THE EXTENT OF AGGLOMERATION IN TURKISH MANUFACTURING INDUSTRIES:1980-2001

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ABSTRACT

This paper investigates the phenomenon of agglomeration in Turkish manufacturing industries; which by definition takes both industrial and geographical concentration into consideration. For this purpose Ellison and Glaeser index (E-G) of agglomeration is used (Ellison & Glaeser, 1997). After examining the results from the index, the E-G index is decomposed to its components in order to identify any similarities or patterns between different types of industries and also to understand the main factor behind the change in agglomeration patterns over time.

Keywords: Agglomeration, Ellison and Glaeser Index, Turkish Manufacturing Industry.

TÜRK İMALAT SANAYİNDE YIĞILMANIN DERECESİ:

1980-2001

ÖZET

Bu makale, Türk imalat sanayinde yığılma olgusunu araştırmaktadır. Yığılma, tanımı gereği hem endüstriyel hem de coğrafi yoğunlaşmayı konu almaktadır. Bu amaçla Ellison ve Glaeser tarafından, yığılmayı tespit etmek üzere üretilen E-G endeksi kullanılmıştır (Ellison & Glaeser, 1997). Endeksten elde edilen sonuçlar incelendikten sonra, söz konusu endeks, farklı tiplerdeki endüstriler arasındaki benzerlik ve farklılıkları görebilmek ve aynı zamanda endekste zaman içinde meydana gelen değişimlerin arkasında yatan temel nedeni inceleyebilmek için unsurlarına ayrılarak da incelenmiştir.

Anahtar Kelimeler: Kümelenme, Ellison ve Glaeser Endeksi, Türk İmalat Sanayi.

1. Introduction

Agglomeration is defined as geographic and industrial clustering of firms in economics literature. Early studies usually focused on industrial concentration side of the story. More recent studies proved the point that spatial characteristics are equally important. Agglomeration became a widely discussed topic especially with Krugman (1979b) and examined in various ways.

Prior empirical research mainly focused either on Europe or U.S. The evidence on developing countries, on the other hand, is quite limited. Research on Europe, largely investigated the concentration and/or agglomeration patterns, cross country patterns and/or compare one or several countries with EU. Studies for U.S on the other hand investigated within country patterns for specialization and/or agglomeration on state and regional levels. Both branches of studies use descriptive methods first to identify the extent of specialization or agglomeration for a country/region. Some studies expanded the investigation further and use regressions to identify the determinants of specialization/agglomeration via identifying which theory best explain the current pattern in investigated country/region.

The main purpose of this paper is to investigate whether or not Turkish manufacturing industries are agglomerated. And if there is evidence on agglomeration, is there an underlying pattern. It is hoped that this study will help to broad our understanding of the structure and the agglomeration phenomenon in Turkish manufacturing industries.

It should once more be mentioned that prior research mostly investigated agglomeration in developed countries. Therefore it is important to examine agglomeration for Turkey. The Turkish case might help to extent the research on agglomeration to the developing countries area.

This study differs from previous work on several accounts. First of all in this study, an agglomeration index is used rather than proxies. Further as mentioned above this study examines agglomeration phenomenon in a developing country. And finally, it is one of the first attempts to use the Ellison and Glaeser (1997) agglomeration index (E-G index) for Turkish manufacturing industries using a wide and detailed data set. Furthermore, it is the first to provide a decomposition of the E-G index for further analysis.

2. Empirical Background

There are several measures used in empirical studies to investigate geographical and industrial concentration within and across countries/regions, such as Gini index, Herfindahl index, Krugman specialization index, dissimilarity index and the location quotient. These measures of concentration of geographic and industrial activities are the most widely used measures in empirical studies of locational activity.

The Herfindahl index is a measure of industrial concentration. Its main advantage is the computational simplicity. On the other hand Herfindahl index does not take the areas of the region into account, it assumes they all have same sizes and it is also sensitive to the number of firms in each industry (Bieri, 2006).

