Iranian Economic Review, Vol.15, No.26, Spring 2010

Productivity Changes of Food Processing Industries in Provinces of Iran; 1992-2001 a Non-Parametric Malmquist Approach

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Abstract

Man have always had to confront the crisis of shortage in resources in the history. Therefore civilizations and societies were searching for ways through which they could gain the utomost output. One of the determining factors in developing countries is the increase in efficiency and productivity in various social and economical aspects. In this study we try to investigate and measure the productivity changes in food industry via data envelopment analyses (DEA) and Malmquist index. We have used 27 provinces of Iran, during 1992 to 2001. The average productivity in the period is as following: 1.41, 1.01, 1.25, 0.81, 1.43, 1.21, 1.1, 1.1, and 1.37. Therefore except one year, the productinsty's trend is up warding.

Keywords: Malmquist Productivity Index, Non-Parametric-Frontier, Technical Change, Efficiency Change, Food Industry.

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1- Introduction

Productivity measurement has been accepted by the economists as a standard tool for evaluating the economic performance within firms, industries or whole economies. A comprehensive measurement of productivity of great importance to both policy makers and businessmen. International comparisons of productivity can indicate how competitive a domestic industry is relative to its foreign counterparts and investors are interested in the comparisons of productivity between different industries.

Productivity measurement has a long history, ranging from changes in output per unit of labor input to more complex, but more complete measures of total factor productivity (TFP).

Total productivity index is a ratio in which productivity is linked to all inputs and outputs. It shows the overall characteristics of the firms and does not define upgrading the productivity level only in terms of a specific input (Hscu and shang, 2002). There are various indecies to calculate the total productivity. These include elementary index, Solow index, Kenderiek index, Divisia index, Tornovist index, Hines index, Crag and Harris index, Carl Read index, Vito index, etc.

To calculate total productivity the aforementioned methods require the price statistics for each one of inputs as well as outputs (Khaki, 1998). Since this statistics is difficult and often impossible to calculate, the methods have some limitations. An index called Malmquist index is presented for calculation of productivity which is free from the drawbacks in the aforementioned indexes, requiring no data regarding the prices and no assumption for the type of function (Emami, 2000). In the present study, Malmquist index and data envelopment analysis (DEA) method are used to calculate productivity in food processing industries.

Malmquist index has made it easy to separate total productivity into its two main components, namely technical changes and efficiency changes. Malmquist index (1953) was first introduced in consumption theory. In 1982 came to limelight within the framework of production theory. In 1992, Malmquist index using distance functions within DEA method was applied to calculate productivity on the basis of minimizing production factors. The distance functions allow us to describe a multi-input , multi-output production technology without the need to specify the producer behavior (such as cost minimization or profit maximization). Hines comprehensive data analysis, estimates the production function frontier based on linear (non parametric) programming. Linear programming technique uses all the statistical observations to determine the best performance hence the term comprehensive. In DEA ,a producer or an economic firm is a decision maker unit (DMU) with homogenous inputs and outputs. In this paradigm there is no obligation to find the form of production function and only the efficiency of the firm is measured in relation to other firms. It is of course supposed that all of the firms lay somewhere on or below the production function frontier. Therefore, the linear programming model (DEA) measure the relative technical efficiency of all firms.

The significance of calculating productivity of the food industry in Iran lays in the fact that approximately 30% of the total agricultural products are wasted annually. According to experts this translates into a loss to the order of 3-5 billion US Dollars which can provide food for 15 millions people per year. Presently there are about 5500 factories in food processing industries in the country where due to seasonal work period, money shortage, old machinery and similar reasons, the productivity doesn’t exceed 50%. Therefore the present paper deals with calculation of total productivity in food processing industries so as to help upgrade it.

The article is organized as follows. We begin with a brief discussion of the Malmquist productivity index the distance functions from which it is constructed. The data description is given in section 3. then, the empirical results are presented. The concluding section summarizes the main findings.

2- Malmquist index

In this paper, we adopt the efficient frontier approach using the Malmquist productivity index, based on DEA. The Malmquist productivity index allows changes in productivity to be broken down in to changes in efficiency and technical change. The Malmquist index does not require or share data to aggregate inputs and outputs (Isik and Hassan, 2003).

