The University Of Sheffield.

Access to Electronic Thesis

Author: Selcen Turanli

Thesis title: Agglomeration Patterns in Turkish Manufacturing Industries

Qualification: PhD

AGGLOMERATION PATTERNS IN TURKISH MANUFACTURING INDUSTRIES

Selcen TURANLI

A thesis submitted to the University of Sheffield for the Degree of Doctor of Philosophy in the Department of Economics

Date Submitted: January 2012

ABSTRACT

The main purpose of this thesis is to examine the agglomeration phenomenon in Turkish manufacturing industries in depth. Chapter 1 presents an overall discussion of the thesis. Chapter 2; examines the theoretical background of the agglomeration phenomenon, while the structure of Turkish manufacturing sector is examined in Chapter 3.

Chapter 4 investigates the degree of agglomeration in Turkish manufacturing industries. For this purpose, several specialization and concentration indexes are examined and also calculated, however the Ellison and Glaeser index of agglomeration is used throughout this thesis, for reasons described in chapter 4. The results from the Ellison and Glaeser index indicate a declining trend in agglomeration for Turkish manufacturing industries.

After investigating the degree of agglomeration, the main theory that describes agglomeration in Turkish manufacturing industries is also investigated in Chapter 5. For this purpose several econometric methods are employed and the results indicate that the Ricardian model of technological differences is the main theory that explains agglomeration patterns in Turkish manufacturing industries.

Chapter 6 investigates the relationship between agglomeration and entry-exit. For such investigation a dynamic model, count data models and seemingly unrelated regression techniques are employed. The results from chapter 6 indicate that firms in Turkish manufacturing industries do not want to locate in agglomerated regions.

Chapter 7 investigates the relationship between Total Factor Productivity (TFP) and agglomeration. For such analysis, fixed effect method and dynamic estimation methodologies are employed. The results indicate that firms that are located in agglomerated regions in Turkish manufacturing industries face decreasing productivity levels.

Finally chapter 8 presents an overall conclusion for the thesis.

ACKNOWLEDGEMENTS

First of all I would like to thank Michael Dietrich for his encouragement, guidance and patience throughout this process. I would also like to thank Jonathan Perraton and Peter Wright for their useful comments and precious time. Furthermore I would like to thank the Department of Economics and especially to Steven McIntosh for their interest and help.

I would also like to thank my parents for their constant support, love and understanding. Furthermore I would like to thank Dilek Kilic, who share this whole experience with me and who made this though road a lot easier with her constant support and solid friendship. Furthermore, I thank Dilek for helping me at each stage of my thesis, for the patience she showed while reading this thesis over and over again and of course for the useful comments. I would also like to thank Onur Yeni who never withheld his support and friendship.

Finally, last but not the least I would like to thank Melih Ozturk, who was always there with his love and patience. Thank you for making the distances diminish.

Table of Contents

LIST OF TABLES

LIST OF FIGURES

ABREVIATIONS

AFS: Average Firm Size

DSR: Dissimilarity Index

E-G: Ellison and Glaeser Index

EU: European Union

G: Measure of Geographic Concentration

GDP: Gross Domestic Product

GMM: Generalized Method of Moments

H: Herfindahl Index

H-O: Heckscher-Ohlin

IGR: Industry Growth Rate

IID: Identically and Independently Distributed

INTERM: Intermediate Goods Intensity

KLR: Capital Labour Ratio

KSI: Krugman Specialization Index

LQ: Location Quotient

MLE: Maximum Likelihood Estimation

M-S: Maurel and Seddilot Index

NEG: New Economic Geography

NTT: New Trade Theories

OECD: Organisation for Economic Co-operation and Development

OLS: Ordinary Least Squares

OPEC: Organisation of the Petroleum Exporting Countries

PROD: Labour Productivity

R&D: Research and Development

SFA: Stochastic Frontier Analysis

SPO: State Planning Organisation

SUR: Seemingly Unrelated Regression

TC: Technical Change

TE: Technical Efficiency

TECDIF: Technological Differences

TFP: Total Factor Productivity

U.K: United Kingdom

U.S: United States

VA: Value Added

VAR: Vector Autoregressive Regression

VCE: Variance Covariance Estimator

CHAPTER 1: INTRODUCTION

Specialization has become an important topic in the economics literature for decades. All trade theories have been examining specialization in the context of international trade.

Traditional trade theory, assuming perfect competition, homogenous products and non-increasing returns to scale, suggests that technological differences, natural resource and factor endowments explain and determine specialization patterns (Brulhart, 1998). According to the traditional theory, the spatial characteristics affect and determine the patterns of trade, but they do not have any effect on the location choice (Brulhart, 2001).

New trade theories (NTT) and new economic geography models (NEG), however, questioned the assumptions of the traditional trade theory. Changing the assumptions, of course, led to essential changes in the foundations and consequences of the models. Advances in the theoretical framework had an important result in terms of the spatial characteristics. In contrast to traditional trade theory, NTT and NEG models suggest that location matters (Krugman, 1991a) and numerous empirical studies on the issue also supported this suggestion[1].

After the "new" theories (both NTT and NEG), the economics literature started to examine a new phenomenon: agglomeration. Agglomeration, by definition means: "the act or process of gathering into a mass". In the economics literature, agglomeration means specialization in terms of both spatial and industrial characteristics.

After showing the fact that location and distance both matter, researchers started to investigate the degree, determinants and effects of agglomeration. However, these discussions are mainly limited to the developed economies[2]. Evidence from developing economies is quite scarce.

According to Krugman (1999), agglomeration has two main sources: "first nature" and "second nature". While "first nature" is used to define natural advantages, "second

---

[1] For example see: Amiti (1999), Brulhart (1998), Krugman (1991a). Empirical literature is examined in detail in chapters 4 and 5 on this subject.

[2] For example see: Amiti (1998); Amiti (1999); (Bieri, 2006); Braunerhjelm and Borgman (2004); Brulhart (1998); Brulhart (2001); Brulhart and Torstensson (1996); Devereux et al. (1999); Venables (1996); Krugman (1979a); Krugman (1991a), Krugman (1999).

nature" indicates man-made agglomeration economies. Evidence suggests that they both matter. Hence, it is possible to say that all kinds of trade theories, both traditional and new ones, matter in terms of agglomeration. Traditional theory, while deprived of the agglomeration phenomenon, attributed specialization solely to "first nature" sources. New theories on the other hand investigated agglomeration and attributed such a phenomenon to both "first" and "second nature" sources.

The main concern while investigating agglomeration is its determinants, in this context, researchers widely investigates which trade theory explains agglomeration. Even though traditional theory, was not mentioning agglomeration, it is accepted that since agglomeration captures both kinds of specialization, traditional trade theory might also have important insights on agglomeration.

The main focus of this thesis is on agglomeration. In this respect, agglomeration is investigated in various ways throughout the thesis. As mentioned above, evidence on agglomeration is mainly from developed economies such as the U.S and the E.U member countries. This thesis, directs the attention to a developing economy instead. The issue of agglomeration is examined in the context of Turkish manufacturing industries.

The first step in examining agglomeration in Turkish manufacturing industries is to examine whether Turkish manufacturing industries are agglomerated or not. After investigating the degree and pattern of agglomeration in Turkish manufacturing industries, the attention is directed to the theoretical foundations of the phenomenon. After examining which theory best explains agglomeration patterns in Turkish manufacturing industries, the question stands is: "Why agglomeration matters?" In this thesis, the question of why agglomeration is an important phenomenon is examined in the context of industries and firms rather than workers. There is no doubt on the fact that agglomeration having important effects on workers as well. Investigating the issue in terms of firms and industries is simply a matter of choice. In order to understand the importance and various effects of agglomeration, the relationships between agglomeration and firm mobility and also productivity are investigated.

There are several contributions to the empirical literature. First, this thesis is one of the first attempts to investigate agglomeration for Turkish manufacturing industries.

Previous studies in this context are quite scarce[3]. Second, in terms of Turkish manufacturing industries, this thesis is the first to use an index of agglomeration to investigate the issue, rather than employing several proxies. Further, this study provides a decomposition of the agglomeration index used, which is new for the agglomeration literature. And finally, different empirical methodologies are employed throughout the thesis, in each chapter for a detailed and an appropriate analysis.

The remainder of this thesis is organised as follows: chapter 2 provides a theoretical background. Chapter 3 provides a detailed analysis on the structure of Turkish economy, mainly the manufacturing sector. Chapter 4 investigates the extent and patterns of agglomeration in Turkish manufacturing industries. Chapter 5 investigates the theoretical foundations of agglomeration in Turkish manufacturing industries and aims to examine which trade theory best explain agglomeration. Chapters 6 and 7 aim to answer the question why agglomeration matters as mentioned above. In particular, chapter 6 examines the effects of agglomeration on firm entry and exit behaviour in Turkish manufacturing industry. Chapter 7 focuses on the relationship between productivity and agglomeration in Turkish manufacturing industries. And finally chapter 8 provides an overall conclusion to the thesis.

[3] (Akgungor, 2003) (Filiztekin, 2002) (Coulibaly, Deichmann, & Lall, 2007)

CHAPTER 2: THEORETICAL BACKGROUND

2.1 Introduction

In order to investigate and fully understand agglomeration patterns, understanding the theoretical background and its historical evolution is essential. In this chapter theory regarding agglomeration is investigated in three branches; traditional trade theory, new trade theory and new economic geography also in the historical order to see how the theory developed over time[4].

2.2 Traditional Trade Theory

The main assumptions of classical trade theory in other words traditional trade theory can be summarized following Brülhart (1998). According to the traditional trade theory, market structure is characterised by perfect competition, homogenous products and non-increasing returns to scale. Determinants of location and therefore, specialization patterns are: technological differences, natural resource endowments and finally factor endowments and factor intensities. Trade is only assumed to be inter-industry trade and traditional theory assumes a unique equilibrium result.

Following the literature, traditional theory will be analyzed starting from Ricardo (1817). Ricardo assumes international differences in productivity of labour to be the only underlying reason for differences in production costs across countries. Therefore "comparative advantage" between countries explains patterns of trade. At its simplest, Ricardian theory assumes two countries, two goods, a single productive factor (labour) and constant returns to scale in each activity. In such a model, before trade opens the price of the goods produced is a function of output-factor ratios contained in the production functions. Assuming only one productive factor and constant returns to scale ensures a unique equilibrium in a closed economy which is not affected by demand or supply. Ricardo makes the same assumptions for both countries in the model. These assumptions ensure that the pre-trade price of the goods produced, and also the composition and patterns of trade are determined solely by international differences (Bhagwati, 1964).

Assuming production costs to be independent from the level of output and techniques of production to be independent from factor prices and the composition of output makes

[4] The trade theories mentioned in this chapter are also used in chapter 5 for the econometric analysis.

the Ricardian model a simple and useful model and isolate the effect of inter-country differences in technology. Therefore it is possible to say that in Ricardian theory, technology is treated as exogenous and hence given because of the assumptions of the model. However, the Ricardian model does not explain differences in international distribution on income, since it assumes the single factor to be mobile. Further, since labour is assumed to be the only factor of production, output prices are bound to be correlated directly to wage rates. After trade opens, competition forces countries to specialize in the production of one good that it can produce relatively more effectively. As a result, the Ricardian model assumes relative differences in technology to be the main reason for trade, on the other hand it does not rule out the role of demand (Jones & Neary, 1984). In the Ricardian framework spatial distribution of demand affects and determines the pattern of trade, but it does not affect nor determine the location of production (Brülhart, 2001).

In contrast to the Ricardian model, the Heckscher-Ohlin model assumes two factors of production and makes international differences in factor endowments, rather than differences in technology, the basis of trade and comparative advantage. With these assumptions, costs of production become endogenous and even when the same technology levels are assumed for both countries the model can still explain why trade occurs. The Heckscher-Ohlin model, assuming two factors, two goods and two countries provides an alternative explanation for trade patterns and attempts to explain the international differences in income distribution (Jones & Neary, 1984).

When examining the Heckscher-Ohlin framework, one can choose between two different definitions of factor abundance; the physical and price definitions. When the physical definition is employed, the set of assumptions for the theory can be summarized as follows:

i. Identical production functions across countries
ii. Non-reversible factor intensities
iii. Constant returns to scale
iv. Identical consumption patterns between countries at every commodity-price ratio.

Using these propositions Samuelson (1939; 1948) shows that under perfect competition in perfect markets there will be a unique equilibrium. It is also possible to demonstrate that these four propositions ensure that with identical production functions and technologies, different capital-labour ratios across countries may result in specialization in trade.

If the price definition of factor abundance is employed, the first three propositions become sufficient enough to show that the basis for trade in Heckscher-Ohlin theorem is factor abundance.

For empirical testing and verification of the Heckscher-Ohlin theory, there has been evidence accumulating on either side (Bhagwati, 1964).

The Ricardian and Heckscher-Ohlin approaches have dominated the international trade literature for quite a long time. However, there were other attempts to explain the basis of international trade as well as attempts for improving the Ricardian and Heckscher-Ohlin approaches.

Kravis (1956), attempts to explain international trade by "availability of natural resources". According to Kravis, trade in one country is made up of goods which are not available in the home market. By "unavailable" Kravis describe goods which are either unavailable in the home market in an absolute sense or goods where an increase in the output will cost higher than importing those goods. Kravis explains the reasons for this unavailability of certain goods being due to lack of natural resources, technical change, product differentiation or monopoly of production in the other country due to technical differences and imitation gaps. Kravis explains international trade patterns by focusing on what Krugman (1991a) has termed as "first nature", which means that economic activity is spread or concentrated over space due to the spread or concentration of the underlying features such as, natural resources, technologies and/or factors.

Kravis's theory, however intuitive, does not state a testable hypothesis; it only attempts to provide a logical explanation for patterns of trade. It is however important that Kravis (1956) has intuitively explained "first nature" and also implied the importance of possible imitation gaps.

Another attempt at an alternative explanation of international trade and specialization belongs to Linder (1961). Linder makes an important assumption when he distinguishes between trade in primary products and in manufacturers. Linder explains trading partners in primary products via natural resources. However, he suggests that trade in manufactures cannot be explained as being due to differences in natural resource endowments. He suggests trade in manufactures to be a function of: technological difference, managerial skills and, most importantly, economies of scale. It is quite important that Linder has assumed possible differences in economies of scale to be a reason for international trade and specialization.

Other than attempts for alternative explanations of international trade, as mentioned above there are also improvements to the existing theory.

Posner (1961) introduces the "technology-gap model". According to Posner international trade and specialization in trade was beyond technological differences or factor endowments. Posner argued that international trade and specialization patterns depend on the speed on innovations in the technologically advanced country and the speed of imitation in the other country in a two country model. In this model, the "imitation-gap" is considered as the basis for trade and specialization. Most importantly, in such modelling technology is regarded as endogenous rather than exogenous as in Ricardian model or as an endowment as in the Heckscher-Ohlin model. In this model, technology is treated as an outcome of an innovation, learning, research and imitation process and considered "man-made". This technology-gap model led to product-cycle theories suggested by Grosman and Helpman (1991a, 1991b).

According to product-cycle theory, skilled labour and capital intensive production is used in the "growing stage" of a product. After a while this production technology is imitated and the product becomes common-knowledge. At this "mature" stage low wage, less skilled labour is used in production and the product is now standardised.

Hirsch (1967) proposes an extended version of the Heckscher-Ohlin model. Hirsch suggests that factor proportions are the determining factor of the location of production over a product's life cycle. As a result, developed countries are seen as net exporters of new products at their "growing stage" when skilled labour and capital intensive production is needed. When the product is standardised and reached its "mature stage" developing countries with low wage labour force will become the net exporter of the product.

Vernon (1966) stresses the importance of demand in the process of innovation. According to Vernon new products will be produced in countries where they are needed and then will be exported to other countries. This new product will still be first produced in industrialised countries because according to Vernon new products are needed to satisfy the wants of high-income customers who are more common in developed countries.

It is clear that these models are strongly suggesting a North-South pattern in international trade as well as income disparities. However the formal model was suggested after nearly a decade by Krugman (1979a). In this model Krugman specifies two countries (North and South), two goods (old and new) and only one factor of production (labour). Assuming one factor of production ensures the factor endowments in both countries to be the same. Krugman also assumes that cost functions hence technologies in two countries to be identical as well. Therefore this model, by definition gives an alternative explanation to international trade and specialization by ruling out Ricardian and Heckscher-Ohlin type explanations. In this model the trade pattern is only determined by the North's ability to provide new goods via innovations and exporting these goods to the South. This model has four different implications for policy.

For developed countries:

i. The decline of industries will be persistent.
ii. Technical innovations become quite important for developed countries. The North "must continually innovate, not just to grow but even to maintain their real incomes".

For developing countries:

i. Technology transfer brings indirect benefits while improving terms of trade.
ii. Success in developing countries in the adoption process for new technology can leave workers in the North worse-off.

Grosman and Helpman (1991a, 1991b) also construct North-South models over product cycles. In their models the role of entrepreneurs is quite important. The North devotes resources to innovation (R&D) activities; hence the North exports products in their growing stage and the South only imitates this activity. In the growing stage of the product, the North has the monopoly power. As the South becomes better at imitation and shortens the imitation gap, the North's period of monopoly power and hence profit decreases. On the other hand, this faster imitation increases the North's incentive to innovate. Therefore; it is possible to say these models once again treat technology and innovation as endogenous; man-made.

2.3 New Trade Theories

Traditional trade theories, as mentioned above, explain trade patterns and specialization with technological differences and factor endowments. These theories, while relevant are found to be insufficient in explaining intra-industry trade. Empirical evidence showed that most of the trading activities in developed countries take the form of intra-industry trade, which can be defined as trade of goods that fall into the same industry category (Wolfmayr-Schnitzer, 2000).

To explain intra-industry trade, "new" theories are suggested. These models assume: monopolistic competition as opposed to the perfect competition assumption in traditional trade theory and hence seems more realistic. Furthermore, new trade theories explain determinants of location with increasing returns, differentiated goods and size of the home market; which is known as the "home market effect" proposed by Krugman (1991a). Similar to the traditional trade theory, new trade theories also suggest that the location of economic activity will yield a single equilibrium. Finally, new trade theories predict that large countries will benefit more than small countries, as opposed to the traditional prediction of all countries' gain (Brulhart, 1998).

Krugman (1979b) adopts a Chamberlinian approach to analyse patterns of trade and assumes increasing returns to scale. Krugman shows that, trade does not have to be a result of differences in technology or factor endowments across countries. In this paper, trade is treated as a way of extending the market and allowing for economies of scale. According to Krugman, this explanation of trade is useful to understand trade among countries that are similar in terms of technology and factor endowments and probably differ only in size. When technology and factor endowments are assumed to be identical across countries, the presence of transport costs becomes the basis of trade. With positive transport costs, locating increasing return activities closer to the larger market becomes more profitable. Krugman terms this issue as the “home market effect”. Krugman (1980) combines increasing returns with iceberg type transportation costs and models a strong example of the home market effect.

In new trade theories, economies of scale are considered to be internal to the firm. Marshall (1920) first introduced the distinction between internal and external economies of scale. Internal economies of scale can be described as a “fall in unit costs arising from the expansion of an individual firm, and hence not necessarily associated with an increase in the scale of industry”. On the other hand external economies of scale “take the form of a fall in unit costs arising from an expansion of the industry without an increase in the scale of individual firms” (Broadberry & Marrison, 2002).

Ethier (1979) suggested that increasing returns have long been recognised in the economic literature while examining international trade; however they had never formally modelled or played a central role in theory. While arguing increasing returns to be significant in the modern economy in his 1979 paper, Ethier (1982) adopts a different approach and suggests that the presence of increasing returns in the economy does not affect the conclusions when non-increasing returns to scale is assumed. Ethier uses a model of national internal scale economies with international returns and concludes that intra-industry trade can still be explained by Heckscher-Ohlin type factor endowments.

Even with contradicting results, the most important features of the new trade theories are the assumptions of economies of scale, product differentiation and hence imperfect market structure and several attempts to explain intra-industry trade.

A common feature of new trade theories is that they predict that large countries will play a central role for location of economic activity due to the home market effect and scale economies. Firms will tend to locate with closer proximity to larger markets, hence larger countries. Furthermore intra-industry trade is likely to rise or at least remain high as economic integration increases Brulhart (1995).

The issue of agglomeration is first mentioned in new economic geography models. Economists only considered specialization prior to new economic geography models. It is possible to say that in both traditional trade and new trade theories the spatial part of the analysis was missing.

2.4 New Economic Geography

New economic geography models are characterised by monopolistic competition, externalities and endogenous labour. New economic geography models explain both inter and intra-industry trade and differ from new trade theories as these models suggest multiple equilibria and "u-curve" gains from international trade. This suggests decreasing gains when countries first open their markets to international trade, but increasing gains later on.

According to new economic geography models, location becomes most spatially polarised at intermediate trade costs. In these models location is completely endogenous and "second-nature" determines everything (Brulhart, 1998).

According to Krugman (1999) agglomeration can be sourced on two bases; "first nature" and "second nature". First nature can be defined as natural advantages such as climate, nature resource endowments. Second nature on the other hand is defined as man-made agglomeration economies such as economies of scale, transport costs and externalities.

The idea of externalities having an effect on geographic concentration is first introduced by Marshall (1920) and can be summarized as follows:

i. Labour market pooling: concentration of firms in a specific area offers workers with industry-specific skills a higher probability of employment and at the same time offers firms a lower probability of worker shortage.
ii. Backward and forward linkages: concentration of upstream and downstream firms in the same area will lead to lower transportation costs of intermediate goods and support the production of non-tradable goods.
iii. Informational spillovers: firms will tend to cluster in order to take advantage from technological and other spillovers.

Krugman (1980) can be seen as the framework that represents early economic geography patterns. In this study, Krugman uses a two country, two sector model with only one productive factor (labour). Assuming the same technology levels in both countries, the larger country will by definition offer higher wages and if the countries have dissimilar tastes they will tend to specialize in production of the product with home demand bias (Wolfmayr-Schnitzer, 2000).

More recent studies in new economic geography framework combine Krugman (1980)'s outcome with "circular causation" and "forward and backward linkages" which give rise to agglomeration economies. The agglomeration process can be described as; concentration of economic activity in one place creating further industrial and spatial concentration and becoming a self reinforcing process (Wolfmayr-Schnitzer, 2000).

With agglomeration process centre and periphery patterns occur. This centre and periphery pattern when combined with Marshalian type externalities creates a circular causation. Therefore manufacturers' production will tend to locate in one specific location; which usually is the centre, where the larger market and higher demand is. On the other hand, the market will be large where the manufacturers concentrate; hence creating a circular causation.

The centre is usually characterised with high-skilled, high-wage labour force and the periphery with low-skilled low wage labour force. In the centre for firms it is easy enough to find skilled workers; however they should be willing to pay higher wages. For workers there are better job opportunities in the centre; however there will be higher competition. In periphery workers face less competition but in return they get lower wages and firms have a lower labour cost opportunity; however they face a low-skilled labour force.

Krugman (1991a) forms a model of two countries, two sectors (agriculture and manufacturing) and only one production factor (labour) and assumes international labour mobility in interaction with increasing returns and positive transportation costs. When these assumptions are combined with backward and forward linkages, the market enlarges further. Scale economies that are initially internal to the firm then also become external and the increasing return activity becomes transformed to whole region. Labour is assumed only to be mobile between regions and only in the manufacturing sector. This assumption makes market size for manufacturing endogenous.

Krugman shows that the interaction of increasing returns, transportation costs and mobility of labour give rise to a core-periphery pattern. He asks a crucial question:

"How far will the tendency toward geographical concentration proceed and where will the manufacturing production actually end up; centre or the periphery?"

The answer of this question depends on the level of scale economies and transportation costs and how they are combined. As for the tendency toward concentration, Krugman suggests that it is a self-reinforcing process as a result of the circular causation mentioned above.

Venables (1996) suggests that vertical linkages play a crucial role in new economic geography models and creates cost and demand linkages for the firm. When vertical linkages are concerned, downstream firms can be seen as the market for upstream firms and the region they locate becomes the market for upstream firms. This can be defined as the demand linkage. Furthermore downstream firms tend to locate near upstream firms because they want to minimize the transportation costs. This forms cost linkages for the firms. According to Venables, demand and cost linkages of vertically linked industries and/or firms constitute a driving force for agglomeration.

Krugman and Venables (1996) stress the importance of input-output linkages in agglomeration. They argue that intermediate goods usage encourages agglomeration via cost and demand linkages. They further state that these linkages are stronger within industries than between industries. According to Krugman and Venables agglomeration has been more important for interregional specialization than international. Because in international trade apart from transportation costs there are also barriers for trade which sometimes can fully block any trade between countries.

As a result, among the assumptions of new economic geography models such as imperfect markets, increasing returns, transportation costs; the most important assumption that has been suggested to affect agglomeration is vertical linkages. The possibility of multiple equilibriums, historical path dependencies and externalities also plays a crucial role in agglomeration according to the new economic geography models.

CHAPTER 3: STRUCTURE OF TURKISH MANUFACTURING SECTOR

It is important to understand the structure and development of Turkish economy and of the manufacturing sector to fully comprehend the agglomeration patterns in Turkish manufacturing.

1980 is usually seen as a critical year in Turkish economy. Therefore Turkish economy is analysed in the literature in two periods; pre and post 1980 period ((Senses & Taymaz, 2003); (Boratav, Yeldan, & Kose, 2000)).

The pre-1980 period is mainly characterised by government interference to the economy; import substitution oriented policies and planned development programs. However, the recessionary period that started in 1977 ended with a major crisis in 1979; Turkey was also affected by the OPEC crises which affected the world economy (Yenturk, 1997).

Liberalization programs are seen as a way out from the crisis. Therefore post-1980 period is mainly characterised by liberalization policies in the economy; export oriented policies; privatization throughout the economy and also several attempts to integrate with the world economy especially the EU (Yenturk, 1997).

Turkey has been implementing five-year development plans since 1963 prepared by the SPO (State Planning Organization[5]). Five year plans in the pre-1980 period mainly focus on industry-based growth policies via import substitution. Also regional development and regional disparities have also been an important part of the plans. Five year plans during the post-1980 period focused, however, on international integration, growth via export oriented policies and privatization. The role of government has been gradually decreased since 1980. Further, regional development and disparities remain as an important part of these plans (TUSIAD, 2008).

In the 1980-2001 period, Turkey witnessed three economic crises. An exchange rate crisis in 1994, a crisis affected by the earthquake and also by the crisis in Russia in 1999 and finally a financial market crisis in 2001. Further, Turkey became associated with customs union in 1996 (Boratav, Yeldan, & Kose, 2000).

---

[5] Five-year plans are available online at www.dpt.gov.tr

Mainly because of the data limitations, the major concern of this study is the post-1980 period. Therefore analysis regarding Turkish economy and Turkish manufacturing sector will also be kept to this period. However some tables and figures include 1977-1979 period to encounter the effect of crisis and to supply a base of comparison. After a general description of the economy and industries in Turkey, more detailed regional analysis of the manufacturing industry will also be presented in this chapter.

Table A3.1[6] of the appendix shows the evolution of the growth rates in the economy; namely GNP and GDP growth rates and also sectoral growth.

As can be seen from table A3.1, the biggest growth in the 1977-1979 sub-period is in services sector with a 6.2% average annual growth. The construction sector shows a negative growth and agriculture has a near zero growth rate. The growth rate of manufacturing sector is also quite low in this sub-period, as a result of the recession in the economy. After the crisis, the average annual growth rates increase significantly. However, the construction sector again shows a negative growth rate in the 1995-2000, pre-crisis period. Throughout the 1977-2000 period the manufacturing sector shows fluctuating growth rates. This is due to several crises in Turkish economy. Manufacturing sector shows low growth rates in all pre-crisis periods. Although, manufacturing growth never takes negative values as construction sector, it is still possible to point out the crises in the economy via examining the manufacturing sector. Hence it is possible to say that the manufacturing sector is a good indicator of the overall economy in Turkey. Sectoral growth rates can also be observed from graph 3.1.

[6] Tables A3.1 through A3.10 and graphs 3.1 through 3.5 for this chapter are prepared by the author using Turkish Statistical Institute's various statistics which are also available online (www.turkstat.gov.tr)

Figure 3.1: Sectoral Growth Rates: 1977-2000

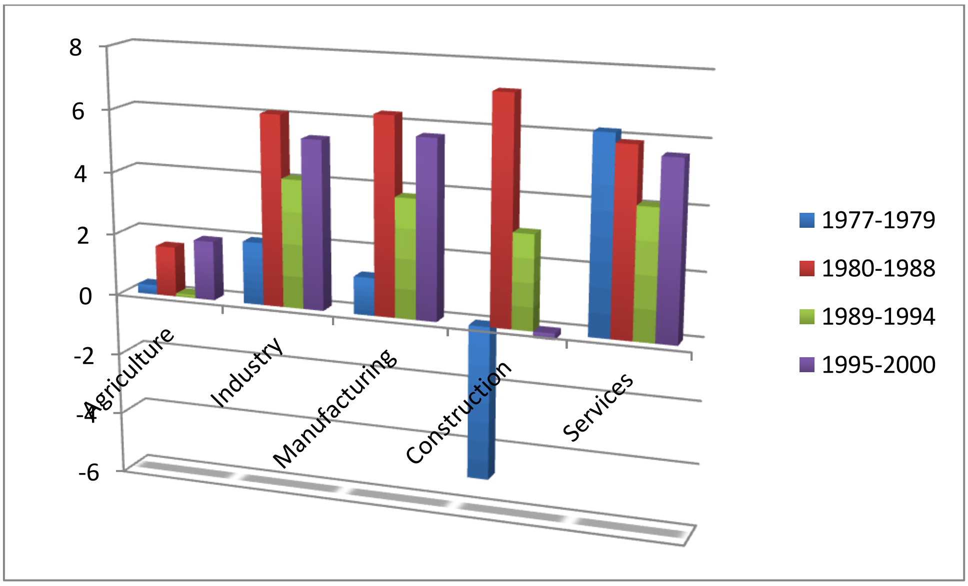


Figure 3.1 shows that in the pre-crises periods most sectors are facing decreasing growth rates, especially construction sector. It is clear from figure 3.1 that 1994 crisis had a big negative impact on Turkish economy.

Sector shares in GDP are presented in table A3.2 of the appendix. Table A3.2 indicates the biggest share in GDP belongs to services sector with 45-50% in all sub-periods. The share of manufacturing has increased gradually until the final sub-period; 1995-2000. Further, the lowest share belongs to construction sector. Finally, the share of agriculture gradually decrease throughout the 1980-2000 period as the effect of post-1980 plans that involves industry based growth and also decreases in subsidies in the agriculture sector caused by the attempts to decrease the role of government in the economy. Figures 3.2a and 3.2b shows the shares of sectors in GDP for the 1977-1979 and 1995-2000 sub-periods.

Figure 3.2a: Sector Shares in GDP

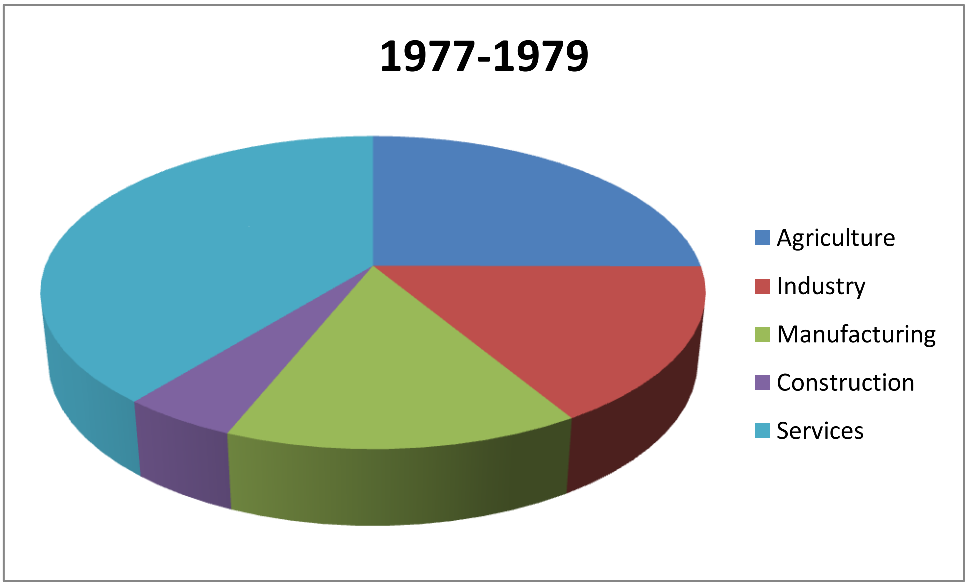
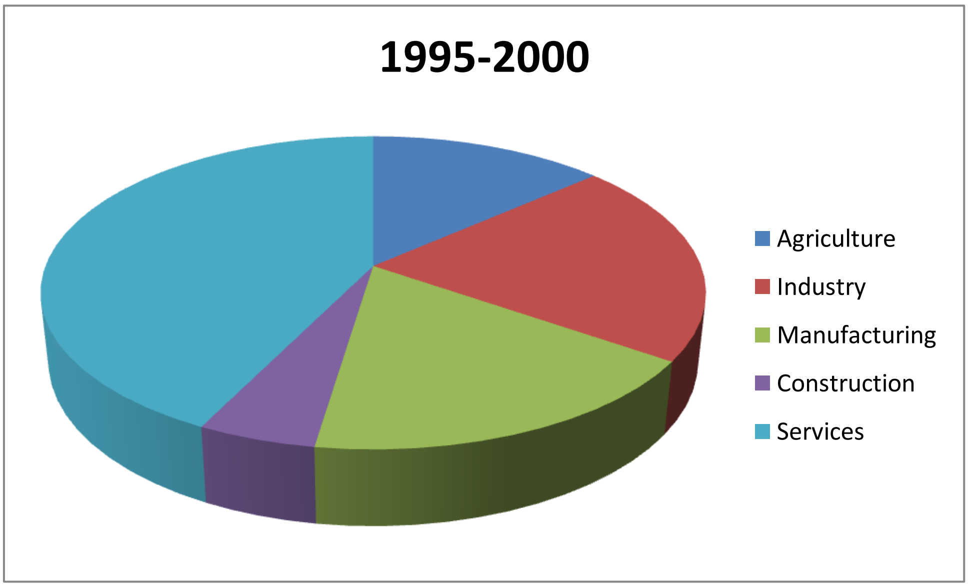


Figure 3.2b: Sector Shares in GDP



It is clear from figures 3.2a and 3.2 b that the biggest share belongs to the services sector and is stable in both sub-periods. Further figures show that share of agriculture has decreased significantly and the share of manufacturing sector in GDP has increased significantly throughout the period.

Table A3.3 shows the changes in employment shares of each sector throughout the 1977-2000 period, represented in four sub-periods. Table A3.3 indicates that highest shares in employment belong to the agricultural sector. However, employment shares are gradually decrease as a result of the policies employed in the post-1980 period. Employment shares in manufacturing increased gradually throughout all sub-periods. The evolution in employment across these five sectors can also be observed from figure 3.3.

Figure 3.3: Employment Shares (%)

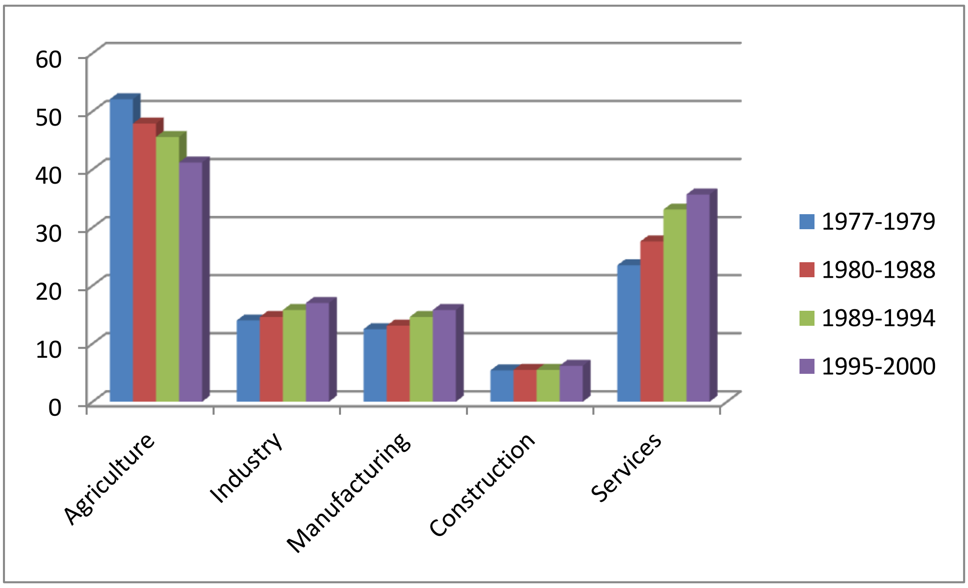


Figure 3.3 clearly indicates the decreasing trend in the agricultural sector's employment share. Throughout this period the employment share of construction sector stayed quite stable. Further employment shares of all other sectors are facing an increasing trend. Biggest increase in employment shares are observed in the services sector.

Table A3.4 shows the changes in main labour market indicators during 1980-2001 period. Table A3.4 indicates a decrease in unemployment rates after a peak in 1985. Such decreases in unemployment rates, however, cannot be interpreted as a positive sign in the Turkish economy because table A3.4 also indicates significant decreases in labour force participation rates. The labour force participation rate decreased from nearly 65% to 49% during this 21 year period. Further, the unemployment rate shows an increase after 1996. Such changes in unemployment rates and labour force participation rates can be seen as a result of the privatization period in Turkish economy and indicates the negative effects of such policy.

Further, the condition of the labour market in Turkey can also be seen from figure 3.4, which shows the employment rates in Turkey by education.

Figure 3.4: Employment Rates by Education (%)

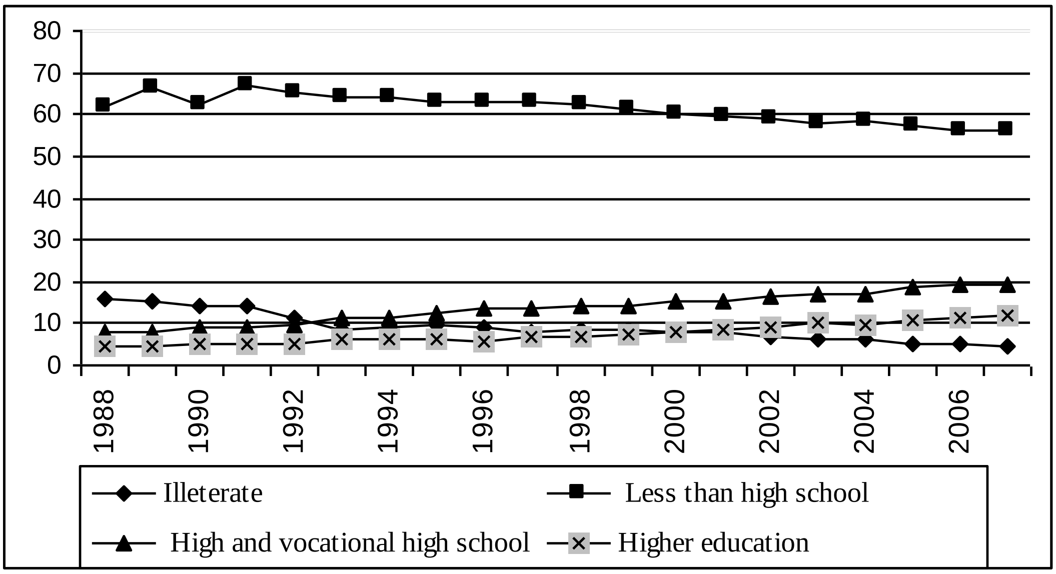


Figure 3.4 indicates that employment rates for workers with higher degrees shows an increasing trend, but are still much lower than employment rates for workers who do not have high school degrees. It is possible to say that unemployment rates for high school graduates and especially university graduates are far worse in Turkey.

After this general information about Turkish economy and comparison of the manufacturing sector in Turkey with other sectors, more detailed investigation of the manufacturing sector is also necessary.

Figure 3.5 demonstrates the employment rates by education for the manufacturing sector only.

