The Study of inflation effects on Iran Large Industrial Workshops profit: Combination of System Dynamic and Econometrics

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1. Abstract

In the most of the done studies, such as Anindya Banerjee & Brill Russell (2005) and Anindya Banerjee & at el. (2001), inflation has a negative effect on markup. In this paper, the effects of inflation on profit of big industrial companies have been inspected. The variables such as inflation, international CPI levels, profits of agencies, sale (income), total costs, cost of R&D, total factor of product (TFP) and quality of products are being inspected. In this study, first the relation between the variables have been estimated by using panel data during 2000-2007, then the acquired results were simulated by system dynamics method, we used from Vensim PLE,. The results show that the inflation causes more increase in incomes than expenses of agencies and finally the profit increase. The reason is that because the agencies don't respect the standards of the products –in inflation conditions-, they generally can decrease the quality of the products and as a result increases the prices of their product.

Main vocabulary: inflation, markup, total costs, total incomes, R&D, TFP, quality

2. Introduction

As it is clarified in many internal and external studies, inflation has negative and strong effect on economic growth. Also with considering the relation between inflation, markup, costs and incomes, it was clarified that inflation has negative effect on these variable in short-run and long run. So in this paper we want to inspect the relation between inflation and profit of industries and also effect of inflation on industries operation (other variables such as: costs, incomes, investment, TFP and quality). For this purpose we estimated econometrical equations between inflation with costs and incomes, profit and investment, production function and TFP function. Then we simulated these function and relations in system dynamic methods and finally we could see the effect of inflation on industries performance and the simulation was according to econometrical estimations. Finally we inspected the effect of inflation shock on system dynamic model.

We defined the membership scenario in Global Trade Organization and assumed that in this condition the price of goods are exogenous and there are no tariff and share imports. For this purpose we changed the system dynamic models.

3. Theoretical bases

In this paper, theoretical bases are Solow growth theory, cost and revenue functions in microeconomics and Romer economics growth model and tariff model. The Romer model is concentrated to effect of Research and development on growth rate. In tariff model, governments could effect on payment balance by determining of tariff, imports shares, taxes and subsides. Setting of these conditions is usually a bad international behavior and is in contrast with membership of WTO. According to microeconomics theory, incomes and cost has affected by quantity of output and inflation.

4. Previous studies

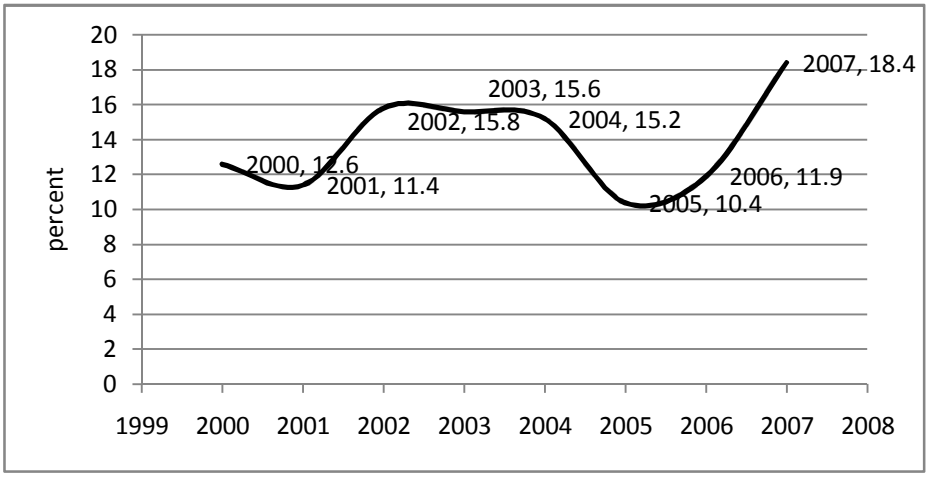
- Banerjee and Russell in 2005 in their paper with "inflation and measure of the markup" title estimated a negative long-run relation between inflation and markup. They used nearly 50 years of quarterly United States data and they identified a strong negative long-run relationship between inflation and both measures of the markup.
- Gwin and Vanhoose in 2008 did study with "alternative measures of marginal cost and inflation in estimations of new Keynesian inflation dynamics" title. In this paper they used Gali,J and Gertler, M study and replicate their results and compared the replicated results to those obtained when alternative measures of marginal cost and inflation were utilized. They found that estimations of the structural new Keynesian model of inflation dynamics are not particularly altered by using a marginal-cost measure based on actual industry costs but are sensitive to using PPI-inflation measure that arguably is more appropriate for testing a theory of firm pricing. Furthermore, they found that utilizing a measure of marginal cost yields

results that are at least as plausible as those of Gali and Gertler, yet which generally suggests greater aggregate US price flexibility.

