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Investigation on the Impact of an Energy Desubsidization Shock on the General Price Index Via a Nonlinear Inflation Model: Case of Iran

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Abstract

For decades, energy prices have been controlled by the government in Iran. This policy had a long lasting impact on almost all economic variables in Iran. To date, under tremendous pressure to adequately meet the huge domestic demands for energy inputs, the government has decided to reduce/eliminate the energy subsidies. Thus, its impact on the consumer price index is unavoidable. This paper investigates the dynamics of that impact via a dynamic nonlinear inflation model. It is shown that an increasing shock in fuel price has less increasing effect on the general price index, compared to the steady state effect of a continuously increasing signal. Based on this fact, it is deduced that other factors, e.g. the Money Supply Growth and the Goods Market Gap, has much more impact on the inflation. Therefore, unsubsidizing energy price, particularly fuel, will empower the government to save more money and avoid expansionary monetary policies. The currency not used for subsidizing fuel price can help to decrease the money supply growth, and contribute subsidence of extremely growing inflation due to the money gap.
Keywords: Fuel Prices, Desubsidization, Nonlinear Inflation Model, System Dynamics

1- Introduction

For three decades Iranian economy faced the problem of subsidies for the basic goods such as food and energy. However, now desubsidization is one of the top list programs of the Iranian government, the impacts of which is not studied well 15-. This paper is dedicated to study one of the impacts of

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removing the energy subsidies. According to the electricity and gas bids, averagely about 60% of the real price of energy in Iran is subsidized. Gasoline prices also reveal that there is at least 75% of subsidy. This has caused Iran to stand on the top of the most energy consuming countries. Iran pays more than 15 B$ per year (5 B$ for electricity and 10 B$ for fuel) as subsidy, with about 15 B$ additional cost energy wastes caused by low prices. This makes a total of 30 B$ cost, which is paid to avoid an eventual social crises due to a probable general inflation growth caused by energy price increase 8-, while noticeable environmental harms are ignored 11-.

During the last decade gasoline consumption had an average growth of near 10% per year, while the GDP growth was about 5%. The government, paid more than $US 5 Billion in 2005 to import gasoline and burned more than $US 12 Billion in mostly old cars. Although gasoline consumption was limited to a small quota (80 liters per car per month), gasoline import exceeded 8 Billion tones in 2009. It is several years that odd/even day traffic rules are executed in a large region of the city center. Obviously, this will decrease the number of unnecessary inner-city trips. After all, still there are enough justifications that convince the government to help the problem of unlashed fuel consumption in the country by removing subsidies. However, the impact of fuel price inflation on the other markets has been the most important hinder to execute this policy.

This paper investigates how much the fuel price growth in Iran may affect general price index. A dynamic nonlinear complex model for inflation of the general price index, which is based on a system approach, is used to study how the government can adjust the fuel price with less shock to the economy. In the next section a brief review on the economic theories and historical data of inflation is given and some of inflation models are introduced. The proposed model is then explained in the third section, where results of estimation and simulation are obtained describing the dynamic behavior of the inflation caused by a shock into the fuel price index. Section four concludes the paper.

2- Inflation Models

There are different measures of inflation but herein, we consider the most commonly used annual measure of inflation, which is the percentage change in the average consumer price index. Various models can be introduced for inflation; actually, the literature is so large that no one has recently attempted to survey the field 18--17-. Economic theories and statistical properties, as well as the mathematical approach, have been the main origins for such a variety in these models. Moreover, special conditions in different countries lead to different inflation mechanisms and models, although the measures for inflation are the same in any country. As a result, this part of most macroeconomic models usually is much more complicated than the other parts, and even may lead to chaos in the behavior of the system [3], [4], 13-, 25-, 16-.

Economic Theories of Inflation

Analytically it is very difficult to propose a general theory of inflation because as economies evolve over time both new causes of inflation emerge and the consequences of inflation become more complex. Recent works mostly emphasis on chaotic behavior of the inflation rate, sometimes called mild inflation, and even some try to control this behavior 25-.