Figure 3.5: Employment by Education in Manufacturing (%)

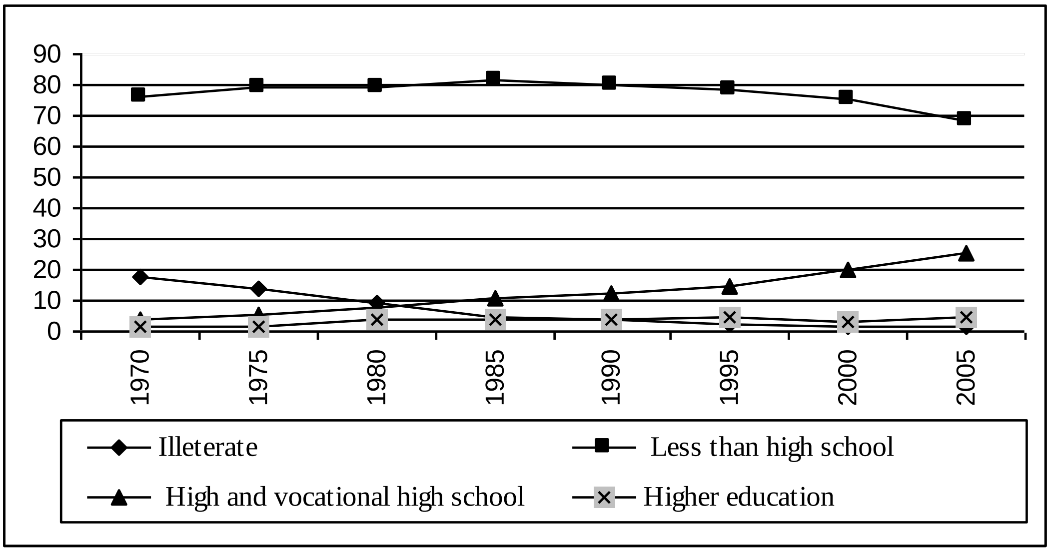


Figure 3.5 demonstrates a similar pattern in Turkish manufacturing with general employment by education in Turkey, illustrated in figure 3.4. In Turkish manufacturing sector, highest employment rates belong to workers who have less than high school degree, again indicating much higher unemployment rates than average for high school and university graduates. However, in contrast to figure 3.4, in Turkish manufacturing employment rates of university graduates are stable across the observed period. Employment rates of high and vocational high school graduates are showing an increasing trend after 1995.

The privatization policy employed in Turkey after 1980 can be clearly observed in manufacturing industry. Table A3.5 shows government and private sector shares in Turkish manufacturing sector. Table A3.5 clearly illustrates the effect of privatization policies in Turkish manufacturing sector. Both employment and value added shares of the government sector are decreasing while shares of private sector are increasing over time. In 2000, nearly 90% of employment is allocated in the private sector.

Value added and employment shares in Turkish manufacturing industries can be observed form tables A3.6 and A3.7 respectively. Table A3.6 indicates machinery, chemicals and food, beverages and tobacco industries have the highest shares in value added in manufacturing sector. The share of food, beverages and tobacco industry stayed the same during the first two sub-periods and then declined in 1989-2001 sub-period. Share of chemicals industry in value added increased significantly in the last sub-period; 1989-2001. Machinery industry on the other hand, shows a slight decrease in the second sub-period and then increase in the 1989-2001 sub-period. The share of textile industry in value added decreases in the 1980-1988 sub-period and then increases in 1989-2001 sub-period. However, this increase in the last sub-period is less than the decrease in the second sub-period. Shares of wood product and furniture, paper products and printing and mining industries are pretty much stable over the whole period. Finally metal industry's share in value added shows a significant decrease throughout the whole period.

As can be observed from table A3.7, the biggest share in employment in manufacturing sector belongs to textile, food, beverages and tobacco and machinery industries respectively. Relatively low value added and high employment shares in textile industry indicate textile in Turkish manufacturing is highly labour abundant and characterised by low labour productivity. The chemicals industry on the other hand, appears to be relatively more high-tech and creating high levels of labour productivity. As it can be seen from table A3.7, the employment share of textile industry increased throughout the whole 1977-2001 period. Employment shares in wood products and furniture, paper products and printing and chemicals industries are on the other hand stable for the whole period. Metal industry shows a declining trend in employment rates throughout the whole period.

Tables A3.8a through A3.8h illustrates shares in employment in each region in the manufacturing sector. As can easily be seen from tables A3.8a through A3.8h, textile and food, beverages and tobacco industries have high levels of employment shares in each region. These two industries also have increasing employment shares in most regions. Metal and machinery industries have high levels of employment in particular regions such as Mediterranean, Anatolia, Black Sea and Marmara; however shares in employment in these industries showing declining trends.

To sum up, the Turkish economy has gone through a liberalization period after 1980 and has 3 economic crises in the 1980-2001 period. Post-1980 liberalization era in Turkey is characterised by, trade liberalization policies, decreases in the role of government in the economy and increasing degrees of privatization. It is not the main focus of this thesis to argue the advantages and disadvantages of such policy changes in an economy. Therefore, the evolution of Turkish economy in general and Turkish manufacturing sector in specific is just examined and presented as facts. From this overview, it is possible to say that Turkish manufacturing sector usually follows the general patterns in Turkish economy and hence can be evaluated as a good indicator of the overall economy. Further, since most focus on growth and regional disparities and patterns are based on industry growth manufacturing industry in Turkey is quite important for policy purposes as well. As a result, Turkish manufacturing sector is a hot and important topic to examine in Turkey; furthermore it is quite important to understand the general structure of Turkish manufacturing in order to be able to evaluate the agglomeration patterns in this sector.

CHAPTER 4: THE EXTENT OF AGGLOMERATION IN TURKISH MANUFACTURING INDUSTRIES: 1980-2001

4.1 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. However, prior to detailed econometric analysis regarding agglomeration, it should be examined whether or not Turkish manufacturing industries are agglomerated. Further, if they are agglomerated, the degree of this agglomeration and its patterns should be examined in detail.

The main focus of this chapter is to examine the extent of agglomeration in Turkish manufacturing industries. For this purpose, first alternative ways to measure specialization and industry location will be analysed. Furthermore, an index of agglomeration will be investigated and the degree of agglomeration for Turkish manufacturing industries will be examined. In addition, regional high point clusters and driver industries will be investigated and finally a decomposition of the agglomeration index will be introduced in order to identify the underlying reason behind the change in the agglomeration index.

The remainder of this chapter is organized as follows; section 4.2 provides background information on the previous empirical literature. Section 4.3 lists some stylized facts about agglomeration which arises from the previous literature. Section 4.4 provides information about the main aim and focus of the chapter and lists the research questions that will be addressed. Section 4.5 provides information on the data used and also the methodologies employed throughout the study. Section 4.6 gives and discusses the estimation results and finally section 4.7 summarizes and concludes the chapter.

4.2 Empirical Background

There are several measures used in empirical studies to investigate geographical and industrial concentration within and across countries/regions. Following Traistaru and Iara (2002) on notation, some of the widely used measures can be summarized as follows where; *E* denotes employment, *s* denotes shares, *i* denotes industry and *j* denotes region:

i. Herfindahl Index:

$$H=\sum_j\left(s_{ij}{}^c\right)^2$$

Where, s_{ij}^c denotes share of employment in industry i in region j in total employment of industry i and calculated as follows;

$$s_{ij}{}^c=\frac{E_{ij}}{E_i}=\frac{E_{ij}}{\sum_j E_{ij}}$$

ii. The Dissimilarity Index:

Regional Specialization

$$DSR_j=\sum_i\left|s_{ij}{}^s-s_i\right|$$

Where; s_{ij}^s denotes share of employment in industry *i* in region *j* in total employment of region j and s_i denotes share of total employment in industry *i* in total employment and calculated as follows;

$$s_{ij}{}^s=\frac{E_{ij}}{E_j}=\frac{E_{ij}}{\sum_i E_{ij}} \qquad s_i=\frac{E_i}{E}=\frac{\sum_j E_{ij}}{\sum_i\sum_j E_{ij}}$$

Industrial Concentration:

$$DCR_i=\sum_j\left|s_{ij}{}^c-s_j\right|$$

Where; s_j denotes share of total employment in region *j* in total employment and calculated as follows;

$$s_j=\frac{E_j}{E}=\frac{\sum_i E_{ij}}{\sum_i\sum_j E_{ij}}$$

iii. Krugman Specialization Index:

KSI= $\sum_i |s_{ik}{}^{s} - s_{il}{}^{s}|$, where k and l are two different regions

iv. Gini Coefficient:

Locational Gini coefficients are based on Balassa index[7]

Regional Specialization

$GINI_j{}^{s} = \frac{2}{n^2\bar{R}}\left[\sum_{i=1}^{n} \lambda_i |R_i - \bar{R}|\right]$

where, $R_i = \frac{s_{ij}{}^{s}}{s_i}$ and $\bar{R} = \frac{1}{n}\sum_{i=1}^{n} R_i$

λ_i indicates the position of the industry *i* in the ranking of R_i in descending order.

Industrial concentration

$GINI_i{}^{c} = \frac{2}{m^2\bar{C}}\left[\sum_{j=1}^{m} \lambda_j\, C_j - \bar{C}\right]$

where, $C_j = \frac{s_{ij}{}^{c}}{s_j}$ and $\bar{C} = \frac{1}{m}\sum_{j=1}^{m} C_j$

λ_j indicates the position of the region in the ranking of C_j in descending order.

v. Location Quotient

LQ= $\frac{E_{ij}}{E_j} \Big/ \frac{E_i}{E} = \frac{s_{ij}{}^{s}}{s_i}$

LQ>1, means a higher concentration in the region than in the country and *LQ*>1.25 considered as an initial indicator of regional specialization.

vi. The Ellison and Glaeser Index (E-G)[8]

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

$\gamma = \frac{\sum_{j=1}(s_{ij}{}^{s} - s_i)^2 - (1 - \sum_j s_i{}^2)H}{(1 - \sum_j s_i{}^2)(1 - H)}$

where, *j*=1,…,m indicates regions and *i*=1,…,n indicates industries and *H* is the Herfindahl index.

---

[7] For detailed information see; (Amiti, 1998).

[8] (Ellison & Glaeser, 1997)

$E(\gamma)=0$ 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

These six measures of concentration of geographic and industrial activities are the most widely used measures in empirical studies of locational activity. In this thesis 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 A4.7 and Figure A4.2 of the appendix. It is clear from table A4.7 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. Furthermore, when the distributions of the indexes are considered, the E-G index (gamma) is normally distributed while other indexes are not. This also suggests that the E-G index would be a better choice as a dependent variable.

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. The E-G index; uses a measure of geographic concentration (G) and also the Herfindahl index as a measure of industrial concentration.

Therefore 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 and 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.

According to Maruel and Seddilot (1999), the Gini index can give biased results when it is used to investigate agglomeration rather than geographical concentration. Using the Gini index, an industry will be regarded as geographically concentrated if its employment is concentrated in a small number of plants in a specific area. However, this does not always mean that the firms' location decisions are not random. The E-G index, on the other hand, shows whether a firm's decision of locating in a specific area is random or not, by conditioning the geographical concentration index -which is quite similar to the Gini index- on Herfindahl index. Furthermore the E-G index is also robust to region size[9].

Prior empirical research mainly focuses either on Europe or U.S. the evidence on developing countries is quite limited. Research on Europe, largely investigates 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 investigate 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 expand the investigation further and use regressions to identify the determinants of

[9] A robustness check is also performed on the index and details can be found the methodology section of this chapter.

specialization/agglomeration via identifying which theory best explain the current pattern in investigated country/region.

One of the most common tools used in descriptive studies is the Gini index. Krugman (1991a) uses the Gini index for US manufacturing industries with 3-digit data. He finds, 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.

Brulhart (1998) uses the Gini index for 12 EU countries[10] for a ten year period; 1980-1990. He also uses the OECD's technology classification and a centrality measure to examine if manufacturing firms choose to locate in the centre or the periphery. Results indicate that industrial specialization in EU has increased in the 1980s. Furthermore he finds 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 Brulhart (1998) 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 the Gini index.

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

Dominics, Arabia and Groot (2007) use Location Quotient (LQ index) on a data set for covering the 1991-2001 period for Italy. The data they used covers 2-digit sector levels for 24 manufacturing and 17 service industries. They differ from other studies they also analyse the service sector in their study. They calculate the LQ index, following Kim (1995), and find that in the period covered concentration has substantially declined in the manufacturing industries while increased in service industries. Consistent with Krugman (1991a) they find that in Italy, the most concentrated sectors belong 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 indices 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 indices cannot be considered a proper tool to investigate agglomeration.

Aiginger and Pfaffermayr (2004) investigate specialization for the EU. They use 1985-1998 3-digit NACE data for 14 member countries. They investigate the shares of manufacturing industries' employment and apply non-parametric sign tests to examine whether the increases or decreases in these shares are random. Their findings indicate that the three largest countries in their data set faced decreasing shares between 1992 and 1998. Furthermore, they conclude that Europe is not following, in other words does not have similar patterns with the US in regional concentration. Performing 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 and Davis (2004), also investigate 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 find that over time industries become less geographically concentrated. From this result they conclude 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 use 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, Chamorro-Rivas and Gonzales-Cerdeira (2004) examine the extent of geographical concentration in Spanish manufacturing industry for years between 1993 and 1999. They use mainly the Maurel and Seddilot index (M-S) [11] however they also compare the results from M-S index with E-G and Gini indices. With this descriptive study they find that firms are independent in location choice and also consisting with Krugman (1991a) they find that traditional industries show high degrees of agglomeration when compared to high-tech industries. In this study authors choose to use indices to measure agglomeration such as M-S index and E-G index; however the results in this study are interpreted as geographical concentration.

Devereux, Griffith and Simpson (1999) offer 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 indices. They use 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 investigate the strengths and weaknesses of those indices and also examine correlations between indices used. Furthermore, they investigate the effects of entry and exit by calculating the agglomeration measures only on entrants and examine what

[11] A similar index to the Ellison and Glaeser index of agglomeration. For detailed information see (Maurel & Sedillot, 1999).

percentage of entrants locate in already agglomerated regions. The authors compare results from indices they used with prior studies from France and US. Their findings indicate that agglomeration patterns for UK remained fairly stable over the 1985-1992 period and their results are again consisting 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 and Decrop (2005) use the E-G index to examine the agglomeration patterns in Belgium using firm level data for years between 1997 and 2000. They find 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 find consistent results from E-G indices from these countries.

4.3 Some Stylised Facts about Agglomeration

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

i. Krugman (1991a) finds 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. Brulhart (1998) finds that labour intensive sectors show a strong trend towards geographical concentration; however he finds that these industries are usually localized in the periphery rather than core. Similarly Dominics et al (2007) find consistent results with Krugman 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 and 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”.

4.4 Aim and Focus of the Chapter

Considering findings of the previous studies on specialization and agglomeration this chapter attempt to address the following questions in particular:

i. The main focus of this analysis is to identify the degree and general trend of agglomeration in Turkish manufacturing industries prior to attempting to answer more complex questions such as the main reasons for agglomeration. In order to answer such question, it is essential to examine how agglomerated the industries are.
ii. Apart from trying to identify the extent of agglomeration in Turkish manufacturing, another question in mind is whether the stylized fact that low tech industries tend to be more concentrated than high tech industries is also true for Turkish manufacturing? In other words, is such stylised fact valid for Turkey as well?
iii. Is there a distinctive trend in agglomeration in Turkish manufacturing industries?
iv. Are there any major similarities/differences in agglomeration between different technology groups?

4.5 Data and Methodology

Panel data or longitudinal data sets are defined as data sets that combine time series and cross sections, in other words panel data sets are repeated measurements at different points in time on the same unit such as an individual, household, country, firm or, in this case, industry. Estimations based on panel data sets can therefore capture variation in cross sectional units over time. However, modelling in this setting requires more complex stochastic specifications. The main focus of the analysis when using panel data is the heterogeneity across cross-sectional units (Greene (2002); Wooldridge (2002)).

There are several advantages that arise from using panel data. These advantages can be summarized following Baltagi (2001):

i. Panel data allows controlling for individual heterogeneity.
ii. Panel data have more information since it combines cross section and time series information. Further panel data give more variability and less collinearity among

variables. Finally panel data give more degrees of freedom and as a result of all these features it can improve efficiency.

iii. Panel data are better suited to investigate the dynamics of a certain relationship.

iv. Panel data is more reliable because it is usually gathered on micro units; hence do not contain the risk of bias resulting from aggregation.

v. As a result it is possible to say that using a panel data set gives researcher flexibility when investigating differences in behaviours across cross sectional units (Greene, 2002).

There are also some disadvantages that arise from using panel data. These limitations of panel data can again be summarized by following Baltagi (2001):

i. There can be problems with design and collection of the data.

ii. Distortions of measurement errors.

iii. Wide format of the data; panel data usually have a shorter time dimension than cross sectional units which can create problems in regression.

In this chapter 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 data. 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. Regions used are purely geographical. Descriptive statistics of the data can be found in table A4.1 in the appendix. Using such data, the E-G index of agglomeration and also the LQ indices are calculated in order to examine the extent of agglomeration in Turkish manufacturing industries. However, a sensitivity analysis on the index calculated using this data is also performed using industrial districts rather than geographical regions. In order to provide a sensitivity analysis of the index, the index is also calculated using industrial districts of Turkey[12]. Descriptive statistics of the index using industrial districts and geographical regions are provided in table 4.1:

[12] Industrial districts contain 12 regions where geographical regions contain 7.

Table 4.1: Descriptive Statistics of E-G index based on industrial districts

	Mean	Std. Deviation	Min.	Max.
E-G based on industrial districts	0.214242	0.09321	0.00027	0.61237
E-G based on geographical regions	0.193697	0.06311	0.00010	0.56191

Table 4.1 shows that, the E-G index is not very sensitive to region size. However the differences in the indices calculated on the regional and industrial districts basis is the industrial districts are formed according to the clusters of economic activity; hence it is expected that E-G index of industrial districts to be slightly higher than of geographical regions. Throughout the thesis however, as mentioned before the E-G index calculated using geographical regions is used in order to fully capture the geographical distribution of economic activity of Turkish manufacturing industries.

In addition to the E-G index of agglomeration, the LQ index of specialization is also calculated to find out regional high point clusters in Turkish manufacturing on 2 and 4-digit levels.

Finally, this chapter 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.

4.6 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 4.2a through 4.2d present descriptive statistics of the E-G index for high tech, medium-high tech, medium-low tech and low tech industries.

Table 4.2a: 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[13]	-0.8348	0.1792	-0.3108	0.1164

Table 4.2b: 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 4.2c: 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

Table 4.2d: 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 4.2a through 4.2d indicate the most agglomerated industries in Turkish manufacturing belong in the low tech group in 1980[14]. 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 4.2a through 4.2d 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.

[13] 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.
[14] Furthermore, graphs for the means of the E-G index for different technology groups can be found in Figure A4.3 of the appendix.

Detailed results for the E-G index, shown in the appendix[15], 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.

For the technology classification; 1 indicates high tech industries, 2 indicates high-medium tech industries, 3 indicates medium-low tech industries and finally, 4 indicates low-tech industries.

When it is further investigated considering the technological classification it can be seen from table A4.2, 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 tech industries, 19 of low-medium tech industries and 28 of the low tech industries are highly agglomerated.

To understand the extent of agglomeration, examining the most and least agglomerated industries is quite useful. Table A4.3 of the appendix shows the least and most agglomerated industries for 1980 and 2000.

The highlighted industries are the industries which stayed in the same category throughout 1980 to 2000. Among the least agglomerated 20 industries, seven of them stayed least agglomerated. However in 1980 only three of the industries show dispersion, while in 2000 six of the least agglomerated industries show dispersion. In 1980, 12 of the least agglomerated industries are considered highly agglomerated according to the E-G index. In 2000, this number is 4. Among the most agglomerated industries, four industries remained in the group most agglomerated.

As we can easily see from table A4.3a and A4.3b, the least agglomerated industries have become more dispersed from 1980 to 2000 and the most agglomerated industries have become more concentrated; indicating a polarisation of industries. An interesting result is that, five of the industries which belonged to the least agglomerated group in 1980, are observed in the most agglomerated group in 2000. These industries are;

[15] Table A4.2

shipbuilding and repairing, manufacture of photographic and optical goods, manufacture of watches and clocks, manufacture of jewellery and related articles and manufacture of musical instruments.

In order to examine high point clusters and driving industries within regions, the LQ index must be investigated. Table A4.4 of the appendix shows the high point clusters in Turkey's geographical regions, based on the information obtained from 2-digit level industry classification.

Table A4.4 shows, textile industry cluster and food beverages and tobacco industry cluster are quite common for most of the regions. Considering both of the industries are low tech, this result is again consistent with Krugman (1991a). In Mediterranean, Central Anatolian and Black Sea regions, the number of clusters has increased from 1980 to 2000.

The change in regional clusters over time is also important. For this purpose, the regional clusters are grouped as:

i. Specialized and increasing concentration
ii. Specialized and decreasing concentration
iii. Not specialized and increasing concentration
iv. Not specialized and decreasing concentration

Table A4.5 of the appendix shows the change in clusters over time for each region, throughout the 1980-2001 period. Table A4.5 once again emphasizes the importance of food, beverages and tobacco industries in Turkish manufacturing industries. In Eastern Anatolia, Central Anatolia and Black Sea regions; food, beverages and tobacco industries are already specialized and this specialization has increased since 1980s. Food, beverages and tobacco industry is also specialized in the Aegean region, however with a decreasing trend over time. Finally in the Mediterranean region this industry was not specialized in 1980s; however showing increasing degrees of specialization over time. The second common specialized industry across Turkey's regions is the textile industry. The textile cluster in Southeast Anatolia and Marmara regions are increasing over time. However; the textile industry is facing decreasing degrees of specialization in Mediterranean region. Table A4.5 shows that in Turkish manufacturing usually low tech and medium-low tech industries show high degrees of specialization and this specialization is also increasing over time.

After examining the regional highpoint clusters, at the 2-digit level, each region can be further investigated to identify the main driver industries. For this purpose, the LQ index is used again. However examining at a 2-digit level does not give useful information. Therefore, the LQ index is calculated on a more specific 4-digit level for every region to see the driver industries in the main clusters.

4.6.1 Driver Industries in the Mediterranean Region:

Table 4.3 shows the high-point cluster, the driver industries and the shares of that industry in the regions' manufacturing employment, for the years 1980 and 2000.

Table 4.3a: Mediterranean Region 1980

High-point cluster 1980	Driver Industries	LQ	Share in employment (%)
Textile	Spinning, weaving and finishing textiles	2.63	47.49
Basic metal industries	Iron and steel basic industries	3.67	24.79

In 1980, the highpoint clusters in the Mediterranean region are textile and basic metal industries. The driver industry for the textile cluster is spinning, weaving and finishing textiles. This driver industry alone forms nearly 50% of manufacturing employment in the region. Driver industry for the basic metal industry cluster is; iron and steel basic industries. And it forms almost 25% of regions employment. Textile industry, therefore, spinning, weaving and finishing textiles industry also belongs to the low-tech industry group. And the high employment share in this industry is consistent with its labour intensive characteristic.

Table 4.3b: Mediterranean Region 2000

High-point cluster 2000	Driver industries	LQ	Share in employment (%)
Textile	Spinning, weaving and finishing textiles	2.08	30.37
	Manufacture of wearing apparel except leather and fur	1.24	9.95
Chemicals	Petroleum refineries	1.65	0.73
	Manufacture of plastic products not classified elsewhere	1.49	3.95
Non-metallic mineral products	Manufacture of glass and glass product	3.06	3.70
	Manufacture of cement, lime and plaster	1.39	1.31
Basic metal industries	Iron and steel basic industries	4.15	17.57

In 2000, the high point clusters in the region are textiles, chemicals, non-metallic mineral products and basic metal industries. In 2000 the clusters and the driver industries have both increased in number. However, the textile cluster now forms almost 40% of the region's manufacturing employment. Spinning, weaving and finishing textiles industry now forms 30% of regions employment, which is still consistent with labour intensive characteristic of the industry; however the ratio has decreased from almost 50%. Petroleum refineries and manufacture of plastic product industries belong to the medium-low tech group according to the OECD's classification. The chemicals cluster forms nearly 4% of the region's manufacturing employment. The non-metallic mineral products cluster forms nearly 5% of the region's manufacturing employment. Finally, the basic metal industries cluster forms nearly 18% of the region's manufacturing employment. The LQ index of iron and steel basic industries, has increased from 1980 to 2000, however its share in the region's manufacturing employment has decreased. This can be interpreted as follows: the regional specialization has increased in this industry however the industry has became less labour intensive. Even though the highest LQ ratios belong to iron and steel basic industries both in 1980 and 2000, the highest shares of the region's manufacturing employment are in textile industry.

4.6.2Driver industries in Eastern Anatolia Region:

Table 4.4 shows high point clusters, driver industries, LQ index and share of industries employment in the region for years 1980 and 2000.

Table 4.4a: Eastern Anatolia Region 1980

High point cluster 1980	Driver industries	LQ	Share in employment (%)
Food, beverages and tobacco	Slaughtering, preparing and preserving meat	10.94	10.24
	Dairy products	6.38	3.02
	Sugar factories and refineries	7.38	19.66
	Prepared animal feeds	3.60	1.45
	Tobacco	2.87	19.03
Non-metallic mineral industries	Cement, lime and plaster	4.37	8.36
Basic metal industries	Non-ferrous metal basic industries	3.96	10.42

In 1980, food, beverages and tobacco cluster forms more than 50% of the region's manufacturing employment. Among driver industries of the cluster, slaughtering, preparing and preserving meat; sugar factories and refineries and tobacco manufacturers make up nearly 47% of regions employment. Even though the sugar factories and refineries and tobacco manufacturers have relatively small LQ ratios, they make up the biggest portion in share in employment.

Table 4.4b: Eastern Anatolia Region 2000

High point cluster 2000	Driver industries	LQ	Share in employment (%)
Food, beverages and tobacco	Slaughtering, preparing and preserving meat	3.37	4.77
	Grain mill products	1.83	1.35
	Sugar factories and refineries	22.95	43.42
	Prepared animal feeds	1.83	1.02
	Wine industries	15.02	0.91
	Tobacco	8.15	13.78
Basic metal industries	Iron and steel basic metal industries	3.21	13.58

In 2000, the food, beverages and tobacco industry forms nearly 65% of the region's manufacturing employment. The highest LQ and highest share in employment belongs to sugar factories and refineries. The industries LQ and share in employment have risen significantly from 1980 to 2000. It is possible to say that the most specialized industry is the sugar factories and refineries. As a driver industry 'wine industries' has a quite high LQ index, however it has the lowest share in the region's manufacturing employment. Since, food, beverages and tobacco industries, are considered to be mainly labour-intensive, this result is interesting. It can be explained by wine industries not being quite common among Turkey's regions and mostly concentrated in only a small number of regions and also this result might be due to wine industries using relatively high levels of technology and industry specific labour skills compared to all the other low tech industries and mainly to food, beverages and tobacco industries. The LQ index of 'tobacco manufacturers' has increased significantly, however the share in the region's manufacturing employment has decreased from 1980 to 2000. This can again be explained by usage of relative higher level of technology and becoming less labour intensive. It can also be explained by outsourcing of some of the work such as gathering and drying tobacco. In such a manner outsourcing will cause an increase in the value added of a firm because of less number of workers and relatively high amount of output and also decreases firms' and hence industry's share of employment in the region. Finally, both in 1980 and 2000, the basic metal industry cluster forms almost 10% of the regions employment; however the driver industries are different for both years.

4.6.3 Driver Industries in Aegean Region:

Table 4.5 shows high point clusters, driver industries, LQ indices and shares of the industries' employment for years 1980 and 2000 in the Aegean Region.

Table 4.5a: Aegean Region 1980

High point cluster 1980	Driver industries	LQ	Share in employment (%)
Food, beverages and tobacco	Canning and preserving of fruits and vegetables	3.95	4.69
	Vegetables and animal oils and fats	2.30	3.66
	Sugar factories and refineries	1.29	3.45
	Distilling, rectifying and blending spirits	1.74	0.62
	Soft drinks and carbonated waters industries	2.04	0.93
	Tobacco	2.65	17.65
Textile	Spinning, weaving and finishing textiles	1.21	21.81
	Wearing apparel except leather and fur	1.02	1.23
Paper and paper products, printing and publishing	Pulp, paper and paperboard	2.43	3.67
Non-metallic mineral products	Structural clay products	2.49	5.80
	Non-metallic mineral products not classified elsewhere	1.78	1.78

In 1980, the two main clusters in the region are food, beverages and tobacco cluster and textile cluster. Food, beverages and tobacco cluster forms almost 30% of the region's manufacturing employment, whereas the textile cluster forms almost 23%. The main driver industry in food beverages and tobacco cluster is tobacco manufacturers. In the textile cluster the main driver industry is spinning, weaving and finishing textiles. Despite the low values of LQ for the textile cluster, textile sector is quite important in the Aegean region. Low LQ index and high employment share situation is also present for the Aegean region. The only driver industry in the paper and paper products cluster is, manufacture of pulp, paper and paper board and forms almost 4% of the region's manufacturing employment. Finally the main driver industry in the non-metallic mineral cluster is structural clay products and forms almost 6% of the region's manufacturing employment.

Table 4.5b: Aegean Region 2000

High point cluster 2000	Driver industries	LQ	Share in employment (%)
Food, beverages and tobacco	Dairy products	1.20	0.92
	Canning and preserving of fruits and vegetables	3.18	5.72
	Vegetable and animal oils and fats	1.95	1.53
	Soft drinks and carbonated water industry	1.14	0.53
	Tobacco	3.59	6.05
Textile	Made-up textile goods except wearing apparel	3.72	12.19
	Wearing apparel except leather and fur	2.16	1.43
	Tanneries and leather finishing	1.12	0.44
Chemicals	Paints varnishes and lacquers	1.52	0.86
	Petroleum refineries	1.75	0.78
	Plastic products not classified elsewhere	1.25	3.32
Non-metallic mineral products	Pottery, china and earthenware	3.55	3.25
	Structural clay products	1.96	2.92

In 2000, the main clusters are still food, beverages and tobacco industries and textile industries. However, the ‘food, beverages and tobacco’ cluster forms only 15% of the region’s manufacturing employment and the ‘textile’ cluster forms 14% of the region’s total manufacturing employment. The numbers of driver industries, LQ indices of the industries and shares in regions employment have decreased from 1980 to 2000 in Aegean region. The other two clusters in 2000 are: chemicals and non-metallic mineral products. These two clusters form a total of 11% of the region’s employment. The highest LQ value and the highest employment share in 2000, belongs to made-up textile goods except wearing apparel. The driver industry which has the highest share in 1980 was ‘spinning, weaving and finishing textiles’ industry, which is not a driver industry in 2000 anymore. Although textiles are still one of the main high point clusters both in 1980 and 2000, the driver industries are completely changed.

4.6.4 Driver Industries in Southeast Anatolia Region:

Table 4.6 shows the high point clusters, the driver industries, LQ indices and the shares in the region’s manufacturing employment, for years 1980 and 2000 in Southeast Anatolia Region.

Table 4.6a: Southeast Anatolia Region 1980

High point cluster 1980	Driver industries	LQ	Share in employment (%)
Food, beverages and tobacco	Slaughtering, preparing and preserving meat	6.55	6.13
	Dairy products	2.08	0.98
	Vegetable and animal oils and fats	2.40	3.79
	Grain mill products	1.59	1.96
	Prepared animal feeds	2.40	0.96
	Distilling, rectifying and blending spirits	16.78	5.98
	Tobacco	1.37	9.06
Textile	Spinning, weaving and finishing textiles	1.63	29.39
	Carpets and rugs	4.07	4.5
Chemicals	Petroleum refineries	33.37	28.31
	Plastic products not classified elsewhere	2.06	2.97

In 1980, there are three clusters in the Southeast Anatolia region: food, beverages and tobacco cluster, textile cluster and chemicals cluster. The food, beverages and tobacco cluster forms nearly 30% of the region's manufacturing employment. The highest LQ ratio in food, beverages and tobacco cluster belongs to distilling, rectifying and blending spirits; however the highest share in employment belongs to tobacco manufacturers. The textile cluster makes up to nearly 35% of the region's manufacturing employment and is the main cluster of the region. In the textile cluster there are only two driver industries: spinning, weaving and finishing textiles and carpets and rugs. Carpets and rugs industry have the highest LQ ratio in the textile cluster. This industry has an historical background in the region, however it only forms 4.5% of the region's manufacturing employment. This might be because carpets and rugs industry in this region are quite labour intensive and require industry specific skills. The highest employment share in the region belongs to spinning, weaving and finishing textiles, despite its relatively low LQ index. The highest LQ index in the region belongs to petroleum refineries industry with a relatively high share of employment in the region. As can easily be seen from table 4.6a, the above driver industries belonging to three clusters form almost 95% of the region's manufacturing employment in 1980.

Table 4.6b: Southeast Anatolia Region 2000

High point cluster 1980	Driver industries	LQ	Share in employment (%)
Textile	Spinning, weaving and finishing textiles	3.77	55.08
	Made-up textile goods except wearing apparel	1.58	5.16
	Carpets and rugs	11.89	8.60

There is a significant decrease in the region's clusters when compared to 1980. In 2000, the only cluster in the region is textiles and it forms almost 70% of the region's manufacturing employment. The highest LQ index in the cluster again belongs to carpets and rugs and there is also a significant increase in the index and the share in employment when compared to 1980. However, the highest share in employment again belongs to spinning, weaving and finishing textiles.

4.6.5 Driver Industries in Central Anatolia Region:

Table 4.7 shows, the high point clusters, driver industries, LQ indices and shares in employment, for years 1980 and 2000 in Central Anatolia Region.

Table 4.7a: Central Anatolia Region 1980

High point cluster 1980	Driver industries	LQ	Share in employment (%)
Basic metal industries	Non-ferrous metal basic industries	4.11	10.83
Fabricated metal products, machinery and equipment	Structural metal products	2.65	2.41
	Fabricated metal products except machinery and equipment	1.30	3.16
	Engines and turbines	3.74	0.94
	Agricultural machinery and equipment	2.89	3.31
	Metal and woodworking machinery	2.80	1.35
	Special industry machinery	1.96	2.39
	Machinery and equipment except electrical	2.57	7.06
	Railroad equipment	6.22	8.13

In 1980, there are only two clusters in Central Anatolia: basic metal industries and fabricated metal products. The basic metal industries cluster forms only 10% of the region's manufacturing employment with one driver industry. Fabricated metal products industry, on the other hand, makes up nearly 30% of the region's manufacturing employment. 'Non-ferrous metal basic industries' has the highest share in the region's employment among driver industries. The highest LQ index, however, belongs to the railroad equipment industry. All these driver industries belong to medium-high tech and medium-low tech industries. Therefore it is possible that they are capital abundant industries using relatively skilled labour and also creating high value added with less labour relative to the low tech industries, hence this might explain the reason behind their low shares in employment.

Table 4.7b: Central Anatolia Region 2000

High point cluster 2000	Driver industries	LQ	Share in employment (%)
Food, beverages and tobacco	Grain mill products	2.40	1.76
	Bakery products	2.70	5.01
	Sugar factories and refineries	2.43	4.59
	Distilling, rectifying and blending spirits	2.54	0.72
	Wine industries	1.90	0.11
	Malt liquors and malt	2.18	0.35
Wood and wood products, furniture	Furniture and fixtures except metal	4.59	6.36
Non-metallic mineral products	Non-metallic mineral not classified elsewhere	2.12	4.30
Fabricated metal products, machinery and equipment	Furniture and fixtures primarily of metal	2.38	2.13
	Structural metal products	3.05	4.20
	Fabricated metal products	2.39	5.19
	Agricultural machinery and equipment	1.57	0.98
	Metal woodworking machinery	2.79	1.14
	Special industrial machinery and equipment	3.23	3.09
	Machinery and equipment except electrical not classified elsewhere	3.87	9.87
	Radio, television and communication apparatus	2.44	3.84
	Electrical appliances and household goods	2.37	1.70

In 2000, there are four clusters in the region. These are: food beverages and tobacco, wood products and furniture, non-metallic mineral products and fabricated metal products. The only common cluster between 1980 and 2000 is fabricated metal products, and in 2000 this cluster has more driver industries and forms nearly 32% of the region’s manufacturing employment. Food, beverages and tobacco cluster forms almost 13% of the region’s manufacturing employment. In 2000, in contrast to 1980, there are low tech industry clusters as well as medium-high and medium-low tech clusters. There is also one high-tech industry in 2000 as a driver industry, which is the radio, television and communication appliances industry.

4.6.6 Driver Industries in Black Sea Region:

Table 4.8 shows the high point clusters, the driver industries, LQ indices and shares in employment for the years 1980 and 2000 in the Black Sea region.

Table 4.8a: Black Sea Region 1980

High point cluster 1980	Driver industries	LQ	Share in employment (%)
Food, beverages and tobacco	Sugar factories and refineries	2.06	5.48
	Food products not elsewhere classified	7.90	32.30
	Tobacco	2.60	17.29
Basic metal industries	Iron and steel basic industries	3.79	25.58

In 1980, there are only two clusters in the Black Sea region: food, beverages and tobacco cluster and basic metal industries cluster. The highest LQ index and the highest share in regions employment belongs to food products. The tobacco industry, having a relatively low LQ index, forms almost 18% of the region’s manufacturing employment. Finally iron and steel basic industries form almost 26% of the region’s manufacturing employment. The only two clusters make up nearly 81% of the region’s employment together.

Table 4.8b: Black Sea Region 2000

High point cluster 2000	Driver industries	LQ	Share in employment (%)
Food, beverages and tobacco	Slaughtering, preparing and preserving meat	3.25	4.60
	Grain mill products	1.47	1.08
	Sugar factories and refineries	2.75	5.19
	Food products not classified elsewhere	14.13	29.32
	Distilling, rectifying and blending spirits	2.24	1.25
	Tobacco	5.19	8.78
Wood and wood products	Sawmills, planning and other wood mills	7.34	6.83
Basic metal industries	Iron and steel basic industries	5.83	24.66
	Non-ferrous metal basic industries	1.22	1.44

In 2000, there are three clusters in the region: food, beverages and tobacco cluster, wood and wood products cluster and basic metal industries cluster. In the food, beverages and tobacco cluster, again the highest LQ index and the highest share in employment belong to food product industries. However, when compared to 1980, the LQ index has increased significantly, whereas the share in the region’s manufacturing employment has fallen. Similarly, tobacco manufacturers industry has a higher LQ index in 2000; however it has a lower share in the region’s manufacturing employment.

The iron and steel basic industries has a 25% share in the region's manufacturing employment. Although there are three clusters in 2000, the total share in the region's manufacturing employment is about 67%, which is significantly smaller than the two clusters total share in 1980.

4.6.7 Driver Industries in Marmara Region:

Table 4.9 shows, the high point clusters, the driver industries, the LQ indices and the shares in the region's manufacturing employment for the years 1980 and 2000 in the Marmara Region.

Table 4.9a: Marmara Region 1980

High point cluster 1980	Driver industries	LQ	Share in employment (%)
Textile	Knitting mills	2.15	2.38
	Cordage, rope and twine industries	2.30	0.12
	Textiles, not elsewhere classified	2.42	0.32
	Made-up wearing apparel except leather and fur	1.99	2.39
	Tanneries and leather finishing	1.61	0.78
	Footwear	2.11	1.26
Paper and paper products, printing and publishing	Containers and boxes	1.78	1.05
	Pulp, paper and paperboard not classified elsewhere	1.88	0.28
	Printing, publishing and allied industries	1.61	2.13
Chemicals	Basic industrial chemicals	1.30	1.53
	Synthetic resins, plastic material and man-made fibres	1.55	1.47
	Drugs and medicines	2.28	2.33
	Soap and cleaning preparations, cosmetics, perfumes, toilet paper	1.41	0.82
	Chemical products not classified elsewhere	1.39	0.69
	Metallic oils	1.83	0.30
	Gas bottling	2.19	0.41
	Rubber products	1.43	1.07
	Plastic products	1.72	2.48
Fabricated metal products, machinery and equipment	Cutlery, hand tools and general hardware	1.63	1.54
	Fabricated metal products	1.82	4.40
	Electrical industrial machinery and apparatus	1.35	1.55
	Radio television and communication equipment apparatus	2.19	1.94
	Electrical apparatus and supplies	1.95	2.92
	Shipbuilding and repairing	2.20	2.59
	Motor vehicles	1.64	5.59

Marmara is the most important region for manufacturing industry in Turkey. Marmara region includes Istanbul: the biggest city in Turkey, and this region is the closest region to Europe, the main trading zone for Turkish economy, other cities in the region besides Istanbul are also quite specialized and industrialized. Hence it is not surprising that Marmara region has many clusters and driver industries and have low shares of employment but still specialized. In 1980, there are four main clusters in the region: textiles, manufacture of paper and paper product, printing and publishing, chemicals and finally fabricated metal products, machinery and equipment. Since there are many clusters and many driver industries, the driver industries' shares in employment are relatively low. The textile cluster in the region makes up nearly 8% of the region's manufacturing employment. The paper and paper products, printing and publishing cluster, makes up only 4% of the region's manufacturing employment. The chemicals cluster, forms 11% of the region's manufacturing employment and finally, the fabricated metal products, machinery and equipment cluster makes up almost 20% of the region's manufacturing employment and therefore is the main cluster of the region in 1980.