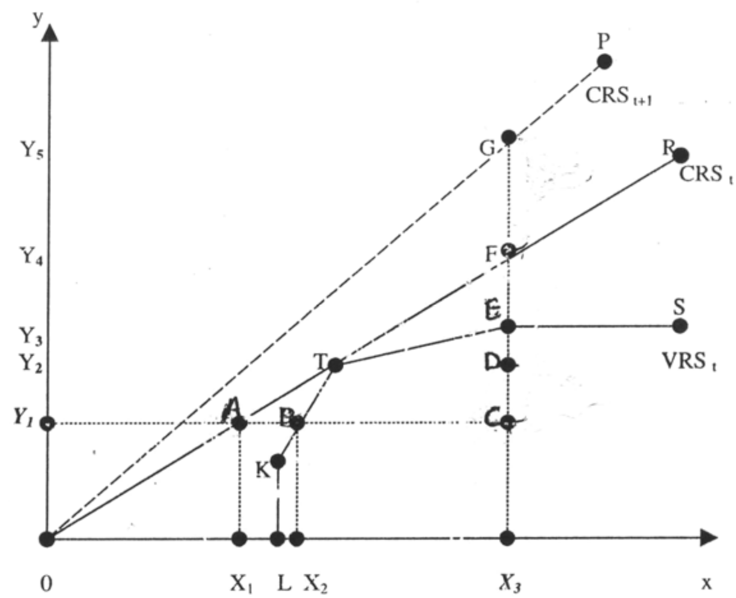

Fig1-Efficiency and productivity concepts

With a simple case of single-input (x) and single-output (y). Fig. 1 illustrates efficiency and productivity concepts based on the DEA. Assuming that all firms are operating at an optimal scale (i.e., one corresponding to the flat portion of the long run average cost curve), we obtain a constant returns to scale (CRS) frontier (CRS_t: 0ATFR or CRS_{t+1}: 0GP). However, firms in practice might face either economies or diseconomies of scale because of imperfect competition, constraints on finance, etc. Relaxing the CRS assumption and introducing convexity restriction, proposed a variable returns to scale (VRS) frontier (VRS_t: LKBTES). The VRS_t technology indicates increasing returns to scale (IRS) to the left of point T, decreasing returns to scale (DRS) to the right of T and CRS at point T.

The frontiers constructed are, however, not static but subject to change over time due to innovation (technological progress), shocks (financial crises), changes in market structure (higher concentration due to M&As) and regulatory policies (financial deregulation).

Assume the following: The technology is one of CRS, and has not changed from year t to year t+1 and a firm was observed at point C in year t,(X_3, y_1) and at point D in year t+1, (X_3, Y_2). Both observations, C and D represent feasible but technically inefficient production points because they are interior to the CRS_t frontier. In Farrell (1957), output-oriented technical inefficiency (TlE_o) is represented by the distance CF at time t (DF at time t + 1). Thus, the TlE_o at point C is simply the amount by which output could be proportionally increased (from Y_1 to Y_4) without a rise in input (X_3). Alternatively, input-oriented TIE_i, at point C can be represented by the distance AC. Efficiency scores are generally stated in percentage terms. For instance, the TIE_i of the firm is AC/Y_iC, which reflects the percentage by which input usage could be reduced (from X_3 to X_1) without reducing the level of output (Y_1), Following the input orientation, the technical efficiency (TE) at , point C is given by: TE = 1 – TIE_i = 1 - (AC/Y_1C) = Y_1A/Y_1C. Adopting VRS assumption, we can calculate the pure technical efficiency (PTE) at point C: Y_1B/Y_1C.

The firm becomes technically efficient by moving to point B, because given the VRS frontier this is the point where input usage is minimized to produce Y_1. However, the point B is not scale efficient, i.e., this is an incorrect scale for cost minimization. The firm can reduce its input usage further (from X_2 to X_1) if it can attain the CRS. Thus, the firm's scale efficiency (SE) is Y_1A/Y_1B, that is, the firm can produce its current level of output (Y_1) with fewer inputs if it operates at the 'right' size. If TE = PTE, then SE= 1 (fully scale efficient), because overall technical efficiency, TE=PTE * SE.

