Socio-political and Environmental Study of Iran's Industrial Growth between 1974-2017

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Abstract

We construct a simultaneous panel data system of equations and estimate it with error component 3SLS (with TSP), to assess the performance of industrial subsystems of Iran in terms of social (Gini), political (democracy) environmental (CO2 emission) and economic variables. Results show that industrial value added increases, leads to more pollution (in terms of CO2), and GDP, too, while at the same time value added and export increase reduce Gini coefficient. But even increasing real wages increase Gini. When Gini coefficient increases, the real wages of labor will reduce sharply. Increasing tariff rates increase the demand for labor and exports, and reduce imports of sub-sectors, while increase in interest rates boost value added and exports. Also results show that human capital accumulation has positive impact on production and reduce imports of sub-sectors. In sum, it can be said that the industrial sub-sectors, which define in terms of ISIC2 digit codes has very complex development path which pose serious challenges for policy makers to program an industrial policy favorable for the economy and other sectors of it.

Keywords: Industrial Production, Industrial Export, Error Component 3 Stage least square, simultaneous panel data model, Socio-Economic systems engineering.

Jel classification:C10, C33, C50

1- Introduction

After the burden of economic sanctions and blockade of Iran economy increased, in year 2010, government of Iran declared an economic and Socio-political Plan known as resistive economy. By resistive economy, we mean independent growth and

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development of industrial base from foreign countries, and Iran become ready to be inward looking, outward-orientated country which capable to produce industrial goods domestically, which constitute inward looking aspects of resistive economy, and export these goods to secure foreign exchange necessary for economic and social activities which constitute outward orientation aspects of the plan. This comprehensive and ambitious plan must be assessed to what extent will be successful. We must assess whether the industrial sector of Iran, and the economy as a whole, could tolerate these pressures to manage the society according to guidance of government plan.

For this purpose, we chose an industrial engineering view to construct a model for socio-political and economic systems which together constitute a grand system of industrial growth and development. By this task we attempt to disclose some important facts about this grand system and assess whether the system could reach its goals according to desires and objectives of government. Therefor we choose the 1974-2009 period exactly before declaration of the plan to study the potentials of grand system according to the social, political, environmental and economic criteria and set a hypothetical systems of equations according to industrial engineering view. This task will be one by a simultaneous panel data system to see what will be the capabilities of industrial sector to reach the government goals. To done the task we construct a panel data model from the sector specific statistical data of industry-specific variables, as will be described later and will setup with them a system to unfold the facts of this sector and see whether it has the sufficient and necessary characteristics to perform the objectives and desires. After some review of characteristics, we estimate the hypothetical grand system by error component 3 stage least square (EC3SLS) and will draw a clear picture of history of industrial sub-sectors and their accordance to objectives of the plan. After that we have some conclusions about this system and will show that many undesired aspects of the system will preclude reaching to objectives.

The paper is organized as follows. In the second section we will briefly surveyed the literature regarding the performance of industrial sector of Iran, and to some extent, other countries. In the third section, we analyze the economic, political, sociological and historical environment pertaining to industrial sector and propose our simultaneous panel data model. Section 4 devoted to estimation of systems and its results. Section five concludes.

2- Literature survey of industrial sector

Now, with regard to recent advances in the literature of industrial sector and polices of Islamic Republic of Iran, we construct a simultaneous panel data model of 9 sub-sectors and estimate it with EC3SLS estimator to infer some facts about them. These

sub-sectors have interaction with political, social and environmental aspects of economy, and try to reach the status of industrialization.

perhaps the closer article to our work is Ashrafzadeh and Rahmani (2015). But their algorithm to estimate the model is not a true EC3SLS and closer to estimation of 3SLS model for a simultaneous equation. But in addition, they pointed out two important issues, the first of which is that the relationship between export (and especially industrial export) and GDP growth is empirical one, and the second and more important, is that we must not regress growth or GDP on policy variables such as monetary volume or variables and government spending. In the latter issue, it is important to mention domestic studies such as Nemati and Falihi (2003), Jalali Naeeni and Nazifi (2001), Nazari and Goharian (2002) and Falihi and Amini (2000) which all repeat this mistakes. This is Rodrick (2005) critique of such approach to empirical relationship between growth and policies. In the international arena, we might point to Ran (1986), Landau (1986), Bairam (1990) and Lin (1992).

With these important caveat, Ashrafzadeh and Rahmani (2015) construct 8 equations for 8 indigenous variables such as export demand, export supply, import, CPI, labor demand, real wages, capital stock and industrial investment, and estimate these equations with 3SLS method.

In essence, using simultaneous panel data estimation is rare and include a few papers, inter alia, saleh, et. al. (2017), Hsiao and Zhou (2015) and yang and Lee (2019) and Alaedini and Ashrafzadeh (2018). Baltagi and Longliv (2009), Baltagi and Deng (2015) and Lundberg and squire (2003), are also among these few papers.

3- Economic, political, Social and historical environment of Industrial sector

In this section we construct a system out of four subsystem of Economic, social, political and environmental dimensions of industrial growth of Iran in 36 years, 5 years before Islamic Revolution and 31 years after that. The main reason why we employ this time period is that first, the statistical availability of data on these aspects in terms of 2degit ISIC codes, and then, tracking the historical evolution of the industrial sector. For this to done, we must put together the four subsystems and estimate the resulting big system, and this is why we try simultaneous panel date estimation.

The variable to represent sociological aspects is GINI coefficient, which measures the inequality of income distribution. The political variable is an index of democratic government in Iran, which download from ICRG site. The economic variables are production, export, import, employment, wage, the number of industrial firms and the like, which are gathered from statistical center of Iran (SCI). In addition, a variable from environmental aspects of industrial growth entered in the system (i.e. CO2 emission in the atmosphere) to assess the performances of four systems together and their interactions.

The performance of trade and growth in Iran was the subject of many articles. Ashrafzadeh and Askari1385(1996), consider the effect of trade and foreign exchange policies on export and import of industrial goods in Iran. In the trade and growth models, many articles have been written which all is empirical. Since up to date there are no theoretical papers on this subject, usually, in these paper productivity or export or industrial production were regressed on an index of trade and they concluded that productivity or export have a positive relationship with open trade policy or trade liberalization. Bernard, Jensen and schot (2003) and Melitz (2002) and Yeaple (2005) show that between productivity and the reduction of trade cost, including tariffs and transport cost, there are negative relationship.

