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RELATED VARIETY IN SECTORAL GROWTH IN WESTERN ANATOLIA

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Yüksek Lisans Tezi olarak sunduğum "**Related Variety in Sectoral Growth in Western Anatolia**" adlı çalışmanın, tarafımdan, bilimsel ahlak ve geleneklere aykırı düşecek bir yardıma başvurmaksızın yazıldığını ve yararlandığım eserlerin kaynakçada gösterilenlerden oluştuğunu, bunlara atıf yapılarak yararlanılmış olduğunu belirtir ve bunu onurumla doğrularım.

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Yüksek Lisans Tezi

Batı Anadolu'daki Sektörel Büyüme de İlişkili Çeşitlilik

Kurtuluş KIDIK

Dokuz Eylül Üniversitesi
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Bu tezin amacı, Türkiye'nin batı Anadolu bölgesindeki yığılma ekonomilerinin (dışsal ekonomiler) varlığını ve bu bölgedeki illerin büyümesi üzerindeki etkilerini incelemektir. Bu amaçla, illerin istihdam büyümesi, verimlilik büyümesi ve kişi başına düşen milli gelir büyümesi verileri illerin büyüme göstergeleri olarak kullanılmıştır. Analizde, Batı Anadolu bölgesinde yoğunlaşmış olan Türkiye'nin en gelişmiş 35 ili için düzenlenmiş 1992–2001 yıllarını kapsayan dört basamak düzeyinde ISIC Revize.3 imalat sanayi (uluslar arası sanayi sınıflaması) verileri kullanılmıştır ve Arellano ve Bond (1991) tarafından önerilen GMM (Genelleştirilmiş Moment Metodu) dinamik panel veri analizi yöntemleri uygulanmıştır.

Yığılma ekonomilerinin illerin büyümesi üzerindeki etkilerini incelemenin yanında bu tezin literatüründeki diğer çalışmalardan farkı ise, endüstriyel çeşitliliği (Jacobs dışsallıkları) ilişkili çeşitlilik (related variety) ve ilişkili olmayan çeşitlilik (unrelated variety) olarak ayrılmasıdır.

Regresyon sonuçlarına göre, MAR, Porter ve Jacobs dışsallıklarının istihdam büyümesine pozitif etkisi olmasına rağmen, MAR ve Porter dışsallıklarının etkisinin zamanla azalmakta, Jocabs dışsallıklarının (ilişkili

çeşitliliğin) ise etkisi giderek artmaktadır. Verimlilik büyümesinde ise, MAR dışsallıkları ve kentleşme ekonomilerinin olumlu etkisinin yanında ücret ve yatırımlardaki büyümenin pozitif etkisi bulunmuştur. Kişi başına düşen milli gelir de ise sadece kentleşme ekonomilerinin uzun dönemde pozitif etkisi bulunmuştur. Ayrıca, şehirlerin tarihsel ve dinamik yapıları yığılmaların ve dışsallıkların oluşmasına ve şehirlerin gelişmesin de etkili rol oynamaktadır. Sonuç olarak, illerin sanayi politikaları belirlenirken illerin tarihsel yapıları ve hangi hedefe yöneleceği göz önüne alınmalı, bunun yanında dışsallıkların da etkileri unutulmamalıdır.

Anahtar Kelimeler: **Yığılma ekonomileri, dinamik dışsallıklar, ilişkili çeşitlilik, entropi, dinamik panel veri analizleri.**

ABSTRACT

Master Thesis

Related Variety in Sectoral Growth in Western Anatolia

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The purpose of this thesis is to examine the existence of agglomeration economies (external economies) in Western Anatolian region of Turkey and the impact of agglomeration economies on regional growth in this area. For this purpose, employment growth, productivity growth and GDP per capita growth of cities are used as indicators of economic growth. In the analysis, the data which is designed for Turkey's 35 most developed cities that are concentrated in Western Anatolia in the four-digit level of ISIC Revize.3 manufacturing industry (international industrial classification) is covering the years 1992-2001; also, GMM (Generalized Method of Moments) dynamic panel analysis methods are applied that is proposed by Arellano and Bond(1991).

In addition to examining the impact of the agglomeration economies on cities growth, the difference of this dissertation from other studies in the literature is that it distinguished industrial diversity/ variety (Jacobs externalities) as related variety and unrelated variety.

According to regression results, although MAR, Porter and Jacobs externalities have positive effect on employment growth, the effect of MAR and Porter externalities have been decreasing while the effect of Jacobs externalities (related variety) have been increasing over time. Regarding the productivity growth, the positive effect of MAR externalities and urbanization economies are founded; moreover, wage growth investment growth has positive effect on productivity growth. The only long-term positive impact of urbanization economies is found for gross domestic product per capita growth. In addition, historical and dynamic conditions of the cities should play an effective role in

agglomerations and externalities as well as growth of cities. As a result, historical structure and aim of the policy should be taken into consideration while determining the regional policy of cities as well as the effects of externalities should not be forgotten.

Key Words: Agglomeration economies, dynamic externalities, related variety, entropy, dynamic panel data analyses.

ÖNSÖZ

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RELATED VARIETY IN SECTORAL GROWTH IN WESTERN ANATOLIA

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LIST OF ABBREVIATIONS

Comp	Competition
Egr	Employment Growth
GDPpcgr	Gross Domestic Product per capita Growth
GMM	Generalized Method of Moments
ISIC Rev.2	International Standard Industrial Classification of All Economic Activities Revision 2
ISIC Rev.3	International Standard Industrial Classification of All Economic Activities Revision 3
invgr	Investment Growth
LQ	Location Quotient
MAR	Marshall – Arrow – Romer
NUTS-3	Nomenclature of Territorial Units for Statistics or Nomenclature of Units for Territorial Statistics - level 3
Popden	Population Density
Prodgr	Productivity Growth
Rvar	Related Variety
TURKSTAT	Turkish Statistical Institute
Uvar	Unrelated Variety
Wgr	Average Wage Growth

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CHAPTER 1

INTRODUCTION

It has been argued that the rapid development of technology and knowledge causes the rapid economic development in the last decades, and technological innovation is the key factor of the long-term economic growth (Romer, 1986; 1990). Therefore, knowledge, technological change, and spillovers are considered to be engine of economic growth in the literature on economic growth in recent years (Lucas, 1988). Some economists have been trying to internalize the information and technological change in the economic models, and they produce new theories which are called endogenous growth models. According to endogenous growth models (Romer, 1986; 1990; Lucas, 1988), technological change and innovation depend on the exchange of knowledge and ideas between individuals and spreading the knowledge that is commonly known as spillovers. Endogenous economic growth models (Romer, 1986; 1990; Lucas, 1988) claimed that innovations and economic growth depend on knowledge spillovers between individuals and firms. Many economists (Romer, 1986; Krugman, 1991, Lucas, 1988) especially emphasize knowledge creation and knowledge spillovers that create increasing returns to scale while previous theories assumed to decreasing returns to scale. Knowledge spillovers, which are the main source of externalities, stimulate innovation and agglomeration; therefore, it stimulates economic growth. Externalities such as education, knowledge accumulation, knowledge spillovers, learning by doing, or research and development (R&D) are referred as additional inputs of economic growth (Frenken et.al., 2004).

1.1. BACKGROUND AND EXISTING EMPRICAL EVIDENCE ON AGGLOMERATION IN TURKEY

In the economic growth literature, agglomerations or dynamic externalities are thought with the source and the engine of growth. It is believed that they are explained by knowledge spillover theories; also, they speed up the innovation and

growth process. The dynamic externalities are distinguished in three main theories. These are MAR[1] (Marshall-Arrow-Romer) externalities (Marshall, 1890; Arrow, 1962; Romer, 1980), Jacobs externalities (Jacobs, 1969), and Porter externalities (Porter, 1990). Although both MAR, Jacobs and Porter externalities agreed that knowledge spillovers stimulate innovation and growth; they have different perspectives on market structures and agglomerations. (Gleaser et al., 1992)

The first theory, MAR (Marshall-Arrow-Romer) externalities or externalities of specialization arise from intra industry knowledge spillovers (Bun and Makhloufi, 2007). The theory argued that this type of spillovers is the source of the economic growth. The idea of specialization goes back to Marshall (1890) who first mentioned that firms benefit by determining the location close to other companies because firms gain advantage of knowledge, specialization, skilled labor, exchange of input and output from this closeness, and the theory was formalized by the contribution of Arrow (1962) and Romer (1986). Interactions of the firms within the same industry cause more knowledge spillovers and innovations. For these reasons production and transaction cost are reduced, and geographically specialized industries expand. This leads to economic growth. In addition, MAR-externalities are favor of monopoly because competition reduces the benefits from innovations while other firms adopt imitation strategy. Monopolistic market restricts the imitations and enhances to make new innovations for firms; thus, monopoly is better than competition in the perspective of MAR-externalities. (Glaeser et al., 1992).

In contrast to MAR-externalities, Jacobs externalities (Jacobs, 1969) agrees that the source of spillovers is diversity/variety, and interactions between firms within different industries stimulate innovations and economic growth. According to theory, this kind of spillovers leads to more creative and radical products. It argues that regions where has diversified economic structure may grow faster than specialized regions. In addition, it is believed that competitive market structure is beneficial for transaction of information rather than local monopolies. Following Frenken et al. (2007), this thesis argue that it is beneficial to separate diversity/

[1] "MAR" as the abbreviation of Marshall-Arrow-Romer externalities will be used in the rest of the thesis.

variety to related variety and unrelated variety because according to Frenken (2007) knowledge spill over effectively between firms that are in complementary in terms of shared competences or related sectors, so the existence of Jacobs externalities are expected to be higher in the related variety. On the other hand, the existences of knowledge spillovers are not expected in the unrelated sectors. (Boschma, 2007) Therefore, we assumed that related variety is the best measure of Jacobs externalities.

The last theory, Porter externalities, is suggested by Porter (1990) em phasizes the effect of local competition on innovation and growth in the specialized industries. Porter externalities have the same thought with the MAR-externalities imply that geographically specialized economies lead to more knowledge spillovers, but it supports competition, unlikely with MAR-externalities. Porter externalities have the same thought with Jacobs externalities that competition is better than monopoly because competition induces firms to innovate. This theory argues that specialization and competition has positive effect on economic.

In the existing literature, there has been debate on the effect of agglomeration (external) economies on economic growth. Not only studies for different countries but also studies for the same countries have mixed results. For example; the seminal paper of Gleaser et.al.(1992) finds positive relations between diversity (Jacobs externalities) and economic development for the U.S. cities for the period 1956-1987 while Henderson (1995, 1997) finds only MAR externalities and specialization effect on growth. The previous studies for Turkey have also differentiated and conflicting evidences. Doğan (2001) finds the positive effect of urbanization economies on textile and food industries, while he finds evidence on the effect of localization economies on forest and furniture industries with using manufacturing data in 1985. On the other hand, Filiztekin (2002) argues that urbanization economies have positive effect on only high-tech industries; also, the paper finds negative effect of industrial specialization on employment growth for the period between 1980 and 1995. In addition, Kıymalıoğlu and Ayoğlu (2006; 2007) confirmed different effect of externalities in their studies that have same panel data covers 67 cities for the

period 1985-2000. In their first study, the evidence support localization economies (MAR externalities) have mainly effect on growth of cities in Turkey in the industrial level. However, in their following study, they find mixed results that supports both urbanization and localization economies in the city level.

1.2. OBJECTIVES OF THE RESEARCH

The highlight of the brief background and existing empirical evidence, it is important to determine the effect of agglomeration economies on cities growth while constructing the future regional economic policy of the cities because agglomerations give the information about the economic structure of the city. Thus, policies that support the economic structure of the city would stimulate sustainable economic growth.

The aim of this thesis is to examine existence of the agglomeration economies that are MAR, Porter, related variety (Jacobs externalities) and urbanization economies, and investigate which type of externality or externalities have more effect on the growth of the regional economy in the thirty-five western Anatolian cities for the period 1992-2001. In addition to this, especially, we assumed that related variety as Jacobs externalities enhances employment growth, and MAR externalities lead to productivity growth. The data is constituted by four-digit level of ISIC Revize.3 Turkish manufacturing industry (international industrial classification).

The contribution of the thesis is threefold: first, the thesis uses both employment growth, productivity growth, and GDP per capita growth as an indicator of regional economic growth for the period 1992-2001 with ISIC Rev.3 classification data while recent other studies use employment growth and productivity growth in different periods with ISIC rev.2 classification data for Turkey. Second, the entropy methodology is applied for Turkish manufacturing industry as the first in this thesis. The last contribution of this thesis is that this is the first study has distinguished diversity/variety as related and unrelated variety for Turkish manufacturing data.