Table 4.9b: Marmara Region 2000

High point cluster 2000	Driver industries	LQ	Share in employment (%)
Textile	Knitting mills	1.85	10.43
	Cordage, rope and twine industries	1.74	0.02
	Textiles not elsewhere classified	2.09	0.48
	Made-up wearing apparel except leather and fur	1.52	12.26
	Leather and leather substitutes	1.71	0.16
	Footwear	2.11	0.92
Chemicals	Basic industrial chemicals except fertilizers	1.30	0.37
	Synthetic resins, plastic materials and manmade fibres	1.55	0.17
	Drugs and medicines	2.29	2.87
	Soap and cleaning preparations, perfumes, cosmetics and toilet paper	1.41	0.97
	Chemical products not classified elsewhere	1.39	0.56
	Metallic oils	1.83	0.08
	Gas bottling	2.19	0.51
	Rubber products not classified elsewhere	1.43	1.10
	Plastic products not classified elsewhere	1.72	3.18
Fabricated metal products, machinery and equipment	Cutlery, hand tools and general; hardware	1.55	1.61
	Furniture and fixtures primarily of metal	1.46	1.30
	Electrical industrial machinery and apparatus	1.66	2.31
	Electrical apparatus not classified elsewhere	1.56	2.62

In 2000, there are only three clusters in Marmara region. These are: textile, chemicals and fabricated metal product, machinery and equipment cluster. In the textile cluster, the knitting mills driver industry has significantly lower LQ index but a higher share in the region's manufacturing employment, compared to 1980. The made-up wearing apparel cluster has a share of 12% in the region's manufacturing employment. Therefore it is the main driver industry in the textile cluster. Other than the knitting mills and made-up wearing apparel clusters, the shares of driver industries in the region's manufacturing employment are relatively low. Textile cluster makes up to almost 25% of the region's manufacturing employment, which is a quite significant rise from 1980. The chemicals cluster, forms almost 10% of the region's manufacturing employment. Finally the fabricated metal products cluster makes up almost 8% of the region's manufacturing employment, which is a significant fall compared to 1980.

4.6.8 Decomposition Results

Figure A4.1 of the appendix, show the change in the EG index throughout the 1980-2001 period for selected industries such as: slaughtering, preparing and preserving meat (3111), manufacture of dairy products (3112), sugar factories and refineries (3118), wine industries (3132), tobacco manufacturers (3140), spinning weaving and finishing textiles (3211), manufacture of drugs and medicines (3522), petroleum refineries (3530), iron and steel basic industries (3710), shipbuilding and repairing (3841) and finally manufacture of aircraft (3845). These industries are representing low tech, medium-low tech and high tech industries and are among the most common agglomerated industries and are observed in many regions.

As can be seen from Figure A4.1, most of the selected industries are quite volatile in terms of change in their agglomeration levels, apart from the aircraft industry (3845), which only faces a severe de-agglomeration process in 1991. This decrease in agglomeration in 1991 is common in all manufacturing industry sectors. It is not surprising considering 1991 is the year of a severe economic crisis in Turkey. And again it is clear from Figure A4.1 that manufacturing industries began giving signals of the 1991 crisis from 1990 and it seems after 1993, all the agglomeration levels start to rise again; showing that the effect of the crisis declines gradually.

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 affected 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, Ellison and Glaeser (2002) suggested a decomposition of the E-G index. However, their decomposition is to reveal the mean reversion and the randomness which affects the agglomeration index. Their first motivation for the decomposition is 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 is 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 trying to examine whether this effect is caused by firms being immobile and/or tend to locate in the same region with old firms. They find 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 argue that historical accidents are important in geographical concentration and have long lasting effects.

The motivation of this chapter, 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), uses a proxy for the E-G index when decomposing. They ignore the term (1-H_t) from the equation, however, they argue 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 industry 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(1999) and applying his decomposition to the case of agglomeration the E-G index is decomposed to its determinants as follows:

$$\gamma_t = \frac{G_t}{(1-X_t)(1-H_t)} - \frac{H_t}{(1-H_t)} \qquad (1)$$

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

$$\gamma_t = \frac{1}{A_t}.G_t - M_t \quad (2)$$

Where;

$$M_t = \frac{H_t}{(1-H_t)}, A_t = (1 - \sum X_t)(1 - H_t)$$

$$\gamma_{t-1} = \frac{1}{A_{t-1}}.G_{t-1} - M_{t-1} \quad (3)$$

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

$$\Delta\gamma = \frac{1}{A_t}.\Delta G - \Delta M - \frac{G_{t-1}}{(A_t)(A_{t-1})}.\Delta A \quad (4)$$

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

$$\Delta\gamma = a.\Delta G - \Delta M - b.\Delta A \quad (5)$$

Where;

$$a = \frac{1}{A_t}, b = \frac{G_{t-1}}{(A_t)(A_{t-1})} \quad (6)$$

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 A4.6 shows the main forces behind the change in the E-G index throughout the 1980-2001 period.

The results of the decomposition presented in table A4.6 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 sectors is an important factor for changing agglomeration levels in Turkey.

4.7 Summary and Conclusion

The findings of this chapter 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. Examining the LQ index indicates that low tech industries such as textiles, food beverages and tobacco industries are present in most of the regions, however, they are more agglomerated than others in some. 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 Allonso-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. Finally to fully understand what is affecting agglomeration in Turkish manufacturing industries and to investigate the reasons behind this declining trend a further econometric analysis is necessary.

CHAPTER 5: THEORETICAL FOUNDATIONS OF AGGLOMERATION IN TURKISH MANUFACTURING INDUSTRIES

5.1 Introduction

Agglomeration has become a widely discussed topic in economic literature in the last decade. At the heart of concerns about agglomeration lies the various reasons behind agglomeration and also the effects of agglomeration on industries and economies are discussed. Krugman (1991a) asks; "why and when manufacturing industries concentrate" and researchers are trying to find out the impacts of this concentration.

Traditional trade theories examine the specialization process but without the dimension of space. The advancement in this theoretical context by the inclusion of space dimension is relatively new and began with the new trade theories and new economic geography theories, often called spatial economics. After these "new" theories, geography became vital for economists. In this sense agglomeration: geographical and industrial concentration becomes very important.

Examining agglomeration and the factors behind this process may reveal why some sectors are agglomerated and why some are dispersed. Furthermore the agglomeration process can also help researchers to understand why regional disparities occur. The effects and implications of the process are also important.

In order to examine the effects and implications of agglomeration, first of all agglomeration and its determinants should be fully examined and understood. Therefore in this chapter the process of agglomeration is examined and the underlying reasons behind this process are investigated. To uncover these underlying reasons: different trade theories conditioning on different assumptions to explain specialization are used.

There are three main theories that explain regional specialization of industries; traditional trade theory, new trade theory and new economic geography models. The main purpose of this chapter is to investigate which theory best explains the agglomeration patterns in Turkish manufacturing industry between 1980 and 2001.

The remainder of this chapter is organized as follows; section 5.2 provides background information on the previous empirical literature. Section 5.3 lists some stylized facts about agglomeration which arises from the previous literature. Section 5.4 provides information about the main aim and focus of the chapter and lists the research questions that will be addressed. Section 5.5 provides information on the data used and also the methodologies employed throughout the study. Section 5.6 gives and discusses the estimation results and finally section 5.7 summarizes and concludes the chapter.

5.2 Empirical Background

The E-G index is the most appropriate tool to examine agglomeration. However, a descriptive analysis, while necessary, is not sufficient to fully understand the patterns of agglomeration.

In the literature, numerous studies use specialization or agglomeration indices as dependent variables and attempt to identify the main determinants of those indices.

Amiti (1999) uses the Gini index, calculated with production and employment data for EU countries with two data sets: EUROSTAT including 5 EU countries and UNIDO including 10 EU countries. In this study both country and industry Gini coefficients are calculated to see both the industrial and spatial dimension. Results indicate increasing specialization for some countries such as: France, Portugal, Spain and U.K. Then Amiti regresses the Gini coefficient on three independent variables representing different trade theories; Heckscher-Ohlin theory of trade, new trade theories (NTT) and new economic geography (NEG) models. She estimates such equation using pooled OLS and attempts to capture industry and time specific effects via industry and time dummies. The results indicate that new trade theories and NEG have the best explanatory power for geographical concentration.

This study can be considered as one of the most important cornerstones in economic geography literature. This importance comes from the regression model. Using proxies for different trade theories and testing their significance and effect on geographical concentration is a useful tool in the process of understanding the specialization process. Using solid theories makes the application simple, intuitive and easy to interpret. However, it can be argued that the proxies used to represent trade theories might not necessarily be good proxies and might not always capture all the elements and assumptions of a theory. Amiti herself also argues the strength and weaknesses of such proxies and concludes that they can be used for such representation.

Brulhart (2001) also uses the Gini index to examine specialization in Europe. To identify any time trend, he regresses the logarithm of Gini index on a time trend and finds a declining trend in Europe's specialization.

Paluzie, Pons, & Tirado (2001) also use the Gini coefficient as a dependent variable. These differ from Amiti (1999) in using 4 independent variables representing Ricardian trade theory; Heckscher-Ohlin theory of trade; NTT and NEG models. They use 1979-1992 data for Spain and performs OLS and 2SLS (using lagged values of independent variables as instruments). They find no evidence for increasing specialization for Spain in the period under study. Furthermore, they concluded that the most important determinant of geographical concentration is scale economies which means NTT best explains geographical concentration.

These studies can be considered among the first important steps towards explaining geographical concentration. However, it must be said that using OLS as a method of estimation can only reveal limited information about specialization and/or agglomeration. Regional concentration and agglomeration are issues with many dimensions; such as regions, industries and time. Hence, to understand the agglomeration or specialization process fully it is important to consider all of these dimensions.

Falcioglu and Akgungor (2008) adopt the same technique and apply it for Turkey. They use the Gini index as a dependent variable and regress it on 4 different independent variables representing four different trade theories. They use panel data for the years between 1980 and 2000 and find that Turkish manufacturing industry has an increasing trend of geographical concentration and conclude that Ricardian theory and NTT best explain this pattern in Turkish manufacturing.

As mentioned before, the Gini index can either be calculated for industrial concentration or regional concentration. Therefore it is not a suitable measure for agglomeration. Hence none of the above studies attempt to explain the agglomeration process. Furthermore they only use 4 proxies to represent 4 trade theories. However in reality it is not unrealistic to assume that one or more of those independent variables can be seen together, interacting in an economy.

It is also possible to find studies using similar methods only with different dependent variables such as Haaland et al. (1999) using absolute and relative concentration indices as a dependent variable. They regress the concentration measures on 6 independent variables: a Ricardian proxy, Heckscher-Ohlin proxy, NTT proxy, and 3 different NEG proxies using input-output tables for 13 EU countries. They employ the OLS technique as the estimation method for the 1985-1992 period and find that NTT and NEG models explain both relative and absolute geographical concentration.

Kim (1995) uses the Krugman specialization index as a dependent variable and estimates a model with two independent variables representing Heckscher-Ohlin theory and NTT for US manufacturing industries. The author uses a panel regression method and finds that NTT explains industry localization over time and Heckscher-Ohlin theory explains localization patterns across industries. Kim's study shows that using panel regression method helps indentifying between different dimensions. However, this study again does not consider agglomeration; Kim is rather interested in regional concentration only.

Recent studies use E-G index and regress the index on different independent variables to examine agglomeration.

Alecke et al. (2006) use the E-G index in a descriptive and empirical manner. They have a large data set covering 116 industries on firm level. They regress the index on variables such as: size, natural advantages dummy, increasing returns and transport costs; mostly proxies for NEG models. However they only have one year; 1998 and hence employ OLS method for estimation.

Rosentahl and Strange (2001) use the E-G index to measure agglomeration in US manufacturing industries. Then they use the index as a dependent variable and use industry characteristics that proxy knowledge spillovers, labour market pooling, input sharing, shipping costs and natural advantages as independent variables. They use 2-3 and 4 digit level data to check for sensitivity for the year 2000. Results from OLS estimation indicate that labour market pooling explains and positively affects agglomeration. Rather than using proxies for different trade theories, Rosentahl and Strange employ independent variables which are considered as the main reasons of agglomeration in theory. Hence this study can be considered as proper modelling is applicaple however with a large, detailed data set, which is unavailable for Turkish manufacturing industries.

5.3 Some Stylzed Facts on Agglomeration

As mentioned before, most empirical evidence regarding agglomeration is from Europe and the US. Evidence regarding developing economies are quite scarce. Judging from the previous literature, some generalizations regarding the determinants of agglomeration can be made:

i. The basic methdology in the literaure is to identify the determinants of agglomeration and/or specialization using the index for agglomeration or specialization as a dependent variable and using proxies to represent different trade theories taking into account their main assumptions regarding specialization.
ii. The findings suggest that for Europe NTT and NEG models have the best explanation power regarding geographic speciazliation and agglomeration.
iii. For the US the findings indicate that NTT and Heckscher-Ohlin theory best explains the current specialization trends in manufacturing.

5.4 Aim and Focus of the Chapter

This chapter aims to identify the main determinants of agglomeration process in Turkish manufacturing following the widely used methodology, regressing the agglomreation index on independent variables which proxy for different trade theories. The main contribution of this chapter is to add to the scarce evidence on Turkish manufacturing industry. To my knowledge there are no studies using the agglomeration index as a dependent variable for Turkish manufacturing industries. Agglomeration being such an important and widely discussed topic in the literature it is surprising that there are no such studies for Turkish manufacturing and this issue remains as a main gap in the literature. This chapter will focus on answering following questions:

i. Which theory or theories best explain the agglomeration patterns in Turkish manufacturing industries?
ii. Are there any similarities/differences among the determinants of agglomeration between Turkey and developed economies?

iii. The importance of employing the right methodology and exploring the differences that arise from using different methodologies such as fixed effects models, random effects models, pooled OLS with differences and dynamic models.

5.5 Data and Methodology[16]

In this chapter, the E-G index is used as a dependent variable in order to examine which theory best explains and/or determines the patterns of agglomeration in Turkish manufacturing industries. For such analysis, fixed effects, random effects and pooled OLS with differences and dynamic GMM estimation methods are employed. Methods and formulas regarding these estimation techniques are examined further in this chapter.

5.5.1 Linear Regression Using Panel Data

The basic framework for such analysis is that:

$$y_{it} = \alpha + \mathbf{X}'_{it}\beta + u_{it} \quad \text{where } i=1,...,N \text{ and } t=1,...,T \tag{7}$$

In general framework, i denotes the cross sectional units and t denotes year. In such case, i denotes industries and t denotes years throughout 1980-2001. The composite error term u_{it} can be further decomposed:

$$u_{it} = \mu_i + v_{it} \tag{8}$$

Where; μ_i denotes the unobservable individual effect of the ith term and v_{it} is the remainder disturbance. μ_i, is time invariant and captures the time invariant industry specific effects in such case. The remainder disturbance, varies with industries and also time. There are several methods to estimate an equation in form of equation (7). However, only fixed effects, random effects and pooled OLS with differences are examined in this chapter because only these methods are used further in the study.

5.5.2 The Fixed Effects Model

In the fixed effects model, the μ_i which represents the industry specific effects are assumed to be fixed parameters to be estimated and the reminder disturbance; is assumed to be identically and independently distributed with zero mean and a constant variance; v_{it}~IID$(0,\sigma_v^2)$. Further the X_{it}; being the independent variables that varies over

[16] (Baltagi, 2001); (Greene, 2002); (Wooldridge, 2002).

industry and time are assumed to be independent of the v_{it} for all i and t. If the focus of attention is on a specific set of N industries, then the fixed effects model is an appropriate specification because in such modelling the inference will be conditional on the specific set of N industries.

The fixed effects estimator, however, cannot estimate the effect on any time invariant variable because these variables are differenced out by the transformations used to estimate the model. Deviations from means are formulated as follows:

$$y_{it} - \bar{y}_i = (\mathbf{x_{it}} - \bar{\mathbf{x}}_i)'\beta + u_{it} - \bar{u}_i \quad (9)$$

With group means being:

$$\bar{y}_i = \bar{\mathbf{x}}_i{}'\beta + \alpha + \bar{u}_i \quad (10)$$

Where:

$$\bar{y}_i = \frac{1}{n}\sum_{i=1}^{n} y_{it}\ ;\ \bar{x}_i = \frac{1}{n}\sum_{i=1}^{n} x_{it}\ \ ;\ \bar{u}_i = \frac{1}{n}\sum_{i=1}^{n} u_{it} \quad (11)$$

As $T\rightarrow\infty$, the fixed effects estimators are consistent. However, with panel data the typical issue is that, T is fixed and $N\rightarrow\infty$, then only the fixed effects estimator of β is consistent.

5.5.3 The Random Effects Model

The problem with the fixed effects estimator is that of too many parameters and degrees of freedom can be higher if the industry specific effects; μ_i can be assumed random. In this case, μ_i~IID(0, σ_μ^2) and v_{it}~IID(0, σ_v^2) and further μ_i and v_{it} is assumed to be independent of each other. In addition, similar to the fixed effects model, X_{it} are assumed to be independent of μ_i and v_{it} for all i and t. Random effects model, different than fixed effects assume that the sample of N industries is drawn randomly from a large population. In this case the inference is based on the large population from which N is randomly drawn. In particular, the random effects estimator turns out to be equivalent to the estimation of:

$$(y_{it} - \theta\bar{y}_i) = (1-\theta|\alpha + (\mathbf{x_{it}} - \boldsymbol{\theta}\bar{\mathbf{x}}_i)'\beta + \{(1-\theta)\mu_i + (v_{it} - \theta\bar{v}_i)\} \quad (12)$$

Where; Θ is a function of σ_v^2 and σ_μ^2.

The random effects estimator of (9) requires μ_i and $\bar{x_i}$ to be uncorrelated. The random effects estimator use both within and between transformations.

Consider the following model, similar to (1), with the exception of explicitly identified variables:

$$y_{it} = \alpha + x_{it}\beta_1 + s_i\beta_2 + z_t\beta_3 + \mu_i + v_{it} \quad (13)$$

In equation (10) x_{it} varies over both i and time, s_i varies only over i and is time-invariant and finally z_t varies only over time. The between transformation of (10) is:

$$\bar{y_i} = \alpha + \bar{x_i}\beta_1 + s_i\beta_2 + \bar{z}\beta_3 + \mu_i + \bar{v_i} \quad (14)$$

And the within transformation is:

$$(y_{it} - \bar{y_i}) = (x_{it} - \bar{x_i})\beta_1 + (z_t - \bar{z})\beta_3 + (v_{it} - \bar{v_i}) \quad (15)$$

The within estimator provides no information on β_2 since the time invariant factors are differenced away. The key to the random effects estimator is the GLS transformation. The GLS transform of a variable z for the random effects model is:

$$z_{it}^* = z_{it} - \widehat{\theta_i}\bar{z_i} \quad (16)$$

Where: $\bar{z_i} = \frac{1}{T_i}\sum_t^{T_i} z_{it}$ and $\widehat{\theta_i} = 1 - \sqrt{\frac{\sigma_v^2}{T_i\sigma_\mu^2 + \sigma_v^2}}$

As mentioned before, fixed effects allow μ_i and x_{it} to be correlated while random effects require no correlation between the two. Therefore, fixed effects is the more widely employed method in literature, however random effects is also applied in some situations. If the random effects estimation holds the random effects is preferred to fixed effects because it is more efficient. One way to identify which method should be used is the Hausman specification test.

5.5.4 Hausman Specification Test

The main and critical assumption in the error component model is; $E(u_{it}|x_{it})=0$. The within transformation differences out the time invariant variables and hence the within estimator becomes unbiased and consistent even when this assumption does not hold. However, when the assumption does not hold the random effects (or GLS) estimator becomes biased and inconsistent. Hausman (1978) suggests a comparison between $\widehat{\beta_{GLS}}$, which is the random effects estimator for β and $\widehat{\beta_w}$; which is the fixed effects estimator of β. The Hausman statistic has a χ^2 distribution and is computed as:

$$H = \left(\widehat{\beta_w} - \widehat{\beta_{GLS}}\right)'(V_w - V_{GLS})^{-1}(\widehat{\beta_w} - \widehat{\beta_{GLS}}) \quad (17)$$

Where; β_w is the fixed effects estimator of β, V_w is the covariance matrix of the within estimator, β_{GLS} is the random effects estimator of β and finally V_{GLS} is the covariance matrix of the random effects estimator.

As mentioned before, the fixed effects estimator is consistent whether the assumption of $E(u_{it}|x_{it})=0$ holds or not, however when the assumption holds the random effects estimator is BLUE, consistent and asymptotically efficient, but inconsistent when the assumption does not hold.

5.5.5 Pooled OLS with differences

Another method of dealing with the unobserved heterogeneity is to pool cross-section data and estimate the model employing OLS. This method, similar to random effects requires the time invariant error component (μ_i) to be uncorrelated with the explanatory variables (x_{it}). Even if x_{it} is uncorrelated with the composite error term (μ_i+v_{it}) considering equation (10), pooled OLS estimator is inconsistent and biased if the time invariant error term is correlated with the explanatory variables. For a cross section observation i of equation (10):

$$y_{i2} = \alpha + x_{i2}\beta_1 + s_i\beta_2 + z_2\beta_3 + \mu_i + v_{i2} \quad (18)$$

$$y_{i1} = \alpha + x_{i1}\beta_1 + s_i\beta_1 + z_1\beta_3 + \mu_i + v_{i1} \quad (19)$$

Subtracting (15) form (16) yields;

$$(y_{i2} - y_{i1}) = (x_{i2} - x_{i1})\beta_1 + (z_{i2} - z_{i1})\beta_3 + (v_{i2} - v_{i1}) \quad (20)$$

Equation (17) can be written as;

$$\Delta y_i = \beta_1\Delta x_i + \beta_3\Delta z_i + \Delta v_i \quad (21)$$

With such a transformation, similar to the within transformation time invariant effects are differenced away. After such transformation, the parameters of (18) can be estimated using OLS, provided that Δv_i is uncorrelated with Δx_i. This is the case of strict exogeneity, for this assumption to hold v_{it} and x_{it} should be uncorrelated in both periods. Then the OLS estimator of β is called the first differenced estimator. Under the strict exogeneity assumption, first differenced estimator can be used as an alternative to fixed effects estimator (Baltagi, 2001).

5.5.6 Dynamic Panel Data Models

Many economic relationships are actually dynamic in nature and one of the advantages of panel data is that it gives the researcher the required tools for the estimation of a dynamic relationship. These dynamic relationships are characterised by the presence of a lagged dependent variable in the model as an explanatory variable. Consider the following model:

$$y_{it} = \delta y_{it-1} + \mathbf{x}'_{it}\beta + u_{it} \qquad i=1,...,N \text{ and } t=1,...,T \qquad (22)$$

Where, $u_{it}=\mu_i+v_{it}$ is again the composite error term, including both the time invariant individual heterogeneity and the remainder error term. Again it is assumed that; $\mu_i \sim IID(0,\sigma_\mu^2)$ and $v_{it} \sim IID(0,\sigma_v^2)$ are independent of each other and among themselves.

Since y_{it} is a function of μ_i, y_{it-1} is also a function of μ_i. Therefore a right hand regressor in (19) is correlated with the error term. Therefore, the methods discussed above such as OLS, fixed and random effects is not suitable for the estimation of such modelling. Even if the v_{it} is not serially correlated, y_{it-1} being correlated with μ_i causes the OLS estimator to be biased and inconsistent. The within transformation for the fixed effects estimator will difference out the time invariant parameters such as μ_i, however $(y_{it} - \overline{y_\imath})$ will still be correlated with $(v_{it} - \overline{v_\imath})$ and hence the fixed effects estimator will also be biased and inconsistent for small T panels, which is typical with panel data sets as mentioned before (small T, large N). Similarly, the random effects estimator which requires μ_i and x_{it} to be uncorrelated will also be biased in a dynamic panel data setting.

Arellano and Bond (1991) derived an estimation method for the estimation of parameters in dynamic panel data models such as (19). This GMM estimator which is consistent in a dynamic setting is designed especially for data sets with fixed T and large N. The consistent GMM estimator requires there to be no autocorrelation in the idiosyncratic error term. Anderson and Hsiao (1982) propose using further lags of the dependent variable as instruments after the panel-level effects have been removed by first differencing. Arellano and Bond (1991) build upon this idea and argue that there are more instruments available. They build on Holtz-Eakin, Newey and Rosen (1988) who propose vector autoregression techniques to analyse the dynamic relationship in panel data and use the GMM framework developed by Hansen (1982). Arellano and Bond (1991) identify how many lags of dependent, predetermined and endogenous variables can be considered as valid instruments. Using such large instrument matrix Arellano and Bond (1991) derive one-step and two-step GMM estimators to estimate the parameters of a dynamic relationship such as (19). They also derive the robust variance covariance estimator (VCE) for the one-step model. They also argue that the robust two-step VCE is biased. Windmeijer (2005) provides a bias corrected robust two-step VCE's for GMM estimators.

Furthermore, Arellano and Bover (1995) and Blundell and Bond (1998) build upon Arellano and Bond (1991). They make an additional assumption and assume that first differences of instrumenting variables are uncorrelated with the fixed effects hence allow introduction of more instruments and this larger instrument matrix improves efficiency. In Arellano and Bover (1995) and Blundell and Bond (1998) studies use system of two equations instead of one as in Arellano and Bond (1991). They augment Arellano and Bond (1991) by using a transformed equation as well as the original equation. Therefore Arellano and Bond (1991) is also known as "difference-GMM" while Arellano and Bover (1995) and Blundell and Bond (1998) study is known as "system-GMM".

5.5.7 The GMM estimator

OLS minimizes the sum of squared error terms. 2SLS is implemented via OLS regressions in two stages using instrument variables. In OLS and 2SLS, moments of regressors are set to zero. The main difference with 2SLS is that this methodology distinguishes between regressors and instruments. However in 2SLS methodology, no matter it is more general than OLS and allows for the use of instrument variables, an ambiguity arises when there are more instruments than regressors. In other words, when moment conditions outnumber parameters, the moment conditions will hold asymptotically however not hold perfectly in finite samples do. In such case it can be said that the specification is over identified. The GMM estimator is designed specifically for such situations and minimizes the magnitude of the moment vector rather than trying to set them all to zero. The GMM estimator is linear in y and is consistent.

5.5.8 Difference and System GMM

According to Roodman (2006), the difference and system GMM estimators are specifically designed to deal with following problems:

i. If the process in question is dynamic, i.e. if the dependent variable is influenced by its own past values. In other words dynamic panel data models can cope with the autocorrelation problem which arises from the presence of lagged dependent variables in the model.
ii. Endogenous or pre-determined regressors in the model.
iii. Idiosyncratic disturbances that have individual-specific patterns of heteroskedasticity and/or serial correlation. Autocorrelation might arise from using the lagged dependent variable in the model. Heteroskedasticity might be a result of time-invariant individual characteristics such as geography and demographics being correlated with the explanatory variables.
iv. The panel data set might have a short time dimension and a large individual dimension.
v. The only available instruments might be "internal", i.e. depends on lags of the variables itself; however it also allows the use of exogenous instruments.

The Arellano and Bond estimator uses first difference transformation as mentioned before. With first difference transformation deeper lags of regressors remain orthogonal to the error term and hence can be used as instruments. However, if the data in hand is an unbalanced panel data, first difference transformation magnifies the gaps in the data set. This problem can be overcome with the use of forward orthogonal transformation as suggested in Arellano and Bover (1995). Forward orthogonal deviation subtracts the average of all future observations of a variable. Hence it is computable for all observations except the last one, and therefore minimizes data loss. Further, the lagged observations are valid instruments in such case because they are not used in transformation, unlike first differencing. Finally, the main and most important difference between these two estimators is that Arellano and Bond estimator differences with levels and implies that past changes are predictive of current realizations of the dependent variable. However, Arellano and Bover estimator levels with differences and implies past levels themselves are predictive of current realizations of the dependent variable rather than past changes.

When trying to examine which trade theory explains the agglomeration process in Turkish manufacturing industries, it is possible to use two different variables to represent the neo-classical model. One is to represent the Ricardian explanation of specialization which is due to the effect of technological differences. And one is to represent the Heckscher-Ohlin explanation of trade specialization; differences in factor endowments across countries/regions (Wolfmayr-Schnitzer, 2000).

5.5.9 *The Independent Variables*

In traditional trade theory, Ricardo explains trade with technological differences between countries. Ricardo (1817) assumes the differences in labour productivity to be the only reason behind cross-country differences in production costs and hence specialization. The following variable is used to capture Ricardian technological differences, letting differences in technology to be represented by the differences in productivity of labour, following Haaland et al. (1999) however in this case it is used to represent the technological differences between regions rather than countries;

$$TECDIF_{it} = \sqrt{\frac{1}{n}\sum_j \left[\frac{\frac{VA_{ijt}}{E_{ijt}}}{\frac{1}{n}\sum_j \frac{VA_{ijt}}{E_{ijt}}} - \frac{\sum_i \frac{VA_{ijt}}{E_{ijt}}}{\frac{1}{n}\sum_j \sum_i \frac{VA_{ijt}}{E_{ijt}}}\right]^2}$$

Where; *i* denotes industries, *j* denotes regions, *n* denotes number of regions, *VA* denotes value added, *E* denotes employment and finally *t* denotes year.

This variable shows the deviation of labour productivity in a particular industry in one region from the average labour productivity in the same industry across the country. This measure only takes high values for high technological differences in region j relative to the other regions; it is not a measure of absolute technological differences. This measure, however, does not imply positive or negative technological differences for one region since it is using the squared term of differences between one region and the other, it takes on high values with both positive and negative technological differences. Ricardo's comparative advantage theory implies that higher technological difference results in higher geographical specialization (Ricardo, 1817). However, the relationship between geographical concentration and agglomeration is not straightforward. It is not possible to say that high degrees of geographical concentration will result in high levels of agglomeration. When considering agglomeration, one should also take into account industrial concentration as well as geographical concentration.

When technological differences occur, there is a possibility of an increase in firm exit. Firms which cannot keep up with the technological change will become inefficient in terms of production costs and will decide to exit. Schumpeter (1976) posits that the incentives of innovation of a small sized firm in competitive markets will be more costly than large sized firms. According to Schumpeter, large sized firms are more innovative because large sized firms can finance the costs of R&D and technological advancements without taking on debts, can take advantage of scale economies and protect their new technologies from their opponents better in comparison to small sized firms. Large sized firms can also hire more R&D personnel. Large sized firms with product differentiation are more advantageous of utilizing unexpected technological advancements than small sized firms. Therefore, when TECDIF takes high values; i.e. when relative technological difference increases, firm exit might increase, and the firms that exit will tend to be small firms rather than large firms. This increase in firm exit will affect industrial concentration by raising the Herfindahl index. Assuming similar numbers of small firms exiting in each region, hence assuming the geographical concentration stays constant; an increase in technological difference will result in a decrease in the level of agglomeration. On the other hand, if the majority of the firms can keep up with the technological change, the Herfindahl index will not change, production will be more concentrated and therefore agglomeration index will rise. As a result it can be argued that the expected sign of TECDIF is ambiguous.

As mentioned above, neo-classical models predict that countries will specialize in industries that are intensive in their relatively abundant factors (Amiti, 1999). This implies that, labour abundant countries will specialize in labour intensive production while capital abundant countries will specialize in capital intensive production. In either case there will be geographical concentration of the production activity. To use factor intensity data in order to capture Heckscher-Ohlin type concentration would be ideal. However; because of the data limitations, in order to capture the factor intensities suggested by the Heckscher Ohlin theory of trade below variable is used as a proxy following Amiti (1999);

$$(H-O)_{it} = \left| \frac{\sum_j LC_{ijt}}{\sum_j VA_{ijt}} - \frac{\sum_j \sum_i LC_{ijt}}{\sum_j \sum_i VA_{ijt}} \right|$$

Where; *i* denotes industries, *j* denotes regions, *LC* denotes labour costs and *VA* denotes value added and finally *t* denotes year.

This variable, measures the deviation of factor intensities in an industry in a specific region from the average. Such measure takes high values for both labour intensive industries and capital intensive industries. However since Heckscher Ohlin theory of trade does not imply that the capital abundant industries will be more geographically concentrated than the labour abundant industries or vice versa, the measure is used in absolute terms (Amiti, 1999). Therefore this measure implies that; the more intensive a country/region in use of one specific factor in production will be more geographically concentrated. Again this is a measure of relative factor abundances rather than absolute. This variable will affect geographical concentration but not industrial concentration. Therefore it is possible to say that the expected sign of the relationship between H-O and agglomeration index is positive.

The neo-classical theory of trade only assumes and explains inter-industry trade across countries/regions. It is however observed that regions that are similar in technology also experience high levels of trade. Therefore, comparative advantage is seen as insufficient as an explanation of trade and specialization (Wolfmayr-Schnitzer, 2000). New trade theories and new economic geography models are designed to encompass both inter-industry and intra-industry trade.

Contrary to the neo-classical models, the new trade theory assumes, scale economies, increasing returns, product differentiation and imperfect competition. Models of new trade theory also assume that market size is determined by the size of labour force in a country/region and that labour is immobile across countries, or in this case regions (Brulhart, 2001).

According to Helpman (1999), scale economies are the main reason behind product differentiation and this drives countries to specialize in different products and therefore increases the incentives for trade. Therefore models that allow scale economies and product differentiation can explain the high volume of trade between similar countries. To capture this aspect of new trade theory SCALE variable is used, following Amiti (1999);

$$SCALE_{it} = \frac{\sum_j E_{ijt}}{\sum_j NF_{ijt}}$$

Where; *i* denotes industries, *j* denotes regions, *E* denotes employment, *NF* denotes number of firms and finally *t* denotes year. This measure can be used as a proxy to capture plant-specific scale economies. From theory, scale economies are expected to increase geographical concentration and hence increase the level of agglomeration. Therefore it is possible to say that there is a positive relationship between scale economies and agglomeration.

New economic geography models are basically built upon the assumptions of increasing returns to scale and transport costs across countries/regions. Within this framework market size is also an important dimension. Contrary to the new trade theory, new economic geography models take mobility of workers into account. According to new economic geography models; agglomeration of manufacturing industries is basically demand driven and related with vertical linkages between upstream and downstream firms (Amiti 1999, Brulhart 2001). Krugman and Venables (1995) and Venables (1996) argue that a large number of downstream firms will attract upstream firms due to demand linkages and similarly, a large number of upstream firms will attract downstream firms due to cost linkages. Basically, the implication of the economic geography models is that industries using a high proportion of intermediate goods will tend to concentrate geographically.

In order to capture the intermediate goods intensity, implied by the new economic geography models, the following measure is used;

$$INTERM_{it} = \frac{\sum_j (P_{ijt}Q_{ijt} - VA_{ijt})}{\sum_j P_{ijt}Q_{ijt}}$$

Where; *i* denotes industries, *j* denotes regions, *VA* denotes value added, *PQ* denotes the value of output and finally *t* denotes year. Since, the input-output tables for the covered period for Turkey's regions are not available; this measure is used as a proxy for intermediate goods intensity, following Amiti (1999).

According to the new economic geography models, if firms use a high proportion of intermediate goods in their production processes, i.e. as vertical integration rises; this will result in high levels of agglomeration.

Table 5.1 summarizes the independent variables used, their definitions and sign expectations.

Table 5.1: Summary of Independent Variables

Variable	Definition	Sign expectation
TECDIF	Proxy for technological differences representing Ricardian theory	Ambiguous
H-O	Proxy for relative factor abundances representing Heckscher-Ohlin theory of trade	Positive
INTERM	Proxy for intermediate good intensity representing new economic geography	Positive
SCALE	Proxy for scale economies representing new trade theories	Positive

5.6 Results

5.6.1 Random Effects Results without Interaction Terms

The E-G index for agglomeration is used as a dependent variable to estimate the following model:

$$\gamma_{it} = \beta_0 + \beta_1 \mathrm{TECDIF}_{it} + \beta_2 \mathrm{H} - \mathrm{O}_{it} + \beta_3 \mathrm{SCALE}_{it} + \beta_4 \mathrm{INTERM}_{it} + \varepsilon_{it} \quad (23)$$

Where, ε_{it} is the composite error term including both time invariant industry characteristics and the remainder error term.

This type of estimation is widely used in the literature[17] to examine which type of trade theory best explains the main forces behind agglomeration.

As can be seen from table A5.1 of the appendix, the means and standard deviations of the explanatory variables, differ a lot from each other; therefore when interpreting the

[17] Amiti (1999), Brulhart (1996), Brulhart (1999).

results comparing the magnitudes of the impact of each variable would be misleading, hence standardized coefficients are used for the sake of interpretation. The estimation results of equation (23) are shown in table 5.2:

Table 5.2: Random effects estimation results without interaction terms

Dependent variable: Gamma

	Eq.23	Eq.23	Eq.23(robust s.e.)	Eq.23(robust s.e.)
Constant	.0728* (0.038)	.0723*** (0.023)	.0728* (0.040)	.0723** (0.025)
TECDIF	.0161 (0.0198)	.0088 (0.0196)	.0161** (0.005)	.0088 (.007)
(H-O)	-.0491** (0.021)	-.0548** (0.020)	-.0491** (0.020)	-.0548** (0.025)
SCALE	.0724** (0.032)	.0545** (0.022)	.0724** (0.032)	.0545*** (0.014)
INTERM	.0214 (0.028)	.0201 (0.023)	.0214 (0.031)	.0201 (0.023)
Year dummies	No	Yes	No	Yes
Prob.> (chi2/F.stat)	0.0301	0.0000	0.0004	0.0000
Fixed effects	No	No	No	No
Hausman test (prob.)	0.0782			
Number of obs.	1677			

*** 0.01<p, ** 0.05<p, * 0.1<p
Numbers in parentheses are standard errors

While estimating equation (23); judging by the result of Hausman test statistic the random effects model is employed rather than fixed effects. The first column shows the random effects estimation results without year dummies, the second column shows the random effects estimation result with year dummies, and the third column shows the robust random effects estimation results without year dummies and last column shows the robust random effect estimation results with year dummies for Equation (23). Results presented in columns three and four are robust to clusters in the data.

The TECDIF variable has a positive effect on agglomeration in all cases, indicating a technological advancement will result in rising levels of agglomeration. This result can be interpreted as; an increase in TECDIF variable increases the geographic concentration without affecting the industrial concentration or as the increase in the raw concentration index is higher than the decrease in the Herfindahl index. Technological difference is found to be significant only in the robust case without year dummies. Including year dummies when estimating the equation is expected to increase the impact of the variables and it also acts as a control for the time effects. Surprisingly the TECDIF variable becomes statistically insignificant in the robust case with year dummies which might indicate a specification problem.

Contrary to the expectations there is an inverse relationship between factor abundances, which is used to proxy Heckscher-Ohlin type of specialization, and agglomeration. The coefficients of H-O variable are significant in all cases.

The SCALE variable has a positive and significant effect on agglomeration in all cases. Finally the INTERM variable, representing the vertical linkages is insignificant in all cases, suggesting that the agglomeration process in Turkish manufacturing industries is not due to vertical linkages.

Since the standardized values for each variable are used, the magnitudes of the impacts are comparable. When results with robust standard errors are investigated, it can be seen that the biggest impact on agglomeration is caused by SCALE. This result suggests that in Turkish manufacturing industries the agglomeration process can be best explained by new trade theories.

5.6.2 Fixed Effects Results with Interaction Terms

Using this equation to examine the explanatory power of trade theories on agglomeration, however intuitive, might not be sufficient. Therefore, a second equation including the interaction effects between some independent variables is also estimated. The interaction variables are; TECDIF*HO, TECDIF*SCALE, TECDIF*INTERM and HO*SCALE.

TECDIF*HO; basically represents the neo-classical theory of trade which explains specialization via technological differences and factor intensities.

Posner (1961) used technological differences and factor intensities together to explain the trade between countries which are similar in their economic conditions, which is a type of trade which classical theory could not explain. In Posner’s dynamic model, technology is used as an independent determinant for specialization. According to

Posner, trade and specialization can still occur between countries that are similar in factor endowments. This usually happens via innovations. Comparative cost differences occur after innovations and induce trade and specialization in specific goods during the learning period (imitation gap). Therefore in this model countries with similar factor endowments can still specialize because of technological differences. The resulting specialization depends on the speed of innovations and the length of the imitation gap. The most important feature of this model is that it treats technology as "man-made" rather than exogenous (Wolfmayr-Schnitzer, 2001).

Davis (1995) used Heckscher-Ohlin-Ricardo approach to explain intra-industry trade in classical theory. According to Davis, increasing returns can explain intra-industry trade and therefore specialization; however, with the Heckscher-Ohlin-Ricardo model increasing returns is not necessary.

According to Harrigan (1997), relative technology levels and factor endowments are the main reasons behind specialization. Harrigan used Hicks-neutral technological change and factor endowments to test neo-classical theory of trade and how it explains specialization for manufacturing industries.