In Iran, Yousefi (1996), Pirasteh and sameti (2001) and Yekta ashrafi (2002) analyze the performances of sub-sectors of industrial sector, and Behar and Edwad (2004) say that the document of growth, employment and redistribution of income in south Africa insists on the reduction of unit cost of production and export led growth and competitive advantages, since south Africa compete based on price.

This theme was the main emphasize of economic and social planning of Islamic Republic of Iran. But since (2005) onward the target and direction of policies have been changed and economy and industrial sector follow another different path. In the plan of Targeted Subsidies of government which fourfold the prices of energy carriers and paying pecuniary subsidies in 2010 their points were perfectly ignored.

The plan of targeted subsidies leads to a severe decline of GDP and high inflation, and in the "document of non-inflationary exit from recession" which president Rohani cabinet announced in 2013, we see an emphasize on increasing export and industrial production, while we now see higher inflation and negative growth.

Figures (3-1) below shows the historical performance of industrial exports in Iran. In 1968 up to 1981 it can be seen that industrial export increased from 1968 to 1974 and starts from US$24.6M and reach to US$163.1M, but after the positive oil price shock in 1974 it reduced to US$145.7M in 1975 due to this shock which increased the foreign exchange revenue of oil export and produce a biased against industrial exports. Immediately after that it begins to fluctuate about US$ 163M but from 1979, the incipient of Islamic revolution, it dropped sharply and decreased to US$13.2M in 1981, about one tenth of 1974 figure. Since this Dutch disease effects of oil shocks together with the effects of Islamic revolution, industrial production follows the swinging path and as can

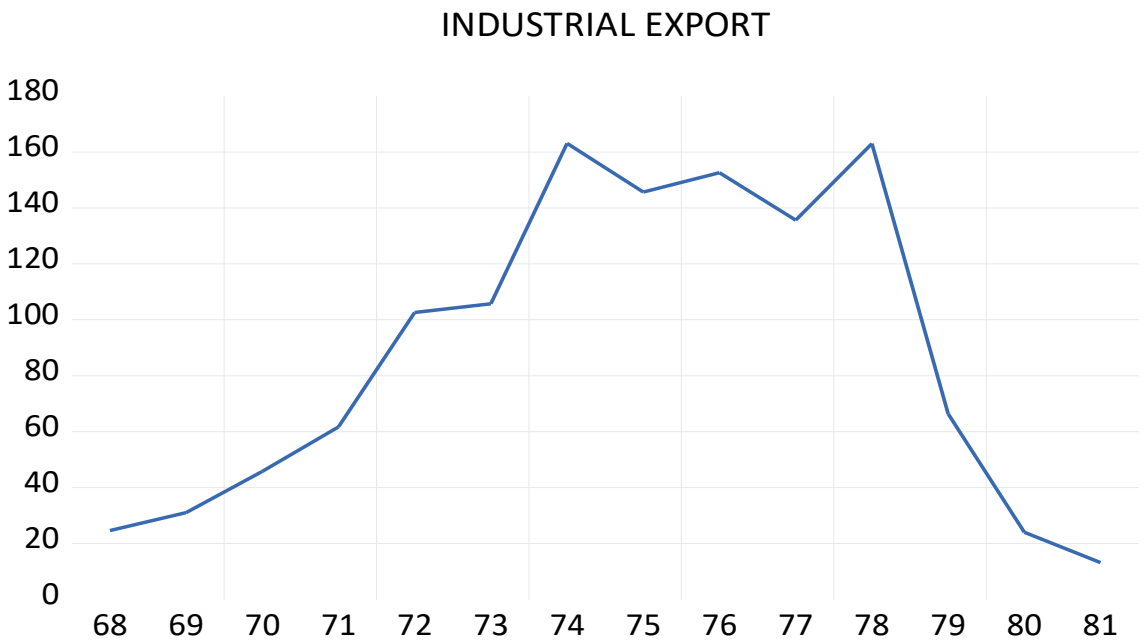


Figure (3-1)-industrial exports, 1968-1981: US$M. Source: central bank of Iran.

be seen from figure (3-2), the value added of this sector drop sharply in 1978 and with the effects of Islamic revolution in 1979, too. But after that some positive move is seen in value added in 1980 and 1981. Some political upheaval, such as social class transformation could produce this situation but the anomaly of this sector has many other causes especially the nationalization of industries and manufactures and escape or execution of industrial entrepreneurs.

After 2 years of revolution, the war with Iraq began and had very bad effects on industrial sector and the economy as a whole. Many near socialistic policies and rationing, multiple exchange rate system and financial suppression with eliminating interest rates imposed on economy which together with the drop in foreign exchange revenue and destruction of industrial sites during war, led to sever fluctuations of industrial production and GDP.