It is found that MAR, Porter and Jacobs externalities have positive effect on employment growth and the effect of MAR and Porter externalities have been decreasing while the effect of Jacobs externalities (related variety) have been increasing over time. Regarding the productivity growth, the positive effect of MAR externalities and urbanization economies are founded; moreover, wage growth investment growth has positive effect on productivity growth. The positive effect of urbanization economies is found for gross domestic product per capita growth.

1.3. OUTLINE OF THE STUDY

The rest of the thesis is organized as follows: The next chapter gives a brief review of existing empirical literature on agglomeration and growth. Chapter 3 explains the theoretical background of agglomeration economies and growth and reviews hypotheses. Chapter 4 demonstrates details of data. Chapter 5 sets out the model and the econometric methodology. The results of empirical analysis follow by Chapter 6, and conclusion reports some concluding remarks.

CHAPTER 2

LITERATURE REVIEW

In the literature, there has been increasing attention on agglomeration economies and its impact on economic growth. The In this chapter, we briefly reviewed some important studies[2] because there is a vast amount of literature on agglomeration economies and economic growth. Thus, this chapter summarizes the studies that have the same methodology with this thesis.

2.1. RESEARCH ON AGGLOMERATION ECONOMIES

This thesis is influenced by the seminal paper "Growth in cities" of Glaeser et al. (1992), which investigates dynamic externalities on the city growth by using the 170 U.S. cities data and the employment data in two years (1956 and 1987). They construct specialization, diversity and competition indicators to test MAR, Jacobs and Porter externalities. Using with the production function model in their analyses, they find that not only diversity, the existence of urbanization economies, is an important factor on growth of employment in the cities but also competition has positive effect on employment growth, as Jacobs externalities suggest; however, they does not find any evidence to support MAR externalities, and specialization view of Porter thesis in the city level. Hence, the evidence supports the theories of Jacobs and Porter, but contrast to MAR externalities. In addition to Glaeser et al. (1992), Handerson et al. (1995) examine the U.S. data for the period 1970-1987. They criticized Glaeser for studying the whole industry, and they constitute the data set of 224 regions by dividing into eight industrial sectors. The authors argue that local historical industrial conditions affect some characteristics of the industry. The study concentrates on specialization and diversity; meanwhile it excludes to competition. The findings of this study support MAR externalities in the basic industries, while the paper does not find any evidence to support Jacobs externalities; moreover, they

[2] We choose the studies that are interested in different countries and that are the same methodology with our paper.

find evidence both MAR externalities and Jacobs externalities for the high tech industries. Henderson (1997) again, examines the impact of dynamic externalities on economic performance with using dynamic panel data model with general lag structure between 1977 and 1990. The paper studies MAR and Jacobs externalities emphasizes the effects of nature of the externalities, the timing and permanence on employment growth. The data is classified by five industries for 742 provinces. According to results, there is a strong evidence to support both MAR externalities and Jacobs externalities though their effect has slowly disappeared on traditional industries in four or five years. However, the impact of externalities on high-tech industry has continued for many years. Henderson (2003) again tests dynamic externalities for the U.S. The data consists of 5 machinery and 4 high-tech industry over the period 1972-1992 for 742 cities. He reaches similar conclusion with using with production function approach for machinery and high-tech industries that MAR externalities contemporaneously and with a large scale enhances growth; however, he fails to find any correlation between diversity and growth. Another interesting result is that small enterprises get more external benefit from dynamic externalities than big and corporate firms.

Studies that are done by European countries have also complicated results. First study, De Lucio, Herce and Goicolea (1996), investigates the effect of dynamic externalities on growth in Spain for the period 1978-1992 following by the method of Gleaser at all(1992). Furthermore, the study intends to test the impact of competition on innovation and growth. The study uses data set that consists of the 30 industrial classes for 50 provinces, and uses industrial employment growth as a dependent variable. The results of the study support Glaeser et al. that Jacobs and Porter externalities have positive effect on growth although MAR externalities has negative effect on growth. Second, De Lucio, Herce and Goicolea (2002) again examine dynamic externalities for Spain with the same data used in 1996. Difference from the other study, they use value added growth rather than employment growth as a measure of the economic growth. They obtain similar results with previous study and their findings are in line with results of Glaeser et al. (1992). According to results, Jacobs and Porter externalities have positive impact on value added growth as well as

economic growth; however, they find confusing results on MAR externalities. For France, Combes (2000) examines the effect of the local economic structure on employment growth. He tests both industry and service sectors in 341 French provinces for the period 1984-1993. The results of this study proved that local industrial structure has an influence on economic growth and differs in industry and service. According to study, competition has negative effect both in industrial sector and in service sector with some exception of some sectors. Similarly, Specialization has negative impact both in service sector and in industrial sector exception of a few sectors. Diversity has positive effect in service sector, whereas it has negative effect on growth exception of a few sectors. In other words, but also includes some exceptions, MAR and Porter externalities has a negative impact on many sector.

For Asian countries, first, Gao(2004) examines not only dynamic externalities but also natural advantages, investments, trade, and market conditions for China. The paper studied on 32 industries for 29 cities between 1985 and 1993, and it uses industrial output growth as dependent variable. According to results, regional competition has positive impact on industrial growth. Moreover, the study finds small industries have faster growth performance than others, and also a better transportation system speed up growth. As a result, the evidences support that spillovers has positive impact on long-term economic growth. Second, Batisse (2001) analyses the relationship between dynamic externalities and value added growth as an indicator of growth over the period 1988-1994 for China. The study is investigates 30 industries in 29 cities by using panel data models. He finds diversity and competition has positive impact on regional growth; in contrast, specialization has negative effect on regional growth. In other words, the results supports Jacobs and Porter externalities- in terms of competition although the paper against MAR externalities in China. Third, Kameyama (2004) investigates the effect of dynamic externalities on employment growth in manufacturing industry for the period 1972-1981 for Japan. The study uses the data of 17 industries in 80 cities. While he does not emphasize on competition, he especially tests performance of MAR externalities and Jacobs externalities. He finds that there is a positive effect on employment growth both MAR and Jacobs externalities. Besides, MAR externalities have

stronger impact than Jacobs externalities in manufacturing industries. Accordingly, this study supports MAR externalities are more effective that Jacobs externalities.

For developing country empirical study, Bun and Makhloufi (2007) study the effect of dynamic externalities on regional economic growth for Morocco over the periods 1885-1995. The study investigates specialization, diversity and competition for 18 industries in 6 provinces. Unlike other studies, the dependent variable in this study is determined by employment as well as value added as indicator of growth. The study finds that MAR externalities has positive effect in traditional and low-technology industries such as textile and clothing industry; however, Jocabs externalities has positive impact in large urban areas. All in all, results of the study supports that MAR and Jacobs externalities have positive effect on long-term growth but regional competition has negative effect on growth.

Attaran (1986) investigates the relationship between economic diversity and economic performance for the 50 U.S. states for the period 1972 to 1981. The importance of this paper is that it uses the entropy measurement as an indicator of diversity. According to study, economic diversity negatively but very weakly correlated to unemployment and there is a negative correlation between diversity and per capita income. Indeed, he does not find a clear evidence to support relation between economic diversity and growth.

In addintion to Gleaser at al. (1992), this thesis is strongly influenced by Frenken et al. (2007), which analyze the effect of agglomeration economies on regional economic growth in Netherlands over the period 1996-2002. In addition to employment growth, productivity growth and unemployment growth were applied as dependent variables. The importance of the paper is twofold; first, they divide the diversity/variety, as called Jacobs externalities, into two; related variety and unrelated variety. They believe that related variety (within sectors) is the best indicator of Jacobs externalities, and unrelated variety (between sectors) better represents the portfolio argument. Second, differently, they implement the entropy methodology to compute variety; therefore this study differs from other studies. The

results of the paper are; first, although related variety is positively related to employment growth, there is not any evidence to urban density has positive impact. In other words, Jacobs externalities enhance the employment growth but the effect of urbanization is ambiguous. Second, unrelated variety is negatively related to unemployment growth. Third, the effect of localization economies as well as MAR externalities on productivity could not be supported; also, investment and R&D expenditures are the main determinants of productivity growth.

2.2. RESEARCH ON AGGLOMERATION ECONOMIES FOR TURKEY

Regarding for Turkey, first study is from Dogan (2001) who examines the relation between external economies and productivity with using manufacturing industry data (ISIC Rev2) only the year 1985. His study aims to test the source of the productivity growth with the perspective of specialization (MAR) and urbanization (Jacobs) externalities. In addition to MAR and Jacobs externalities, employment, population and other related variables are used as an explanatory variables. The results show that although urbanization economies are effective on textile and food industry, localization economies are effective on forest and furniture industry.

Filiztekin (2002) investigates the effect of agglomeration (external) economies on employment growth for Turkey. He uses panel data that classified the manufacturing industry (ISIC Rev2) by traditional, heavy and machinery and high-tech industries for provinces during 1980 and 1995 period. According to results, although specialization has negative effect on employment growth in the short run, it is positive effect in the long-run. Competition effects variously and depends on the industry. In sum, the paper does not support specialization in the short-run for manufacturing sector although urbanization economies (Jacobs externalities) has positive impact on only high-tech industries.

Kiymalioglu and Ayoglu (2006) investigate dynamic agglomeration economies in the lower sectors (2-digit, ISIC Rev2) of the Turkish manufacturing industry for the period between 1985 and 2000. The data consists of nine lower

sector of manufacturing industry of 67 provinces. The study applies dynamic panel data models by using employment growth as a dependent variable. The paper could not find any evidence to support Jaocbs externalities on the lower sector in Turkish manufacturing industry. In addition, the paper finds labor intensive sectors that are textile, leather, and metal industry, are more specialized and localized than other sectors; furthermore, it finds confusing result about competition. In short, they suggest that localization economies (MAR externalities) explain and have heavily effect on the agglomeration in Turkish manufacturing industry. Another study from Kiymalioglu and Ayoglu (2007) identifies the agglomeration economies in Turkish manufacturing industry within the context of static externalities that are localization and urbanization economies. The data is same to previous research of them for the period 1985-2000. The difference of previous study to this one is that the paper aims to find agglomeration economies for each city, not for sectors. They find that localization economies has impact on Burdur, Corum, Diyarbakir, Erzincan, Erzurum, Hatay, Isparta, Icel, Kastamonu, Malatya, Mugla, Sivas, and Yozgat although urbanization economies has impact on Balikesir, Isparta, Icel, Istanbul, Malatya, Bilecik. Thus, static externalities support growth of cities depends on their location characteristics and the dominant feature of the city. Last, the paper suggests that it is important to define cities features while making the policy implications.

Gülcan, Kuştepeli and Akgüngör (2010) tested three hypotheses on their work

i) Jacobs externalities (related variety) are positively related to employment growth
ii) Localization economies are positively related to productivity growth
iii) Unrelated variety is negatively related to regional employment growth.

for 81 cities for the years 1992-2001 ISIC Rev.3 by employing panel data analysis with fixed and random effects to check the robustness. They found out that:

1) There is no relationship between related variety and employment growth.
2) There is no relationship between unrelated variety and employment growth.

3) There might be a relationship between localization and productivity growth. (Gülcan, Kuştepeli and Akgüngör, 2010)

In summary, this chapter reviewed a number of empirical studies on agglomeration (external) economies and economic growth. It is shown that there has been conflict on the effect of different type of externalities on economic growth. In Table 1, brief summary of the literature review is given. In the light of the information given, this thesis investigates the external economies on the Turkish manufacturing data which is classified ISIC Rev.3[3] that differs from the studies for Turkey; also, this thesis uses both employment growth, productivity growth and GDP per capita growth for indicator of economic growth while other studies mainly use employment growth. In addition, the other difference of this thesis is that it follows the notion from Frenken at. al. (2007) that distinguishes diversity/ variety to related variety and unrelated variety with the help of the entropy measure that will be discussed following chapters.

[3] ISIC Rev.3 classification is more detailed than ISIC Rev.2 classification. While ISIC Rev.3 classification has 23 two-digit, 61 three-digit and 127 four-digit industries in manufacturing sector, ISIC Rev.2 classification has 9 two-digit, 30 three-digit and 82 four-digit industries.

