SPATIAL AGGLOMERATIONS OF TWO-DIGIT MANUFACTURING INDUSTRIES WITHIN AND ACROSS VIETNAMESE LOCATIONS

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ABSTRACT:
The paper aims to investigate the geographic employment distribution and the industrial concentration of two-digit manufacturing industries in 2010 among provinces and the main five municipalities in Vietnam using discrete and continuous-space statistics. The evidence shows that Vietnam was characterized by high inequality in terms of employment concentration where the strength flows of dwellers' migration towards more developed areas reinforced the disparity. It is notable that few locations led the country's economic growth such as Hanoi, Ho Chi Minh, Dang Nang, Long An, Binh Duong and Dong Nai. Besides this imbalance, an agglomeration bell emerged around Ho Chi Minh favouring a regional integration. Furthermore, the research shows a relative high concentration of low technology intensity industries, whereas medium-high and high technology intensity industries have a relative low employment concentration in Vietnam in 2010. This could be explained as the difficulties of those industries to recruit suitable skilled workers as low trained labour forces characterized the country, which does not favour business localization and start-up.

JEL Classification: R11, R12, C21

Key words: economic agglomeration, discrete and continuous-space, autocorrelation, Vietnam.

1 INTRODUCTION

Vietnam as one of the most dynamic emerging countries in the South-East Asia and it has witnessed a rapid economic growth in the last twenty years. The Vietnamese's GDP constantly grew with an average of 7% between 2000 and 2012 (World Bank & Donor

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Working Group, December 06, 2011). Vietnam is densely populated and it is characterized by abundant workforce, which favours the establishments of labour-intensive industries (UNIDO & MPI, 2012). Moreover, the number of total enterprises in Vietnam grew more than 150% between 2005 and 2010 and the inward FDI largely grew more than 200% between 2005 and 2010, of which more than 85% within the manufacturing industry (General Statistics Office, 2011). This increase was mainly due to the reduction of barriers to foreign direct investment as Vietnam became a member of WTO in 2007. Despite these favourable economic conditions, there is little academic attention to Vietnamese economic geography with particular reference to the country's agglomeration and industrial concentration (Ishizuka, 2010). Therefore, this research aims to fulfil this empirical gap investigating the economic agglomeration and the concentration of two-digit manufacturing industries in 2010 among Vietnamese provinces and the five main municipalities. Therefore, the discrete and continuous-spatial statistics will be employed such as the location quotient, locational Gini, the Moran's *I* index, the Moran scatterplots and LISA statistics, in order to unfold the employment agglomeration and identify spatial clusters within and between Vietnamese locations in 2010.

This research highlights that Vietnam was characterized by high inequalities in terms of employment concentration where the migration flows among locations fostered the polarization especially towards urban centres and more developed areas. The Red River Delta and the South East held 70% of the total country's employment in 2010. This inequality became more evident within provinces and cities, for instance, Hanoi, Ho Chi Minh (hereafter HCM), Dang Nang, Long An, Binh Duong and Dong Nai held more than 50% of the total country's employment, foreign direct investments, and value added. As a result, few locations in Vietnam led the economic development and this polarization inevitably created socio-economic asymmetry among locations. Besides this imbalance, it is notable that an agglomeration cluster around the core business center (HCM) emerged in the South of Vietnam in 2010. This could be explainable as the favorable economic externalities in HCM fostered the economic growth of its surrounding regions such as Dong Nai, Long An and Binh Duong provinces and also because economic agglomerations may be sprawled in more than one administrative units. The high value of employment concentration in the South might promote regional integration. Furthermore, evidence shows that Vietnam was characterized by the concentration of low technology intensity industries such as manufacture of wearing apparel, the manufacture of leather and related products, and the manufacture of

food products. In addition, the resource-intensive industries had a relative high concentration of employment, for instance, the manufacture of other non-metallic mineral products, manufacture of coke and refined petroleum products, and manufacture of tobacco product. By contrast, medium-high and high technology intensity industries showed a relative low concentration of employment such as manufacture of chemicals and chemical products, manufacture of computer, electronic and optical products.