- Banerjee, Cockerell and Russell in 2001 did study with "An I(2) Analysis of Inflation and the Markup" title. It is found that the levels of prices and costs are best characterized as integrated of order 2 and that a linear combination of the levels (which may be defined as the markup) co integrates with price inflation. From the empirical analysis they obtained a long-run relationship where higher inflation is associated with a lower markup and vice versa. The impact in the long run of inflation on the markup is interpreted as the cost to firms of overcoming missing information when adjusting prices in an inflationary environment.
- Dadgar & Keshavarz in 2006 inspected the relation between inflation and growth economic during 1959-2004. In this paper they estimated two models that one of them had delay. In model with delay, the defeat has happened in 10 and 26 inflation rate and the other one has happened in 10 and 16 percent. With comparing these two models, they had resulted when inflation is fewer than 10 percent, it has positive effect on growth but it happens with a delay and when inflation is under 26 percent, it has negative effect only in instant period. When we have hyperinflation it has negative and meaningful effect on growth in instant and later period.
- Komijani & Alavi in 1999 inspected the relation between inflation and growth economic during 1951-1998. The method of this paper is time series. This paper says that inflation could have positive effect only in short time but in medium and long time it has bad and negative effect on growth economic. Growth economic has negative effect on inflation in long time and also in medium and short time but its effect is less than increasing liquidity effect on inflation.

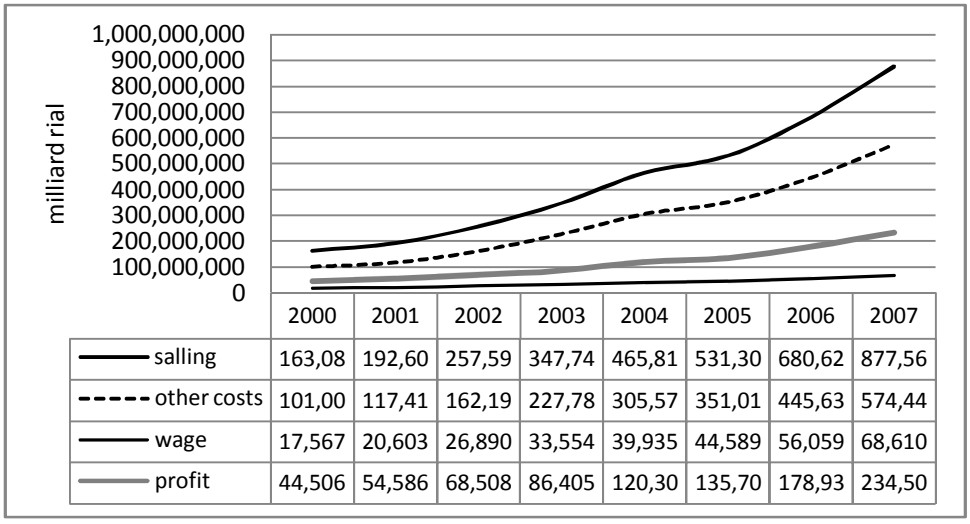
5. Inflation and profit trend function

As it is specified in the below graph, inflation has increased during these eight years. It was 11.3% in 2000 and 16.4& in 2007. The maximum amount of inflation was in 2007 and the minimum was in 2004



Graph 5-1- inflation

In the below graph the trend of profit, incomes, costs and wages has been shown. In this model profit = nominal value of incomes - nominal value of wages- nominal value of other costs. As it is specified in the graph, incomes and other costs are increasing but increasing of incomes are more than other costs increasing so nominal profit increase during these years.



	2000	2001	2002	2003	2004	2005	2006	2007
salling	163,08	192,60	257,59	347,74	465,81	531,30	680,62	877,56
other costs	101,00	117,41	162,19	227,78	305,57	351,01	445,63	574,44
wage	17,567	20,603	26,890	33,554	39,935	44,589	56,059	68,610
profit	44,506	54,586	68,508	86,405	120,30	135,70	178,93	234,50

Graph 5-2- profit, costs and incomes

6. Model estimation

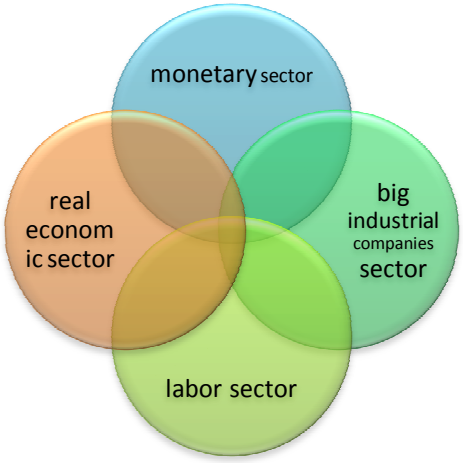
System dynamic method is including some independent variables such as: stock & level, rate & flow, auxiliary and constant that level and stock variables have differential and

integral equation but other variable have different mathematical and econometrical equation.