Assuming Hicks-neutral technological change is simple for modelling and testing however, it is not sufficient to explain specialization, and in the same sense, agglomeration. Considering the Heckscher-Ohlin-Ricardo model i.e., the effect of factor endowments and technological change, if Hicks-neutral technical change is assumed, the pattern of trade and the specialization is bound to stay the same. The only difference would be one country or region becoming more efficient and producing the same good at lower cost. The results of this effect will not differ from the Ricardo model when only technological change is considered. When the technological change is, however, non-neutral i.e., in favour of one particular endowment then the effect of this change on TECDIF*HO variable will be different than the technological change effect in the Ricardian model. After a non-neutral technological change the agglomeration index will be affected both by the technological differences across regions and also the differences among factor endowments across regions. An increase in technological differences is expected to decrease the agglomeration index via raising the Herfindahl index, assuming there will be significant number of firms which cannot keep up with current technological change; on the other hand a technological change in favour of one specific production factor will increase the differences in factor endowments across regions even more. In such a case the firms which can keep up with the technological change will tend to concentrate in the same geographical area due to the effect of the H-O variable and the agglomeration index will rise. Therefore, the actual sign of the relationship between agglomeration and the TECDIF*HO variable will depend on which effect outweighs the other. Furthermore, the TECDIF variable's major and probably only effect tends to be on the industrial concentration rather than geographical concentration. The TECDIF*HO variable on the other hand is expected to affect both geographical concentration and industrial concentration. In either case, if the technological change is not Hicks-neutral than the impact of the effect will differ from the impact of the TECDIF variable.

The TECDIF*SCALE variable basically attempts to capture the impact of economies of scale and technological difference on agglomeration. Classical trade theory tries to explain specialization by technological differences and recent trade theories, specifically the new trade theory, suggest that scale economies explain specialization of production across countries even under the assumption of same technology levels. However, in the real world it is possible to observe economies of scale, product differentiation and technological change at the same time. According to Helpman (1999), both technological change and economies of scale only managed to explain parts of trade and specialization patterns and there is no reason that they cannot be used together. When TECDIF is considered together with SCALE, the expected impact on agglomeration differs. Firms taking advantage of scale economies will tend to concentrate in the same geographical area, which will raise the agglomeration index; however, since large scale firms invest more in R&D, this will lead to an increase in technological differences among regions. The increase in the technological difference will again cause small firms to become inefficient in terms of production and to exit. On the other hand the positive effect on agglomeration from scale economies might outweigh the negative effect of technological differences because large scale firms will still be able to produce a high amount of value added with relatively small number of firms. Therefore a positive relationship between TECDIF*SCALE and agglomeration is expected.

In a similar sense, TECDIF*INTERM variable tries to capture the impact of technological difference and vertical linkages on agglomeration. Vertical linkages are assumed to increase the specialization of firms. However; when firms are using the advantage of the vertical linkages and therefore located in a specific area it is not straightforward if the change in technological differences still force them to exit the industry or being concentrated by demand and supply linkages will help them to stay in the industry and not become inefficient as a result of the technological change. The expected sign of TECDIF*INTERM variable is positive, because it is expected that firms located in the same area taking advantage of vertical linkages tend to stay in the market even though when there are negative effects due to technological differences. Furthermore since firms using high proportions of intermediate goods locate in a similar area technological spillovers might also occur and help the firms to keep up with the technological change better than firms producing in areas with different industry groups.

Finally, HO*SCALE is used to examine the relationship between agglomeration and the joint case of factor endowments and scale economies. This is again an attempt to see the effects of classical trade theories with recent theoretical developments. The expected sign of this variable is positive, because if firms are already agglomerated due to the differences in their factor endowments, taking advantage of scale economies will make firms to concentrate even more and hence increase the level of agglomeration due to both factor intensities and scale economies.

Table 5.3: Summary of the Interaction Terms

Variable	Definition	Sign expectation
TECDIF*HO	Interaction of technological differences and factor endowments	Ambiguous
TECDIF*SCALE	Interaction of technological differences and scale economies	Positive
TECDIF*INTERM	Interaction of technological differences and intermediate goods intensity	Positive
HO*SCALE	Interaction of factor endowments and scale economies	Positive

The equation with interactions is as follows:

$$\gamma_{it} = \beta_0 + \beta_1 \mathrm{TECDIF}_{it} + \beta_2 (\mathrm{H} - \mathrm{O})_{it} + \beta_3 \mathrm{SCALE}_{it} + \beta_4 \mathrm{INTERM}_{it} + \beta_5 (\mathrm{TECDIF} * \mathrm{HO})_{it} + \beta_6 (\mathrm{TECDIF} * \mathrm{SCALE})_{it} + \beta_7 (\mathrm{TECDIF} * \mathrm{INTERM})_{it} + \beta_8 (\mathrm{HO} * \mathrm{SCALE})_{it} + \varepsilon_{it} \quad (24)$$

Where, ε_{it} is again the composite error term including time invariant industry specific effects and the remainder error term which varies both over time and industry.

Using these interactions in the equation can help to capture any non-linear relationship that might exist within the equation. The estimation results of Equation (24) are shown in table 5.4:

Table 5.4: Fixed Effects Estimation Results with Interaction Terms

Dependent variable: gamma

	Eq.24	Eq.24	Eq.24(robust s.e.)	Eq.24(robust s.e.)
Constant	.1383*** (0.026)	.142*** (0.026)	.1383*** (0.022)	.142*** (0.023)
TECDIF	-5.368*** (1.46)	-6.247*** (1.44)	-5.368* (3.25)	-6.247* (3.53)
H-O	.163** (0.07)	.1751** (0.07)	.1630 (0.13)	.1751 (0.13)
SCALE	.1109* (0.06)	.1219* (0.06)	.1109 (0.13)	.121 (0.144)
INTERM	-.1104** (0.047)	-.1555*** (0.04)	-.1104 (0.07)	-.1555* (0.08)
(TECDIF*HO)	-1.788** (0.69)	-1.787** (0.66)	-1.788 (1.20)	-1.787 (1.18)
(TECDIF*SCALE)	1.551** (0.51)	1.649*** (0.49)	1.551 (0.94)	1.649* (0.93)
(TECDIF*INTERM)	5.836*** (1.64)	6.645*** (1.60)	5.836 (3.61)	6.645* (3.88)
(HO*SCALE)	-.1105** (0.04)	-.1087** (0.04)	-.1105 (0.08)	-.1087 (0.08)
Year dummies	No	Yes	No	Yes
Prob.(F.stat)	0.0005	0.0000	0.0000	0.0000
Fixed effects	Yes	Yes	Yes	Yes
Hausman test (prob.)	0.0424			
Number of obs.	1677			

*** 0.01<p, ** 0.05<p, * 0.1<p
Numbers in parentheses are standard errors

The first column in table 5.4 represents the fixed effects estimation results for Equation (24) without year dummies. The second column shows the results of the fixed effects estimation results of the equation with year dummies. The third column shows the results of the robust fixed effects estimation without year dummies and finally the fourth column represents the results of robust fixed effects estimation with year dummies.

In the first two columns of Table 5.4 all variables are statistically significant. The results with year dummies have a higher overall significance when compared to the results without year dummies, which implies that the time dimension has an important impact on the agglomeration process. The standard errors of the independent variables stay the same; however, the impacts of all variables have increased significantly. These results indicate that there are year specific effects. When the estimation results for the case without year dummies are compared, it is seen that the overall fit of the model is better in the robust case; however, only the TECDIF variable is significant. The effects of all the independent variables are still the same; the only difference is that the standard errors in the robust case are significantly higher. In the case with robust standard errors with year dummies, the coefficients are exactly the same with the results with non-robust standard errors; the only difference again is higher standard errors. When robust estimates with and without year dummies are compared; it can be seen from Table 5.4 that the standard errors are quite similar; however the coefficients are higher and more significant in the case where year dummies are used. This result again highlights the importance of time dimension in the agglomeration process.

According to the estimation results of Equation (24); TECDIF, assuming all the interactions to be zero, has a negative and significant effect on agglomeration in all cases. This suggests that the technological change in Turkish manufacturing industries has a bigger impact on the industrial concentration rather than geographical concentration. Technological difference increases firm exit and therefore has a negative impact on agglomeration. The H-O variable, representing factor intensities, and assuming all interaction terms to be zero, has a positive and significant effect on agglomeration in the non-robust cases. This effect gets stronger when the year specific effects are included in the model. However, the H-O variable is insignificant when the standard errors are robust. The variable used to represent the effect of scale economies has a positive significant impact again in the non-robust cases assuming no effects from interactions. The INTERM variable, representing the vertical linkages in the economy, and assuming all the interaction terms to be zero, is only insignificant in the robust case without year dummies. In all other cases, it has a negative and significant impact on agglomeration. This result, however, contradicts the theory. The TECDIF*HO variable, representing the joint case of technological difference and factor intensities has a negative impact on agglomeration. This result implies that the effect of technological difference on agglomeration is dominant over the effect of the factor intensities. Another explanation might be that this result is due to the structure of Turkish manufacturing industry. Since the labour abundant industries are predominant in most of the regions, it is not surprising that the effect of technological difference outweighs the effect of factor intensities. TECDIF*SCALE and TECDIF*INTERM variables have both positive and significant effect on agglomeration, suggesting that the technological difference has a positive impact on agglomeration when scale economies or vertical linkages are considered. SCALE variable has no significant effect on agglomeration when no interactions are assumed however the positive significant effect of TECDIF*SCALE variable implies that the effects of scale economies are important when considered jointly with technological differences. Finally HO*SCALE has a negative but small impact on agglomeration. This result again contradicts the expectations. In the robust case with year dummies, the only significant variables are TECDIF, INTERM, TECDIF*SCALE and TECDIF*INTERM.

When the results of the two equations used are compared, it is clear that the interaction terms are quite important for such estimation. When interaction terms are included all of the variables have larger impacts on agglomeration. Including interaction terms also show that the Ricardian trade theory best explains the agglomeration process in Turkish manufacturing industries, without interaction terms however it appeared to be the new trade theory. As a result it is possible to say that there was an omitted variable bias in the estimation of equation (23), and this bias might be reason of unexpected negative sign of the H-O variable and it might also explain why TECDIF variable was insignificant in the robust case with year dummies.

5.6.3 Marginal Effects

According to Brambor et al. (2006), models with interaction terms should be interpreted considering the partial marginal effects. Therefore, when interpreting the variables in model (2) the marginal effects should also be considered. Following Dietrich (2010), the marginal effects at the 25^{th}, 50^{th} and the 75^{th} centiles are shown in table A5.2, A5.3 and A5.4 using the results from Table 5.3:

According to table A5.2, it is possible to say that TECDIF has a negative marginal impact on agglomeration. Holding other variables constant, when the effect of the TECDIF variable is increased the level of agglomeration decreases. Furthermore; holding the effect of TECDIF variable constant, when the effects of H-O, SCALE and INTERM variables are increased it is clear that the level of agglomeration increases. This effect can also be seen from figure 5.1a.

Figure 5.1a: Marginal effects of the TECDIF variable on H-O, SCALE and INTERM

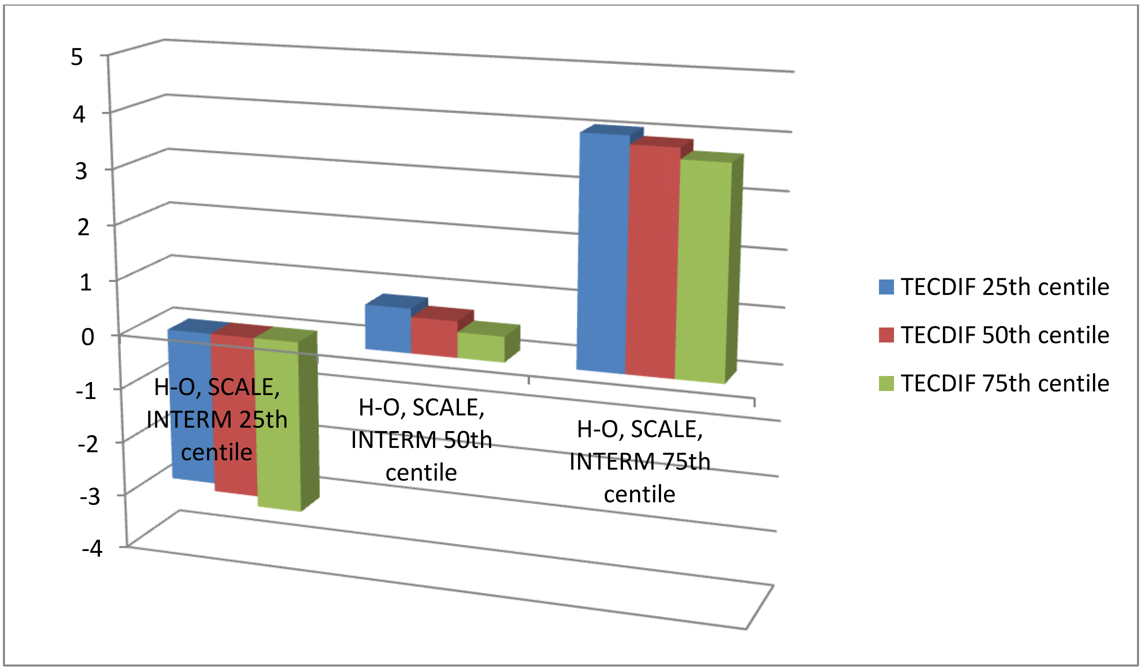
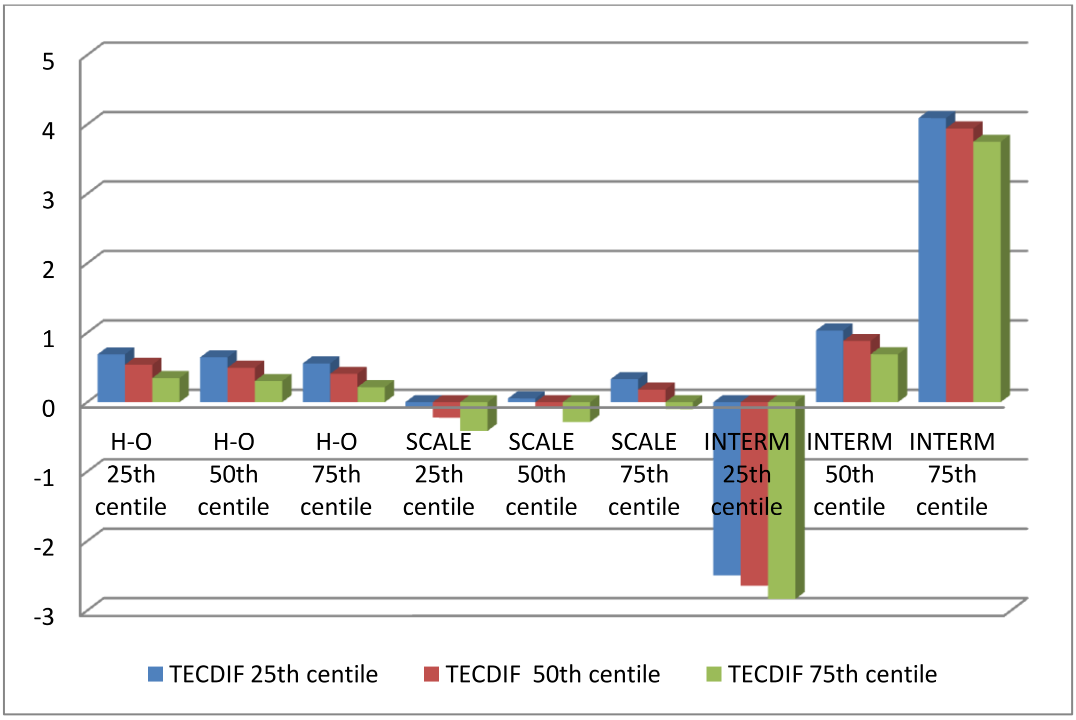


Table A5.3 shows the marginal effects of the TECDIF variable on H-O, SCALE and INTERM separately.

Figure 5.1b: Marginal effect of TECDIF

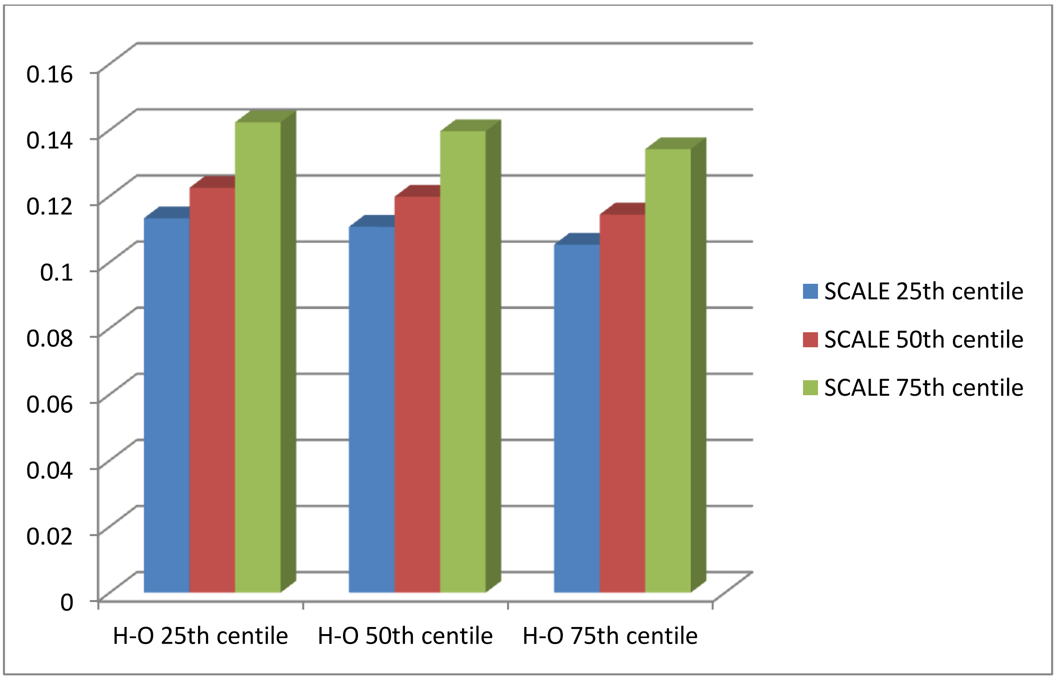


It is again clear that TECDIF has a negative marginal impact on each variable. Table A5.3 also shows that a big technological difference can outweigh the impact of H-O and SCALE variables. Furthermore, when the marginal effects of the TECDIF and INTERM variables are considered, it is clear that the INTERM variable actually has a positive impact on agglomeration and this impact decreases with increasing rates of technological difference. On the other hand, when TECDIF is kept constant and H-O is increased gradually, it can be seen that the level of agglomeration decreases, therefore it is clear that H-O has a negative impact on agglomeration contradicting with expectations; however the coefficients of H-O, TECDIF*HO and HO*SCALE were all insignificant in the estimation. Hence it is possible to say that Heckscher-Ohlin theory of trade has no explanatory power on agglomeration in Turkish manufacturing industries. Since Heckscher-Ohlin theory of trade only considers inter-industry trade, such result is not surprising. This effect can also be seen from figure 5.1b.

Finally table A5.4 shows the marginal effects of the H-O and SCALE variables.

From table A5.4, it is clear that scale economies have a positive impact on agglomeration and the magnitude of this impact outweighs the negative impact of H-O; hence increases agglomeration. This effect can also be seen from figure 5.1c.

Figure 5.1c: Marginal effects of H-O and SCALE



Considering the marginal effects it is possible to say that, technological difference has a negative impact on agglomeration and when combined with small impacts from SCALE and INTERM variables the negative effect from technological differences dominates and decreases agglomeration. Scale economies have a positive impact on agglomeration. Finally the intermediate goods intensity, which represents vertical linkages in an economy, has a positive impact on agglomeration, which reveals itself while examining marginal effects.

When the estimation results are considered with the marginal effects, it is possible to say that agglomeration in Turkish manufacturing industries can be explained by technological differences as suggested by Ricardo and vertical linkages, proxied by intermediate goods intensity as suggested by new trade theories. The negative sign of the INTERM variable in the estimation results suggests that the technological difference has a much larger impact on agglomeration which can dampen the effect of the vertical linkages in the economy. Furthermore scale economies have significant effects on agglomeration via technological differences. As a result the dominating reason behind the agglomeration in Turkish manufacturing industries is the relative technological difference across regions. So powerful is the effect of the TECDIF variable, it also outweighs the positive impact of vertical linkages and cause decreasing degrees of agglomeration. This result also explains the reason of decreasing agglomeration levels throughout the sample period.

5.6.4 Results from Pooled OLS

When estimating equation (24), fixed effects estimation method has been used, however such estimation method might not be the right specification for the question in hand. The issue with agglomeration is that not only that it is a dynamic process, it also involves industry-specific characteristics which differ between and within regions; therefore fixed effects might lead to biased results due to a specification error. Hence; equation (24) is estimated using pooled OLS with differences to account for the industry-specifics characteristic that change between and within regions and also over time. However, using differences decreases the number of observations and hence degrees of freedom, therefore equation (24) is estimated only up to 5 differences. For the sake of comparability again standardized coefficients are used. The estimation results are presented in table 5.5.

Table 5.5: Estimation results from pooled OLS

Dependent variable: Gamma (EG index of agglomeration)

	1st differences	2nd differences	3rd differences	4th differences	5th differences
constant	.001	.002	-.011	-.081	-.005
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
TECDIF	-6.2354**	-8.939**	-8.234**	-7.795**	-.9465**
	(0.06)	(0.07)	(0.08)	(0.09)	(0.09)
H-O	.1306*	.1148**	.1096*	.1268**	.1219*
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
SCALE	.1949***	.1853***	.1989***	.1935***	.1722***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
INTERM	-.0075	-.0296	-.0256	-.0295	-.0346
	(0.16)	(0.17)	(0.18)	(0.20)	(0.22)
TECDIF*HO	-1.264	-3.207**	-2.493*	-2.610**	-.2287**
	(0.00)	(0.00)	(0.08)	(0.00)	(0.01)
TECDIF*SCALE	1.349*	2.590**	2.149**	2.144**	.0938*
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
TECDIF*INTERM	6.179**	9.582**	8.609**	8.290**	1.073**
	(0.07)	(0.08)	(0.08)	(0.10)	(0.11)
HO*SCALE	-.0952**	-.0752	-.0836	-.0810	-.0656
	(0.00)	(0.000	(0.00)	(0.00)	(0.00)
Number of obs.	1495	1430	1361	1282	1204
Prob.>F	0.000	0.000	0.000	0.000	0.000

*** 0.01<p, ** 0.05<p, *0.1<p
Numbers in parentheses are standard errors

Results from the pooled OLS estimation with differences indicate that TECDIF has the biggest impact on agglomeration and the relationship between technological differences and agglomeration is negative, suggesting that as technological differences increase this increases firm exit via increasing the number of firms that cannot keep up with the technological advancement, become inefficient and hence exit the industry. The result from this type of estimation differs from the fixed effects estimation on the variable INTERM. Table 5.5 indicates that INTERM variable is insignificant. Furthermore H-O variable is significant and has a positive impact on agglomeration when interactions are assumed to be zero. Finally, SCALE has the best explanation power on agglomeration. As a result, in Turkish manufacturing industries, new economic geography theory best explains the agglomeration process according to the results from pooled OLS and Ricardian trade theory and also factor abundances seem to explain agglomeration. Therefore it is possible to say that the agglomeration process in Turkish manufacturing industries is driven by the relative technological differences between regions and the factor abundances, but most importantly it is characterised by spatial dynamics under the assumptions of imperfect market conditions, increasing returns to scale, labour mobility and transport costs; suggested by the new economic geography theory. When the results from 5^{th} differences are further examined it can be seen that the impact of all the variables decrease dramatically.

By combining all the estimation results it is possible to say that the results indicate that technological differences have a powerful negative effect on agglomeration when the interaction terms are not considered and hence causes decreases in agglomeration index in most cases. However, when technological differences are considered together with vertical linkages and scale economies the effect on agglomeration is positive in both cases suggesting that the existence of scale economies and vertical linkages helps firms to keep up with the technological changes or take advantage from technological spillovers and helps them to stay in the market. The results indicate that in Turkish manufacturing industry the agglomeration process can be explained by Ricardian theory of trade, new trade theories and new economic geography models. This suggests that technological differences are one of the main reasons behind the agglomeration process in Turkish manufacturing industries for the 1980-2001 period and has a negative effect on agglomeration; however, the existence of scale economies and vertical linkages are important and shows that when considered with technological differences they increase the level of agglomeration.

All these results support the issue of agglomeration being a dynamic process rather than static. Therefore a further examination of the issue using dynamic modelling is unavoidable and can be much more revealing. Using a dynamic model not only allows using the lagged value of the dependent variable as an independent variable, it also allows to use the explanatory variables and their lagged values as instrument to control for endogeneity of explanatory variables.

5.6.4 Dynamic Estimation Results

As mentioned before, agglomeration is a dynamic process. Therefore, estimating a model of agglomeration with linear regression models, however intuitive can lead to biased results.

Equation (24) is estimated to reveal which trade theory best explains the agglomeration process in Turkish manufacturing.

In such modelling, to cope with the endogeneity problem, instrumental variables could have been a solution. However, because of data limitations there are no available variables which can be used as instruments. Using a dynamic estimation method on the other hand solves both problems. Further, the E-G index which is the dependent variable in this equation is most likely to be affected by its past values. Agglomeration process is a cumulative and dynamic process. In addition, some of the explanatory variables might be endogenous or pre-determined. Finally the data set with T=21 and N=86, has a relatively short time dimension.

TECDIF, representing the Ricardian trade theory in this model is assumed to be exogenous as in the theory. SCALE, representing NTT is also assumed to have a one-way relationship with the agglomeration index. However, H-O and INTERM variables can be endogenous and/or pre-determined. H-O, representing the Heckscher-Ohlin explanation of trade theory and hence specialization is proxied by relative factor abundance. Relative factor abundances are assumed to be pre-determined. The reasoning behind this assumption can be explained intuitively. An industry which has an advantage in producing labour intensive goods will specialize in the production of labour intensive goods and an industry which has an advantage in producing capital intensive goods will specialize in the production of capital intensive goods, no matter what the reason behind these advantages are. Furthermore, it is not easy to change these advantages and hence the areas of specialization. It is not likely for a firm and hence an industry to produce labour intensive goods for a short time period and then switch to capital intensive production. Such a change may not be impossible but will be costly and less profitable for firms. Therefore H-O is assumed to be pre-determined. INTERM on the other hand is assumed to be endogenous because the causality may run in both directions. Vertical linkages as represented by INTERM will cause the agglomeration index to rise on the other hand as agglomeration increases vertical linkages may increase further.

As a result, to cope with problems of endogeneity, autocorrelation, heteroskedasticity, short time dimension in the panel and internal instruments a dynamic panel data estimation method is adopted.

Equation estimated to reveal which trade theory best explains the agglomeration process in Turkish manufacturing is as follows:

$$\gamma_{it} = \beta_0 + \beta_1\gamma_{i\,t-1} + \beta_2 \mathrm{TECDIF}_{it} + \beta_3(\mathrm{H-O})_{it} + \beta_4\mathrm{SCALE}_{it} + \beta_5\mathrm{INTERM}_{it} + \beta_6(\mathrm{TECDIF} * \mathrm{HO})_{it} + \beta_7(\mathrm{TECDIF} * \mathrm{SCALE})_{it} + \beta_8(\mathrm{TECDIF} * \mathrm{INTERM})_{it} + \beta_9(\mathrm{HO} * \mathrm{SCALE})_{it} + \varepsilon_{it} \quad (25)$$

Where, ε_{it} is the composite error term including both time invariant industry characteristics and also the remainder error term.

Since agglomeration appears to be a dynamic process, lagged value of the dependent variable is also added to the equation. Equation (25) is estimated using a two-step difference GMM dynamic panel data estimation method. As explained above, H-O and INTERM variables are treated as pre-determined/endogenous. Furthermore, by definition the lagged dependent variable is also treated as pre-determined. Results are presented in table 5.6:

Table 5.6: Dynamic Panel Data Estimation Results

Dependent variable: gamma

	Eq.3	Eq.3(robust s.e)
$GAMMA_{t-1}$	-0.131*** (0.001)	-0.131*** (0.027)
TECDIF	-25.5668*** (0.392)	-25.5668* (14.165)
H-O	3.2387*** (0.034)	3.2387* (1.936)
SCALE	1.4472*** (0.013)	1.4472* (0.794)
INTERM	-0.6062*** (0.106)	-0.6062 (0.428)
(TECDIF*HO)	-25.6903*** (0.27)	-25.6903* (15.386)
(TECDIF*SCALE)	16.1159*** (0.208)	16.1159* (9.417)
(TECDIF*INTERM)	36.004*** (0.476)	36.004* (20.231)
(HO*SCALE)	-2.1151*** (0.023)	-2.1151 (1.294)
Year dummies	Yes	Yes
Prob.(>chi^2)	0.000	0.000
Sargan test stat.	0.000	0.000
Diff. In Hansen test stat.	1.000	1.000
Number of obs.	1436	1436
Number of groups	86	86
Number of instruments	88	88
Arellano-Bond test for AR(2)	0.425	0.509

*** 0.01<p, ** 0.05<p, * 0.1<p
Numbers in parentheses are standard errors

Difference GMM is employed as a method of estimation because past changes in the differences of the dependent variable are assumed to affect the variable rather than past levels. Furthermore, two-step estimation is used because according to Roodman (2006) in two step estimation, the covariance matrix is robust to panel specific autocorrelation and heteroskedasticity since two-step results are already corrected with Windmeijer correction (Windmeijer, 2005) and hence always prior to one-step estimation. However, with the finite sample correction in two-step estimation the standard errors are downward biased and hence robust estimation method is employed (Roodman, 2006).

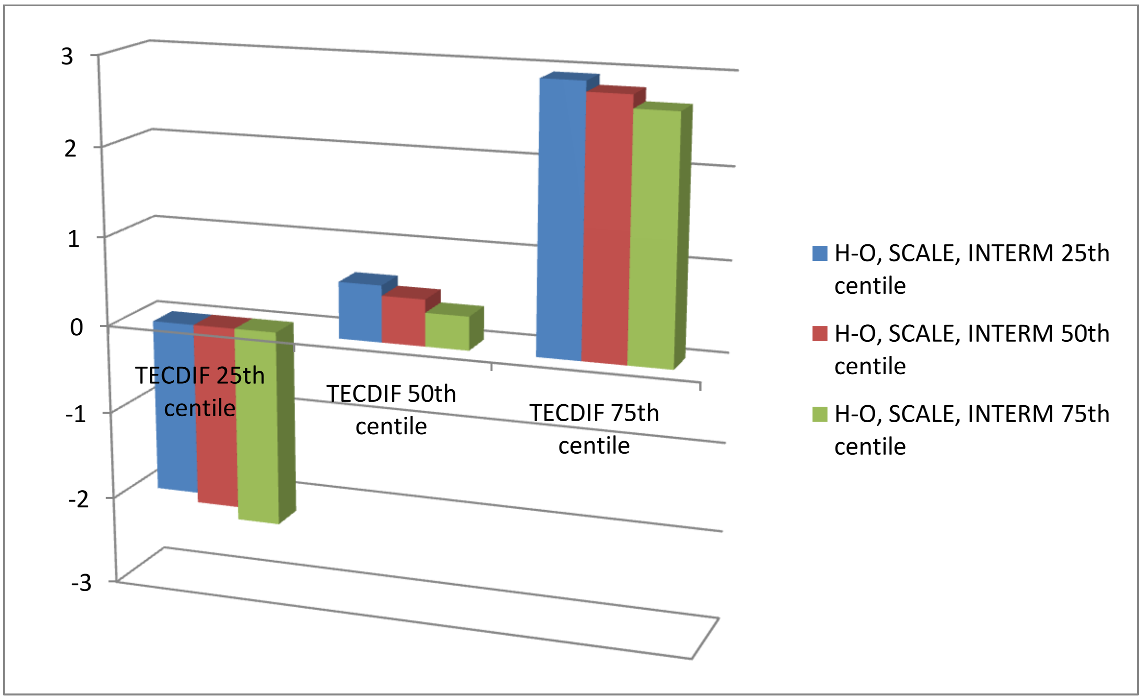
The first column in table 5.6 shows results from two-step difference GMM estimation with uncorrected standard errors. The second column shows results with robust standard errors. Both estimations include time dummies as control variables. Although the number of instruments are slightly higher than number of groups, Sargan test statistic and Difference in Hansen tests of exogeneity of instruments indicates the estimation is not weakened by many instruments. Furthermore, Arellano-Bond test for autocorrelation indicates no sign of autocorrelation problem. Since lagged dependent variable is included in the model, first degree autocorrelation is already expected and GMM solves such problem. Therefore only the result of the Arellano-Bond tests for AR(2) is presented in table 5.6.

Robust results indicate that as expected agglomeration is a dynamic process and current realizations in the agglomeration index is affected by the past realizations. Results show that the agglomeration index is negatively correlated with its lagged value. This result proves the descriptive analysis in chapter 5 which indicated a decreasing trend in agglomeration in Turkish manufacturing. It can also be interpreted as long run elasticity or as the speed of changing in the index. All independent variables are again standardized for the sake of interpretation. Findings indicate that TECDIF, representing the Ricardian explanation of specialization proxied by relative technological differences, has the biggest impact, assuming all interactions to be zero, on agglomeration in Turkish manufacturing. The negative correlation between agglomeration and technological differences indicate a significant increase in firm exit due to technological differences and hence a decrease in the agglomeration index supporting the results obtained from a fixed effects estimation of Equation (24) and also from the pooled OLS. Positive correlation between H-O and E-G index of agglomeration indicates as expected, factor abundances tend to increase the degree of agglomeration in Turkish manufacturing industries, when all interactions are assumed to be zero. Positive relationship between SCALE and E-G index indicates NTT also has some explanatory power on agglomeration patterns in Turkish manufacturing industry. The SCALE variable was not significant in the robust cases in panel data estimation, suggesting that dynamic modelling has a higher power of explanation when estimating such equation. However, INTERM is statistically not significant in the dynamic case. In fixed effects estimation INTERM was significant in the robust case; however, it had a negative sign contrary to the expectations, which was thought as a sign of specification problem. According to the dynamic approach new economic geography models does not explain the agglomeration patterns in Turkish manufacturing economy. According to these results, TECDIF has the biggest impact as it was the case in fixed effects and pooled OLS estimations. Again, when interpreting the results from table 5.5, marginal effects of the interaction terms should be considered.

Marginal effects, calculated at the 25^{th}, 50^{th} and 75^{th} percentiles from table 5.5 are presented in tables A5.5 through A5.7.

According to table A5.5 it is possible to say that TECDIF has a negative marginal impact on agglomeration. However the negative impact of TECDIF is less observed when the effects of H-O, SCALE and INTERM variables are increased. This effect can clearly be seen from Figure 5.2:

Figure 5.2a: Marginal Effects of TECDIF on H-O, SCALE and INTERM



In a similar fashion, Figure 5.2b shows the marginal effects of TECDIF variable on H-O, SCALE and INTERM separately:

Figure 5.2b: Marginal effect of TECDIF

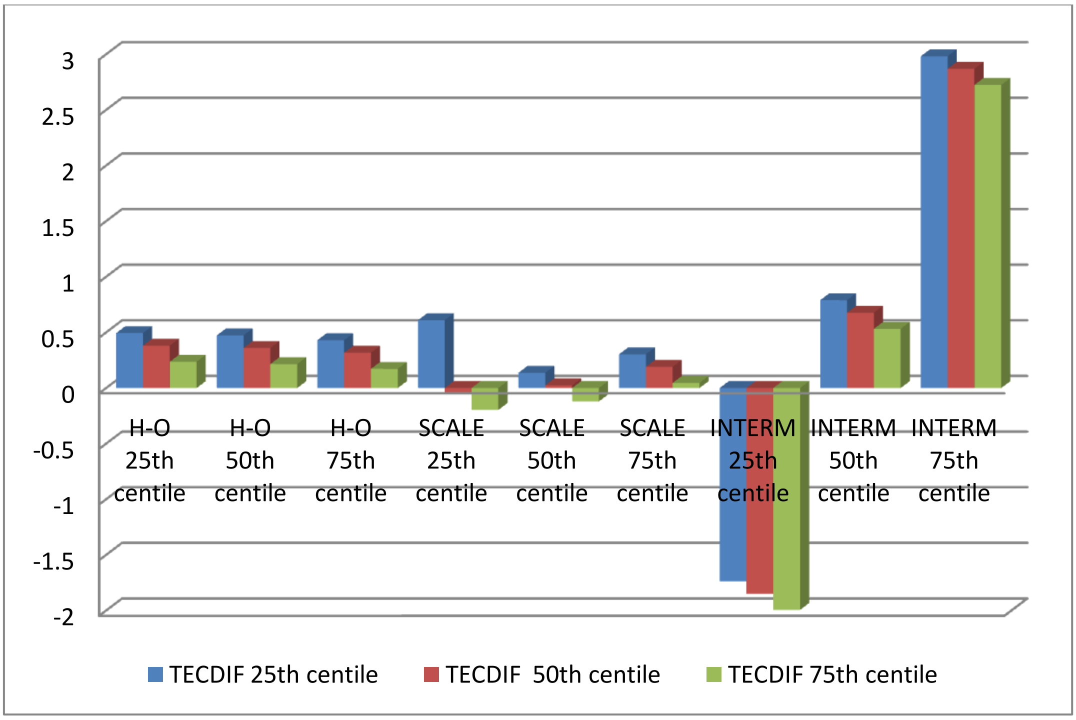


Figure 5.2b again shows the negative effect of TECDIF on agglomeration. However the marginal effects calculated after fixed effects estimation indicated a much bigger impact for TECDIF, so big that TECDIF outweighed the effects of all the other independent variables. Comparison of figures 5.1b and 5.2b clearly shows that the negative impact from TECDIF is less when marginal effects are calculated after GMM estimation. This might indicate that fixed effects overestimated the impact of TECDIF.

Finally Figure 5.2c shows the marginal effects of H-O and SCALE.

Figure 5.2c: Marginal Effects of H-O and SCALE

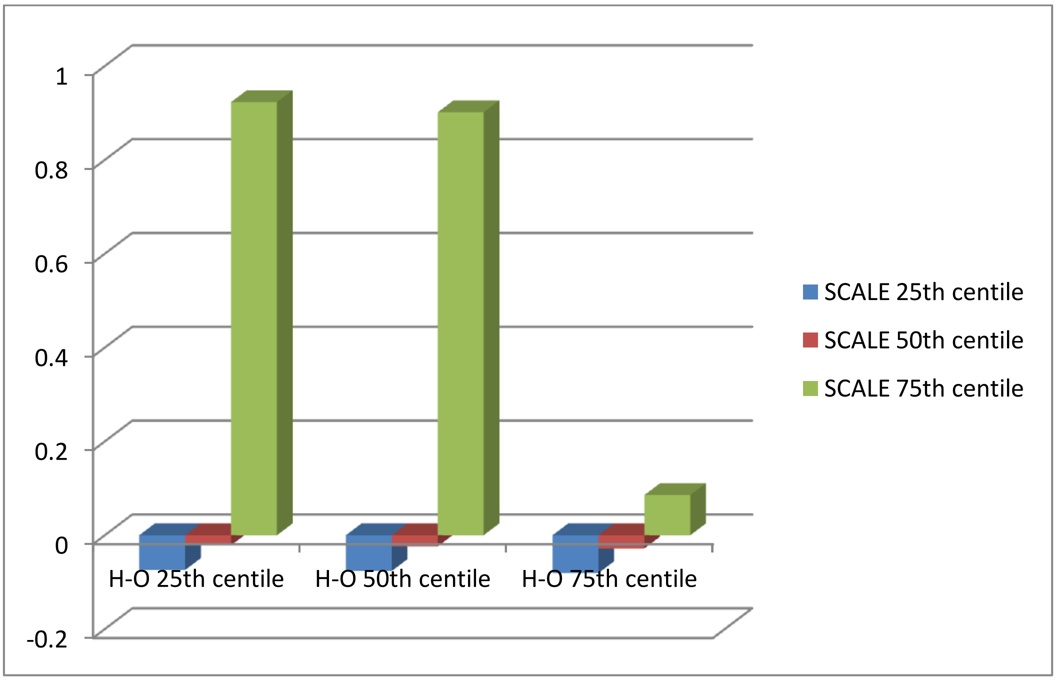


Figure 5.2c shows that H-O has in fact a negative impact on agglomeration and this impact gradually vanishes when the effect of SCALE is increased. Furthermore, the significant positive impact of SCALE can be observed from Figure 5.2c.