Table 1. Literature Review

Author (Year)	Country, region, period	Indicator of Growth-dependent variable	Results
Attaran, M. (1986).	U.S.A.,50 state 1972-1981	Unemployment growth Per capita income	Diversity negatively correlated to unemployment and per capita income
Glaeser et al. (1992)	U.S.A.,170 city 1956 and 1987	Employment growth	Jacobs & Porter
Henderson et al. (1995).	U.S.A.,224 regions 1970-1987	Employment growth	Basic industries -MAR, High tech industries - MAR & Jacobs
De Lucio et al. (1996).	Spain, 50 province 1978-1992	Employment growth	Jacobs & Porter
Henderson et al. (1997).	U.S.A., 742 provinces 1970-1987	Employment growth	MAR & Jacobs
Combes, P.P. (2000).	France, 341 Provinces 1984-1993	Employment growth	Sectoral specialization & diversity negative impact on growth
Batisse, C. (2001).	China, 29 cities 1988-1994	Value added growth	Jacobs & Porter
De Lucio et al. (2002).	Spain 50 province 1978-1992	Productivity growth	Jacobs & Porter
Henderson et al. (2003).	U.S.A. 742 provinces 1972-1992	Employment growth	MAR- High tech industries
Gao, T. (2004).	China 29 cities 1985-1993	Employment growth	Regional competition Weakly specialization & Jacobs

Kameyama, Y (2004)	Japan 80 cities 1972-1981	Employment growth	MAR & strongly Jacobs
Bun, M. J. G. and Makhloufi, A. E. (2007).	Morocco 6 provinces 1885-1995	Employment growth Value added growth	MAR & Jacobs + Competition-
Frenken et al. (2007)	Netherlands 40 regions 1996-2002	Employment growth Unemployment growth Productivity growth	Related variety+ employment Unrelated variety- Unemployment growth
Dogan, E. (2001).	1985, Six regions	Productivity	Urbaniztion+textile &food Localization +forest & furniture industry
Filiztekin, A. (2002).	1980-1995 Traditional Heavy &machinery High-tech	Employment growth	MAR & Porter, Jacobs hightech industry
Kıymalıoglu, Ü. and Ayoglu, D. (2006).	1985-2000 67 cities	Employment growth	MAR externalities
Kıymalıoglu, Ü. And Ayoglu, D. (2007).	1985-2000 67 cities	Employment growth	localization economies in Burdur, Corum, Diyarbakir, Erzincan, Erzurum, Hatay, Isparta, Icel, Kastamonu, Malatya, Mugla, Sivas, and Yozgat, Urbanization economies in Balıkesir, Isparta, İçel, İstanbul, Malatya, Bilecik
Gülcan, Y., Kuştepeli Y. and Akgüngör, S. (2010).	1992-2001 81cities	Employment growth	No relationship between related variety and employment growth. No relationship between unrelated variety and employment growth.

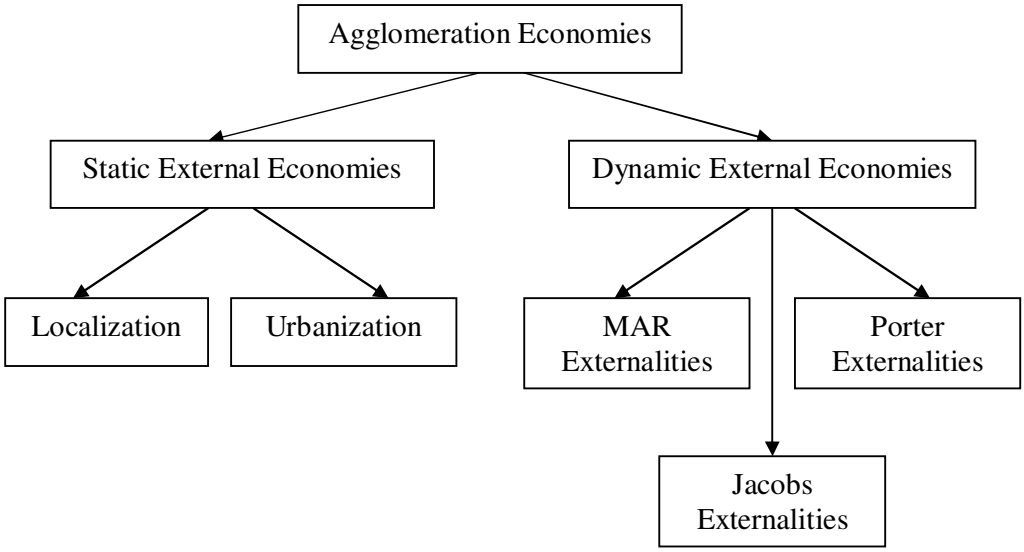
CHAPTER 3

THEORETICAL BACKGROUND

3.1.0. AGGLOMERATION ECONOMIES

Agglomeration economies or external economies can be briefly defined savings or benefits that are unpaid factor of productions obtained from the outside of the firms. As also defined benefits that decrease the cost of production as a result of the choosing the best place with close to other firms. Externalities are important source of agglomerations. An existence of external economies makes a snowball effect on an accumulation of economic activities. (Kıymalıoğlu, 2006)

Figure-1. Summary of Agglomeration economies



Source: Adapted from Frenken et.al. (2004) and Gleaser et.al. (1992)

Agglomeration (external) economies can be classified as static and dynamic externalities in the literature[4]. This classification is shown in Figure-1 briefly. Static externalities can be separated into localization and urbanization economies. Dynamic externalities can be divided into MAR, Jacobs and Porter externalities.

3.1.1. Static External Economies

Static externalities concentrated on impact of the scale or size of the industry on innovation capacity of firms, or the effect of the city size on innovation of firms in a certain point of time. In other words, according to Glaeser et al. (1992), static externalities explain clusters of firms and industry structure, but they are unable to generate economic growth permanently. Static externalities are emerging because of the clustering of the same or different industries in the geographic concentration. Static externalities are divided into two branches that are localization economies and urbanization economies that explain clusters of firms within a particular geography.

3.1.1.1.Localization Economies

Externalities that are due to the agglomeration of firms in the same industry in a specific region are called "Localization economies" (Glaeser et al., 1992). Although localization economies are exogenous for firms, they are endogenous for industry, and localization economies increase when the local industry size increases. While localization economies formed from clustering the same industries in a geographically particular religion, urbanization economies, which are other type of static external economies, are formed clusters of different type of industries. In other words, localization economies refer to specialization of an industry in a particular region. Localization economies share the same specialized services and infrastructure; also, they have common research and development activities across the region such as marketing. Moreover, firms can take advantage of the specialized labour pool. Thus, firms can be located in a particular geographical area or clustered to reduce production costs. (Kıymalıoğlu, 2007)

[4] Agglomeration economies are classified as static and dynamic in the context of "New Economic Geography" literature.

MAR externalities are the dynamic aspect of the localization economies that will be discussed in the following part. (Glaeser et al., 1992)

3.1.1.2.Urbanization Economies

Urbanization economies are external economies formed from clustering many different types of firms (industries) in a city. In other words, diversity is occurred in the cities dominated by urbanization economies. Particularly, the source of this diversity comes from the increased demand of populous or crowded population in the city; also, urbanization economies have the cost savings effects results from the abundance of local economy or economies of scale of urbanization. (Frenken et.al., 2004)

Urbanization economies are different from localization economies in two aspects. First, in contrast to localization economies, urbanization economies do not emerge in only one or a few industries; they emerge across the city. Second, all firms in the city can benefit from urbanization economies; on the contrary, localization economies apply firms that are only in the same industry. Although localization economies are results of externalities which stems from a particular industry, urbanization economies are results of externalities which cause from growing of whole economy in a region or city. (Glaeser et al., 1992) This leads us to set up our first hypothesis:

Hypothesis one: Urbanization economies have a positive effect on regional economic growth.

As with the localization economies, urbanization economies also have dynamic dimension which is called Jacobs externalities and will be discussed following section.

3.1.2. Dynamic External Economies

Dynamic external economies can be defined as permanent effect of agglomeration factors on the direction of reducing costs in the industry. In other words, it means that the effect of external factors in the past on current output and current productivity level decreases the cost of production, and it causes permanent increase on industry output. Dynamic external economies decrease the average and the marginal costs in the industry over and over again with . (Vor, F. and Groot, H., 2008)

The most important source of dynamic externalities is knowledge accumulation and knowledge spillovers. In general, dynamic externalities have technological externalities. Innovations or information that is produced in a firm or in an industry create externalities for other firms or industries by knowledge spillovers, and interactions; such as imitation, co-producing. (Frenken et.al., 2004) For example; if a firm produce a new product or production technology, other firms benefit from this improvement by imitation. People or firms in a region interact with each other easily, so they can reach and exchange knowledge. In this way, knowledge spillovers make external effects on the economy. Furthermore, persistence of these knowledge spillovers can lead sustainable economic growth, and this can only made by spatial proximation that means locating close to each other in a same place. (Frenken et.al., 2004)

There is an ongoing argument on the source and process of the knowledge creation and the knowledge spillovers. There are three main views considered to be important for innovation and growth with the explanation of knowledge spillovers in the dynamic aspect; 1) MAR externalities (Marshall, 1891; Arrow, 1962; Romer, 1986), 2) Jacobs externalities (Jacobs, 1969) and 3) Porter externalities (Porter, 1990). (Glaeser et all.,1992) In sum, although all of these views agree that the knowledge spillovers are an important factor for growth and innovation they have disagreement about the source of spillovers. Table-2 summarizes the dynamic external economies.

3.1.2.1.MAR (Marshall-Arrow-Romer) Externalities

Externalities are expressed as MAR externalities when the spillovers occur between firms within the same industry, and they represent the positive effect of the specialization on innovation and growth. The idea of MAR externalities goes back to Marshall (1890) propounded the knowledge spillovers theory. Later on, this theory is expanded by Arrow (1962) and Romer (1986). According to MAR externalities, increasing the number of firms operating in the same industry cause knowledge spillovers; thus, it leads to an increase in productivity. In other words, specialization of the firms in the same industry at the region creates a positive effect on local economic growth.

Knowledge spreads from firm to other firm in the industry by imitations, spying, and movements of the skilled labor between firms. According to MAR externalities, the density of a certain industry in a city helps and increases the emergence of knowledge spillovers between firms. Geographical proximity of the firms both reduces the production and distribution of costs and encourages the use of knowledge. Knowledge spillovers directly occur by some activities such as exchange of ideas cooperation of production, or indirectly occur by some activities such as movements of skilled workforce between firms. Thus, MAR externalities accompanied by specialization of a particular industry in a particular region. (Frenken et.al., 2004)

In addition, as the market structure is concerned the theory supports that local monopoly is more beneficial than local competition. Because it claims that local monopoly restricts the information gathering from other firms and causes the information as endogenous for firms. If the externalities become endogenous, it supports innovation and growth. (Glaeser et. al., 1992) According to MAR externalities, competition decreases firm's benefits that stem from innovations because firms implement the imitation strategy in order to the catch up strategy, and firms adopt and improve other firms' innovations quickly. Therefore, firms in the

competitive markets can not receive absolute profit from their investments; under this market structure prefer to invest less on research and development. In contrast, monopoly markets generate more innovation and maximize the innovation benefits because of fewer imitators in the market. (Glaeser et. al., 1992)

It is also argued that specialization (MAR externalities) leads to incremental innovation and process innovation, so the impact of the specialization or MAR externalities is expected to be effective on the increase of the output and productivity. (Frenken et.al., 2007) This leads us to construct hypothesis two:

Hypothesis two: MAR externalities are positively effect on productivity growth.

MAR externalities corresponded to localization economies in the view of static externalities where externalities are accompanied by a positive effect of specialization. Both MAR externalities and localization economies are proponent of specialization and monopoly.

3.1.2.2.Porter Externalities

Positive effect of competition on innovation and growth is expressed as Porter externalities. Porter claims that more knowledge spillovers can occur in the industries which have more spatial seller and buyer interaction, similarly with MAR externalities. Porter argues that geographical closeness of the sellers and buyers; also, their interactions are the source of the knowledge spillovers. Furthermore, he claims that this closeness have positive effect on production costs. In others words, this interactions stimulate to the firms for innovations. (Porter, 1990)

Porter externalities assumed that knowledge spillovers can mostly occur within the industry like MAR externalities. Although the similarity between these arguments is both of them believed that specialized and geographically concentrated industries have more spillover capacity, they have different view on the effect of competition. According to MAR externalities, local competition has negative effect

on economic growth; in contrast, Porter externalities rejected the monopoly, and Porter externalities contended that local competition promotes innovation and economic growth. (Gleaser et al., 1992) In addition to the importance of the specialized industries in a region, Porter emphasized the interactions and competition of both sectors and industries; also, the consumer behaviors and preferences in a region.