The dissimilarity index, Gini coefficient and the location quotient on the other hand, investigate either regional specialization or industrial concentration. The Krugman specialization index, compares two regions and identifies how specialized or despecialized these regions are. To find out if there is agglomeration; by definition we need to investigate regional specialization and industrial concentration. Therefore in this study the E-G index is used. The E-G index; uses a measure of geographic concentration (G) and also the Herfindahl index as a measure of industrial concentration. Hence the E-G index can be classified as a measure of agglomeration. Agglomeration measures take a firm's decision of location choice into account. If the index takes the value of zero, it means a firm's location choice is completely random; as "throwing darts on a map". According to Ellison & Glaeser (1997) a value of zero shows a "complete lack of agglomerative forces". These forces are defined as natural advantages and technological or informational spillovers. Unfortunately E-G index can only indicate the presence of the agglomerative forces; it does not distinguish between the two types of agglomerative forces.

One of the most common tools used in descriptive studies is the Gini index. Krugman (1991a) used the Gini index for US manufacturing industries with 3-digit data. He found, as opposed to the expectations, that traditional industries such as textile are the most concentrated industries in U.S. Such results seem surprising because high tech industries are expected to be highly concentrated in a geographic sense in order to benefit from informational spillovers as well as other types of externalities. The Gini index however can only capture one side of the story; either industrial concentration or geographical concentration. Therefore it is worthwhile to investigate whether this finding also holds when the subject of concern is agglomeration; capturing both industrial and geographical aspects of the issue. Furthermore it might also be interesting to see if this finding again holds for a developing country, in this case Turkey. And if it does, can this be seen as a similarity between developed and developing countries, i.e. if it is possible to generalize.

Brülhart (1998a) used the Gini index for 12 EU countries[1] for a ten year period; 1980-1990. He also used the OECD's technology classification and a centrality measure to examined if manufacturing firms choose to locate in the centre or the periphery. Results indicated that industrial specialization in EU has increased in the 1980s. Furthermore he found that labour intensive sectors have the strongest trend towards localization; however these industries are concentrated in the periphery rather than the core.

As mentioned above, the Gini index can be used either to investigate industrial concentration or geographical concentration. When the question in mind is industrial concentration as in Brülhart (1998a) then Gini index is a proper tool for investigation. However, the Gini index cannot be used to investigate the degree of agglomeration.

Using the technology classification for the manufacturing firms is quite useful for revealing any patterns or dissimilarities between sectors and the centrality measure is also fairly important to capture the geographic dimension which is left out by using

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[1] These 12 countries include;Belgium, Netherlands, Germany, UK, France, Luxembourg, Italy, Denmark, Ireland, Spain, Portugal and Greece.

the Gini index.

Dominics et al. (2007) used the Location Quotient (LQ index) on a data set covering the 1991-2001 period for Italy. The data they used covers 2-digit sector levels for 24 manufacturing and 17 service industries. They differed from other studies by also analysing the service sector in their study. They calculated the LQ index, following Kim (1995), and found that in the period covered concentration has substantially declined in the manufacturing industries while increased in service industries. Consistent with Krugman (1991a) they found that in Italy, the most concentrated sectors belonged to the traditional group rather than high-tech industries.

The LQ index is useful when it comes to identifying the driving industries in specific regions; however, this index only reveals information on regional specialization. Hence a similar case emerges when the Gini index or the LQ index is used to investigate agglomeration rather than industrial or geographical concentration; the results will be biased. This simply occurs because both indexes are designed to acknowledge only one side of the story; as mentioned above. When agglomeration is investigated, the researchers interest is on both industrial and spatial characteristics hence both Gini and LQ indexes cannot be considered a proper tool to investigate agglomeration.

