# THE ESTIMATION OF DEMAND FOR NATURAL GAS CONSUMPTION IN INDUSTRY SECTOR IN IRAN AND PREDICTION IT UNTIL 2021: STRUCTURAL TIME SERIES MODEL ANALYSIS

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**ABSTRACT**

According on indigenous and exogenous economic factors, estimation of natural gas demands in industry sector from 1986 to 2013 will be discussed respectively, and the consumption of it will be predicted. In this study, structural time series models have been applied due to the considering exogenous economic factors, implicit Underlying Energy Demand Trend (UETD) which mainly are unobservable. Estimation's results imply on stochastic trend and demonstrate that uneconomical unobservable factors have effective role on featuring natural gas demand in industry sector.

Upward trend of UEDT indicate that industrial natural gas has been consumed in non-optimized way. In fact, the effects of unobservable factors on consumption of natural gas are positive. So, the resent result implicate that some unobservable factors like technology advancement, structural reforms, have failed in decreasing consumption of natural gas duo to not regarding some efficiency standards. The estimation's results confirm that natural gas relevant to all variable is inelasticity in a short-run, unlike long-run. The final results of estimation of industrial electricity demand it is predicted that Iran industrial natural gas demand will be 50 million m3 by 2021.

**Keywords:** *Structural time series, Kalman filter, Maximum likelihood, Auto regressive Distributed Lag, Underlying Energy Demand Trend.*
**JEL:** Q41, Q43, Q38, C22, C32.

## 1. INTRODUCTION

One of the key issues in this world is management of energy need and trying for usability of using energy an effective usage of it. Industry section as a pioneer section, with having previous and next relations with other economic sections is as one of the key sections of economic. In addition, this section is one of the most important sections of energy users that its aim are improving the produce condition and increasing effectiveness of usage amount, correct management and exact programming toward controlling of natural gas that replaced with other energy tools. For estimation of requirement used of various models, that in most of them non-observable variables and developing technology not considered. For solving this problem, the trend variable introduced in the model and some of the researchers believed that on the base of the deterministic nature (non- stochastic) of the variable, the effect of change and improvement not considered exactly. For solving this issue proposed Structural Tim Series Model (STSM) by Harvey (1989). In this model, the trend variable, the process formed in stochastic shape and so we can concluded that the effect of unobserved exogenous variables by using of estimation method of Kalman filter and maximum likelihood (Harvey, 1989 and Shepard, 1990). In this thesis also with using of Structural Time Series Model and using of Kalman filter with maximum likelihood, estimation of orientation of the parameters of demand function achieved and represented the required proposes.

## 2. LITERATURE REVIEW

### 2.1. Experimental studies

On the base of the importance of in and out performed many studies for requirement and using energy especially gas. Mirbagheri Jam (2006) with using of structure time series demand of gas in the household and trade sectors estimated in Iran. The results indicated that in the function not observed the trend components (UEDT)[1], also income and price elasticity were -0/3 and 0/17 respectively. Mohammdreza Lotf Ali pour et al (2014) in an essay with introducing the underling energy demand trend and using of structure time series model, estimated demand function of electricity of Iran in the household and industrial sections for 1976- 2011. The results indicated that the nature of UEDT in the electricity demand function in the household section is the smoothed. Also, in the short run

[1] Underlying Energy Demand Trend

and long run, the price and income elasticity of electricity demand are lower than unite. Imami Meybodi et al (2010) estimated the seasonal demand function of natural gas for household section of Tehran by using of Kalman filter. In this study unobservable factors was described and for prevention of biased coefficient, the kalman filter method used of them. Price and income elasticity estimated -0/098 and 0/114 respectively. Teimoir Mohammdi et al (2014) estimated the function of electricity demand in the industry section during 1976-2012. They in their studies used from a time series model approach. The results of estimation indicated that the natural of trend is random and the demand for electricity relevant to price and income is inelasticity. Keshavarz Hadad and Mohammad Mir Bagheri (2007) by using of STSM, estimated the natural gas function in the household and trade section in Iran. In the estimated demand function, no observed the trend's parameter and the seasonal factor identified as stochastic. The amount of the natural gas depended to the temperature is -0/26. Price and income elasticity achieved -/13 and /17 respectively. Hant et al (2003) modeled the total demand of energy of British by using of STSM and seasonal date for period 1997-1972 for various sections and concluded that the trend variable had statistic identity. Dimirtoplos et al (2005) by using of the annual data for for 1967-2002 estimated the energy demand for various sections and concluded that STSM showed better results other than ARIMA model.