The results from two-step difference GMM and investigation of the marginal effects indicate that TECDIF has a negative impact on agglomeration which is interpreted as technological difference is causing similar number of small firms to exit in each region and hence causing an increase in the Herfindahl index without a change in the geographical concentration. It also possible to explain the decrease in the agglomeration caused from technological differences without assuming geographical concentration to stay constant. In this case, the negative impact of TECDIF simply means that the increase in the Herfindahl index is outweighing the increase in geographical concentration. Even though results from GMM in table 5.5 indicate a positive sign for H-O, examining the marginal effects indicate a negative impact from H-O on agglomeration. Such a result contradicts the theory and expectations. Finally, SCALE and INTERM variables have positive impacts on agglomeration when marginal effects are considered. However, GMM results indicate that INTERM has no explanatory power on agglomeration patterns in Turkish manufacturing industry.

5.7 Summary and Conclusions

After employing different methodologies and comparing the results; it can be said that employing the proper methodology is important to get the right answers for the questions in mind. It is clear that agglomeration has a dynamic structure and it is important to acknowledge this structure while examining the main reasons behind agglomeration.

Results indicate that, TECDIF and SCALE; i.e. Ricardian explanation of specialization and existence of scale economies as suggested by NTT models explain the agglomeration patterns in Turkish manufacturing. In addition, scale economies can outweigh the negative effect of technological differences. However, when the decreasing trend in agglomeration in Turkish manufacturing is considered, it is clear that apart from shocks such as economic crisis, technological differences seems to be the main determinant of agglomeration patterns in Turkish manufacturing industry.

When the results for Turkish manufacturing industry are compared with Europe and US it is clear that Turkey has different patterns of agglomeration. As mentioned before, for EU countries NTT and NEG models have the best explanatory power for agglomeration trends. And for the US NTT and H-O theory explains agglomeration. However, for Turkey Ricardian theory is dominant as the source of agglomeration and NTT models also has explanatory power.

CHAPTER 6: THE EFFECTS OF AGGLOMERATION ON FIRM ENTRY AND EXIT BEHAVIOUR

6.1 Introduction

In addition to studies attempting to examine the determinants of agglomeration hence using agglomeration indices as dependent variables, there are also vast amount of studies, using agglomeration as independent variables and trying to examine the spatial characteristics of several issues. One of such issue is firm mobility.

Entry and exit of firms are highly discussed topics in the economics literature because firm mobility plays a crucial role in all markets. Since the number of firms is fixed in the short run, the profit of the firm is a function of price and quantity in the short run. However, in the long run, when entry and exit becomes feasible, profit becomes a function of number of firms in the market. In the long run the number of firms in a market becomes endogenous, while it is exogenous in the short run (Dunne et al, 2009).

Studies on entry start with Bain (1956)'s pioneering work on barriers to entry. Definitions of entrants in literature however vary. Three main definitions can be summarized as follows:

i. Switchers: Firms which initially were in industry j and then switch to industry i and no longer operate in industry j.
ii. Diversifiers: Firms which start operating in industry i, but also keep operating in industry j.
iii. New firms: Firms which have never operated in any industry prior to start operating in industry i. (Storey, 1991)

The previous literature on entry suggests that different type of entrants may have different patterns in entry-exit and survival.

Exit on the other hand has received much less attention from researchers than entry. Studies on exit start after Caves and Porter (1976) investigating barriers to exit. In a similar manner to entry, exit also has different definitions such as:

i. Switchers: Firms which initially started operating in industry i and then switch to industry j.
ii. New firms: Exit of wholly new firms from industry i.

Exit is also grouped by its reason in some studies; such as exit by bankruptcy or general exit.

The main reasons behind entry and exit have been investigated for decades. Theory and empirical work on the subject indicate that there are several incentives and barriers (impediments) to entry and exit[18].

Incentives to entry can be summarized as follows:

i. High rates of current and past profits.
ii. High or increasing rates of market demand.

Barriers to entry can be summarized as follows:

i. Scale economies.
ii. Cost barriers.
iii. Multi-plant operations.
iv. Limit pricing.
v. Excess capacity.
vi. Advertising.

There are also some factors that can be seen as incentives and/or barriers under different circumstances:

i. Product differentiation.
ii. R&D and innovation.
iii. Diversification.

These factors become incentives when they are realized by entrants however are entry barriers when realized by incumbents.

Incentives to exit can be summarized as follows:

i. Low current and past profit rates.
ii. Low or declining rates of market demand.
iii. Displacement of old firms with new firms.

Barriers to exit can be summarized as follows:

[18] Incentives and barriers to entry and exit are summarized following Sigfried and Evans (1994).

i. Sunk costs.
ii. Low managerial skills.
iii. Diversification.

Entry and exit is important in a market because, entry can increase competition in the market. Even when there is no entry, threat of entry can force incumbents to act as if they were operating in a competitive market. Further, entry brings new and efficient technology and also new products to the market. In addition, entry increases employment opportunities. Exit, on the other hand can have severe increasing effects on unemployment; however, it can be argued that in the long run exit clears out the old and inefficient technology from the market (Sigfried & Evans, 1994; Ilmakunnas & Topi, 1999; Kleijweg & Lever, 1996).

The remainder of this chapter is organized as follows: section 6.2 provides background information on the previous empirical literature. Section 6.3 lists some stylized facts about entry-exit and agglomeration which arises from the previous literature. Section 6.4 provides information about the main aim and focus of the chapter and lists the research questions that will be addressed. Section 6.5 provides information on the data used and also the methodologies employed throughout the study. Section 6.6 gives and discusses the estimation results and finally section 6.7 summarizes and concludes the chapter.

6.2 Empirical Background

As mentioned before there are several studies on firm mobility patterns and its determinants.

Dunne et al. (1988) use plant level US data to examine patterns of gross entry, exit and survival rates of firms in US manufacturing industry, covering a period of 1963-1982. Their findings show that the highest survival rates are observed among diversifiers.

Baldwin and Gorecki (1991) investigate firm entry and exit in Canadian manufacturing covering the 1970-1982 period. Their data allow following plants through time and also making it possible to link plants under common ownership. With such detailed information, authors grouped firms as entrants, exitors and continuing. However, the authors only performed descriptive analysis of the data and reveal patterns of firm mobility in Canadian manufacturing.

Mayer and Chappell (1992) use the same data set as Chappell et al (1990) however employed a slightly different methodology. Determinants of entry and exit are investigated using 1972-1977 US manufacturing industry data in both studies. Chappell et al (1990) argues entry and exit data are integer values and hence needed to be handled differently than classical regression assumptions. According to Chappell et al (1990) entry and exit data should be estimated using probability distribution models and hence employs a univariate Poisson distribution. Mayer and Chappell (1992) on the other hand use bivariate Poisson distribution analysis, arguing that observations on entry and exit have some common aspects. They argue that even though entry and exit can be influenced by common elements, it is important and essential to separate the two. The authors estimate entry and exit models which have common independent variables with a quasi-maximum likelihood method.

Ilmakunnas and Topi (1999) investigate determinants of entry and exit on Finnish manufacturing industry for 1988-1993. They argue, however, that macroeconomic factors have equally important effects on firm entry and exit as microeconomic factors. They use both macro and micro variables as determinants of entry and exit. Micro variables include profit rates, market size and demand growth. Macro variables include variables such as GDP growth and unemployment. The authors consider the possibility of interdependency between entry and exit and therefore included lagged values of each in their models. However, they still estimated two separate entry and exit models. They use Poisson and negative binomial models as a method of estimation. Their findings indicate macroeconomic influences are also important on firms' entry and exit decisions.

Doi (1999) investigates firm exit only in Japanese manufacturing industries using profitability, industry growth and several exit barriers such as concentration rate, scale economies, R&D intensity as independent variables. Doi employs OLS as a method of estimation.

Dunne et al. (2009) investigate the determinants of entry and exit using US census data via estimating a profit function using entry and exit as independent variables for dentistry and chiropractor industries.

The empirical literature on firm mobility reviewed so far, mainly neglects the interdependence of entry and exit on the models they use. Some like Ilmakunnas and

Topi (1999) mention a possible interdependence, however they still choose to estimate entry and exit separately. Such studies, however intuitively appealing, might be missing quite important and relative information on firm mobility by not considering the effect of entry and exit on each other.

The “symmetry hypothesis” suggested by Caves and Porter (1976) implies a symmetrical relationship between entry and exit barriers.

Shapiro and Khemani (1987) investigate the symmetry hypothesis using data from Canadian manufacturing industry for the years 1972-1976. They estimate two equations while employing entry in the exit equation and vice versa. They adopt seemingly unrelated regressions technique as an estimation method. Authors use pretty standard independent variables such as profitability, industry growth rate, economies of scale, advertising ratio, concentration index etc. Their findings support the symmetry hypothesis and indicate that such symmetry arises because barriers to exit are also barriers to entry.

Austin and Rosenbaum (1990) examine the determinants of entry and exit rates in US manufacturing industries using 4-digit data. They employ OLS and simultaneous equations as methods of estimation. Their findings indicate profits increase entry rates and advertising and sunk costs act as barriers to entry. However they argue while entry and exit are definitely related, it seems unclear whether they are simultaneously determined or not.

Flynn (1991), investigates the determinants of exit in U.S manufacturing sector covering the 1978-1984 period. He uses basic independent variables such as profit, concentration, industry growth and size. He also uses entry as an independent variable suggesting a possible interdependence between entry and exit. However he employs OLS as a method of estimation. Therefore it is possible to say that Flynn (1991) implies the possibility that entry and exit to be interdependent however does no employ the proper methodology to take into account this relationship econometrically. He finds that profit, industry growth and entry foster exit in U.S manufacturing.

Kleijweg and Lever (1996) examine entry and exit in Dutch manufacturing industries for the years 1986-1990. They use different definitions of entry and exit to investigate similarities and differences among their determinants. The authors also specify entry and exit as a function of incentives and barriers. As incentives they use export share, expected profitability and production growth. As barriers they use capital intensity, advertising intensity, R&D intensity and the concentration ratio. Entry and exit equations are estimated both separately and simultaneously. Their findings indicate that there are different patterns for different kinds of entry and exit.

While these studies take firm mobility studies one step further by taking into account the fact that entry and exit are interdependent, they once again neglect an important and vital piece of the puzzle; spatial variation.

Fritsch (1992) investigates regional differences in new firm formation in West Germany for the years 1985,1986 and 1987. He uses a large number of independent variables such as share of employment, unemployment, regional income tax, salaries, skilled/unskilled workers, share of housing. He employs OLS as a method of estimation. The findings suggest that unemployment rate of a specific region is positively related to new firm formation in that region. Skilled labour force and income levels also have positive effects on firm entry. This study is important because it investigates firm entry on a regional level and suggest that regional factors are important. However it is not possible to say that this study takes into account specialization in any form or agglomeration.

Garofoli (1994) states that higher firm birth rates are observed in Italy when compared to other countries. He also states that new firm formation differs in region and hence investigates the regional factors in firm entry. This paper covers the 1987-1991 period for 84 provinces in Italian manufacturing. Garofoli (1992) also chooses to employ OLS as a method of estimation. His findings suggest that local production structure, firm size, social structure and employment structure are the most important factors in new firm formation and for its regional differentiation. This study gains importance because it takes into account the spatial factors. However again it is not possible to say that it takes into account agglomeration or regional specialization.

It should also be noted that new firm formation is only one specific branch of firm entry. Although the above studies are important in the sense that they take into account the regional factors, unfortunately they do it only for one type of entry.

Love (1996) on the other hand investigates the determinants of variations in exit rates across the British counties during the 1980-1988 period. He uses entry rate, GDP per capita, wage, unemployment, change in unemployment, socioeconomic class and population density as independent variables in the study. This study is quite important because it takes into account both the interdependence of entry and exit rates and the spatial side of the story. The results indicate that entry and exit are interrelated, local labour market conditions have an important effect on firm exit and agglomeration – proxied by population density- has a significant effect on exit. Furthermore the results from population density variable indicates that agglomeration has a positive effect on firm exit as opposed to Krugman (1991).

Davidsson et al. (1994) examine new firm formation and regional development in Sweden using establishment data for the 1985-1989 period. They use data on regional characteristics such as entrepreneurial culture and living conditions. They suggest that the pattern of firm mobility differ considerably across countries and also regions.

Johnson and Parker (1996) investigate spatial variations in the determinants of firm mobility. They use one year data; 1990 for UK on county level. They use VAR (vector autoregressive regression) technique assuming full interdependency between all variables in the system. This study accounts for both regional aspects of firm mobility and interdependence.

Devereux et al. (1999) investigate job creation and job destruction rates via entry, exit and survival of firms considering their geographical distribution. They investigate firm mobility and job creation and destruction on a geographical basis in UK for the years 1985-1991. Their findings indicate geography to be an important aspect of entry, exit and survival. However, they keep this analysis on a descriptive level.

Berglund and Brannas (2001) investigate entry and exit in Swedish municipalities. In this study they use plant level data in order to capture the regional effect better. Although, realizing regional effects might be important and attempting to capture spatial variations, they proxy agglomeration economies with population density. They argue agglomeration economies have a negative impact on exit. However, population density is a very poor proxy for agglomeration economies. A good proxy for agglomeration should include industrial and geographical characteristics. Population density on the other hand includes neither. They employ GMM as a method of estimation for the analysis. A dynamic model, whilst it can capture the effect of past values of the dependent variable, however completely neglects a more important aspect; interdependency.

Huiban (2009) investigates the spatial demography of new plants in France between 1993 and 2002. Using a quite rich data set, the author includes a location dummy alongside the usual survival determinants. Findings indicate that new plant formation is easier in urban areas; however it is easier for firms to survive in rural areas. Huiban suggests agglomeration forces can explain such results.

Numerous empirical works on entry and exit imply high current and past profit rates and market growth triggers entry and reduce exit. Highly concentrated industries usually have lower entry rates. However there is less support and ambiguous results from evidence that entry and exit barriers from scale economies, excess capacity and limit pricing. Sunk costs have been found to be significant actors as exit barriers. Finally R&D intensity does not seem to be an efficient entry barrier. Further a common finding in the literature is that entry and exit are interdependent. Recent studies also show that spatial characteristics are important on firms' entry and exit decisions. However to my knowledge, there is a gap in the literature that tries to combine spatial characteristics with firm mobility. This gap arises from using poor proxies for agglomeration economies or only regional dummies to analyze the effect of regional effects. Therefore it is essential to examine the effect of agglomeration on firm entry and exit with proper tools.

6.3 Some Stylized Facts on Entry-Exit and Agglomeration

Reviewing previous literature on entry and exit and also their relationship with agglomeration allows us to make some generalizations on entry-exit and agglomeration:

i. Entry and exit are quite common in almost every industry.
ii. It is widely accepted that entry and exit are interrelated.
iii. It is also widely accepted that spatial factor are quite important in terms of firm entry and exit.
iv. Proxies are quite commonly used in the investigation of agglomeration and firm entry and exit. Furthermore studies tend to take into account only one factor –

either the interdependency or the spatial side of the study- while examining the determinants of entry and exit.

6.4 Aim and Focus of the Chapter

As mentioned before, the main gap in the literature arises from the use of poor proxies in the studies. Therefore, the main contribution of this chapter is to use the E-G agglomeration index as a measure rather than proxies. In addition, by using two different data sets –net and gross entry and exit data- and applying same methodology this study also shows differences between uses of those data. This chapter aims specifically to answer following questions:

i. What is the effect of agglomeration on firm entry and exit when agglomeration index rather than proxies is used?
ii. What are the differences between net and gross entry-exit data?
iii. What differences arise from use of different methodology?

6.5 Data and Methodology

This chapter analysis the effect of agglomeration on firm entry and exit behaviour using two different data sets. First is the 1980-2001 data set used in previous chapters regarding Turkish manufacturing. Second is the 1995-2001 data set providing similar information regarding Turkish manufacturing. The difference between two data sets is that the first one has a long time dimension but only provides information on net entry and exit on industry level. The latter data set, on the other hand provides information on gross firm entry and exit on industry level. Using these two distinct data sets and employing the same methodologies will reveal important information on the use of net and gross entry and exit data.

The second data set which covers a shorter time period; 1995-2001 is used only in this chapter similar to 1980-2001 data set 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.

The data set covering 1995-2001 period provides information on gross entry and exit of firms to and from industries, only available for 4-digit and again industry level. This additional data set only covers a 7 year period because of unavailability of gross entry and exit data regarding Turkish manufacturing industry prior to 1995. Further data sets 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. Data are obtained from Turkish Statistical Institute (TurkStat).

Entry and exit in both data sets includes all types of entry and exit, such as switchers, diversifiers and wholly new firms. Evidence from previous literature suggests that profit rates and/or profitability of firms are important on firms' entry and exit decisions. Dunne et al (2009) estimate a profit function and find that profitability has an important and significant affect on potential entrants. Sigfried and Evans (1994) find that current and past profits are one of the main incentives to enter and usually have a positive relationship with entry. Further, Austin and Rosenbaum (1990) finds that for US manufacturing industries high profits increase entry rates. Similarly Storey (1991) lists profit levels under the "pull hypothesis"; i.e. profits are seen as the main attraction for firms to enter the market. Doi (1999) while examining firm exit in Japanese firms also considers profitability to be one of the main determinants and finds a significant and negative impact from profitability on firm exit. Ilmakkunnas and Topi (1999) while investigating both microeconomic and macroeconomic influences on entry and exit also argue as a microeconomic factor high profit rates attract entry and low profit rates or losses encourage exit. Klaijweg and Lever (1996) includes expected profitability in both entry and exit equations as an incentive to entry and barrier to exit. Mayer and Chappel (1992) use profit rates in entry and exit equations and find significant impact from profits on both entry and exit. As a result it is possible to say that, most researchers use profit rates or profitability in their analyses and find that profit is one of the main factors that affects entry and exit.

Another important variable that influences entry and exit is industry growth. Similar to profit, industry growth is also used in most of the empirical studies and findings indicate that it has a positive impact on entry and a negative impact on exit. Hence; it can be said that industry growth act as an incentive to entry and a barrier to exit[19].

---

[19] (Baldwin & Gorecki, 1991); (Berlgrund & Brannas, 2001); (Chappell, Kimeyni, & Mayer, 1990); (Doi, 1999); (Dunne, Klimek, Roberts, & Xu, 2009); (Dunne, Roberts, & Samuelson, 1988); (Georski, 1995); (Ilmakunnas & Topi, 1999); (Mayer & Chappell, 1992).

Apart from profitability and industry growth, those seen as two main factors that affect entry and exit, several additional variables are also used in previous studies such as; scale economies, cost barriers, limit pricing, excess capacity, product differentiation, R&D expenditures, sunk costs and many others as incentives and/or barriers to entry and exit.

Following the literature some standard independent variables are used such as profitability, industry growth, labour productivity and sunk costs. However, the main focus of this chapter is to examine the relationship between agglomeration and entry-exit behaviour of firms. Hence the E-G index of agglomeration is also used as an independent variable. The variables used and their definitions and sign expectations are presented in table 6.1:

Table 6.1: Variable definitions and sign expectations

	Definition	Sign Expectation	
		Entry	Exit
PROFITABILITY (PROFIT)	Measured by price-cost margin	Positive	Negative
INDUSTRY GROWTH (IGR)	Measured by income growth of the industry	Positive	Negative
AGGLOMERATION	E-G index	Ambiguous	Ambiguous
PRODUCTIVITY	Labour productivity	Not included in entry equation	Negative
SUNK COSTS	Investments in fixed capital	Not included in entry equation	Negative

Profitability, industry growth and agglomeration are included in both entry and exit equations. However, labour productivity and sunk costs are not included in entry equation while included in exit equation because these two variables are expected to have an effect on incumbent firms' exit decisions only.

In this chapter, in order to analyse the effects of agglomeration on firm entry and exit, dynamic GMM modelling, seemingly unrelated regression and count data models are used. GMM methodology is described in chapter 5 in detail. Further methodology used in the chapter is examined as follows:

6.5.1 Seemingly Unrelated Regression[20]

Seemingly unrelated regressions approach is quite popular in econometrics. This approach allows the researcher to estimate a set of equations with different dependent variables, which can potentially be estimated on their own, as a system. Zellner's (1962) seemingly unrelated regressions (SUR) approach allows for estimating p equations assuming error terms are correlated across equations. The general model can be specified as:

$$y_{it} = \mathbf{x}'_{it}\beta + u_{it}$$

$$z_{it} = \mathbf{m}'_{it}\beta + a_{it}$$

$$. \qquad (26)$$

$$.$$

$$.$$

$$f_{it} = \mathbf{k}'_{it}\beta + b_{it}$$

Avery (1977) considers such model (26) with error component disturbances and Nguyen and Nguyen (2010) develop a model for SUR in panel data building upon Biorn (2004). This model particularly deals with unbalanced panels; however it can be used with balanced panels as well. Hence with Avery (1977) the composite error term can be written as; $u_{it}=\mu_i+v_{it}$ and with Nguyen and Nguyen's (2010) work, β's can be estimated using a one way random effects estimation, letting the composite error terms in each equation interact with each other while estimating.

This approach allows fitting a many-equation SUR model using random effects estimators and is based on constructing a stepwise algorithm using GLS and maximum likelihood (ML) procedures. Since it uses a random effects GLS estimator, the SUR model also requires all composite error terms to be uncorrelated with the explanatory variables. Again, in this case, inference depends on the large population from which the sample was randomly drawn.

[20] (Baltagi, 2001) (Wooldridge, 2002)

6.5.2 Count Data Models[21]

A count variable can only take on nonnegative integer values. In principle, we can analyse such data using linear regression methods. However, since the data is discrete in nature it is possible to improve on the linear estimation methods by employing a specific methodology which accounts for the discrete structure of the data. The Poisson regression model is one of the main methodologies employed when the dependent variable is count data. The specification of such modelling is as follows:

$$\mathrm{Prob}(Y_i = y_i | x_i) = \frac{e^{-\lambda_i}\lambda_i^{y_i}}{y_i!} \qquad (27)$$

Where, y_i=0,1,2,...

The most common formulation for λ_i is the log linear model:

$$\ln\lambda_i = \mathbf{x_i}'\beta \qquad (28)$$

The expected number of events per period is given by:

$$E[y_i|x_i] = \mathrm{var}[y_i|x_i] = \lambda_i = e^{\mathbf{x_i}'\beta} \qquad (29)$$

Hence;

$$\frac{E[y_i|x_i]}{\partial x_i} = \lambda_i\beta \qquad (30)$$

The poisson model is simply a nonlinear regression; however it is easier to estimate the parameters of the model with maximum likelihood techniques. The log-likelihood function in such case is:

$$\ln L = \sum_{i=1}^{n}[-\lambda_i + \mathbf{y_i}\mathbf{x_i'}\beta - \ln y_i!] \qquad (31)$$

However widely used, the Poisson model is criticized because it assumes that the variance of y_i is equal to its mean. Many extensions to the Poisson model which relaxes this assumption are proposed in the literature[22].

---

[21] (Greene, 2002) (Wooldridge, 2002) (Cameron & Trivedi, 1998)

[22] See; Hausman, Hall and Griliches (1984); McCullagh and Nelder (1983); Cameron and Trivedi (1986) for detailed information.

The assumption of equal mean and variance is, as mentioned above the major shortcoming of the Poisson model. The most common method used as an alternative to the Poisson model is the negative binomial model. To specify the negative binomial model, the Poisson model is generalized by introducing cross-section heterogeneity in the formulation via adding an individual, unobserved effect into the conditional mean of the Poisson model:

$$\ln\mu_i = \mathbf{x_i'}\beta + \varepsilon_i = \ln\lambda_i + \ln v_i \quad (32)$$

Poisson and negative binomial models can also be applied to panel data. Hausman, Hall and Griliches (1984), who were examining the relationship between patent applications of firms and their R&D activities, is considered as the pioneering work in unobserved effects count data models (Wooldridge, 2002). They developed random and fixed effects Poisson regression models. The fixed effects Poisson regression approach is specified as follows:

$$\ln\lambda_{it} = \mathbf{x_{it}'}\beta + \alpha_i \quad (33)$$

The fixed effects approach has the same advantages and disadvantages in this setting as the linear regression models. Further, again similar to the linear regression; random effects in this setting assumes the composite error term to be uncorrelated with the explanatory variables. If the assumption holds, the random effects model is an alternative model. Further, again similar to the linear models, the Hausman specification test can be used as a specification test. However, different than the linear model case, GLS is not applicable in this setting. The approach used for random effects Poisson or similarly negative binomial model is that formulating the joint probability conditioned upon the heterogeneity and then integrate it out of the joint distribution.

In the literature, the preference is usually for the fixed effects over the random effects. However, a serious shortcoming arises from the use of fixed effects model in Poisson and negative binomial models. The fixed effects setting is preferred because usually the unobserved heterogeneity in the composite error term is correlated with the explanatory variables and in such cases random effects setting will result in inconsistent estimates as discussed in the linear case. However, when the fixed effect setting is used, since the time invariant parameters are wiped out from the model; such as α_i in equation (33), and hence the constants are necessary to calculate the marginal effects obtaining marginal effects in such case becomes impossible.

6.5.3 The Censored Regression (Tobit) Model[23]

The Tobit model involves a censored dependent variable. Which means that the dependent variable is continuous but constrained in some way. Such a model; which have a dependent variable which is constrained to be nonnegative ($y \geq 0$) is first analysed by Tobin (1958) and hence called the Tobit model. The general formulation of the model is:

$$y_i^* = \mathbf{x_i'\beta} + e_i \tag{34}$$

$$y_i = 0 \text{ if } y_i^* \leq 0 \tag{35}$$

$$y_i = y_i^* \text{ if } y_i^* \geq 0 \tag{36}$$

Here y_i^* is a latent variable which can be observed only when it is nonnegative. For the cases that the latent variable is negative zero is observed instead.

Tobin (1958) investigates household expenditures on durable goods. In such case the dependent variable can sometimes be zero for some household and positive for others. In any case the dependent variable is nonnegative hence censored. The Tobit model uses MLE (maximum likelihood estimation) technique.

For panel data; it is possible to adapt the random effects model to the censored regression using a simulation or quadrature –the adaptive Gauss-Hermite quadrature in this case-. Fixed effects model on the other hand is more problematic then the random effects because a sufficient statistic does not exist allowing the fixed effects to be conditioned out of the likelihood. There has been some work which tries to make fixed effects work for censored regression models however unconditional fixed effects estimates are usually biased.

For this chapter, apart from the seemingly unrelated regression and the count data models the Tobit model is also used. When SUR and count data models are used the dependent variable is used as counts as in numbers of entry and exit of firms in a given

[23] (Greene, 2002); (Griffiths, Hill, & Judge, 1992)

year. However; with the Tobit model the dependent variable is used as rate, as in the rate of entry and exit. The reasoning behind using rates rather than count numbers is to take into account the industry size. It is clear that in a large industry entry and exit will be a lot higher in numbers. In order to take into account of this fact the dependent variables are also used as rates which is obtained by dividing the entry/exit counts to the total number of firms in that industry.

6.6 Results

Entry and exit equations estimated are as follows:

ENTRY=f (Profitability, Industry Growth, Agglomeration)

EXIT=f (Profitability, Industry Growth, Agglomeration, Productivity, Sunk Costs)

6.6.1 Dynamic Estimation results

Since past levels of firm entry and exit affect current realizations, it is possible to argue that market structure is dynamic. Hence first, entry and exit equations are estimated separately using a two-step system GMM dynamic panel data estimation method. This method allows using lagged values of entry and exit variables in order to analyse possible dynamic patterns in firm mobility. Results using net entry and exit data covering the 1980-2001 period are shown in table 6.2:

Models estimated using net and gross entry and exit data are as follows:

$$ENTRY_{it}= \beta_0+\beta_1 ENTRY_{it-1}+\beta_2 PROFIT_{it}+\beta_3 IGR_{it}+\beta_4 AGGLOMERATION_{it}+\varepsilon_{it} \qquad (37)$$

$$EXIT_{it}= \beta_0+\beta_1 EXIT_{it-1}+\beta_2 PROFIT_{it}+ \beta_3 IGRit+\beta_4 AGGLOMERATION_{it}+ \beta_5 PRODUCTIVITY_{it}+\beta_6 SUNK\ COSTS_{it}+\varepsilon_{it} \qquad (38)$$

Where; ε_{it} is the composite error term including both time invariant industry specific characteristics and also the remainder error term.

Table 6.2: GMM estimation results with net entry-exit data

	Entry	Exit
ENTRY/EXIT$_{t-1}$	-0.1205** (0.041)	-0.4489*** (0.023)
PROFIT	0.4706** (0.176)	0.5428** (0.189)
IGR	4.0735** (2.023)	-3.7647** (1.453)
AGGLOMERATION	-1.3124 (1.953)	0.0296 (0.679)
PRODUCTIVITY	-	-0.00001 (0.000)
SUNK COSTS	-	-0.0431 (0.027)
Year dummies	Yes	Yes
Prob.(>chi^2)	0.000	0.000
Sargan test stat.	0.000	0.000
Diff. In Hansen test stat.	0.910	0.585
Number of obs.	1610	1599
Number of groups	86	86
Number of instruments	46	49
Arellano-Bond test for AR(2)	0.043	0.069

*** 0.01<p, ** 0.05<p, * 0.1<p
Numbers in parentheses are standard errors

Standard errors are robust to clustering in the data. Results from Table 6.2 indicate past entry levels are negatively correlated with current entry implying high levels of entry in year t-1, reduces entry in year t. Profit and industry growth rate have positive and significant effects on firm entry consistent with theory and expectations. Finally agglomeration variable is negative in sign however statistically insignificant. Results from exit equation indicate a negative correlation with past levels of firm exit similar to entry results. Industry growth rate, labour productivity and sunk costs are negative and agglomeration is positive in sign as expected; however agglomeration, productivity and sunk costs are statistically insignificant. Profitability on the other hand has a positive and significant impact on firm exit contrast to theory and expectations. Such results can be attributed to the use of exit variable in the model. As mentioned before, because of data limitations it is not possible to differentiate between different types of entry and exit. It is possible for firms having high profit to change industry or sector rather than exit as a whole; however there is no possible way to track such effects. Further, there is also a possible misspecification problem. As Chappell et al (1990) and Mayer and Chappell (1992) point, firm entry and exit takes only integer values and hence needed to be handled using a model with maximum likelihood assumptions such as count data methods rather than using models with classical regression assumptions regarding the distribution of dependent variable. AR(2) test statistic indicates an autocorrelation problem again indicating a specification problem.

Results from two-step GMM estimation using gross entry-exit data covering 1995-2001 period is shown in Table 6.3:

Table 6.3: GMM estimation results with gross entry-exit data

	Entry	Exit
$ENTRY/EXIT_{t-1}$	0.0557 (0.074)	0.1394 (0.188)
PROFIT	-6.1344 (14.015)	-7.6053 (6.465)
IGR	-1.1631 (0.722)	0.4583 (0.775)
AGGLOMERATION	-8.4023* (4.556)	3.945*** (1.171)
PRODUCTIVITY	-	0.0009 (0.000)
SUNK COSTS	-	-1.905** (0.770)
Year dummies	Yes	Yes
Prob.(>chi^2)	0.332	0.000
Sargan test stat.	0.000	0.000
Diff. In Hansen test stat.	0.698	0.530
Number of obs.	396	392
Number of groups	79	79
Number of instruments	17	20
Arellano-Bond test for AR(2)	0.162	0.722

*** 0.01<p, ** 0.05<p, * 0.1<p
Numbers in parentheses are standard errors

Results on entry equation from table 6.3 indicate agglomeration has a negative and significant effect on firm entry; where all other explanatory variables are statistically insignificant. Further, the overall explanation power of the model is quite low. However, the AR(2) statistic indicates no autocorrelation problem with gross entry-exit data. Results from the exit equation indicate that agglomeration is again positively correlated with firm exit and sunk costs are valid exit barriers. Again the AR(2) test statistic indicates no autocorrelation problem. However, the problem of possible misspecification is still valid and more pronounced with gross entry and exit data set results.

6.6.2 Results from Count Data Estimations

Figures A6.1 through A6.4 show the distribution of entry and exit in net entry-exit data and gross entry exit data. From these figures it is clear that count data methods should be employed as a method of estimation.

Considering this misspecification problem, entry and exit equations are estimated using fixed effects Poisson and Negative Binomial count data models as well. Results from fixed effects Poisson model with net entry and exit data and gross entry and exit data are provided in tables A6.1 and A6.2 respectively. The fixed effects method is employed according to the result of Hausman test statistics. However, employing the fixed effect Poisson and negative binomial model has an important disadvantage. Since the constant is needed to obtain marginal effects, with the fixed effects model it is not possible to calculate the marginal effects after estimation.

The models estimated using count data models are as follows:

$$ENTRY_{it}= \beta_0+\beta_1 PROFIT_{it}+\beta_2 IGR_{it}+\beta_3 AGGLOMERATION_{it}+\varepsilon_{it} \quad (39)$$

$$EXIT_{it}= \beta_0+\beta_1 PROFIT_{it}+ \beta_2 IGRit+\beta_3 AGGLOMERATION_{it}+ \beta_4 PRODUCTIVITY_{it}+\beta_5 SUNK\ COSTS_{it}+\varepsilon_{it} \quad (40)$$

Results from the entry equation from Table A6.1 indicates profit has no explanatory power on firm entry where industry growth has a positive and significant impact and further agglomeration has a negative and significant impact on firm entry when net entry data is used. Results from the exit equation, however, indicate that profitability has a positive impact on firm exit as in the dynamic estimation results, in contrast to theory and expectations. The exit equation also indicates industry growth, productivity and sunk costs act as exit barriers in Turkish manufacturing; agglomeration on the other hand does not explain firm exit behaviour.

When gross entry and exit data results are examined from Table A6.2, it is clear that agglomeration is negatively correlated with entry and positively correlated with exit. Industry growth has a negative sign in the entry equation in contrast to expectations. Finally sunk costs act as exit barriers.

However over dispersion of the data indicates the negative binomial model is a better fit for such modelling. The descriptive statistics of net and gross entry-exit data provided in table A6.3 of the appendix indicates that clearly in both cases means of entry and exit variables are greater than the standard deviations of the corresponding variables. Hence using the Poisson regression method, which assumes the mean and the standard deviation to be equal, would be wrong. Further, even though there are significant numbers of zeros in dependent variables in both data sets predicted probabilities from the negative binomial and zero inflated negative binomial models are similar or slightly in favour of the negative binomial method.

Results from the fixed effects negative binomial model using net entry-exit data are presented in Table 6.4:

Table 6.4: Negative Binomial Regression Results with net entry-exit data

	Entry	Exit
PROFIT	-0.020* (0.011)	0.008 (0.012)
IGR	2.5778*** (0.233)	-0.8143*** (0.082)
AGGLOMERATION	0.06155 (0.150)	-0.2415*** (0.061)
PRODUCTIVITY	-	0.0001 (0.00)
SUNK COSTS	-	-0.0135** (0.006)
Prob.(>chi^2)	0.000	0.000
Number of obs.	1610	1574
Number of groups	86	83

*** 0.01<p, ** 0.05<p, * 0.1<p
Numbers in parentheses are standard errors

Results from Table 6.4 indicate that profit has a negative impact on firm entry, in contrast to expectations, and industry growth has a positive and significant effect on firm entry as expected. However, agglomeration has no explanatory power on firm entry according to these results. Further profitability and productivity has no explanatory power on firm exit where, industry growth, agglomeration and sunk costs have negative impacts on firm exit. Results contrast to expectations and theory can be in such case attributed to the use of net entry and exit data, rather than a specification problem.

Table 6.5 shows the results from fixed effects negative binomial regression estimation using gross entry and exit data:

Table 6.5: Negative Binomial Regression results with gross entry-exit data

	Entry	Exit
PROFIT	0.8424** (0.489)	-0.1861** (0.061)
IGR	0.0472** (0.026)	-0.0409** (0.049)
AGGLOMERATION	-0.1630** (0.096)	0.1501* (0.113)
PRODUCTIVITY	-	0.0006 (0.000)
SUNK COSTS	-	-0.2485*** (0.046)
Prob.(>chi^2)	0.000	0.000
Number of obs.	446	422
Number of groups	73	70

*** 0.01<p, ** 0.05<p, * 0.1<p
Numbers in parentheses are standard errors

Results from fixed effects negative binomial regression using gross entry and exit data indicates that profitability and industry growth have positive impacts on firm entry and agglomeration has a negative impact on entry. Further regarding exit, results from table 6.5 indicate a negative relationship between profitability, industry growth and exit as expected. Sunk costs having a negative impact on firm exit indicate sunk costs act as exit barriers in Turkish manufacturing sectors. Finally agglomeration has a positive impact on firm exit.

6.6.3 Results from Seemingly Unrelated Regression

Count data models, being suitable specifications for such models; however use of count data models means missing out the important effect from the interdependency of entry and exit variables. In order to account for such interdependency net and gross entry and exit data are used to estimate seemingly unrelated regression which allows taking into account the interdependency between entry and exit. Seemingly unrelated regression estimation fits a many equation model allowing their error terms to affect each other[24]. Three equations are estimated simultaneously using seemingly unrelated estimation methodology. The equations estimated are as follows:

$$ENTRY_{it}=\beta_0+\beta_1 EXIT_{it}+\beta_2 PROFIT_{it}+\beta_3 IGR_{it}+\beta_4 AGGLOMERATION_{it}+\varepsilon_{it} \quad (41)$$

$$EXIT_{it}=\beta_0+\beta_1 ENTRY_{it}+\beta_2 PROFIT_{it}+\beta_3 IGRit+\beta_4 AGGLOMERATION_{it}+\beta_5 PRODUCTIVITY_{it}+\beta_6 SUNK\ COSTS_{it}+v_{it} \quad (42)$$

$$STAY_{it}=\beta_0+\beta_1 ENTRY_{it}\ \beta_2 EXIT_{it}+\beta_3 PROFIT_{it}+\beta_4 IGRit+\beta_5 AGGLOMERATION_{it}+\beta_6 PRODUCTIVITY_{it}+\beta_7 SUNK\ COSTS_{it}+u_{it} \quad (43)$$

Since incumbent firms are making a decision of either exiting or staying in the market a third equation which shows the staying decision of an incumbent firm is also used. Similar to prior equations, productivity and sunk costs are not included in the entry equation because they are seen as factors which can only affect the incumbent firms. These three equations are run simultaneously using net entry-exit data and gross entry-exit data allowing interaction between the equations. Further entry is included in the exit equation and vice versa. Finally entry and exit are both included in equation (43) representing firm immobility.

Results from seemingly unrelated regression using net entry and exit data are presented in Table 6.6:

[24] Detailed explanation regarding the methods employed can be found in chapter 4.

Table 6.6: Seemingly unrelated regression results with net entry-exit data

	Entry	Exit	Stay
ENTRY	-	1.4403*** (0.000)	-1.2345*** (0.027)
EXIT	0.6912*** (0.000)	-	-0.7518*** (0.050)
PROFIT	1.6712*** (0.029)	-2.4295*** (0.043)	7.8342*** (0.265)
IGR	-11.3248*** (0.599)	16.5163*** (0.867)	-47.0378*** (3.034)
AGGLOMERATION	-3.206*** (0.536)	4.7927*** (0.776)	-21.0092*** (3.220)
PRODUCTIVITY	-	-0.0009*** (0.000)	-0.0017*** (0.000)
SUNK COSTS	-	0.0008*** (0.000)	-6.2614*** (0.167)
Number of obs.		1599	
Number of eqn.		3	
Number of panels		13	

*** 0.01<p, ** 0.05<p, * 0.1<p
Numbers in parentheses are standard errors

Results from Table 6.6 indicate that entry and exit are positively correlated and hence interdependent. Profitability has a positive impact on firm entry, a negative impact on firm exit and finally a positive impact on firm immobility, as expected. Industry growth on the other hand has a negative impact on entry, a positive impact on exit and a negative impact on firm stay, is contrast to expectations. Agglomeration has a negative impact on entry, positive impact on exit and negative impact on firm stay, implying that agglomeration has negative effects which cause incumbent firms to exit and new firms not to enter at all. Finally productivity and sunk costs also have different signs than expected. High levels of significance and different signs than expected in the results indicates underlying econometric problems, however it can also be attributed to the unhealthy structure of the data used. Therefore the same model is also estimated using gross entry and exit data and the results are presented in table 6.7:

Table 6.7: Seemingly unrelated regression results with gross entry-exit data

	Entry	Exit	Stay
ENTRY	-	0.5218*** (0.017)	-0.5477*** (0.015)
EXIT	1.3295*** (0.083)	-	-0.0398* (0.021)
PROFIT	4.0696*** (3.271)	-9.8294*** (9.709)	29.3157*** (5.870)
IGR	9.0831*** (0.618)	-2.1230*** (0.929)	9.8223*** (0.603)
AGGLOMERATION	-48.7062*** (6.697)	1.3976** (2.00)	-36.0643*** (1.183)
PRODUCTIVITY	-	-0.0001** (0.00)	0.0001*** (0.000)
SUNK COSTS	-	-18.2507*** (0.993)	33.4578*** (0.596)
Number of obs.		467	
Number of eqn.		3	
Number of panels		6	

*** 0.01<p, ** 0.05<p, * 0.1<p
Numbers in parentheses are standard errors

Results from table 6.7 indicate entry and exit are interrelated and have positive impacts on each other, consistent with theory and expectations. All variables have expected signs when gross entry and exit data is used. Profit affects entry and firm stay in the market positively while it has a negative effect on firm exit. Industry growth tells a similar story. It is positively correlated with firm entry and stay and negatively correlated with firm exit as expected. Productivity has a quite small impact on incumbent firms' decisions. Sunk costs on the other hand are valid exit barriers in Turkish manufacturing and also high levels of sunk costs force firms to choose to operate in the market rather than exiting. Finally agglomeration has a negative impact on entry and positive impact on exit, indicating firms do not choose to locate in agglomerated regions. Further as agglomeration increases firm stay decreases indicating a possible increase in competition forces incumbent firms to exit the industry. However, as mentioned before, it is not possible to differentiate between different definitions of firm exit. Hence if firms choose to start operating in another industry where agglomeration is relatively low and which requires similar technology or knowledge, this is also seen as firm exit.