Aiginger & Pfaffermayr (2004) investigated specialization for the EU. They used 1985-1998 3-digit NACE data for 14 member countries. They investigated the shares of manufacturing industries' employment and applied non-parametric sign tests to examine whether the increases or decreases in these shares are random. Their findings indicated that the three largest countries in their data set faced decreasing shares between 1992 and 1998. Furthermore, they concluded that Europe is not following, in other words does not have similar patterns with the US in regional concentration. They performed a descriptive analysis using the shares of industries' employment, however intuitive can be misleading for both specialization and agglomeration issues. An industry with low employment shares can still be considered as concentrated when the shares of those industries are compared with other regions. Or an industry with high shares of employment cannot always be considered as concentrated in terms of both industrial and spatial characteristics. Hence, to investigate the issue of specialization an index and ranking industries according to that index seems necessary.

Aiginger & Davis (2004), also investigated 14 EU countries with 3-digit industry level data for the years between 1985 and 1998 using the entropy index. They investigated regional and industrial concentration separately and then examined the relationship between the two. The authors found that over time industries became less geographically concentrated. From this result they concluded that greater degrees of industrial concentration do not always mean greater degrees of geographical concentration. This study is important to show that regional and industrial concentration can follow different patterns and are not "two sides of the same coin". Furthermore, such study highlights the importance of an agglomeration index without using one. The authors choose to use the entropy index because entropy index makes it possible to see the relationship between changes in individual industries and aggregate change. Furthermore it uses complete distribution of industry shares; hence it does not focus on the largest shares like the Herfindahl index.

Some studies used several measures of concentration and compare the results to see how correlated they are and also to obtain sensitivity check in a sense.

Alonso-Villar et al. (2004) examined the extent of geographical concentration in Spanish manufacturing industry for years between 1993 and 1999. They used mainly the Maurel and Seddilot index (M-S) [2] however they also compared the results from M-S index with E-G and Gini indexes. With this descriptive study they found that firms are independent in location choice and also consistent with Krugman (1991a) they found that traditional industries show high degrees of agglomeration when compared to high-tech industries. In this study authors chose to use indexes to measure agglomeration such as M-S index and E-G index; however the results in this study are interpreted as geographical concentration.

Devereux et al. (1999) offered a quite detailed and revealing analysis. They start with investigating geographical concentration, agglomeration and co-agglomeration in UK manufacturing at 4-digit level for 1992 using several indexes. They used the E-G index, M-S index an alternative agglomeration measure based on industrial and geographic concentration, Gini index and co-agglomeration measures. They also investigated the strengths and weaknesses of those indexes and also examined correlations between indexes used. Furthermore, they investigated the effects of entry and exit by calculating the agglomeration measures only on entrants and examined what percentage of entrants locate in already agglomerated regions. The authors compared results from indexes they used with prior studies from France and US. Their findings indicated that agglomeration patterns for UK remained fairly stable over the 1985-1992 period and their results are again consistent with Krugman (1991a) indicating most agglomerated industries tend to belong to the older and relatively low-tech industries.

Finally there are also a number of descriptive studies using the E-G index to investigate agglomeration patterns. Bertinelli & Decrop (2005) used the E-G index to examine the agglomeration patterns in Belgium using firm level data for years between 1997 and 2000. They found that in Belgium traditional sectors, such as textiles, are highly agglomerated. They also compared their findings with other European countries such as the UK and France and also the US and found consistent results from E-G indexes from these countries.

3. Some Stylized Facts About Agglomeration

4. *It is possible to make some generalizations that arise from the previous literature regarding agglomeration.*

i. Krugman (1991a) found that for US manufacturing industries, traditional industries such as textile are the most geographically concentrated industries. There are also supporting evidence to such result from European based studies. Brülhart (1998b) found that labour intensive sectors show a strong trend towards geographical concentration; however he found that these industries are usually localized in the periphery rather than core. Similarly Dominics et al.

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[2] A similar index to the E-G index of agglomeration. For detailed information see (Maurel & Sedillot, 1999).