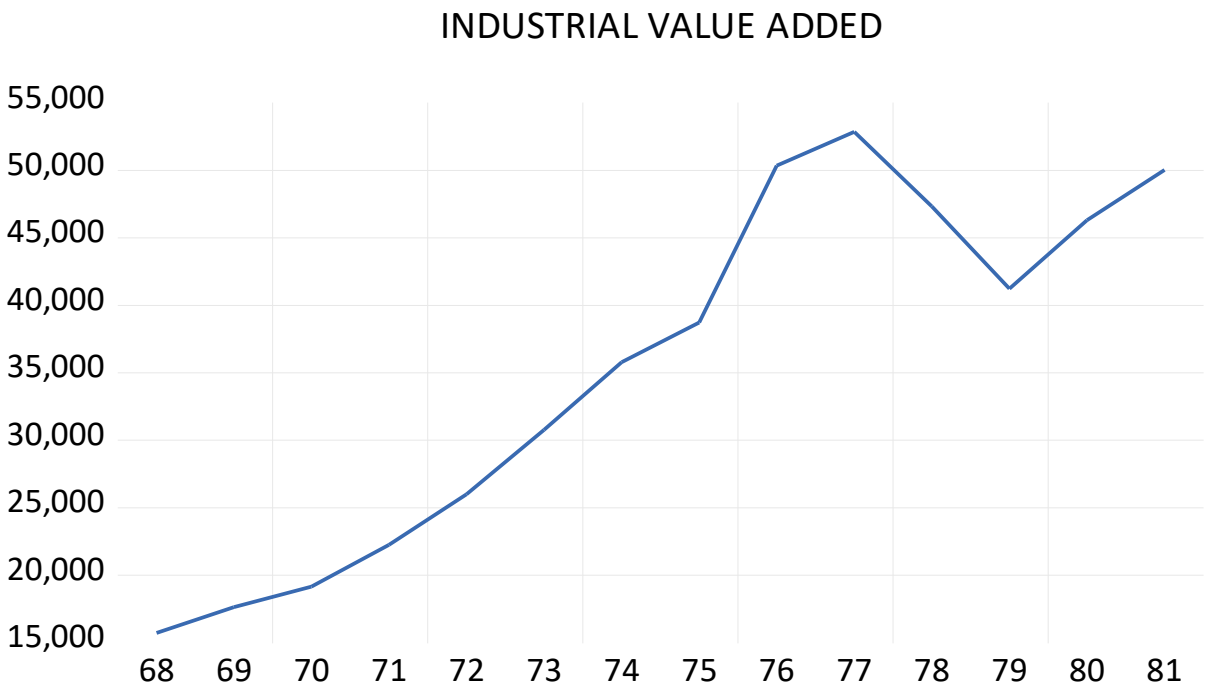


Figure (3-2)-industrial value added, 1968-1981: billion Rials of Iran. Source: central bank of Iran.

These harmful fluctuations and upheavals continue in the 1980s and produce many inefficiencies and wrong price signals which guide the direction of investment in the after war reconstruction and setting up of new production sites (1988 onward). Whit this wrong signal the economy entered in the after war economic activities prone to financial and exchange rate crisis which occurred in 1995 onward several time and the economy is still in the stagflation statues. As is evident in figure (3-3), GDP fall several times which even after the 2010s continue up to now. Although some blame sanctions and blockade the causes of this stagflation and high inflation during 2010s, it must be added that quite wrong and awkward economic policies play important role in this process. In the 2020, inflation surged and recession continue.

Especially in 2010 a recession started and up to now there is no sign of recovery. But industrial exports increased. This is another sign of unfolded root cause of this anomaly, but certainly it must be high growth of monetary volume, badly developed socioeconomic five-year program of government and massive prevalence of wrong price signal and recession of gross fixed capital formation and fiscal deficit of government which feed from rapid monetary growth that deliver this bad results. The government perused export led growth, but the growth of industrial exports is not enough to compensate and solve the economic problem as a whole. We see in the figure

(3-4) that industrial exports growth is not bad, but has not produce high volume of foreign exchange to offset the nose dive decrease of oil export. In short this history of economic activities has bad and harmful effect on the whole economy. Exactly, these sever fluctuations of GDP that don't allow the economy exit from stagflation and derailed investment and innovation.

The extent of such derailing was so vast that after the plan of targeting subsidies and four folding of the price of energy carries which called great surgery, a financial and foreign exchange rate crisis engulfed the country and badly affect industrial sector. According to central bank report the number of firms dropped from 2013 in 2011 to 1982 in 2012 and finally to 1922 in 2015.

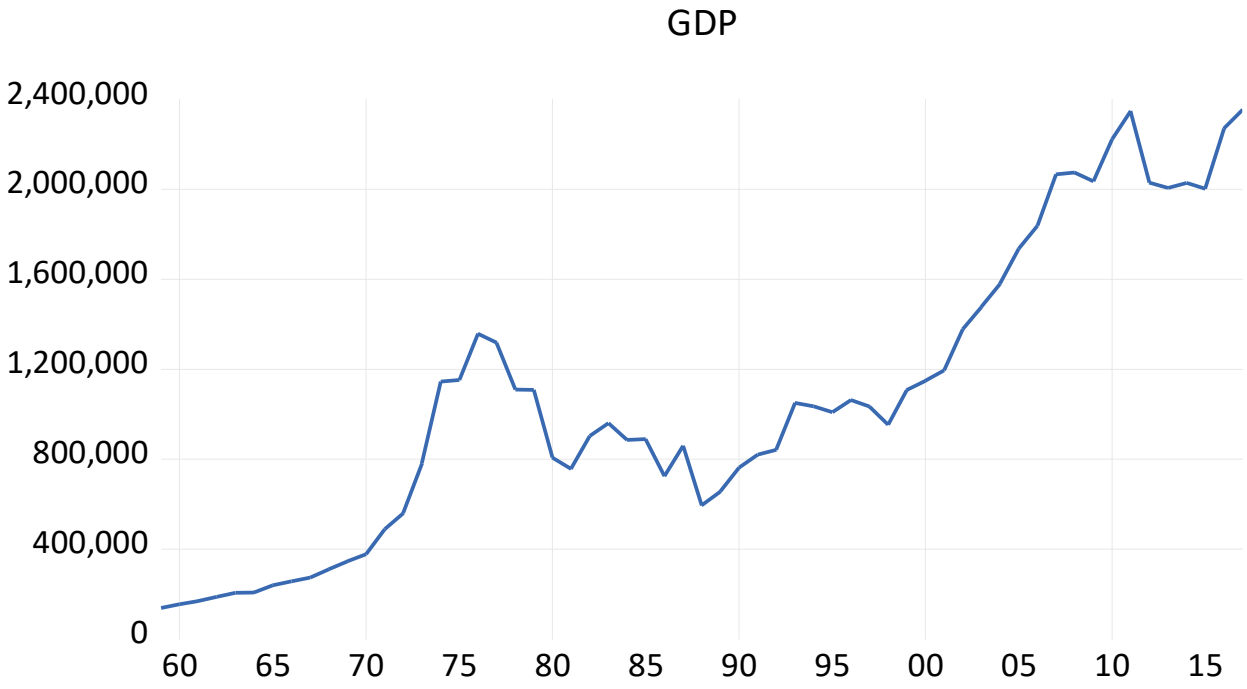


Figure (3-3) GDP from 1959 to 2017, billion Rials of Iran. Source: central bank of Iran.

Figure (3-4)-Industrial export, 1982-2017: US$M. Source: central bank of Iran.

