

The Analysis of Interregional Sectoral Productivity in Turkey

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Extensive Summary

Introduction

Productivity is an important area of discussion and analysis in the working economy. In general, productivity differs between sectors and business lines. This difference leads to productivity differences between countries and regions. The main objective of this study is to analyze the differentiation of the sectoral productivity between regions in Turkey. Another objective is to test the existence of difference of traditional-modern economic structure in the agricultural sector, depending on the main purpose. Thus, it can be determined whether the closed family economy disappeared or not by adapting itself to market economies of the production. The second sub-objective of the main purpose is the relation between regional Specialization in sectors and sectoral productivity. In this way, potentialities based on the comparative advantage of regional units can be determined in terms of the possibility of internal growth.

Method

In practice, two sets of data for 2014 were used according to NUTS 2. The first data set is production in three main sectors, and the second data set is employment. All data are from Turkey Statistical Institute. The statistical application consists of three steps. At the first stage, an analyze was made by Atkinson regional inequality index. In the second stage, location coefficient analysis was performed. In the third stage, the relationship between regional Specializations in production and employment was analyzed.

The Atkinson regional inequality index is formulated as follows:

$$A_{(\Omega)} = 1 - \left[\frac{L_i}{L} \times \sum_{i=1}^n \frac{Y_i/L_i}{\bar{Y}/\bar{L}} \right]^{1-\Omega} \text{ eğer } \Omega \neq 1 \quad [1]$$

In Equation 1, $A(\Omega)$ is the Atkinson regional inequality index; Ω is sensitivity coefficient (it is usually given 2 due to ease of calculation); Y_i is production in i-zone; and L_i is the number of employees in the i-zone. \bar{Y} stands for the arithmetic average of the country's production, and \bar{L} stands for the arithmetic average of the workers.

Based on the indices, the rate of social welfare (equation 2), the rate of social welfare loss (equation 3), the total felt income/production (equation 4), the total income/production (equation 5) per capita income/production (equation 7) can be calculated.

$$Y_{sr} = \%(1 - A_{(\Omega)}) \times 100 \quad [2]$$

$$Y_{srk} = \%A_{(\Omega)} \times 100 \quad [3]$$

$$Y_{hm} = (1 - A_{(\Omega)}) \times 100 \times Y_g \quad [4]$$

$$Y_{-hm} = (1 - A_{(\Omega)}) \times 100 \times Y_g \quad [5]$$

$$KBY_{hm} = (1 - A_{(\Omega)}) \times 100 \times Y_g \quad [6]$$

$$KBY_{-hm} = A_{(\Omega)} \times 100 \times KBY_g \quad [7]$$

In Equation 3-8, Y_{sr} represents the rate of social welfare provided from income/production (%), and Y_{srk} represents the rate of social welfare loss (%) that can not be obtained from production. Y_g also represents production volume per employee, KBY_g represents production volume per employee (productivity, TL) Y_{hm} represents part of production felt by employees (TL), Y_{-hm} represents part of production not felt by employees (TL), KBY_{hm} production amount per employee which is felt by them (felt productivity, TL), and KBY_{-hm} represents the amount of production per employee (productivity loss, TL) not felt by employees.

The Atkinson index has many examples in the literature according to different fields, subjects and disciplines. Particularly income, the measurement of the distribution of wealth and the welfare losses are predominant in the studies carried out. Some examples of international literature are: Robinson et al., 1985; Braun, 1988; Jordá and Fullerton, 2005; Frank, 2009; Jordá and Sarabia, 2015; Sun et al., 2015; Du et al., 2015; Lakner and Milanovic, 2016; Ravallion, 2017; Atems and Shand, 2018. Some examples of national literature are: Limanlı and Yamak, 2014; Çiftçi, 2015a, 2015b.

The location coefficient is the most widely used statistical method for evaluating sectoral Specialisation among regions, which was developed by Florence in 1939 (Figueiredo et al., 2009, p. 856) This coefficient measures the accumulation of employment in any sector or measure relative to other regional units. The coefficient value of 1 defines that the sectoral accumulation in the regional unit where the accumulation is measured is the average weight on the entirety constituted by regional units. The coefficient value above 1 indicates sectoral Specialization (Hildebrand and Mace, 1950, p. 243).

