

## **A SYSTEM DYNAMICS MODEL ON THE REASONS OF CAR PRICE SHOCKS AFTER ECONOMIC SANCTIONS**

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### **ABSTRACT**

International Community can decide to establish several types of sanctions on the economy of a country. No matter the reasons of these sanctions, generally, they can have many adverse effects on the economy of the sanctioned country. This depends on the variety and extent of the sanctions. We propose a system dynamics model to capture some of the main reasons behind the economic instability in a sanctioned country. We consider a case study of the car price shocks occurred in Iran after the various economic sanctions that was established on 2012. Iran's economy depends heavily on the oil production and in fact, their main exports consist of the crude oil products. In our model, we combine causal loops for prediction of oil price after sanctions with those on predicting the car price. Our simulation results are consistent with the real data of the most common car's price in Iran.

### **1 INTRODUCTION**

Economic sanctions are established by the international community on a country can have various causes or goals. However, independent of their goals or reasons, they can cause severe damages on the economies of the countries under sanctions (Rafieisakhaei and Jabbari 2012). There are various examples in recent years that international community has used these kinds of sanctions. As an example, on 2012, the UN, EU and the US, established various sanctions on the economy of Iran including the ones aimed specifically on Iran's crude oil exports. The scope of these sanctions are beyond the scope of this paper, however, the interest of this paper is specifically to follow the set of causes and effects that were initiated by the sanctions' trigger in the car industry of Iran that caused high price shocks. Particularly, since Iran's economy is heavily oil-dependent, we follow the roots of these price fluctuations in the Iran's oil industry. Therefore, we use our previous model on predicting the oil price (Rafieisakhaei, Barazandeh, Bolursaz, and Assadzadeh 2015), which takes into account the reasons of fluctuations in the global oil price, and combine it with the causal loops that are active in the car industry.

### **2 MODEL AND CAUSAL LOOPS**

Our methodology is based on a system dynamics modeling approach (Sterman 2000). First, we derive the causal loops that incorporate the concepts behind the modeling, then, we build a stock and flow model based on the casual loops adding the mathematical formula. The main loop that determines the car price consists of oil price and oil production which determine the main portion of the Iran's revenue in a foreign currency (usually in USD). The Iranian government can seel a part of this revenue to the to Central Bank of Iran (CBI) to facilitate the government's expenses. The CBI can keep portions of these dollars and the rest are mainly sold in the free market to the businesspeople that import merchandise in exchange for the Iranian currency. In the exchange market, like any other market, the supply and demand forces determine the exchange rate. Therefore, oil exports play an important role in the exchange rate of the foreign currencies in the Iranian market by providing the main supply resource of the foreign currencies. Therefore, any

change in the amount of oil production or exports can affect the exchange rate significantly, specially if those changes are persistent for a long period of time. For instance, in the case of sanctions against Iran's oil (and energy) industry, Iran's oil production was nearly halved and therefore, the Iranian government lost a big portion of its revenues. This shortage of the foreign currencies, caused a big plunge in the value of Iran's currency against USD. Particularly, Iranian Rial lost two-thirds of its value against USD. This influence was propagated to Iran's whole industry and goods. The reason is clear for the imported goods. However, for many of the domestic products like cars, the material are imported, as well. This could explain the main reason behind the %200 increase in the general car price in Iran in a two-year period. Therefore, the sanctions triggered a casual loop that led to the increased expenses in the raw material and supply chain of the car industry and subsequently in the car prices itself. However, in the car market itself, the increased car price caused a drop in the car demand leading to the drops in the car supply as well, leading to a balance in the car price. The core causal loop is shown in Fig. 1a.

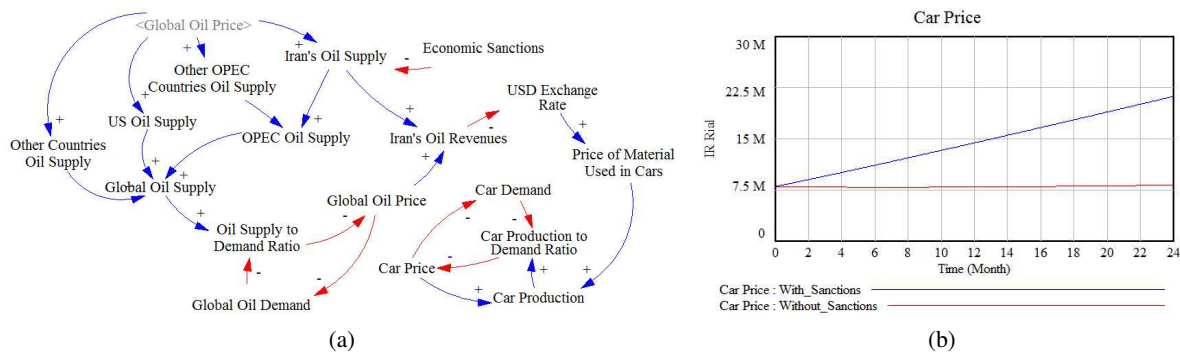


Figure 1: a) The main causal loop of the Vensim Model, and b) simulation results before and after sanctions.

### 3 SIMULATION RESULTS AND CONCLUDING REMARKS

Figure 1b shows the simulations results in Vensim PLE. In this figure, after initialization of the sanctions, the car price starts to climb to nearly third times its initial price, which is nearly flat before sanctions. Moreover, the damped oil price fluctuations are propagated with some delay to the car price. Note that if we continue the simulation for a long time, the car price reaches to its final value after the supply and demand forces in the car market reach to a new balance. In this paper, we proposed a model to explain the main reasons behind drastic fluctuations that can happen after economic sanctions on a country whose revenues are heavily dependent on the exports of the sanctioned product. We brought an example of the Iranian car industry after sanctions on the Iran's oil and energy sector. We showed that the shortage in the foreign currency leads to the increased material prices in the supply chain of the car industry leading to the higher balanced car prices. Our future works will provide a more detailed and extended model to explain the other causes and effects in this industry.

### REFERENCES

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