When the results from Table 6.7 are compared with the negative binomial results for gross entry-exit data from Table 6.5 it is possible to say that all variables have their expected signs and indicate a similar story. However, possibly because of the specification issues in seemingly unrelated regressions, all variables are over estimated. Using count data models are the right specification choice for such data in hand however in order to see and account for the effect of interdependency between firm entry and exit a seemingly unrelated regression was necessary. Although as mentioned above both estimations tell a similar story.

6.6.4 Results from the Tobit Model

As mentioned above the dependent variable in this case is entry and exit rates rather than count numbers. Similar to the estimations above, the models estimated are as follows:

$$ENTRY_{it}=\beta_0+\beta_1 PROFIT_{it}+\beta_2 IGR_{it}+\beta_3 AGGLOMERATION_{it}+\varepsilon_{it} \quad (44)$$

$$EXIT_{it}= \beta_0 +\beta_1 PROFIT_{it}+ \beta_2 IGRit+\beta_3 AGGLOMERATION_{it}+ \beta_4 PRODUCTIVITY_{it}+\beta_5 SUNK\ COSTS_{it}+v_{it} \quad (45)$$

Again the models are estimated using two different data sets; net and gross entry and exit data. Table 6.8 presents the results of the Tobit model with the net entry-exit data.

Table 6.8: Tobit model results with net entry-exit data.

	Entry		Exit	
	Coefficients	Marginal Effects	Coefficients	Marginal Effects
PROFIT	-0.0775* (0.043)	-0.0318* (0.017)	-0.0322 (0.049)	-0.013 (0.019)
IGR	0.3628*** (0.028)	0.149*** (0.011)	-0.2949*** (0.019)	-0.1192*** (0.008)
AGGLOMERATION	-0.0055 (0.014)	-0.0022 (0.006)	-0.0712*** (0.013)	-0.0288*** (0.005)
PRODUCTIVITY	-	-	-0.0001*** (0.000)	-0.00008*** (0.000)
SUNK COSTS	-	-	-0.0023 (0.0015)	-0.0009 (0.000)
Prob.(>chi^2)	0.0000		0.0000	
Number of obs.	1610		1599	
Number of groups	86		86	
Number of left censored observations	911		881	
Number of uncensored observations	699		718	
Number of right censored observations	0		0	

*** 0.01<p, ** 0.05<p, * 0.1<p
Numbers in parentheses are standard errors

The results from the Tobit analysis of the net entry and exit data can be seen as problematic. According to table 6.8 profit has a negative effect on firm entry which means higher profits deters entry as opposed to expectations. Furthermore agglomeration also has a negative sign however is statistically insignificant. Industry growth rate on the other hand has a positive and significant impact on entry as expected. When looked at the exit side of the table, it can be seen that all variables have expected signs. The negative and significant agglomeration variable implies that rising levels of agglomeration triggers firm exit from the industry. However, productivity has a really small effect and sunk cost has no effect on firm exit. As mentioned and observed earlier net entry and exit data might not be the best data for the analysis. Table 6.9 presents the results from the gross entry and exit data.

Table 6.9: Tobit model results with gross entry-exit data.

	Entry		Exit	
	Coefficients	Marginal Effects	Coefficients	Marginal Effects
PROFIT	1.3218	0.8	-1.9284**	-1.0218**
	(0.804)	(0.489)	(0.974)	(0.519)
IGR	0.1526***	0.0923***	-0.0186**	-0.0099**
	(0.043)	(0.026)	(0.032)	(0.027)
AGGLOMERATION	-0.6495***	-0.3932***	0.2604***	0.1379***
	(0.187)	(0.116)	(0.193)	(0.123)
PRODUCTIVITY	-	-	-0.0002**	-0.0001**
			(0.000)	(0.000)
SUNK COSTS	-	-	-0.2907***	-0.154***
			(1.05)	(0.051)
Prob.(>chi^2)	0.0000		0.0000	
Number of obs.	472		476	
Number of groups	79		79	
Number of left censored observations	106		118	
Number of uncensored observations	366		349	
Number of right censored observations	0		0	

*** 0.01<p, ** 0.05<p, * 0.1<p
Numbers in parentheses are standard errors

Results from table 6.9 shows that profit and industry grow rates have positive and significant effects on firm entry. On the other hand agglomeration has a negative and significant effect on firm entry. Which indicates that rising agglomeration deters firm entry. When we look at the results from exit equation it can be seen that the sign of the variables are as expected. Profit, industry growth rates, productivity and sunk costs have negative and significant effects on exit. On the other hand agglomeration has a positive and significant effect on firm exit indicating that exits will be higher in agglomerated regions.

All methods used in this chapter have some advantages and disadvantages. While GMM allows the use of lagged dependent variable, count data methods are better fit for the data being used. On the other hand, the only way to incorporate for the interdependency between entry and exit is by using SUR. Furthermore in the Tobit analysis entry and exit rates are used dependent variables to take into account the industry size. Also Tobit model takes into account the censoring in the data. Since the results from count data models, SUR and Tobit model are quite similar when gross entry and exit data is used in terms of agglomeration and firm mobility, some overall conclusions can be drawn from the results obtained using these distinct methodologies. First, similar to the findings from previous literature profit and industry growth act as incentives to entry and barriers to exit in Turkish manufacturing industries. Second, sunk costs act as an important exit barrier in Turkish manufacturing. Productivity on the other hand, while being statistically significant has a quite small affect on exit. Further; based on the GMM results it is clear that entry and exit has a dynamic structure and past levels affect current levels. Finally, agglomeration deters entry and triggers exit in Turkish manufacturing as opposed to Krugman's (1991) findings. It should be once again mentioned that all the econometric methods used tackle one side of the story.

6.7 Summary and Conclusions

Results from the analyses indicate that geography is an important aspect in firm mobility, supporting Devereux et al (1999). Findings in their study indicate that entry and exit are lower in agglomerated regions of the UK. Results from Turkish manufacturing industries are consistent with Devereux et al. (1999). Berglund and Brannas (2001) also examined this important aspect using GMM for Sweden and found a negative effect of agglomeration on firm exit. While agglomeration can have different impacts on firm mobility in different countries, GMM is not the right specification for such analysis; further, they use population density as a proxy for agglomeration economies and as argued before this is a poor proxy. Finally Huiban (2009) argues it is easier to survive in rural areas than urban areas resulting from a study on France and its regions, indicating firms might chose to locate in rural areas or in areas that are not over represented by one industry; i.e. not agglomerated. Results from Turkish manufacturing industry also are consistent with such findings. It is also important to underline that industry level data is not the ideal tool for such analysis. Firm level or plant level data would reveal much more and healthier information on entry and exit patterns of firms in Turkish manufacturing; however as a result of data limitations industry level data is used. Results from Turkish manufacturing using both net and gross entry and exit data reveal quite important information. First, differences in estimation results with different data sets indicate that it is essential to use gross entry and exit data in such studies. Second, using the right specification is also important; however the main point should be seen as taking account of the interdependence between entry and exit to fully understand the underlying patterns. Finally it is necessary and again essential to account for the effects form agglomeration and to do so using the right proxy is vital.

Most important aspect of these results is that they are indicating that firms in Turkish manufacturing do not want to locate in agglomerated regions and clearly do not benefit from agglomeration. This result can explain the declining trend in agglomeration in Turkish manufacturing industries. However the possible explanation for such result should be further investigated. Hence the relationship between agglomeration and productivity is analysed in the following chapter.

CHAPTER 7: PRODUCTIVITY AND AGGLOMERATION

7.1 Introduction

Productivity is a widely discussed topic in the economics literature, in many ways. The aim of this chapter is to investigate the effect of agglomeration in Turkish manufacturing industries on productivity. This analysis hopes to shed some light on the question of why agglomeration matters. Further, such analysis will help to reveal more information on the results from chapter 6, suggesting that agglomeration has a negative correlation with entry and a positive relation with exit.

Figures A7.1a through A7.1g show the total factor productivity (TFP) trends of selected industries over time. Figures indicate that TFP has quite a volatile trend in Turkish manufacturing industries. Such a trend in Turkish manufacturing industries cannot solely be attributed to the various economic crises. Such fluctuations and different trends among industries imply that heterogeneous industry-specific effects are present for Turkish manufacturing industries. Investigating the underlying reasons behind such volatile trends in TFP for Turkish manufacturing industries is an appealing topic.

The remainder of this chapter is organized as follows: section 7.2 provides background information on the previous empirical literature. Section 7.3 reports some stylized facts about productivity and agglomeration which arises from the previous literature. Section 7.4 provides information about the main aim and focus of the chapter and lists the research questions that will be addressed. Section 7.5 provides information on the data used and also the methodologies employed throughout the study. Section 7.6 presents and discusses the estimation results and finally section 7.7 summarizes and concludes the chapter.

7.2 Empirical Background

An important discussion topic regarding agglomeration economies is the relationship between agglomeration and productivity. In the economics literature, productivity has been analysed in many different ways. First of all, the distinction among various studies in literature is based on the definition and use of productivity. Some studies choose to use labour productivity[25] as a dependent variable while some choose firm

[25] For example see: Ciccone (2002), Bradley and Gans (1998).

productivity[26]. The definition of firm productivity also varies: some researchers employ total factor productivity (TFP)[27] while some use more direct approaches and employ output or value added[28].

Many of the studies in the productivity literature examine the relationship between exports and productivity.[29] Besides exports and productivity, there are also studies examining the relationship between productivity and R&D expenditures, skilled labour, technology, training, and trade liberalization.[30]

However, the main aim of this chapter is on the relationship between agglomeration and firm productivity. After agglomeration economies draw attention from researchers, causes and effects of agglomeration has became a widely discussed topic. One main area of attention became the effect of agglomeration on firm productivity. While researchers expected positive effects from agglomeration via static and dynamic externalities, the results from empirical studies appear to be mixed.

Ciccone (2002) uses output per worker as a dependent variable and examines the relationship between agglomeration and output also using standard explanatory variables such as number of workers, human capital, physical capital and TFP using spatial data on Germany, Italy, France, Spain and the UK and finds that agglomeration effects increase productivity. However, he argues that there is a possible endogeneity problem between agglomeration and productivity. He suggests that the relationship between agglomeration and productivity can run both ways: first, productivity can be high as a result of agglomeration effects; on the other hand, firms might choose to locate in close proximity as a result of high and appealing productivity levels in a specific area and a specific industry. Therefore, the author employs 2SLS method using output per land as an instrumental variable to overcome this problem. Further, he attempts to capture agglomeration effects using employment density. It is quite important that Ciccone addresses the possible endogeneity problem between agglomeration and productivity, however the instrument he chooses to overcome such a problem; output per land, seems to be a poor one, when it is considered that he uses

[26] For example see: Lall et al. (2004), Graham (2006).
[27] For example see: Cingano and Schivardi (2004), Onder et al. (2003).
[28] For example see: Glaeser et al. (1992), Combes (2000).
[29] (Arnold & Hussinger, 2005), (Greenaway & Kneller, 2003) and for an excellent survey see; (Wagner, 2005)
[30] (Hay, 2001), (Griliches & Regev, 1995), (Topalova & Khandelval, 2010)

output per worker as a dependent variable. Clearly, the instrumental variable and the dependent variable will be correlated. Further, his choice of a proxy for agglomeration economies is also questionable. Agglomeration, meaning concentration of firms both geographically and industrially can hardly be captured by employment density. Manufacturing employment being dense in specific regions does not directly imply that the firms' choice of location is not random. Further, as mentioned above, employment density cannot capture both spatial and industrial characteristics.

Lall et al. (2004) also use output as a dependent variable in their study in order to investigate the relationship between agglomeration and productivity. They use plant level data for 1994-1995 for Indian industry. Independent variables again include standard variables such as capital, capital costs, labour, labour costs, inputs, manager quality, market access and two proxies for agglomeration economies; location quotient (LQ) and urban density. They also use a wide range of control variables such as proxies for regional quality of life, levels of economic development, literacy etc. They estimate production and cost functions simultaneously. Again it can be argued that LQ and urban density are poor proxies for agglomeration; LQ can capture only geographical specialization and urban density cannot capture industry concentration. Further they do not take into account the possible endogeneity problem. Their findings indicate that specialization effects vary between sectors and are negative for some. In particular they find that market access has a significant and positive effect on productivity and firms do not benefit from locating in dense urban areas.

Graham (2006) also uses output as a dependent variable for the UK in several sectors and finds diminishing returns to agglomeration in some sectors including manufacturing, distribution hotels and catering and also transport and communication. However, the agglomeration proxy that Graham uses is based on employment density and again a poor proxy for agglomeration. Using employment and/or population density as a proxy for agglomeration is highly questionable because high levels of population or employment density in a region do not show that firms' location choice is not random.

Glaeser et al. (1992) use employment growth as a dependent variable to proxy production because of data limitations. They use US data for 1956-1987 period to determine the underlying reasons behind local productivity growth. They use specialization index; LQ to see the effect of regional specialization on local growth.

Their findings indicate that specialization has a negative effect on local growth again suggesting negative externalities to be evident. They also highlight the fact that industry growth would be a better proxy for productivity however due to data limitations they use employment growth.

Bradley and Gans (1998) following Glaeser et al. (1992) investigate local productivity growth in Australia for a 10 year period; 1981-1991. Consistent with Glaeser et al (1992) they find agglomeration is negatively correlated with local productivity gains. Again productivity is proxied by an employment based measure in this study which is not a good proxy for productivity. Further they mention possible path dependence while agglomeration economies are considered; however they do not employ a dynamic method to capture such effects.

Combes (2000) provides an application to France again following Glaeser et al (1992). He also uses employment growth to proxy productivity and LQ for specialization. Neglecting a possible endogeneity problem between dependent and independent variables, he finds negative effects from specialization for both industry and services sector in France for the 1984-1993 period.

Cingano and Schivardi (2004) argue that Glaeser et al (1992) and studies following them use a poor proxy for productivity and hence suffer from an identification problem. Instead they use TFP as a dependent variable which perfectly proxies firm productivity, which is measured via Solow's residual. Employing weighted least squares method to examine the relationship between agglomeration and productivity in Italy, they find agglomeration has a positive effect on productivity. However, their study also suffers a serious identification problem. They proxy agglomeration economies with the LQ specialization index and also with a proxy for scale economies. As mentioned before LQ can only reveal information on regional specialization, not agglomeration. Further, scale economies are argued theoretically to be one of many reasons behind agglomeration and hence are again a poor choice of proxy.

Although, the relationship between agglomeration and productivity is quite important and investigated for most of the developed economies, the evidence from Turkish manufacturing is scarce. For Turkish manufacturing, productivity studies mainly focus on the productivity export, FDI, trade or technological efficiency relationships[31]. In the case of productivity and agglomeration; Coulibaly, Deichman and Lall (2007) attempt to capture this relationship using two-digit Turkish manufacturing data for 1980-2000 period. However; they try to capture agglomeration effects via several proxies such as accessibility, localization and urbanization that arise from the NEG literature. However, NEG explanations of agglomeration are not the only reasons of agglomeration, hence using such proxies can only capture one side of the story. Further, they use output as a dependent variable; which again is questionable. Finally, two-digit data cannot reveal detailed information on such relationships. Their findings indicate a positive relationship between the proxies used to represent agglomeration and productivity.

Onder et al. (2003) is among the rare attempts to acknowledge the spatial characteristics of TFP in Turkish manufacturing industries. They investigate technical efficiency, technical change and TFP changes by estimating a translog Cobb-Douglas type production function employing stochastic frontier analysis (SFA) methodology. Their findings suggest that average firm size and regional characteristics are the main determinants of technical efficiency. Their findings indicate that large scale firms are more efficient than small scale ones and industries located in metropolitan areas are more technically efficient than their peers in the peripheries. They use regions' share in production and population density and also a specialization index based on the value added to represent regional characteristics. Since, they only attempted to account for the spatial characteristics, rather than agglomeration, their choices of proxies and the methodology used is a proper one. If the question in mind is agglomeration, however, a slightly different attempt is necessary.

As a result, it is possible to say that the evidence on the relationship between agglomeration and productivity is mixed; mostly because different choices on proxies and methods employed. However, evidence suggesting a negative relationship between agglomeration and productivity are interesting. Because; then the question becomes, why do firms still chose to locate in agglomerated areas in spite of such effects from negative externalities and agglomeration diseconomies. As a result, the relationship between productivity and agglomeration remains as an interesting question that should be addressed.

[31] (Taymaz & Yilmaz, 2007); (Aslanoglu, 2000); (Taymaz & Saatci, 1997), to name a few.

The main gap in the literature on agglomeration and productivity studies is the poor proxies that are used to represent agglomeration economies such as population density or scale economies. The choice of dependent variable while measuring productivity is also mixed in the literature. Some researchers choose to use output or value added as a measure of productivity; however recent studies show that total factor productivity (TFP) is a better choice as a measure of productivity. Further, regarding Turkish manufacturing industries the evidence on agglomeration and productivity is limited as mentioned above.

7.3 Some Stylized Facts about Agglomeration and Productivity

i. There is no consensus on the choice of dependent variable in the literature as a right measure of productivity. TFP, however, is argued to be the most appropriate.
ii. Previous literature, lack the use of proper variable to represent agglomeration.
iii. The possible endogeneity problem between agglomeration and productivity is acknowledged in most studies.
iv. Finally; the results from previous studies on agglomeration and productivity are quite mixed. However; recent evidence indicates the presence of negative externalities in most countries.

7.4 Aim and Focus of the Chapter

As mentioned above, the main gap in the literature is the poor proxies used for agglomeration. The main contribution of this study to the literature is the use of a proper agglomeration index rather than proxies in the analysis[32]. Furthermore, it is the first study that attempts to capture the relationship between TFP and agglomeration for Turkish manufacturing industries using a quite detailed data set. Further, the endogeneity problem is taken into account and hence a dynamic panel data methodology (GMM) is employed to overcome this problem. This chapter attempts to answer the following questions:

i. Does agglomeration affect productivity in Turkish manufacturing industries?

[32] The agglomeration index used and how it is calculates is explained in detail in chapter 4.

ii. Do Turkish manufacturing firms experience productivity gains or losses from agglomeration? In other words; do Turkish manufacturing industries support the recent studies for the US and Europe and face negative externalities.

iii. How do the results change when the endogeneity problem between agglomeration and productivity is acknowledged via employing a dynamic GMM estimation method?

7.5 Data and Methodology

In this chapter, using 1980-2001 panel data for Turkish manufacturing industries, the effect of agglomeration on productivity is examined. For such analysis firm level data would be the ideal tool; however, because of data limitations industry level data is used instead. However since the main concern of this chapter is to investigate the relationship between agglomeration and productivity industry level data can still provide important information and be regarded as a good indicator. In this context, TFP is used to capture productivity in Turkish manufacturing industries. TFP can be measured in various ways and as mentioned before there is no consensus in the economics literature on how it should be measured. One of the commonly used methodologies to estimate TFP is via calculating Solow's residual using Cobb-Douglas type production function as follows:

$$Q_{it}=A_{it} F_t(K_{it}, L_{it}) \quad (46)$$

Where; *i* denotes industries, *t* denotes time, *K* denotes capital, *L* denotes labour and *A* denotes TFP. TFP is then extracted from the equation as:

$$\ln Q_{it}= \ln A_{it} + \beta \ln K_{it} + \alpha \ln L_{it} \quad (47)$$

$$\ln A_{it}= \ln Q_{it} - \beta \ln K_{it} - \alpha \ln L_{it} \quad (48)$$

Although, the Solow's residual is widely used because of its computational simplicity, this methodology to measure TFP also received much criticism. In theory, *A* gives the TFP, however in practice, it also contains unwanted components such as the measurement error, omitted variable bias, aggregation bias and model misspecification (Hulten, 2000). Therefore, in this chapter TFP is estimated using SFA in panel data as suggested by Battese and Coelli (1995). The stochastic frontier production function estimates allows for technical inefficiencies in the process of producing a particular input. A production frontier can be described or characterised in two ways. First is the minimum input bundles which required to produce a certain output and the second is the maximum output that can be produced by various amounts of inputs with a given technology. The econometric implication of these two definitions is the inclusion of "composed" error terms. Because the standard residuals which are symmetrically distributed with zero means are not suitable for such analysis. The "composed" error terms are not symmetric and they do not have zero means. In other words the error terms for the SFA are skewed with non-zero means (Kumbhakar & Lovell, 2000).

The production function in this case takes the form:

$$Q_{it} = \beta_0 + \sum_{j=1}^{k} \beta_j X_{jit} + v_{it} - u_{it} \tag{49}$$

Where, *Q* denotes the output and *X*'s denote the k explanatory variables, *i* denotes industries and *t* denotes time. The disturbance term in the stochastic frontier model is assumed to have two components (v_{it} and u_{it}). U_{it} is assumed to have a nonnegative distribution and v_{it} is assumed to have a symmetric distribution as the idiosyncratic error term. Such modelling permits two different parametizations of the error term; time invariant and time varying. In this chapter, the time varying decay model is used to account for the year specific effects. Technical efficiency (TE) and technical change (TC) are then estimated as follows:

$$TE_{ijt} = \exp(-u_{ijt}) \tag{50}$$

$$\text{Efficiency change} = TE_{ijt}/TE_{ijs} \tag{51}$$

$$TC = [1 + \partial \ln E(Q)/\partial t] + [1 + \partial \ln E(Q)/\partial s]/2 \tag{52}$$

Where; *E(Q)* denotes the expected value of production and *t* and *s* denotes subsequent years. Finally the multiplication of TE and TC yields to TFP change.

After TFP is estimated via SFA, it is used as a dependent variable and the E-G index of agglomeration is used as an independent variable in addition to other standard independent variables such as capital labour ratio, labour productivity and average firm size. Since the capital stock data for Turkish manufacturing industries are not available, it is calculated using the perpetual inventory method following Yilmaz (2007):

The starting capital is calculated as follows:

$$K_0 = \overline{I_n} * \frac{1-(1-\delta)^n}{\delta} \quad (53)$$

Where; K_0 denotes the initial capital, n denotes the number of years and δ denotes the depreciation rate for machinery which is used as 10%. After calculating the initial capital, investments to fixed capital is added for each year to get the capital stock variable. Table 7.1 presents the definitions and sign expectations of variables used.

Table 7.1: Definitions and Sign Expectations of Variables Used

	Definition	Sign Expectation
$TFPC_{t-1}$	Lagged value of the TFP change	Ambiguous
KLR	Capital labour ratio	Positive
PROD	Labour productivity	Positive
AFS	Average firm size	Positive
AGGLOMERATION	E-G index	Ambiguous

The expected signs of capital labour ratio, labour productivity and average firm size are all positive. It is widely accepted in the literature that all these variables would have a positive impact on productivity. It is also clear that the TFP will be affected from its past values. However the sign of this relationship is ambiguous, depending on the internal characteristics and structure of the industry and also of the country. There are also other factors that might affect productivity, such as human capital, R&D expenditures etc; however these factors are not used in this model because of the limitations on the data available regarding Turkish manufacturing industries. The sign of agglomeration variable in this modelling is ambiguous. Agglomeration can have a positive impact on productivity via externalities such as vertical linkages, labour market pooling and knowledge spillovers[33]. On the other hand, there are vast amount of evidence on negative externalities of agglomeration economies, specifically in the urban economics literature[34]. Following Glaeser (1998) such negative externalities can be summarized as follows:

i. Costs of living and commuting.
ii. Pollution costs.
iii. Crime rates.

[33] Different types of externalities are argued in chapter 2 in detail.
[34] Such as; (Cohen & Paul, 2005); (Desmet & Fafchamps, 2005); (Glaeser, 1998).

Hence, it is possible to say that if the negative externalities outweigh the impact from agglomeration economies (i.e. positive externalities that arise as a result of agglomeration) a negative relationship can be expected between agglomeration and productivity. Such relationship can arise from one or more of the independent variables. For example, if labour costs are high in agglomerated regions than firms would choose to employ less people or even with a chance to do so not to expand their scale in order to avoid the increases in labour costs. In addition, Marshalian externalities suggest that labour market pooling is one of the important positive externalities that arise from agglomeration economies (Marshall, 1920). Labour market pooling suggests that skilled labour will also be concentrated where agglomeration is high. Clearly skilled labour would be relatively costly to the firms. Further, it can also be argued that unions work more effectively in agglomerated areas; which is usually assumed to be urban areas rather than rural. Apart from labour costs, rental costs are expected to be higher in agglomerated areas. Furthermore, as mentioned above, pollution costs also increase as a result of agglomeration and regulations regarding pollution can be stricter in agglomerated areas. And finally, people might not be willing to choose in areas with high rates of crime. Hence, firms' pool of employment might be scarce in such areas. Therefore the effect of agglomeration on productivity of firms is not straightforward. However, there is no available data to test the effects of the negative externalities directly; therefore such analysis will be carried out through a productivity analysis.

For such analysis, fixed effects linear regression model and also a dynamic GMM model are employed in this chapter[35].

7.6 Results

7.6.1 Fixed Effects Estimation Results

First, a linear regression model is used to estimate such model. According to the result of the Hausman specification test[36] fixed effects panel data estimation method is employed rather than the random effects model to estimate the following model:

$$TFP_{it}=\beta_0+\beta_1 KLR_{it}+\beta_2 PROD_{it}+\beta_3 AFS_{it}+\beta_4 AGGLOMERATION_{it}+\varepsilon_{it} \quad (54)$$

[35] Detailed analysis and description of the methodologies used can be found in chapter 5.
[36] The linear regression model and Hausman specification test is examined in chapter 5.

Where; ε_{it} is the composite error term including both time invariant industry specific effects and the remainder error term:

$$\varepsilon_{it} = \mu_i + v_{it} \quad (55)$$

Results of the fixed effects panel data estimation are shown in Table 7.2:

Table 7.2: Fixed effects estimation results on productivity

Dependent variable: TFP	
KLR	0.0316** (0.245)
PROD	0.0877*** (0.274)
AFS	0.7462** (0.283)
AGGLOMERATION	-0.0030** (0.006)
CONSTANT	1.859*** (0.332)
Year dummies	Yes
R^2(overall)	0.0089
Number of obs.	1506
Number of groups	84

*** 0.01<p, ** 0.05<p, * 0.1<p
Numbers in parentheses are standard errors

The results suggest that all variables are statistically significant and have the expected signs. Capital-labour ratio, labour productivity and average firm size have positive and statistically significant impacts on TFP change. The results indicate that as capital labour ratio and labour productivity increase, TFP also increases in Turkish manufacturing industries. Further, large scale firms produce higher TFP consistent with Onder et al. (2003), who suggested that large scale firms will face high technical efficiency levels. The results from table 7.2 suggest that agglomeration has a negative impact on TFP in Turkish manufacturing industries, consistent with the negative externalities literature mentioned above.

7.6.2 Dynamic Estimation Results

However, such methodology does not take into account the dynamic relationship which might be present in such modelling. Past values of the dependent variable might have an important effect on the current realizations. Rather a dynamic panel data estimation method should be employed in order to account for the effect from past values of the dependent variable; TFP and also in order to deal with the possible endogeneity problem that might occur between agglomeration and productivity. As mentioned by Ciccone (2002), high levels of agglomeration can be both result and cause of high levels of productivity (i.e. the relationship between agglomeration and productivity can run both ways). Hence the following model is estimated using a two-step system GMM[37] method of dynamic panel data estimation:

$$TFP_{it} = \beta_0 + \beta_1 TFP_{it-1} + \beta_2 KLR_{it} + \beta_3 PROD_{it} + \beta_4 AFS_{it} + \beta_5 AGGLOMERATION_{it} + \varepsilon_{it} \qquad (56)$$

Where; ε_{it} is again the composite error term including both time invariant industry specific effects and the remainder error term. The results of the two step GMM estimation of equation (56) are provided in table 7.3. Results are different than for linear regression results in terms of magnitude, provided in table 7.2, and are again robust to the clusters in the data.

[37] Detailed examination of the methodology can be found in chapter 5.

Table 7.3: Dynamic panel data estimation results on productivity

Dependent variable: TFP	
TFP_{t-1}	-0.0947*** (0.027)
KLR	0.1379** (0.243)
PROD	0.1530** (0.210)
AFS	0.7023** (0.502)
AGGLOMERATION	-0.2851*** (0.007)
CONSTANT	1.7328** (0.631)
Year dummies	Yes
Prob.(>chi^2)	0.000
Sargan test stat.	0.000
Diff. In Hansen test stat.	0.956
Number of obs.	1406
Number of groups	82
Number of instruments	107
Arellano-Bond test for AR(2)	0.964

*** 0.01<p, ** 0.05<p, * 0.1<p
Numbers in parentheses are standard errors

As can be seen from table 7.3, AR(2) test statistic indicates no autocorrelation problem and Hansen test statistic and difference in Hansen test statistic indicates a correct use of instruments. Results indicate that past levels of TFP has negative and statistically significant impact on current realizations. Results from table 7.3 again have expected signs. The results indicate that as the capital-labour ratio and labour productivity increase, TFP increases as well. Further, average firm size has a positive and statistically significant impact on TFP change, indicating that large scale firms will be more efficient.

Further; results indicate a negative relationship between agglomeration and productivity supporting the negative externalities literature and consistent with results from Glaeser et al (1992), Bradley and Gans (1998) and Combes (2000), who also found that agglomeration negatively affects productivity. Since they used employment based measures of productivity these studies were criticised by Cingano and Schivardi (2004); who found positive relationship between agglomeration and productivity using TFP. However, they used the LQ index to proxy agglomeration. The results presented in this chapter for Turkish manufacturing indicates a negative relationship between agglomeration and productivity, meaning that employing a right proxy for agglomeration economies is equally important as employing the right measure for productivity. Further, it is important to take into account the endogeneity between agglomeration and productivity.

The results from productivity analysis imply that negative externalities outweigh the positive agglomerative forces in Turkish manufacturing industries. The results from the estimations differ from the previous studies for Turkish manufacturing industries. As mentioned above Onder et al. (2003) found that the regional characteristics are one of the main determinants of technical efficiency. However, it was also mentioned that this study was not aiming to examine the relationship between agglomeration and TFP and used regions' share in production and population density to capture the spatial characteristics. Further, as mentioned above Coulibaly et al. (2007) attempted to capture the relationship between agglomeration and productivity. However, as argued before, they use poor proxies to capture agglomeration. Their choices of proxies only capture the NEG explanation of agglomeration. Examination of the theoretical foundations of agglomeration in Turkish manufacturing industries from chapter 5, suggests that Ricardian explanation of specialization is the main determinant of agglomeration in Turkish manufacturing industries. NEG models also explain the agglomeration patterns in Turkish manufacturing industry, however using proxies that only capture the NEG explanation will lead to biased results. Further it is clear that rather than using proxies to capture agglomeration economies, using a proper index of agglomeration leads to more reliable results and hence is seen as the main contribution of this chapter.

The estimation results are consistent with the recent studies which support the negative externalities hypothesis. Further, the results are also consistent with the findings from previous chapter on firm mobility. The negative relationship between agglomeration and productivity explains why entry would be negatively related and exit would be positively related with agglomeration. Such results also explain the decreasing trend in agglomeration in Turkish manufacturing.

7.7 Summary and Conclusions

In the light of the results from firm mobility and productivity, it is possible to say that negative externalities that arise from agglomeration are present for Turkish manufacturing industries. However, analysis of the extent of agglomeration in Turkish manufacturing carried out in chapter 4 indicates there are still several highly agglomerated industries. Hence, the question remains why some firms would still choose to locate or remain in the agglomerated regions even though there is persistent evidence on negative externalities in other words even though agglomeration will negatively affect their productivity in several ways. As an answer to this question, it can be argued that in order to take advantage of the agglomeration economies such as vertical linkages, access to markets or other several benefits of locating in dense areas might not offset the associated costs. Firms in specific industries still choose to agglomerate even though this will cause a decrease in their productivity. Such fact can explain the finding of Krugman (1991) arguing that low-tech firms are the ones usually choose to agglomerate. It can be argued that low-tech firms are usually highly depending on natural resources as opposed to high-tech firms. Further baring the transport costs can be harder for low-tech firms and also vertical linkages are important in a similar sense. Therefore it is possible to say that low-tech firms choose to locate or stay in agglomerated areas, bearing the costs arise from negative externalities in order to have easy access to natural resources, the market and the upstream and downstream firms. Further, it can be argued that some high tech firms also would like to choose to locate in agglomerated regions to take advantage of knowledge spillovers. As a result, even though in terms of productivity negative externalities outweigh the positive ones, in general, in specific industries firms might choose to agglomerate despite of this fact in order to take advantage form positive externalities.

The main finding of this chapter is that in Turkish manufacturing industries, agglomeration measured by the E-G index has a negative effect on productivity which is measured by TFP. Using a proper agglomeration index is, as mentioned above is the main contribution of this chapter. Also this study is one of the first attempts to capture the relationship between agglomeration and productivity in Turkish manufacturing industries as mentioned above. However; this analysis has one important main drawback arising from data limitations. This study could reveal more detailed information if data were plant or firm level data instead of industry level. Regardless of this drawback; such analysis reveals important information on the relationship between agglomeration and productivity which is the main focus of attention in this chapter.

CHAPTER 8: CONCLUSION

The main focus of attention of this thesis was to investigate the agglomeration phenomenon in Turkish manufacturing industries. In this respect, agglomeration is investigated in terms of manufacturing industries and firms.

The results from the E-G index and the LQ index indicate that in Turkish manufacturing industries, throughout the 1980-2001 period agglomeration followed a declining trend in general. However, in particular there are several highly agglomerated industries such as textiles, food beverages and tobacco, wood and wood products and chemicals industries. Consistent with Krugman (1991a) most agglomerated industries mainly belong to the low-tech sectors. When agglomeration for different technology groups are investigated, results indicated that there is a similar pattern between low-tech and high-tech groups. Furthermore, decomposition of the E-G index, suggested that small changes in the low-tech and high-tech groups result from changes in the geographical concentration. On the other hand, big changes in the E-G index in all technology groups result from the changes in industrial concentration. The decomposition of the E-G index provides important information about the agglomeration phenomenon in Turkish manufacturing industries. The decomposition results imply that, as suggested by Allonso-Villar et al. (2004), industrial concentration and geographical specialization are indeed different facts and do not always follow similar trends.

Further, the theoretical foundations of the agglomeration in Turkish manufacturing industries are investigated. For this analysis, proxies for the Ricardian explanation of specialization and the Heckscher-Ohlin explanation of specialization of the traditional trade theory, the NTT and NEG models are used. The results suggest that agglomeration has a dynamic structure and in Turkish manufacturing industries, for the covered period, technological differences, as suggested by the Ricardian explanation of specialization and also scale economies, as suggested by the NTT models, explain the agglomeration patterns. The technological differences have a significant negative impact on agglomeration, while the impact from scale economies is positive.

In addition to the attempt to determine the underlying theoretical explanations of agglomeration in Turkish manufacturing industries, the effects of agglomeration on firm mobility and productivity are also examined. In terms of firm mobility, several empirical methodologies such as GMM, count data methods and SUR technique are employed. The results indicate that firm entry and exit in Turkish manufacturing industries are dynamic in structure and support the symmetry hypothesis suggested by Caves and Porter (1976). The results also suggest that geography is an important aspect in firm mobility. Entry in Turkish manufacturing industries is negatively correlated with agglomeration, while exit has a positive relationship. Furthermore, firms in Turkish manufacturing industry are not willing to stay in agglomerated areas. These results are also consistent with the results from the investigation of productivity and agglomeration. The results from TFP analysis indicate that agglomeration has a negative impact on firm productivity, measured by TFP.

When all estimation results are considered together, it can be said that agglomeration in Turkish manufacturing industry is in line with the negative externalities literature[38]. The overall declining trend in agglomeration and the negative relationship between entry and agglomeration can be attributed to the productivity losses arise from agglomeration. However, as mentioned before there are still highly agglomerated sectors in Turkish manufacturing industries. This result can be explained by the agglomerative forces (i.e. positive externalities) such as labour market pooling, natural resources, proximity to market, historical path dependencies and vertical linkages. It is clear that some firms, especially low-tech firms in Turkish manufacturing industries, are still staying in the agglomerated areas baring the negative externalities and the productivity losses. However, the general trend indicates firms in Turkish manufacturing industries choose not to locate in agglomerated areas.

As mentioned before, the main contribution of this thesis is the use of the E-G index to investigate agglomeration. Furthermore, to my knowledge, it is the first attempt to investigate agglomeration using proper tools and methodologies for Turkish manufacturing industries. The main drawback of this study is the data limitation. Unfortunately, there are no regional data available for the post-2001 period. Further, post-2001 data on the country level is not compatible with the pre-2001 data. Finally, there are no available data on firm or plant level and hence industry level data are used. However, the industry data used are on 4-digit level and hence provide quite detailed information. If firm level data covering a more recent period becomes available, much

[38] For example see: Glaeser (1998), Cohen and Paul (2005) and Desmet and Fafchamps (2005).

more information can be drawn regarding agglomeration in Turkish manufacturing industries. Apart from data issues, investigating agglomeration in terms of workers can also be seen as a possible future research area.

REFERENCES

Aiginger, K., & Davis, S. W. (2004). Industrial Specialization and Geographic Concentration: Two Sides of the Same Coin? Not for the European Union. *Journal of Applied Economics* , vol.7 no.2 pp.231-248.

Aiginger, K., & Pfaffermayr, M. (2004). The Single Market and Geographic Concentration in Europe. *Review of International Economics* , 12, 1-11.

Akgungor, S. (2003). Exploring Regional Specialization in Turkey's Manufacturing Industry. *Regional Studies Association International Conference.* Pisa, Italy.

Alecke, B., Alsleben, C., Scharr, F., & Untiedt, G. (2006). Are There Really High-Tech Clusters? The Geographic Concnentration of German Manufacturing Industries and its Determinants. *The Annals of Regional Science* , vol.40 no.1 pp.19-42.

Alonso-Villar, O., Chamorro-Rivas, J. M., & Gonzales-Cerdeira, X. (2004). Agglomeration Economies in Manufacturing Industries: The Case of Spain. *Applied Economics* , vol.36 no.18 pp. 2103-2116.

Amiti, M. (1998). New Trade Theories and Industrial Location in the EU: a Survey of Evidence. *Oxford Review of Economic Policy* , 14:45-53.

Amiti, M. (1999). Specialization Patterns in Europe. *Review of Worl Economics* .

Anderson, T., & Hsiao, C. (1982). Formulation and Estimation of Dynamic Models Using Panel Data. *Journal of Econometrics* , vol.18 pp.47-82.

Arellano, M., & Bond, S. (1991). Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations. *The Review of Economic Studies* , vol.58 no.2 pp.277-297.

Arellano, M., & Bover, O. (1995). Another Look at the Instrumental Variable Estimation of Error Component Methods. *Journal of Econometrics* , vol.68 pp.29-51.

Arnold, J. M., & Hussinger, K. (2005). Export Behaviour and Firm Productivity in German Manufacturing: A Firm Level Analysis. *Review of World Economics* , vol.121 no.42 pp.219-243.

Arrow, K. J. (1962). Economic Welfare and the Allocation of Resources for Invention. K. Arrow içinde, *The Rate and Direction of Inventice Activity: Economic and Social Factors.* New Jersey: Princeton University Press.

Aslanoglu, E. (2000). Spillover Effects of Foreign Direc Investments on Turkish Manufacturing. *Journal of International Development* , vol.12 no.8 pp.1111-1130.

Audretsch, D. B., & Feldman, M. P. (1996). Innovative Clusters and the Industry Life Cycle. *Review of Industrial Orginazation* , 253-273.