The coefficient is determined by dividing the sectoral value in the regional unit by the total value and dividing the result by the total value of the sectoral value in the whole country. In the equation, LQ represents the location coefficient, i represents the economic sector, j represents the regional unit which is subject, n represents the whole units, $E_{i,j}$ represents the employment in the sector i, E_j represents all workers in the zone j, and E_n represents all the workers. (See Brantingham and Brantingham, 1998: 268):

$$LQ_{i,j} = \left(\frac{E_{i,j}/E_{i,n}}{E_j/E_n} \right) \quad [8]$$

The question of which LQ value sectoral Specialization begins in the regional unit is the most important debate issue (Crawley et al., 2013). Bergman and Feser (1999) argue that the first evidence of sectoral Specialization in the region is formed by the coefficient of 1.25. Likewise, in a large number of studies it is accepted as the border for regional Specialization of 1.25 (eg Trullén and Boix, 2005; Mans et al., 2008; Champion and Wein, 2008; Woźniak, 2015). While another cut-off point in this issue is 2, it is argued that a strong Specialization exists in the region that catches this threshold. (Virtanen and Honkanen, 2001; McCord and Ratcliffe, 2009; Groff, 2011; Li, 2015; Yuanyuan and Bingliang, 2017). Malmberg and Maskell (2002) find that the value of 2 for the Specialization is inadequate and the coefficient for the absolute sectoral Specialization in the region for the labour market should be 3 or more. According to this:

- $LQ < 1,25$ \Rightarrow no regional specialization;
- $1,25 \leq LQ < 2,00$ \Rightarrow started regional specialization;
- $2,00 \leq LQ < 3,00$ \Rightarrow high regional specialization;
- $LQ \geq 3,00$ \Rightarrow full regional specialization.

Some examples from international literature are: Kortus, 1969; Cortes and Leftwick, 1975; Prohit, 1975; Winsberg, 1979; Boylan, 1980; Brantingham and Brantingham, 1998; Blinova, 1999; Toussaint-Comeau and Rhine, 2005; Brown and Chung, 2006; Széles et al., 2010; Owusu and Agyei-Mensah, 2011; Soelistijo et al., 2015. And some examples from the national literature are: Dinçer, 2007; Karakayacı and Dinçer, 2012; Yardımcı, 2014; Lazaretti et al., 2014; Yakar, 2015; Seçkin, 2015; Seçilmiş, 2015; Sungur, 2015; Değirmen et al., 2016; Sandal and Şen, 2016; Şahin and Türkoğlu, 2017.

Correlation analysis was applied with Pearson, Spearman and Kendall approaches. Coefficients of correlation values were changed according to three boundary values. According to this:

- $r < |0,50|$ \Rightarrow low correlation.
- $|0,50| \leq r < |0,75|$ \Rightarrow middle correlation.
- $|0,75| \leq r \leq |1,00|$ \Rightarrow high correlation.

Findings

The three-stage analysis process begins with the calculation of Atkinson's regional inequality index coefficients. The analysis findings based on the Atkinson index are presented in table 1.

Table 1. Summary Table for the Analysis based on Atkinson Index (2014)

	Agriculture	Industry	Services	Total of Sectors	
Atkinson Index	0,197	0,050	0,066	0,108	
Rate of Social Welfare	80,3	95,0	93,4	89,2	
Rate of Loosing for Social Welfare	19,7	5,0	6,6	10,8	
Current Price (Billion TLs)	Actual Production	135	576	1097	1808
	Production as Felt	108	548	1025	1613
	Production as Unfelt	27	29	72	195
Fixed Prices of 2017 (Billion TLs)	Actual Production	171	733	1395	2300
	Production as Felt	138	697	1303	2051
	Production as Unfelt	34	36	92	249
Current Price (Billion TLs)	Actual Productivity	24630	79773	82888	69728
	Productivity as Felt	19778	75820	77432	62192
	Productivity as Unfelt	4851	3953	5456	7536

Fixed Prices of 2017 (Billion TLs)	Actual Productivity	31325	101457	105419	88682
	Productivity as Felt	25155	96430	98480	79098
	Productivity as Unfelt	6170	5028	6939	9584
Total of Sectors=100	Actual Productivity	35,3	114,4	118,9	100
	Productivity as Felt	31,8	121,9	124,5	100
	Productivity as Unfelt	64,4	52,5	72,4	100

LQ analysis was carried out in the second stage and the findings are presented in tables 2 and 3.

