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Spatial Analysis of Concentration in Production and Trade: An Exploratory Spatial Data Analysis for Emerging Markets

Üretim ve Ticarette Yoğunlaşmanın Mekansal Analizi: Yükselen Piyasa Ekonomileri İçin Bir Açıklayıcı Mekansal Veri Analizi

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Agricultural Production, Manufacturing Industry Production, Trade, Spatial Statistics, Exploratory Spatial Data Analysis (ESDA)

ABSTRACT

The aim of this paper is to investigate spatial analysis of concentration in production and trade in emerging market economies over 1990-2009 by means of spatial statistics. In this purpose, we use quartile maps, box plots, Moran's Scatter plots and LISA statistics. We firstly found that both important evidence of global and local spatial autocorrelation and spatial heterogeneity in the distribution of production and trade in a sample of 135 countries in the world. In this context, we see that there is a big inequality and heterogeneity in term of spatial concentration of production and trade. When we look at the LISA analysis, especially Asia – Pacific countries as India, China, Indonesia, Malaysia, Singapore, Vietnam, Thailand become prominent in the recent years. We determined a significant spatial interaction among these countries. Asia-Pacific countries have over production and over trade in the period of 1990-2009 vis-à-vis the other emerging market countries. As a result, this region is making of center of spatial concetration in terms of production and trade in the world.

Anahtar Kelimeler:

Tarımsal Üretim, Endüstriyel Üretim, Ticaret, Mekansal İstatistik, Açıklayıcı Mekansal Veri Analizi

ÖZET

Bu çalışmanın amacı, mekansal istatistikler vasıtasıyla 1990-2009 döneminde yükselen piyasa ekonomilerinde üretim ve ticaretin yoğunlaşmasının mekansal analizini incelemektedir. Bu amaçla, kartil haritalar, kutu diyagramları, Moran's dağılım diyagramları ve LISA istatistikleri kullanılmaktadır. Çalışmada, dünyadaki 135 ülke örneğinde üretim ve ticaretin dağılımında hem global ve hem de lokal mekansal otokorelasyon ve mekansal farklılıkların önemli kanıtı bulunmuştur. Bu kapsamda, anlaşılmıştır ki, üretim ve ticaretin mekansal yoğunlaşması açısından büyük bir eşitsizlik ve farklılık vardır. LISA analizi incelendiğinde, özellikle Asya-Pasifik ülkeleri (Hindistan, Çin, Endonezya, Malezya, Singapur, Vietnam, Tayland) son yıllarda öne çıkar hale gelmiştir. Bu ülkeler arasında belirgin bir mekansal etkileşim belirlenmiştir. Asya-Pasifik ülkeleri 1990-2009 periyodu için diğer yükselen piyasa ekonomileri ile karşılaştırıldığında fazla üretim ve ticarete sahiptir. Sonuç olarak, bu bölge dünyanın üretim ve ticaret açısından mekansal yoğunlaşmanın merkezi olma yolundadır.

1. INTRODUCTION

"Emerging markets" was used by World Bank economist Antoine van Agtmael early 1980's. Since that time, this term has been discussed by academia, economic and politic circles and global think thank institutions. The answer of "what is emerging markets" question is not very clear that many economist give different definitions of emerging markets. There is not also any consensus about the answer of "which countries" question.

"Emerging market" term is defined as by Blanco (2010) "an economy with low-to-middle per capita income that is in transition to a more developed economy, characterized by stable and sustained economic growth and high standards of living". Pelle, (2007) give more specific definition of emerging markets. He says "they have started to reinforce their economies and gain importance as trade partners, recipients of foreign investments and political players within the transnational institutions. Such countries are those which we refer to as Emerging Markets." Besides Arnold and Quelch (1998) say that there are two characteristics of a country that has become emerging market. First one is, rapidly economic development, secondly, government policies favoring economic liberalization and the adoption of a free-market system.

Many economists have investigated reasons of rapid growth process of emerging markets in scope of politic and economic reforms in the recent years. Many factors as democracy, FDI inflows, trade and financial liberalization have affected on this process. In this context, we give some of these papers below.

After collapsing Socialism, financial liberalization, trade liberalization, and economic freedom process gained speed in the world (*especially transition countries and generally emerging markets*). Bekaert et al. (2001) provide an analysis of real economic growth prospects in emerging markets after financial liberalizations. He finds across a number of different specifications that financial liberalizations are associated with significant increases in real economic growth. The effect is larger for countries with high education levels. Similarly Levine (2001) finds international financial integration can promote economic development by encouraging improvements in the domestic financial system. Edwards (2001) use a new cross-country data set to investigate the effects of capital mobility on economic growth. The paper suggests that an open capital account positively affects growth only after a country has achieved a certain degree of economic development. This provides support to the view that there is an optimal sequencing for capital account liberalization.

Bayar (2002) investigates the effects of foreign trade liberalization of Turkey after 1980 on the productivity of manufacturing industry sectors. Their findings show that, on the basis of the available evidence, there is a positive shift in productivity and a negative shift in manufacturing industry markups after trade liberalization. Moreover, returns to scale is decreased after trade liberalization.

The other paper belongs to Edison et al. (2004), investigate the literature on the effects of capital account liberalization and stock market liberalization on economic growth. They find some support for a positive effect of capital account liberalization on growth, especially for developing countries. Huang (2006) examines the effect of financial openness on the development of financial systems in a panel of 35 emerging markets during the period of 1976 to 2003. Huang find that strong and robust evidence that this link between openness and development exists in stock markets of emerging markets. Khan and Qayyum (2006) empirically investigate the impact of trade and financial liberalization on economic growth in Pakistan using annual observations over the period 1961-2005. Their empirical findings suggest that both trade and financial policies play an important role in enhancing growth in Pakistan in the long-run.

Quinn and Toyoda (2008) test whether capital account liberalization led to higher economic growth using *de jure* measures of capital account and financial current account openness for 94 nations, from 1950 (*or independence*) onward. They find that capital account liberalization had a positive association with growth in both developed and emerging market nations. Besides the paper confirm that equity market liberalization has an independent effect on economic growth. Cakir (2008) examine whether there is any positive relationship between trade liberalization and competitiveness of emerging economies. He find that trade liberalization does improve economic growth which in turn leads to competitiveness.