We used the system dynamic method, although many of the behavioral equation have been estimated using econometrical methods. This model inspects cause and effect relation between some sectors. These sectors are: real economic, monetary sectors, big industrial companies and labor sectors. System dynamic model has planned by forester for the first time.

In real economic part, consumption and investment expenditure of government is specified. Monetary sector is including CPI, inflation and liquidity. Labor sector is including skillful labor and total labor.

In econometric estimations we did not examine stationary tests because all data were panel data.



Graph- 6-1- sectors of system dynamics model (subsystems)

a) Causal loop diagram

The main variables, linkages and feedback loops in the models are shown in figure 1 and will be discussed briefly in this paper. The figure illustrates the interaction between the monetary/real economic and big industrial companies/ labor. SD model had been designed to examine behavior generated by these interactions during 2000-20024.

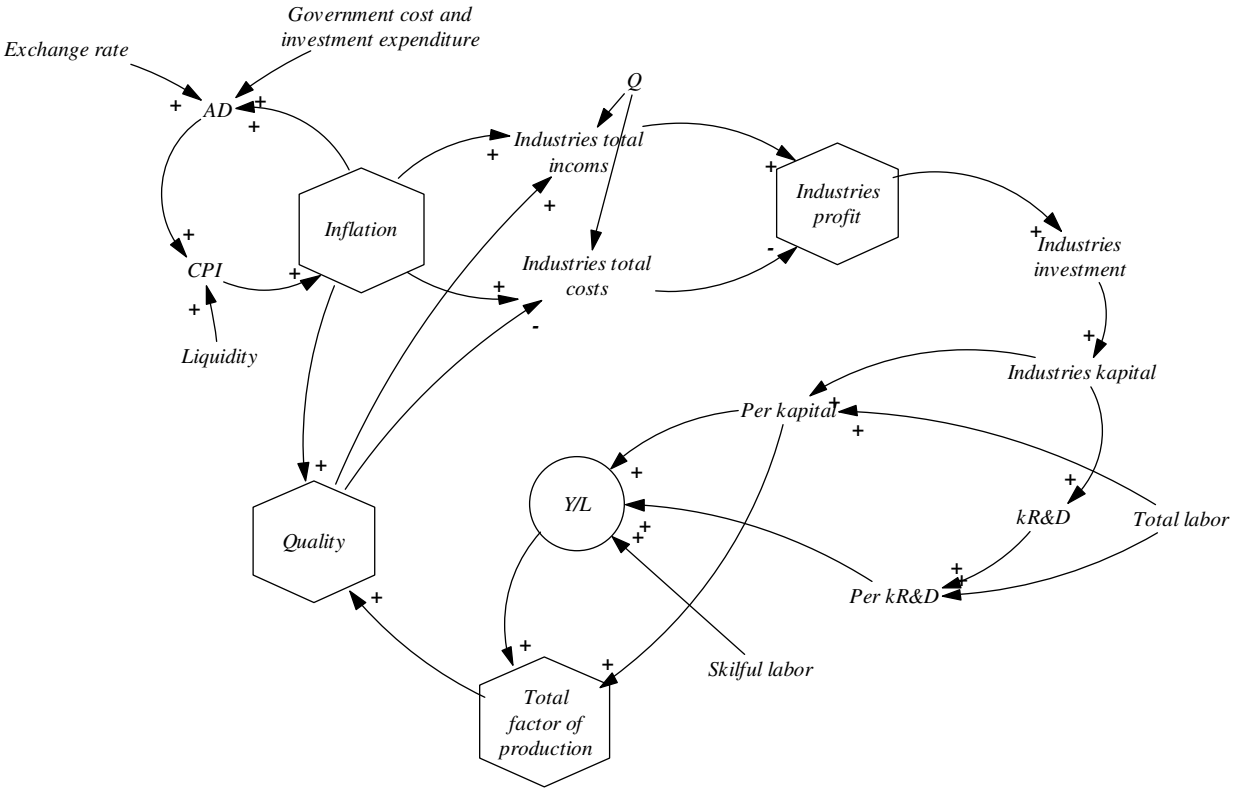


Figure1. Casual loop diagram for SD

As it is shown in the above figure, increasing in inflation rate, increase incomes and costs but according to the econometrical estimation coefficient correlation of incomes is greater than expenditure coefficient. There for with increasing inflation, industries profit will increase.

When TFP increase, quality of industries production will increase but with increasing inflation, industries decrease their qualities because of increasing their profit.