Porter claimed that the best condition for the knowledge spillovers is the competitive market structure in a specialized and geographically concentrated industries; also, he asserted that local competition accelerates innovation and introduction of new products. According to Porter, the imitation of the ideas and innovations by the competitive firms makes the obligation to produce new ideas and innovations; besides, he pointed out that the firms which have technological innovation capacity have more competitive power; thus, these firms can be permanent in the market. In other words, when the firms can not produce technological innovation, they fall behind their competitors, and they perish in the market. (Porter, 1990)

In brief, according to Porter, externalities emerge in the competitive industries that specialized in an industry; also, existence of this local competition boosts innovation and the economic growth. Porter believed that strong competition in the same industry is the source of the innovation for the firms. He asserted that innovations are adapted from other firms because of the competition with local firms, so self-sustaining industrial mechanism is automatically formed. Therefore, competition speeds up the innovation process and industrial growth. In sum, there are more externalities in the specialized industries that have many firms than specialized industries that have one or a few firms. This leads us to formulate hypothesis three:

Hypothesis three: Local competition has positive effect on regional growth.

3.1.2.3. Jacobs Externalities

In contrast to MAR externalities, Jacobs externalities (Jacobs, 1969) refer to spillovers between different firms in different industries, and they represent positive effect of industrial diversity/ variety on innovation and growth. Jacobs claimed that interactions between different perspectives in different sectors can lead to more creative and innovative ideas; also, people influence each other, so this event leads to development of new ideas, products and methods. (Bun, 2007)

Jacobs externalities assume that knowledge spillovers mostly occur within different industries. According to this view, not only innovations depend on diversity and abundance of sectors but also the diversity of economic structure is engine of the economic growth. On the contrary of the MAR externalities, Jacobs externalities derive from knowledge spillovers within different industries, and industrial diversity has an important role on economic growth. According to Jacobs the most important externalities are resulting from the interaction of different firms in different industries in a region. While Jacobs externalities denied specialization, it claimed that diversity in the local industrial structure stimulates innovation and economic growth. In other words, she argued that regions with more diversified economic structure have more growth potential than specialized regions. (Glaeser et al., 1992)

In addition to diversity, Jacobs supporter of the competitive market conditions like Porter. She argued that innovation takes place in the cities which have competitive market conditions; also, she claims that local monopoly obstructs the innovation although local competition encourages the new ideas, methods, and products. At this point, it is similar with Porter externalities though it is contrary to MAR externalities because according to these externalities, local competition causes faster knowledge spillovers between firms. (Bun, 2007)

Jacobs externalities or diversity/variety can be corresponded with urbanization economies which assumes the agglomeration of firms independent from the industry structure. In other words, urbanization economies are static view of the

Jacobs externalities. Both perspectives assume that industrial diversity increases the production of new ideas, and this diversity facilitates knowledge spillovers, and accelerates economic growth.

Table-2. Hypothesis of Dynamic External Economies

	Specialization	Competition	Diversity
MAR Externalities	**X**	**--**	**--**
Porter Externalities	**X**	**X**	**--**
Jacobs Externalities	**--**	**X**	**X**

Source: Vor, F. and Groot, H., 2008.

3.1.2.3.1. Variety, Related Variety and Unrelated Variety

Some economists (Frenken, 2007, Boschma, 2007) argued that, there is some confusion about the notion of Jacobs externalities. They claimed that it could be better when diversity/variety is distinguished as related variety and unrelated variety. While the knowledge spill over between the complementary sectors or related sectors, knowledge is easily absorbed and used by firms, so spillovers create more growth when the industry concentration is related in region. They believed that knowledge spillovers occur only between two sectors that are complementary or relation with each other. Moreover, they define related variety that is related in terms of shared or complementary competences. (Boschma, 2007) On the other hand, unrelated variety protects the region from sector specific shocks in demand and averts to unemployment. Also, unrelated variety has been arguing that portfolio strategy or portfolio argument. (Frenken, 2007) This thesis follows the idea that Jacobs externalities are the best measured by related variety, while the portfolio argument is better captured by unrelated variety. (Boschma, 2007)

Related variety (Jacobs externalities) are expected to promote the radical innovation and product innovation and related variety leads to creation of new sectors, markets and jobs as well as it increases the employment. On the other hand,

unrelated variety dampers unemployment and we expected that there would not be negative relation between unrelated variety and employment growth. This leads us to formulate following hypotheses:

Hypothesis four: Jacobs externalities (related variety) have a positive effect on employment growth.

Hypothesis five: Unrelated variety is positively related to employment growth.

CHAPTER 4

DATA AND MEASUREMENT ISSUES

In this chapter, this part first introduces the data set, and then it describes the measurement of variables and introduces dependent and independent variables in the second part.

4.1. THE DATA

All data were taken from TURKSTAT (Turkish Statistical Institute) for the period between 1992 and 2001[5]. The primary data consist of annual manufacturing industry surveys[6] accomplished by TURKSTAT. The data arranged for NUTS-3 provinces (Nomenclature of Units for Territorial Statistics – level 3) at the four-digit level ISIC Rev.3 classification (International Standard Industrial Classification of All Economic Activities, Rev.3). There are 23 two-digit, 61 three-digit and 127 four-digit industries under the manufacturing industry. The study interests in thirty-five socio-economic developed and industrialized provinces where locate in the west Anatolia.[7] Table 3 shows selected citied. Some districts were separated from main provinces, and they became cities during this period, so Osmaniye added to Adana, Düzce added to Bolu, Kilis added to Gaziantep, Yalova added to Istanbul, Karabuk added to Zonguldak to make continuity of these provinces.

[5] All prices are 1987 reel prices.
[6] The data is appropriate for only manufacturing industry and years between 1992 and 2001 because ISIC Rev.3 classification starts at 1992 and ends in 2001. This survey includes the data from the firms that have 10 employee and more, are both private entrepreneur and government institutions.
[7] See appendix 1, and Dinçer et. al. (1996) and (2003) for more detailed information. In addition, we argued that more spillovers would be occurring between these provinces.

Table 3: Provinces

Cities	Code	Cities	Code
1.Adana + Osmaniye	TR621	19.İstanbul + Yalova	TR100
2.Afyon	TR332	20.İzmir	TR310
3.Ankara	TR510	21.Kayseri	TR721
4.Antalya	TR611	22.Kırklareli	TR213
5.Aydın	TR321	23.Kırşehir	TR715
6.Balıkesir	TR221	24.Kocaeli	TR421
7.Bilecik	TR413	25.Konya	TR521
8.Bolu + Düzce	TR424	26.Kütahya	TR333
9.Burdur	TR613	27.Manisa	TR331
10.Bursa	TR411	28.Muğla	TR323
11.Çanakkale	TR222	29.Nevşehir	TR714
12.Denizli	TR322	30.Sakarya	TR422
13.Edirne	TR212	31.Tekirdağ	TR211
14.Eskişehir	TR412	32.Uşak	TR334
15.Gaziantep + Kilis	TRC11	33.Zonguldak + Karabük	TR811
16.Hatay	TR631	34.Karaman	TR522
17.Isparta	TR612	35.Kırıkkale	TR711
18.Mersin	TR622		

4.2. MEASUREMENT ISSUES

4.2.1. Dependent Variables

Employment growth, productivity growth and gross domestic product growth for provinces are dependent variables in the regressions as expression of the cities growth.

4.2.1.1. Employment Growth

First dependent variable in the analysis is defined as annual employment growth for the manufacturing industry in the city as computed:

$$Egr = \ln\left(\frac{E_{it}}{E_{i(t-1)}}\right) \quad (1)$$

where; E_{it} represents employment level in the city i in t year.

4.2.1.2. Productivity Growth

Second dependent variable in the analysis is defined as annual productivity growth for the manufacturing in the city as computed:

$$prod = productivity = \left(\frac{VA_{it}}{E_{it}}\right) \quad (2)$$

$$prodgr = \ln\left(\frac{prod_{it}}{prod_{i(t-1)}}\right) \quad (3)$$

where; E_{it} represents employment level in the city I in t year. VA_{it} represents value added in the city I in t year. $prod_{it}$ represents productivity in manufacturing industry in the city I in t year.

4.2.1.3. GDP per capita Growth

Third dependent variable in the analysis is defined as annual GDP per capita growth for the city as computed:

$$GDPpcgr = \ln\left(\frac{GDPpc_{it}}{GDPpc_{i(t-1)}}\right) \quad (4)$$

where; $GDPpc_{it}$ represents gross domestic product for the city I in t year.

4.2.2. Independent Variables

4.2.2.1.Entropy measure, Related and Unrelated Variety

4.2.2.1.1. Entropy measure

Entropy, with the rough definition, is a measure of disorderliness of a system. The origins of entropy are physics, and in many disciplines are used to separate the function of entropy. Any function that increases with the increase of the disorderliness of system can be an entropy function. "The origin of the entropy measure goes back to Ludwig Boltzmann (1877) and has been given a probabilistic interpretation in information theory by Claude Shannon (1948)." (Frenken et. al., 2004) After that, Henri Theil (1967;1972) developed several applications of information theory in economics((Frenken et. al., 2004)

The entropy formula expresses the expected information content or uncertainty of a probability distribution. Let E_i stand for an event (e.g., one technology adoption of technology i) and p_i for the probability of event E_i to occur. Let there be n events E_1, …, E_n with probabilities p_1,…, p_n adding up to 1. Since the occurrence of events with smaller probability yields more information (since these are least expected), a measure of information h should be a decreasing function of p_i. Shannon (1948) proposed a logarithmic function to express information $h(p_i)$: (Frenken et. al. ,2004)

$$h(p_i) = \log_2\left(\frac{1}{p_i}\right) \qquad (5)$$

which decreases from infinity to 0 for p_i ranging from 0 to 1. The function reflects the idea that the lower the probability of an event to occur, the higher the amount of information of a message stating that the event occurred. Information is here expressed in bits using 2 as a base of the logarithm, while others express information in 'nits' using the natural logarithm.

From the n number of information values h (p_i), the expected information content of a probability distribution, called entropy, is derived by weighing the information values h (p_i) by their respective probabilities:

$$H = \sum_{i=1}^{n} p_i \log_2 \left(\frac{1}{p_i} \right) \qquad (6)$$

where H stands for entropy in bits.

It is customary to define (Theil 1972: 5):

$$p_i \log_2 \left(\frac{1}{p_i} \right) = 0 \qquad \text{if} \qquad p_i = 0 \qquad (7)$$

which is in accordance to the limit value of the left-hand term for p_i approaching zero (Theil 1972: 5).

The entropy value H is non-negative. The minimum possible entropy value is zero corresponding to the case in which one event has unit probability:

$$H_{\min} = 1 \cdot \log_2 \left(\frac{1}{1} \right) = 0 \qquad (8)$$

When all states are equally probable ($p_i = \frac{1}{n}$), the entropy value is maximum:

$$H_{\max} = \sum_{i=1}^{n} \frac{1}{n} \log_2 (n) = n \frac{1}{n} \log_2 (n) = \log_2 (n) \qquad (9)$$

(proof is given by Theil 1972: 8-10). Maximum entropy thus increases with n, but decreasingly so. One of the most powerful and attractive

properties of entropy statistics is the way in which problems of aggregation and disaggregation are handled (Theil 1972: 20-22; Zajdenweber 1972). This is due to the property of additivity of the entropy formula.