Disregarding applications of the chaos theory in economics, there are some theories in the literature that attempt to explain the phenomenon of inflation. The Keynesian theory of demand-supply gap and the Philips curve are two of the most important theories of inflation 5-, 25-. The former believes that if the supply for a product has been declined, the intersection of demand and supply curves shifts to a new point in which the price for the new point is higher than before. Based upon the latter, there is a strong relationship between unemployment rate and real salary, whereas in a free market the price level is strongly a function of the unemployment rate. A modified version of this theory, namely the “new-Keynesian Philips Curve”, has combined the theory of rational expectations and introduces a model for inflation in which price levels changes by both unemployment rate and rational expectations of the inflation 5-, 22-.

However, the structure of inflation subsystem of developing countries has its own characteristics. Specially, money supply plays an essential role in the inflation. Evidently, according to the quantity theory of money, an increase in money supply causes a proportionate increase in prices when the velocity of money remains constant. Recent work in Kenya, as an example of developing countries, shows that the exchange rate, foreign prices, and terms of trade have long-run effects on inflation, while the money supply and interest rate have short-run effects 7-.

In general, it is very useful to distinguish between two different types of causes affecting inflation rate. Anticipated inflation occurs when prices increase at a rate of growth that all economic agents expect, while unanticipated inflation that may be originated in a crisis, demand pull and/or cost push, usually surprises many agents who did not expect it 4-. Another categorization of inflation causes is introduced in this paper according to how exceptional the mechanism of inflation in a country is. Homogenous causes are factors that lead to inflation in all economies, while we named those factors which are specialized to a certain country as "Non-homogenous" factors. This will be clarified more in section 4-1.

History of Inflation in Iran

A glance on graph of the historical data of monthly calculated inflation in the general consumer price index (*CPI*), as Fig 1 shows, promotes such an imagine that it has a chaotic behavior too and may cause the modeling process to be complicated. To facilitate understanding the phenomenon, it is important to divide the history to several periods and specify some special points in the signal. Let us drop 1900 from the beginning of the years' numbers for brevity. First we have the period of [60, 72], a relatively stable low growth situation in the economy of Iran. Then we face the period of oil crisis, i.e. [73, 75], and Islamic Revolution just after that in the next period of [76, 79]. War led to another inflation increase in 80 and 81, but again another shock to the international oil market during the following years between generated the fourth period of [80, 84]. The next period is [86, 90], including the last years of the war. After the war, government's liberal financial policies caused a mild inflation growth, which ended by a 50% inflation caused by the policy of freeing exchange rates in 1995. Therefore a 7-year period of [91, 97] is detected. The rest of inflation signal shows a fluctuating decay in two 4-year cyclic periods.

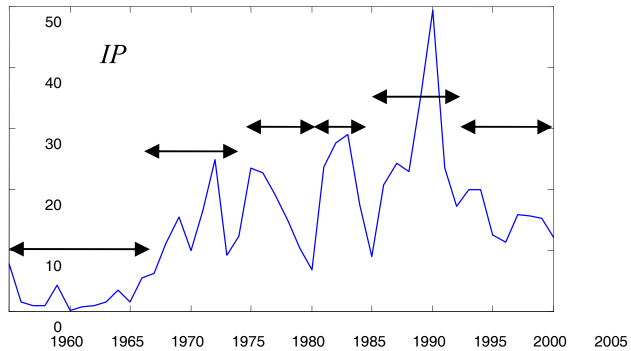

Fig 1: History of Inflation Rate of the General Price Index, *IP*, in Iran

Source: CBI (Central Bank of Iran

In Fig. 2 the whole sales inflation rate for mineral fuels and related materials (IP_F) is depicted. The correlation matrix of these two signals, given bellow, shows a close relationship. It shows that the correlation is very close to the auto-correlation of *IP*, which means a high dependence between the two variables, with a correlation coefficient of about 0.7. The correlation is found as:

$$C = Corr(IP, IP_F) = \begin{bmatrix} 315 & 290 \\ 290 & 422 \end{bmatrix} \qquad (1)$$