Amarakerama and Hunt (2008) estimated the electricity demand of Serilnaka 1970-2003 by using of six various methods that one of them was STSM process. The results indicated that the comparable method is cointigration, but it is indicated that STSM is the only method that allow that for identifying the exogenous non-linear trend. Agnolucci (2010), estimated the energy demand function during 1973-2005 and with using of method STSM and OLS, and considered price reaction for these two process. The achieved results indicated that the structure time series is effective for estimation of energy demand. Alrabbaaie and Hunt (2006) used of structure time series process for modeling of underling energy demand trend of the countries OECD, and then long time income and price elasticity estimated. Statistic trend preferred for deterministic trend for prevention of the bias of the estimations. Suleiman Sa'ad (2011) deal to estimation of function of energy demand for South Korea and Indonesia in macro level and the household section estimated by using of structure time series . In addition, he through using of this process estimated underling energy demand trend that not only showed technical development but also indicated structure and foundation of the economic.

Bianco (2009) on the base of the studies of data 1970-2007 estimated electricity demand of Italy. On the base of the results of this study, the per capita income, the price of electricity in current period and also with three lag and consumption of electricity with three lag is effective on consumption of electricity. In this thesis estimated the amount of non household section by electricity price variables for non-household section, gross domestic production, time variable as productivity and technology and also electricity consumption with three lag. The results indicate that income elasticity is more than price elasticity. Also the results indicated that the income elasticity is about 80% and it is stable, and the structure changes, energy price and effective variables all of them are negative and below 1. Zafar Delavar and Hunt (2011) investigated the relation among consumption of industrial electricity, added value of the industry section and electricity price during 1960-2008 for prediction of industrial electricity consumption. They used of STSM in their study. The results indicated that added value of the industry section and electricity price had determinant role on the demand of electricity of this section. Price and income elasticity achieved -0/16 and 0/15 receptively.

## 3. Theoretical framework of the study

On the base of the fact that the natural gas in the industry section is for producing process, so for achieving the demand function of gas in this section and investigation among effective factors used of Conditional factor demand function. The conditional demand function of any produce factor is equal to amount of using these produce factor, that according their stable price, minimized the required cost for achieving the determined level of produce. For achieving the conditional function in forcibly is sufficient that the cost of producer relevant to certain level of product to be minimum. The conditional demand function is depended on price of produce factor (input), level of produce, in addition to this function is homogeneous from zero degree relevant to the price of inputs.

The produce function of agency with considering two produce factors, we deal as the following:

$$q = f(x_1, x_2) \tag{1}$$

That in this equation x1 is the amount of considered input, and x2 indicated other input for produce, for achieving the input conditional function it is required that the cost of equation be as the following, and be minimized in the determined level of produce.

$$r_1 x_1 + r_2 x_2 = c \tag{2}$$

In this equation r1, indicated the price of the x1 and r2 indicated the price of substitute production input, so with minimization of the above function, the considered demand function of the production input that is a function of its price and function of price of other inputs and also function of the amount of production achieved.
So, the materials that mentioned in the above, abbreviated in the mathematics relations as the following:

$$Min \quad r_1x_1 + r_2x_2 \qquad (3)$$
$$\overline{q} = f(x_1,x_2)$$

With considering the above sign as Lagrange index, the condition of the firs stage is as the following:

$$R_1 - \lambda f_1 = 0$$
$$R_2 - \lambda f_2 = 0$$
$$\bar{q} - f(x_1,x_2) = 0$$

That of solving the three equation system, and three above equation we can use of the following data:

$$X_1 = f(x_1,x_2,y) \qquad (4)$$

For determining the sign of price effect of the considered production input and the sign of price effect of substitute production input the second condition is used. Then after doing required mathematics operations, the relation of price coefficient of considered production input (the coefficient of price of natural gas) achieved as the following:

$$\frac{\partial x_1}{\partial r_1} = \frac{f_2^{\,2}}{H}$$

That in which H is the hessian matrix as the following:

$$H = \begin{vmatrix} -\mu f_{11} & -\mu f_{12} & -f_1 \\ -\mu f_{12} & -\mu f_{22} & -f_2 \\ -f_1 & -f_2 & 0 \end{vmatrix}$$

