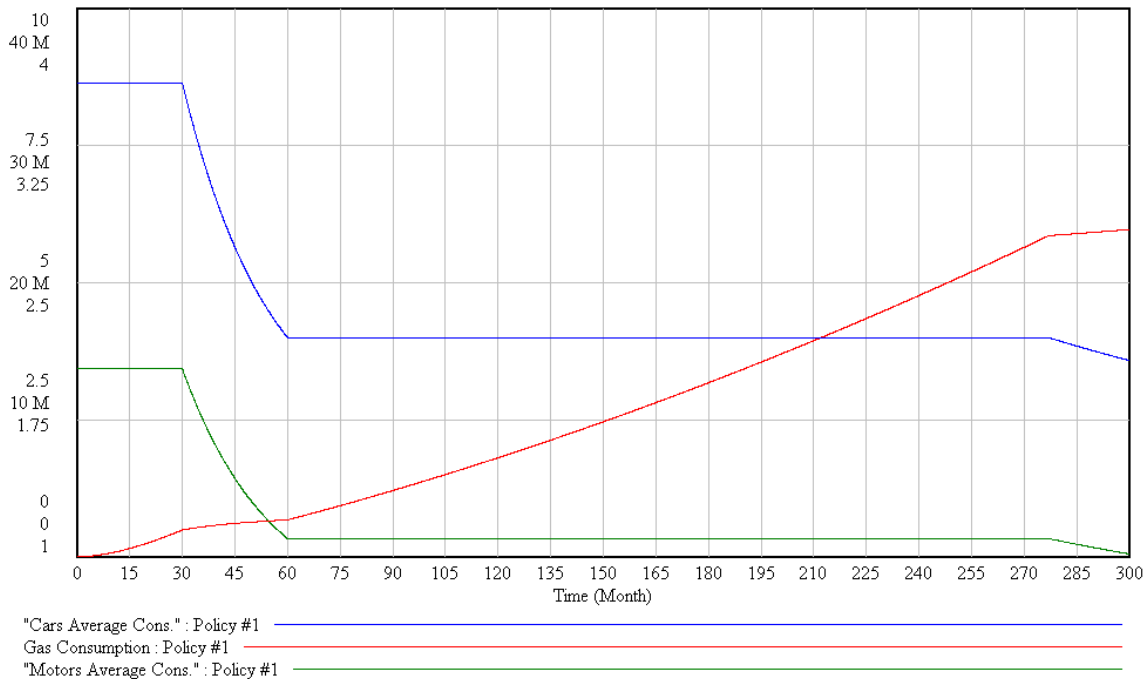
We will test two complementary policies to manage demand in a way that there should be no need to rationing plan. Actually we want to reduce the demand naturally not by force. Policies are:

- 1- If the gasoline price is increased to its real price without any change in other parameters such as technology improvement and public transportation attractiveness. This assumption is rational because in short run, those factors can't be improved.
- 2- If supplementary policies such as technology improvement, and public transportation improvement are conducted. This policy is a long-term solution and actually it is a package of continuous improvements.

5-1: First Policy Simulation and Results

As fig. 19 shows by reaching to real price, demand will decrease naturally and there is no need to be concerned about limitations specially budget limitation for a long time. But as car makers are producing day and night, the country will again encounter limitations of gasoline stock after a while. By executing this policy, we just postponed the rationing plan. Therefore this solution is not enough by itself and we need to have a policy in long-term and improvements in other dynamics.

Fig. 19: First Policy Simulation and Results



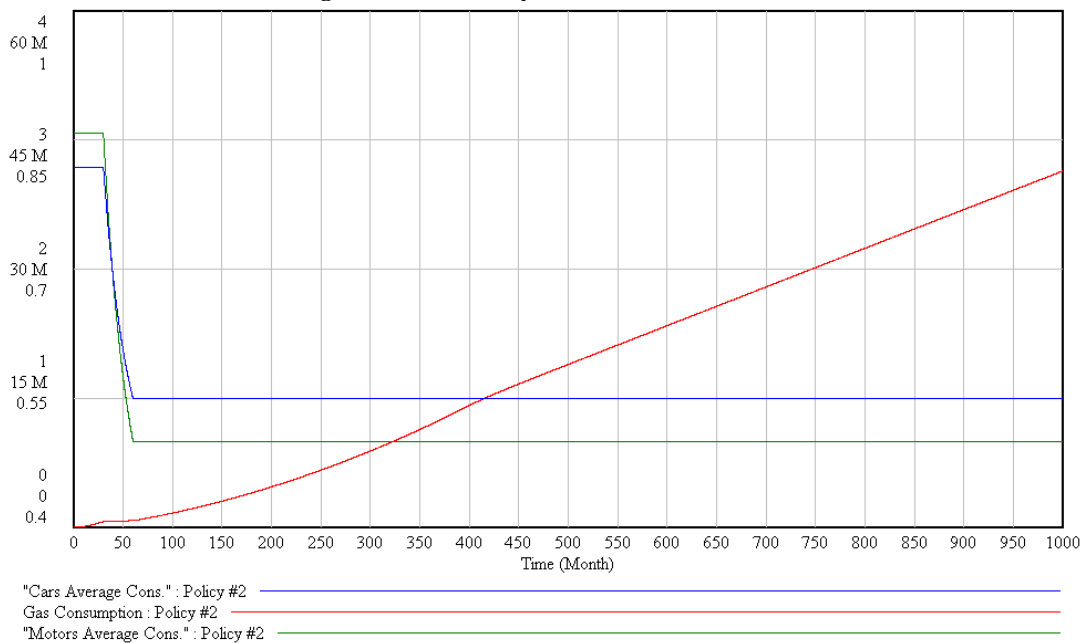
5-2: Second Policy Simulation and Results