This paper is divided in five sections. First of all the literature background will be examined based on economic agglomeration forces, and a-spatial and spatial statistics in order to employed them empirically in Vietnam in 2010. Afterwards, the data collected will be described and the research's results will be discussed based on employment agglomeration and autocorrelation, and the industrial concentration of two-digit manufacturing industries in Vietnam in 2010. Finally, conclusions and addresses for further research will be also provided.

2 LITERATURE BACKGROUND

It is possible to identify two macro determinants within the literature, which influence the distribution of economic activity: the first nature and the second nature. The former is related to the physical landscape (i.e. climate, access to sea), the presence of natural resources, infrastructure development, among others factors. The later mainly refers to pecuniary externalities and technological externalities, which are generated by human actions and economic incentives. The first nature and the second nature are highly interdependent as their interaction modifies themself. In other words, the first nature influences the second nature and vice versa (Ottaviano & Thisse, 2003). Ellison and Glaeser (1999) argue that the presence of competitive natural advantages with a location can explain half of geography colocalization. Black and Henderson (1998) state that mobility of workers and growth of the city is highly connected to the first nature advantages. Beeson et al. (2001) find that the access to natural communications (i.e. ocean) and produced communications (i.e. railroad), play a paramount role in the city growth as they facilitate trade interconnection to other locations However, the economic agglomeration is not only due to the first nature, as many clusters are less natural resources dependent such as Chicago, which became the central city of the America heartland without any natural competitive advantage (Cronon, 1991, pp. 46-54; Krugman, 1993, p. 129). Therefore, pecuniary externalities need to be taken into account such as migratory flows and input-output linkages. The interaction of these forces causes several cumulative effects

related to backward linkages (demand side) and forward linkages (cost side). However, the economic agglomeration within a location could be generated in absence of labour mobility (Krugman & Venables, 1995; Venables, 1996). Migratory flows and input-output linkages generate the market-size effects, the thick labour market and technological economies, which foster industrialization. However, agents' concentration accrue factor-market competition and product-market competition, which lead deindustrialization. Therefore, positive pecuniary externalities are essential in the genesis and growth of locations in terms of density of economic activities and they can be mainly generated and enforced by the first nature, migratory flows, input-output linkages and technological externalities. The role of knowledge spillovers in the regional innovation and growth is highly accepted among scholars (Karlsson & Manduchi, 2001). However, there is a little agreement among researchers of which externalities, specialized (see, for instance, Glaeser, et al., 1992; Marshall, 1920) or diversified (see, for instance, Bairoch, 1988; Jacobs, 1969), play a predominant role within the regional innovation and growth (Van der Panne, 2004, p. 594).

3 SPATIAL MEASURES

Geographic proximity of agents generates economic externalities fostering agglomeration and dispersion of business activities. Therefore, it is paramount to employ suitable measures to assess the distribution and effects of agent's colocalization. Scholars have developed numerous theoretical and empirical studies (see for instance, Brülhart & Torstensson, 1996; Ellison & Glaeser, 1997; Midelfart-Knarvik et al., 2002) to identify and tested appropriate indicators to measure intra and inter-industries proximity effects. However, there is little agreement among researchers on which indicator and approach captures more appropriately the phenomenon. Most of geographic concentration indices are built based on discrete space (see, for instance, Ellison & Glaeser, 1997; Krugman, 1991a). This approach considers the space-independent based on discrete "states" hypothesis (Krugman, 1991b), which is unrealistic situation. Quah (2002) argues that the geographic space has to be considered continuous due to the spatial dynamism and interaction between economic agglomerations nearby. Several authors proposed a composite measure based on discrete and continuous indices (see, for instance, Guillain & Le Gallo, 2007). In this paper will be proposed a measure based on discrete and continuous spatial distribution employing the locations quotient to assess the employment concentration within the provinces and five municipalities in Vietnam in 2010. Whereas, the global Moran's *I*, the Moran scatterplots and LISA statistics will be used to identify the significant autocorrelated spatial clusters in the

country. Furthermore, the locational Gini coefficient will be used to unfold the industrial concentration of two-digit manufacturing industries in Vietnam in 2010.

