

FACTOR DEMANDS OF FOOD-MANUFACTURING INDUSTRY IN TURKEY

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Abstract

This paper analysis the demand for labor, capital, and energy in Turkey food manufacturing industry using Morishima elasticities of substitution. Depend on the subsectors of food manufacturing industry, the demand for capital is more elastic than labor and energy.

Key words: Factor demands, elasticity of substitution.

INTRODUCTION

The food manufacturing industry is special importance to Turkey due to the increasing population and its great contribution to the national economy. The share of the food-manufacturing industry to the total value added in manufacturing industry is about 20 %.

In Turkey, the Food-processing technologies require a heavy use of energy and capital equipment and labor. The cost of energy, capital and labor faced a steady increase in the price ratio through changes in the Turkish economies. In order to make decisions in resource allocation, manufacturers need information of the nature of industrial demand for factor inputs.

The objective of this study is to analyse the demand for labor, capital and energy in Turkey food-manufacturing industry using MORISHIMA elasticities of substitution. In addition to this, suggestions will be made for the use of the food-manufacturing industries.

In this paper, the food- manufacturing sector is composed of: (1)slaughtering, preparation of meat and preserving meat, (2)manufacture of dairy products, (3)canning and preservation of fruits and vegetables, (4)the manufacture of vegetable and animal oil fats, and finally, the grain milling industry.

To investigate the demand for labor, capital, and energy in the Turkish food-manufacturing industry, data was required on the unit price and total cost for each factor as well as on the value and quantity of industrial production.

Most of data are compiled from the “Annual survey of Manufactures of the State Institute of Statistic Prime Ministry Republic of Turkey for 1985-2001.

The cost of labor represents the total wage payments for production workers, while unit labor price refers the average wage payments per production worker per hour. The cost of energy is the total cost of purchased electric energy. Implicit price deflators are included for gross fixed non-residential capital investment for structures and producers durable equipment.

Conceptual Framework

Consider a production technology F(X) for a vector of n-factors X. The corresponding cost function is defined

as the minimum cost of attending product Q at a vector of prices W as;

$$C(W,Q)=\min [W'X;F(X)=Q] \tag{1}$$

This cost function is concave and linear in W. The conditional factor demand function is homogenous of degree zero in factor prices. Furthermore, the cross-price elasticity,

$$E_{ij}=W_j C_j(W,Q)/ C_i(W,Q). \tag{2}$$

Morishima’s elasticity of substitution(MES) is defined as a logarithmic derivative of a quantity ratio in factors with respect to a ratio of its factor prices:

$$MES_{ij}=-\partial \ln[X_i^*(W,Q)/X_j^*(W,Q)]/\partial \ln[W_i/W_j]. \tag{3}$$

MES measures the percentage change in the ration of a pair of factors in response to a change in the ratio of another pair of factors in response to a change in their relative prices. It is a natural generalization of the Hicksian two variable elasticity.

MES expressed as,

$$MES_{ij}=E_{ji} - E_{ii} \tag{4}$$

MES can also provide complete comparative static information about relative factor cost shares in response to a change in factor prices expressed as

$$\partial \ln[W_i X_i^*(W,Q)/ W_i X_j^*(W,Q)]/\partial \ln[W_i/W_j]=1-MES_{ij} \tag{5}$$

The cost function is not estimated directly; rather the set of the factor cost share is estimated.

$$S_i = a_i + \sum_{j=1}^n \beta_{ij} \ln W_j + \beta_{iq} \ln Q + \delta_i T \quad i=1,2,\dots,n \tag{6}$$

Given the estimated cost parameters, one can derive MES and price elasticities of conditiona factor demands as follows:

$$MES_{ij}=(\beta_{ij} + S_i S_j / S_j - (\beta_{ii} + S_i^2 - S_i)/ S_i) \tag{7}$$

The Structure of Food Manufacturing Industry in Turkey

Turkey boasts a young population, a dynamic private sector, private sector, regional connections, and a rapidly developing infrastructure. Turkey has been a strategic intersection between Europe/Asia and Middle East, allowing trade to flourish. It is referred to as one of the world's ten most important "Big Emerging Markets".

Turkey is one of the world's most dynamic markets for processed food with its large (approximately 70 million) and young population (%55 under age 25). Moreover, rapid urbanization and growing numbers of working woman are increasing the demand for processed foods. Major U.S.exports to Turkey which enter the processing food sector include rice and vegetable oils.Other ingredients and ready to consume items, offer a small share of imports is very small.