The foreign exchange crisis deprived firms access to foreign exchange and value added decreased. This unfortunate destination for this sector still do not revolt and after the imposition of sanctions of Donald Trump government intensified. Now we are in position to build our model and see what was the picture for industrial sub-sectors before the plan and intensifying sanctions and then draw some inference about the events surpassed these sub-sectors.

4- The model

Based on the path the industrial sector of Iran followed from 1974 up to 2009, we construct a simultaneous panel data model and the claims that industrial sector is not capable of delivering inclusive growth, and good performance in resistive economy, is tested. The period of study is from 1974 to2009, the last year in which data in terms of ISIC 2 digit codes are available.

Baradaran and Mohammadi (2016), in a system of panel equation, specify the value added of industrial sector and export, and import of it using EC2SLS model for 9 subsectors. Another paper which consider the relationship between macro-economic environment and industrial sector is Shahbazi and Karimzadeh 2015, but with the big mistake of regressing value added on money volume and government budget. Ashrafzadeh and Rahmani 2015 escape from this mistake and we have, like their model, construct a systemic model, but this time, augmented with variables from socio-

political and environment. The contribution here is that if industrial growth is not inclusive growth, with more emphasize on more equal income distribution and maintaining social and political balance, its direction is far from the targets of resistive economy. Enders and Ma (2011) provide time series analysis of GDP sub-sectors, and we here attempt on panel data.

To do this, we construct the following system as follows, but at this point we must mention some very important issues in systemic works and especially in the model we construct here. The first point is that here we encounter with the problem of uncertainty and indeterminacy in the sign and significance of estimated coefficient, just like the quantum physics. If we try to correct the sign of a coefficient, we will lose its statistical significance, and when we try to correct significance, we will lose its sign. This is very important problem which at the first sight may cause confusion for the reader.

The second issue is that the reader of this system may want a theoretical foundation for each equation and we must try to do this under the problem of uncertainty. Now we try to do this and justify the equations.

The first equation is for value added of each sub-sector:

$$LNvalad_{it} = \alpha_1 LN\,(k_{it} / l_{it}) + \alpha_2 \text{int}oney_t + \alpha_3 LNhcapital_t + \alpha_4 LNtariffrate_{it} + \alpha_5 LNfirm_{it} + \alpha_6 LNprimst_t + \varepsilon_{1it} \quad (1)$$

In which LN represents the logarithm of variables;

Valad represents per capita value added of each sub-sector; Source: Statistical center of Iran (SCI)

k/l represents per worker capital stock of each sub-sector; Source: Statistical center of Iran (SCI) which capital calculated from investment flow in each sub-sector.

l represents the number of labor in each sub-sector; Source: Statistical center of Iran (SCI).

Intoney represents one-year interest rate; Source: central bank of Iran (CBI).

Hcapital is the sum of primary, secondary and tertiary students in Iran; Source: World development Indicator (WDI) of World Bank,

Tarrifrate is the tariff imposed on the import of each sub-sector; Source Iranian Custom data for tariff lines which transformed by the authors to ISIC 2 digit codes,

primst is the number of primary pupils. Source WDI,

Firm represents the number of firms in each sub-sector. Source: SCI,

And ε represents error term for the equation.

Here this production function is quite similar to the endogenous production function. Per capita product is related to per capita capital and augmented with the number of students, which is a proxy for human capital. Also we enter in this equation the price of capital (intoney, the interest rate). Our theoretical justification for adding the number

of firms in the sub-sectors is that trying to show the economies of scale for each sub-sector. It is important to note that we have a separate equation for the number of firms which constitute a real system with the production function, and to some extent tariffs that have a very important relation with the production. If tariff rates increased the price of domestic goods will fall in terms of imported goods and domestic production will encouraged. And the presence of primary students in the equation is for distinction with all kind of human capital which will see it has no positive and significant effect on production and the sum of primary, secondary and tertiary students is a good measure of human capital.

The second equation is for CO2 emission:

$$LNco2_t = \beta_1 LNvalad_{it} + \beta_2 LNexd_{it} + \beta_3 LNgdp_t + \beta_4 \text{int}oney_t + \beta_5 LNere_t + \beta_6 LNfirm_{it} + \varepsilon_{2it} \quad (2)$$

Co2 is the carbon de oxide emission in the atmosphere; Source WDI.
Exd is the export of each sub-sector; Source: Iranian Custom data.
GDP is the gross domestic product of Iran; Source: central bank of Iran.
Ere is the nominal exchange rate, one US$ per Rials of Iran; Source: CBI.

We must provide some theoretical foundation for this equation. In this equation we directly enter the per capita production which is a good index for emission of co2. By default, we note that industrial production is energy intensive and cause the emission of co2 and other pollutant in the atmosphere. This quite is derived from environmental literature and is legal in this equation. Also,

Other activities like export and GDP is influenced the emission, especially we want to know whether export is pollutant or not. This point is discussed in the environmental issues and international trade to show that whether trade is caused pollution or activities which is pollutant house. Fortunately export of industrial goods will reduce the pollution and it has very important policy implications, and so for the GDP which we want to see what condition it produce in this system. Two other important policy variables such as exchange rate or interest rate which enter the equation are for controlling pollution in the society and economy as a whole, in addition to efforts of organizations responsible for that matter. Finally, it is very important problem whether increasing the number of firms will reduce or increase pollution, and by observing this effects policy intervention will be necessary.