(2007) find consistent results with Krugman (1991) for Italy, Devereux et al. (1999) for UK and also Bertinelli and Decrop (2005) for Belgium.

ii. Industrial concentration and geographical concentration are different from each other and do not necessarily follow similar trends (Aiginger & Davis, 2004).

iii. Empirical literature reviewed in the previous section indicates that there is an increasing trend in agglomeration for US manufacturing industries. On the other hand, Europe follows a different trend than US; evidence suggest that Europe is facing increasing degrees of industrial concentration but decreasing degrees of geographical concentration; again indicating that industrial concentration and geographical specialization are not the "two sides of the same coin".

4. Data and Methodology

In this paper data covering 1980-2001 period providing information on Turkish manufacturing industries are used. Annual Manufacturing Statistics are obtained from the Turkish Statistical Institute provide information on; number of firms, number of workers, number of workers on payroll, payments to workers on payroll, total hours worked, changes in stocks, changes in fixed capital, value of inputs, value of outputs, value added, total income, total labour cost, Herfindahl index. Data is available on 2 and 4-digit and are industry level and 4-digit data is used for a comprehensive analysis. Data end at year 2001, because data for post 2001 period is not compatible with pre 2001 data because of major changes in data collection procedures. Further there is no regional data available after 2001. 1980-2001 data are provided on city level and aggregated to form regional level data by the author. Regions used are purely geographical.

The Ellison and Glaeser Index (E-G)[3]

$$\gamma_i = \frac{G - (1 - \sum_j s_i{}^2)H}{(1 - \sum_j s_i{}^2)(1 - H)}$$

$$\gamma_i = \frac{\sum_{j=1}(s_{ij}{}^s - s_i)^2 - (1 - \sum_j s_i{}^2)H}{(1 - \sum_j s_i{}^2)(1 - H)} \qquad \text{where } j=1,\dots,m \text{ and } i=1,\dots,n$$

where, *s* denotes shares, *j* indicates regions, *i* indicates industries and *H* is the Herfindahl index.

$E(\gamma)=0$ if the data are generated by the simple dartboard model of random location choices with no natural advantages or industry specific spillovers.

$\gamma=0$ indicates a random location choice

$\gamma>0.05$ indicates high level of agglomeration,

$0.02<\gamma<0.05$ indicates medium level of agglomeration,

$\gamma<0.02$ indicates low level of agglomeration and

$\gamma<0$ indicates dispersion of economic activity

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[3] Ellison and Glaeser (1997).

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In this paper the main index used is the E-G index, however Gini index for specialization and concentration and the LQ indexes are also calculated and the correlations between the indexes and their distributions are presented in Table 1.

Table 1: Correlations Between The Indexes

	E-G	Gini (sp.)	Gini (con.)	LQ	Herfindahl
E-G	1.0000				
Gini (sp.)	0.0281	1.0000			
	(0.0952)				
Gini (con.)	0.1076	0.0886	1.0000		
	(0.0064)	(0.0843)			
LQ	-0.0264	-0.0307	0.0560	1.0000	
	(-0.1071)	(0.0792)	(0.0238)		
Herfindahl	-0.5298	0.0221	-0.0178	0.0110	1.0000
	(-0.0002)	(0.1529)	(-0.235)	(0.6173)	

Calculated by the author
Numbers in parentheses are standard errors.

It is clear from Table 1 that the E-G index is not highly correlated with other indexes. This result implies that the E-G index cannot easily be replaced by other indexes, except the Herfindahl index. However such negative correlation between E-G index and the Herfindahl index is not surprising since the Herfindahl index is already used in the E-G index. As mentioned before the Gini index, LQ index and the Herfindahl indexes are widely used in the economics literature and they are perfect tools if the aim is to investigate the geographical or industrial concentration. However, in case of agglomeration it is essential that the index should include both factors.

Hence it is argued here that the E-G index is the most suitable one for such purpose. However, it should be kept in mind that this proposition does not imply that the E-G index is the best or the most significant index of them all.

Finally, this paper also provides information on decomposition of the E-G index into its components in order to identify and differentiate the effects from geographical specialization and industrial concentration on the change of E-G index.