The other paper was prepared by Smimou and Karabegovic (2010). They examine the relationship between economic freedom index and equity market returns after accounting for a number of control variables. Their evidence shows that changes in economic freedom have a positive impact on equity market returns, which are not explained by business-cycle control variables related to expected returns, and that legal structure and security of property rights have the most significant impact. Gamra and Plihon (2010) examine the reforms (*implemented significant reforms to foster financial liberalization*) that have benefited advanced economies and emerging market economies. They focus on four groups of countries: the G-7, other European countries, Latin America and East Asia over the period 1973–2006. Their main finding is that the benefits of financial liberalization are more important for advanced economies. In contrast, financial liberalization in emerging market economies has a weak positive impact on growth when its scope is limited, whereas full liberalization has been associated with slower economic growth.

Additionally, democracy, institutional system, property rights and bureaucratic quality also play important role in the developing process of emerging markets. Maxfield (1998) explores the impact of financial internationalization on prospects for sustainable democratic developing in non-OECD countries. She concludes by stipulating several hypotheses about the causal link between financial internationalization and social democracy in emerging market countries that are consistent with empirical evidence on the determinants of capital flows.

Chousa et al. (2005) give an alternative empirical approach for evaluation of the institutional system's development in transition economies and the impact it has on economic performance. They suggested an operational indicator of institutional system dynamics to observe the "institutional reforms-economic growth" interdependence in transition economies. Their empirical works reveal certain dependence between institutional development and economic recovery. An application of the approach to the problems of international economic integration of transition economies in the context of EU accession allows assessing the role of democratization and the rule of law in particular. According to the paper of Banerjee et al. (2006) property rights and bureaucratic quality play a significant role in promoting private infrastructure investment in developing countries / emerging markets. Guerin and Manzocchi (2009) investigate the effect of the political regime on bilateral FDI flows from advanced to emerging countries in the period 1992–2004. Their results suggest that democracy does have a positive effect on the amount and probability of FDI flows from developed to emerging countries. Besides they find that the effect of democracy on FDI also works through the total factor productivity channel.

Foreign Direct Investment (FDI) is the most effective factor on the growth rates of emerging markets countries that has developing democracy, financial and commercial liberalization. Hermes and Lensink (2003) argue that the development of the financial system of the recipient country is an important precondition for FDI to have a positive impact on economic growth. According to this paper, of the 67 countries in data set, 37 have a sufficiently developed financial system in order to let FDI contribute positively to economic growth. Most of these countries are in Latin America and Asia. Yao (2006) focuses on the effect of exports and foreign direct investments (FDI) on economic performance, using a large panel data set

encompassing 28 Chinese provinces over the period 1978-2000. Yao find that both exports and FDI have a strong and positive effect on economic growth.

Baharumshah and Almasaied (2009) explore the role of foreign direct investment (*FDI*) in economic growth in Malaysia. Domestic capital formation, FDI, human capital, and financial deepening significantly affect economic growth. FDI has a positive and significant effect on economic growth, but its effect is of lesser magnitude than that of domestic investment. Human capital and financial markets interact with FDI and, thus, are important for both short- and long-term growth processes. The results suggest that it is important to encourage domestic as well as foreign investment to put Malaysia back on its pre-crisis growth path.

Apart from these, we investigate spatial distribution and interaction of emerging market economies in the four continents (*Eurasia, Africa and Australia*) in the way of production and trade. We explain data set, quartile maps and box plots in the next section. In the third section, we look at emerging markets with lens of ESDA (*Exploratory Spatial Data Analysis*)[1]. Finally, we give conclusion remarks in the last section.

2. DATA ANALYSIS

Our data comes from UNDATA (*National Accounts Main Aggregates Database*)[2]. As variable, we use growth rates of agricultural production (*ISIC – A and B*), manufacturing industry production (*ISIC – D*) and trade (*goods - services import and export*) values of 135 countries in the period of 1990-2009. All data are expressed in 2005 constant prices and per capita values.

Although different classifications, we use Dow Jones and Goldman Sachs Investment Bank classification. These institutions accept the following 40 countries as emerging markets: Argentina, Bangladesh, Bahrain, Brazil, Bulgaria, Chile, China, Colombia, Czech Rep., Egypt, Estonia, Hungary, India, Indonesia, Iran, Jordan, Kuwait, Latvia, Lithuania, Malaysia, Mauritius, Mexico, Morocco, Nigeria, Oman, Pakistan, Peru, Philippines, Poland, Qatar, Romania, Russia, Slovakia, South Africa, South Korea, Sri Lanka, Thailand, Turkey, United Arab Emirates, Vietnam. But we exclude America continent countries as Brazil, Argentina, Chile, Colombia, and Mexico. Our first evaluation is about mapping distribution for the period of 1990-2009 in the next section.

2.1. Mapping the Distributions

We start our analysis with the quartile maps of the distribution of our variables for each country. The darker areas indicate a greater level of values. In the contrary, the lighter areas in the maps indicate lower values.

Figure 1-3 displays the distribution of growth rates of agricultural production and manufacturing industry production and trade in the period of 1990-2009. It appears from these maps that the distribution of our variables shows spatial heterogeneity across the four continents.