Using Farrell's (1957) distance functions and Fare et al.'s (1994) definition of productivity, we specify the Malmquist total factor productivity change (TFPCH) index, M, simply as the product of efficiency change (EFFCH), which is how much closer a firm gets to the efficient frontier (catching-up effect or falling behind), and technological change (TECHCH), which is how much the benchmark production frontier shifts at each firm's observed input mix (technical innovation or shock):

$$\boldsymbol{M}(t,t+1)=\overbrace{\underbrace{\frac{D_{t+1}^{\mathrm{VRS}}(x_{t+1},y_{t+1})}{D_t^{\mathrm{VRS}}(x_t,y_t)}}_{\text{PEFCH}}\times\underbrace{\left[\frac{D_{t+1}^{\mathrm{CRS}}(x_{t+1},y_{t+1})/D_{t+1}^{\mathrm{VRS}}(x_{t+1},y_{t+1})}{D_t^{\mathrm{CRS}}(x_t,y_t)/D_t^{\mathrm{VRS}}(x_t,y_t)}\right]}_{\text{SECH}}}^{\text{EFFCH}}$$
$$\times\underbrace{\left[\frac{D_t^{\mathrm{CRS}}(x_{t+1},y_{t+1})}{D_{t+1}^{\mathrm{CRS}}(x_{t+1},y_{t+1})}\times\frac{D_t^{\mathrm{CRS}}(x_t,y_t)}{D_{t+1}^{\mathrm{CRS}}(x_t,y_t)}\right]^{1/2}}_{\text{TECHCH}}.$$

TFPCH (M) index can attain a value greater than, equal to, or less than unity depending on whether the firm experiences productivity growth, stagnation or productivity decline, respectively, between periods t and t + 1. EFFCH index takes a value greater than 1 for an efficiency increase, 0 for no efficiency change, or less than 1 for an efficiency decrease. Similarly, TECCH attains a value greater than 1 for technical progress, 0 for technical stagnation, or less than 1 for technical regress. Fare et al. (1994) also decomposed the (CRS) TE change into SE and PTE changes components (EFFCH = PEFFCH x SCH). This requires the calculation of distance functions under VRS (rather than CRS) technology. To understand this decomposition, reconsider the example in Fig. 1, in which the firm located at point C moves to point D from year t to year t+ 1, but the estimated CRS_t and VRS_t frontiers remain the same. From Eq.(l), EFFCH = $(X_3D/X_3F)/(X_3C/X_3F)>1$ and TECCH = $[((X_3D/X_3F)/(X_3D/X_3F))^* ((X_3C/X_3F)/(X_3C/X_3F))]^{1/2} = 1$, thus, TFPCH > 1, indicating productivity growth. In moving from point C to point D, not only does the firm become more efficient but also more productive.

In the new location, using the same level of input (X_3), the firm increases its output from Y_1 to Y_2. The cause of the productivity growth is the catching-up effort (EFFCH) of the firm rather than an innovation in technology (TECCH). It seems that the efficiency increase (EFFCH > 1) is driven by increases both in PTE (PEFCH $=(X_3D/X_3E)/(X_3C/X_3E)>1$) and SE (SECH= $((X_3D/X_3F) / (X_3D/X_3E))/((X_3C/X_3F)/(X_3C/X_3E)) > 1$).

Efficiency by itself can bias the measurement of a production unit's performance, especially of those operating in an industry facing technological and regulatory changes. Hence, efficiency studies based on cross-sectional data may not contribute to explaining productivity growth. A technological advance adopted by a few firms, but not the average firm, could expand the estimated production frontier. A firm that fails to take advantage of technological advances will be increasingly inefficient relative to firms adopting the new technology. Thus, productivity growth does not always imply an efficiency increases.

3- Data

In this study, the statistics from food processing industries in 27 provinces in Iran[1] were used to calculate the total productivity. It should be mentioned that the food processing industries productivities of provinces such as Golestan, Qom, Qazvin and Ardebil that acquired the states of independent provinces in 1996, were calculated after their independence. Annual statistics were used, covering the period from 1992-2001.

To calculate productivity , two inputs , namely number of employees and capital stock, and an output, namely added value were used. The data required and information were collected from statistics available in large workplaces with more than 10 staff based on the ISIC3 classification codes. It should be mentioned at the outset that due to the problems in collecting, recording, classifying and processing the statistics and information in Iran the research community suffers statistical poverty. This may lead to some incongruity in the present study.