5. Results

5.1. General Results

Ellison and Glaeser index is used to identify the extent of agglomeration in

Turkish manufacturing industries for the period 1980-2001. Since E-G index only indicates the level of agglomeration in a specific region and cannot be used to identify which industry is the main driving force behind this agglomeration, LQ index is also used for further investigation. Furthermore, OECD's classification of industries based on technology (OECD, 2006) is used to investigate the patterns of regional specialization among industries which differ on a technological basis. Finally, the composition of the E-G index is also examined to see the underlying patterns of agglomeration.

Tables 2a through 2d present descriptive statistics of the E-G index for high tech, medium-high tech, medium-low tech and low tech industries.

Table 2a: Descriptive Statistics For High-Tech Industries

	Mean	Std. deviation	Min.	Max.
1980	0.2308	0.4137	0.1942	0.2845
2000	0.1473	0.2156	-0.108	0.4
change[4]	-0.8348	0.1792	-0.3108	0.1164

Table 2b: Descriptive Statistics For Medium-High Tech Industries

	Mean	Std. deviation	Min.	Max.
1980	0.2263	0.1101	-0.101	0.3772
2000	0.2403	0.2192	-0.1826	0.453
change	0.0048	0.2622	-0.5599	0.3489

Table 2c: Descriptive Statistics For Medium-Low Tech Industries

	Mean	Std. deviation	Min.	Max.
1980	0.2033	0.3011	-0.6022	0.4348
2000	0.2232	0.2101	-0.2030	0.4944
change	-0.1277	0.2276	-0.5545	0.4021

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[4] Here, change referrers to the descriptive statistics for the annual change of the E-G index, not the difference between the years 1980 and 2000.

Table 2d: Descriptive Statistics For Low-Tech Industries

	Mean	Std. deviation	Min.	Max.
1980	0.3073	0.0976	-0.0565	0.5092
2000	0.1815	0.5178	-2.1919	0.7015
change	-0.132	0.4717	-2.2484	0.373

Tables 2a through 2d indicate the most agglomerated industries in Turkish manufacturing belong in the low tech group in 1980. However throughout the investigated period low tech industries faced a serious de-agglomeration process. It is clear from the tables that low tech and high tech industries faced decreasing degrees of agglomeration when the means from 1980 and 2000 are compared. This observation can indicate a similarity between low and high tech industries however in order to say more about similarities between different groups of industries a further analysis will be necessary. Although there is a decrease in the mean of the E-G index the highest agglomeration levels are still observed in the low tech group, consistent with Krugman (1991a). Apart from comparing the means, comparing the standard deviations of the E-G index presented in tables 2a through 2d can reveal some information. The standard deviation of E-G index is quite low in high-tech industries and relatively high in medium high and medium low tech industries and the highest for low tech ones, meaning the highest deviation from the mean occurs in the low tech group. The similarity between the high tech and low tech industries in terms of decreasing degrees of agglomeration is interesting. This result brings to mind the direct implication of similar factors affecting both low and high tech industry groups. Such implication can be tested via the decomposition of the index. Decreasing degrees of agglomeration suggests that firms in Turkish manufacturing industries do not wish to locate in highly agglomerated regions. Locating in the periphery seems to be the choice of firms in high and low tech industries. Especially for high tech industries this means that firms would not be able to take advantage of technological or informational spillovers. Another possible outcome for both type of industries is that transportation costs will increase, as a result of locating away from the centre.

Detailed results for the E-G index, are not presented in terms of space issues[5], indicate that in 1980; 78 out of 86 industries show high degrees of agglomeration. However in 2000; 66 out of 86 industries show high degrees of agglomeration. Throughout 1980 to 2000, 36 industries have faced increasing degrees of agglomeration. Only 3 industries have moved from dispersion to high degree of agglomeration, and 11 moved from high degree of agglomeration to dispersion.

When it is further investigated considering the technological classification, in 1980; 4 out of 4 high tech industries, 20 out of 22 high-medium tech industries, 20 out of 24 medium low tech industries and 34 out of 36 low tech industries are highly agglomerated. However on 2000; 3 of the high tech industries, 16 of the high-medium

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[5] Available from the author by request.

tech industries, 19 of low-medium tech industries and 28 of the low tech industries are highly agglomerated.