Austin, J. S., & Rosenbaum, D. I. (1990). The Determinants of Entry and Exit Rates into US Manufacturing Industries. *Review of Industrial Organization* , vol.5 no.2 pp.210-223.

Avery, R. B. (1977). Error Components and Seemingly Unrelated Regression. *Econometrica* , vol.45 no.1 pp.199-208.

Bain, J. S. (1956). *Barriers to New Competition: Their Character and Consequences in Manufacturing Industries.* Cambridge: Harvard University Press.

Baldwin, J. R., & Gorecki, P. K. (1991). Firm Entry and Exit in the Canadian Manufacturing Sector,1970-1982. *The canadian Journal of Economics* , vol.24 no.2 pp.300-323.

Baltagi, B. H. (2001). *Econometric Analysis of Panel Data.* Sussex: John Wiley& Sons.

Battese, G. E., & Coelli, T. J. (1995). A Model for Technical Inefficiency Effects in A Stochastic Frontier Production Function for Panel Data. *Empirical Economics* , vol.20 pp.325-332.

Berlgrund, E., & Brannas, K. (2001). Plants' Entry in Swedish Municipalities. *The Annals of Regional Science* , vol.35 pp. 431-448.

Bertinelli, L., & Decrop, J. (2005). Geographical Agglomeration: Ellison and Glaeser's Index Applied to the Case of Belgian Manufacturing Industries. *Regional Studies* , 39(5), 567-583.

Bhagwati, J. (1964). The Pure Theory of International Trade: A Survey. *The Economic Journal* , vol.74 no.293 pp.1-84.

Bieri, D. (2006). Picking a Winner? Evidence From the Non-Manufacturing High-Tech Industry in the Blackburg MSA. *MPRA* .

Biorn, E. (2004). Regression system for unbalanced panel data: a stepwise maximum likelihood procedure. *Journal of Econometrics* , vol.122 pp.281-291.

Blundell, R., & Bond, S. (1998). Initial Conditions and Moment Restirictions in Dynamic Panel Data Models. *Journal of Econometrics* , vol.87 pp.115-143.

Boratav, K., Yeldan, E. A., & Kose, A. H. (2000). *Globalization, Distribution and Social Policy: Turkey, 1980-1998.* New School University, New York: Center for Economic Policy Analysis (CEPA).

Bradley, R., & Gans, J. (1998). Growth in Australian Cities. *The Economic Record* , vol.74 no.226 pp.266-278.

Brambor, T., Clark, W. R., & Golder, M. (2006). Understanding Interaction Models: Improving Empirical Analyses. *Political Analysis* , vol 14, pp. 63-82.

Braunerhjelm, P., & Borgman, B. (2004). Geographical Concentration, Enterpreneurship and Regional Growth: Evidence from Regional Data in Sweeden, 1975-99. *Regional Studies* , 38(8), 929-947.

Broadberry, S., & Marrison, A. (2002). External Economies of Scale in the Lancashire Cotton Industry. *Economic History Review* , vol.55 no.1 pp.51-77.

Brulhart, M. (1995). Scale Economies, Intra-Industry Trade and Industry Location in "New Trade Theory". *Trinity Economic Paper Series* , technical paper no.95/4.

Brulhart, M. (1998). Trading Places: Industrial Specialisation in the European Union. *Journal of Common Market Studies* .

Brulhart, M. (1998). Economic Geography, Industry Location and Trade: The Evidence. *The World Economy* , vol. 21.

Brulhart, M. (2001). Evolving Geographical Concentration of European Manufacturing Industries. *Review of World Economics* , 137(2), 215-243.

Brulhart, M., & Torstensson, J. (1996). Regional Integration, Scale Economies and Industry Location in the European Union. *Centre for Economic Policy Research Paper* , No1435.

Cameron, A. C., & Trivedi, P. K. (1986). Econometric Models Based on Count Data: Comparisons and Applications of Some estimators and Tests. *Applied Econometrics* , vol.1 no.1 pp.29-53.

Cameron, A. C., & Trivedi, P. K. (1998). *Regression Analysis of Count Data.* Cambridge University Press: New York.

Caves, R., & Porter, M. (1976). Barriers to Exit. R. Masson, D. Qualls, & eds içinde, *Essays on Industrial Organization in Honor of Joe Bain.* Cambridge: Ballinger.

Chappell, W. F., Kimeyni, M. S., & Mayer, W. J. (1990). A Poisson Probability Model of Entry and Market Structure with an Application to US Industries During 1972-77. *Southern Economic Journal* , pp.918-927.

Ciccone, A. (2002). Aggloemration Effetcs in Europe. *European Economic Review* , vol. 46 no.2 pp.213-227.

Cingano, F., & Schivardi, F. (2004). Identifying the Sources of Local Productivity Growth. *Journal of the European Economic Association* , vol.2 no.4 pp.720-742.

Cohen, J. P., & Paul, C. J. (2005). Agglomeration Economies and Industry Location Desicions: The Impact of Spatial and Industrial Spillovers. *Regional Science and Urban Economics* , vol.35 pp.215-237.

Combes, P.-P. (2000). Economic Structure and Local Growth. *Journal of Urban Economics* , vol.47 no.329-355.

Coulibaly, S., Deichmann, U., & Lall, S. (2007). Urbanization and Productivity: Evidence from Turkish Provinces over the Period 1980-2001. *World Bank Policy Research Working Paper* , WPS4327.

Davidsson, P., Lindmark, L., & Olofsson, C. (1994). New Firm Formation and Regional Development in Sweden. *Regional Studies* , vol.28 no.4 pp.395-410.

Davis, D. R. (1995). Intra-industry Trade: A Heckscher-Ohlin -Ricardo Approach. *Journal of International Economics* , vol 39, pp.201-206.

Desmet, K., & Fafchamps, M. (2005). Changes in the Spatial Concentration of Employment Across US Industries: A Sectoral Analysis 1972-2000. *Jorunal of Economic Geography* , vol.5 pp.261-284.

Devereux, M., Griffith, R., & Simpson, H. (1999). The Geographic Distribution of Production Activity in the UK. *The Institute for Fiscal Studies WP* , 26/99.

Dietrich, M. (1999). Explaining Economic Restructuring: an Input-Output Analysis of Organizational Change in the European Union. *International Review of Applied Economics* , Vol.13 No.2 .

Doi, N. (1999). The Determinants of Firm Exit in Japenese Manufacturing Industries. *Small Business Economics* , vol.13 pp.331-337.

Dominics, L. d., Arbia, G., & de Groot, H. (2007). The Spatial Distribution of Economic Activity in Italy. *Tinbergen Institute Discussion Paper* , 094-3.

Dumais, G., Ellison, G., & Glaeser, E. (2002). Geographic Concentration as a Dynamic Process. *The Review and Economics and Statistics* , Vol. 84 No.2 pp.193-204.

Dunne, T., Haltiwanger, J., & Troske, K. (1996). Technology and Jobs: Secular Changes and Cyclical Dynamics. *NBER Working Papers* , 5656.

Dunne, T., Klimek, S. D., Roberts, M. J., & Xu, D. Y. (2009). Entry, Exit and the Determinants of Market Structure. *NBER Working Paper Series* , WP 15313.

Dunne, T., Roberts, M. J., & Samuelson, L. (1988). Patterns of Entry and Exit in US Manufacturing Industries. *The Rand Journal of Economics* , vol.19 pp.495-515.

Ellison, G., & Glaeser, E. L. (1997). Geographic Concentration in US Manufacturing Industries: a Dartboard Approach. *Journal of Political Economy* , vol 105 no 5, .

Ethier, W. (1979). Internationally Decreasing Costs and World Trade. *Journal of International Economics* , vol.9 pp.1-24.

Ethier, W. (1982). National and International Returns to Scale in Modern Theory of International Trade. *American Economic Review* , vol. 72 no.3 pp.389-405.

Falcioglu, P., & Akgungor, S. (2008). Regional Specialization and Industrial Concentration Patterns in the Turkish Manufacturing Industry: An Assesment for the 1980-2000 Period. *European Planning Studies* , 16(2).

Filiztekin, A. (2002). *Agglomeration and Growth in Turkey, 1980-1995*. Istanbul: Sabanci University.

Flynn, J. E. (1991). The Determinants of Exit in an Open Ecoomy. *Small Business Economics* , vol:3 pp.225-232.

Fritsch, M. (1992). Regional Differences in New Firm Formation: Evidence from West Germany. *Regional Studies* , volume 26.3, pp.233-241.

Garofoli, G. (1994). New Firm Formation and Regional Development: The Italian Case. *Regional Studies* , vol 28.4 pp.361-393.

Georski, P. (1995). What Do We Know About Entry? *International Journal of Industrial Organization* , vol.13 pp. 421-440.

Glaeser, E. (1998). Are Cities Dying? *The Journal of Economic Perspectives* , vol.12 no.2 pp.139-160.

Glaeser, E. L., Kallal, H. D., Scheinkman, J. A., & Shleifer, A. (1992). Growth in Cities. *The Journal of Political Economy* , vol.100 no.6pp.1126-1152.

Graham, D. J. (2006). *Investigating the Link Between Productivity and Agglomeration for UK Industires.* London: UK Department of Transport.

Greenaway, D., & Kneller, R. (2003). Exporting, Productivity and Agglomeration: A Difference in Differece Analysis of Matched Firms. *The University of Nottingham research Paper Series* .

Greene, W. H. (2002). *Econometric Analysis.* New Jersey: Pearson Inc.

Griffiths, W. E., Hill, R. C., & Judge, G. G. (1992). *Learning and Practicing Econometrics.* John Wiley & Sons Inc.

Griliches, Z., & Regev, H. (1995). Firm Productivity in Israeli Industry. *Journal of Econometrics* , vol.65 pp.175-203.

Grosman, G. M., & Helpman, E. (1991). Endogenous Product Cycles. *The Economic Journal* , vol.101 no.408 pp.1214-1229.

Grosman, G. M., & Helpman, E. (1991b). Quality Ladders and Product Cycles. *The Quarterly Journal of Economics* , vol.106 no.2 pp.557-586.

Haaland, J. I., Kind, H. J., Knarvik, K. H., & Torstensson, J. (1999). *What Determines The Economic Geography of Europe.* Centre for Economic Policy Research.

Hansen, L. P. (1982). Large Sample Properties of Generalized Method of Moments Estimators. *Econometrica* , vol.50 no.4 pp.1029-1054.

Harrigan, J. (1997). Technology, Factor Supplies and International Specialization:Estimating the Neo-classical Model. *American Economic Review* , vol 87, no4, pp.475-494.

Hausman, J. (1978). Specification Tests in Econometrics. *Econometrica* , vol.46 no.6 pp.1251-1271.

Hausman, J., Hall, B. H., & Griliches, Z. (1984). Econometric Models for Count Data with an Application to the Patents R&D Relationship. *Econometrica* , vol.53 no.4 pp.909-938.

Hay, D. A. (2001). The Post-1990 Brazilian Trade Liberalization and the Performance of Large Manufacturing Firms: Productivity, Market Shares and Profit. *The Economic Journal* , vol.111(July) pp.620-641.

Helpman, E. (1999). The Structure of Foreign Trade. *The Journal of Economic Perspectives* , vol 13, no2, pp.121-144.

Hirsch, S. (1967). *Location of Industry and International Competitiveness.* Oxford.

Holtz-Eakin, D., Newey, W., & Rosen, H. S. (1988). Estimating Vector Autoregressions with Panel Data. *Econometrica* , vol.56 no.6 pp.1371-1395.

Huiban, J.-P. (2009). The Spatial Demography of New Plants: Urban Creation and Rural Survival. *Small Business Economics* .

Hulten, C. R. (2000). Total Factor Productivity: A Short Biography. *NBER Working Papers* , WP 7471.

Ilmakunnas, P., & Topi, J. (1999). Microeconomic and Macroeconomic Influences on Entry and Exit of Firms. *Review of Industrial Organization* , vol. 15 pp.203-301.

Johnson, P., & Parker, S. (1996). Spatial Variations in the Determinants and Effects of Firm Births and Deaths. *Regional Studies* , vol.30 no.7 pp.679-688.

Jones, R. W., & Neary, J. P. (1984). The Positive Theory of International Trade. e. R. Jones, & P. B. Kenen içinde, *Handbook of International Economics* (s. 4-53). Elesvier.

Kamien, M. I., & Schwartz, N. L. (1982). *Market Structure and Innovation.* Cambridge: Cambridge University Press.

Kim, S. (1995). Expansion of Markets and the Geographic Distribution of Economic Activities: The Trends in U.S Regional MAnufacturing Structure, 1860-1987. *The Quarterly Journal of Economics* , vol.110 no.4 pp.881-908.

Kleijweg, A. J., & Lever, M. H. (1996). Entry and Exit in Dutch Manufacturing Industries. *Review of Industrial Organization* , vol.11 pp.375-382.

Kravis, I. B. (1956). "Availability" and Other Influences on the Commodity Composition of Trade. *The Journal of Political Economy* , vol.64 no.2 pp.143-155.

Krugman, P. (1979a). A Model of Innovation, Technology Transfer, and the World Distribution of Income. *The Journal of Political Economy* , vol.87 no.2 pp.253-266.

Krugman, P. (1979b). Increasing Returns, Monopolistic Competition, and International Trade. *Journal of International Economics* , vol.9 pp.469-479.

Krugman, P. (1980). Scale Economies, Product Differentiation and the Pattern of Trade. *American Economic Review* , vol70.

Krugman, P. (1991a). *Geography and Trade.* London: MIT Press.

Krugman, P. (1991b). Increasing Returns and Economic Geography. *Journal of Political Economy* , 483-99.

Krugman, P. (1999). The Role of Geography in Development. *International Regional Science* , vol.33 pp. 129-144.

Krugman, P., & Venables, A. J. (1990). Integration and Competitiveness of Peripheral Industry. In G. d. C. Bliss, *Unity With Diversity in the European Community* (pp. 56-75). Cambridge and London: Cambridge University Press.

Krugman, P., & Venables, A. (1995). Globalization and the Inequality of Nations. *The Quarterly Journal of Economics* , vol 110, no4 (november), pp. 857-880.

Krugman, P., & Venables, A. (1996). Integration, Specialization and Adjustment. *European Economic Review* , vol.40 pp.959-967.

Kumbhakar, S. C., & Lovell, C. K. (2000). *Stochastic Frontier Analysis.* New York: Cambridge University Press.

Lall, S., Shalizi, Z., & Deichmann, U. (2004). Agglomeration Economies and Productivity in Indian Industry. *Journal of Development Economics* , vol.73 no.2 pp.643-673.

Linder, S. B. (1961). *An Essay on Trade and Transformation.* New York: Wiley.

Love, J. H. (1996). The Determinants of Variations in Exit Rates. *Empirica* , vol. 23 pp. 107-118.

Marshall, A. (1920). *Principles of Economics.* London: Macmillan.

Maurel, F., & Sedillot, B. (1999). A Measure of Geographic Concentration in French Manufacturing Industries . *Regional Science and Urban Economics* .

Mayer, W. J., & Chappell, W. F. (1992). Determinants of Entry and Exit: An Application of the Compunded Bivariate Poisson Distribution to US Industries, 1972-1977. *Southern Economic Journal* , vol.58 no.3 pp.770-778.

McCullagh, P., & Nelder, J. A. (1983). *Generalized Linear Models.* Chapman and Hall: London.

Mydral, G. (1957). *Economic Theory and Underdeveloped Regions.* London: Duckworth.

Nguyen, M., & Nguyen, H. (2010). Estimation of system of regression equations with unbalanced panel data and random effects. *Stata Module* .

OECD. (2006). *Science Technology and Industry Outlook.* Paris: OECD.

Onder, A. O., Deliktas, E., & Lenger, A. (2003). Efficiency in the MAnufacturing Industry of Selected Provinces in Turkey. *Emerging Markets Finance and Trade* , vol.39, no.2, pp.98-113.

Paluzie, E., Pons, J., & Tirado, D. A. (2001). Regional Integration and Specialization Patterns in Spain. *Regional Studies* , vol.35 no.4 pp. 285-296.

Posner, M. V. (1961). International Trade and Technical Change. *Oxford Economic Papers* , vol. 13 no.3 pp.323-341.

Ricardo, D. (1817). *On the Principals of Political economy and Taxation.* London: Penguin Harmondsworth 1971 edition.

Roodman, D. (2006). How to Do xtabond2: An Introduction to "Difference" and "System" GMM in Stata . *Center for Global Development Working Paper* , WP no.103.

Rosenthal, S. S., & Strange, W. C. (2001). The Determinants of Agglomeration. *Journal of Urban Economics* , 50,191- 229.

Samuelson, P. A. (1939). The Gains From International Trade. *The Canadian Journal of Economics and Political Science* , vol.5 no.2 pp.195-205.

Samuelson, P. A. (1948). International Trade and the Equalisation of Factor Prices. *The Economic Journal* , vol.58 no.230 pp.163-184.

Sapir, A. (1996). The Effects of Europe's Internal Market Programme on Production and Trade: a First Assesment. *Weltwirtcshaftliches Archive* , 132(3), 457-75.

Saracoglu, B., & Suicmez, H. (2006). *Verimlilik Raporu 2006: Turkiye Imalat Sanayinde Verimlilik, Teknolojik gelisme, Yapisal Ozellikler ve 2001 Krizi Sonrasi reel Degisimler (1985-2005).* Ankara: MPM.

Schumpeter, J. A. (1976). *Capitalism, Socialism and Democracy.* New York: Harper Torchbooks.

Senses, F., & Taymaz, E. (2003). *Unutulan Bir Toplumsal Amac: Sanayilesme Ne Oluyor, Ne Olmali?* Middle East Technical University, Ankara: ERC Working Papers in Economics.

Shapiro, D., & Khemani, R. S. (International Journal of Industrial Organization). The Determinants of Enrtry and Exit Reconsidered. *1987* , vol.5 pp.15-26.

Sigfried, J. J., & Evans, L. B. (1994). Empirical Studies of Entry and Exit: A Survey of the Evidence. *Review of Industrial Organization* , vol.9 pp. 121-155.

Storey, D. J. (1991). The Birth of New Firms-Does Unemployment Matter? A Review of Evidence. *Small Business Economics* , vol.3 pp. 167-178.

Tan, H., & Batra, G. (1997). Technology and Firm Size Wage Differentials in Colombia, Mexico and Taiwan (China). *The World bank Economic Review* , vol 11, 59-83.

Taymaz, E., & Saatci, G. (1997). Technical Change and Efficiency in Turkish Manufacturing Industries. *Journal of Productivity Analysis* , vol.8 pp.461-475.

Taymaz, E., & Yilmaz, K. (2007). Productivity and Trade Orientation: Turkish Manufacturing Industry Before and After Customs Union. *The Journal of International Trade and Diplomacy* , vol.1 pp.127-154.

Tirole, J. (1988). *Theory of Industrial Organization.* MIT Press.

Tobin, J. (1958). Estimation of Relationships for Limited Dependent Variables. *Econometrica* , vol. 26 pp.24-36.

Topalova, P., & Khandelval, A. (2010). Trade Liberalization and Firm Productivity: The Case of India. *Review of Economics and Statistics* .

Traistaru, I., & Iara, A. (2002). *European Integration, Regional Specialization and Location of Industrial Activity in Accession Countries: Data and Measurement.* Bonn: Phare ACE Project P98-1117-R.

Traistaru, I., Nijkamp, P., & Longhi, S. (2002). Regional Specialisation and Location of Industrial Activity in Accession Countries. *Congress of the European regional Science association.* Dortmund.

TurkStat (Turkish Statistical Institute). (2006). *Statistical Indicators* . 2010 tarihinde www.turkstat.gov.tr adresinden alındı

TUSIAD (Turkish Industrialist's and Businessman Association). (2008). *Turkiye'de Bolgesel Farklar ve Politikalar.* Istanbul: TUSIAD.

Utterback, J. M., & Abernathy, W. J. (1975). A Dynamic Model of Process and Product Innovation. *OMEGA, The International Journal of Management Science* , vol.3 no.6 pp.639-656.

Venables, A. (1996). Localization of Industry and Trade Performance. *Oxford Review of Economic Policy* , vol.12 no.3, pp. 52-60.

Vernon, R. (1966). International Investment and International Trade in the Product Cycle. *The Quarterly Journal of Economics* , vol.80 no.2 pp. 190-207.

Wagner, J. (2005). Exports and Productivity: A Survey of the evidence from Firm Level Data. *University of Luneburg Working Paper Series in Economics* .

Windmeijer, F. (2005). A Finite Sample Correction for the Variance of Linear Efficient Two-Step GMM Estimators. *Journal of Econometrics* , vol. 126 pp. 25-51.

Wolfmayr-Schnitzer, Y. (2000). Economic Integration, Specialisation and the Location of Industries. A Survey of Theoretical Literature. *Austrian Economic Quarterly* , vol 5(2) 73-80.

Wooldridge, J. M. (2002). *Econometric Analysis of Cross Section and Panel Data.* London: MIT Press.

Yenturk, N. (1997). *Turk Imalat Sanayinde Ucretler, SItihdam ve Birikim.* Istanbul: Friedrich Ebert Vakfi.

Yilmaz, K. (2007, March 17). *Sermaye Stoku Hesaplari:Isyeri Bazli Yatirim Verileri.* February 17, 2011 tarihinde http://www.ku.edu.tr/ku/images/EAF/sermaye_stoku_sunum_kyilmaz.pdf: http://www.ku.edu.tr/ku/images/EAF/sermaye_stoku_sunum_kyilmaz.pdf adresinden alındı

Zellner, A. (1962). An Efficient Method of Estimating Seemingly Unrelated Regressionsand Tests for Aggregation Bias. *Journal of American Statistical Association* , vol.57 no.298 pp.348-368.

APPENDIX

Table A3.1: Growth rates in Turkish economy

	1977-1979	1980-1988	1989-1994	1995-2000
GNP Growth (%)	1.2	4.3	3.3	4.6
GDP Growth (%)	1.4	4.5	3.2	4.6
Sectoral Growth Rates (%)				
Agriculture	0.3	1.6	0.1	1.9
Industry	2.0	6.1	4.1	5.4
Manufacturing	1.2	6.3	3.8	5.7
Construction	-4.9	7.2	3.0	-0.2
Services	6.2	5.9	4.1	5.6

Table A3.2: Sector Shares in GDP

GDP- Sector Shares (%)	**1977-1979**	**1980-1988**	**1989-1994**	**1995-2000**
Agriculture	29.4	21.0	15.9	15.6
Industry	19.1	23.0	25.8	24.4
Manufacturing	17.3	19.9	22.0	20.5
Construction	5.6	6.0	6.9	5.7
Services	45.9	50.0	47.8	49.3

Table A3.3: Employment Shares

Employment Shares (%)	**1977-1979**	**1980-1988**	**1989-1994**	**1995-2000**
Agriculture	52.1	47.9	45.6	41.2
Industry	14.0	14.6	15.8	17.0
Manufacturing	12.5	13.1	14.6	15.8
Construction	5.4	5.5	5.5	6.2
Services	23.5	27.6	33.1	35.7

Table A3.4: Main Labour Market Indicators (1000 people)

Year	Population	Population age 15+	Labour force	Labour force participation rate (%)	Employed	Unemployment rate (%)
1980	44439	27303	17842	65.35	16523	7.4
1985	50307	31654	20177	63.74	17547	13.03
1988	53284	33746	19391	57.50	17755	8.4
1993	58478	38957	20314	52.10	18500	8.9
1996	61724	42243	22697	53.70	21194	6.6
2001	67296	47158	23491	49.80	21524	8.4

Table A3.5: Shares of Government and Private Sectors in Turkish Manufacturing (%)

	1980	**1985**	**1990**	**1995**	**2000**
Value Added					
Government	40.5	38.1	31.3	24.4	20.3
Private	59.5	61.9	68.7	75.6	79.7
Number of Workers					
Government	36.1	29.5	24.3	17.4	11.0
Private	63.9	70.5	75.7	82.6	89.0

Table A3.6: Value Added Shares in Manufacturing Sector (%)

	Food, beverages and tobacco	Textile	Wood products and furniture	Paper products and printing	Chemicals	Mining	Metal	Machinery	Other
1977-1979	18.9	17.3	1.7	3.4	19.3	6.4	12.9	19.8	0.3
1980-1988	18.9	14.5	1.1	3.1	28.8	6.9	8.7	17.8	0.3
1989-2001	16.1	16.2	1.1	3.2	28.5	7.1	7.0	20.4	0.3

Table A3.7: Employment Shares in Manufacturing Sector (%)

	Food, beverages and tobacco	Textile	Wood products and furniture	Paper products and printing	Chemicals	Mining	Metal	Machinery	Other
1977-1979	22.5	23.3	2.0	3.4	9.7	7.5	10.5	20.7	0.5
1980-1988	21.0	25.1	2.2	3.7	9.7	7.5	8.9	21.4	0.5
1989-2001	17.2	31.9	2.2	3.3	9.6	6.9	6.5	21.7	0.6

Table A3.8a:Food beverages and tobacco industry employment shares (%)

	MEDITERRENIAN	E.ANATOLIA	AEGIAN	S.E.ANATOLIA	ANATOLIA	B.SEA	MARMARA
1980	14.3	54.3	34.5	28.7	22.1	56.0	13.4
1985	14.1	54.0	27.9	29.9	22.7	50.1	11.4
1990	14.6	53.0	23.2	18.9	23.7	44.7	10.2
1995	14.0	49.7	20.9	17.7	22.4	48.5	9.9
2000	13.5	50.9	18.5	14.1	19.1	46.5	8.9

Table A3.8b:Textile industry employment shares (%)

	MEDITERRENIAN	E.ANATOLIA	AEGIAN	S.E.ANATOLIA	ANATOLIA	B.SEA	MARMARA
1980	46.5	21.7	25.4	32.1	18.2	0.8	24.0
1985	41.1	23.4	26.3	43.9	13.0	0.7	29.4
1990	41.5	21.1	30.0	59.1	12.8	1.0	33.6
1995	42.2	27.6	34.6	57.3	13.2	2.9	38.9
2000	42.4	34.5	35.0	72.0	14.3	7.9	39.7

Table A3.8c: Wood products and furniture employment shares (%)

	MEDITERRENIAN	E.ANATOLIA	AEGIAN	S.E.ANATOLIA	ANATOLIA	B.SEA	MARMARA
1980	1.6	n.a	1.4	n.a	1.6	5.4	1.6
1985	1.7	n.a	1.4	n.a	2.4	7.4	1.3
1990	0.6	n.a	0.9	n.a	2.2	8.7	1.1
1995	1.2	0.1	1.0	1.2	3.9	6.2	1.3
2000	1.4	0.09	1.3	n.a	5.5	5.8	1.4

Table A3.8d: Paper products and printing industry employment shares (%)

	MEDITERRENIAN	E.ANATOLIA	AEGIAN	S.E.ANATOLIA	ANATOLIA	B.SEA	MARMARA
1980	0.3	n.a	4.3	0.7	2.5	1.9	4.8
1985	1.6	n.a	4.1	1.0	2.7	2.5	4.7
1990	1.4	n.a	3.5	1.1	2.3	2.6	4.2
1995	1.7	n.a	3.3	1.4	2.3	2.1	3.7
2000	1.8	n.a	3.0	1.2	2.9	1.8	2.9

Table A3.8e: Chemicals industry employment shares (%)

	MEDITERRENIAN	E.ANATOLIA	AEGIAN	S.E.ANATOLIA	ANATOLIA	B.SEA	MARMARA
1980	9.2	2.9	8.5	31.5	2.5	2.2	13.0
1985	11.8	3.7	10.3	9.1	2.3	2.8	12.3
1990	11.4	2.0	13.2	8.4	3.2	3.0	11.7
1995	11.1	2.4	11.1	9.1	4.4	3.6	11.0
2000	11.0	n.a	9.6	6.6	4.3	4.12	11.4

Table A3.8f: Mining industry employment shares (%)

	MEDITERRENIAN	E.ANATOLIA	AEGIAN	S.E.ANATOLIA	ANATOLIA	B.SEA	MARMARA
1980	5.2	9.7	9.6	3.1	7.4	6.3	7.0
1985	5.3	9.9	8.9	9.3	6.9	8.6	7.0
1990	5.3	9.0	9.6	8.0	6.2	10.7	6.6
1995	5.1	6.4	10.2	8.4	6.8	10.8	5.1
2000	6.8	3.5	11.0	3.3	7.3	9.3	4.3

Table A3.8g: Metal industry employment shares (%)

	MEDITERRENIAN	E.ANATOLIA	AEGIAN	S.E.ANATOLIA	ANATOLIA	B.SEA	MARMARA
1980	18.2	9.5	2.4	0.2	13.4	25.2	4.8
1985	18.2	5.8	3.2	0.7	12.1	24.3	4.6
1990	18.3	12.6	3.0	0.7	11.0	25.4	4.5
1995	16.7	10.9	3.0	0.7	8.0	20.2	3.8
2000	12.7	8.7	3.7	n.a	5.3	18.5	3.3

Table A3.8h: Machinery industry employment shares (%)

	MEDITERRENIAN	E.ANATOLIA	AEGIAN	S.E.ANATOLIA	ANATOLIA	B.SEA	MARMARA
1980	4.3	1.6	13.2	3.3	32.0	1.8	30.3
1985	5.8	3.0	17.1	5.8	37.2	3.0	27.9
1990	6.7	1.9	16.0	3.3	37.8	3.5	26.9
1995	7.7	2.6	15.3	3.8	38.4	5.3	24.9
2000	9.8	2.0	17.3	2.5	40.9	5.8	26.5

Table A4.1: Descriptive statistics

Variable	Mean	Std. Dev.	Min	Max
Number of Firms	9.610182	16.21709	1	133
Number of Workers	1581.336	4122.243	21	34713
Investments to machinery	7243782	35600000	0	855000000
Changes in fixed capital	540105.9	2626782	-8724371	32100000
Input	11200000	49600000	1	773000000
Output	17900000	74900000	2	909000000
Value Added	6753584	32200000	-1477023	474000000
Total income	17200000	72900000	2	900000000
Labour costs	1918562	10400000	1	151000000

Table A4.2: Ellison Glaeser index based on technology

ISIC	Technology	Description	1980	2000	1980-2000
3522	1	Manufacture of drugs and medicines	0.24	0.22	-0.02
3825	1	Manufacture of office, computing and accounting machinery	0.19	0.08	-0.1
3832	1	Manufacture of radio, television and communication equipment and apparatus	0.28	0.40	0.12
3845	1	Manufacture of aircraft	0.20	-0.11	-0.31
3511	2	Manufacture of basic industrial chemicals except fertilizers	0.25	0.05	-0.20
3512	2	Manufacture of fertilizers and pesticides	0.27	-0.04	-0.31
3513	2	manufacture of synthetic resins, plastic materials and manmade fibres except glass	0.23	-0.07	-0.30
3521	2	Manufacture of paints and lacquers	0.32	0.10	-0.21
3523	2	Manufacture of soap and cleaning preparations, perfumes, cosmetics and other toilet paper	0.31	0.10	-0.21
3529	2	Manufacture of chemical products not classified elsewhere	0.28	0.43	0.14
3821	2	Manufacture of engines and turbines	0.38	-0.18	-0.56
3822	2	Manufacture of agricultural machinery and equipment	0.33	0.45	0.11
3823	2	Manufacture of metal and woodworking machinery	0.35	0.29	-0.05
3824	2	Manufacture of special industrial machinery and equipment except metal and woodworking machinery	0.33	0.28	-0.04
3829	2	Machinery and equipment except electrical not classified elsewhere	0.21	0.01	-0.19
3831	2	Manufacture of electrical industrial machinery and apparatus	0.25	0.41	0.16
3833	2	manufacture of electrical appliances and household goods	0.28	0.39	0.11
3839	2	Manufacture of electrical apparatus and supplies not classified elsewhere	0.17	0.40	0.24
3842	2	Manufacture of railroad equipment	0.24	0.41	0.17
3843	2	Manufacture of motor vehicles	0.04	0.35	0.31
3844	2	Manufacture of motorcycle and bicycles	0.19	0.41	0.22
3849	2	Manufacture of transport equipment not classified elsewhere	0.21	-0.18	-0.38
3851	2	Manufacture of professional and scientific and measuring and controlling equipment not classified elsewhere	0.17	0.39	0.21
3852	2	Manufacture of photographic and optical goods	0.17	0.42	0.25
3853	2	Manufacture of watches and clocks	0.10	0.45	0.35
3854	2	Other manufacture of professional and scientific and measuring and controlling equipment not classified elsewhere	-0.10	0.41	0.30
3530	3	Petroleum refineries	0.43	0.44	0.01
3541	3	Manufacture of miscellaneous products Of petroleum and coal1	0.37	-0.14	-0.51

3542	3	Manufacture of miscellaneous products of petroleum and coal2	0.37	-0.16	-0.53
3543	3	Manufacture of miscellaneous products of petroleum and coal3	0.37	0.34	-0.03
3544	3	Manufacture of miscellaneous products of petroleum and coal4	0.31	0.38	0.07
3551	3	Tyre and tube industries	0.35	-0.20	-0.55
3559	3	Manufacture of rubber products not classified elsewhere	0.34	0.40	0.05
3560	3	Manufacture of plastic products not classified elsewhere	0.33	0.10	-0.23
3610	3	Manufacture of pottery, china and earthenware	0.35	0.22	-0.13
3620	3	Manufacture of glass and glass products	0.34	0.41	0.08
3691	3	Manufacture of structural clay products	0.32	0.44	0.12
3692	3	Manufacture of cement, lime and plaster	0.35	0.07	-0.28
3699	3	Manufacture of non-metallic mineral products not classified elsewhere	0.33	0.15	-0.19
3710	3	Iron and steel basic industries	0.35	0.22	-0.13
3720	3	Non ferrous metal basic industries	0.32	0.17	-0.15
3811	3	Manufacture of cutlery hand tools and general hardware	0.32	0.17	-0.15
3812	3	Manufacture of furniture and fixtures primarily of metal	0.34	0.25	-0.09
3813	3	Manufacture of structural metal products	0.32	0.15	-0.18
3819	3	Manufacture of fabricated metal products except machinery and equipment not classified elsewhere	0.31	0.34	0.03
3841	3	Shipbuilding and repairing	0.05	0.46	0.40
3901	3	Manufacture of jewellery and related articles	-0.60	0.47	-0.14
3902	3	Manufacture of musical instruments	-0.49	0.49	0.01
3903	3	Manufacture of sporting and athletic goods	-0.39	-0.03	-0.42
3909	3	Manufacturing industries not classified elsewhere	-0.24		
3111	4	Slaughtering, preparing and preserving meat	0.35	0.46	0.11
3112	4	Manufacture of dairy products	0.35	0.46	0.11
3113	4	Canning and preserving of fruits and vegetables	0.29	0.41	0.12
3114	4	Canning, preserving and processing of fish, crustaces and similar foods	-0.03	-0.08	-0.10
3115	4	Manufacture of vegetable and animal oils and fats	0.33	0.46	0.13
3116	4	Grain mill products	0.35	0.49	0.14
3117	4	Manufacture of bakery products	0.30	0.45	0.15
3118	4	Sugar factories and refineries	0.33	0.70	0.37
3119	4	Manufacture of coca, chocolate and sugar Confectionery	0.34	0.44	0.10
3121	4	Manufacture of food products not elsewhere classified	0.40	0.49	0.09
3122	4	Manufacture of prepared animal feeds	0.36	0.34	-0.02
3131	4	Distilling, rectifying and blending spirits	0.37	0.31	-0.06
3132	4	Wine industries	0.38	0.37	0.01
3133	4	Malt liquors and malt	0.33	-0.12	-0.45
3134	4	Soft drinks and carbonated waters industries	0.34	0.44	0.10
3140	4	Tobacco manufactures	0.31	0 .45	0.14
3211	4	Spinning, weaving and finishing textiles	0.51	0.68	0.17
3212	4	Manufacture of made-up textile goods except	0.30	0.27	-0.03

		wearing apparel			
3213	4	Knitting mills	0.29	0.20	-0.09
3214	4	Manufacture of carpets and rugs	0.35	0.42	0.07
3215	4	Cordage, rope and twine industries	0.34	0.31	-0.03
3219	4	Manufacture of textiles not elsewhere classified	0.36	0.19	-0.17
3221	4	Manufacture of leather and fur wearing apparel	0.35	-0.36	-0.71
3222	4	Manufacture of wearing apparel except fur and leather	0.25	0.01	-0.24
3231	4	Tanneries and leather finishing	0.31	0.22	-0.09
3232	4	Fur dressing and dying industries	0.32	0.35	0.03
3233	4	Manufacture of products of leather and leather substitutes except footwear and wearing apparel	0.34	0.31	-0.03
3240	4	Manufacture of footwear, except vulcanised or moulded rubber or plastic footwear	0.31	0.06	-0.25
3311	4	Sawmills, planing and other wood mills	0.31	0.06	-0.25
3312	4	Manufacture of wooden and cane containers and small cane ware	0.33	-0.91	-1.24
3319	4	Manufacture of wood and cork products not classified elsewhere	-0.06	-2.19	-2.25
3320	4	Manufacture of furniture and fixtures, except primarily of metal	0.31		
3411	4	Manufacture of pulp, paper and paperboard	0.26		
3412	4	Manufacture of containers and boxes of paper and paperboard	0.26	0.28	0.02
3419	4	Manufacture of pulp, paper and paperboard articles not classified elsewhere	0.28	0.09	-0.19
3421	4	Printing publishing and allied industries	0.26	0.10	-0.15

Table A4.3a: Least agglomerated 20 industries

ISIC	Description	1980	ISIC	Description	2000
3901	manufacture of jewellery and related articles	-0.60	3319	manufacture of wood and cork products not classified elsewhere	-2.19
3902	manufacture of musical instruments	-0.49	3312	manufacture of wooden and cane containers and small cane ware	-0.91
3903	manufacture of sporting and athletic goods	-0.39	3221	manufacture of leather and fur wearing apparel	-0.36
3909	manufacturing industries not classified elsewhere	-0.24	3551	tyre and tube industries	-0.20
3854	other manufacture of professional and scientific and measuring and controlling equipment not classified elsewhere	-0.10	3821	manufacture of engines and turbines	-0.18
3319	manufacture of wood and cork products not classified elsewhere	-0.06	3849	manufacture of transport equipment not classified elsewhere	-0.18
3114	Canning, preserving and processing of fish, crustaces and similar foods	-0.03	3542	manufacture of miscellaneous products of petroleum and coal2	-0.16
3843	manufacture of motor vehicles	0.04	3541	manufacture of miscellaneous products of petroleum and coal1	-0.14
3841	shipbuilding and repairing	0.05	3133	malt liquors and malt	-0.12
3853	manufacture of watches and clocks	0.10	3845	manufacture of aircraft	-0.11
3839	manufacture of electrical apparatus and supplies not classified elsewhere	0.17	3114	Canning, preserving and processing of fish, crustaces and similar foods	-0.08
3852	manufacture of photographic and optical goods	0.17	3513	manufacture of synthetic resins, plastic materials and manmade fibres except glass	-0.07
3851	manufacture of professional and scientific and measuring and controlling equipment not classified elsewhere	0.17	3512	manufacture of fertilizers and pesticides	-0.04
3844	manufacture of motorcycle and bicycles	0.19	3903	manufacture of sporting and athletic goods	-0.03
3825	manufacture of office, computing and accounting machinery	0.19	3222	manufacture of wearing apparel except fur and leather	0.01
3845	manufacture of aircraft	0.20	3829	machinery and equipment except electrical not classified elsewhere	0.01
3829	machinery and equipment except electrical not classified elsewhere	0.21	3511	manufacture of basic industrial chemicals except fertilizers	0.05
3849	manufacture of transport equipment not classified elsewhere	0.21	3311	sawmills, planing and other wood mills	0.06
3513	manufacture of synthetic resins, plastic materials and manmade fibres except glass	0.23	3240	manufacture of footwear, except vulcanised or moulded rubber or plastic footwear	0.06
3522	manufacture of drugs and medicines	0.24	3692	manufacture of cement, lime and plaster	0.07