The third equation is for GINI coefficient for distribution of income in the economy and society:

$$gini_t = \gamma_1 LNco2_t + \gamma_2 LNvalad_{it} + \gamma_3 LNexd_{it} + \gamma_4 LNhcapital_t + \gamma_5 LNere_t + \gamma_6 LNimd_{it} + \gamma_7 LNwagereal + \varepsilon_{3it} \quad (3)$$

In which imd is the import of each sub-sector; Source: Iranian Custom data.
Wagereal is the real wage in each sector; calculated by author from SCI statistics from labor compensation in each sub-sector divided by number of labor and then by CPI; Source: SCI.
The theoretical foundation for this equation follows similar path in which it is very important to know how pollution affects GINI index. For example, pollution, like a war, can cause massive immigration which is followed by mass poverty, as you might see in Baluchistan, a province of Iran, following the shortage of water and recurring drought. Other variables are economic activities and the social one (hcapital) which can affect gini index. On the other hand, the poor can pollute the environment by choosing pollutant fuel, destruction of jungles and water resources and the like. We must await to see how coefficients appear in estimation table. We cannot impose expectations on the sign of them at this moment.
The fourth equation is for the export of each sub-sector:

$$LNexd_{it} = \delta_1 LNgdp1_t + \delta_2 \text{int}indust_t + \delta_3 \text{int}oney_t + \delta_4 LNere_t + \delta_5 LNtariffrate_{it} + \delta_6 LNfirm_{it} + \delta_7 LNprimst_t + \delta_8 LNl\,\text{sec}st_t + \varepsilon_{4it} \quad (4)$$

gdp1 is the one-year lag of GDP; Source: CBI.
Intindust is the interest rate for industrial sector; Source: CBI.
Secst is the number of secondary pupils.
Here we see that export is a function of gdp1 which is economic activity index and all other variables appeared in the equation are quite relates to export. Intindust and intoney are interest rates which have influence export because export requires capital for its operation. Exchange rate(ere) and tariffs is come from new international trade theory, clamming tariffs cause negative biased on export while exchange rate has direct effect on export. On the other hand, tariffs may cause the value add yo increase and then export begins. We have tariffs in the production function and if it increases the production it may have positive sign in export equation. Countries with this characteristic may be processor of imported goods for re-export.
The fifth equation is for import of each sub-sector in terms of US$

$$LNimd_{it} = \xi_1 LNere_t + \xi_2 LNvalad_{it} + \xi_3 LNtariffrate1_{it} + \xi_4 \text{int}\ fivey_t + \xi_5 LNfirm_{it} + \varepsilon_{5it} \quad (5)$$

Imd is the import of each sub-sector in terms of US$; Source: Iranian custom data.
Tariffrate1 is the one-year lag of tariff rate for each sub-sector; Source: Iranian Custom data.
Intfivey is five-year interest rate; Source: CBI.
The theoretical foundation for import equation is quite similar to export except we enter here five-year interest rate since importers may use usanse credit for imports and

its rate is smaller than the short rate interest for importers and greater for foreign exporters. Then we may have here the sign indeterminacy. And finally when new firms start its operation they need imported goods and materials.

The sixth equation is for labor force in each sub-sector:

$$LNl_{it} = \theta_1 LNvalad_{it} + \theta_2 \text{int}oney_t + \theta_3 LNwagereal_{it} + \theta_4 LNtariffrate1_{it} + \theta_5 LNfirm_{it} + \varepsilon_{6it} \quad (6)$$

Wagereal is the real wage in each sub-sector; calculated by author from SCI statistics from labor compensation in each firm; Source: SCI.

In this equation the theoretical foundation is quite clear. This equation and the next one constitute the labor market which play a very important role in industrial sub-sector and in the development path of country as a whole. We must await to see how labor market behave in the system. Note that the interest rate is a proxy for capital price and this mix of interest rate and tariff rate have a strong effect on the role discussed above.

Seven equation relates to real wages:

$$LNwagereal_{it} = \varphi_1 LNl_{it} + \varphi_2 \text{int}oney_t + \varphi_3 LNvalad_{it} + \varphi_4 \ln food\ \exp_{it} + \varphi_5 gini + \varphi_6 LNfirm_{it} + \varepsilon_{7it} \quad (7)$$

Foodexp is the proxy for the price of food in Iran calculated by the dollar export of food stuff divided by the weight of food export; Source SCI.

It is quite clear here that real wage is a function of number of labor, the price of capital(intoney) which is a sustainable input in production process, the price pf food stuff, indeed the wage good for labors, gini coefficient which measure the poverty of labor force, with the possible effect on the wage that labor demand. Increase in the number of firms which demand labor and value added that may be labor intensive or capital intensive, in any way labor is the essential input in the production process.

And finally the eight equation is for the number of firms which by the nature of political-economic facts of these 36 year is affected by the index of democracy:

$$LNfirm_{it} = \sigma_1 LNtariffrate_{it} + \sigma_2 LNvalad_{it} + \sigma_3 LNimd_{it} + \sigma_4 LNdemoc_t + \sigma_5 LNmoney_t + \sigma_6 LNg_t + \varepsilon_{8it} \quad (8)$$

Democ is the index of democracy; Source: International Country Risk Guide (ICRG).

Money is the volume of money, M2: Source CBI.

G is the government consumption expenditure; Source: CBI.

We will discuss the coefficients and theory in the model section below.

This panel data approach (ec3sls) is used by Esquivias and Harianto (2020) to study the effects of market competition and foreign direct investment on the technical efficiency of firms in Indonesia. Yang et. al. (2021) try on the framework of industrial sector of each province of china, investigate the regional disparities in the industrial carbon productivity; as we try here in this paper on CO2 emission and find that sub-sectors emission increases with the increase of industrial value added in Iran. As an example, Lin et. al. (2019) consider the problem CO2 emission in Chinese industrial sub-sectors.

The results of estimation of this system with 8 equations is reported in table (4-1):

Table (4-1)-3sls and ec3sls estimates of the system of equations*

3SLS				EC3SLS	
Parameter	Estimate	t-statistic	P-value	t-statistic	P-value
α_1	0.012227	0.270749	[0.787]	.168842	[.866]
α_2	.119585	4.06567	[.000]	2.53539	[.011]
α_3	.407848	20.9489	[.000]	13.0639	[.000]
α_4	.720227	11.1919	[.000]	6.97939	[.000]
α_5	1.94255	10.4015	[.000]	6.48648	[.000]
α_6	-.747077E-06	-22.6250	[.000]	-14.1092	[.000]
β_1	.084790	6.86054	[.000]	4.27830	[.000]
β_2	-.117802	-8.07770	[.000]	-5.03733	[.000]
β_3	.726473	11.8700	[.000]	7.40222	[.000]
β_4	.586365E-02	1.84674	[.065]	1.15164	[.249]
β_5	.328824	22.5653	[.000]	14.0720	[.000]
β_6	-.824657	-19.3686	[.000]	-12.0784	[.000]