4- Empirical results

Table 1 displays the calculated productivity changes in food processing industries of all provinces of Iran over the period 1992-2001, as represented by the Malmquist output-based productivity. We also show the average productivity change for each province and period. As noted earlier, a greater-than- one Malmquist index denotes improvement in the relevant performance.

Over the last decade, there were eight periods (1992-93,1993-94, 1994-95, 1996-97, 1997-98, 1998-99, 1999-2000, 2000-2001) showing productivity gains. Period 1996-97 recorded the highest growth, 43.1% , across the food industry in provinces of Iran. In the same period, eight provinces' productivity decreased, (Yazd's by 6%, Khoozestan's by 28%, Sistan's by 16%, Isfahan's by 5%, Kerman's by 26%, Markazi's by 7%,

1- The provinces include : Fars, west Azarbaijan, Booshehr, Mazandaran, Kermanshah, Zanjan, Gilan, Khorasan, Yazd, Khoozestan, Sistan va Baloochestan, Chaharmahal va Bakhtiary, Isfahan, Hamedan, Lorestan, East Azarbaijan, Kerman, Tehran, Markazi, Semnan, Kordestan, Ardebil, Hormozgan, Kohgiloye va Booyer Ahmad, Qom, Qazvin and Golestan.

Kordestan's by 47%, Ardebil's by 5%). Between 1995-96, showing regress in productivity (-19%) in all provinces except Fars, Zanjan, Sistan, Kerman, and Ardebil.

Generally speaking , the food processing industries in provinces of Iran had productivity growth. Table 2, shows the annual efficiency change. And industry which has been efficient at time t and t+1, will naturally show no change in relative efficiency, i.e. efficiency scores in table 2 would be equal to 1. we found Ardebil to be efficient in all time periodes. The Kohgiloye's efficiency declined by 66% during 1995-96 and by 65% during 1999-2000 periods only. For the rest of the provinces of Iran, we found periods with decline in efficiency as well as periods with improvement. For the sampled periods as a whole , the average efficiency change ranged from -65% to 41% while for the provinces as a whole the average efficiency ranged from -3.7% (Qom) to 66% (Kerman). Only one province, Qom showed deterioration in efficiency.

Table 3 presents annual technical progress or regress. We found six periods with technical progress and three with technical regress. Period 1993-94 had the strongest technical progress 167%. All or almost all the provinces showed technical progress in 1994-95, 1996-97, 1997-98 periods. Between 1995-96, only two provinces, Ardebil and Hormozgan achieved technical progress.

Average technical change for the period 1995-96 was -72%, the worst technical regress over the whole period. Focusing on the technical change in each province, we found that Chaharmahal had the highest technical progress, 52.5% over the whole period, Followed by Markazi's 40.8% and Kordestans's 40.2%.

The multiplication of efficiency change and technical change leads to the productivity growth. Therefore, we can tell from table 2 and table 3 that whether the productivity growth came from efficiency improvement or technical progress or both. For example, the Kordestan's efficiency declined by 41.8% (ECS 0.582, table 2) and technical progress of 98.3% (TC=1.983, table3), between 2000 and 2001. this led to the productivity increase of approximately 15.4% (TFPC=1.154, table 1).

Generally, the productivity change was due to technical change rather than improvement in efficiency. Allowing variable-return- to – scale technology, we further decomposed the efficiency change into pure efficiency change and scale, respectively, as shown in table 4 and table 5.

We found in table 4 that average pure efficiency change moved up and down over the observed periods. For example, in Fars, pure efficiency declined by 34.1% between 1997 and 1998. this was followed by 44.7% improvement. However, the overall average in pure efficiency for Fars was 12.4 again. According to table 5, one province, only Ardebil achieved scale efficiency during the sampled periods. Kordestan showed a 3.7% deterioration in the scale efficiency between 1992 and 2001.

5- Summary and Conclusion

In this study, a Malmquist non-parametric approach was used to measure total factor productivity for the food processing industries in 27 provinces of Iran over the 1992-2001 period.

The Malmquist index was constructed from output-based distance functions without assuming specific technology and producer behavior. Furthermore only quantity data were needed to solve the linear programming problems. The Malmquist productivity index can be fully decomposed into technical change, efficiency and scale change, so that we could have insight into the factor, which had contributed to the productivity growth.