Table A4.3b: Most agglomerated 20 industries

ISIC	Description	1980	ISIC	Description	2000
3116	grain mill products	0.35	3852	manufacture of photographic and optical goods	0.42
3823	manufacture of metal and woodworking machinery	0.35	3529	manufacture of chemical products not classified elsewhere	0.43
3111	slaughtering, preparing and preserving meat	0.35	3691	manufacture of structural clay products	0.44
3112	manufacture of dairy products	0.35	3134	soft drinks and carbonated waters industries	0.44
3214	manufacture of carpets and rugs	0.35	3119	manufacture of coca , chocolate and sugar confectionery	0.44
3551	tyre and tube industries	0.35	3530	petroleum refineries	0.44
3710	iron and steel basic industries	0.35	3822	manufacture of agricultural machinery and equipment	0.45
3221	manufacture of leather and fur wearing apparel	0.35	3117	manufacture of bakery products	0.45
3610	manufacture of pottery, china and earthenware	0.35	3853	manufacture of watches and clocks	0.45
3122	manufacture of prepared animal feeds	0.36	3140	tobacco manufactures	0.45
3219	manufacture of textiles not elsewhere classified	0.36	3841	shipbuilding and repairing	0.46
3543	manufacture of miscellaneous products of petroleum and coal3	0.37	3112	manufacture of dairy products	0.46
3131	distilling, rectifying and blending spirits	0.37	3115	manufacture of vegetable and animal oils and fats	0.46
3541	manufacture of miscellaneous products of petroleum and coal1	0.37	3111	slaughtering, preparing and preserving meat	0.46
3542	manufacture of miscellaneous products of petroleum and coal2	0.37	3901	manufacture of jewellery and related articles	0.47
3132	wine industries	0.38	3121	manufacture of food products not elsewhere classified	0.49
3821	manufacture of engines and turbines	0.38	3116	grain mill products	0.49
3121	manufacture of food products not elsewhere classified	0.40	3902	manufacture of musical instruments	0.49
3530	petroleum refineries	0.43	3211	spinning, weaving and finishing textiles	0.68
3211	spinning, weaving and finishing textiles	0.51	3118	sugar factories and refineries	0.70

Table A4.4: High point clusters

Region	1980	2000
Mediterranean	Textile Basic metal industries	Textile Chemicals Non-metallic mineral products Basic metal industries
Eastern Anatolia	Food, beverages and tobacco Non-metallic mineral products Basic metal industries	Food, beverages and tobacco Basic metal industries
Aegean	Food, beverages and tobacco Textile Paper and paper products Non-metallic mineral products	Food, beverages and tobacco Textile Chemicals Non-metallic mineral products
Southeast Anatolia	Food, beverages and tobacco Textile Chemicals	Textile
Central Anatolia	Basic metal industries Fabricated metal products, machinery and equipment	Food, beverages and tobacco Wood and wood products, including furniture Non-metallic mineral products Fabricated metal products, machinery and equipment
Black Sea	Food, beverages and tobacco Basic metal industries	Food, beverages and tobacco Wood and wood products, including furniture Basic metal industries
Marmara	Textile Paper and paper products Chemicals Fabricated metal product, machinery and equipment Other	Textile Chemicals Fabricated metal product, machinery and equipment Other

Table A4.5: Change in clusters over time

Region	Specialized and increasing concentration	Specialized and decreasing concentration	Not specialized and increasing concentration	Not specialized and decreasing concentration
Mediterranean	Basic metal industries	Textile	Food, beverages and tobacco Chemicals Paper and paper products Non-metallic mineral products	-
Eastern Anatolia	Food, beverages and tobacco Basic metal industries	Non-metallic mineral products	Textile	Chemicals
Aegean	Non-metallic mineral products	Food, beverages and tobacco Paper and paper products	Chemicals	Wood and wood products Other
Southeast Anatolia	Textile	Food, beverages and tobacco Chemicals	Non-metallic mineral products	Basic metal industries Fabricated metal products, machinery and equipment
Central Anatolia	Food, beverages and tobacco Non-metallic mineral products Fabricated metal products, machinery and equipment	Basic metal industries	Wood and wood products, including furniture Paper and paper products Chemicals	Textile
Black Sea	Food, beverages and tobacco Wood and wood products, including furniture Basic metal industries	-	Non-metallic mineral products	-
Marmara	Textile	Paper and paper products Chemicals Fabricated metal products, machinery and equipment	-	Wood and wood products, including furniture

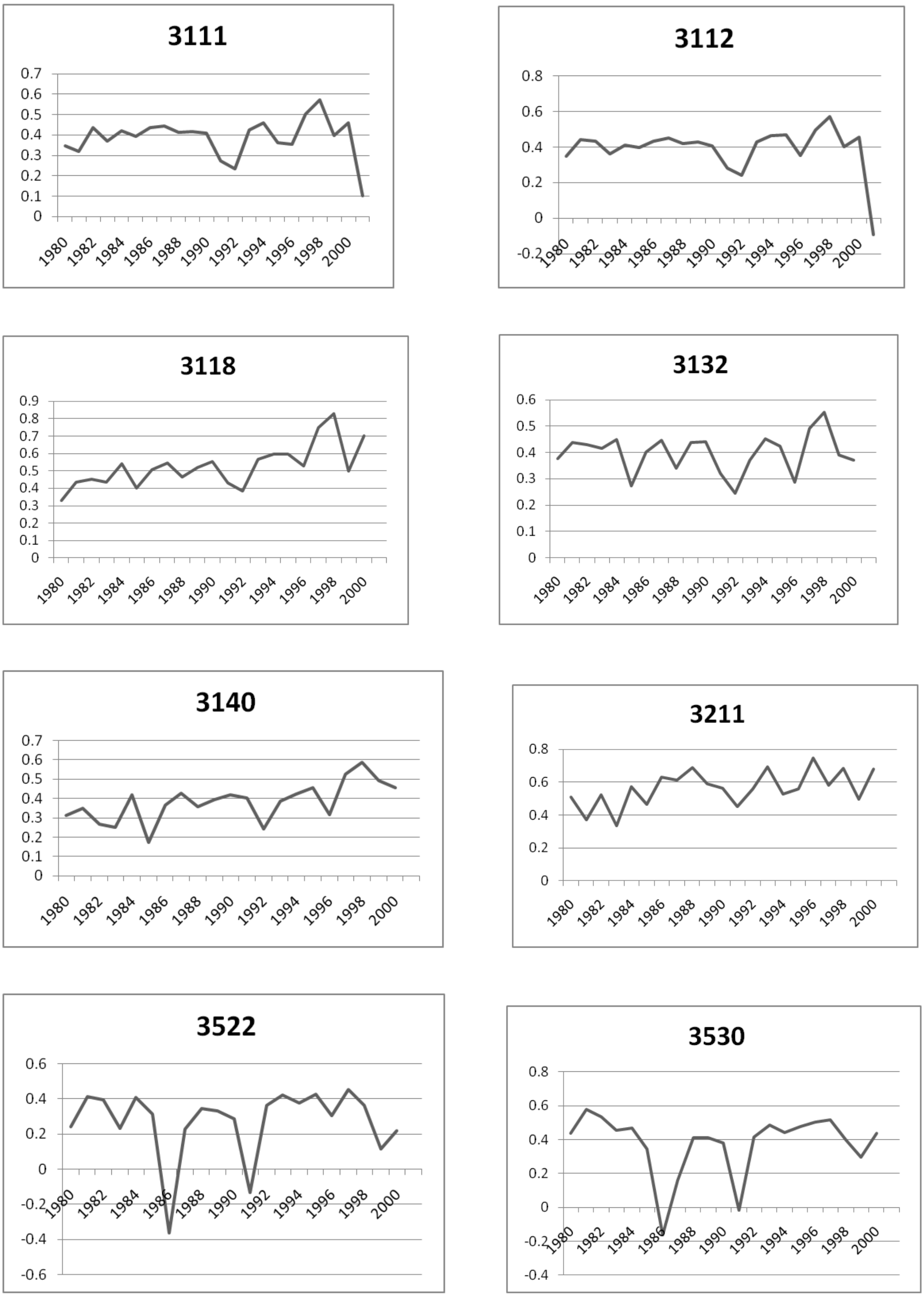
Table A4.6: Decomposition results

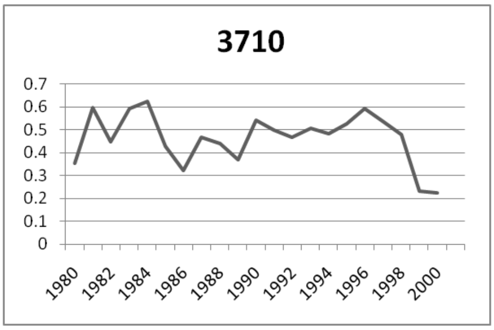
Technology classification	Change in the EG index				
	Big and negative	negative	No change	positive	Big and positive
1 (high tech)	M	G, M	G, M	G	M
2 (medium-high tech)	M	G, M	G, M	G, M	M
3 (medium-low tech)	M	G, M	G, M	G, M	M
4 (low tech)	M	G, M	G, M	G	M

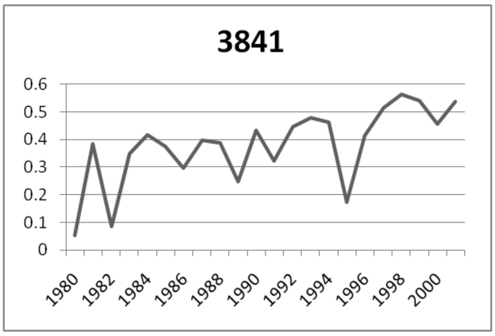
Table A4.7: Correlations between the indexes

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

Figure A4.1: Trend of the EG index for selected industries







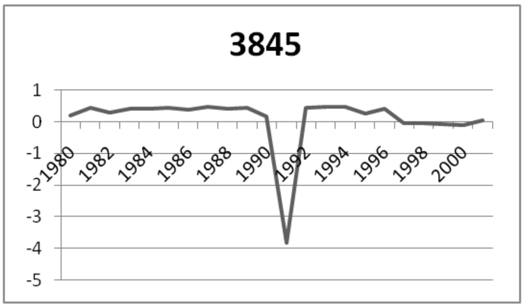
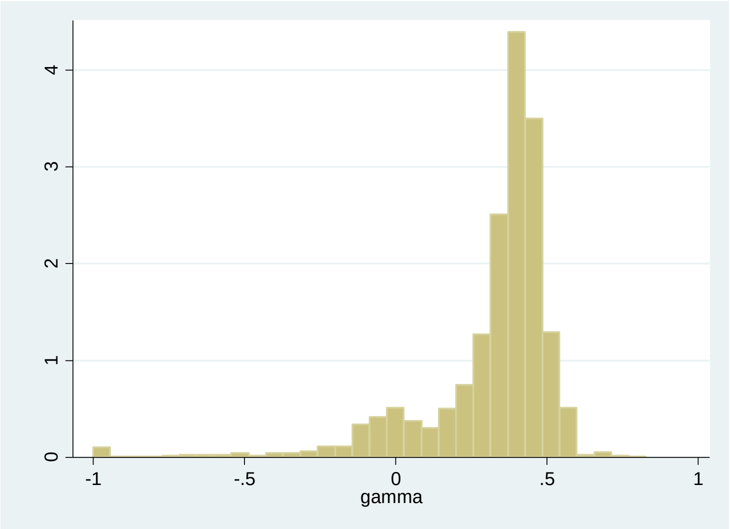
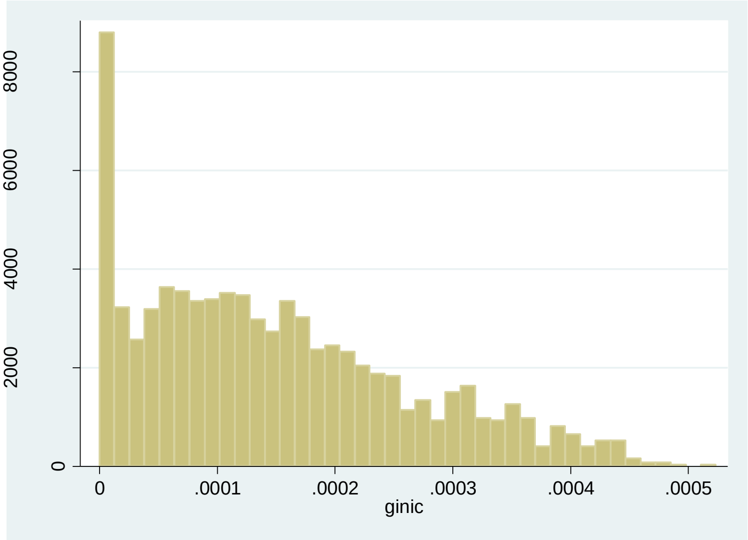
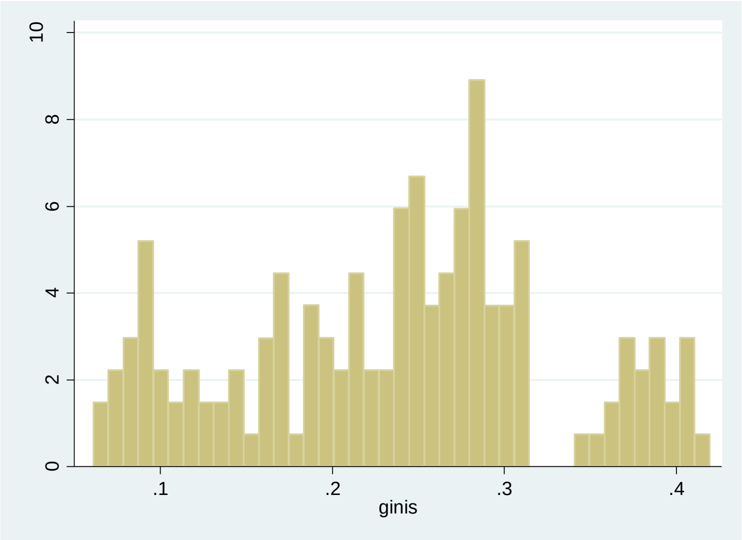


Figure A4.2: Distributions of the indexes

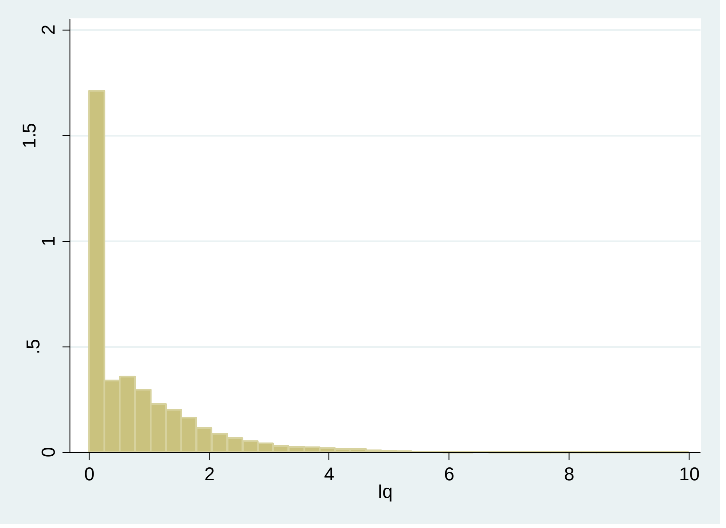




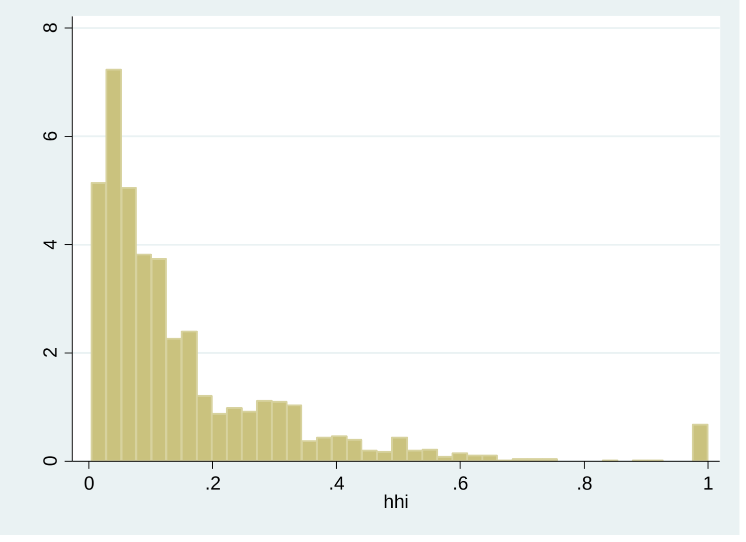
0
2000
4000
6000
8000
0
.0001
.0002
.0003
.0004
.0005
ginic



0
2
4
6
8
10
.1
.2
.3
.4
ginis



0
.5
1
1.5
2
0
2
4
6
8
10
lq



0
2
4
6
8
0
.2
.4
.6
.8
1
hhi

Figure A4.3a: Mean of the E-G index for low-tech industries

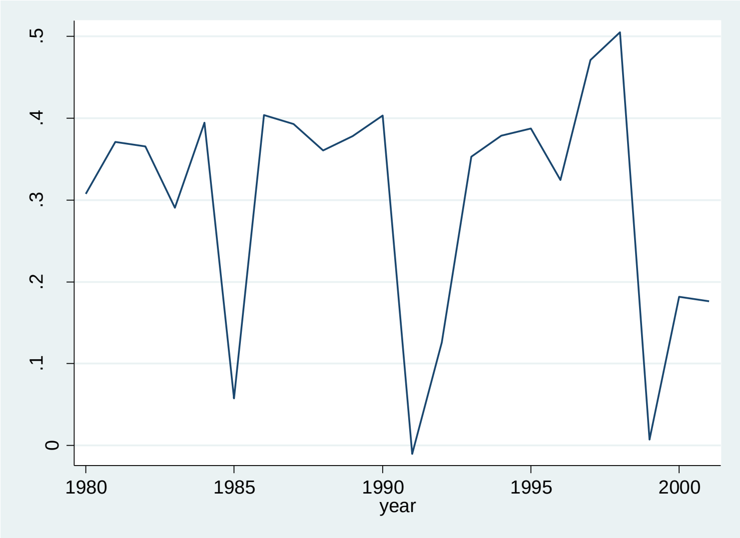


Figure A4.3b: Mean of the E-G index for the medium-low tech industries

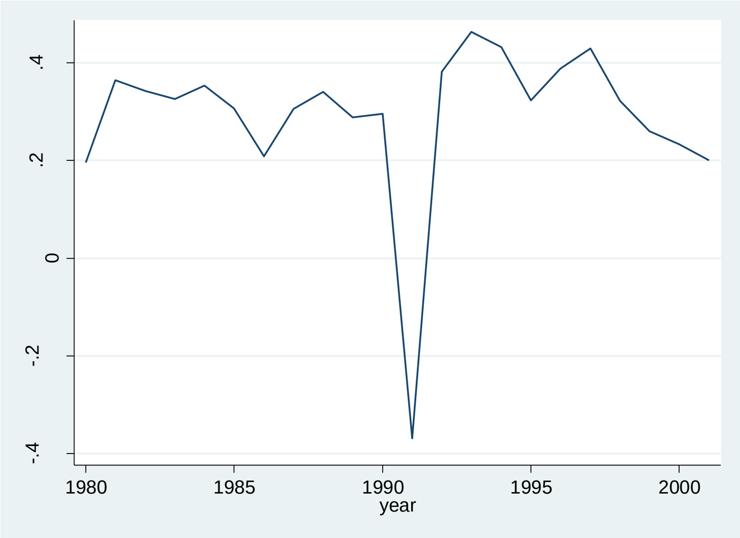


Figure A4.3c: Mean of the E-G index for the medium-high tech industries

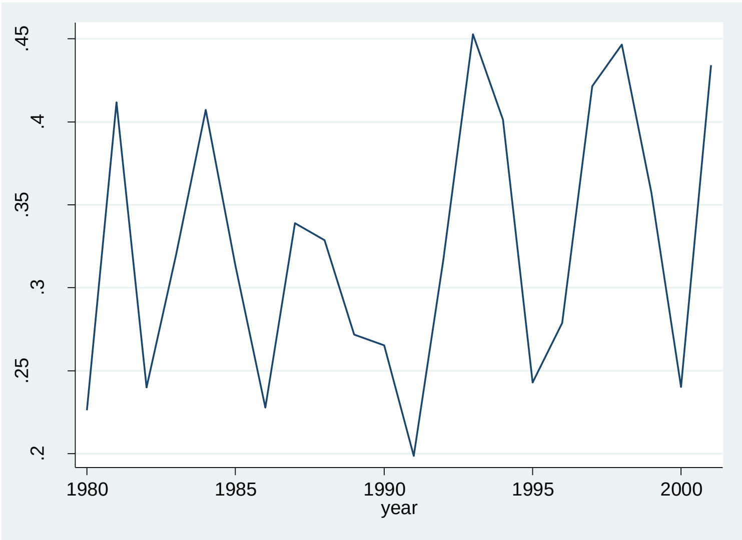


Figure A4.3d: Mean of the E-G index for the high-tech industries

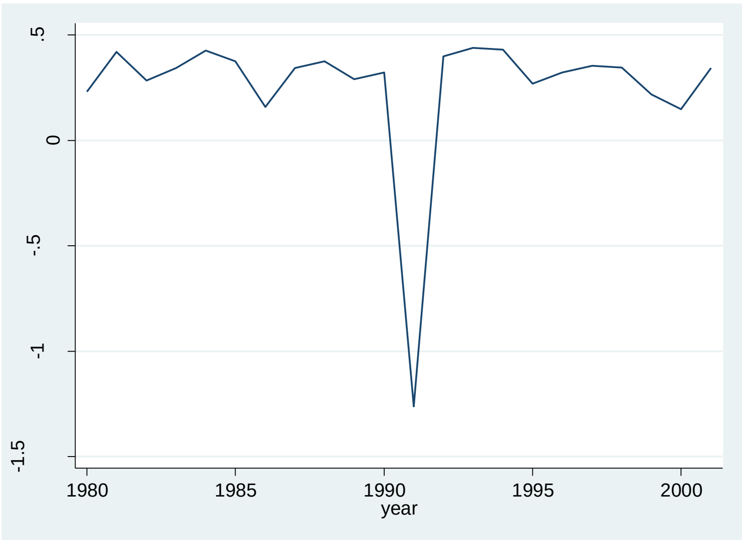


Table A5.1 Descriptive statistics:

	Mean	Median	Standard Deviation
Gamma	0.3061	0.3880	0.3755
TECDIF	1.2545	0.9046	10.4762
H-O	0.3035	0.0890	2.1460
SCALE	127.7249	55.2252	272.6179
EG	0.6167	0.6303	0.1405

Table A5.2: Marginal effects of the TECDIF variable on H-O, SCALE and INTERM

	TECDIF 25th centile	TECDIF 50th centile	TECDIF 75th centile
H-O, SCALE, INTERM 25th centile	-2.811	-2.961	-3.1532
H-O, SCALE, INTERM 50th centile	0.7979	0.6486	0.4565
H-O, SCALE, INTERM 75th centile	4.0470	3.8977	3.7055

Table A5.3: Marginal effect of TECDIF

	TECDIF 25th centile	TECDIF 50th centile	TECDIF 75th centile
H-O 25th centile	0.6884	0.5390	0.3469
H-O 50th centile	0.6457	0.4963	0.3042
H-O 75th centile	0.5581	0.4088	0.2167
SCALE 25th centile	-0.0729	-0.2222	-0.4143
SCALE 50th centile	0.0544	-0.0948	-0.2869
SCALE 75th centile	0.3313	0.1820	-0.1011
INTERM 25th centile	-2.4933	-2.6427	-2.8348
INTERM 50th centile	1.0317	0.8824	0.6902
INTERM 75th centile	4.0914	3.9421	3.7500

Table A5.4: Marginal effects of H-O and SCALE

	SCALE 25th centile	SCALE 50th centile	SCALE 75th centile
H-O 25th centile	0.1133	0.1225	0.1423
H-O 50th centile	0.1107	0.1198	0.1396
H-O 75th centile	0.1053	0.1144	0.1342

Table A5.5: Marginal effects of the TECDIF variable on H-O, SCALE and INTERM

	TECDIF 25th centile	TECDIF 50th centile	TECDIF 75th centile
H-O, SCALE, INTERM 25th centile	-1.9514	-2.0641	-2.2091
H-O, SCALE, INTERM 50th centile	0.6301	0.5174	0.3724
H-O, SCALE, INTERM 75th centile	2.9458	2.8331	2.6881

Table A5.6: Marginal effect of TECDIF

	TECDIF 25th centile	TECDIF 50th centile	TECDIF 75th centile
H-O 25th centile	0.4940	0.3812	0.2362
H-O 50th centile	0.4729	0.3602	0.2152
H-O 75th centile	0.4298	0.3171	0.1721
SCALE 25th centile	0.6092	-0.0517	-0.1967
SCALE 50th centile	0.1373	0.0246	-0.1203
SCALE 75th centile	0.3035	0.1908	0.0458
INTERM 25th centile	-1.7365	-1.8492	-1.9942
INTERM 50th centile	0.7896	0.6769	0.5319
INTERM 75th centile	2.9823	2.8696	2.7246

Table A5.7: Marginal effects of H-O and SCALE

	SCALE 25th centile	SCALE 50th centile	SCALE 75th centile
H-O 25th centile	-0.0741	-0.0216	0.9232
H-O 50th centile	-0.0762	-0.0238	0.9015
H-O 75th centile	-0.0807	-0.0282	0.0856

Figure A6.1: Distribution of net Entry

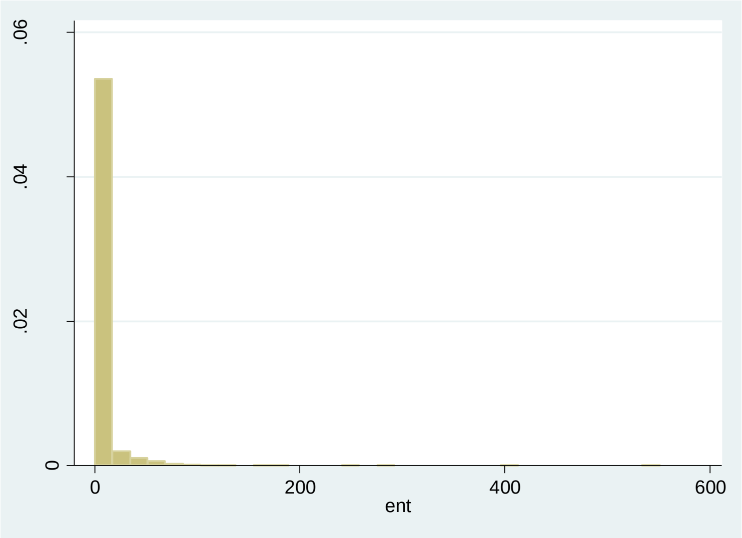


Figure A6.2: Distribution of gross Entry

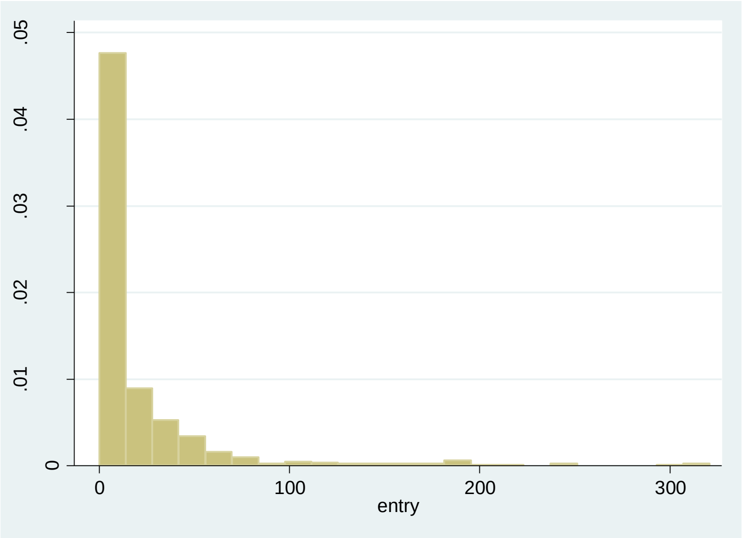


Figure A6.3: Distribution of net Exit

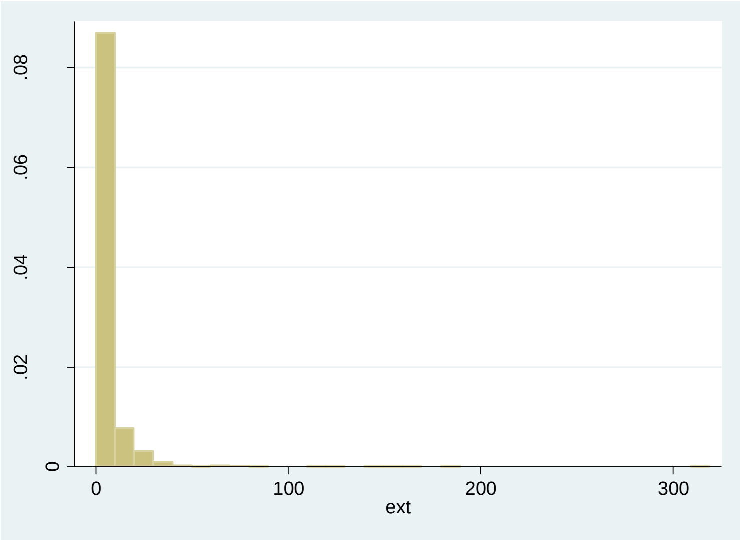


Figure A6.4: Distribution of gross Exit

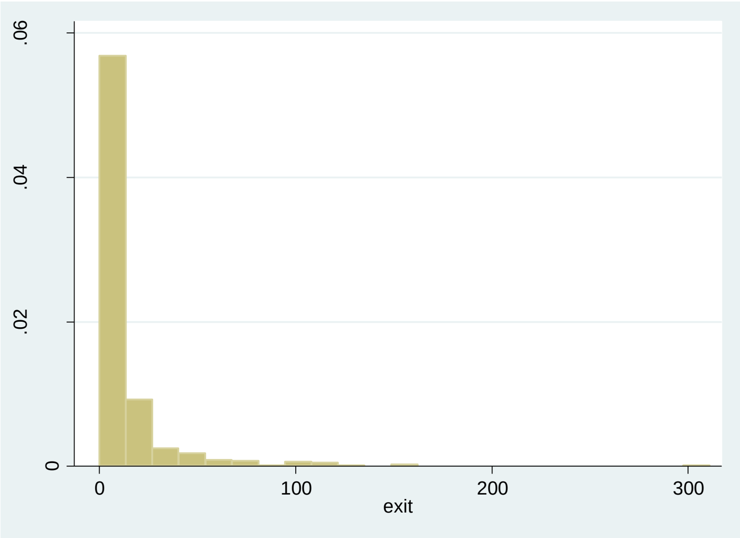


Table A6.1: Poisson estimation results with net entry and exit data

	Entry	Exit
PROFIT	0.0019 (0.024)	0.0554** (0.025)
IGR	3.5959*** (0.572)	-1.3443*** (0.414)
AGGLOMERATION	-0.9639* (0.502)	-0.0086 (0.316)
PRODUCTIVITY	-	-0.0002** (0.000)
SUNK COSTS	-	-0.0083* (0.004)
Prob.(>chi^2)	0.000	0.000
Number of obs.	1610	1610
Number of groups	86	86

*** 0.01<p, ** 0.05<p, * 0.1<p
Numbers in parentheses are standard errors

Table A6.2: Poisson estimation results with gross entry and exit data

	Entry	Exit
PROFIT	0.7397 (0.636)	-0.4877 (0.516)
IGR	-0.0610** (0.030)	-0.006 (0.088)
AGGLOMERATION	-0.1535** (0.049)	0.313** (0.142)
PRODUCTIVITY	-	0.0009 (0.000)
SUNK COSTS	-	-0.3301*** (0.089)
Prob.(>chi^2)	0.008	0.000
Number of obs.	446	446
Number of groups	73	73

*** 0.01<p, ** 0.05<p, * 0.1<p
Numbers in parentheses are standard error

Table A6.3: Descriptive Statistics

	Net entry-exit data		Gross entry-exit data	
	Entry	Exit	Entry	Exit
Mean	5.725	4.363	20.345	12.001
Std. Deviation	22.837	13.931	41.250	24.574
Min.	0	0	0	0
Max.	551	319	321	311

Figure A7.1a: 3118 TFP

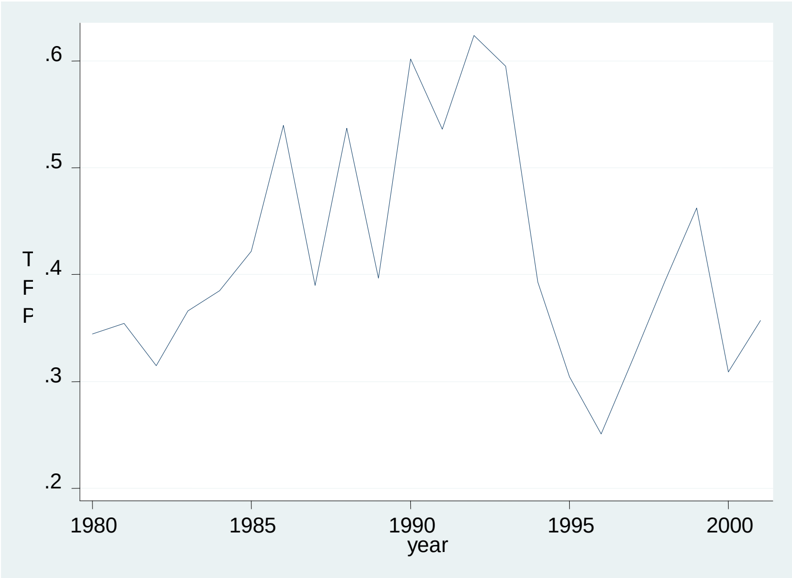


Figure A7.1b: 3140 TFP

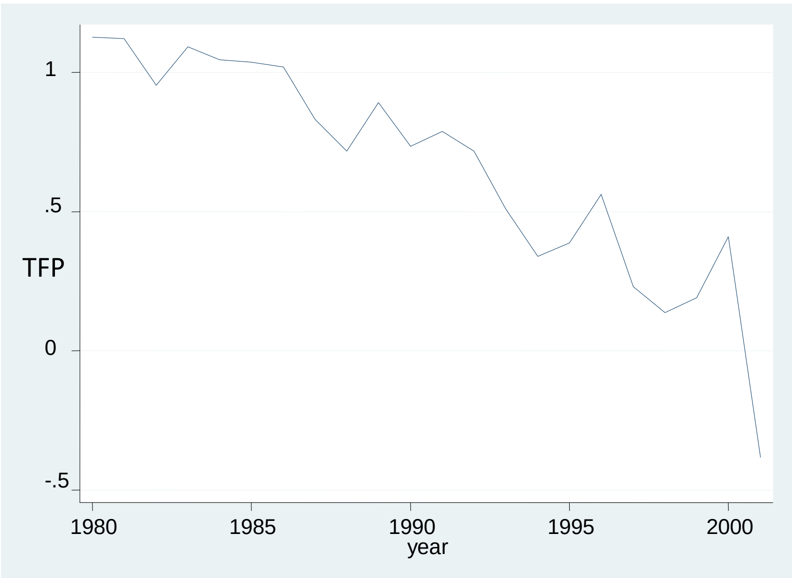


Figure A7.1c: 3211 TFP

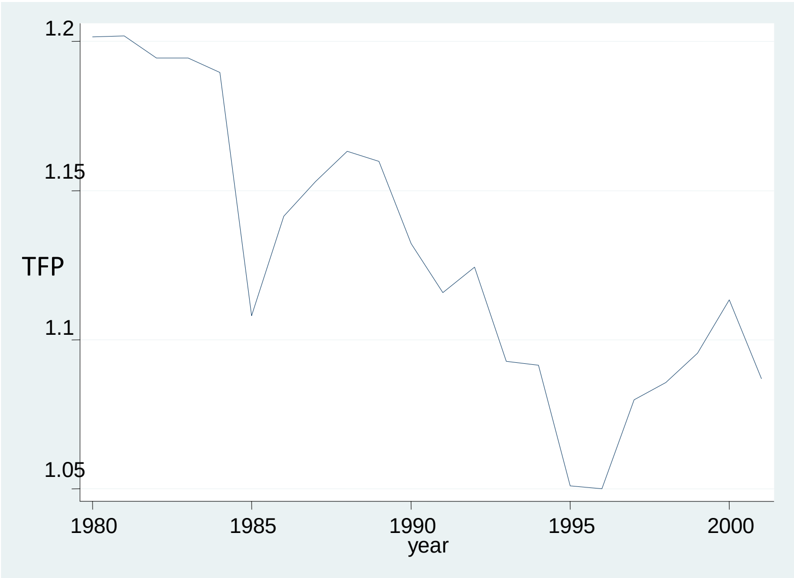


Figure A7.1d: 3212 TFP

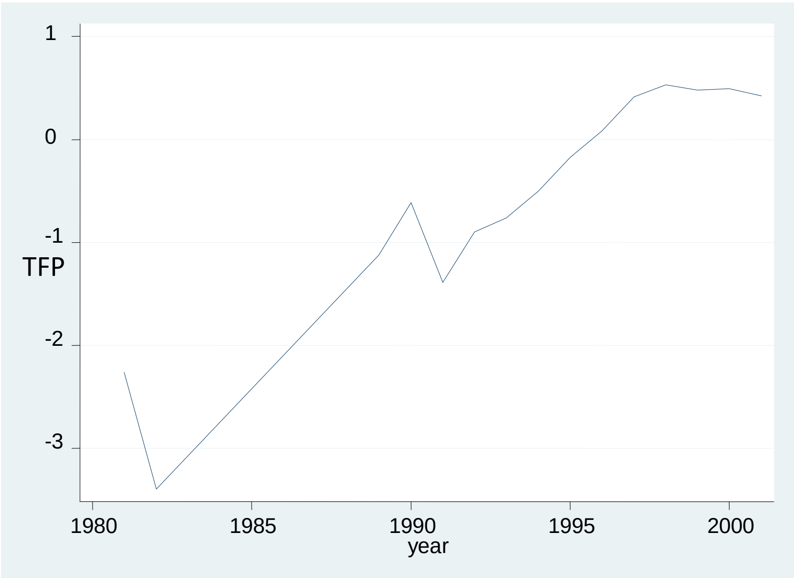


Figure A7.1e: 3522 TFP

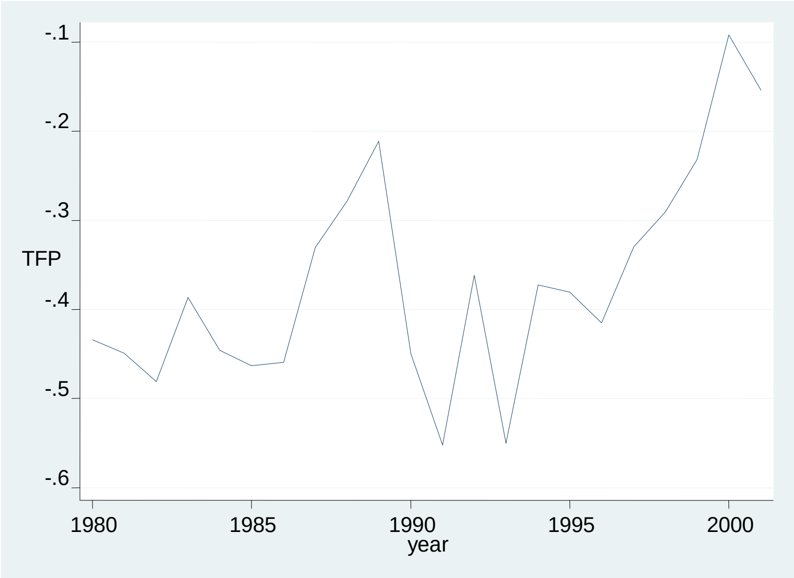


Figure A7.1f: 3710 TFP

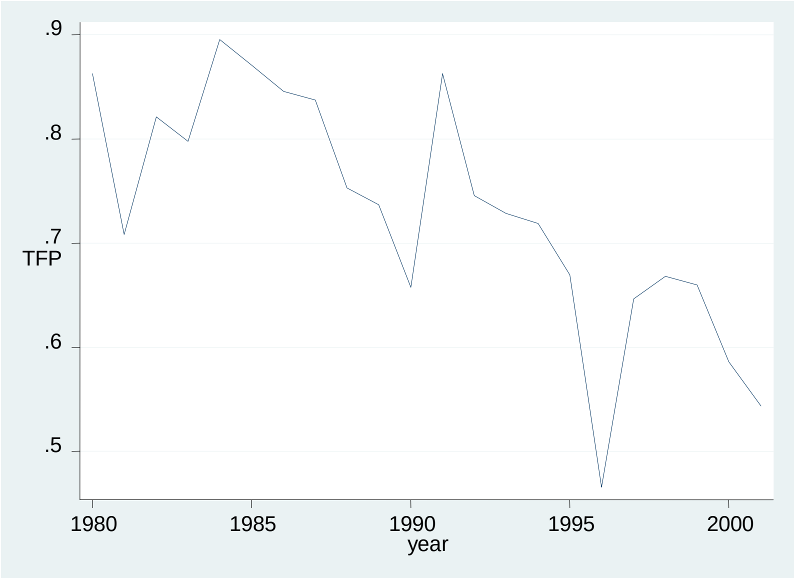


Figure A7.1g: 3811 TFP