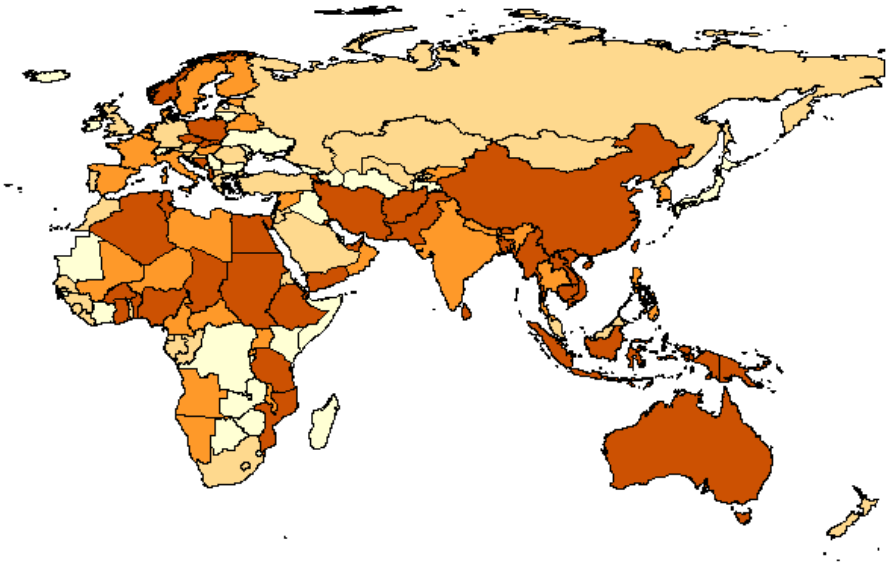

Figure 1: Agricultural Production Growth in the period of 1990-2009

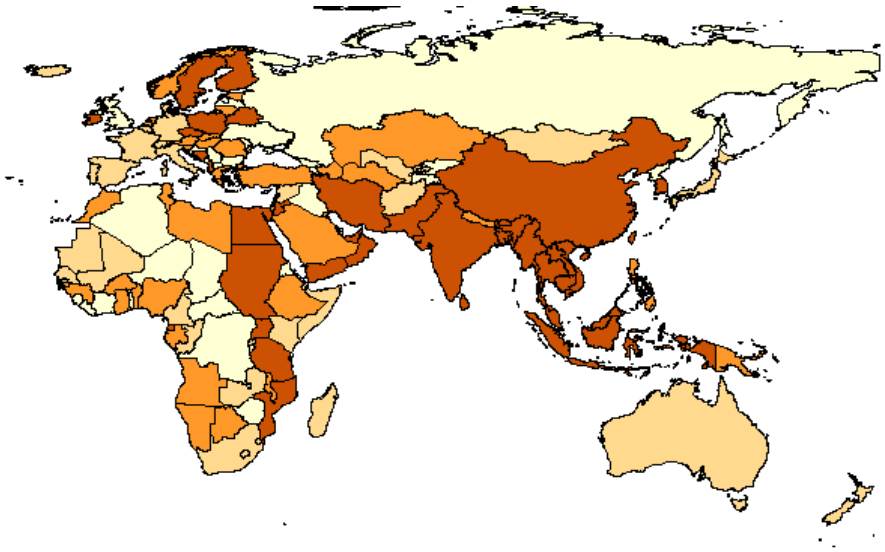

Figure 2: Manufacture Production Growth in the period of 1990-2009

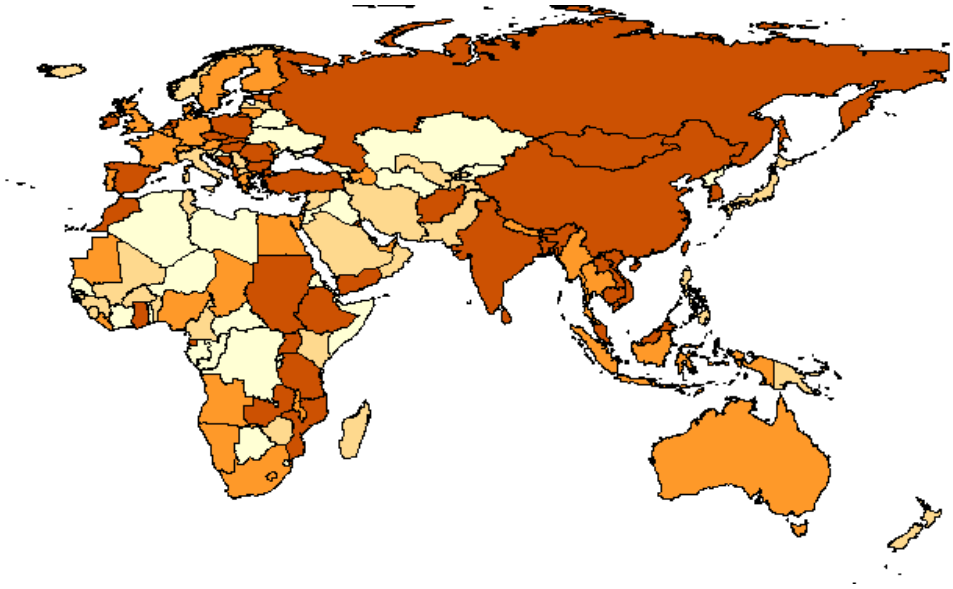

Figure 3: Trade Growth in the period of 1990-2009 Box Plots

The box plot is another tool of ESDA. Designed by John Tukey (1977), box plots display five interesting pieces of information about a dataset: the lowest value, the lower quartile of the distribution (*25 % of the cumulative distribution, noted Q1*), the median (*Q2*) the upper quartile (*75 % of the cumulative distribution, noted Q3*), and the highest value. The median is represented by the line in the center of the rectangular box. In addition, a box plot display the outliers which are defined as the values above or below a given multiple (*either 1.5 or 3 by GeoDa*) of the difference between the first and third quartile. For instance, a lower outlier corresponds to a value below [Q1 – 1.5*(Q3-Q1)] and an upper outlier is defined as a value above [Q3+1.5*(Q3-Q1)]. The thin line on the upper part of box plots is called the hinge, here corresponding to the default criteria of 1.5 times the difference between the first and third quartile (Thompson 2003). This tool has been commonly used in exploratory data analysis (*see, for instance, Chambers et al., 1983; Leinhardt and Leinhardt, 1980*).

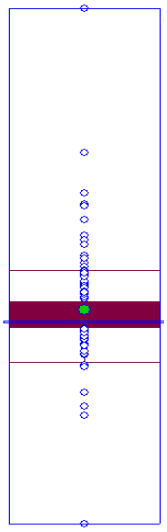

Figure: 4
Agricultural Production Growth

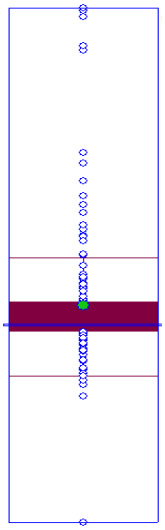

Figure: 5
Manufacturing Production Growth

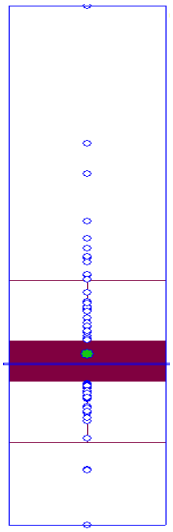

Figure: 6
Trade Growth

Agricultures	Manufacturing Industry	Trade
Myanmar, China, Georgia, Vietnam, Moldova, Latvia, Cambodia, Zimbabwe, Papua New Guinea, Nigeria, Bulgaria, Indonesia, Singapore.	Myanmar, China, Cambodia, Vietnam, Zimbabwe, Niger, Singapore, South Korea, India, Laos, Bhutan, Congo DRC, Thailand, Bangladesh, Indonesia, Malaysia.	Cambodia, China, Vietnam, South Korea, India, Laos, Bhutan, Somalia, Congo DRC, Iraq.