To investigate direction of this relationship we may apply the well-known Granger Causality Test. Basically the causality direction is expected to be from the fuel price to the general price index. However, applying the Granger Test on all the pairs *IP* and IP_F, ΔIP and ΔIP_F, and even ΔIP / *IP* and ΔIP_F / IP_F, the result is vice versa, which might be due to the mild inflation in expenditure of the government leading to a subordinate decision made to balance the budget. It may worth noting that if we get this result using all the samples, for the fact that the structure of economy has changed after the oil shocks of the 1970's, also the revolution had a noticeable impact on the behavior of both people and the government. However, considering the post 1979 era, causality direction is still from CPI to the Fuel Price Index for almost all degrees of the $ARMA(n, n)$, $n > 1$, models. The results are shown in
Table **1**.

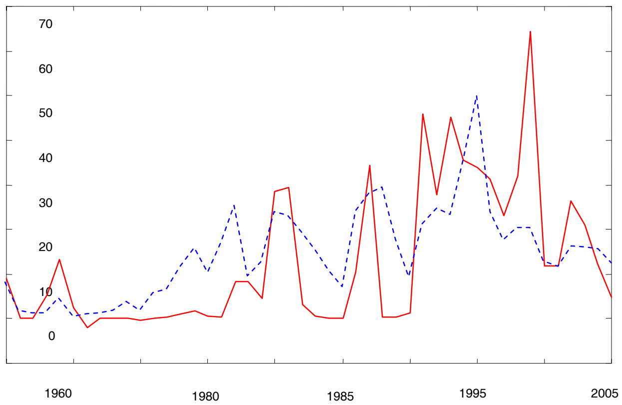

Fig 2: History of the Whole Sales Inflation Rate for Mineral Fuels in Iran

Table 1: Granger Causality Test Results Using ARMA(*n*, *n*)

n	1	2	3	4	5	6	7	8
$\{IP , IP_F\}$	1	1	1	1	2	1	1	1
$\{\Delta IP , \Delta IP_F\}$	1	1	1	2	1	1	1	1
$\{\Delta IP / IP , \Delta IP_F / IP_F\}$	1	1	1	1	1	1	1	1
$\{IP , IP_F\}_{1979-2005}$	1	1	1	1	2	1	1	1
$\{\Delta IP , \Delta IP_F\}_{1979-2005}$	1	1	1	2	1	1	1	1
$\{\Delta IP / IP , \Delta IP_F / IP_F$	1	1	1	1	1	2	1	1

Each 1 means that the first variable causes the second one and each 2 means the opposite.

Some related works on inflation models for Iran

There are number of papers that investigate the causes of inflation in Iran. Some use single variable models in single equation models to study how individual factor impact inflation 26-, but almost all of them apply conventional or modern econometrics models, like ARDL, ECM and P* models 23--20-, for de-trending, decomposition and elasticity calculations.

On the other hand, this paper is interested in a system dynamics approach to carry out a system of equations which can describe the mechanism of inflation in Iran to some extent. The following lays out the ground base for this approach.

The quantity theory of money, which is a basis for the P* models, relates the price level to the money supply, i.e.:

$$p = M.\ v\ /\ T \qquad (1)$$

Where, p is the general price level as an average price per transaction; M is the quantity of money, v is the velocity of money circulation to finance all T number of the total transactions per a certain time period. Traditionally, the velocity of money is appositive function of economic activities, interest rates and the price levels. This can be formulized in a general form by 18-:

$$v = f\,(\,y\,,\,r\,,\,p) \qquad (2)$$

Where, y represents the aggregate income and r is the average interest rate.