γ_1	-.150520	-5.26092	[.000]	-3.28076	[.001]
γ_2	-.406125E-02	-2.41412	[.016]	-1.50547	[.132]
γ_3	-.011566	-2.58486	[.010]	-1.61194	[.107]
γ_4	.516677E-02	3.40130	[.001]	2.12108	[.034]
γ_5	.481967E-02	.892186	[.372]	.556376	[.578]
γ_6	.041824	2.69671	[.007]	1.68169	[.093]
γ_7	.182032E-02	.828616	[.407]	.516733	[.605]
δ_1	.816632	28.1102	[.000]	17.5298	[.000]
δ_2	.052080	5.14983	[.000]	3.21148	[.001]
δ_3	.149944	17.2832	[.000]	10.7780	[.000]
δ_4	1.42927	25.0957	[.000]	15.6499	[.000]
δ_5	1.96353	40.1341	[.000]	25.0280	[.000]
δ_6	4.12599	20.6885	[.000]	12.9016	[.000]
δ_7	13.2748	21.7411	[.000]	13.5580	[.000]
δ_8	-26.7892	-29.3062	[.000]	-18.2757	[.000]
ξ_1	.208188	2.66745	[.008]	1.66345	[.096]
ξ_2	.431693	8.60264	[.000]	5.36469	[.000]
ξ_3	-.241425	-4.40335	[.000]	-2.74597	[.006]
ξ_4	-.120447	-5.91596	[.000]	-3.68925	[.000]
ξ_5	-.085000	-.333433	[.739]	-.207932	[.835]
θ_1	.084288	8.91804	[.000]	5.56138	[.000]
θ_2	.092675	18.2163	[.000]	11.3599	[.000]
θ_3	.053624	11.5665	[.000]	7.21299	[.000]
θ_4	.490609E-03	.013757	[.989]	.857903E-02	[.993]
θ_5	.020889	.497309	[.619]	.310127	[.756]
φ_1	7.05242	18.4573	[.000]	11.5101	[.000]
φ_2	-.434252	-6.32992	[.000]	-3.94740	[.000]
φ_3	-.661983	-7.06495	[.000]	-4.40577	[.000]
φ_4	-1.80218	-19.4605	[.000]	-12.1358	[.000]

φ_5	-29.9995	-5.02043	[.000]	-3.13079	[.002]
φ_6	1.66102	4.53613	[.000]	2.82878	[.005]
σ_1	-.072824	-5.33546	[.000]	-3.32725	[.001]
σ_2	-.111039	-6.43990	[.000]	-4.01598	[.000]
σ_3	1.15400	22.9006	[.000]	14.2810	[.000]
σ_4	-.121240	-3.68335	[.000]	-2.29697	[.022]
σ_5	-.685605	-22.8756	[.000]	-14.2655	[.000]
σ_6	.165778	24.2250	[.000]	15.1069	[.000]

*Credit goes to Client Cummins for providing TSP codes to estimate EC3SLS model.

In this table the column2 of right hand side relate to the coefficient of 3sls estimation and ec3sls, which is equal and the 3 column report standard deviation and t-statistics for 3SLS. The fifth column is the standard deviation of coefficient for EC3SLS and the 5th column of model is standard deviation for the latter model. Most of coefficient is significant statistically but in the systemic estimation statistical significant is not important.

As you can see in table (4-1), we put together 4 subsystems of social, economic, environmental and political, and estimate the grand system. All α_i 's refer to the value added equation and we see that the parameter of per worker capital stock in this equation has positive sign, as expected in the production function literature. But more importantly, the effects of all human capital index are positive which show that there is a long way for sub-sectors to benefit from human capital accumulation.

The one-year interest rate and import tariffs has positive impact on value added and this confirms that the necessary change and new technology transfer have not taken place during 36-year sample. In any way, all other coefficient in the value added equation is positive, according to theoretical expectations except the coefficient of primary pupils. the increase in the number of firms increases the value added and this confirms that as the industry size increase, production will rise, which is another sign of potential economies of scale in the production.

In the equation (2), which reports the coefficients of CO2 emission, we see that as value added increases, pollution will increase too, and this is an important result shows that the industrial sector production has negatively impact environment. Also we see that the increase of GDP increases the CO2 pollution and is a sign that overall economy is pollutant. We can see that even increasing interest rate and exchange rate, also, result in more pollution and these points pose very challenging tasks for government to plan a correct industrial policies and program. But increasing the number of firms will

reduce pollution. Moler (2016) pursue the same problem for Danish economy for 8 sub-sectors.

In the third equation it can be seen that increasing CO2 emission, value added and export will reduce Gini coefficient and more equitable distribution of income. In that events we must conclude that emission of more co2 will require for decreasing gini index and it is not wondering since the poor or the country try to escape poverty or damper it by the pollutant way. That is, social system can perform better if these three variable increase. Also, it is evident that increasing human capital, exchange rate and import increase Gini coefficient and that is a wondering results for resistive economy policies, especially that increasing real wages increase Gini, another wondering result but not against expectation, because as the real wages increase the demand for labor decrease and unemployment results which increase GINI index.

In the export equation we see that all 7 variables have positive impact on export, the number of pupils in the secondary education has negative impact while at the same time increasing tariffs will increase export. These results are not unexpected since exports require more educated human capital. In this point it must be added that when increasing tariffs increase export, it can be either the economy is not liberalizing and technology does not transfer or we cannot observe processing of importing semi-processed goods for reexport.

In the import equation it can be seen that increasing exchange rate will not decrease import and value added will also increase import (the more the production, the more semi-finished materials and parts will be needed), but tariffs, interest rate and the number of firms will reduce imports, as expected.

The equation of labor demand shows that increasing tariff rates will increase the demand for labor and all other variables have positive impact on the demand for labor too.

In the real wage equation, only interest rate and value added has negative impact on that variable, while the negative effect of value added is not at odd with expectation because more production needs more labor and when the technology of production is labor intensive, industrial employer will prefer cheaper wage when there is not trade union. The price of food stuff also has negative impact on real wage which has correct sign, because it is wage goods, while increasing the number of firms will increase the wages.

Indeed, these two equation represent labor market and we see that while the value added reduce the real wage, it increases the demand for labor which is another sign of correct labor market specification.