The highest values are given above (*in figure 4-6*). We understand from these figures that emerging markets in Asia-Pacific region have high values in terms of each variable in the period of 1990-2009.

Quartile maps and box plots are useful tools to get some insights into the distribution of a variable. However, they do not formally test whether the spatial distribution of a variable is random or not. For instance, the distribution of agricultural production growth, manufacturing industry production growth and trade growth across countries is marked by two distinct clusters as can be seen from figures 1 and 6 above. This observation needs to be tested by the formal tools of Exploratory Spatial Data Analysis. It starts with the definition of a spatial weight matrix and continues with the measurement of spatial autocorrelation.

2.2. Exploratory Spatial Data Analysis

2.2.1. Spatial Weight Matrix

A spatial weight matrix is the necessary tool to impose a neighborhood structure on a spatial dataset. In Geoda[3], neighbors are defined by a binary relationship (*0 for non-neighbors, 1 for neighbors*). There are two basic approaches to define neighborhood: contiguity (*shared borders*) and distance. Contiguity-based weights matrices include rook and queen. Areas are neighbors under the rook criterion if they share a common border, not vertices. Distance-based weights matrices include distance bands and k nearest neighbors. We decided to create a weight matrix to investigate the distribution of our variables of interest: distance (*1000 mile*), k_13, k_14 and k_15 nearest neighbor matrix. Due to space constraints, we give the k_13 nearest neighbor matrix only below:

$$\begin{cases} w_{ij}(k)=0 \; if \; i=j \\ w_{ij}(k)=1 if \; d_{ij} \le D_i(k) \; and \; \overset{*}{w}_{ij}(k)=w_{ij}(k)/\sum_j w_{ij}(k) \; for \; k=13 \\ w_{ij}(k)=0 \; if \; d_{ij} > D_i(k) \end{cases} \qquad (1)$$

where d_{ij} is great circle distance between centroids of region i and j and $D_i(k)$ is the 13th order smallest distance between regions i and j such that each region i has exactly 13 neighbors. Now that the weight matrix has been defined, we estimate a couple of spatial statistics that will shed some light on the spatial distribution of our variables. The most common of them is Moran's I which is a measure of global spatial autocorrelation (Anselin 1988).

2.2.2. Moran's I for Global Spatial Autocorrelation

Spatial autocorrelation refers to the correlation of a variable with itself in space. It can be positive (*when high values correlate with high neighboring values or when values correlate with neighboring low values low*) or negative (*spatial outliers for high-low or low-high values*). Note that positive spatial autocorrelation can be associated with a small negative value (*e.g., -0.01*) since the mean in finite samples is not centered on 1. Spatial autocorrelation analysis includes tests and visualization of both global (*test for clustering*) and local (*test for clusters*) Moran's I statistic (Anselin et al. 2006).

Global spatial autocorrelation is a measure of overall clustering and it is measured here by Moran's I. It captures the extent of overall clustering that exists in a dataset. It is assessed by means of a test of the null hypothesis of random location. Rejection of this null hypothesis suggests a spatial pattern or spatial structure, which provides more insights about a data distribution that what a quartile map or box plot does. For each variable, it measures the degree of linear association between its value at one location and the spatially weighted average of neighboring values (Anselin et al. 2007; Anselin 1995) and is formulated as follows:

$$I_t = \frac{\sum_{i=1}^{n}\sum_{j=1}^{n} \overset{*}{w}_{ij}(k)\, x_{it} x_{jt}}{\sum_{i=1}^{n}\sum_{j=1}^{n} x_{it} x_{jt}} \qquad (2)$$

Where $\overset{*}{w}_{ij}$ is the (*row-standardized*) degree of connection between the spatial units i and j and x_{ij} is the variable of interest in region i at year t (*measured as a deviation from the mean value for that ye*ar). Values of I larger (*smaller*) than the expected value $E(I) = -1/(n-1)$ indicate positive (*negative*) spatial autocorrelation. In our study, this value is *(-0.0074*). There are different ways to draw inference here. The approach we use is a permutation approach with 999 permutations. It means that 999 re-sampled datasets were automatically created for which the I statistics are computed. The value obtained for the actual dataset has then been compared to the empirical distribution obtained from these re-sampled datasets.

The results of Moran's I are given in table 1 below. All the results indicate a positive spatial autocorrelation, i.e. the value of a variable in one location depends positively and significantly (*p-values are into brackets*) on the value of the same variable in neighboring locations. For instance, when the trade growth rate in one country increases by 1%, the one of its neighbors increases, on average, by slightly more than 0.35%. All variables of interest are significant (*at 1%*) with the k_13 nearest neighbor matrix. For this reason, this is the weight matrix we will use in the rest of our study.

Table 1: Moran's I and P-Value

Variables	K_13	K_14	K_15	D_1000
Agricultural Production Growth Rate (1990-2009)	0.2309 (0.001)	0.2178 (0.001)	0.2064 (0.001)	0.0560 (0.001)
Manufacturing Industry Production Growth Rate (1990-2009)	0.3648 (0.001)	0.3607 (0.001)	0.3524 (0.001)	0.0135 (0.001)
Trade Growth Rate (1990-2009)	0.3502 (0.001)	0.3456 (0.001)	0.3351 (0.001)	0.0725 (0.001)

2.2.3. Moran's Scatter Plot for Global and Local Spatial Autocorrelation

The Moran scatter plot often complements Moran's I because it provides an easy way to categorize the nature of spatial autocorrelation into four types: low–low (*noted LL*), low–high (*LH*), high–low (*HL*), and high–high (*HH*). The *x*-axis captures the value of a variable compared to the average value of the sample. For instance, all the points on the right-hand side of the figure mean (*the vertical axis in the middle*) that in the corresponding provinces, the value of the variable under study was above the sample's The result of this approach is a figure with four windows which reflect the correlation between the relative (*to the mean*) value of a variable in one location and the relative value of the same variable in neighboring locations. For instance, the quadrant HH means a high value in the studied area and a high value in the neighboring areas. Regions located in quadrants I and III refer to positive spatial autocorrelation, i.e., the spatial clustering of similar values, whereas quadrants II and IV represent negative spatial autocorrelation, i.e., the spatial clustering of dissimilar values. Note also that the link between a scatter plot and Moran's I is reflected by a line of which slope is the value of Moran's I statistic.

