An input-output Model for Assessing the Alternative Growth Strategies in Iran

Zahra Afshari

****Professor of Economics, Alzahra University***

Iman Sheibani
B.A student, Sharif University of Technology

Maryam Afshari
Graduate student, Shahid Beheshti University

Application of a multisectoral input- output model of Iranian economy, this paper has examined the ability of different sectors of economy to create jobs per unit of output as well as capital. The results reveal that there is no conflict in a growth strategy that simultaneously attempts to improve efficiency i.e. reallocating production to sectors with low DRCs, equity and job creation .Although sectoral performance on these measures is not perfectly correlated, but in general we find good performance on equity associated with a relatively high degree of efficiency.

The results of this paper lend some interesting insights into the debate regarding distributive impact of structural adjustment in Iran. If Iran move closer to free trade regime with undistributed relative prices, it is reasonable to expect that the sectoral allocation of production would be altered in favor of these sectors in which Iran has comparative advantage. The measures of efficiency, domestic resource cost (DRC), provide an important benchmark for measuring comparative efficiency.

Key words: **Growth Strategies, Employment, Efficiency, Iran**

***Professor of Economics, Alzahra University**
****Graduate student , Shahid Beheshti University**

ABSTRACT

Application of a multisectoral input- output model of Iranian economy, this paper has examined the ability of different sectors of economy to create jobs per unit of output as well as capital. The results reveal that there is no conflict in a growth strategy that simultaneously attempts to improve efficiency i.e. reallocating production to sectors with low DRCs, equity and job creation .Although sectoral performance on these measures is not perfectly correlated, but in general we find good performance on equity associated with a relatively high degree of efficiency.

The results of this paper lend some interesting insights into the debate regarding distributive impact of structural adjustment in Iran. If Iran move closer to free trade regime with undistributed relative prices, it is reasonable to expect that the sectoral allocation of production would be

altered in favor of these sectors in which Iran has comparative advantage. The measures of efficiency, domestic resource cost (DRC), provide an important benchmark for measuring comparative efficiency.

Key words: **Growth Strategies, Employment, Efficiency, Iran**

Introduction

Some scholars of the Iranian economy argue that in order to reach sustainable development a new model of economic growth is required .Central to this debate regarding a new model of growth is the reallocation of production among sectors. Not only economic growth must accelerate, but also the benefits of economic development must be fully shared by lower income groups. The distribution of income in Iran is much skewed, The results show that countrywide the Gini coefficients in 1986 and 1996 in rural areas were .458 and .421 and in urban areas the coefficients were .430 and .403 respectively ,which indicates a decrease of 8.08 and 6.28 percent ,respectively .Among the rural areas of 24 provinces , the Gini coefficient of 9 provinces increased and that of 15 provinces decreased from 1986 to 1996.This is while the comparison o for urban areas in the same provinces and for the same period indicates that the Gini coefficient of 6 provinces increased and that of 17 provinces decreased(Arsalanbod,M, pp,1).

Central to this debate regarding a new model of growth is the effect of changes in the sectoral composition of production .Those advocating from a less government intervention, expect diminishing trade barriers will direct the production away from inefficient economic activities. With regard to different abilities of sectors to create job for skilled and unskilled labor the reallocation of production among sectors undoubtedly has consequences for lower income groups in Iran. This paper assesses the impact of any such reallocation of production on income distribution and job creation by quantifying the employment and distributive consequences of production growth in 29 sectors of the Iranian economy.

The question of which sectors of the Iranian economy enhance employment growth has been addressed in earlier work (Sheibani&Afshari, 2000, Komeijani &Esanejad, 2000). Utilizing input – output techniques, these studies demonstrate the increase in employment

that can be expected from an increase in final demand. The earlier studies estimate employment in terms of job creation per unit of capital .Given that capital scarcity is a substantial impediment to employment growth in Iran, The important issue is which sectors create the greatest job opportunity per unit of capital. In this paper an input-output model is applied to measure the capital requirements associated with sectoral expansion and job creation. In this paper the emphasis is on distributive and employment consequences of output growth in various sectors of the Iranian economy.

This paper is not attempt to fashion an optimal allocation of sectoral production for the Iranian economy. This paper is organized as follows. First ,The model applied to analyze the impact of sectoral growth on employment and income distribution is describe; second, empirical results are presented. Third, the relationship between various measures of sectoral income distribution, job creation, and domestic resource cost (DRC) are considered. We conclude the paper with the summary session.

Methodology

The purpose of model developed here is to assess the distributive and employment performance of different sectors of the economy .A model were used for linking input-output analysis and income distribution (Miyazawa 1976).