The predominate view among economists is that the inflation, at least in the long run, is a monetary phenomenon 4-. Based on the developing countries experiments, also what we will put forward so far, there are two basic causes have been detected as the main reasons for the inflation. These are the money market gap and the yield market gap, which force prices to displace from their equilibrium. Considering the first cause, many of inflation models assume that the price index change is a function of changes in money demand and money supply. Generally, this can be shown by:

$$\dot{p} = f\left(\dot{m}_{\mathrm{S}}, \dot{m}_{\mathrm{D}}\right) \qquad (4)$$

Where m_{S} and m_{D} are the money supply and the money demand respectively. These models, inherently adopt an implicit combination of the two relations in (1) and (2). Explicitly, this function could be presented as the following:

$$\dot{p} = f\left(\dot{m}_{\mathrm{S}} - \dot{m}_{\mathrm{D}}\right) \qquad (5)$$

Based on to model inflation, the only difference is how a model explains demand for the money. In many of the models, the money demand is shown implicitly. Following, we review some of the models.

The model developed for the second five-year economic plan of the country employed two econometric equations to explain the general price level, which are almost similar to each other. This can be shown with some assumptions for the variables as well as the coefficients 1-.

$$p(t)=\alpha_0+\alpha_1 p(t-1)+\alpha_2 p(t-2)+\alpha_3 y(t)+\alpha_4 m_S(t) \tag{6}$$

$$p(t)=\frac{\alpha m_S(t)}{y^{\beta}(t)\left(m_S(t-1)/p(t-1)\right)^{\gamma}} \tag{7}$$

Here, α's, β and γ are constant parameters. It can be observed that is derived from (1), and its logarithm will lead to the following formula, in which the letter L is replaced for the natural *log* function:

$$Lp = L\alpha + Lm_S - \gamma\left(Lm_S - Lp\right)_{-1} - \beta Ly \tag{8}$$

Where the subscribe -1 denotes lag of the terms in the parentheses.

We review two different classes of modeling methodologies to be compared herein. The first is an econometric *AR*(1) model, which is very similar to, except that it adds the price level of imported goods, and a dummy variable related to capture the revolution impact. This leads to 12-:

$$Lp=\alpha_0+\left(\alpha_1+\alpha_5 u_R\right)Lm_S+\left(\alpha_2+\alpha_6 u_R\right)Ly+\left(\alpha_3+\alpha_7 u_R\right)Lp_M+\alpha_4 Lp_{-1} \tag{9}$$

Where u_R is the dummy variable, and p_M denotes the price index of imported goods. Obviously, the general price index is affected by the world price index, through the imported goods. This variable is therefore sometimes replaced by the price index in OECD countries or even by a combination of the world prices and the exchange rate.

The second type of model, which is introduced by 6-, explicitly uses the quantity theory of money as follows:

$$\Delta Lp = \Delta Lm_S - \Delta Lm_D \tag{10}$$

which is the discrete logarithmic version of, where Δ is the difference operator. Then the model adds a linear trend term plus a dummy variable to represent the government's price control for 1980's.

The third economic development plan of the country also employs two models, both based on the difference values of the consumer price index 3-. The first one is just like except that it uses the following model for the money demand:

$$\Delta Lm_D = \alpha_0 + \alpha_1 \left(\Delta Lm_D\right)_{-1} + \alpha_2\, Ly + \alpha_3\, E\{p\} \tag{11}$$

where $E\{p\}$ means expectations of the price, p.

The second model of the third plan is a short-run ECM as:

$$\Delta Lp = \alpha_0 + \alpha_1\ \Delta Lm_S + \alpha_2\ Lv + \alpha_3\ Lp_M - \beta\, Ly \tag{12}$$

for which the model given bellow is applied to describe the velocity of money:

$$Lv = \alpha_0 + \alpha_1\ Lv_{-1} + \alpha_2\ Ly_{-1} + \alpha_3\ Lp_{-1} \tag{13}$$

On the other hand, we refer to an exclusive system dynamics based model implemented in 19-, which has inspired to build the model proposed in this paper. The model is actually a two gap model, containing both the money market and the yield market; that is:

$$Lv = \alpha_0 + \alpha_1\ Lv_{-1} + \alpha_2\ Ly_{-1} + \alpha_3\ Lp_{-1} \tag{14}$$

where y_D is the aggregate demand, and $f_1(.)$ is a monotonically increasing convex function. In a more general form, this model may be rewritten by:

$$\pi = f\left(m_S / m_D, y / y_D\right) \tag{15}$$

which is an alternative for, with two gaps, where $\pi = \dot{p}/p$ is the inflation rate in its continuous version. The idea of two-gap models considers both the money and yield market gaps, and is common in many inflation models.