Finally, at the eight equation for the number of firms, we see that political system has odd sign and effects for the number of firms. This result especially is expected in such

sociolect political system whit up and down of the social class. Of course some other variables have negatively impacted the number of firms, among which are the tariffs (another sign that new technology is not transferd), and value added, but more important to note is that the government consumption has positive impact on the growth of number of firms, but increasing money volume reduce this variable. There must be pointed out that during the post revolution era and especially in recent years, money volume rapidly increases which, as a result, the number of firms decrease. We can add this time that when money volume increases, the inflation surges, whit it the investment horizon is deteriorate and prefer to more investment will decline, and the number of firms reduce.

5- discussion, summary and conclusion

The resistive economy plan in Iran set forth from 2010 onward to conduct economic affair of this country. Here, in this paper, we review the growth path of industrial sub-sectors of Iran from 1974 to 2009 and see that this path is not inclusive growth. The inequality and pollution were the characteristics of this path. With this background, the government of Iran implements the plan of targeted subsidies and increasing the price of energy carriers, 4 fold, to raise money to pay pecuniary subsidies. This plan was a sever blown to industrial sector and in the early of 2011 a complete financial and foreign exchange crisis engulfed industrial sector. Many firms closed and workers fired from firms. Unemployment increase and industrial value added decreased sharply. This new situation rises in the wake of foreign sanctions and blockade of Iranian economy. GDP drastically reduced and this was another blow to the people, and to sub-sectors. They were promised to have a good part of fund raised from 4-fold increase of energy prices, but never realized. therefore, we can conclude that this sector is not a good candidate for outward orientation and inward looking elements of resistive economy plan. Indeed, a mix of several plans (resistive economy, targeted subsidies, and increasing the price of energy) totally swoop a big part of industrial base, and the plan of resistive economy was not implemented properly.

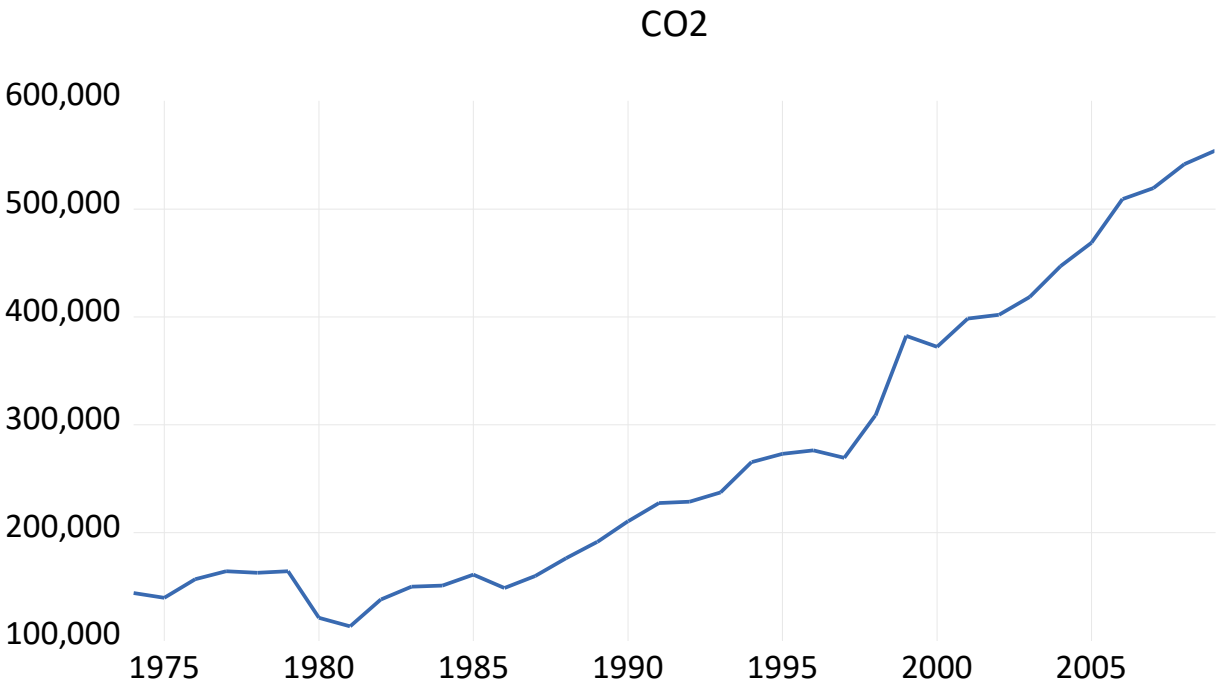
As a conclusion we must summarize that we need a new plan for resistive economy and other plans to solve new problem faced industrial sector. Especially now that we encounter other crisis such as covid-19 viruses, recession in the world economy and slowing down the price of crude oil, the main export of Iran and provider of foreign exchange necessary to run the path of development and industrial growth.