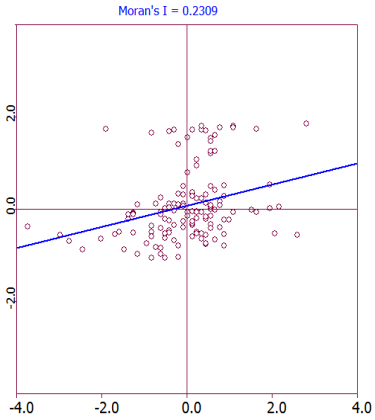

Figure 7: Agricultural Production Growth

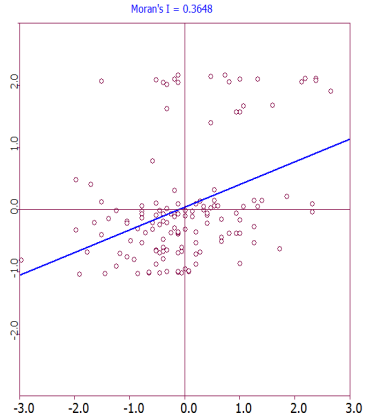

Figure 8: Manufacturing Industry Production Growth

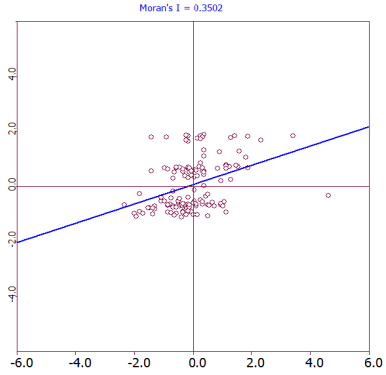

Figure 9: Trade Growth

Table 2 indicates the names of the countries according to their distribution in the Moran scatterplot quadrants. Positive global spatial autocorrelation is reflected by the fact that most provinces are in the high-high and low-low quadrants. General, as we see that Asia Pacific (*such as China, India, Sri Lanka, S. Korea, Singapore, Indonesia, Malaysia, Thailand, Pakistan, Bangladesh and Vietnam*) and Eastern European (*such as Czech R., Hungary, Poland, Slovakia, Estonia, Lithuania, Romania and Bulgaria*) emerging markets countries are high-high quadrant.

Table 2: Distribution of Global Spatial Autocorrelation

	HH	LL	LH	HL
Agricultural Production Growth Rate period of 1990-2009	Ghana, Burkina Faso, Mali, Gambia, Sudan, **Russia**, Cameroon, Central African R., Tunisia, Benin, Chad, Niger, **Nigeria**, Bosnia and H., Italy, **Czech R.**, **India**, **Sri Lanka**, Afghanistan, Kyrgyzstan, Nepal, **Pakistan**, **Bangladesh**, Bhutan, Brunei, **China**, **Philippines**, **S. Korea**, Cambodia, Myanmar, **Thailand**, **Vietnam**, New Zealand, **Indonesia**, Australia, Papua New Guinea	Iceland, Ireland, UK, Morocco, Portugal, Iraq, Israel, **Jordan**, Kazakhstan, Croatia, **Bulgaria**, Cyprus, Georgia, Greece, **Turkey**, Luxemburg, Switzerland, **Latvia**, **Lithuania**, Moldova, **Romania**, Ukraine, Somalia, Turkmenistan, Uzbekistan, Azerbaijan, **Qatar**, Saudi Arabia, Botswana, Burundi, Kenya, Zambia, Zimbabwe, Lesotho, **South Africa**, Swaziland, Congo DRC., Madagascar, Montenegro, Serbia	Cote d'Ivoire, Liberia, Guinea, Guinea-Bissau, Mauritania, Senegal, Sierra Leone, Mongolia, Equatorial Guinea, Togo, Malta, Austria, Slovenia, Germany, Tajikistan, Japan, N. Korea, **Malaysia**, **Singapore**, Congo, Gabon	Spain, Djibouti, Eritrea, Ethiopia, Uganda, Norway, Sweden, Algeria, Libya, Albania, Macedonia, **Egypt**, Lebanon, Syria, Denmark, **Hungary**, **Poland**, **Slovakia**, Belgium, France, Belarus, **Estonia**, Finland, **Oman**, Yemen, Armenia, **Bahrain**, **Iran**, **Kuwait, Uni. Arab Em.**, Rwanda, Tanzania, Malawi, Mozambique, Angola, Namibia, Netherlands
Manufacturing Industry Production Growth Rate period of 1990-2009	Sweden, Austria, **Czech R.**, **Hungary**, **Poland**, **Slovakia**, Slovenia, **Estonia**, Finland, **Lithuania**, **Romania**, **India**, **Oman**, **Sri Lanka**, Yemen, **Bahrain**, **Kuwait**, Saudi Arabia, **Uni. Arab Em.**, Nepal, **Pakistan**, **Bangladesh**, Bhutan, **China**, **S. Korea**, Cambodia, Laos, **Malaysia**, Myanmar, **Singapore**, **Thailand**, **Vietnam**, **Indonesia**	Iceland, UK, Cote d'Ivoire, Liberia, Portugal, Spain, Guinea, Guinea Bissau, Mali, Mauritania, Senegal, Sierra Leone, Gambia, Iraq, Israel, Algeria, Cameroon, Central African R., Libya, Benin, Chad, Niger, Togo, Macedonia, Malta, **Bulgaria,** Cyprus, Georgia, Greece, Syria, Belgium, France, Luxemburg, Switzerland, Moldova, Ukraine, Botswana, Burundi, Kenya, Rwanda, Zambia, Zimbabwe, Malawi, **S. Africa**, Swaziland, Congo, Congo DRC, Madagascar, Netherlands	Djibouti, Eritrea, Mongolia, **Russia**, Croatia, Italy, Denmark, Germany, **Latvia**, Somalia, Uzbekistan, Armenia, **Qatar**, Afghanistan, Kyrgyzstan, Tajikistan, Brunei, Japan, N. Korea, **Philippines**, New Zealand, Australia, Papua New Guinea, Serbia	Ireland, Ghana, Burkina Faso, Ethiopia, Sudan, Uganda, Jordan, Kazakhstan, Tunisia, Equatorial Guinea, **Nigeria**, Albania, Bosnia and H., Egypt, Lebanon, **Turkey**, Belarus, Turkmenistan, Azerbaijan, **Iran**, Tanzania, Lesotho, Mozambique, Angola, Gabon, Namibia
Trade Growth Rate period of 1990-2009	Ireland, UK, Spain, Mongolia, **Russia**, Sweden, Albania, Bosnia and H., **Bulgaria**, Greece, Austria, **Czech R.**, Denmark, **Hungary**, **Poland**, **Slovakia**, Germany, Luxemburg, **Estonia**, Finland, **Romania**, **India, Sri Lanka**, Nepal, **Bangladesh**, Bhutan, **China**, **S. Korea**, Cambodia, Laos, **Malaysia**, Myanmar, **Singapore**, **Thailand**, **Vietnam**, **Indonesia**, Australia, Netherlands	Cote d'Ivoire, Burkina Faso, Guinea, Guinea-Bissau, Mali, Mauritania, Senegal, Sierra Leone, Gambia, Djibouti, Eritrea, Iraq, Israel, **Jordan**, Kazakhstan, Algeria, Cameroon, Central African R., Benin, Niger, Togo, Cyprus, **Egypt**, Lebanon, Syria, **Oman**, Somalia, Turkmenistan, Uzbekistan, Armenia, Azerbaijan, **Bahrain**, **Iran**, **Qatar**, Saudi Arabia, Kyrgyzstan, **Pakistan**, Tajikistan, Burundi, Kenya, Rwanda, Zimbabwe, **S. Africa**, Swaziland, Congo, Congo DRC., Gabon, Namibia, Madagascar	Iceland, Norway, Libya, Tunisia, Croatia, Italy, Macedonia, Malta, Slovenia, Belgium, France, Switzerland, Belarus, **Latvia**, **Lithuania**, Moldova, Ukraine, Brunei, Japan, N. Korea, **Philippines**, New Zealand, Papua New Guinea, Montenegro, Serbia	Ghana, Liberia, Portugal, Ethiopia, Sudan, Uganda, Chad, Equatorial Guinea, **Nigeria**, **Turkey**, Yemen, **Kuwait**, **Unit. Arab Em.**, Afghanistan, Tanzania, Zambia, Lesotho, Malawi, Mozambique, Angola