The Proposed Inflation Model

In this paper, we introduce a system of nonlinear dynamic equations to model the inflation. To this end, first we review the factors in the model, separating them into two sets of *homogenous* and *non-homogenous* factors among which the fuel price is of special importance in this study.

Homogenous Factors

The homogenous factors are those that theoretically and empirically have similar impacts on the inflation rate in almost all economies, as far as we concern. These factors are listed below.

Money Supply

As mentioned, this variable is unambiguously accepted as an effective factor. Some approaches try to model it as function of the money basis as well 3-, but mostly is considered as a control variable.

Money Demand

Many theories are proposed for the money demand. However, we focus on a modified version of quantity theory of money, which includes the aggregate income, as one may deduce by combination of (1) and (2):

$$m_D = f\,(y, r, \pi) \tag{16}$$

where $0 \leq r < 1$ is the interest rate. The model given by 6- replaces with an AR(1) model:

$$Lm_{\mathrm{D}}(t) = \delta_0 + \delta_1\, Lm_{\mathrm{D}}(t-1) + \delta_2\, Ly(t) + \delta_3\, Lr_{\mathrm{E}}(t) \tag{17}$$

while defining $r_{\mathrm{E}}(t) = r(t) + E\{\Delta Lp(t{+}1)\}$ as the effective interest rate. Therefore we may add both the interest rate and the income to the list of homogenous factors. On the other hand, based on a system approach, 19- applies the aggregate demand to model the money demand as:

$$m_{\mathrm{D}} = \mu\, y_{\mathrm{D}}\, f_2(\bar{\pi}) \tag{18}$$

where $f_2(.)$ is a saturating function of the average inflation rate, $\bar{\pi} = \dot{\bar{p}}/p$, which is replaced for the expectation used by 3-19-:

$$\dot{\bar{p}} = \frac{1}{\tau_{\mathrm{P}}}(\bar{p} - p) \tag{19}$$

The bar on the variables indicates average values. Herein, τ_{P} represents a time constant by which the average inflation is adapted. Despite of (2) which states that $r(t)$ influences the money demand. However, some as in 3-19- believe that this variable is not an effective factor on the inflation rate in Iran.

The Yield Market Gap

The difference between the total demand, which is the summation of the total consumption, the total investment and the net exports (exports minus imports), and the entire economy outputs, which is the sum of all sectors' value added, as the total supply forms the yield market gap. This variable has an evident positive effect on the inflation rate. If the supply side cannot cover the whole demand, price levels will increase. This fact in accordance with the money market gap can be easily shown by. In the proposed model the factor is calculated exogenously.

Non-homogenous factors

Beside the homogenous factors, other factors, such as the historical, political, social and cultural facts, form a list of the non-homogenous factors. These factors tightly depend on individual countries and vary over time. Such factors, which are of interest for this paper, are listed below.

Historical Events

This dummy variable includes both Islamic Revolution and the Iran-Iraq war.

Exchange Rate

For this paper, exchange rate is the weighted mean of the exchange rates issued by the Central Bank of Iran, as Iran experienced multiple exchange rates in our sample period.

Price Index for Imported Goods

During the study period the OECD countries were the major trade partner for Iran, thus a weighted average of their price indices used for imported goods price index.

Fuel Price Index

As mentioned, this variable which is determined by the government has a predominant impact on the inflation in Iran. While linear models such as *ARMA* cannot represent a real relationship between the two price indexes, in a nonlinear model there is capability to evaluate complex relations. In this study, a weighted average of different fuel prices is applied as the last non-homogenous factor into the nonlinear model to study dynamic behavior of the phenomenon.