5.2. Decomposition Results

It is clear that in economic crisis years, the sudden decrease in the E-G index is caused by the increased exit rates of firms, and hence effects the Herfindahl index. However, it is still worthwhile to investigate the main forces behind the change in the agglomeration index and whether there are similarities between different kinds of industries.

For this purpose a decomposition of the E-G index is necessary. It is useful to try to identify the sources of the changes in the E-G index. The main purpose of the decomposition of E-G index is to be able to identify the main source of changes in the index; are the changes caused by geographical structure, market structure or anything else?

Dumais et al. (2002) suggested a decomposition of the E-G index. However, their decomposition aimed to reveal the mean reversion and the randomness which affects the agglomeration index. Their first motivation for the decomposition was to encounter the industry mobility and to examine the importance of industry mobility as suggested by Krugman (1991b). The second motivation for such a decomposition of the index was to examine the effects of new firm birth on geographical concentration. And finally, they are also motivated by the rather stable geographic concentration trend in the US for a long time period and tryed to examine whether this effect is caused by firms being immobile and/or tend to locate in the same region with old firms. They found that, except for the textile industry, firms are mobile and the equilibrium state of the geographic concentration is happening despite the fact that most firms are mobile and interpret this result as a strong evidence for agglomeration mostly being affected by industrial characteristics rather than geographic ones. However, they still argued that historical accidents are important in geographical concentration and have long lasting effects.

The motivation of this paper, is to examine whether or not there are similarities between different industry characteristics and also to investigate which factors are responsible for the change in the E-G index. Dumais et al. (2002), used a proxy for the E-G index when decomposing. They ignore the term $(1-H_t)$ from the equation, however, they argued that this changed version of the index to be decomposed is still a good proxy for the original E-G index. However in this study, it is vital to keep using the same index and decompose this index to its components to identify the source of the change.

In contrast to the USA, there is a declining trend in agglomeration in Turkish manufacturing industries over the 1980-2001 period. Furthermore considering the finding from Dumais et al. (2002) that textile industries being immobile can have quite important inferences for Turkish manufacturing industry since textile is one of the dominating sectors in Turkish economy and has clusters in most regions. Decomposing the E-G index into its determinants not only reveals the main source of change in the index but can also reveal an underlying trend for the dynamics of the agglomeration

process. As a result, it is important to understand the components of the E-G index. For this purpose following Dietrich (2010) and applying his decomposition to the case of agglomeration the E-G index is decomposed to its determinants as follows:

$$\gamma_{it} = \frac{G_{it}}{(1-X_{it})(1-H_{it})} - \frac{H_{it}}{(1-H_{it})} \tag{1}$$

Equation (1) is the E-G index used, and can also be written as follows:

$$\gamma_{it} = \frac{1}{A_{it}} \cdot G_{it} - M_{it} \tag{2}$$

Where;

$$M_{it} = \frac{H_t}{(1-H_{it})} \quad \text{and} \quad A_t = (1 - \sum X_{it})(1 - H_{it})$$

$$\gamma_{it-1} = \frac{1}{A_{it-1}} \cdot G_{it-1} - M_{it-1} \tag{3}$$

Subtracting equation (3) from equation (2) yields:

$$\Delta\gamma = \frac{1}{A_{it}} \cdot \Delta G - \Delta M - \frac{G_{it-1}}{(A_{it})(A_{it-1})} \cdot \Delta A \tag{4}$$