2.2.4. LISA Statistics for Local Spatial Autocorrelation

Moran's I values give global spatial approaches, but can't explain local spatial association. Therefore to explain situation of local spatial association we need LISA statistics. LISA statistics (*Local Indicators of Spatial Association*) measure the presence of spatial autocorrelation for each of the location of our sample. It captures the presence or absence of significant spatial clusters or outliers for each location. Combined with the classification into four types defined in the Moran scatter plot above, LISA indicates significant local clusters (*high–high or low–low*) or local spatial outliers (*high–low or low–high*). The average of the Local Moran statistics is proportional to the Global Moran's I value (Anselin, 1995; Anselin *et al.,* 2007).

Anselin (1995) formulated the local Moran's statistics for each region i and year t as follows:

$$I_i = \left(\frac{x_i}{m_0} \right) \sum_j w_{ij} x_j \quad with \;\; m_0 = \sum_i x_i^2 / n \qquad (3)$$

where w_{ij} is the elements of the weights matrix W and $x_i(x_j)$ is the observation in region $i\,(j)$. The significant results (*at 5%*) of the LISA statistics are given in appendix. Their significance level is based on a randomization approach with 999 permutations of the neighboring provinces for each observation.

Table 3: Countries with Significant LISA Statistics at 5% (*with spatial weight matrix k_13 nearest neighbors*)

Country	Agricultural Production Growth Rate 1990-2009	Manufacturing Industry Production Growth Rate 1990-2009	Trade Growth Rate 1990-2009	Country	Agricultural Production Growth Rate 1990-2009	Manufacturing Industry Production Growth Rate 1990-2009	Trade Growth Rate 1990-2009
Afghanistan			HL	E. Guinea			
Albania				Eritrea			
Algeria				Estonia			
Angola		HL		Ethiopia			HL
Armenia			LL	Finland			
Australia		LH		France			
Austria				Gabon		HL	
Azerbaijan			HL	Georgia			
Bahrain				Germany			
Bangladesh	HH			Ghana			
Belarus	HL			Greece			
Belgium				Guinea		LL	
Benin				Guinea-Bis.		LL	
Bhutan	HH	HH	HH	Hungary			HH
Bosnia & H.				Iceland			
Botswana				India	HH	HH	HH
Brunei				Indonesia	HH	HH	HH
Bulgaria				Iran			LL
Burkina Faso		HL		Iraq			LL
Burundi				Ireland			
Cambodia	HH	HH	HH	Israel			
Cameroon		LL		Italy			
C. African R.				Japan	LH	LH	LH
Chad				Jordan			
China	HH	HH	HH	Kazakhstan			LL
Congo				Kenya			
Congo, DRC				Kuwait			
Cote d'Ivoire		LL		Kyrgyzstan		LH	
Croatia			LH	Laos	HH	HH	HH
Cyprus				Latvia			
Czech Rep				Lebanon			
Denmark			HH	Lesotho			
Djibouti				Liberia		LL	
Egypt				Libya			

Table 3 continued

Country	Agricultural Production Growth Rate 1990-2009	Manufacturing industry Production Growth Rate 1990-2009	Trade Growth Rate 1990-2009	Country	Agricultural Production Growth Rate 1990-2009	Manufacturing industry Production Growth Rate 1990-2009	Trade Growth Rate 1990-2009
Lithuania				Senegal		LL	
Luxembourg				Serbia			LH
Macedonia				Sierra Leone		LL	
Madagascar				Singapore	LH	HH	HH
Malawi				Slovakia			HH
Malaysia	LH	HH	HH	Slovenia			LH
Mali		LL	LL	Somalia			
Malta				South Africa			
Mauritania		LL		South Korea	HH	HH	HH
Moldova				Spain			
Mongolia	LH	LH	HH	Sri Lanka			
Montenegro				Sudan			HL
Morocco				Swaziland			
Mozambique	HL	HL	HL	Sweden			
Myanmar	HH	HH	HH	Switzerland			
Namibia				Syria			LL
Nepal	HH	HH	HH	Tajikistan			
Netherlands				Tanzania			
New Zealand		LH	LH	Thailand	HH	HH	HH
Niger	HH			The Gambia			
Nigeria		HL		Togo			
North Korea	LH	LH	LH	Tunisia			
Norway				Turkey	LL	HL	
Oman			LL	Turkmenistan			LL
Pakistan				Uganda		HL	HL
Papua N. G.		LH	LH	Ukraine	LL		
Philippines	HH	LH	LH	United Arab Em.			
Poland				United Kingdom			
Portugal				Uzbekistan			LL
Qatar				Vietnam	HH	HH	HH
Romania				Yemen			
Russia				Zambia			
Rwanda				Zimbabwe			
Saudi Arabia			LL				

The randomization approach is used in the context of a numeric permutation approach to describe the computation of pseudo significance levels for global and local spatial autocorrelation statistics. In order to determine how likely it would be to observe the actual spatial distribution at hand, the actual values are randomly reshuffled over space 999 times. Table 3 point out that some emerging market economies (*China, India, Indonesia, Malaysia, Singapore, Thailand, South Korea and Vietnam*) have HH-type autocorrelation in the way of agricultural production growth rate, manufacturing industry production growth rate and trade growth rate. Following the results displayed in table 3, we also provide the LISA maps (*figures 10 to 12*) as a visual representation of these results.