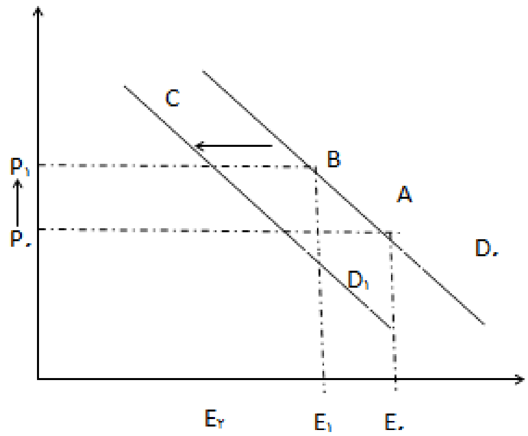
So we can show that the slope of the natural gas demand ( x1) as compare as its price is negative , since on the base of this fact $\frac{f_2^2}{H}$ is positive and in other hand the condition of second stage for minimization of it is required the considered cost that amount of determinant H is a negative figure, so all of the deduction $\frac{\partial x_1}{\partial r_1} = \frac{f_2^2}{H}$ is negative.

In the other hand, we can say that the cross price effects be positive since:

$$\frac{\partial x_1}{\partial r_2} = -\frac{f_1 f_2}{H}$$

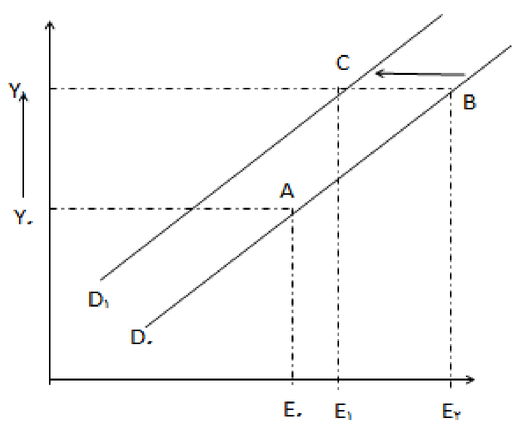
That in this equation r2 indicated of price of electricity as substitute of gas. So on the base of the negative of determinant H and on the base the marginal production is positive, so we can say that the amount of the above deduction will be positive. In addition of the changes of price and income, there are effective factors as well as changes of economic structure and also change of likes and technology development over behavior of producers. In the past through entering deterministic trend in the model, the advancement of technology considered as a process that has changed with fixed-rate over the time. But the advancement of technology has stochastic trend and it is thoroughly stochastic process. All of the factors that are effective on the changes of technology lead to transform of function of energy demand. The energy price is from endogenous factor on technology that through its changes changed the effectiveness of the energetic tools. Investigation of the changes of energy demand since of changes of income and price or since of technology development is a challengeable discussion. Jones (1994) considered the reduction of energy demand due to technology development is different of reduction of energy demand due to increasing of price of energy.
On the base of a lack of information for enter of these variables for estimated models, in the previous studies for considering such factors, used of price changes and income changes that result in bias estimation of price elasticity and income elasticity. Curve 1 and 2 showed this issue.

**Figure 1. Biased price elasticity estimates**




In the curve 1when the price increase from p0 to p1 the amount of energy demand reduced to E1, and transformed to point B. but in the long term changes in demand resulting from changing patterns of consumption.
For example if development of technology result in lower consumption of the energy, the curve of the demand transformed to the left and the balance be in point C. As it is observable in the curve, the price elasticity without considering the changes mentioned above is over estimated. Also in the curve 2, with increasing income of consumer until level Y1, he purchase of equipments with gas fuel. If the development of technology results in increasing efficiency of these equipments, the curve will be transferred in the left side and this case result in the fact that the income effect changed from E1-E0 to E2-E0. In the case of ignoring the mentioned factor, income elasticity is low estimated.(haddad et al, 2007).

**Figure 2. Bias estimate of the income elasticity**




The seasonal pattern maybe determined, and not changed during time, or changed during time, and the stochastic form will be created. Many of researches when work by unadjusted data, for removing seasonal effects use the dummy variables. So, when the seasonal effects changed during time entering the seasonal dummy variables lead to incorrect assessment of dynamic model.
In this study for prevention of such problem used of Kalman filter. This method have especial feature that for estimate of coefficients change the time series to state spas model. Then with considering a primitive state, the coefficients of model estimated in next time. This makes to changes of consumption that is in result of changes of motivation and likes and developing technology, adjusted in the next stage.

## 4. METHODOLOGY

Structure method involved analysis of the depended variable to the effect of explanation variables as well as price and income, in addition of trend and irregular issue.