Therefore, this approach could provide an improvement complementary information to traditional methods.

The results showed that in last decade, the productivity change of food industry in 27 provinces of Iran ranged from Khorasan's -1.6% to Chaharmahal's 198.9%. we found that the average productivity in the 1996-97 period had the highest gain, 43.1% during the sampled periods.

Generally, the food industry had productivity growth. The decomposition of Malmquist index into efficiency change and technical change showed that, usually, the productivity change was due to technical change rather than improvement in efficiency. Productivity gains of Ardebil and Qazvin all come from the technical progress. For these provinces whose production is right on the frontier (i.e. efficiency scores equal to 1).

Scale efficiency change also accounted for productivity growth, but slightly. For the provinces whose scale efficiency fluctuated during the sampled periods, scale adjustment by industrial vertical or horizontal integration might also be a good was to raise productivity.

Because of some problems in data system in Iran, maybe there is some incongruity in the result of this study, too.

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Appendix

table 1

annual productivity change of food industry in 27 provinces in iran from 1992 to2001

province	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-2000	2000-2001	Mean
Fars	0.919	0.515	1.172	1.119	1.089	0.681	1.444	0.774	1.372	1.009
west Azarbaijan	1.057	1.443	0.803	0.814	1.562	0.662	0.983	1.342	0.745	1.046
Booshehr	1.852	0.842	0.969	0.891	1.306	0.628	2.384	1.14	0.613	1.181
Mazandaran	1.023	0.816	1.151	0.98	1.635	0.893	1.099	0.873	1.225	1.077
Kermanshah	0.93	0.724	1.073	0.829	1.116	1.112	1.682	0.625	0.894	0.998
Zanjan	0.78	1.91	0.711	1.006	1.093	1.766	0.563	1.028	0.894	1.083
Gilan	1.669	0.403	1.364	0.824	1.496	0.871	0.874	0.012	1.74	1.028
Khorasan	1.374	0.856	0.768	0.926	1.021	0.996	1.058	1.053	0.808	0.984
Yazd	2.612	0.343	4.625	0.289	0.94	3.34	1.509	0.542	0.806	1.667
Khoozestan	1.691	0.91	0.577	0.975	0.728	2.228	0.509	1.057	1.567	1.138
Sistan...	1.324	0.872	0.725	1.035	0.845	1.211	0.546	2.088	1.732	1.153
Chahar mahal	0.545	1.901	6.516	0.061	2.554	2.072	0.613	0.872	2.964	2.011
Isfehan	1.836	0.809	0.853	0.823	0.958	1.041	0.668	0.895	1.314	1.022
Hamedan	0.969	0.628	1.215	0.783	2.027	0.689	1.117	1.109	1.218	1.084
Lorestan	2.551	0.382	2.57	0.534	2.821	0.91	0.819	0.63	2.342	1.507
East Azarbaijan	1.154	1.774	0.673	0.86	1.308	0.775	1.149	1.013	1.313	1.113
Kerman	1.156	3.408	0.18	1.036	0.747	0.965	1.232	1.848	0.735	1.256
Tehran	1.479	0.783	0.966	0.824	1.035	1.227	0.908	0.895	1.003	1.013
Markazi	2.364	0.518	0.802	0.956	0.93	1.337	1.062	0.837	5.59	1.600
Semnan	0.453	1.476	0.852	0.57	1.402	0.966	1.774	1.028	1.193	1.079
Kordestan	2.07	0.775	1.773	0.832	0.534	1.211	0.937	1.553	1.154	1.204
Ardebil	A	0.624	1.264	1.384	0.957	1.251	1.482	1.302	0.693	1.120
Hormozgan	A	0.189	1.384	0.771	1.723	1.249	1.357	1.78	1.031	1.186
Kohgiloye	A	1.485	2.154	0.324	4.52	1.025	1.624	0.397	1.303	1.604
Gom	A	A	A	A	A	0.772	0.802	2.234	0.489	1.074
Gazvin	A	A	A	A	A	1.705	0.729	0.948	1.333	1.179
Golstan	A	A	A	A	A	1.071	0.956	1.483	0.88	1.098
Mean	1.419	1.016	1.254	0.811	1.431	1.209	1.106	1.087	1.369	