The basic supply-demand equation of the Leontief input-output system states that domestic sectoral output (x) is the sum of intermediate (AX) and final demand(Y) for that sectors output (Afshari ,2001).

$$X = AX + Y$$

$$Y = (I-A)^{-1} X$$

$$A = \sum a_{ij}, \quad a_{ij} = X_{ij} / X_j$$

$$a_{ij} < 1, \ (J = 1, 2, ...n)$$

X_j = Total output of the Jth industry

X_{ij} = number of units of ith good used by Jth industry

It follows that the value of primary input required producing one unit of Jth good is given by:

$\sum bkj = 1 - \sum a\ ij$

$bkj = B\ kJ\ /Xj,\ k = (1, 2, k)$

bkj = number of units of kth input required producing one unit of jth industry or direct input coefficient

$bkj < 1$

The direct and indirect effect of an increase in final demand can be calculated as follows:

$$Z = Bkj\ (I - A)^{-1}\ Y$$

$Bkj\ (I - A)^{-1}$ = direct and indirect input coefficient

$Bkj - Bkj\ (I - A)^{-1}$ = indirect input coefficient

The number of jobs created per unit of capital is measured by calculating the amount of capital required to support the sectoral output associated with one unit increase in output.

The distributive impact of sectoral expansion can be assessed by their ability to create jobs for low income groups .For this purpose the normalized income per unit of workers in different sectors are calculated .

The domestic resource cost (DRC) is used as a measure of sectoral efficiency. These DRC measure the total cost of domestic resource, at shadow prices that are needed to generate one dollar of foreign exchange. DRC provides a useful indicator of efficiency. Sectors characterized by relatively low DRC are those that produce the greatest amount of output per unit of output.

Four kinds of data are required for model : 1) input –output table , 2)wages and capital by sector , 3) number of employer in different sectors ,and DRC indices .The 29 * 29 sector input –output table constructed by the Central Bank of Iran in 2002, the latest available (Central Bank ,2000) are used .Data on the distribution of income by sector to wages and capital incomes are given in input –output

tables .DRCs were available for 11 sectors Poursadegh,H,2000 and Pazangian, M , 2001) . Data on Employment requirement were drawn from 1996 population census (Statistical Center of Iran, 2000)

Empirical Results

In interpreting the empirical results .the usual caveats regarding input – output analysis should be observed .Our model assumes fixed technical and distributive coefficients ,sectoral output growth could lead to changes in the these coefficient unless we assumed constant –cost supply curves . Policies, such as import substitution and export promoting, used to change the sectoral composition of output .As it is caveats regarding some of our data should be mentioned as well .With respect to DRC data, only for 11 sectors the information was available.

Table 1 . Distributive and employment performance by sector

sector	Direct coefficients	Indirect coefficients	Total coefficients	Labor/capital	DRC**	High paying jobs *
1-agriculture	.225(16)	.171(27)	.396(27)	6.288(7)	.312	1.317(19) -3.23
2- Livestock & hunting	.043(27)	.437(23)	.480(25)	1.285(16)	.556	.218(26) -5.43879
3-fishing	.290(9)	-.080(29)	.210(29)	24.89(1)	.955	1.836(17) -2.20301
4- forest	.265(12)	.437(28)	.701(19)	22.49(2)	.04	4.168(9) 2.462587
5- oil &natural gas	.033(28)	.241(2)	.273(28)	.041(28)		8.129(4) 10.3839

6- mining	.429(3)	.01(	.439(26)	1.259(17)		8.998(3) 12.12131
7- food industry	.059(25)	.518(22)	.576(24)	.579(21)	.831	1.0414(19) -3.79119
8- textile	.105(18)	.539(20)	.644(20)	2.157(14)	.191	.735(23) -4.40422
9 wood and its products	0.045(26)	.535()	.581(23)	.218(26)	.204	.174(27) -5.52666
10- paper printing industry	.102(20)	.608(16)	.710(21)	.803(19)	.149	1.984(16) -1.90593
11- -plastic& its products	.062(23)	.582(17)	.644(22)	.398(24)	.360	3.308(11) 0.74218
12-mineral products	.096(10)	.544(19)	.640(14)	.561(22)	1.07	1.560(18) -2.75433
13--basic ٭metallic industries	.083(22)	.961(10)	1.044(11)	4.420(9)	.321	4.619(7) 3.364576
14- machinery product industries	.005(29)	1.159(	1.164(2)	.372(25)	.427	.128(28) -5.61851
15- electric ties	.287(10)	1.195	1.48(16)	.173(27)		2.067(15) -1.7406
16-gas distribution	.240(14)	.776	1.016(10)	8.358(5)		32.86(1)' 651.3892
17- water supplies	.714(2)	.451(23)	1.166(15)	.637(20)		4.77(6) 3.67242
18--private construction	.267(13)	.757(14)	1.024(6)	2.593(12)		1.191(20) -3.49139
19- public construction	.281(11)	1.053(1)	1.334(17)	4.844(8)		10.68(2) 15.48113
20- transportation	.092(17)	.889	.981(12)	2.207(13)		1.073(21) -3.72861
21- communications	.333(7)	.791	1.126(4)	1.648(15)		2.906(14) -0.06196
22- trade	.189(15)	1.378	1.410(9)	.446(23)		.270(25) -5.33355
23- hotel restaurant	.420(1)	1.024	1.213(13)	14.2(3)		.924(24) -4.0263
24-financial mediation	.420	.697	1.117(3)	7.884(6)		5.01(5) 4.147663
25-insurance	.06(24)	1.36	1.427(3)	.872(18)		4.283(8)