Let E_i stand again for an event, and let there be n events E_1, …, E_n with probabilities p_1,…, p_n. Assume that all events can be aggregated into a smaller number of sets of events S_1, …, S_G in such a way that each event exclusively falls under one set S_g, where g=1,…,G. The probability that event falling under S_g occurs is obtained by summation:

$$P_g = \sum_{i \in S_g} p_i \qquad (10)$$

The entropy at the level of sets of events is:

$$H_0 = \sum_{g=1}^{G} P_g \log_2 \left(\frac{1}{P_g} \right) \qquad (11)$$

H_0 is called the between-group entropy. The entropy decomposition theorem specifies the relationship between the between-group entropy H_0 at the level of sets and the entropy H at the elevel of events as defined in (2). Write entropy H as:

$$H = \sum_{i=1}^{n} p_i \log_2 \left(\frac{1}{p_i} \right) = \sum_{g=1}^{G} \sum_{i \in S_g} p_i \log_2 \left(\frac{1}{p_i} \right) \qquad (12)$$

$$= \sum_{g=1}^{G} P_g \sum_{i \in S_g} \frac{p_i}{P_g} \left(\log_2 \left(\frac{1}{P_g} \right) + \log_2 \left(\frac{P_g}{p_i} \right) \right) \qquad (13)$$

$$= \sum_{g=1}^{G} P_g \left(\sum_{i \in S_g} \frac{p_i}{P_g} \right) \log_2 \left(\frac{1}{P_g} \right) + \sum_{g=1}^{G} P_g \left(\sum_{i \in S_g} \frac{p_i}{P_g} \log_2 \left(\frac{P_g}{p_i} \right) \right) \qquad (14)$$

$$= \sum_{g=1}^{G} P_g \log_2 \left(\frac{1}{P_g} \right) + \sum_{g=1}^{G} P_g \left(\sum_{i \in S_g} \frac{p_i}{P_g} \log_2 \left(\frac{1}{p_i / P_g} \right) \right) \qquad (15)$$

The first right-hand term in the last line is H_0. Hence:

$$H = H_0 + \sum_{g=1}^{G} P_g H_g \qquad (16)$$

where:

$$H_g = \sum_{i \in S_g} \frac{p_i}{P_g} \log_2 \left(\frac{1}{p_i / P_g} \right) \qquad g = 1, \ldots, G \qquad (17)$$

The probability p_i/P_g, $i \in S_g$ is the conditional probability of E_i given knowledge that one of the events falling under S_g is bound to occur. H_g thus stands for the entropy within the set S_g and the term $\sum P_g H_g$ in (9) is the average within-group entropy. Entropy thus equals the between-group entropy plus the average within-group entropy. Two properties of this relationship follow (Theil 1972: 22):

i) *$H \geq H_0$ because both P_g and H_g are nonnegative. It means that after grouping there cannot be more entropy (uncertainty) than there was before grouping.*

ii) *$H = H_0$ if and only if the term $\sum P_g H_g = 0$ and $\sum P_g H_g = 0$ if and only if $H_g = 0$ for each set S_g. It means that entropy equals between-group entropy if and only if the grouping is such that there is at most one event with nonzero probability.*

In informational terms, the decomposition theorem has the following interpretation. Consider the first message that one of the sets of events occurred. Its expected information content is H_0. Consider the subsequent message that one of the events falling under this set occurred. Its expected

information content is H_g. The total information content becomes $H_0 + \sum P_g H_g$.[8]

4.2.2.1.2. Related and Unrelated Variety

We apply the entropy methodology to measure sector variety for employment data from the annual manufacturing survey which is based on ISIC Rev3 four-digit classifications.

"The main advantage of the entropy measure over other alternative measures is that entropy can be decomposed at each sectoral digit level. The decomposable nature of entropy implies that variety at several digit levels can enter a regression analysis without necessarily causing collinearity." (Jacquemin and Berry, 1979; Frenken et. al., 2007)

Following Frenken et. al. (2007), and Gülcan and Akgüngör (2009), we measure the degree of related variety in each province though the weighted sum of the entropy indicator at the four-digit level within each two-digit classes and it measures the variety within each two classes. The variable related variety is measured as follows. Let all four-digit sector I fall under a two-digit sector S_g, where $g = 1,2,....,G$. We can derive the two-digit shares P_g, by summing the four-digit shares p_i:

$$P_g = \sum_{i \in S_g} p_i \tag{18}$$

Related variety (RVAR), as the weighted sum of entropy within each two-digit sector, which is given by:

[8] Frenken, K., Van, Oort F. G., Verburg, T., and Boschma R. A. (2004). Variety and regional economic growth in the Netherlands, *Ministry of Economic Affairs*, The Hauge. pg 18 and 53.

$$RVAR = \sum_{g=1}^{G} P_g H_g \tag{19}$$

Where:

$$H_g = \sum_{i \in S_g} \frac{p_i}{P_g} \log_2 \left(\frac{P_g}{p_i} \right) \tag{20}$$

Unrelated variety (UVAR), which is the entropy at the two-digit level, is given by:

$$UVAR = \sum_{g=1}^{G} P_g \log_2 \left(\frac{1}{P_g} \right) \tag{21}$$

4.2.2.2. Specialization of Industry

"Spel" represents the specialization in manufacturing industry by four digit sectors. We use the specialization measure which is suggested by Glaeser et al. (1992) and Gülcan and Akgüngör (2008); as also known location quotient. We computed sector specialization indicators by cities and selected the most three sectors in each cities.

$$Spel = LQ = \ln \left(\frac{E_{jit} / E_{it}}{TE_{jt} / TE_{Nt}} \right) \tag{22}$$

where; E_{jit} represents employment level in industry j in the city i in t year E_{it} represents employment level in the city i in t year. TE_{jt} represents total employment level in industry j in the country in t year. TE_{Nt} represents total employment level in the country in t year.

Specialization index expresses the industry concentration in an area the; that is, relationship between an area's share of specific industry and the national share. The value of greater than 1.25 is considered to be an evidence of high industry consideration relative to nation as well as specialization of that industry. Specialization variable is used an indicator of both localization economies and MAR externalities that is the dynamic view of localization economies. Thus that means, if there is an effect of MAR externalities on growth of cities, we expect that specialization indicator need to be a positive, or do not need to be a negative sign.

4.2.2.3. Population Density

Population density is used for indicator of urbanization economies[9] that supposes diversity is engine of the growth of city. Population density is the number of people per area calculated as:

$$Popden = \ln\left(\frac{Pop_{it}}{Area_{it}}\right) \tag{23}$$

where; Pop_{it} represents population of the city i in t year $Area_{it}$ represents area of in the city i in t year.

The positive relation of population density and growth is the evidence of the urbanization enhances the cities growth.

4.2.2.4. Competition

Competition (comp) is the indicator of market structure in manufacturing industry by four digit sectors, expresses the degree of competition within a sector. We use the competition calculation which is suggested by Glaeser et al. (1992). We

[9]Also, it can be interpreted as Jacobs externalities, that is the dynamic view of the urbanization economies but we employ other variables to test Jacobs externalities.

computed sector competition indicators by cities and selected the most competitive sectors in each city. We calculate a competition index as the ratio of the number of firms on employment in sector on its average across the country;

$$Comp = \ln\left(\frac{F_{jit} / E_{jit}}{TF_{jt} / TE_{jNt}}\right) \tag{24}$$

where; F_{jit} represents number of firms in the industry j in the city i in t year, E_{jit} represents employment level in the industry j in the city i in t year. TF_{jt} represents total number of firms in the industry j in the country in t year. TE_{jNt} represents total employment level in the industry j in the country in t year.

A high level of this variable implies that there is more firms in that sector relative to average of country, so a high value of competition can be interpreted as greater competition within sector in that province. In terms of dynamic externalities, a positive sign of this value can be interpreted as Porter and Jacobs externalities; in other words, it implies that competition has impact on growth of cities. In contrast, a negative sign of this value can be interpreted as theory of MAR externalities argued that monopoly is more effective than competitive market to enhance innovation and growth.

4.2.2.5. Average Wage Growth

It is computed from the annual manufacturing survey taken from the Institute of Statistical of Turkey.

$$Wgr = \ln\left(\frac{AW_{it}}{AW_{i(t-1)}}\right) \tag{25}$$

where; AW_{it} represents average wage in the manufacturing industry in the city i in t year.

There is a general agreement on that wage and employment level has reverse relationship. In other words, it is assumed that, when the wage level of a particular sector, or city increases, employment in that sector, or city decreases. It is expected the sing of this variable is negative.

4.2.2.6. Investment Growth

Investment growth is other control variable that is covering the expenditures of fix capital in the manufacturing industry year to year. It is computed with the 1987 prices.

$$invgr = \ln\left(\frac{Inv_{it}}{Inv_{i(t-1)}}\right) \tag{26}$$

where; Inv_{it} represents investment in the manufacturing industry in the city i in t year.

CHAPTER 5

METHODOLOGY AND HYPOTHESES

5.1. THE ECONOMETRIC METHODOLOGY

The method that has a cross-section dimension of time series estimation of economic relationship is called panel data analysis. In this analysis, time series together with the series of sections, with both time and cross-section data set is created. The static panel data model is expressed as an equation:

$$y_{it} = \beta_{1it} + \beta_{2it} x_{2it} + \ldots\ldots\ldots + \beta_{kit} x_{kit} + \varepsilon_{it} \qquad \text{i= 1,….,n} \quad \text{t=1,….,t} \tag{27}$$

Where i represents cross section data, t represents time.

Panel data models have several advantages compared with both the cross-sections data and time series data. These are: in the panel data models, the number of observations is more than cross-section and time series models. In this case, parameters of estimates are more reliable and the models that are estimated are less restrictive. Whereas, the estimates that are using only time series or only cross-section models have a subject of the risk of deviation results. Moreover, panel data models allow us to establish more complex models than cross-sections and time series models; also, they allow us to test these models. In addition, excluded variables led to biased results in the cross-section or time series studies; however, using panel data models provide to under control the deviation that results of excluded, or omitted variables and variables that are not changing by sections or the time dimensions. Another advantage of using panel data models is that although cross-section estimates allow investigating only the differences between units, panel data estimates allow us to investigate both the differences between units and the differences that occur over time in the units. (Baltagi, 2001; 5-7)

Dynamic panel data analysis methods are used in the estimations. Static panel analyses techniques could give biased and inconsistent results in the dynamic panel data sets. In other words, in the static panel data analysis, methods that are used to estimate the group and the time effects lead to biased and inconsistent coefficient estimates where the dynamic structure is concerned (Baltagi, 2001). In addition, errors due to unobserved features of cross-sections prevented by dynamic panel data models with estimated GMM (generalized method of moments), and GMM estimator eliminates issue of simultaneity, omitted variables, endogeneity and heterogeneity (Baltagi, 2001; Arellano and Bond, 1991). Arellano and Bond (1991) suggest GMM method that uses lagged dependent variable as an instrumental variable in the first difference transformation; also, GMM estimation acquires consistent estimates where the panel data sets have a small time, large cross-section dimension, and they have dynamic nature of empirical specification. (Baltagi, 2001).

First order dynamic panel model is:

$$y_{it} = \alpha_1 y_{i(t-1)} + \beta' X_{i(t-l)} + ... + \mu_{it} \qquad \text{i= 1,….,n} \quad \text{t=1,….,t} \qquad (28)$$

Where $\mu_{it} = \lambda_t + \eta_i + \nu_{i,t}$ is an error term with unobserved time effect (λ_t), unobserved individual effect (η_i) and the idiosyncratic error term ($\nu_{i,t}$). $X_{i(t-l)}$ is the set of current and lagged explanatory variables. This transformation allows us to use values of lagged dependent variable (lagged twice or more) as instruments (Arellano and Bond, 1991).

The consistency of the GMM estimates depends on two factors. First one of these is tests the validity of the instruments. The GMM instruments are tested by Sargan test which tests the null hypothesis of the validity of the instruments. This test asymptotically distributed as X^2_{j-k} where j-k is the degrees of over-identification. Second factor requires non serial-correlated errors. Arellano and Bond (1991) propose m_1 and m_2 tests which examine the absence of first and second–order serial correlations in the first differenced residuals. m_1 ,which tests the first order serial

correlation in the differenced residuals, can be acceptable and it do not affect the results, but m_2 that can not accepted tests the second order serial correlation in the differenced residuals. In addition to testing the consistency, Arellano and Bond (1991) suggest Wald test which test the overall significance of the independent variables.

5.2. THE MODEL

We examine the effect of agglomeration economies on a city growth by following the methodology from Gleaser et al. (1992) that is the basic Cobb-Douglas production function:

$$Y_t = A_t f(l_t) \tag{29}$$

Where A_t represents the overall level of technology at time t measured nominally, and (l_t) is the labor input at time t. Also, $f(l_t)$ abstracts from capital inputs.