table 2

Aannual efficiency change of food industry in 27 provinces in iran from 1992 to2001

province	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-2000	2000-2001	Mean
Fars	1.000	0.170	0.893	6.588	1.000	0.455	1.995	0.918	0.685	1.523
west Azarbaijan	1.008	0.445	0.612	5.036	1.208	0.516	1.226	1.580	0.440	1.341
Booshehr	1.657	0.288	0.596	5.880	0.966	0.536	3.138	1.423	0.310	1.644
Mazandaran	1.129	0.259	0.877	5.771	1.259	0.697	1.349	1.086	0.693	1.458
Kermanshah	0.814	0.248	0.818	5.281	1.082	0.566	2.297	0.796	0.458	1.373
Zanjan	0.693	0.674	0.366	6.983	1.000	1.000	0.593	1.334	0.434	1.453
Gilan	2.001	0.127	0.827	5.921	1.462	0.484	1.233	0.014	1.130	1.467
Khorasan	1.334	0.263	0.585	5.454	0.828	0.748	1.283	1.228	0.479	1.356
Yazd	2.551	0.141	2.741	1.912	0.910	1.763	1.262	1.000	0.335	1.402
Khoozestan	1.854	0.297	0.440	5.755	0.667	1.459	0.693	1.242	0.920	1.481
Sistan…	1.475	0.302	0.553	6.469	0.752	0.934	0.700	3.029	0.575	1.643
Chahar mahal	0.493	0.640	3.067	0.408	1.826	1.343	1.000	1.000	1.000	1.197
Isfehan	1.982	0.227	0.650	5.060	0.787	0.876	1.296	1.045	0.779	1.411
Hamedan	1.049	0.194	0.717	4.925	1.516	0.586	1.045	1.260	0.727	1.335
Lorestan	2.513	0.158	1.794	3.557	2.332	0.793	1.262	0.845	1.183	1.604
East Azarbaijan	1.059	0.557	0.485	5.086	1.068	0.643	1.402	1.228	0.782	1.368
Kerman	1.260	1.191	0.108	7.253	0.666	0.661	1.194	2.319	0.344	1.666
Tehran	1.455	0.244	0.736	5.084	0.884	0.832	1.467	1.014	0.544	1.362
Markazi	2.086	0.231	0.611	5.926	0.765	0.899	1.091	1.025	1.554	1.576
Semnan	0.397	0.505	0.649	3.646	1.257	0.593	2.376	1.695	0.425	1.283
Kordestan	1.845	0.262	0.922	6.036	0.527	0.647	1.255	1.812	0.582	1.543
Ardebil	A	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Hormozgan	A	0.473	0.975	0.639	2.082	0.996	0.813	1.497	1.345	1.103
Kohgiloye	A	2.070	1.000	0.340	2.945	1.000	1.000	0.357	1.647	1.295
Gom	A	A	A	A	A	0.568	1.100	1.734	0.450	0.963
Gazvin	A	A	A	A	A	1.000	1.000	0.977	1.023	1.000
Golstan	A	A	A	A	A	0.673	1.173	1.463	0.922	1.058
Mean	1.410	0.450	0.910	4.580	1.190	0.825	1.305	1.256	0.769	

table 3

annual technical change of food industry in 27 provinces in iran from 1992 to2001