Table 2. Summary Table for LQ Analysis

Region	Agriculture				Industry				Services			
	Employed		Production		Employed		Production		Employed		Production	
	LQ	Range	LQ	Range	LQ	Range	LQ	Range	LQ	Range	LQ	Range
	TR10	0,03	26	0,02	26	1,32	3	0,95	10	1,23	2	1,15
TR21	0,93	20	1,49	17	1,43	2	1,49	1	0,79	18	0,68	26
TR22	1,47	12	2,39	7	0,76	15	0,94	11	0,94	12	0,86	20
TR31	0,50	24	0,73	23	1,14	6	1,16	6	1,13	3	0,95	12
TR32	1,39	13	2,17	11	0,87	11	0,85	15	0,91	13	0,94	13
TR33	1,86	7	2,78	5	0,81	14	1,11	7	0,75	20	0,72	25
TR41	0,51	23	0,79	22	1,55	1	1,43	3	0,90	14	0,80	23
TR42	0,87	22	0,56	24	1,31	4	1,49	2	0,89	16	0,80	24
TR51	0,14	25	0,25	25	0,92	9	0,94	12	1,40	1	1,13	3
TR52	1,22	16	2,96	3	1,04	8	0,87	14	0,89	15	0,83	21
TR61	1,31	14	1,45	18	0,52	24	0,57	25	1,13	4	1,17	1
TR62	1,00	19	1,64	14	0,86	12	0,88	13	1,08	6	0,99	10
TR63	1,02	18	1,50	16	1,06	7	1,11	8	0,96	8	0,88	18
TR71	1,63	10	3,04	2	0,64	21	0,76	19	0,94	9	0,88	19
TR72	1,26	15	1,79	13	0,92	10	1,01	9	0,94	11	0,90	17
TR81	1,82	9	0,81	21	0,85	13	1,18	5	0,74	22	0,93	14
TR82	2,21	4	2,80	4	0,57	23	0,72	21	0,74	23	0,93	15
TR83	1,90	6	2,29	9	0,74	16	0,69	22	0,77	19	1,01	8
TR90	2,12	5	1,50	15	0,63	22	0,81	17	0,74	21	1,04	6
TRA1	2,41	2	2,36	8	0,43	26	0,62	24	0,73	24	1,03	7
TRA2	2,82	1	3,46	1	0,51	25	0,45	26	0,52	26	0,99	9
TRB1	1,50	11	1,21	19	0,65	20	0,84	16	0,99	7	1,06	4
TRB2	2,22	3	2,23	10	0,69	19	0,77	18	0,67	25	0,97	11
TRC1	0,89	21	0,95	20	1,20	5	1,37	4	0,94	10	0,82	22
TRC2	1,85	8	2,65	6	0,71	18	0,75	20	0,81	17	0,93	16
TRC3	1,16	17	2,00	12	0,72	17	0,66	23	1,09	5	1,05	5

Table 3. Productivity for the Highest and the Lowest Three Regions According to Sectoral Specialisation for Employed and Production (Current Prices, Fixed Prices of 2007, Turkey Average=100)