In one classic regression, the trend variable has determined natural while maybe change during time and maybe has stochastic nature. One univariate STSM model can be explained by the regression that in which the parameters changed during time and also the explanation variables in which are functions of time. The most important tool for estimation of time series model is state space form that represents state of system by unobservable component such as trends and seasons. Through access to the new observation, the estimation of the parts be able thorough filter, and maybe said that smoothing algorithm, is the best estimation from state in anywhere in the sample.

Assumed that the demand function of gas is as the following:

$$E_t = f(Y_t, P_t, PE_t, UEDT_t) \quad (5)$$

That in which **Et** is the industrial gas demand,**Yt** added value of the industrial section , **Pt** is the real price of natural gas, **PEt** is the real price of the industrial electricity, and **UEDTt** is the underling energy demand trend of the natural gas.

Hunt et al (2003-2000) in their studies concluded that the structural time series approach is the best model for modeling the side process of the underling energy demand trend, since this process allow that the non observable trend move in stochastic form and compounded with a autoregressive distributed lag (ARDL) model. In addition of modeling the variables and their lags, with considering the lag of dependent variable, we can dynamic the model and can estimate the long run elasticity. (Mohammdi et al, 2014). So we will have:

$$A(L)E_t = B(L)Y_t + C(L)P_t + D(L)PE_t + \varepsilon_t \quad (6)$$

That in which **Et, Yt, Pt, PE** , **εt** are respectively, energy demand, added value of the industry section, price of the natural gas, price of the industrial electricity as energy of replacement of gas and error term. (L, is the polynomial lag operator)[2]

$$A(L) = 1 - \lambda_1 L - \lambda_2 L^2 - \lambda_3 L^3 - \lambda_4 L^4$$

$$B(L) = 1 - \alpha_1 L - \alpha_2 L^2 - \alpha_3 L^3 - \alpha_4 L^4$$

$$C(L) = 1 - \varphi_1 L - \varphi_2 L^2 - \varphi_3 L^3 - \varphi_4 L^4$$

$$D(L) = 1 - \theta_1 L - \theta_2 L^2 - \theta_3 L^3 - \theta_4 L^4$$

The long run output elasticity of industrial electricity demand- $\frac{B(L)}{A(L)}$

The long run price elasticity of industrial electricity demand- $\frac{C(L)}{A(L)}$

The long run cross price elasticity -$\frac{D(L)}{A(L)}$

The UEDT is stochastic and can be estimated by the STSM, consisting of level and slope components with the following formulation:

$$\mu_t = \mu_{t-1} + \beta_{t-1} + \eta_t, \quad \eta_t \sim NID(0, \sigma_\eta^2) \quad (7)$$

$$\beta_t = \beta_{t-1} + \xi_t, \quad \xi_t \sim NID(0, \sigma_\xi^2) \quad (8)$$

$\mu_t$ = level of the UEDT

$\beta_t$= Slope of the UEDT

$\eta_t$ and are the mutually uncorrelated white noise distributed with zero means and variances $\sigma_\eta^2$ and $\sigma_\xi^2$ respectively. Larger variances cause greater stochastic movements in the trend; $\eta_t$ allows the level of trend to shift up and down and $\xi_t$ allows the slope to change (Harvey and Shephard, 1993). The shape of the underling electricity demand trends is determined by this hyper-parameters including $\sigma_\eta^2$, $\sigma_\xi^2$ and $\sigma_\varepsilon^2$. The hyper-parameters and other parameters of the model are estimated by a combination of maximum likelihood and the kalman filter. Equation residuals and a set of auxiliary residuals are also estimated in order to evaluate the model. The auxiliary residuals consist of smoothed estimates of model disturbances (the 'irregular residuals'), smoothed estimated of the level disturbances (the 'level residuals'), smoothed estimates of the slope disturbances (the 'slope residuals').

[2] . A four-year lag is chosen for the polynomial lag operator it is seen as reasonable length to capture any possible dynamics.

In order to maintain the normality of the auxiliary residuals, some irregular, slope and level interventions can be identified (koopman et al. 2000). These interventions generally give information about important breaks and structural changes at certain dates during the estimation period. The irregular intervention can be described as a pulse effect since it has only a temporary effect on the UEDT; it is therefore a short run response normally used to account for an unexpected event or shock. However level and slop interventions do have a permanent effect on the estimated UEDT; hence these effects are longer lasting. In energy demand modeling, these interventions normally illustrate a 'structural changes' that might arise because of a number of factors that are captured by the estimated UEDT, as discussed above. If there are no interventions then the estimated UEDT is given by:

(9) slope interventions+ level interventions+ irregular interventions +ut= UEDT

Therefore, in addition to identifying appropriate interventions, the estimation strategy involves estimating equation (9), (8), (7) and (6) and testing down by excluding statistically insignificant variables, providing the model passes an array of diagnostic tests. The software package STAMP 8.10 (koopman et al, 2007) is used to estimate the model and the results given in the next section after discussing the data.