7. Model Description

- In this part we estimate relation between exchange rate, government expenditure, liquidity, aggregate demand and consumption price index (CPI). The equations are as the following:

LOG (AD) = -4.3 + 0.86 *LOG (G) + 0.001*LOG (INF) + 0.35*LOG (EXR)
t = -140.3 t= 301.21 t= 2.12 t=1598.66
F=2142401 R^2=0.99
CPI= -5 + 0.003*M + 0.03*AD
t = -2.11 t= 8.03 t=2.81 F=817.811 R^2= 0.98

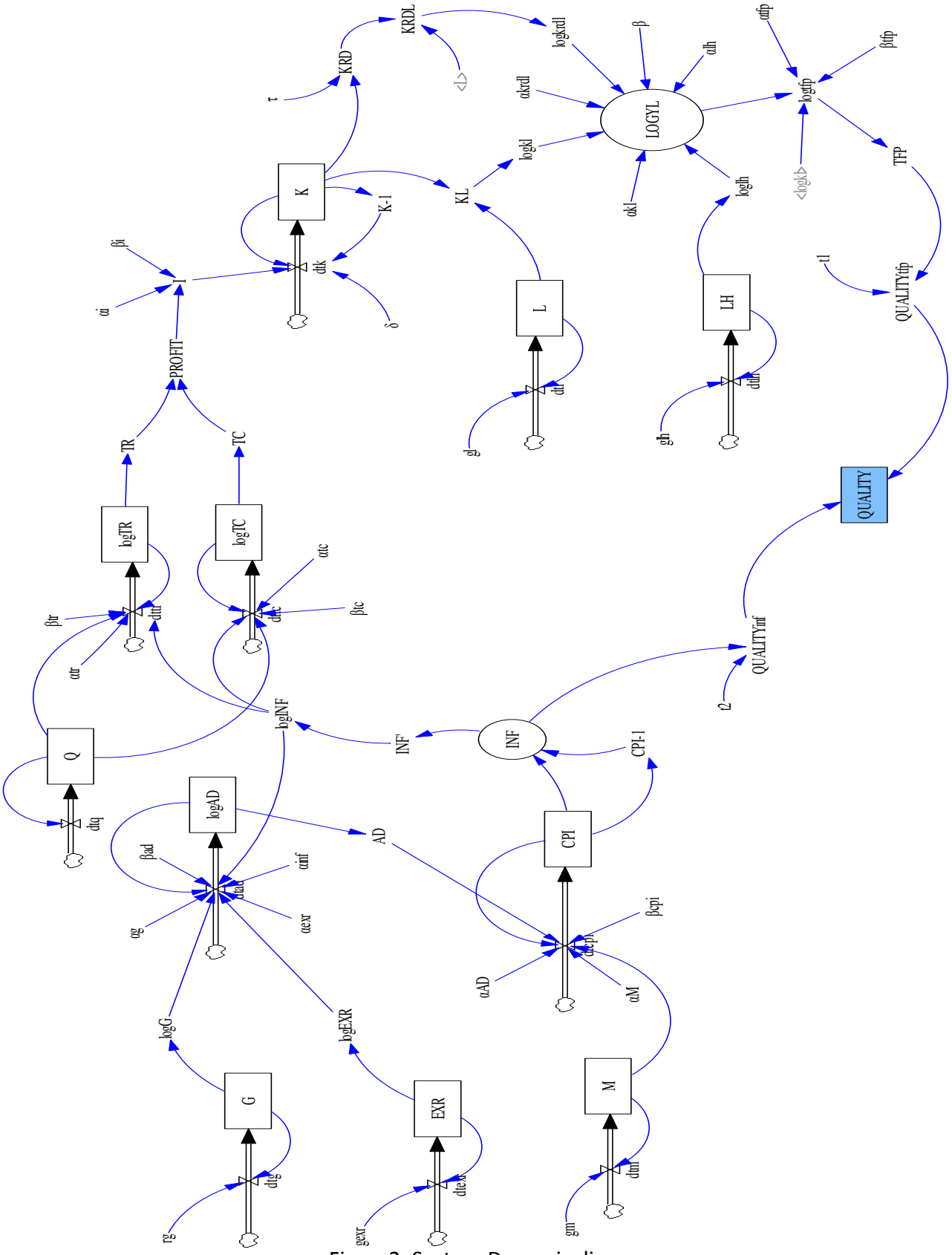


Figure2. System Dynamic diagram

According to the equations, exchange rate and government expenditure have positive effect on aggregate demand. On the other hand liquidity has positive effect on CPI and also increasing in CPI increases the inflation.

- In this part we estimate the relation between inflation & production with industries income and cost. We did not have profit of industries, so with estimating the above equation we found the relation between inflation and profit.