province	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-2000	2000-2001	Mean
Fars	0.919	3.031	1.313	0.170	1.089	1.497	0.724	0.843	2.003	1.288
west Azarbaijan	1.049	3.246	1.313	0.162	1.293	1.283	0.802	0.849	1.694	1.299
Booshehr	1.118	2.925	1.626	0.152	1.352	1.172	0.760	0.801	1.980	1.321
Mazandaran	0.907	3.148	1.313	0.170	1.299	1.281	0.815	0.804	1.767	1.278
Kermanshah	1.142	2.927	1.313	0.157	1.031	1.964	0.732	0.785	1.954	1.334
Zanjan	1.126	2.833	1.943	0.144	1.093	1.766	0.948	0.771	2.057	1.409
Gilan	0.834	3.177	1.649	0.139	1.023	1.800	0.709	0.859	1.039	1.248
Khorasan	1.030	3.248	1.313	0.170	1.233	1.331	0.825	0.857	1.687	1.299
Yazd	1.024	2.431	1.760	0.151	1.033	1.895	1.196	0.542	2.405	1.382
Khoozestan	0.912	3.062	1.313	0.169	1.092	1.527	0.787	0.851	1.703	1.268
Sistan…	0.898	2.885	1.313	0.160	1.123	1.296	0.875	0.689	3.014	1.361
Chahar mahal	1.104	2.970	2.058	0.151	1.399	1.542	0.668	0.872	2.964	1.525
Isfehan	0.926	3.567	1.313	0.163	1.217	1.187	0.861	0.856	1.686	1.308
Hamedan	0.924	3.244	1.695	0.159	1.337	1.176	0.784	0.880	1.675	1.319
Lorestan	1.015	2.417	1.432	0.150	1.210	1.148	0.911	0.746	1.980	1.223
East Azarbaijan	1.090	3.185	1.313	0.169	1.225	1.205	0.879	0.825	1.680	1.286
Kerman	0.917	2.861	1.668	0.143	1.121	1.461	0.761	0.797	2.135	1.318
Tehran	1.016	3.206	1.313	0.162	1.171	1.476	0.724	0.883	1.845	1.311
Markazi	1.133	2.237	1.313	0.161	1.217	1.487	0.711	0.817	3.598	1.408
Semnan	1.140	2.925	1.313	0.156	1.115	1.631	0.747	0.607	2.811	1.383
Kordestan	1.122	2.963	1.923	0.138	1.014	1.871	0.747	0.857	1.983	1.402
Ardebil	A	0.624	1.264	1.384	0.957	1.251	1.482	1.302	0.693	1.120
Hormozgan	A	0.399	1.420	1.206	0.828	1.254	1.669	1.189	0.766	1.091
Kohgiloye	A	0.718	2.154	0.953	1.535	1.025	1.624	1.112	0.791	1.239
Gom	A	A	A	A	A	1.358	0.729	1.288	1.087	1.116
Gazvin	A	A	A	A	A	1.705	0.729	0.970	1.303	1.177
Golstan	A	A	A	A	A	1.591	0.814	1.014	0.955	1.094
Mean	1.010	2.670	1.510	0.280	1.160	1.451	0.889	0.877	1.824	

table 4

annual pure change of food industry in 27 provinces in iran from 1992 to2001

province	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-2000	2000-2001	Mean
Fars	1.000	0.300	2.328	1.430	1.000	0.659	1.447	1.049	0.904	1.124
west Azarbaijan	1.039	0.589	1.596	1.421	1.173	0.729	0.910	1.506	0.689	1.072
Booshehr	2.149	0.266	1.255	3.053	1.419	0.620	2.493	1.000	0.359	1.402
Mazandaran	1.128	0.575	1.829	1.254	1.261	0.981	1.020	1.000	1.000	1.116
Kermanshah	0.866	0.215	2.192	2.053	1.091	0.845	1.686	0.701	0.587	1.137
Zanjan	0.679	0.700	1.331	1.838	1.000	1.000	0.728	1.184	0.520	0.998
Gilan	1.984	0.273	2.433	1.128	1.516	0.560	0.907	0.015	1.000	1.091
Khorasan	1.000	0.900	0.894	1.111	0.953	0.903	0.976	1.176	0.824	0.971
Yazd	1.000	0.117	8.547	0.581	0.986	1.747	1.000	1.000	0.404	1.709
Khoozestan	1.877	0.496	1.074	1.380	0.663	2.086	0.517	1.174	1.418	1.187
Sistan…	1.000	0.295	0.276	8.977	0.999	0.833	0.437	3.751	0.429	1.889
Chahar mahal	0.821	1.218	1.000	0.607	1.646	1.000	1.000	1.000	1.000	1.032
Isfehan	2.040	0.342	1.611	1.313	0.829	1.186	0.957	0.991	1.211	1.164
Hamedan	1.166	0.175	1.811	2.112	1.385	0.780	0.798	1.244	0.921	1.155
Lorestan	0.611	0.140	11.660	0.464	2.153	0.989	1.011	0.848	1.180	2.117
East Azarbaijan	1.087	0.865	1.191	1.270	1.118	0.874	1.094	1.105	1.217	1.091
Kerman	0.934	1.119	0.354	2.274	0.672	0.859	0.895	2.407	0.412	1.103
Tehran	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Markazi	1.892	0.244	1.929	1.824	0.746	1.386	0.715	1.015	1.552	1.256
Semnan	0.447	0.488	1.275	1.751	1.273	0.761	1.702	1.671	0.439	1.090
Kordestan	1.000	0.310	0.375	8.593	1.000	1.000	1.000	1.000	1.000	1.698
Ardebil	A	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Hormozgan	A	0.708	0.900	0.514	2.365	1.280	1.009	1.000	1.000	1.097
Kohgiloye	A	1.187	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.023
Gom	A	A	A	A	A	1.000	1.000	1.000	1.000	1.000
Gazvin	A	A	A	A	A	1.000	1.000	1.000	1.000	1.000
Golstan	A	A	A	A	A	0.878	0.886	1.456	0.932	1.038
Mean	1.177	0.563	2.036	1.998	1.177	0.998	1.044	1.196	0.888	