## 5. ESTIMATION AND RESULTS OF THE MODEL

### 5.1. Estimation and interpretation of estimated indexes

For investigation and accept of the results from performing model, it necessary that performed tests by using of some of statistics. For this reason for goodness of fit used of prediction error variance statistics, prediction error mean deviation and the coefficient of determination. The normality (corrected Bowman-Shenton), kurtosis and skewness that are for determining normalization of hyperparamters are used. These statistics has distributions $\chi^{2}_{(2)}$, $\chi^{2}_{(2)}$ and $\chi^{2}_{(1)}$ respectively. Statistics H(6) indicated heteroscedasticity statistic distributed as F(6,6). r(1) and r(3) are serial correlation coefficients at the equivalent residuals lags, approximately normally distributed. DW is the Durbin-Watson statistic and Q(3,1) is the Box- Ljung statistic distributed as $\chi^2(1)$ that in fact show the serial correlation of variant lags. Table 1, showed the results of estimation of the model of gas demand in the industrial section. In the suitable model that achieved by remove of insignificant variable of model, demand of natural gas is function of itself with three lag, price of electricity with three lag, also price of natural gas with two lag and value added in current period and with three lag. The results showed that the trend in level and slope is stochastic.

The results of estimation indicate that in short run coefficient of dependent variable with three lag is equal to 0/485. The coefficient of the real price of the electricity with three lag is equal to 0/108. The coefficient of real price of gas with two lag is equal to -0/289. The coefficient of the added value of the industrial section is equal to -1/185 and with three lag is equal to 1/254, that all of them are significant statistically. In this model UEDT is 5/682 with slope 0/043 in the end of the period that indicated the non observable factors annually lead to increasing natural gas in the section of industry in the amount of 0/043 %. It is important to note that if the effects of interventions of the model will be significant, for achieving slope UEDT we should gather them that in this estimated model the interventions haven't significant effect and hyper-parameters have normal distribution.

After estimation of the short run coefficients, the long run elasticity used of the following formula:

Cross long run elasticity: $\frac{C(L)}{A(L)}$

Price long run elasticity: $\frac{D(L)}{A(L)}$

Income long term elasticity: $\frac{B(L)}{A(L)}$

The results of calculation of long run coefficients that showed in the table 1 showed that the cross price elasticity in the long term is 4/768 that indicated the price cross elasticity of using gas relevant to the real price of industrial electricity is high. In other hands, the coefficient of this variable show that, with increasing of electricity price, the amount of consumption of natural gas will be increased and the equipment with gas fuel will be alternative for equipment with electricity fuel. The price elasticity is equal to -1/782 that indicating of high price elasticity of gas consumption. Also the estimated coefficient show that by increasing of price of gas amount one percent, the consumption of this will be decreased amount 1/782 percent. The coefficient of value added estimated 7/463, this coefficient also show that income elasticity is high. Due to the coefficient of likelihood ratio, stochastic modeling can't be rejected. As discussed above, in addition to the residuals of regression, the residuals of irregular, level and trend should be distributed normally. Therefore, if these components had not normal distribution, this is necessary that the intervention be used in the model. According to what was discussed, statistically these interventions may be signal of structural break in the time series model during the estimation period. In this model year of 1995 considered as intervention in the slope, but on the base of normal distribution of the residuals of irregular, slope and level, also be no significant of the coefficients of it, no entered of model. It is important to note that the interventions that are affected on the slope had shock nature and its effect after years neutralized, and the past process continued. On the base of the table 1 and according the related statistic to the determination tests, approved the results of the model.