Each firm in this industry takes technology, price, and wages w_t, as given and maximizes:

$$A_t f(l_t) - w_t l_t \tag{30}$$

It sets the labor input to equate the marginal product of labor to its wage:

$$A_t f'(l_t) = w_t \tag{31}$$

Than this equation rewrite in terms of growth rates

$$\ln\left(\frac{A_t}{A_{t-1}}\right) = \ln\left(\frac{w_t}{w_{t-1}}\right) - \ln\left(\frac{f'(l_t)}{f'(l_{t-1})}\right) \tag{32}$$

The level of technology A_t in the industry is assumed to have both national components and local components:

$$A = A_{local} A_{national} \tag{33}$$

The growth rate will then be the sum of the growth of national technology in this industry and the growth of local technology:

$$\ln\left(\frac{A_t}{A_{t-1}}\right) = \ln\left(\frac{A_{local,t}}{A_{local,t-1}}\right) + \ln\left(\frac{A_{national,t}}{A_{national,t-1}}\right) \tag{34}$$

The growth of national technology is assumed to capture the changes in the price of the product as well as shifts in national wide technology in the industry, and the local technology is assumed to grow at a rate exogenous to the firm but depending on the various technological externalities present in this industry in the city:

$$\ln\left(\frac{A_{local,t}}{A_{local,t-1}}\right) = g(specialization, localmonopoly, diversity, initialconditions) + e_t \tag{35}$$

If $f(l) = l^{1-\alpha}, 0 < \alpha < 1$, (22), (24), and (35) is combined

$$\alpha \ln\left(\frac{l_t}{l_{t-1}}\right) = -\ln\left(\frac{w_t}{w_{t-1}}\right) + \ln\left(\frac{A_{national,t}}{A_{national,t-1}}\right)$$

$$+ g(specialization, localmonopoly, diversity, initialconditions) + e_t \tag{36}$$

In addition to the existing literature, we develop three models to test growth of cities, and we use an employment growth, productivity growth and GDP per capita as dependent variables[10].

Equation 1:

$$Egr = \alpha + \beta_1 wgr + \beta_2 rvar + \beta_3 uvar + \beta_4 LQ + \beta_5 popden + \beta_6 comp + \beta_7 invgr + \varepsilon_{it} \quad (37)$$

Equation 2:

$$Prodgr = \alpha + \beta_1 wgr + \beta_2 rvar + \beta_3 uvar + \beta_4 LQ + \beta_5 popden + \beta_6 comp + \beta_7 invgr + \varepsilon_{it} \quad (38)$$

Equation 3:

$$GDPpcgr = \alpha + \beta_1 wgr + \beta_2 rvar + \beta_3 uvar + \beta_4 LQ + \beta_5 popden + \beta_6 comp + \beta_7 invgr + \varepsilon_{it} \quad (39)$$

We test the equations in the dynamic structure.

Equation 1:

$$\Delta Egr = \alpha + \beta_1' \Delta Y + \beta'_2 \Delta X + \mu_{it} \quad (40)$$

Equation 2:

$$\Delta Prodgr = \alpha + \beta_1' \Delta Y + \beta'_2 \Delta X + \mu_{it} \quad (41)$$

Equation 3:

$$\Delta GDPpcgr = \alpha + \beta_1' \Delta Y + \beta'_2 \Delta X + \mu_{it} \quad (42)$$

where Y represents lagged dependent variables, and X represents both current and lagged explanatory variables.

[10] Gleaser at al. (1992) suggest that would be better to test additional measures such as value added, productivity, output, or GDP growth.

CHAPTER 6

EMPRICAL RESULTS

6.1. ESTIMATION RESULTS

Before discussing our GMM estimation results, it can be helpful to mentioned that we first test all models with static panel data analysis that are fixed effects and random effects OLS but we have not reach any statistically significant results for interpretation. Thus, we do not put the static panel analyses results in this chapter. We will interpret the consistent and significant GMM estimation results.

Second, in all tables, figures in parentheses behind the coefficient estimates are probabilities and *, **, and *** show significance at the level 1%, 5%, and 10% level respectively. Figures in parentheses behind the z-values are probabilities of specification tests. In addition, both models in the tables include time dummies, whose estimated coefficients are not reported in the tables. All estimated models pass the specification tests. Table 5-7-9 show the test results. First, Wald test verified the overall significance of the independent variables. Second, the Sargan test statistic fails to reject the null hypothesis that the over-identifying restrictions are valid at any standard level of statistical significance in either model. This means that lagged dependent variables are valid instrument in the models. Third, according to the m2 test for second-order autocorrelation in the residuals, under the null hypothesis that there is no second-order autocorrelation can not be rejected at all significance levels. Therefore, all GMM estimators that we report in tables are consistent and efficient.

Finally, we have estimated also two and more lags of the variables in the models, but the coefficients of the variables lagged two and more were not significant, except productivity growth which has significant two-lag.

5.1.1. Estimation Results for Employment Growth

Table-4 presents GMM estimation results for employment growth as the dependent variable. Model-1 specifies the main GMM model, and other models omit insignificant dynamic variables for the robustness of model-1.

According to table-3, several inferences are found for the indicators of externalities. First, related variety as an indicator for Jacobs externalities is found negatively and significantly related to employment growth in the short-run while its lagged term is significantly positive, so its negative affect is weakened in the long-term. The magnitude of the estimates implies that the net effect is negative; however, with the support of other models (model 3 and 4), we can infer that the net effect is positive in the long-run. Second, there is not any significant relation between unrelated variety and employment growth in the baseline model (model-1). According to supporting models, the short-run affect is negative and statistically significant at the %5 level; also, the magnitude of the estimates implies that the net effect is negative. Third, the specialization indicator is insignificant in the short-run while its lagged effect is significantly positive; this means that specialization has positive effect on employment growth. Fourth, current and lagged effects of competition indicator are significantly negative and positive respectively; therefore, its negative affect is weakened in the long-term and the magnitude of the estimates implies that net effect is slightly negative. Regarding the urbanization indicator, we could not find any significant relation between urbanization and employment growth in all models. Finally, control variables that are wage growth and investment growth are insignificant and significant at the 1% level respectively in all models. We could not find any evidence to support that wage growth and employment growth are negatively related but the effect of investment growth on employment growth is significantly positive in both short-run and long-run that is expected.

From the estimation results, it can be concluded that dynamics play an important role in the employment growth in western cities in Turkey. MAR externalities have positive effect on employment growth in the cities. Although

immediate effect of Jacobs externalities (related variety) is negative, lagged effect of Jacobs externalities are much powerful than MAR externalities. Therefore, the results supported that Jacobs externalities (related variety) enhance employment growth with the ability of job creation. This result supports our hypothesis two. Regarding to Porter externalities the immediate effect of Porter externalities is negative while competitive market is becoming an important role on employment growth in the long-run, so the evidences support hypothesis three. We could not find any significant inference for relation with urbanization economies and employment growth in the cities; also, the results are the same for wage growth. However, investment growth has positive effect on employment growth. In addition, according to the results, historical conditions have important role on employment growth in the cities. In brief, although all externalities have positive effect on employment growth in the long-run Jacobs externalities/ related variety is becoming more dominant than MAR and Porter externalities in over time in the western Anatolian cities.

Table-4 GMM estimation results of dynamic panel, Dependent Variable: Employment Growth[11]

Variable	Model 1	Model 2	Model 3	Model 4	Model 5
$Egr_{i,t-1}$	0.066 (0.003)*	0.078 (0.000)*	0.109 (0.000)*	0.118 (0.000)*	0.135 (0.003)*
$wgr_{i,t}$	0.005 (0.885)	----------	0.011 (0.695)	----------	-0.007 (0.800)
$wgr_{i,t-1}$	-0.026 (0.397)	----------	-0.002 (0.960)	----------	0.009 (0.785)
$rvar_{i,t}$	-0.15 (0.002)*	-0.167 (0.001)*	-0.136 (0.002)*	-0.139 (0.000)*	-0.195 (0.000)*
$rvar_{i,t-1}$	0.127 (0.014)**	0.147 (0.006)*	0.158 (0.000)*	0.160 (0.000)*	0.188 (0.000)*
$uvar_{i,t}$	-0.084 (0.142)	-0.117 (0.049)**	-0.112 (0.046)**	-0.133 (0.005)*	----------
$uvar_{i,t-1}$	0.078 (0.112)	0.081 (0.123)	0.099 (0.090)***	0.065 (0.254)	----------
$LQ_{i,t}$	-0.032 (0.284)	-0.041 (0.124)	-0.038 (0.169)	-0.037 (0.163)	-0.041 (0.099)***
$LQ_{i,t-1}$	0.051 (0.000)*	0.046 (0.000)*	0.041 (0.000)*	0.039 (0.000)*	0.044 (0.000)*
$popden_{i,t}$	0.350 (0.516)	0.374 (0.526)	----------	----------	-1.336 (0.059)***
$popden_{i,t-1}$	0.467 (0.197)	0.626 (0.326)	----------	----------	0.856 (0.020)**
$comp_{i,t}$	-0.024 (0.022) **	-0.027 (0.004)*	-0.019 (0.058)**	-0.021 (0.025)**	-0.029 (0.001)*
$comp_{i,t-1}$	0.024 (0.001)*	0.019 (0.021)**	0.031 (0.000)*	0.025 (0.001)*	0.025 (0.005)*
$invgr_{i,t}$	0.024 (0.002)*	0.025 (0.000)*	0.019 (0.007)*	0.024 (0.000)*	0.025 (0.000)*
$invgr_{i,t-1}$	0.019 (0.000)*	0.0192 (0.000)*	0.016 (0.000)*	0.016 (0.000)*	0.017 (0.000)*

[11] Note: "Egr" refers to employment growth as dependent variables. "rvar" and "uvar" refer to related variety which is the measure of Jacobs externalities and unrelated variety respectively. Specialization is presented by "LQ" and competition is shown by "comp". Population density is demonstrated by "popden" as the indicator of urbanization. "wgr" and "invgr" refer to wage growth and investment growth respectively. *, **, and *** show significance at the level 1%, 5%, and 10%.

Table-5 Specification tests for GMM estimation results of dynamic panel, Dependent Variable: Employment Growth[12]

	Model 1	Model 2	Model 3	Model 4	Model 5
Sargan test	20.31 (0.977)	21.45 (0.965)	17.71 (0.993)	20.45 (0.976)	13.89 (0.999)
m1	-2.74 (0.006)	-2.80 (0.005)	-2.82 (0.004)	-2.77 (0.005)	-3.30 (0.001)
m2	0.84 (0.401)	0.87 (0.386)	0.91 (0.362)	0.98 (0.328)	0.92 (0.3586)
Wald test	237.31 (0.000)*	236.65 (0.000)*	462.33 (0.000)*	514.15 (0.000)*	579.33 (0.000)*

[12] Note: Wald test verified the overall significance of the independent variables. Second, the Sargan test statistic fails to reject the null hypothesis that the over-identifying restrictions are valid at any standard level of statistical significance in either model. Third, according to the m2 test, under the null hypothesis that there is no second-order autocorrelation can not be rejected at all significance levels. n=350.

5.1.2. Estimation Results for Productivity Growth

Table-6 presents GMM estimation results for productivity growth as the dependent variable. Model-1 specifies the main GMM model, and other models omit insignificant dynamic variables for the robustness of model-1.

The results indicate that there is not any significant relation between related variety and productivity growth in all models. For Unrelated variety the results from supporting models shows that the estimated coefficients on lagged unrelated variety is negative and statistically significant at the 10% level while its current term is insignificant. Specialization indicator is found positively and significantly related to productivity growth in the short-run while its lagged term is not significant. This means specialization has positive effect on productivity growth. We can not find any significant relation between urbanization and productivity growth in the baseline model although the coefficients of urbanization indicator are positive and significant in the supporting models; also, the lagged coefficients of urbanization indicator are negative but insignificant. That means, urbanization has positive immediate effect on productivity growth. The lagged competition indicator is only significant at the 5% level and it is negative, so the magnitude of the estimates implies that the effect of competition is negative on productivity growth. Moreover, lagged productivity growths have negatively but diminishing effect on current productivity growth. Finally, regarding the control variables that are wage growth and investment growth are significant in all models in the long run. There is a positive relation between wage growth and productivity growth in both short-run and long-run that is expected. The immediate effect of investment growth is negative but insignificant while the coefficient of lagged effect is significantly positive and the magnitude of the estimates implies that the net effect is positive at the 5% level. Thus, the effect of investment growth is positive in the long run.

In general the estimation results on productivity growth suggested that dynamics play an important role in western cities in Turkey as the same as the

employment growth. First, MAR externalities have positive effect on productivity growth in the cities that supports the hypothesis that innovations in MAR externalities have more productive effect such as process and incremental innovations. Regarding the Jacobs externalities the results shows that diversity/variety, both related and unrelated variety, does not any effect on productivity growth. Third, competition has negative effect on productivity growth in the long run, so we can infer that the effect of Porter externalities on productivity growth is negative. Third, the effect of urbanization has positive on productivity growth. We infer that this result comes from demand of the populousness. Fourth, traditional determinants, both wage growth and investment growth has positive effect on productivity growth. Last, historical conditions have more important role on productivity growth in the cities. In short, both MAR externalities and urbanization economies are effective on productivity growth in the western Anatolian cities.