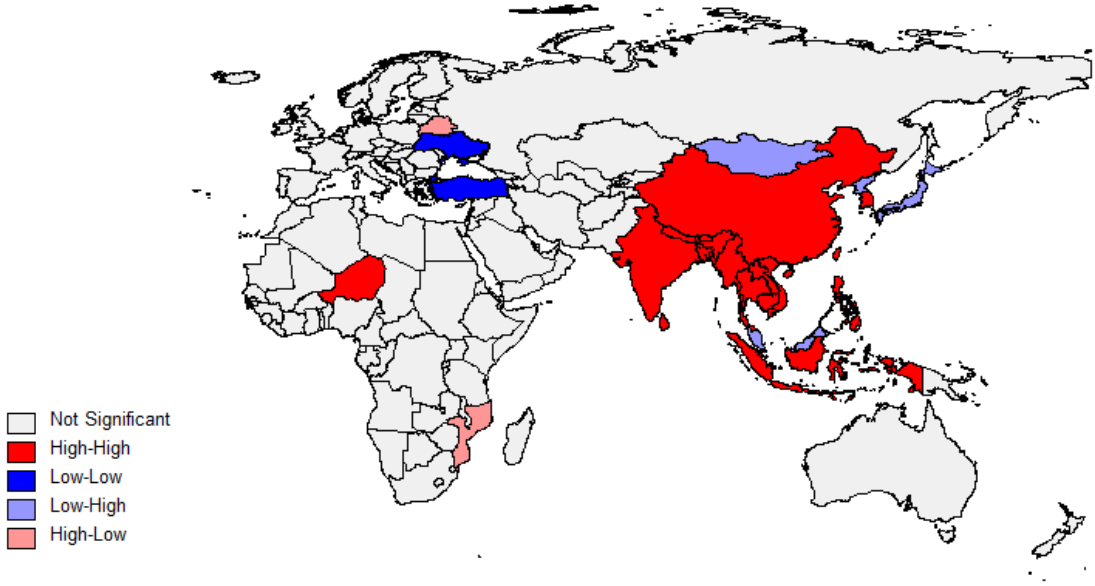

Figure 10: Cluster Map for Agricultural Production Growth Rate 1990-2009

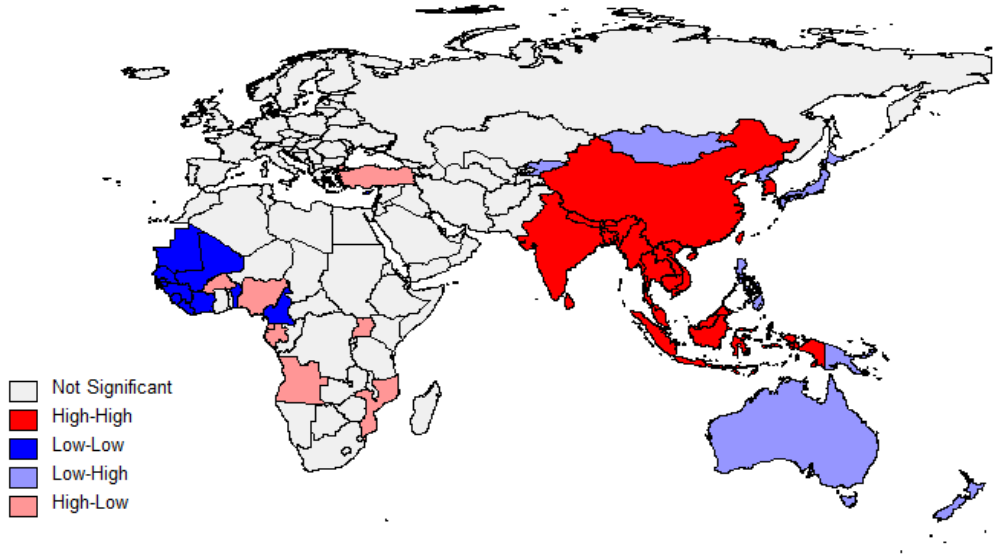

Figure 11: Cluster Map for Manufacturing Industry Production Growth Rate 1990-2009

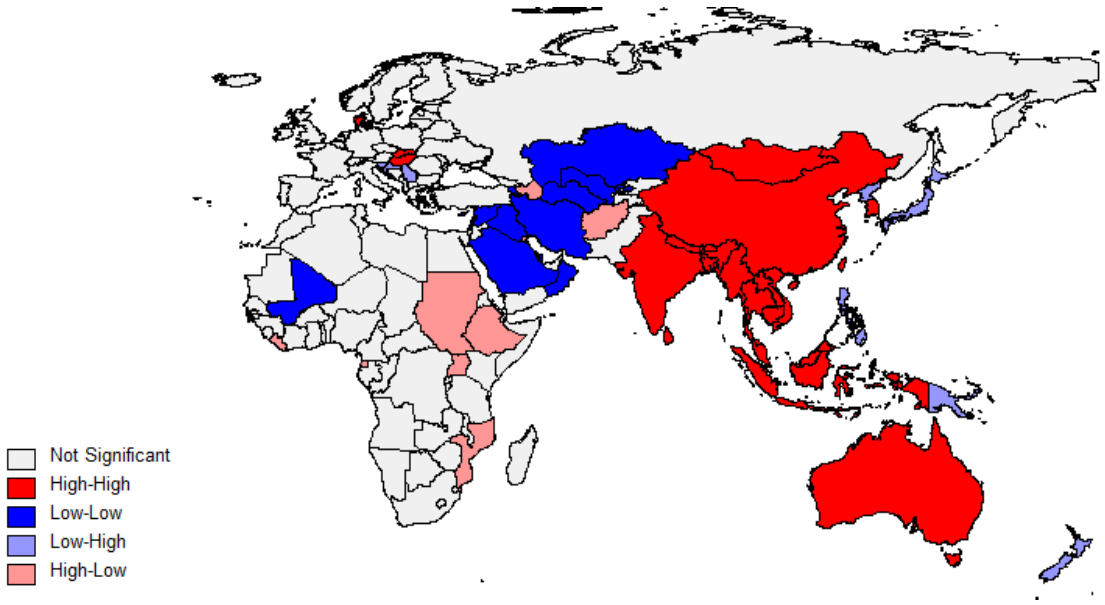

Figure 12: Cluster Map for Trade Growth Rate 1990-2009

3. CONCLUSIONS

Many economists have investigated reasons of rapid growth process of emerging markets in scope of politic and economic reforms in the recent years. Many factors as democracy, FDI inflows, trade and financial liberalization have affected on this process.