Total food expenditures in 2001 are estimated at US\$ 23 billion of which approximately 18.7 billion USA \$ is processed foods. Processed food expenditures decreased in late 2000 due to a severe devaluation of the Turkish Lira and subsequent economic crisis.(USDA,2002).

Annual expenditures on processed food items still only amounts to about US\$ 265 per person and the grown rate averaged 4-5% per year.

In Turkey,the food industry takes its place in the manufacturing industry and is divided into nine

subsectors. These the sector include slaughtering, preparing and preserving meat, manufacture of dairy products, canning and preserving of fruits and vegetables, manufacture of vegetable and animal oil fats, grain mill products, canning ,preserving and fish crustacea and similar goods, manufacture of bakery products, sugar factories and refineries and manufacture of cocoa, chocolate and sugar confectionery.

In this section, the food industry structure is evaluated to determine subgroups.

The number of active establishments in the food-manufacturing industry is shown in table 1.

According to the 2000's inventory results, 20 % of 1255 of food-manufacturing industry is grain mill products, 11 % of canning and preserving of fruits and vegetables,%9 of manufacture of dairy products, %8 of manufacture of vegetable and animal oil fats and Slaughtering, preparing and preserving meat. Most are small medium sized enterprises. There are 114 646 average number of employees in food manufacturing industry. Canning and preserving of fruits and vegetables have 18 % of this total. The share of slaughtering, preparing and preserving meat is 14 % , manufacture of vegetable and animal oil fats is %8, manufacture of dairy products and grain mill products are 7%.

As can be seen the highest added value is in the canning and preserving of fruits and vegetables subsector. The lowest added value is in grain mill products subsector.

Tab. 1.: Some Indicators of Food Manufacturing Industry in Turkey (2000)

Sub-Sectors	Number of establishments	%	Average number of employees	%	Value added Million TL	%
Food-manufacturing industry	1255	100	114646	100	2004827481	100
Slaughtering, preparing and preserving meat	97	8	15839	14	296335313	15
Manufacture of dairy products	108	9	8423	7	256381204	13
Canning and preserving of fruits and vegetables	143	11	20102	18	321124879	16
Manufacture of vegetable and animal oil fats	104	8	8813	8	306498641	15
Grain mill products	255	20	8196	7	113987991	6
Other subsectors	707	44	61373	46	710499453	35

Rapid development in the sector has been accompanied by rising foreign investment. In 2002, for instance, such investment in the food industries amounted to USA \$ 190 million in Turkey. There are 145 companies in the food sector that received foreign investment at some point in the past.

After, 1983 the Turkish government began to liberalize import policies. As a result, various kinds of imported food products can be found in the country. With the movement in the retail sector in the 1990s away from small grocery stores and towards super hypermarkets, consumer expectations have changed significantly. This trend has led to new investments and quality improvements within the food sector.

Turkey is the fifth largest producer of vegetables and ninth largest producer of fruit in the world. Thus, within the last three years canning and preservation of fruits and vegetables have been an increasingly important part of Turkey's total food manufacturing industry exports (49%). Manufacture of vegetable and animal oil fats (40%).Slaughtering the preparation and preservation of meat (31%) have also been an important part of food total imports. In the vegetable oil processing industry, Turkey has insufficient domestic oil seed production to meet demand. In the meat sector, Turkey needs to invest in all aspects herd improvement. On the other hand, grain mill products have performed for production and consumption side.

Tab. 2. : Turkey's Processed Food Balance, 2000 Producers Prices (US\$ million)

Sub-Sector	Production	%	Imports	%	Exports	%	Consumption	%
Food-manufacturing industry	10182	100	566	100	835	100	9609	100
Slaughtering, preparing and preserving meat	1447	14	173	31	31	4	1639	17
Manufacture of dairy products	1228	12	22	4	7	1	1254	13
Canning and preserving of fruits and vegetables	926	9	13	2	405	48	332	3
Manufacture of vegetable and animal oil fats	870	9	228	40	112	13	894	9
Grain mill products	3788	37	37	7	91	11	3729	39
Other subsectors	1923	19	93	16	189	23	1761	18

Factor Demands Of Food-Manufacturing Industry In Turkey

The cost structure of the Turkey food-manufacturing industry is characterized by estimating three cost share equation as in equation (6) for labor, capital and energy. Because the cost shares of the three equation always equals unity, the sum of the disturbances across these equations is zero for each observation. This implies that the covariance matrix of residuals is singular, and that one of the cost share equations can be dropped from direct estimation. In the model the relatively short sample period, of 15 years, precluded testing for structural changes in the food-manufacturing industry.