$\text{Log (TR)}_{it} = 5.87388 \log (\text{inf})_{it} + 0.000003\text{product}$

R^2=0.73 F= 0.77735 D.W= 1.93

$\text{Log (TC)}_{it} = 5.77635 \log (\text{inf})_{it} + 0.000004\text{product}$

R^2=0.73 F= 0.752915 D.W= 1.93

Inflation has positive effect on incomes and costs, but coefficient correlation of incomes is greater than expenditure coefficient. There for with increasing inflation, industries profit will increase.

In this paper data is panel so we have not considered stationary test for variables.

- In this part we estimate the relation between profit and investment.

$I_{it} = -4933.45 + 0.209989(\text{profit})_{it}$

t = -0.031300 t =16.24794

R^2=0.59 D.W=1.55 $F_{(22,160)} = 2.83$

We simulate relation between capital and capital of R&D in system dynamic method. Increasing in capital will increase capital of R&D.

- In this part we estimate production value. According to the estimation, per capital, per capital of R&D and skillful labor have positive relation with production value. This estimation is according to romer theory.

$\text{Log}(Y/L)_{it} = 3.043331 + 0.302532 \log(K/L)_{it} + 0.257573 \log(KR\&D/L)_{it} + 0.48890 \log(lh)_{it}$

t=5.320210 t= 9.599143 t= 7.311456 t= 0.881981

R^2= 0.605 D.W=0.905 $F_{(23,158)} = 30.54$

- Also we simulate TFP of industries and quality. With increasing per production and per capital, TFP will increase. Increasing in TFP increases quality of industries but on the other hand, when inflation increase, industries for increasing their profit, decrease their quality and resultant of these two effects make total quality of industries.

8. Model behavior and results

a) Under the given assumption, we are able to compare the simulation and real amount. We compared real amount of inflation, profit and TFP with simulation amount.

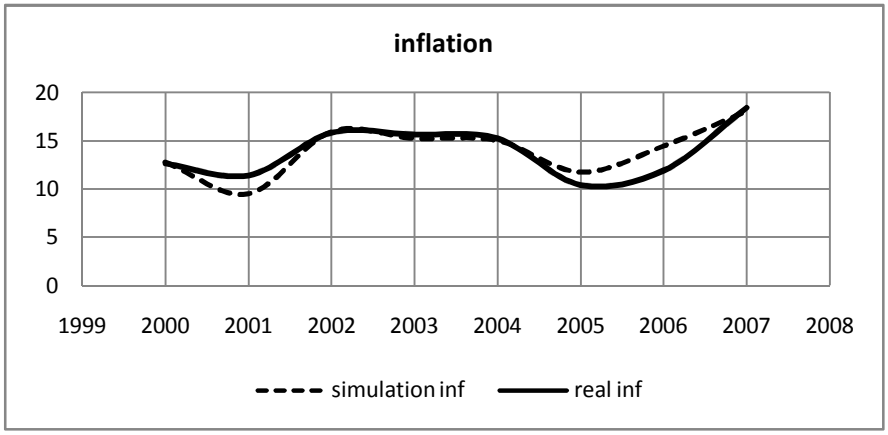


Figure.8-1. Real and simulation inflation

As it is shown in the figure, behavior of simulation inflation is similar to real inflation and it means that our simulation is correct.

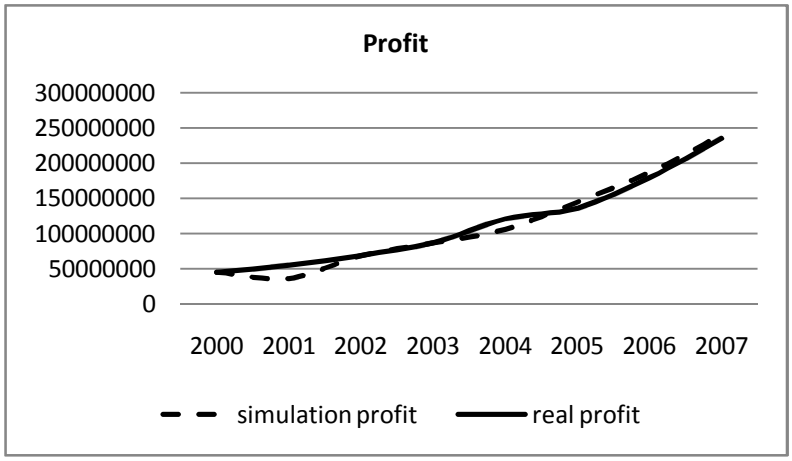


Figure.8-2. Real and simulation profit

With considering behavior of simulation profit and real profit we can see that this simulation is also correct.