The Model Structure

The model presented in this paper tries to explain mechanism of inflation based on a system dynamics approach. Fig 3 shows this mechanism. The behavior of this nonlinear system is such that both homogenous and non-homogenous factors may disturb the system from its equilibrium, but after a short-term fluctuation a long-term stability emerges as a new equilibrium.

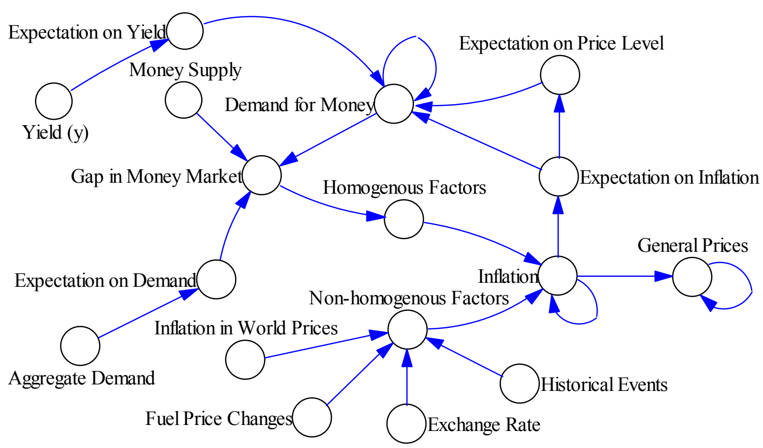

Fig 3: Inflation (Price Level) System

The system has two main loops which are closed by m_D. First, we focus on the model proposed for the money demand. Most applied works show that a step shock in the money demand is partially adjusted by ¾ in the first year 5-. Therefore, a first-order linear dynamics is coupled with a nonlinear term to include the impacts of the variables listed in. By applying a suitable saturation function, it becomes:

$$\dot{m}_D(t) = \mu m_D(t) + \alpha\, p(t) y^{\beta}(t)\, \mathbf{sigm}\left(\dot{p}_E(t)/p(t) + \eta r(t), \gamma\right) \tag{20}$$

where the one-parameter logistic (sigmoid) saturation function is defined by

$$sigm(x,\alpha) = \frac{1}{1+\hat{e}^{-\alpha x}} \tag{21}$$

Saturation property of the function imposes the inflation not to exceed a certain upper/lower level, which is logically and/or experimentally acceptable for a certain economy.

The same function may be applied to model the gap in the money market:

$$\dot{p}(t) = \rho\left[\mathrm{sigm}(\dot{m}_{\mathrm{S}}, \sigma) - \mathrm{sigm}(\dot{m}_{\mathrm{D}}, \delta)\right] \tag{22}$$

However, we use a modified and somewhat simplified discrete form of the system equations, and carefully define leads and lags, and take to account the expectations and stickiness in the price levels 24-. This way, we will have the following system:

$$m_D(t) = \mu\ m_D(t-1) + \alpha\ p_{\mathrm{E}}(t)\left(y_{\mathrm{E}}(t) + \beta / y_{\mathrm{E}}(t)\right) \boldsymbol{sigm}\left(\Delta p_{\mathrm{E}}(t) / p_{\mathrm{E}}(t), \gamma\right) \tag{23}$$

$$u_p(t) = sigm\left(m_{\mathrm{S}}(t) - m_{\mathrm{D}}(t), \kappa, \rho, \nu\right) + sigm\left(y_{\mathrm{D}}(t) / y_{\mathrm{E}}(t) - 1, \delta, \sigma\right) \tag{24}$$

$$\Delta p_1(t) = \varphi\ \Delta p_{\mathrm{E}}(t) + u_p(t) \tag{25}$$

$$\Delta p(t) = \left[1 + \zeta\ \Delta u_{\mathrm{RW}}(t) + \lambda\ \boldsymbol{S}\{\Delta e_{\mathrm{F}}\ \Delta p_{\mathrm{C}}\} + \pi\ \boldsymbol{S}\{\Delta p_{\mathrm{F}} / p_{\mathrm{F}}\}\right] \Delta p_1(t) \tag{26}$$