**Table 1: Industrial Electricity Demand STSM estimates**

| **Dependent variable: LN(E)** | | | |
|---|---|---|---|
| Variable | Estimated Coefficients | | T values |
| LN(C)(-3) | 0/485 | | (5/312) |
| LN(PB)(-3) | 0/108 | | (2/509) |
| LN(PG)(-2) | -0/289 | | (-7/013) |
| LN(Y) | -1/185 | | (-7/487) |
| LN(Y)(-3) | 1/254 | | (7/107) |
| **Slop and Level (UEDT$_{1392}$)** | | | |
| Level | 5/682 | | |
| Slop | 0/043 | | |
| **Long run elasticity** | | | |
| LN(PB) | 4/768 | | |
| LN(PG) | -1/782 | | |
| LN(Y) | 7/463 | | |
| **Hyperparameters** | | | |
| (Irregular) | 0/0023 | | |
| Level | 0/000 | | |
| Slope | 0/000 | | |
| **table (1) : continued** | | | |
| Nature of Trend | Local Trend Model | | |
| **Goodness of Fit** | | | |
| p.e.v | 0/0036 | | |
| p.e.v/m.d$^2$ | 1/513 | | |
| $R^2$ | 0/99 | | |
| $R_d^2$ | 0/69 | | |
| AIC | -4/903 | | |
| BIC | -4/427 | | |
| **Residuals** | | | |
| Std. Error | 0/060 | | |
| Normality | 2/540 | | |
| H (6) | 0/211 | | |
| r (1) | -0/284 | | |
| r (3) | -0/257 | | |
| D.W | 2/5 | | |
| Q (1،3) | 3/941 | | |
| **Auxiliary** | **Irregular** | **Level** | **Slope** |
| Std. Error | 1/005 | 0/815 | 0/514 |
| Normality | 0/154 | 0/419 | 1/764 |
| Skewness | 0/132 | 0/325 | 0/312 |
| Kurtosis | 0/022 | 0/093 | 1/451 |

| **Predictive Test 2013-2021** | |
|---|---|
| CUSUM | 0/906 |
| Failure | 3/475 |

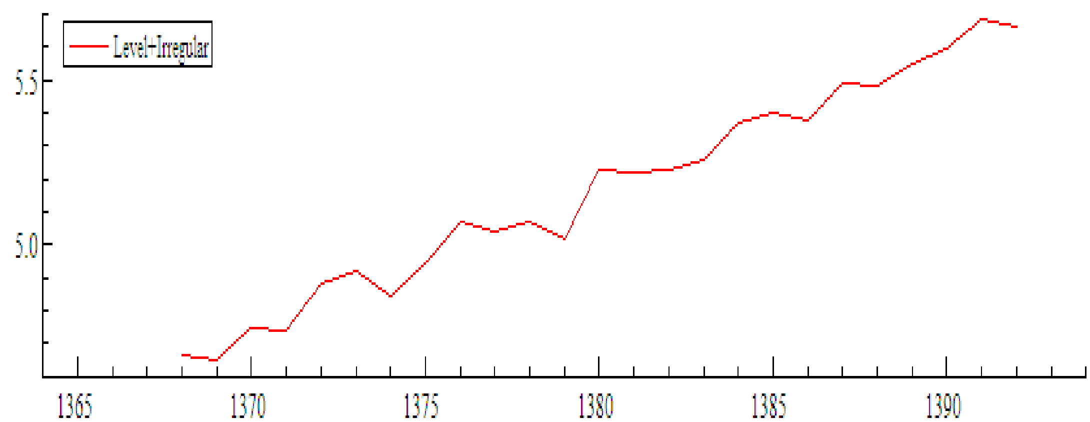
Notes:

- Model estimation and all statistics are from STAMP 8.10
- Model includes a slop intervention for the year 1995
- Prediction Error Variance (p.e.v.), Prediction Error Mean Deviation (p.e.v./m.d.2) and the Coefficients of Determination ($R^2$ and $Rd^2$) are all measures of goodness-of-fit;
- Normality (corrected Bowman-Shenton), Kurtosis and Skewness are and error normality statistics, all approximately distributed as $\chi^2_{(2)}$; as $\chi^2_{(1)}$; as $\chi^2_{(1)}$ respectively;
- H(6) is a Heteroscedasticity statistic distributed as F(6,6);
- r(1) and r(3) are the serial correction coefficients at the equivalent residual lags, approximately normally distributed;
- DW is the Durbin Watson statistic;
- Q(3,1) is the Box-Ljung statistic distributed as $\chi^2(1)$
- Failure is a predictive failure statistic distributed as $\chi^2(8)$ and Cusum is a mean stability statistic distributed as the Student t distribution; both are STAMP prediction tests found by re-estimating the preferred model up to 2000 and predicting for 2014 thru 2021;

**5.2. Underlying Energy (gas) Demand Trend (UEDT) of Iran Industrial Sector Gas Consumption 1986-2013**

As it discussed, there are various non-observable factors as well as technology development, taste, observing standards and etc, are affective on using natural gas. It can be seen that the estimated stochastic trend is generally increasing over the estimation period. Therefore, we can conclude that with be stability of the produce level and price, increased the gas usage. This phenomenon indicated that during investigated period since of not observing required standards and not dealing suitable policies by government result in increasing usage of natural gas, such that even technology development could not prevented from increasing usage it.