						2.691366
26 real states	**.295**	**1.349**	**1.379(5)**	**.071(29)**		**2.333(13)** **-1.20843**
27-specialized services	**.332**	**1.615**	**1.948(1)**	**4.247(11)**		**3.235(12)** **0.59591**
28--social services	**.239**	**1.046**	**1.286(8)**	**4.3(10)**		**1.77(18)** **-2.33385**
29-public services	**.763**	**.549**	**1.312(7)**	**10.375(4)**		**3.514(10)** **1.154477**

The numbers in parenthesis are ranks
****The second rows show the number of standard deviation from the mean***
*****DRCs are calculated on the basis of Weighted exchange rate***

Source: Author `s calculation on the basis of 1993 input –output table of Iran, The Central BANK OF Iran, 2000 by using Excel program

Various aspects of employment creation, i.e. direct, indirect, total, employment per unit of capital, associated with sectoral growth are reported in table 1.The findings on direct input coefficient reveals that public sector(sector 29) ,water supply (sector 17) and mining (sector 6) are most proficient in the economy at generating jobs .

The results on indirect coefficient also reveal that public sector (sector 29), and insurance service (sector 25) have the highest coefficients respectively.

The results on total (Direct and indirect) labor coefficient reveals that professional public sector (sector 26), electricity (sector 15), insurance (sector25), trade (sector 22), real state (sector26), construction (sector 19) are associated with high total job creation.
Forestry and fishing (sectors 3 and 4), restaurants and hotels (sector 23), and public sector (sector 29) are the most proficient sectors in the economy at creating jobs per unit of capital.

Also it is noticeable that some sectors considered capital intensive from standpoint of job creation per unit of output are actually associated with relatively high job creation per unit of capital. In sectors that capture natural resource rents, such as mineral (sector 6), non metallic equipment (sector 12), water supply (sector 17), real states (sector26), and some sectors like communications (sector 21), a relatively small amount of capital is needed per unit of output. Nevertheless expanding output in latter sectors create little new job per unit of output, but it creates a large

number of job generated per unit of capital. Therefore, we can conclude that sectors create a great amount of jobs per unit of output are not associated with those can maximize job creation per unit of capital.

Table 1 also reveals that many modern sectors like chemicals (sector 11) metallic equipments and machinery (sector12) rank among the worst at creating jobs. Construction ranks sixth among all sectors in creating jobs, while ranks (16) among low capital good sectors. Investment project that heavily rely on construction can be expected to create great jobs.

Ranking the sectors according to their ability to create high paying jobs, it shows that gas distribution, construction mining and oil are among the best. The human skilled sectors are professional public sector, social public sector and public sector. Nevertheless, on the basis of wage payments, they rank 10, 11, and 8 respectively.

The distributive performance of different sectors is measured in table 1 by the wage. The sectors with low wages classified as low income group sectors. Income earners belong to a low income group if they earn at least one standard deviation bellow the mean. Ranking of the sectors by distributive performance in table 1 show that sector 14, 9, 2, 22,23,8 are associated with a high degree of income equality. Labor intensive service sectors, such as public sector, are also associated with even distributive performance.

Linkages among indicators of sectoral performance

Further insights into the relationship between measures of sectoral performance can be gained by looking at the correlation coefficients between relevant variables. Of interest is not only the relationship between variable measuring performance on equity and employment, but efficiency as well. In this section, the domestic resource cost (DRC) is used as a measure of sectoral efficiency. These DRC estimates measure the total cost of domestic resources, at shadow prices, that are needed to generate one unit of foreign exchange. Sectors characterized by relatively low DRC are those that produce the greatest amount of output per unit of input. The DRC data are derived from the 1996 input output table of Iran. DRC IS calculated for 12 industrial and agricultural sectors.