Table-6 GMM estimation results of dynamic panel, Dependent Variable: Productivity Growth[13]

Variable	Model 1	Model 2	Model 3	Model 4	Model 5
$Prodgr_{i,t-1}$	-0.166 (0.000)*	-0.165 (0.000)*	-0.110 (0.000)*	-0.13859 (0.000)*	-0.149 (0.000)*
$Prodgr_{i,t-2}$	-0.095 (0.000)*	-0.080 (0.000)*	-0.096 (0.001)*	-0.10979 (0.000)*	-0.091 (0.001)*
$wgr_{i,t}$	0.201 (0.004)*	0.203 (0.000)*	0.202 (0.000)*	0.21414 (0.000)*	0.273 (0.000)*
$wgr_{i,t-1}$	0.297 (0.002)*	0.378 (0.000)*	0.309 (0.000)*	0.366376 (0.000)*	0.314(0.000)*
$rvar_{i,t}$	0.022 (0.794)	----------	0.054 (0.577)	0.009202 (0.907)	----------
$rvar_{i,t-1}$	-0.103(0.465)	----------	0.016 (0.880)	0.015807 (0.864)	----------
$uvar_{i,t}$	0.043 (0.748)	-0.022 (0.857)	----------	0.107861 (0.441)	-0.042 (0.741)
$uvar_{i,t-1}$	-0.235 (0.130)	-0.300 (0.069)***	----------	-0.15862 (0.305)	-0.191(0.083)***
$LQ_{i,t}$	0.132 (0.006)*	0.166 (0.001)*	0.160 (0.000)*	0.178994 (0.000)*	0.133 (0.001)*
$LQ_{i,t-1}$	-0.030 (0.504)	-0.062 (0.144)	-0.020 (0.699)	-0.06826(0.193)	----------
$popden_{i,t}$	2.779 (0.120)	3.207 (0.013)**	3.551 (0.010)***	----------	2.228 (0.043)**
$popden_{i,t-1}$	-1.621 (0.470)	-2.016 (0.180)	-0.771 (0.651)	----------	-0.556 (0.761)
$comp_{i,t}$	0.010 (0.622)	0.016 (0.436)	0.010 (0.597)	-0.00343 (0.859)	----------
$comp_{i,t-1}$	-0.060 (0.024)**	-0.056 (0.016)**	-0.048 (0.046)**	-0.05128 (0.035)**	-0.072 (0.001)*
$invgr_{i,t}$	-0.020 (0.434)	-0.001 (0.984)	-0.040 (0.068)***	-0.0267 (0.167)	-0.040 (0.065)***
$invgr_{i,t-1}$	0.041(0.047)**	0.045 (0.008)*	0.039 (0.007)*	0.034493 (0.036)**	0.028 (0.091)***

[13] Note: "Prodgr" refers to productivity growth as dependent variables. "rvar" and "uvar" refer to related variety which is the measure of Jacobs externalities and unrelated variety respectively. Specialization is presented by "LQ" and competition is shown by "comp". Population density is demonstrated by "popden" as the

Table-7 Specification tests for GMM estimation results of dynamic panel, Dependent Variable: Productivity Growth[14]

	Model 1	Model 2	Model 3	Model 4	Model 5
Sargan test	12.06 (0.999)	12.09 (0.999)	7.75 (1.00)	8.75 (1.00)	11.33 (0.999)
m1	-2.35 (0.019)	-2.35 (0.018)	-2.51 (0.012)	-2.50 (0.013)	-2.45 (0.014)
m2	-0.39 (0.697)	-0.48 (0.632)	-0.07 (0.945)	-0.06 (0.952)	-0.19 (0.846)
Wald test	1727.62 (0.000)*	913.15 (0.000)*	811.54 (0.000)*	702.27 (0.000)*	711.51 (0.000)*

indicator of urbanization. "wgr" and "invgr" refer to wage growth and investment growth respectively. *, **, and *** show significance at the level 1%, 5%, and 10%.
[14] Note: Wald test verified the overall significance of the independent variables. Second, the Sargan test statistic fails to reject the null hypothesis that the over-identifying restrictions are valid at any standard level of statistical significance in either model. Third, according to the m2 test, under the null hypothesis that there is no second-order autocorrelation can not be rejected at all significance levels. n=350.

5.1.3. Estimation Results for GDP per capita Growth

Table-8 presents GMM estimation results for GDP per capita growth as the dependent variable. Model-1 specifies the main GMM model, and other models omit insignificant dynamic variables for the robustness of model-1. According to table-5, the coefficients of related and unrelated variety, specialization indicator and wage growth are not statistically significant at all conventional significance levels in all models. This means that, dynamic externalities have not effect on GDP per capita growth in the western Anatolian cities. However, all coefficients of urbanization indicator are statistically significant at %1 level in all models and current coefficients of urbanization economies are negative sign while their lagged terms are positive. The magnitude of the estimates implies that the net effect is positive. Therefore, we can infer that urbanization has positive effect on GDP per capita growth. Regarding the competition indicator, the coefficients of current/ contemporaneous variables are insignificant while its lagged variables are statistically significant at 5% and 1% levels; also, they have positive sign. Last, both current and lagged coefficients of investment growth are statistically insignificant in the baseline model while it's contemporaneous variables positive and statistically significant at %5 and %1 levels. Thus, we can infer that the immediate effect of investment growth is positive but not so much. To summarize these results, only urbanization economies have positive effect on cities growth if we refer the GDP per capita growth as an indicator of economic growth in the western Anatolian cities.

Table-8 GMM estimation results of dynamic panel, Dependent Variable: GDP per capita Growth[15]

Variable	Model 1	Model 2	Model 3	Model 4
$GDPpcgr_{i,t-1}$	-0.150 (0.000)*	-0.140 (0.000)*	-0.119 (0.002)*	-0.143 (0.000)*
$wgr_{i,t}$	0.024 (0.363)	----------	----------	----------
$wgr_{i,t-1}$	-0.005 (0.716)	----------	----------	----------
$rvar_{i,t}$	-0.010 (0.806)	-0.024 (0.565)	----------	----------
$rvar_{i,t-1}$	-0.032 (0.281)	-0.014 (0.654)	----------	----------
$uvar_{i,t}$	0.013 (0.718)	0.0434 (0.194)	0.007 (0.832)	----------
$uvar_{i,t-1}$	-0.007 (0.819)	0.002 (0.963)	-0.021 (0.509)	----------
$LQ_{i,t}$	0.014 (0.380)	0.023 (0.187)	0.015 (0.310)	----------
$LQ_{i,t-1}$	0.013 (0.362)	0.007 (0.585)	0.017 (0.161)	----------
$popden_{i,t}$	-0.824 (0.000)*	-1.138 (0.000)*	-0.878 (0.000)*	-0.925 (0.000)*
$popden_{i,t-1}$	0.932 (0.000)*	2.288 (0.000)*	0.968 (0.000)*	0.967 (0.000)*
$comp_{i,t}$	0.004 (0.578)	-0.013 (0.336)	-0.003 (0.611)	-0,001 (0.984)
$comp_{i,t-1}$	0.012 (0.042)**	0.011 (0.028)**	0.005 (0.272)	0.009 (0.006)*
$invgr_{i,t}$	0.004758 (0.331)	0.010 (0.022)**	0.011 (0.002)*	0.011 (0.007)*
$invgr_{i,t-1}$	0.001374 (0.763)	0.002 (0.732)	0.004 (0.296)	0.004 (0.246)

[15] Note: "GDPpcgr" refers to gross domestic product per capita growth as dependent variables. "rvar" and "uvar" refer to related variety which is the measure of Jacobs externalities and unrelated variety respectively. Specialization is presented by "LQ" and competition is shown by "comp". Population density is demonstrated by "popden" as the indicator of urbanization. "wgr" and "invgr" refer to wage growth and investment growth respectively. *, **, and *** show significance at the level 1%, 5%, and 10%.

Table-9 Specification tests for GMM estimation results of dynamic panel, Dependent Variable: GDP per capita Growth[16]

	Model 1	Model 2	Model 3	Model 4
Sargan test	14.54 (0.999)	15.61 (0.998)	20.39 (0.976)	24.23 (0.914)
m1	-1.99 (0.046)	-2.12 (0.034)	-2.05 (0.041)	-2.06 (0.039)
m2	0.33 (0.741)	1.01 (0.311)	0.59 (0.555)	0.39(0.694)
Wald test	252.53 (0.000)*	397.58 (0.000)*	558.18 (0.000)*	618.23 (0.000)*

[16] Note: Wald test verified the overall significance of the independent variables. Second, the Sargan test statistic fails to reject the null hypothesis that the over-identifying restrictions are valid at any standard level of statistical significance in either model. Third, according to the m2 test, under the null hypothesis that there is no second-order autocorrelation can not be rejected at all significance levels.

CONCLUSION

This thesis has analyzed the existence of the agglomeration economies or external economies on regional economic growth in 35 Western Anatolian cities in Turkey for the period 1992-2001. In addition to examine the effects of the agglomeration economies which are MAR-externalities, Porter externalities, Jacobs externalities and urbanization economies, the effects of wage growth and investment growth are analyzed for Turkish manufacturing industry for the same period. Furthermore, main contributions of the thesis are: first, both employment growth, productivity growth and GDP per capita growth are used as indicator of economic growth while other studies are using employment growth. Second, entropy methodology is applied for Turkish manufacturing industry while related variety and unrelated variety were being calculated. Related variety is measured at the four-digit sector level within two-digit classes while unrelated variety is measured at the two-digit sector-level.

According to dynamic panel estimations, the general conclusions are that historical conditions of cities has important role on the growth of cities and the effects of different external economies on employment growth, productivity growth and GDP per capita growth are different.

First, the majority of estimates showed that MAR, Porter and Jacobs externalities have positive effect on employment growth. However, related variety that is the indicator of Jacobs externalities is becoming more effective than other type of external economies in over time. In addition, the effect of urbanization economies on employment growth is not founded. From these results, it can be concluded that related variety enhances employment growth with creating new employment areas in the cities; also, Jacobs externalities has an important role on employment growth in Western Anatolian cities. This conclusion is also in line with Frenken et. al. (2004; 2007), but it is contrast with Gülcan et al. (2010).

Second, the empirical results on productivity growth are showed that positive effects of MAR externalities that is support hypothesis three. This can be interpreted that intra-industry spillovers are more effective on increasing to productivity and output. There is not any evidence for Jacobs externalities; however, negative effect of competition is interpreted that competition prevents productivity in the cities. It is also found that urbanization economies have positive effect on productivity growth. The reason of this result can be interpreted by demand of increasing population of cities. While the cities are getting more crowded, the consumption of the cities increases and this leads to increase of the output of the firms. It is also concluded that firms are clustering in big cities because of increasing demand of crowded population.

Third, regarding to GDP per capita growth, it is only found that the positive effect of urbanization economies in the long-term while there is not any significant evidence between any dynamic external economies and GDP per capita growth in cities. This is a strong evidence to explain why big cities are getting bigger and populous while small cities getting smaller in Turkey because people increase their wealth when they immigrate from small city to big city although income inequality gap is wider in the cities. Alternatively, another interpretation of this result can made by dynamic external economies (MAR, Porter and Jacobs externalities) have ability to explain the growing of the industrial structure in this thesis because unlike the other variables (employment growth and productivity growth) in this thesis GDP per capita is not directly related to manufacturing industry.

In conclusion, this thesis emphasizes the impact of agglomeration economies or external economies on Western Anatolian cities growth in Turkey. According to results, each agglomeration economies have different current and lagged effect on employment growth, productivity growth and GDP per capita growth. This is important for policy makers while making regional policies. Policies that support related variety can enhance employment in the cities while it could not affect positively productivity and GDP per capita. On the other hand, policies that support specialization and urbanization can increase productivity. However, policies that

support only urbanization should increase GDP per capita of people in cities. In addition, according to results, historical structure and conditions of cities have important role on employment growth, productivity growth and GDP per capita growth in Western Anatolian cities. For this reason, countries such as Turkey which have a big unemployment problem in their cities should implement regional policies supporting related variety.