It is also possible to write equation (4) as follows;

$$\Delta\gamma = a. \Delta G - \Delta M - b. \Delta A \tag{5}$$

Where;

$$a = \frac{1}{A_{it}}, b = \frac{G_{it-1}}{(A_{it})(A_{it-1})} \tag{6}$$

With this decomposition, it is now possible to identify the sources of the changes in E-G index. Here, G is the concentration index as used in the E-G index. M represents the market structure, by weighting the Herfindahl index. The Herfindahl index, takes a value between zero and one, however M can take any value greater than zero. Finally, A can be seen as a residual. Since agglomeration can be sourced by either geographical concentration or industrial concentration, this decomposition will allow us to see which factor is actually causing the change in the agglomeration index. To perform the decomposition, the industries are grouped according to their technology levels again using the OECD classification as high, medium-high, medium-low and low technology. Change in the E-G index is grouped as big and negative, negative, no change, positive and big and positive. The correlations between change in the E-G index, change in geographical concentration, change in market structure and change in the residual are calculated. Table 3 shows the main forces behind the change in the E-G index throughout the 1980-2001 period.

Table 3: Decomposition Results

Technology classification	Change in the EG index				
	Big and negative	negative	No change	positive	Big and positive
1 (high tech)	M	G, M	G, M	G	M
2 (medium- high tech)	M	G, M	G, M	G, M	M
3 (medium-low tech)	M	G, M	G, M	G, M	M
4 (low tech)	M	G, M	G, M	G	M

The results of the decomposition presented in table 3 can be summarized as follows: when there is a big and negative change in the E-G index, i.e. a significant decrease in agglomeration, the driving force behind this change is market structure in all technology groups. Similarly, when there is a big and positive change in the E-G index, i.e. a significant increase in agglomeration, the driving force is again the market structure in all technology groups. However, when there is a small positive change in the E-G index, the driving force behind this change is the concentration index in high technology industries, representing geographical concentration. Also, when there is a small and positive change in the E-G index, the driving force is again the geographic element of the E-G index in low technology industries. When the change is small and negative or when there is no change in the E-G index the driving force behind the change is both market and spatial characteristics. As a result, it is possible to explain the rising agglomeration behind the high and low technology industries with geographical concentration. However, the reason behind the extreme changes in agglomeration for all technology groups is the market structure. Furthermore, it is possible to say that there is a similar underlying pattern of agglomeration in Turkish manufacturing industries. In high and low tech industries, the rising geographical concentration dominates the agglomeration patterns. In high tech industries, technology and availability of this technology in certain regions, dominates the agglomeration patterns. In low tech industries, availability of raw materials, historical path dependencies; like carpet and rug industry for Southeast Anatolia determines agglomeration. For medium-high and medium-low tech industries, mostly market structure dominates the agglomeration patterns via externalities. It is possible to say that mostly industrial characteristics dominates the change in the E-G index and this result is consistent with the Dumais et al. (2002) decomposition results. The main and important difference is that; low and high tech industries have similar patterns and in these industries big changes are caused by industrial characteristics however; small and positive changes are caused form geographical concentration and this suggests that; as opposed to Dumais et al. (2002) textile sector in Turkish manufacturing industry is not immobile. And mobility of the

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sectors is an important factor for changing agglomeration levels in Turkey.

6. Summary and Conclusion

The findings of this paper indicate that there is a decreasing trend in agglomeration throughout the period covered in Turkish manufacturing industries. However, it is clear that consistent with the stylized fact that low tech industries tend to be more agglomerated than the high tech ones also holds for Turkish manufacturing industries. Further, evidence suggests that there are also increasing degrees of agglomeration in some medium-high tech and high tech industries as well. Investigating agglomeration for different technology groups indicates that there is a similar pattern between low tech and high tech groups. Further investigation of the issue via decomposition of the index also supports this finding. According to the results, small changes in agglomeration for low tech and high tech groups result from changes in geographical concentration. On the other hand big changes in the E-G index, in other words, shocks, are usually caused by the changes in industrial concentration. This result also implies that as suggested by Alonso-Villar et al. (2004) industrial concentration and geographical specialization do not always follow the same trend and are different phenomena that are affected by different factors. The underlying reason of the decreasing degrees of agglomeration in Turkish manufacturing industries is an interesting topic for further investigation. Further, the effects of the decreasing degrees of agglomeration on productivity should also be further investigated.

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