Our first analysis is the quartile maps of the distribution of our variables for each country. Figures display the distribution of growth rates of agricultural production, manufacturing industry production and trade over 1990-2009. It appears from these maps that the distribution of our variables shows spatial heterogeneity across the four continents. Box plots figures show that emerging markets countries in Asia-Pacific region have higher values in terms of each variable over 1990-2009.

All variables of interest are significant (*at 1%*) with the k_13 nearest neighbor matrix. The results of Global (*Moran's I*) and Local Spatial Autocorrelation (*LISA*) analysis indicate positively and significantly a positive global and local spatial autocorrelation.

According to Moran scatterplot quadrants, Asia Pacific (*such as China, India, Sri Lanka, S. Korea, Singapore, Indonesia, Malaysia, Thailand, Pakistan, Bangladesh and Vietnam*) and Eastern European (*such as Czech R., Hungary, Poland, Slovakia, Estonia, Lithuania, Romania and Bulgaria*) emerging markets countries are high-high quadrant.

When our results are evaluated in terms of global spatial autocorrelation, we see that HH quadrant consist of mostly emerging market countries for each variable. Besides when we look at the LISA analysis, we can say that especially Asia – Pacific countries as China,India, Indonesia, Malaysia, Singapore, Thailand, South Korea and Vietname, become prominent in the recent years. Among these countries there is spatial interaction in the way of agricultural production manufacturing industry production and trade growth rates.

Finaly, Asia-Pacific countries have over production and over trade in the period of 1990-2009 vis-à-vis the other emerging market countries. As a result, this region is the making of new production and trade center of the world.

Notes

1. Some of the studies with the ESDA technique: Rey and Montouri (1999), Ying (2000), Manfred et al. (2001), Le Gallo and Ertur (2003), Perobelli and Haddad (2003), Van Oort and Artezema (2004), Dall'erba (2005), Ye and Wei (2005), Voss et al. (2006), Gezici and Hewings (2007), Ezcurra et al. (2007), Ezcurra et al. (2008) Battisti and Di Vaio (2008), Jing and Cai (2009), Celebioglu and Dall'erba (2010).

2. http://unstats.un.org/unsd/snaama/dnlList.asp.

3. In this study we have used GeoDa that is a software package which conducts spatial data analysis, geovisualization, spatial autocorrelation and spatial modeling.

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Appendix 1: Countries

Afghanistan	Equatorial Guinea	Lithuania	Senegal
Albania	Eritrea	Luxembourg	Serbia
Algeria	Estonia	Macedonia	Sierra Leone
Angola	Ethiopia	Madagascar	Singapore
Armenia	Finland	Malawi	Slovakia
Australia	France	Malaysia	Slovenia
Austria	Gabon	Mali	Somalia
Azerbaijan	Georgia	Malta	South Africa
Bahrain	Germany	Mauritania	South Korea
Bangladesh	Ghana	Moldova	Spain
Belarus	Greece	Mongolia	Sri Lanka
Belgium	Guinea	Montenegro	Sudan
Benin	Guinea-Bissau	Morocco	Swaziland
Bhutan	Hungary	Mozambique	Sweden
Bosnia & Herzegovina	Iceland	Myanmar	Switzerland
Botswana	India	Namibia	Syria
Brunei	Indonesia	Nepal	Tajikistan
Bulgaria	Iran	Netherlands	Tanzania
Burkina Faso	Iraq	New Zealand	Thailand
Burundi	Ireland	Niger	The Gambia
Cambodia	Israel	Nigeria	Togo
Cameroon	Italy	North Korea	Tunisia
Central African Republic	Japan	Norway	Turkey
Chad	Jordan	Oman	Turkmenistan
China	Kazakhstan	Pakistan	Uganda
Congo	Kenya	Papua New Guinea	Ukraine
Congo, DRC	Kuwait	Philippines	United Arab Emirates
Cote d'Ivoire	Kyrgyzstan	Poland	United Kingdom
Croatia	Laos	Portugal	Uzbekistan
Cyprus	Latvia	Qatar	Vietnam
Czech Republic	Lebanon	Romania	Yemen
Denmark	Lesotho	Russia	Zambia
Djibouti	Liberia	Rwanda	Zimbabwe
Egypt	Libya	Saudi Arabia	

Appendix 2:

ISIC Rev.3 (*International Standard Manufacturing industry Classification of All Economic Activities, Rev.3*)

- A - Agriculture, hunting and forestry
  - 01 - Agriculture, hunting and related service activities
  - 02 - Forestry, logging and related service activities
- B - Fishing
  - 05 - Fishing, operation of fish hatcheries and fish farms; service activities incidental to fishing
- D - Manufacturing

- 15 - Manufacture of food products and beverages
- 16 - Manufacture of tobacco products
- 17 - Manufacture of textiles
- 18 - Manufacture of wearing apparel; dressing and dyeing of fur
- 19 - Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear
- 20 - Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials
- 21 - Manufacture of paper and paper products
- 22 - Publishing, printing and reproduction of recorded media
- 23 - Manufacture of coke, refined petroleum products and nuclear fuel
- 24 - Manufacture of chemicals and chemical products
- 25 - Manufacture of rubber and plastics products
- 26 - Manufacture of other non-metallic mineral products
- 27 - Manufacture of basic metals
- 28 - Manufacture of fabricated metal products, except machinery and equipment
- 29 - Manufacture of machinery and equipment n.e.c.
- 30 - Manufacture of office, accounting and computing machinery
- 31 - Manufacture of electrical machinery and apparatus n.e.c.
- 32 - Manufacture of radio, television and communication equipment and apparatus
- 33 - Manufacture of medical, precision and optical instruments, watches and clocks
- 34 - Manufacture of motor vehicles, trailers and semi-trailers
- 35 - Manufacture of other transport equipment
- 36 - Manufacture of furniture; manufacturing n.e.c.
- 37 - Recycling