The estimation results are reported in tables 3,4,5. Most of estimated parameters are statistically significant at the 5% level.

The interrelation of factor demand is also shown in the variation of industrial cost structure in response to changes in factor prices. Based on equation (5), the elasticities of each pair wise factor cost share with respect to their factor prices are shown in table 3. The results are closely related to the magnitude of Morishima elasticities; the relative cost share decreases if the Morishima elasticity is greater than zero and increases if it is less than zero.

On the other hand, the factor average cost shares in the calculation are summarized the following table 3.

Tab. 3.: Average Cost shares of Subsectors.

	Average Cost Shares		
	Labor	Energy	Capital
Slaughtering, meat preparation and preserving meat	0.52	0.28	0.20
Manufacture of dairy products	0.42	0.30	0.28
Canning and preservation of fruit and vegetables	0.43	0.26	0.31
Manufacture of vegetable and animal oil fats	0.42	0.34	0.24
Grain mill products	0.27	0.46	0.27

Price elasticities of factor demands are obtained and shown in table 4 for the subsectors understudy. Demand elasticities for Food-manufacturing industry, Slaughtering, preparing and preserving meat, Manufacture of dairy products, Canning and preserving of fruits and vegetables, Manufacture of vegetable and animal oil fats, Grain mill products.

The results suggest that the demand for capital are quite elastic with an elasticities of 1.02 for manufacture of dairy products, 1.24 for Slaughtering, preparing and preserving meat, 0.83 for Canning and preserving of fruits and vegetables 0.86 for Manufacture of vegetable and 0.93 animal oil fats, Grain mill products while the demand elasticities of labor and energy are 0.16 and 0.22 for Manufacture of dairy products, 0.03 and 0.21 for Slaughtering, preparing and preserving meat, 0.25 and 0.22 for Canning and preserving of fruits and

vegetables, 0.37 and 0.029 for Manufacture of vegetable and animal oil fats, Grain mill products. The high elasticity of demand for capital probably reflects the industry's high capital –intensive technologies. So, canning and preserving of fruits and vegetables and Manufacture of vegetable and animal oil fats industries have got less energy elasticities between the others. On the other hand, Slaughtering, preparing and preserving meat industry has got low labor elasticity. Because there are many small size enterprises of slaughtering, preparing and preserving meat in Turkey and it works labor intensive.

Furthermore, labor elasticity of manufacture of vegetable and animal oil fats is igher than the other manufacturing food industries.

The cross price elasticities indicate a small substitution relationship between capital and labor for the manufacture of dairy products and fruit of canning and

preserving of fruits and vegetables; these are also found for the manufacture of vegetable and animal oil fats. At the time, capital and energy are substitutable for the slaughter, preparation and preservation of meat and the grain mill products subsectors.

On the other hand, energy and capital are complementary; between energy and capital with elasticities 0.43 for slaughter, preparation and preservation of meat subsector. The Morishima elasticity of substitution calculated on basis equation (7) are compiled in Table 5. The entries in the off-diagonal of the table reflect the adjustments of relative factors in response to a change in ratio of relative factor prices.

If $MES > 0$ implying that any pair of factors is less substitutable with each other

As a shown in table 5, some of the elasticities of factor ratios are large. ($MES > 0$) Their signs are positive and elasticities of factor ratios capital-labor is large 1.19 for manufacture of dairy products.

On the other hand, the signs are all negative for slaughtering, preparing and preserving meat, canning and preserving of fruits and vegetables, manufacture of vegetable and animal oil fats, grain mill products subsectors. In particular, the elasticities of factor ratios energy-capital are large, respectively -0.82. For slaughtering, preparing and preserving meat, canning and preserving of fruits and vegetables and -1.07 vegetable and animal oil fats -0.97, grain mill products.

CONCLUSIONS

This study analyzes the demand for labor, capital and energy and their interdependence in the Turkey food-manufacturing industry subsectors. The results show that:

Although the factor prices change in the subsectors of the manufacturing food sector, the demand for capital is more elastic than that for labor and energy. The demand elasticities of labor, capital, and energy in response to energy price changes are relatively low. They indicate that relatively large changes in the prices of electricity experienced over the sample period didn't cause much adjustment in factor utilization.

Thus, policy measures are summarized as following,

✓ to reduce the the price of capital such as investment tax credits and lower interest rates, would significantly increase the demand for capital.

✓ to reduce the price of energy with the support of Turkish government, would significantly increase the investment of food manufacturing industry.