As we saw in policy number 1, real price is not a long-term solution. If we want to find a better solution we should offer a package of continuous improvements in other important factors and not just a change in price. Actually we should improve our technology, improve public transportation, decrease the average life of vehicles, increase exportation of cars, and extend the capacity of petrochemical plants.

This would definitely be a far better solution compared to policy 1 suffering from lack of enough gasoline and budget. So if we cut the subsidy, there will be enough money available to construct new plants, to do R&D to improve technology, and also to improve public transportation.

Policy 2 is a package of all these improvements. As the fig. 20 and 21 show there would be no need to reduce demand with rationing plan.

Fig. 20: Second Policy Simulation and Results

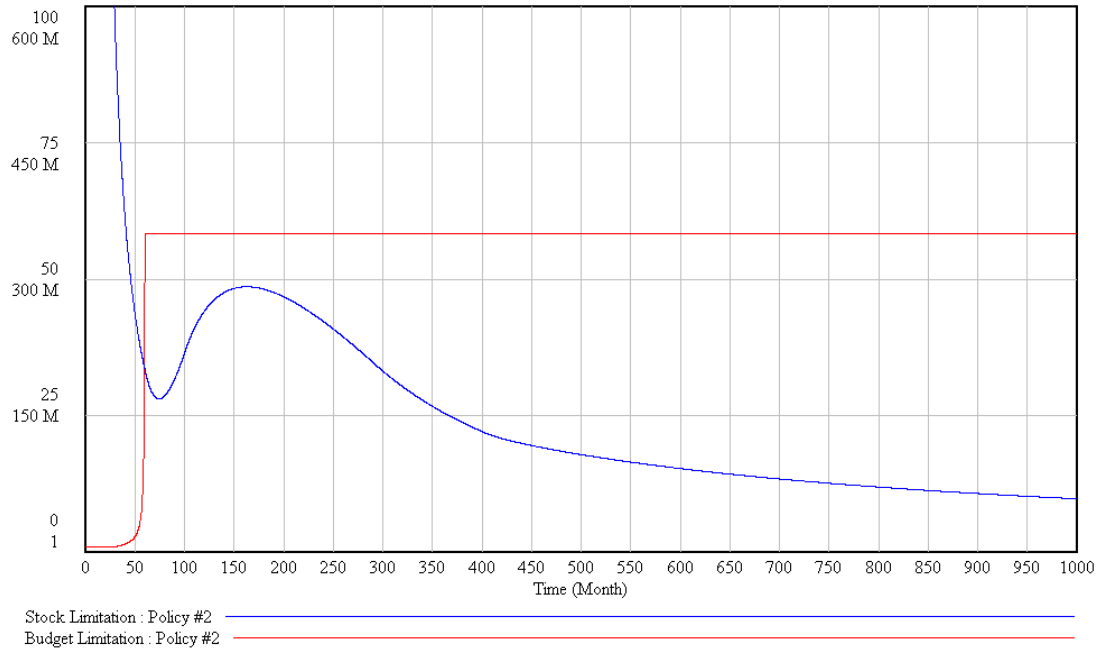


6-Conclusion

Iran's unnatural gasoline consumption is considered to be the result of many dynamics. Rationing plan is not the fundamental solution in that by growth of cars ,inability of petrochemical plants ,and also public transportation, the rationing plan should tighten again. This is what exactly happened in Iran after 2 years.

Increasing the gasoline price to its real price is a good policy but its effect alone is not satisfactory enough. To solve the problem fundamentally, in order to avoid the rationing plan, we should offer a package of improvements in gasoline production and public transportation as well as price realization. The results of such policy seem to be more durable. But we should notice if these solutions are not continuous, other dynamics especially car production may make it necessary that the rationing plan be executed again.

Fig. 21: Second Policy Simulation and Results



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