**Figure 3. Underling Energy (gas) Demand Trend (UEDT) of Iran Industrial Sector Gas Consumption 1986-2013**

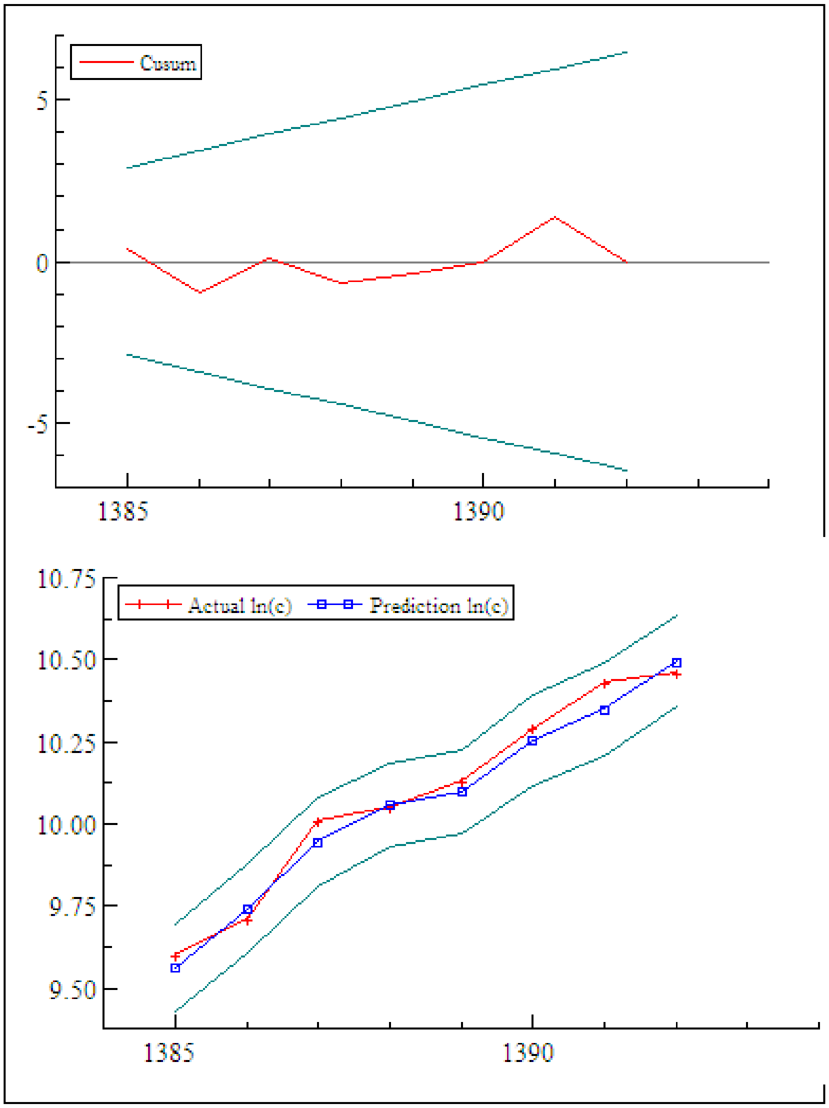



Note: year of 1365 is equal to 1986

**5.3. Prediction tests and investigation model stability**

In the Autoregressive distributed Lag model, for investigation of long-term estimated coefficients used of dynamics of short term samples. This statistic has t-student distribution that showed in graphic form. The test statistic (CUSUM) is equal 0.906 and it is cleared that the estimated coefficient had required stability. Failure statistic had $\chi^2_{(8)}$ distribution that both of the above tests are form STAMP predictions that achieved from repeated estimation model and prediction of it since 2013 up to 2021. Also the other test is prediction that is in the form of graphic that showed in curve 3. As it is observable in the curve, the amount of prediction with real amount electricity consumption is so close and the difference among them is in the critical points that this case showed confident able prediction of the natural gas consumption in the industry sector.