Agriculture									
The Specialisation Based on Employed					The Specialisation Based on Production				
	The lowest 3 Regions	Current Price	Constant Price	Avarage =100		The lowest 3 Regions	Current Price	Constant Price	Avarage =100
1	TRA2	12214	15534	49,6	1	TRA2	12214	15534	49,6
2	TRA1	16106	20484	65,4	2	TR71	32687	41572	132,7
3	TRB2	13007	16542	52,8	3	TR52	49086	62429	199,3
The Specialisation Based on Employed					The Specialisation Based on Production				
	The lowest 3 Regions	Current Price	Constant Price	Avarage =100		The lowest 3 Regions	Current Price	Constant Price	Avarage =100
24	TR31	38600	49093	156,7	24	TR42	18458	23475	74,9
25	TR51	57259	72824	232,5	25	TR51	57259	72824	232,5
26	TR10	32167	40910	130,6	26	TR10	32167	40910	130,6
Industry									
The Specialisation Based on Employed					The Specialisation Based on Production				
	The lowest 3 Regions	Current Price	Constant Price	Avarage =100		The lowest 3 Regions	Current Price	Constant Price	Avarage =100
1	TR41	78625	99997	98,6	1	TR21	77629	98731	97,3
2	TR21	77629	98731	97,3	2	TR42	106408	135332	133,4
3	TR10	88983	113171	111,5	3	TR41	78625	99997	98,6
The Specialisation Based on Employed					The Specialisation Based on Production				
	The lowest 3 Regions	Current Price	Constant Price	Avarage =100		The lowest 3 Regions	Current Price	Constant Price	Avarage =100
24	TR61	78563	99918	98,5	24	TRA1	77883	99053	97,6
25	TRA2	28565	36329	35,8	25	TR61	78563	99918	98,5
26	TRA1	77883	99053	97,6	26	TRA2	28565	36329	35,8
Services									
The Specialisation Based on Employed					The Specialisation Based on Production				
	The lowest 3 Regions	Current Price	Constant Price	Avarage =100		The lowest 3 Regions	Current Price	Constant Price	Avarage =100
1	TR51	89099	113319	107,5	1	TR61	77547	98627	93,6
2	TR10	119916	152512	144,7	2	TR10	119916	152512	144,7
3	TR31	74662	94957	90,1	3	TR51	89099	113319	107,5
The Specialisation Based on Employed					The Specialisation Based on Production				
	The lowest 3 Regions	Current Price	Constant Price	Avarage =100		The lowest 3 Regions	Current Price	Constant Price	Avarage =100
24	TRA1	78388	99695	94,6	24	TR42	87214	110921	105,2
25	TRB2	63583	80867	76,7	25	TR33	57648	73318	69,5
26	TRA2	63930	81308	77,1	26	TR21	66258	84268	79,9

(**TRA1**) Erzurum, Erzincan, Bayburt; (**TRA2**) Ağrı, Kars, Iğdır, Ardahan; (**TRB2**) Van, Muş, Bitlis, Hakkari; (**TR31**) İzmir; (**TR51**) Ankara; (**TR10**) İstanbul; (**TR41**) Bursa, Eskişehir, Bilecik; (**TR21**) Tekirdağ, Edirne, Kırklareli; (**TR61**) Antalya, Isparta, Burdur; (**TR33**) Manisa, Afyon, Kütahya, Uşak; (**TR42**) Kocaeli, Sakarya, Düzce, Bolu, Yalova; (**TR71**) Kırıkkale, Aksaray, Niğde, Nevşehir, Kırşehir.

Correlation analysis was performed at the last stage and the findings are presented in table 4.

Table 4. Correlation Matrix for LQs

			Agriculture		Industry		Services	
			Employed	Production	Employed	Production	Employed	Production
Agr.	Emp.	Pearson	1	-0,446	-0,774	xxx	-0,840	***
		Spearman	1	-0,519	-0,844	xxx	-0,775	***
		Kendall	1	-0,427	-0,668	xxx	-0,604	***
	Prod.	Pearson	-0,446	1	xxx	-0,583	xxx	***
		Spearman	-0,519	1	xxx	-0,582	xxx	***
		Kendall	-0,427	1	xxx	-0,407	xxx	***
Ind.	Emp.	Pearson	-0,774	xxx	1	0,870	***	xxx
		Spearman	-0,844	xxx	1	0,875	0,392	xxx
		Kendall	-0,668	xxx	1	0,695	0,271	xxx
	Prod.	Pearson	xxx	-0,583	0,870	1	xxx	-0,668
		Spearman	xxx	-0,582	0,875	1	xxx	-0,629
		Kendall	xxx	-0,407	0,695	1	xxx	-0,458
Serv.	Emp.	Pearson	-0,840	xxx	-0,840	xxx	1	0,414
		Spearman	-0,775	xxx	-0,775	xxx	1	***
		Kendall	-0,604	xxx	-0,604	xxx	1	***
	Prod.	Pearson	-0,840	***	xxx	-0,668	0,414	1
		Spearman	-0,775	***	xxx	-0,629	***	1
		Kendall	-0,604	***	xxx	-0,458	***	1

* No significant; xxx No analysed.