Table 2 presents correlation coefficients between variables quantifying various aspects of sectoral performance. The table shows that sector with low wages, is linked to high job creation per unit of capital,

given the relatively high correlation coefficient (.414) between these two variables.

Table 2 also reveals that high paying sectors are associated with low job creation per unit of output or final demand sectors , their correlation coefficients are .39 and .22 respectively. It means that the sectors with high job creating ability are linked to better distributive performance.

The internal consistency of a development strategy emphasizing both equity and efficiency is demonstrated by the negative correlation (-.013) between distributive performance (high wages) and our measure of efficiency (DRC). The negative correlation between wages and DRC reveals that those sectors that generate a large share of income for low income groups are also more efficient, because they use less domestic resource per unit of output. Furthermore the sectors with lower job creation per unit of capital are linked to higher DRC (r=.05), i.e. they are less efficient. The efficient sectors (low DRC) are associated with great direct job creation ability(r =.02).Therefore we may conclude that there is consistency between efficiency, job creating ability, and distributive performance of Iranian economy.

Table 2-Correlation among Indicators of Sectoral Performance

	direct job creation	**Direct &indirect Job creation**	**Capital intensity**	**Equity**	**Efficiency**
Direct Job creation	**1**	**.554**	**.896**	**.386**	**.21**
Direct &indirect job creation	**-.554**	**1**	**-.390**	**.214**	**-.355**
Capital intensity	**.896**	**-.390**	**1**	**.414**	**-.013**
Equity	**.386**	**.214**	**.414**	**1**	**.387**
Efficiency	**.213**	**-.355**	**.387**	**-.013**	**1**

Source: Author `s calculation by using Eviews

Summary and Conclusion

Application of a multisectoral input- output model of Iranian economy, this paper has examined the ability of different sectors of economy to create jobs per unit of output as well as capital. The results reveal that there is no conflict in a growth strategy that simultaneously attempts to improve efficiency i.e. reallocating production to sectors with low DRCs, equity and job creation .Although sectoral performance on these measures is not perfectly correlated, but in general we find good performance on equity associated with a relatively high degree of efficiency.

The results of this paper lend some interesting insights into the debate regarding distributive impact of structural adjustment in Iran. If Iran move closer to free trade regime with undistributed relative prices, it is reasonable to expect that the sectoral allocation of production would be altered in favor of these sectors in which Iran has comparative advantage. The measures of efficiency, domestic resource cost (DRC), provide an important benchmark for measuring comparative efficiency. DRC measures the opportunity cost of generating one unit of foreign exchange. For sectors in which DRC is greater than one, the opportunity cost of importing that product is lower than producing it domestically. On the other hand, sectors with DRCs lower than one can be expected to be internationally competitive under a free trade regime. Sectors with The highest DRCs should be the least competitive under a free trade, those with the low DRCs, the most competitive.

Thus if Iran were to move closer to free trade , it is reasonable to expect that the composition of production should shift in favor of low DRC sectors. With respect to positive correlation between performance in efficiency (low DRC) ,employment ,and income inequality ,this implies that structural adjustment , by shifting the composition of production in favor of low DRC sectors ,will contribute to better income distribution .

REFERENCES

Afshari, Zahra, 2001, the Economics of Planning, Tehran, SAMT Publisher, Tehran, Iran

Arsalanbod, M, 2002, working paper,Urmia university,Urimia, Iran

Central Bank of Iran, 2000,1993 Input-output tables, National Accounting Office, Central BANK OF Iran.

Clements,Bendict J,1991,Growth Strategies ,Employment ,and Income Distribution in Brazil: An Input –output Assessment,WP/91/12

Komeijani, A and Isanejad, 2000, TAHGHIGHATeGHTESADI Journal, the school of Economics, Tehran University, pp. 1-45

Miyazawa, K., 1976, Input –output Analysis and the Structure of Income Distribution, Berlin: Springer

Pazangian, M, 2001, M.A. unpublished Dissertation, Alzahra University, Tehran, Iran

Poursadegh, H, 2000, M.A. unpublished Dissertation, Alzahra University, Tehran, Iran

Sheibani, E and Afshari, Z, 2000, TAHGHIGHATe EGHTESADI Journal, Number 59, the school of Economics, Tehran University, pp.36-45

Statistical Center of Iran, the statistical yearbook, Planned and Budget Organization, Tehran, Iran, several years

Statistical Center of Iran, 1999, the detail result of 1996 Census, the planned and Budget Organization, Tehran, Iran