3.1 DISCRETE-SPACE MEASURES

The location quotient (LQ) measures the locational ratio of a variable of interest within a focal region with respect to the aggregation of the same variable. It can be used to measure the absolute concentration of a certain variable (i.e. employment, output, among other vectors) in relation to a given scale (i.e. sector, region, among others parameters). Below, LQ of industrial employment concentration will be exposed as defined by Kim (1995):

$$LQ_{r,i} = \frac{s_i}{x_i} = \frac{e_{r,i} / \sum_i e_{r,i}}{\sum_r e_{r,i} / \sum_i \sum_r e_{r,i}} \quad (1)$$

where s_i denotes the share of employment e in sector r in region i with respect to the total employment in the same sector r, whereas x_i indicates the ratio of regional employment e with respect to the total employment of all regions. Generally, scholars assume that a location is specialized when $LQ > 1$, otherwise the employment with industry r spread around regions. However, there is not agreement among researchers when LQ's value denotes a specialized location. In this paper, LQ will be computed to calculate the agglomeration of employment by provinces and five municipalities in Vietnam in 2010 and it will be also use to compute the univariate global and local Moran's *I*, and the locational Gini coefficient of inequality.

The locational Gini coefficient (see, for instance, Krugman, 1991a) measures the relative concentration of a variable of interest within a location in comparison to the level of the same vector in other locations. There are numerous versions of locational Gini coefficients, in this paper will be employed the equation proposed by Kim et al. (2000) defined as:

$$Gini = \frac{\Delta}{4\bar{\mu}_x} \quad (2)$$

where the numerator is $\Delta = \frac{1}{n(n-1)} \sum_i \sum_j \left| x_i - x_j \right|$, $x_{i(j)}$ denotes the $LQ_{r,i(j)}$. The provinces are

indicated by i and j where $i \neq j$, and n refers to the number of observations. Whereas the denominator denotes 4 times the mean of x, which is the variable of interest. This version of Gini can assume values between 0 and 0.5. The former indicates that the distribution of the variable of interest is symmetrical between locations, whereas the latter denotes the maximum concentration. The Gini coefficient will be employed in order to unfold the concentration of two-digit manufacturing industries among Vietnamese provinces and the five main municipalities.

3.2 CONTINUOUS-SPACE MEASURES

The discrete-space indices do not capture in a meaningful way the agglomeration phenomenon, in particular because they consider the unit as isolated (a-spatial). Therefore, it is necessary to implement them with continuous-space indices in order to increase the statistical significance of space-agglomeration. There are several indicators in the literature to measure the space dependency such as the Moran's *I* index of spatial autocorrelation (Moran, 1950) and the Getis and Ord statistics of local spatial association (Getis & Ord, 1992). The Getis and Ord imply a 2-way split of the sample identifying only high-value and low-value clusters of the variable considered. By contrast, Moran scatterplots and LISA statistics implicate a 4-way split of observations detecting four combinations of patterns: high-high values (hot spots), low-low values (cold spots), and high-low and low-high values. The first term of association refers to the cluster itself whereas the second term regards to its surrounding. Therefore, the global Moran's *I,* Moran scatterplots and LISA statistics will be employed within this research.

The global Moran's *I* (hereafter Moran's *I*) coefficients of spatial autocorrelation are obtained by using the $LQ_{r,i}$. In order to allow comparison among different regions the Moran's *I* coefficients can be written in the standardized form as follows:

$$I_m = \frac{N}{\sum_i \sum_j w_{ij}} \frac{\sum_i \sum_j w_{ij}(x_i - \bar{x})(x_j - \bar{x})}{\sum_i (x_i - \bar{x})^2} \qquad (1)$$

where N is the total observations, x_i and x_j are the observed values of the location quotient for the region i and j with mean $\bar{x}$, $(x_{i(j)} - \bar{x})$ is the deviation of the variable of interest with respect to the mean. Whereas, w_{ij} is one element of the row-standardized spatial weight matrix