$$p(t) = p(t-1) + \Delta p(t) \tag{27}$$

The first equation models the demand for money, where p and y in are replaced by their expectations, p_{E} and y_{E}. The second one represents the gaps in both money market and the yields market. The sigmoid functions of are extended to a three and two-parameter saturation functions in respectively to gain more flexibility. Then $u_{\mathrm{P}}(t)$ is applied as collector of the homogenous factors to (25). Expectation is assumed to be adaptive, and includes the stickiness, as follows:

$$\Delta p_{\mathrm{E}}(t) = q\left[2 + \xi - (1 + \xi)q\right] \Delta p(t) \tag{28}$$

where

$$\xi(t) = sigm(\Delta p(t-1), 1, 0.5) \tag{29}$$

which forms an over-estimating model of stickiness observed in the inflation, based on a fuzzy rule and a sigmoid function given by (21) plus an intercept as the second parameter. It is worthy to mention again that the saturation functions are applied in to limit the inflation rate caused by each of the money market gap and the yield market gap.

Moreover, in (26), the non-homogenous factors are included by multiplication, where Δu_{RW} is a fuzzy dummy variable to include Revolution-War effect, Δe_F is changes in the free exchange rate, Δp_C is the changes in the world price levels, Δp_F is the changes in the fuel price index and $\boldsymbol{S}\{.\}$ shows a fuzzy smoothing process 10-.

To solve the model data sets for 1959 to 1993, mostly from the national accounts (CBI), are applied and the parameters are estimated as given in Table 2. The model is identified first by the Prediction Error Method (PEM) and then calibrated by the simulation results. These led to the two sets of parameter estimations in the table. Closeness of the estimates shows that the model is consistent. Moreover, all parameters are significant at the 95% level of confidence. The simulation results for the years 1993 to 2002 confirms the validity of the model. Except for 1996-1998 period, where a spark of inflation happened which was originated by liberalization of the exchange rate, in all other years the pure simulation (simulation without correction) error is within an acceptable range of 3%.

The model output is sketched in (b) Fig 4

(a) in comparison to the actual data up to the year 1996. Note that the four circles are the actual data which are not used for model estimation, but are served for model validation. In the other sample points the model output and the actual data are almost the same and cannot be distinguished on the curve.

(b)

Fig 4(b) illustrates the money supply curve, which is compared to the money demand curve, which is estimated by equation (23) of the model. It is seen that the gap between the two curves has caused the inflation.

Table 2: Parameter Estimates of the Inflation Model

α	β	γ	μ	κ	ρ	ν	σ	ζ	λ	φ	π
0.5198	1.5609	-5.050	-0.039	0.1491	0.5710	0.0506	0.0309	-0.082	0.8773	0.2261	0.3756
0.5201	1.5869	-4.887	-0.057	0.1549	0.5603	0.0533	0.0320	-0.046	0.8090	0.2378	0.5653

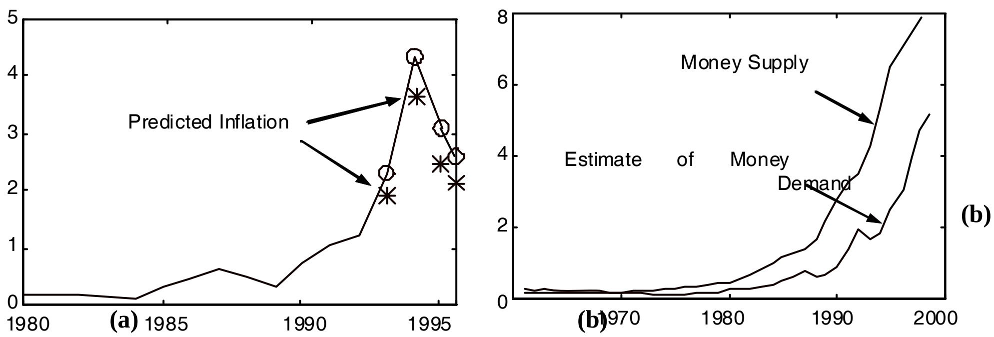

Fig 4: (a) Inflation model output validation; (b) Money Supply and the Estimated Money Demand

Simulation Results

To study how the fuel price changes affect the general price index, the model is simulated applying two designed scenarios for the years 2003 to 2020. The scenarios for the fuel price changes are defined as follows:

(1) A shock of 100% in the fuel prices at 2003 followed by a 50% in 2004, and then stabilizing the prices thereafter;

(2) Increasing the fuel prices with a constant continuous growth rate of 10%.