table 5

annual scale change of food industry in 27 provinces in iran from 1992 to2001

province	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-2000	2000-2001	Mean
Fars	1.000	0.566	0.384	4.606	1.000	0.690	1.379	0.875	0.757	1.251
west Azarbaijan	0.969	0.755	0.384	3.544	1.030	0.708	1.347	1.049	0.638	1.158
Booshehr	0.771	1.081	0.475	1.926	0.681	0.865	1.259	1.423	0.863	1.038
Mazandaran	1.001	0.451	0.479	4.603	0.998	0.711	1.323	1.086	0.693	1.261
Kermanshah	0.940	1.154	0.373	2.573	0.992	0.671	1.362	1.135	0.780	1.109
Zanjan	1.021	0.963	0.275	3.798	1.000	1.000	0.815	1.127	0.836	1.204
Gilan	1.009	0.465	0.340	5.248	0.964	0.864	1.360	0.952	1.130	1.370
Khorasan	1.334	0.293	0.654	4.909	0.868	0.829	1.315	1.045	0.582	1.314
Yazd	2.551	1.205	0.321	3.293	0.924	1.009	1.262	1.000	0.829	1.377
Khoozestan	0.988	0.599	0.409	4.170	1.006	0.699	1.341	1.058	0.649	1.213
Sistan…	1.475	1.023	1.998	0.721	0.753	1.122	1.603	0.808	1.339	1.205
Chahar mahal	0.601	0.526	3.167	0.671	1.109	1.343	1.000	1.000	1.000	1.157
Isfehan	0.972	0.664	0.403	3.855	0.949	0.739	1.355	1.054	0.644	1.182
Hamedan	0.900	1.109	0.396	2.332	1.049	0.752	1.310	1.013	0.790	1.072
Lorestan	4.115	1.127	0.154	7.659	1.083	0.802	1.247	0.997	1.003	2.021
East Azarbaijan	0.974	0.644	0.408	4.005	0.955	0.736	1.282	1.112	0.642	1.195
Kerman	1.348	1.064	0.306	3.189	0.991	0.769	1.334	0.964	0.834	1.200
Tehran	1.455	0.244	0.736	5.084	0.884	0.832	1.467	1.014	0.544	1.362
Markazi	1.102	0.949	0.317	3.250	1.024	0.648	1.526	1.010	1.001	1.203
Semnan	0.890	1.033	0.509	2.082	0.987	0.779	1.396	1.014	0.968	1.073
Kordestan	1.845	0.844	0.457	0.702	0.527	0.647	1.255	1.812	0.582	0.963
Ardebil	A	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Hormozgan	A	0.668	1.083	1.244	0.880	0.778	0.806	1.497	1.345	1.038
Kohgiloye	A	1.744	1.000	0.340	2.945	1.000	1.000	0.357	1.647	1.254
Gom	A	A	A	A	A	0.568	1.100	1.734	0.450	0.963
Gazvin	A	A	A	A	A	1.000	1.000	0.977	1.023	1.000
Golstan 1-	A	A	A	A	A	0.766	1.325	1.004	0.989	1.021
Mean	1.298	0.840	0.668	3.117	1.025	0.826	1.251	1.078	0.873	