W, which indicates the spatial connection of region i to the region j (with $i \neq j$). In this research, the queen weight matrix will be employed based on the first-order contiguity. The expected value of I_m under the null hypothesis (absence of correlation) is $E(I_m) = -1/(n-1)$. $I_m > E(I_m)$ denotes a positive spatial autocorrelation in the employment distribution in the sector m with similar x_i values; whereas $I_m < E(I_m)$ indicates a negative spatial autocorrelation among locations due to very dissimilar values of x_i. The Moran's I coefficient can vary between ± 1, where value close to + 1 denotes clustering and near to - 1 indicates dispersion. The Moran's I statistics is a global measure and it allows the identification of an overall spatial pattern within a single value. However, it can be implemented by the Moran scatterplots, which allow the classification of 4 different spatial associations: high-low (HL) and low-high (LH) denoting dissimilar values; whereas high-high (HH, hotspot) and low-low (LL, coldspot) indicate similar values of the variable of interest. However, the Moran's I index may not identify properly the delimitation and significance of agglomeration, thus the local indicator of spatial association (LISA statistics) will be employed in order to detect significant local spatial clusters, local pockets of spatial non-stationarity, the influence by the magnitude of the global statistics on the single observation and the identification of significant outliers (Guillain & Le Gallo, 2007).

The local Moran's I measures the spatial autocorrelation for each individual observation and it gives indication of the existence of significant spatial clustering of similar values within the dataset. The local Moran's I statistics can be defined as (Anselin, 1995, p. 98):

$$I_i = z_i \sum_j w_{ij} z_j \qquad (2)$$

where $z_{i(j)}$ denotes the standardized values in deviations from the mean as $(x_{i(j)} - \bar{x})$ with $j \neq i$. LISA can be used to test the null hypothesis of absence of local spatial association, in other words whether the distribution of values around a specific location deviates from spatial randomness (Anselin, 1995, pp. 94-95).

4 DESCRIPTION OF DATA

The quantitative data has been collected through the General Statistic Office (GSO) of Vietnam with reference to 6 regions, 58 provinces, five municipalities, and 24 two-digit

manufacturing industries in Vietnam in 2010. The Vietnamese regions refer to the Northern Midlands and Mountain areas, the North Central and Central Coastal areas, the Red River Delta, the Central Highlands, the South East, and the Mekong River Delta. Whereas, the five core cities refer to Hanoi and Hai Phong in the North, Can Tho and Ho Chi Minh (hereafter HCM) in the South and Da Nang in the central of Vietnam. The data has been collected with regard to the net immigration and employment disaggregated by regions, provinces and the five main municipalities. In addition, the locational employment of two-digit manufacturing industries has been collected. The digit code refers to the Vietnam Standard Industrial Classification (VSIC 2007). This data will be used to compute the discrete and continuous-space statistics in order to unfold the agglomeration of employees and the concentration of two-digit manufacturing industries in Vietnam in 2010.

5 RESULTS AND DISCUSSIONS

5.1 ECONOMIC AGGLOMERATION BY PROVINCES AND FIVE MUNICIPALITIES IN VIETNAM

Vietnam is a densely-populated developing country with more than 85 million of inhabitants in 2010. The Vietnamese workforce accounted for more than 55% of the total population of which a half was between 20 and 39 years old in 2010 (General Statistics Office, 2011). The major labor force was concentrated within rural areas with more than 70%, though the immigration flows staidly increased towards urban centers and more developed places within the country between 2005 and 2011. The figure 2 shows the average of net immigration rate (as the difference between inflow and outflow) among provinces and five municipalities in Vietnam between 2005 and 2011. It emerges that the South East region had the highest positive average of net immigration with 15%. By contrast, the Mekong River Delta region had the highest reduction of its population with more than 5%, where the outflow of dwellers was predominant in all of its provinces. This tendency of polarization becomes more evident within provinces and the five municipalities. For instance, Binh Duong province had the highest positive average of net migration rate of 45% between 2005 and 2011, followed by HCM with around 20%, Da Nang with 13%, Dong Nai province with 9% and Hanoi with 6%. As a contrast, many provinces have witnessed a predominant outflow of their inhabitants between 2005 and 2011, such as Ca Mau, Ben Tre, Soc Tran, Quang Ngai and several other locations between 10% and 6%. Therefore, the figure 2 highlights the tendency of dwellers' concentration towards few provinces and the main municipalities in