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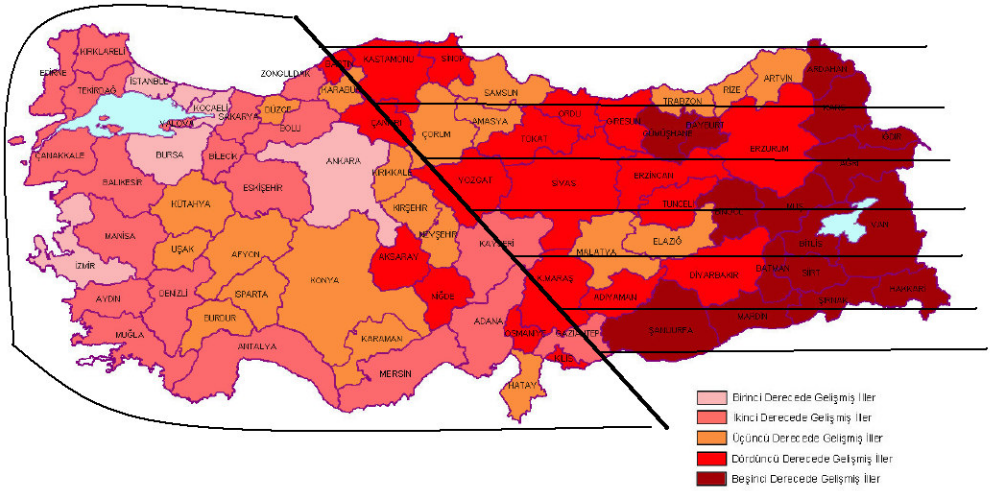
APPENDIX

Appendix 1: Selected cities in the map



Source: Dinçer et. al. (2003). DPT

Appendix 2: ISIC Rev.3 Classification Manufacturing Structure

Table 10. ISIC REV.3 Structure

Code			Description
D			Manufacturing
15			Manufacture of food products and beverages
	151		Production, processing and preservation of meat, fish, fruit, vegetables, oils and fats
		1511	Production, processing and preserving of meat and meat products
		1512	Processing and preserving of fish and fish products
		1513	Processing and preserving of fruit and vegetables
		1514	Manufacture of vegetable and animal oils and fats
	152		Manufacture of dairy products
		1520	Manufacture of dairy products
	153		Manufacture of grain mill products, starches and starch products, and prepared animal feeds
		1531	Manufacture of grain mill products
		1532	Manufacture of starches and starch products
		1533	Manufacture of prepared animal feeds
	154		Manufacture of other food products

		1541	Manufacture of bakery products
		1542	Manufacture of sugar
		1543	Manufacture of cocoa, chocolate and sugar confectionery
		1544	Manufacture of macaroni, noodles, couscous and similar farinaceous products
		1549	Manufacture of other food products n.e.c.
	155		Manufacture of beverages
		1551	Distilling, rectifying and blending of spirits; ethyl alcohol production from fermented materials
		1552	Manufacture of wines
		1553	Manufacture of malt liquors and malt
		1554	Manufacture of soft drinks; production of mineral waters
16			Manufacture of tobacco products
	160		Manufacture of tobacco products
		1600	Manufacture of tobacco products
17			Manufacture of textiles
	171		Spinning, weaving and finishing of textiles
		1711	Preparation and spinning of textile fibres; weaving of textiles
		1712	Finishing of textiles
	172		Manufacture of other textiles
		1721	Manufacture of made-up textile articles, except apparel
		1722	Manufacture of carpets and rugs
		1723	Manufacture of cordage, rope, twine and netting
		1729	Manufacture of other textiles n.e.c.
	173		Manufacture of knitted and crocheted fabrics and articles
		1730	Manufacture of knitted and crocheted fabrics and articles
18			Manufacture of wearing apparel; dressing and dyeing of fur
	181		Manufacture of wearing apparel, except fur apparel
		1810	Manufacture of wearing apparel, except fur apparel
	182		Dressing and dyeing of fur; manufacture of articles of fur
		1820	Dressing and dyeing of fur; manufacture of articles of fur
19			Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear
	191		Tanning and dressing of leather; manufacture of luggage, handbags, saddlery and harness
		1911	Tanning and dressing of leather
		1912	Manufacture of luggage, handbags and the like, saddlery and harness
	192		Manufacture of footwear
		1920	Manufacture of footwear
20			Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials
	201		Sawmilling and planing of wood
		2010	Sawmilling and planing of wood
	202		Manufacture of products of wood, cork, straw and plaiting materials
		2021	Manufacture of veneer sheets; manufacture of plywood,

			laminboard, particle board and other panels and boards
		2022	Manufacture of builders' carpentry and joinery
		2023	Manufacture of wooden containers
		2029	Manufacture of other products of wood; manufacture of articles of cork, straw and plaiting materials
21			Manufacture of paper and paper products
	210		Manufacture of paper and paper products
		2101	Manufacture of pulp, paper and paperboard
		2102	Manufacture of corrugated paper and paperboard and of containers of paper and paperboard
		2109	Manufacture of other articles of paper and paperboard
22			Publishing, printing and reproduction of recorded media
	221		Publishing
		2211	Publishing of books, brochures, musical books and other publications
		2212	Publishing of newspapers, journals and periodicals
		2213	Publishing of recorded media
		2219	Other publishing
	222		Printing and service activities related to printing
		2221	Printing
		2222	Service activities related to printing
	223		Reproduction of recorded media
		2230	Reproduction of recorded media
23			Manufacture of coke, refined petroleum products and nuclear fuel
	231		Manufacture of coke oven products
		2310	Manufacture of coke oven products
	232		Manufacture of refined petroleum products
		2320	Manufacture of refined petroleum products
	233		Processing of nuclear fuel
		2330	Processing of nuclear fuel
24			Manufacture of chemicals and chemical products
	241		Manufacture of basic chemicals
		2411	Manufacture of basic chemicals, except fertilizers and nitrogen compounds
		2412	Manufacture of fertilizers and nitrogen compounds
		2413	Manufacture of plastics in primary forms and of synthetic rubber
	242		Manufacture of other chemical products
		2421	Manufacture of pesticides and other agro-chemical products
		2422	Manufacture of paints, varnishes and similar coatings, printing ink and mastics
		2423	Manufacture of pharmaceuticals, medicinal chemicals and botanical products
		2424	Manufacture of soap and detergents, cleaning and polishing preparations, perfumes and toilet preparations
		2429	Manufacture of other chemical products n.e.c.

	243		Manufacture of man-made fibres
		2430	Manufacture of man-made fibres
25			Manufacture of rubber and plastics products
	251		Manufacture of rubber products
		2511	Manufacture of rubber tyres and tubes; retreading and rebuilding of rubber tyres
		2519	Manufacture of other rubber products
	252		Manufacture of plastics products
		2520	Manufacture of plastics products
26			Manufacture of other non-metallic mineral products
	261		Manufacture of glass and glass products
		2610	Manufacture of glass and glass products
	269		Manufacture of non-metallic mineral products n.e.c.
		2691	Manufacture of non-structural non-refractory ceramic ware
		2692	Manufacture of refractory ceramic products
		2693	Manufacture of structural non-refractory clay and ceramic products
		2694	Manufacture of cement, lime and plaster
		2695	Manufacture of articles of concrete, cement and plaster
		2696	Cutting, shaping and finishing of stone
		2699	Manufacture of other non-metallic mineral products n.e.c.
27			Manufacture of basic metals
	271		Manufacture of basic iron and steel
		2710	Manufacture of basic iron and steel
	272		Manufacture of basic precious and non-ferrous metals
		2720	Manufacture of basic precious and non-ferrous metals
	273		Casting of metals
		2731	Casting of iron and steel
		2732	Casting of non-ferrous metals
28			Manufacture of fabricated metal products, except machinery and equipment
	281		Manufacture of structural metal products, tanks, reservoirs and steam generators
		2811	Manufacture of structural metal products
		2812	Manufacture of tanks, reservoirs and containers of metal
		2813	Manufacture of steam generators, except central heating hot water boilers
	289		Manufacture of other fabricated metal products; metal working service activities
		2891	Forging, pressing, stamping and roll-forming of metal; powder metallurgy
		2892	Treatment and coating of metals; general mechanical engineering on a fee or contract basis
		2893	Manufacture of cutlery, hand tools and general hardware
		2899	Manufacture of other fabricated metal products n.e.c.
29			Manufacture of machinery and equipment n.e.c.
	291		Manufacture of general purpose machinery

		2911	Manufacture of engines and turbines, except aircraft, vehicle and cycle engines
		2912	Manufacture of pumps, compressors, taps and valves
		2913	Manufacture of bearings, gears, gearing and driving elements
		2914	Manufacture of ovens, furnaces and furnace burners
		2915	Manufacture of lifting and handling equipment
		2919	Manufacture of other general purpose machinery
	292		Manufacture of special purpose machinery
		2921	Manufacture of agricultural and forestry machinery
		2922	Manufacture of machine-tools
		2923	Manufacture of machinery for metallurgy
		2924	Manufacture of machinery for mining, quarrying and construction
		2925	Manufacture of machinery for food, beverage and tobacco processing
		2926	Manufacture of machinery for textile, apparel and leather production
		2927	Manufacture of weapons and ammunition
		2929	Manufacture of other special purpose machinery
	293		Manufacture of domestic appliances n.e.c.
		2930	Manufacture of domestic appliances n.e.c.
30			Manufacture of office, accounting and computing machinery
	300		Manufacture of office, accounting and computing machinery
		3000	Manufacture of office, accounting and computing machinery
31			Manufacture of electrical machinery and apparatus n.e.c.
	311		Manufacture of electric motors, generators and transformers
		3110	Manufacture of electric motors, generators and transformers
	312		Manufacture of electricity distribution and control apparatus
		3120	Manufacture of electricity distribution and control apparatus
	313		Manufacture of insulated wire and cable
		3130	Manufacture of insulated wire and cable
	314		Manufacture of accumulators, primary cells and primary batteries
		3140	Manufacture of accumulators, primary cells and primary batteries
	315		Manufacture of electric lamps and lighting equipment
		3150	Manufacture of electric lamps and lighting equipment
	319		Manufacture of other electrical equipment n.e.c.
		3190	Manufacture of other electrical equipment n.e.c.
32			Manufacture of radio, television and communication equipment and apparatus
	321		Manufacture of electronic valves and tubes and other electronic components
		3210	Manufacture of electronic valves and tubes and other electronic components
	322		Manufacture of television and radio transmitters and apparatus for line telephony and line telegraphy

		3220	Manufacture of television and radio transmitters and apparatus for line telephony and line telegraphy
	323		Manufacture of television and radio receivers, sound or video recording or reproducing apparatus, and associated goods
		3230	Manufacture of television and radio receivers, sound or video recording or reproducing apparatus, and associated goods
33			Manufacture of medical, precision and optical instruments, watches and clocks
	331		Manufacture of medical appliances and instruments and appliances for measuring, checking, testing, navigating and other purposes, except optical instruments
		3311	Manufacture of medical and surgical equipment and orthopaedic appliances
		3312	Manufacture of instruments and appliances for measuring, checking, testing, navigating and other purposes, except industrial process control equipment
		3313	Manufacture of industrial process control equipment
	332		Manufacture of optical instruments and photographic equipment
		3320	Manufacture of optical instruments and photographic equipment
	333		Manufacture of watches and clocks
		3330	Manufacture of watches and clocks
34			Manufacture of motor vehicles, trailers and semi-trailers
	341		Manufacture of motor vehicles
		3410	Manufacture of motor vehicles
	342		Manufacture of bodies (coachwork) for motor vehicles; manufacture of trailers and semi-trailers
		3420	Manufacture of bodies (coachwork) for motor vehicles; manufacture of trailers and semi-trailers
	343		Manufacture of parts and accessories for motor vehicles and their engines
		3430	Manufacture of parts and accessories for motor vehicles and their engines
35			Manufacture of other transport equipment
	351		Building and repairing of ships and boats
		3511	Building and repairing of ships
		3512	Building and repairing of pleasure and sporting boats
	352		Manufacture of railway and tramway locomotives and rolling stock
		3520	Manufacture of railway and tramway locomotives and rolling stock
	353		Manufacture of aircraft and spacecraft
		3530	Manufacture of aircraft and spacecraft
	359		Manufacture of transport equipment n.e.c.
		3591	Manufacture of motorcycles
		3592	Manufacture of bicycles and invalid carriages
		3599	Manufacture of other transport equipment n.e.c.
36			Manufacture of furniture; manufacturing n.e.c.

	361		Manufacture of furniture
		3610	Manufacture of furniture
	369		Manufacturing n.e.c.
		3691	Manufacture of jewellery and related articles
		3692	Manufacture of musical instruments
		3693	Manufacture of sports goods
		3694	Manufacture of games and toys
		3699	Other manufacturing n.e.c.
37			Recycling
	371		Recycling of metal waste and scrap
		3710	Recycling of metal waste and scrap
	372		Recycling of non-metal waste and scrap
		3720	Recycling of non-metal waste and scrap