**Figure 4.STAMP Prediction Tests Graphics**

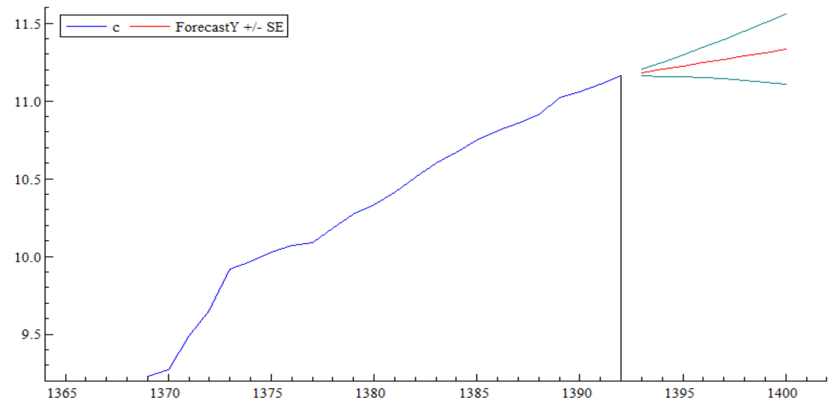



Note: year of 1385 is equal to 2006

**5.4. Prediction of gas demand up to 2021**

In this study by using of structural time series model and by using of STAMP software deal to prediction of industrial gas demand up to 2021. The results of this study showed in the form of table and curve as the following:

**Figure 5: Forecast of Iran Industrial Sector Gas Consumption**




Note: 1365 is equal to 1986

**Table2: . Prediction of gas demand up to 2021**

| year | Weather in industrial gas consumption | Standard error | Down Shore | High Shore |
|---|---|---|---|---|
| **2014** | 10/51 | 0/069 | 10/44 | 10/58 |
| **2015** | 10/56 | 0/086 | 10/47 | 10/64 |
| **2016** | 10/60 | 0/107 | 10/49 | 10/71 |
| **2017** | 10/46 | 0/130 | 10/51 | 10/77 |
| **2018** | 10/69 | 0/154 | 10/53 | 10/84 |
| **2019** | 10/73 | 0/179 | 10/55 | 10/91 |
| **2020** | 10/77 | 0/204 | 10/57 | 10/98 |
| **2021** | 10/82 | 0/230 | 10/59 | 11/05 |

It's important to note that on the base of the fact that the used variables in estimation of model is in logarithm form, so the cited figures in the table indicated prediction of industrial gas usage logarithm, that with increasing of them to the Neprin figure achieved the amount of industrial gas usage on the base of the million sqm, also as it observed from the above table, it is predicted that using gas in 2021 will be about 50 milliard sqm.

## 6. CONCLUSION AND PROPOSES

Demand of energy play key role as a main factor in economic development and also related discussions for considering environment issues. On the base of the dependence of economic of any society to energy and also with considering limitations of the energy resources and increasing growth of its demand now play management plans and demand play important role in long term programming of the country. So the issues of reduction and logic of energy consumption and also managing of demand in the recent years is one of the main aim of the governments in the various countries. This study that is follow from investigation the relation among natural gas consumption in the industry section, industrial electricity price, natural gas price and added value of the industry section and also prediction the natural gas demand in this section involved results that explained widely in the following:

1- In the estimated model, the coefficient of the natural gas real price was negative that indicated of increasing real price with considering the stability of other conditions the natural gas demand is reduced.
2- The price of the industrial electricity was positive and indicated that with increasing the real cost of industrial gas sets, replaced with electricity sets so increased the gas price.
3- Coefficient of added value of the industry section was positive and statistically significant, and indicated that with increasing added value of this section for natural gas it is increased.

In the programming and policy making of the energy it is necessary that the analysis of the effective factors and amount of it on the energy demand in the huge level, should classified and deal to energy carriers. In the past, Iran economic policy on the base of the easy access to the energy and low prices cleared that it was a barrier for comprehension of energy importance and energy carriers and its carriers by users. So maybe say that before performing the rule of subside, there is no fiscal motivation for performing energy save policies by economic agents or users. Since during past three decades, the cost of the energy hadn't key role in decision making and choosing machinery and equipments, the economic agency in this section lead to reducing efficiency. In addition we should point that development of energy industry that result in change in the structure, could be effective in this case. In other words since of non-competitive structure in the economic, increasing the cost lead to increasing good cost easily, so kept the efficiency of the activities and there is no motivation for increasing efficiency for equipment energy and machineries and also their replacement. Given the high price electricity, maybe supposed that with increasing the price, growth of the gas consumption in this section reduced quickly, and if the government in one side created main changes and also the other industries required to standards and regulations, lead to reducing gas demand widely.

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