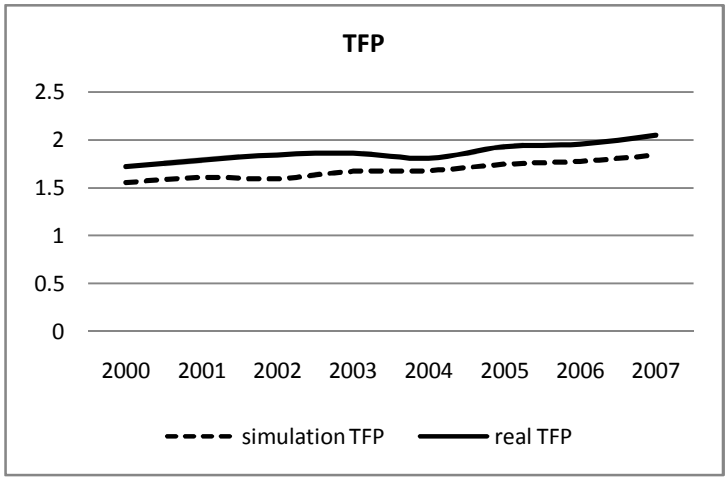


Figure.8-3. Real and simulation TF

According to the figure 8.3 behavior of simulation TFP is similar to real TFP and the simulation is correct.

As it is shown in the figure 8.4 trend of quality is result of simulation. With increasing TFP quality increases but with increasing inflation, quality decreases. Resultant of these two qualities makes the total quality which has shown in the figure.

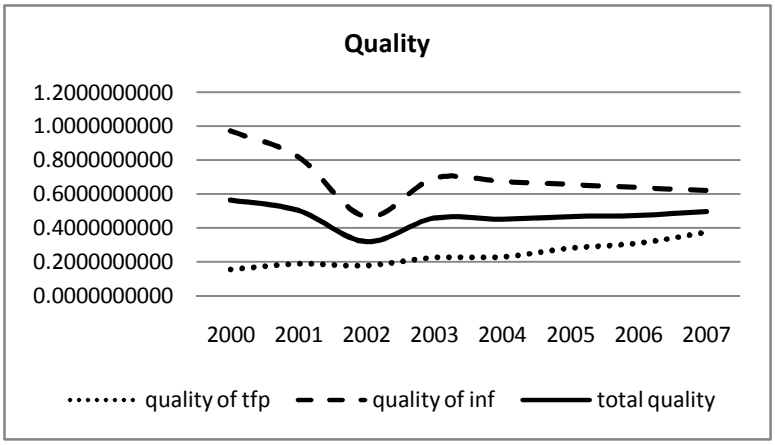


Figure.8-4. Quality

b) In this part we inspected effect of shock on the model. We gave a shock to inflation in 2016 about 4 percent. With Increasing 4 percent inflation, the profit of agencies increases three

times. Also TFP and quality of TFP have increased by giving inflation shock but quality of inflation has decreased. The figure of this shock is as the following:

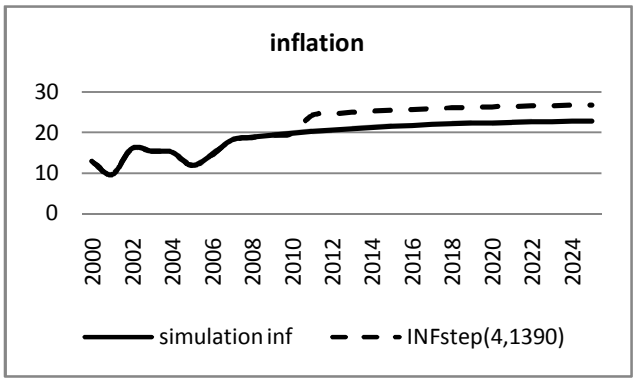


Figure.8-5. Inflation shock

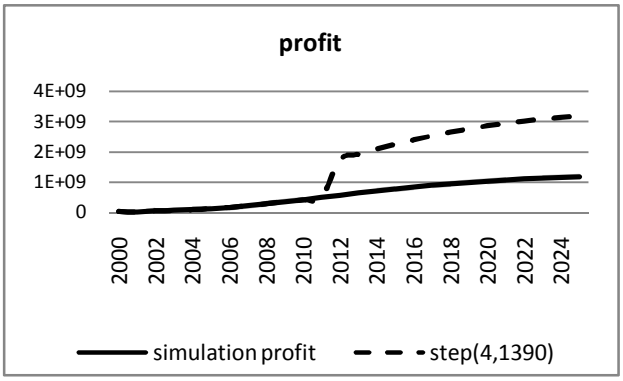


Figure. 8-6. Effect of shock on profit

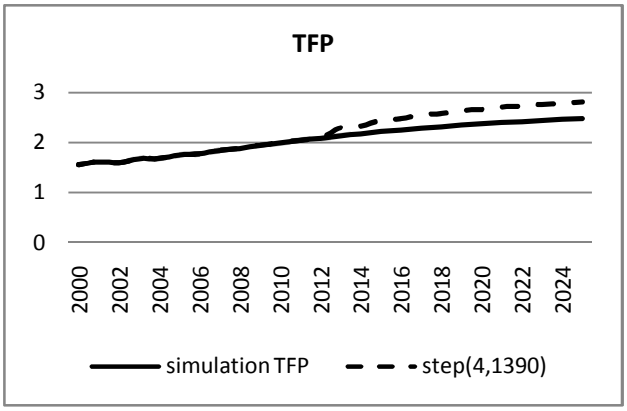


Figure.8-7. Effect of shock on TFP

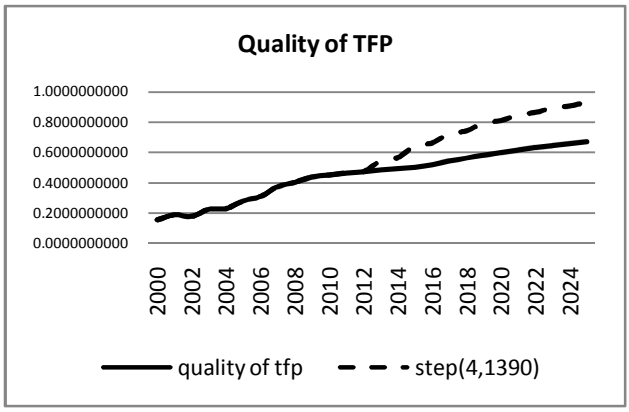


Figure.8-8. Effect of shock on Quality of TFP

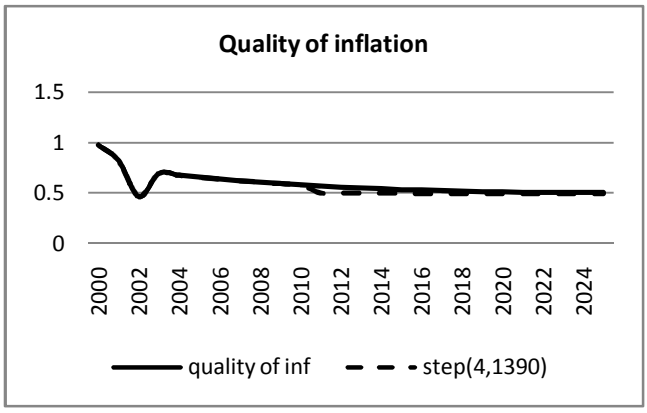


Figure.8-9. Effect of shock on Quality of INF

9. Membership of WTO

In this paper we examine the effect of membership of Iran in WTO. Indeed in this part we want to find that do become a member of WTO has positive effect on industries or not. For simulating this assumption, we suppose that prices are exogenous and world prices directly effects on internal prices and inflation have no effect on income, cost and …. The graphs are as the following:

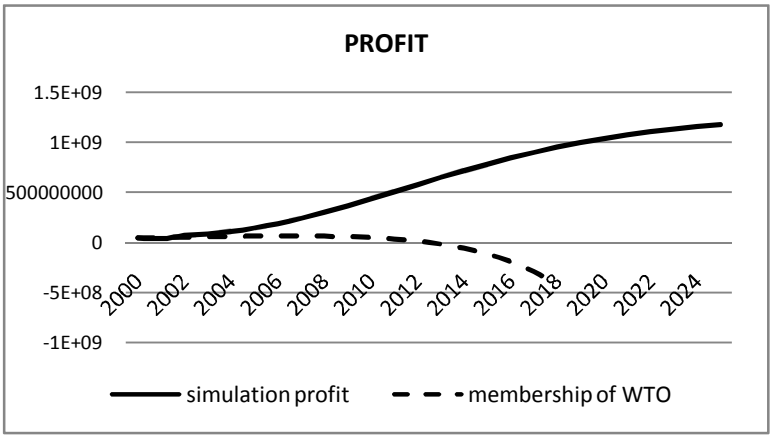


Figure.9-1. Profit-membership of WTO

As it is shown in the figure, membership of WTO has a bad effect on industries and they bankrupt, because the quality of internal industries is so low in comparison with external companies. So with present condition membership of WTO are not to industries advantages.