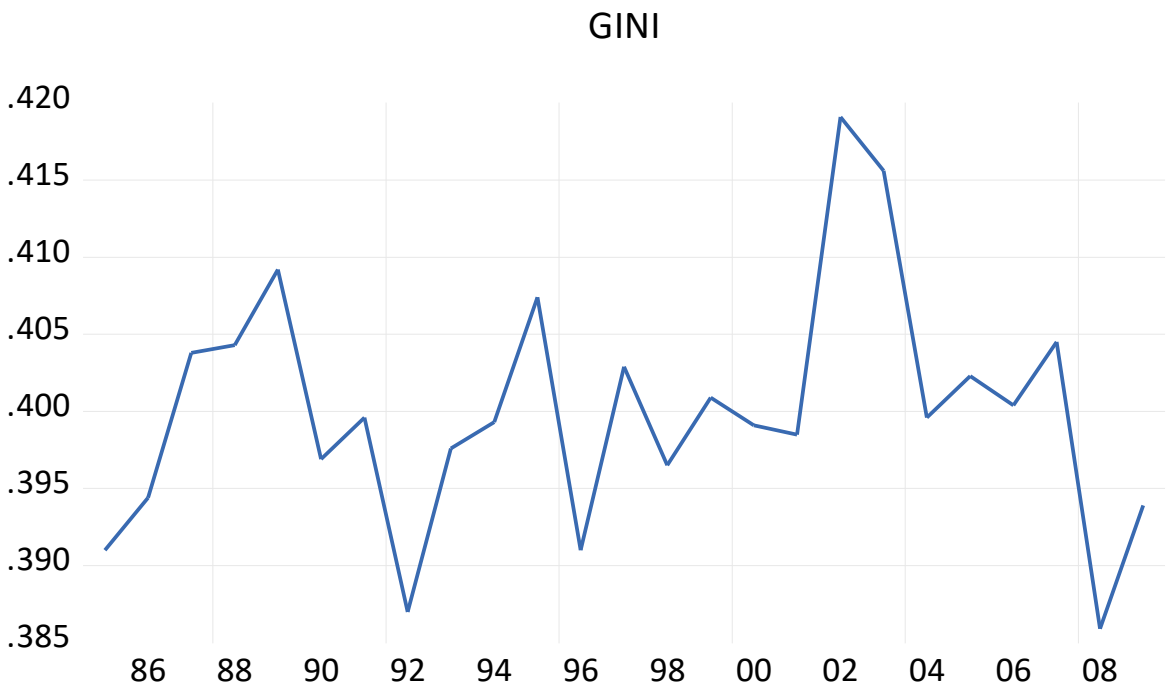
As an evidence to this claim, consider the recent data on industrial firms in 4 digit ISIC 3 revision. The central bank of I.R. Iran, reports the negative growth rate of industrial value added in 2012 (exactly one year after the targeted subsidies plan) equal to -4.1

percent and for 2017 equal to -5.3. Yet we can look at the data of SCI for industrial firms in terms of 4 digit ISIC code rev.3.

Figure (5.1) shows the total number of labor force from 1996 to 2013. As you can see, immediately after the implementation of awkward plan of targeted subsidies and quadrupling the price of energy, the labor force in industry nose dive (1391, 2012).

Figure (5.2) shows the number of industrial firms from 1996 to 2013 which depict a drastic fall. Indeed, a mix of 3 awkward plans engulfed industrial sector. Several points are striking in this figure (5.2). First, after the foreign exchange crisis of 1995, the number of firms drop sharply. Second, in 2002, after the liberalization of trade policy and unifying exchange rate (instead of multiple rate system), the number of firms suddenly increase and after the beginning of Ahmadinejad cabinet, the number of firms gradually reduced up to 2013. It seems that all the policies from 2001 onward were really awkward. This pity path the industrial sector has from 1996 to 2013, there remains no room for other policy implications.

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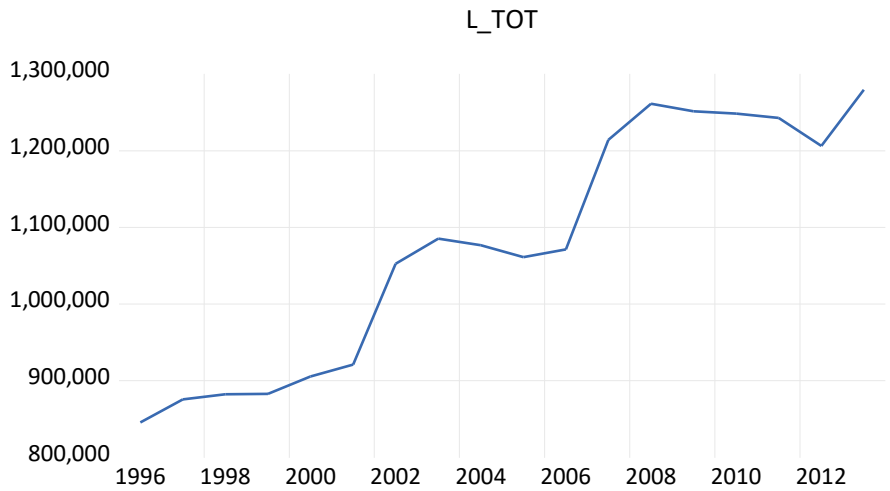
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1,000,000
900,000
800,000
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1998
2000
2002
2004
2006
2008
2010
2012

Figure (5-1)- Total number of industrial employment: Source SCI.

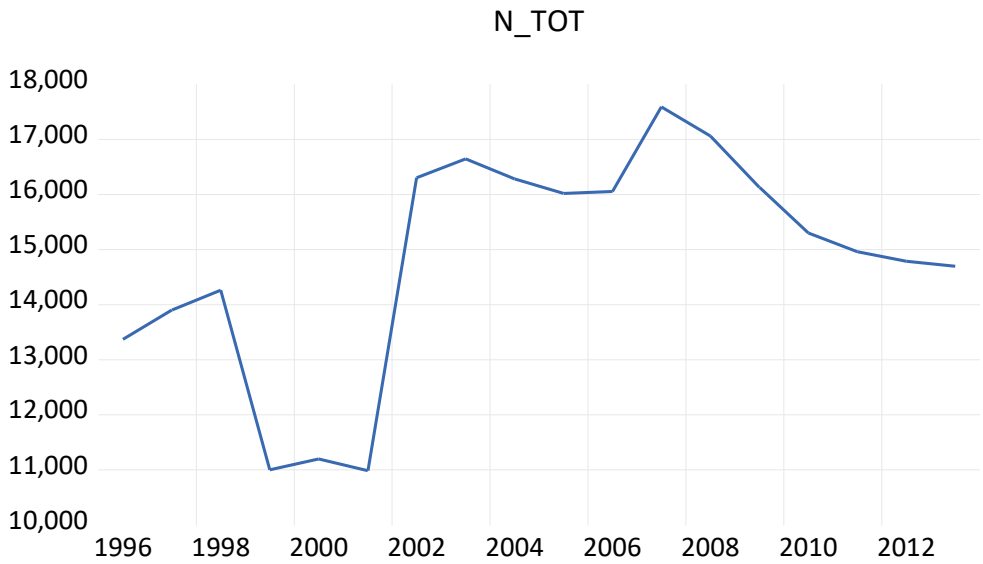

Figure (5-2)- number of firms with yearly movements: Source SCI.

All these polices experienced during this time period and all ineffective, producing catastrophic results. No other polices remain to offer at this section of paper except increasing interest rate, causing a mild and short ended recession, and then the economy and industrial sector gradually return back to positive growth path.

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