The estimated Morishima elasticities indicate that labor, capital, and energy are substitutable especially between labor and capital.

This evidenced by the recent trends in the food manufacturing industry to substitute computers and automated machines for human operations in the light of steady increase in the labor to capital price ratio.

Therefore, it is greatly important that to follow and evaluate the related data (elasticities) on food manufacturing industry of our country for appropriate politics should be determined and implemented in conformity with programme.

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Tab. 4.: Estimated Parameters of Cost Function

	The Factor Cost share														
	Manufacture of dairy products			Slaughtering, preparing and preserving meat			Canning and preserving of fruits and vegetables			Grain mill products			Manufacture of vegetable and animal oil fats		
	Labor	Energy	Capital	Labor	Energy	Capital	Labor	Energy	Capital	Labor	Energy	Capital	Labor	Energy	Capital
	-1,12870	-1,21370		-0,47425	-0,48723		1,11830	1,42220		1,78900	0,60610		-1,45120	1,73090	
CONSTANT	(1,08800)	(1,08600)	2,34240	(0,98620)	(0,80690)	0,96148	(1,09100)	(1,05400)	-2,54050	(1,53200)	(1,40800)	-2,39510	(0,88660)	(1,38200)	-0,27970
Production Value	0,17098	0,06645		0,13763	0,00828		-0,00906	-0,11701		-0,06413	-0,03163		0,13199	-0,11181	
	(0,07679)	(0,07765)	-0,23743	(0,06979)	(0,05865)	-0,14591	(0,07247)	(0,07139)	0,12607	(0,10430)	(0,09573)	0,09576	(0,05392)	(0,08632)	-0,02018
Labor Price/Capital Price	0,17697	-0,10668		0,23546	-0,14375		0,13705	-0,08562		0,13594	-0,07178		0,08778	-0,06849	
	(0,03408)	(0,00937)	-0,07029	(0,03927)	(0,01144)	-0,09171	(0,03107)	(0,00707)	-0,05144	(0,03945)	(0,00932)	-0,06416	(0,02690)	(0,00744)	-0,01929
Energy Price/Capital Price	-0,10668	0,14330		-0,14375	0,14384		-0,08562	0,13601		-0,07178	0,09631		-0,06849	0,12508	
	(0,00937)	(0,00854)	-0,03662	(0,01144)	(0,00914)	-0,00009	(0,00707)	(0,00537)	-0,05040	(0,00932)	(0,00763)	-0,02453	(0,00744)	(0,01068)	-0,05659
Avarage Cost Share	0.42	0.30	0.28	0.52	0.28	0.20	0.43	0.26	0.31	0.27	0.46	0.27	0.42	0.34	0.24

All estimates are significant at the 5% level.

Tab. 4. :
Price Elasticities
of Factor
Demands

	Manufacture of dairy products			Slaughtering, preparing and preserving meat			Canning and preserving of fruits and vegetables			Grain mill products.			Manufacture of vegetable and animal oil fats		
	Labor	Energy	Capital	Labor	Energy	Capital	Labor	Energy	Capital	Labor	Energy	Capital	Labor	Energy	Capital
Labor	-0,16	0,05	0,11	-0,03	0,00	0,03	-0,25	0,06	0,19	-0,23	0,19	0,04	-0,37	0,17	0,20
Energy	0,07	-0,22	0,16	0,00	-0,21	0,20	0,10	-0,22	0,12	0,12	-0,33	0,22	0,21	-0,29	0,08
Capital	0,17	-0,09	-1,02	0,07	-0,43	-1,24	0,26	-0,01	-0,83	0,04	0,21	-0,86	0,34	0,03	-0,93

All estimates are significant at the 5% level

	Manufacture of dairy products			Slaughtering, preparing and preserving meat			Canning and preserving of fruits and vegetables			Grain mill products			Manufacture of vegetable and animal oil fats		
	Labor	Energy	Capital	Labor	Energy	Capital	Labor	Energy	Capital	Labor	Energy	Capital	Labor	Energy	Capital
Labor		0,206	0,269		-0,210	0,199		-0,320	0,017		-0,448	0,102		-0,504	-0,133
Energy	0,290		0,383	0,491		-0,819	0,272		-0,823	-0,170		-1,065	0,304		-0,967
Capital	1,186	0,936		0,314	0,077		0,120	-0,050		0,000	0,190		0,180	0,100	

Tab. 5. : orishima
Elasticities of
Substitution (MES)

All estimates are significant at the 5% level.