The following figures also confirm this mater. These figures are as the following:

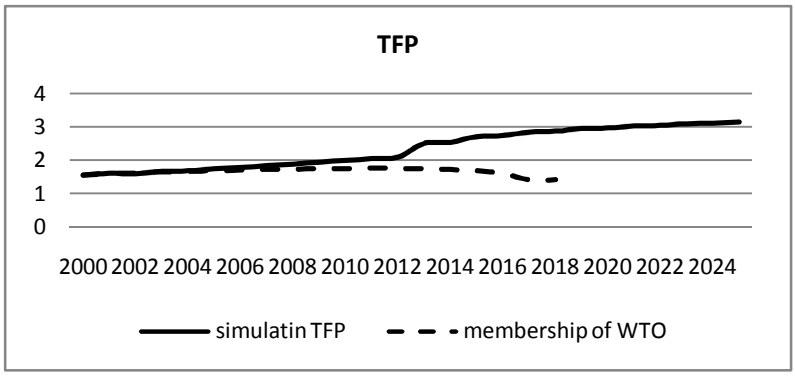


Figure.9-2. TFP-membership of WTO

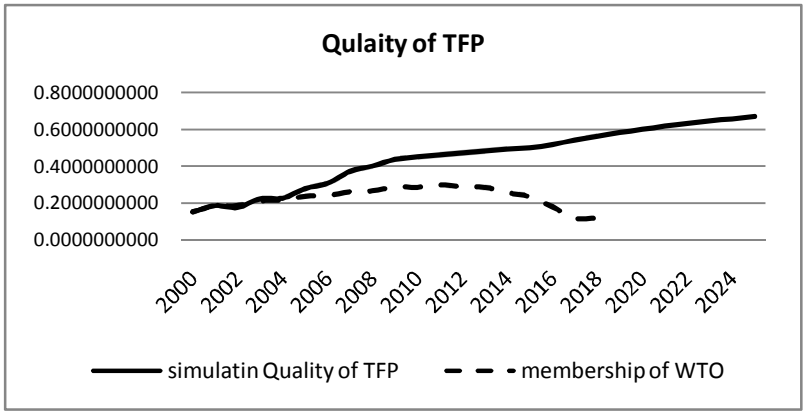


Figure.9-3. Quality of TFP-membership of WTO

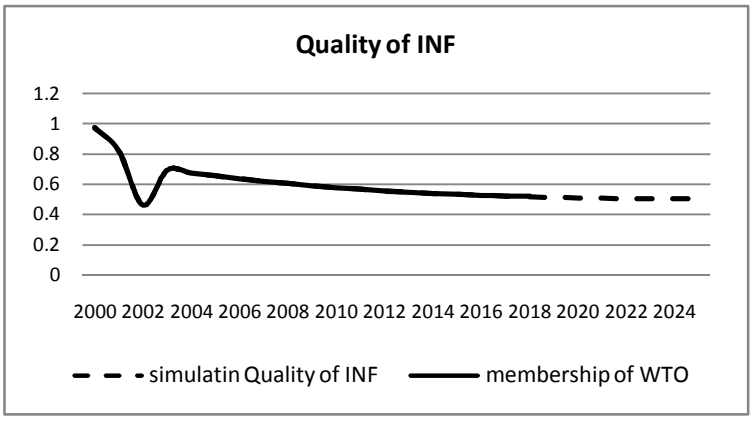


Figure.9-3. Quality of INF-membership of WTO

If Iran wants to be a membership of WTO, it should omit his imports tariffs and shares. In this condition the price of external goods will decrease because they supply with their real prices, and internal goods could not compete with external ones because their quality is lower and industries will bankrupt. So we can express that in present condition become a member of WTO has bad effect[1] and many of industries will bankrupt.

10. Results

In this paper we estimate the relation between incomes and costs with inflation and also we estimate the production function and then by using system dynamic method we simulate these relations, Data was panel data. The results of estimation and simulation are as the followings:

a) Results of econometrical estimations:

- In this part we estimate the relation between inflation & production with industries income and cost. Inflation has positive effect on incomes and costs, but coefficient correlation of incomes is greater than expenditure coefficient and as we did not have profit of industries, so with estimating the above equation we found the relation between inflation and profit. There for with increasing inflation, those industrial enterprises which remain and continue their activity will make profit from inflation conditions.
- With increasing profit, industries investments will increase.
- Variables such as per capital, per capital of R&D and skilful labor increase production.

b) Results of system dynamic simulation

[1] Falihi,n, (2008), " general plane of charmahal bakhtiary province occupation"

- System dynamic simulation is conforming to econometrical estimations, in case with increasing inflation, industries profit increase. Increasing in profit lead to increase investment and capital. Increasing in capital lead to increase TFP and quality. On the other hand increasing in inflation lead to decrease the quality of industries, and resultant of these two makes the total quality.
- 4 percent inflation shock leads to increase the other variable.
- If Iran wants to be a membership of WTO, it should omit his imports tariffs and shares. In this condition the price of external goods will decrease because they supply with their real prices, and internal goods could not compete with external ones because their quality is lower and industries will bankrupt. So we can express that in present condition become a member of WTO has bad effect and many of industries will bankrupt.

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