Discussion and Conclusion

Dualism, which was used to describe the coexistence of traditional and modern economies that began in Western Europe with the industrial revolution and became widespread in low-middle-income countries since the 1950s, has moved to a different dimension. In low- and middle-income countries, which still have the transitional stage of transition beyond the industrial sector, the agriculture sector still has considerable weight in economy and employment, as opposed to the informal information societies where the share of agriculture in the employment and production sector is below 5%. On the contrary, the production structure has largely exceeded the traditional subsistence of the closed family economy, but has not spread to the national scale. In 2014, in Turkey while the share of agriculture is 7.5% in production, it is 21.1% in employment.

In the Atkinson index analysis, the most unbalanced distribution in productivity was identified as the agricultural sector. Compared to agriculture-industry, the loss of social welfare in agriculture is three times more than industrial loss. The soil fertility is very important due to the structure of agricultural production. However, if market-based production is dominant in agricultural production as well as in industrial production in each region, there should be no such great difference. As a result, techniques such as mechanization and fertilization prevent over-diversification of productivity. Otherwise, the employee tends to work in other sectors. Because agricultural production is not made for subsistence like industrial production, but for the market. Making the production for the market is a prerequisite for being in the capitalist process. Therefore, there should be no serious deviation in productivity.

According to sectoral employment, the only sector in which sectoral productivity is at a very low level is agriculture. However, there is no such situation in other sectors. Even in most regions, there is productivity above the sectoral productivity averages in the country. This supports the continued existence of the family closed economy in

Turkey. Ağrı, Kars, Iğdır, Ardahan which constitute TRA2 region; Van, Muş, Bitlis, Hakkari which constitute TRB2 region; Erzurum, Erzincan and Bayburt which constitute TRA1 region are provinces with this feature. In spite of the concentration of employment in agriculture, productivity levels reach only half of the country average.

When examining the relationship between regional Specializations, there is a negative relationship between regional Specializations in the agricultural sector and regional Specializations in the industry and services sectors. This finding also supports the dualism. In fact, this structure can be defined as a neo-dualist structure. Eventually, agriculture sector partially preserves the traditional structure, the subsistence closed family economy partly still exists. There is a fuzzy structure in the agriculture between traditional and modern economy.

According to regional accumulation in sectoral production, in the case of increase in regional accumulation in the industrial sector, accumulation decreases both in agriculture and in services sector. The negative relationship between industry and agriculture also supports regional accumulation in relation to regional accumulation. However, the existence of a negative relationship between regional accumulation and regional accumulation in the services sector is due to the balanced distribution of almost all of the country in the service sector. Service delivery, purchasing, investments and supports of public sector are especially determiner for this.

Only in the industrial sector, the relation between regional Specialization according to sectoral employment and regional accumulation according to sectoral production is statistically significant, positive and high. In the Atkinson index results, industrial sector is the sector in which regional productivity difference is lowest. Due to the high capital utilization for the industry, the existence of similar labor-capital weight in the industrial sector is supported throughout the country.

In the agricultural sector there is a statistically significant moderate and negative relationship between regional Specializations of employment and production. Because of the obstacles to productivity comparison, TRA2 region (Ağrı, Kars, Iğdır, Ardahan), which is at the highest level both in employment-based regional Specialization as well as in production-based regional accumulation, is left out of evaluation. In this case, the two regions, which are at the highest level of regional Specialization based on employment and production, are different. Therefore, productivity levels in agriculture can be compared. Accordingly, the second and the third ranks in the regional Specialization based on employment, TRA1 region (Erzurum, Erzincan, Bayburt) and TRB2 region (Van, Muş, Bitlis, Hakkari) have a rate of 65.4 and 52.8%% of Turkey average, respectively. In contrast, productivity in agriculture are far higher than Turkey average with values of 132.7% and 199.3% in TR71 (Kırıkkale, Aksaray, Niğde, Nevşehir, Kırşehir) and TR52 (Konya, Karaman) regions which have the second and third rank regional accumulation in production. This also supports neo-dualism in agriculture.

A statistically significant, positive and low level of relationship was found between the regional Specialization of employment and production in the service sector. This is the expected result when considering regional Specialization occurs in only one region (Ankara) and is based on only employment. Because there is a distribution which is not regional, highly balanced in the whole country and without Specialization/accumulation.