Meanwhile, the other input variables are also assumed to vary according to one of the following scenarios:

(a) Annual demand growth of 4% in company with the liquidity growth rate of 15%;

(b) Annual demand growth of 4.5% in company with the liquidity growth rate of 20%.

This way, there will be four cases of simulation, the results of which are shown in Fig 5 it can be observed that the shocking fuel price increase has led to less inflation in the long-term, compared to that of the continuously increasing fuel prices. Moreover, based on the model results, it is shown that a proper financial program that the government can plan in order to manage the liquidity growth, may help to control the inflation in a range of 3 to 10 percents. Conversely, as it has happen in the few recent years, uncontrolled liquidity growth of about 40% per year has caused a double rate of inflation reaching to more than 20% inflation rate.

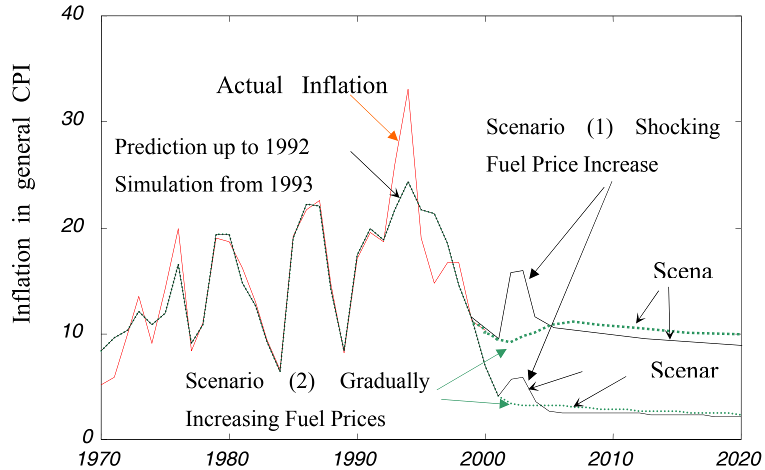

Fig 5: Prediction/Simulation results of the proposed inflation model for the four scenarios

It should be emphasized that due to the government's expansionary monetary policies in the period of 2006-2008, which led to the liquidity growth rate of about 40%, unlike to the above scenarios the real inflation rate has been increased reaching to about 25% in 2009. Therefore, removing subsidies by a sudden shock will cause much higher inflation rates in the next few years, falling to a higher steady state ratio.

Conclusion

In this paper a nonlinear dynamic multi-equation inflation model is proposed that can be used to study effects of different factors on the inflation. In particular, it is shown by the proposed model that a shocking price increase in the fuel price that causes the fuel price index to be equal to the FOB Persian Gulf price index has less effect in the consumer price index in the long-tem. Therefore, it is recommended to avoid continuously increasing fuel (especially gasoline) price increase which was followed by the governments in the past. The only fact that may discourage a sudden increase in the fuel prices is a social chaos that will have unpredictable outcomes. Clearly such a factor could not be modeled in such a pure mathematical model.

Fortunately, the current plan of giving quota has provided the appropriate condition to unsubsidize any extra demand for gasoline, while fixing the quota in the future. This may help the government to stabilize the fuel price around its real price in the world. On the other hand, the liquidity saved by the government (as a consequence of unsubsidizing the fuel) will have a deep and fundamental impact on the inflation control.

Finally, we have to state that the paper is silent about the impacts of removing subsidies other than the inflation. Since, the industries have faced serious problems in the recent years experiencing low growth rates, the current circumstances, having low growth rates in the economy and industry it seems unsuitable for executing desubsidization programs, which may lead to further collapse of the economy.

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