Vietnam. This phenomenon inevitably affects positively and negatively the locational socio-economic development and inequality of regions and cities within the country. It is possible to identify two main effects within the country as inequality among locations and an agglomeration bell in the South of Vietnam, which favors an integrated region. For instance, Dang Nang in the central Vietnam significantly drew dwellers from its neighborhood provinces making their market size smaller and this negatively affects their economic development. This accrues disparities among Vietnamese locations. On the other hand, it is notable that some bordered administrative unites in the South of Vietnam drew exponentially people such as HCM, Binh Duong and Dong Nai fostering their socio-economic development. This generates an agglomeration bell favoring an integrated region in the South of Vietnam.

[Figure 2 about here]

In the new economic geography literature is highly accepted that migration inflow plays a paramount role in the socio-economic development within a location. It increases the dimension of market fostering pecuniary and technological externalities. In addition, inhabitants' colocalization increases the labour market and specialized skills favouring further economic agglomeration. The proximity of business activities also accrues technological externalities such as Jacobian (Jacobs, 1969) and Marshallian (Marshall, 1920) knowledge spillovers enforcing regional growth and innovation within diversified (see, for instance, Bairoch, 1988; Feldman & Audretsch, 1999; Jacobs, 1969) and specialized (see, for instance, Arthur, 1989; Glaeser et al., 1992; Marshall, 1920; Porter, 1990) network of firms. Therefore, the snowball effect within a location may be generated (Fujita, 1989).

The figure 3 shows the standard deviation of location quotient of employment by province and the main five municipalities in Vietnam in 2010. It shows that the core Vietnamese cities (HCM and Hanoi) held the highest employment agglomeration as they polarized gran parte of the country's economic activities on themselves, more than 40% of employees and 50% of active establishments are within these two urban areas in 2010. Whereas in the central Vietnam only Da Nang has a positive LQ's standard deviation. Besides the country' inequality, a contiguity spatial economic agglomeration is notable in the South East region such as HCM, Binh Duong, Dong Nai, Vung Tao and Long An with high LQ. With regard to the North of the country, Hai Duong, Quang Ninh, Lang Son and Thanh Hoa showed a significant high LQ denoted by a positive standard deviation.

[Figure 3 about here]

It is notable two main effects due to the interaction of agglomeration and dispersion forces such as regional inequality, for instance in the central Vietnam; and regional development and integration with particular reference to the locations nearby HCM. With regard to the economic asymmetry, Da Nang city in the central Vietnam represents a good example of such imbalance as it had a relative high LQ employment whereas its neighbourhoods had a quite low agglomeration of economic activities. This can be explainable as positive economic externalities in Da Nang affected negatively the territories nearby in terms of economic establishments and consequently their economic development. On the other hand with reference to the regional economic symmetry, HCM and the neighbourhood provinces such as Dong Nai, Vung Tao, Long An and Binh Duong are an example of self-organization of economic agglomeration. The large socio-economic development in HCM favoured the growth of its locations nearby and the phenomenon favours a regional integration. This spatial dependence recall the concept of the first law of geography (Tobler, 1970, p. 3). Furthermore, the Gini coefficient of inequality shows that Vietnam was characterized by significant provincial disparity of agglomeration of firms, employment, added-value and foreign direct investments as the Gini was 0.34, 0.33, 0.38 and 0.39 respectively in 2010; where the full concentration is denoted by 0.5. By contrast, the labour force was more dispersed among Vietnamese provinces in 2010 as the Gini coefficient was at 0.17. Moreover, it is notable that Dong Nai, Binh Duong and Vung Tao generated a relative high value added without having a large economic agglomeration, market size (population) and labour pool in 2010 (General Statistics Office, 2011). This could be due to the high concentration of large firms and industrial foreign direct investment with a predominant vocation to exportations. Furthermore, it is surprising to note that Vung Tao had higher level of foreign direct investments than the capital Hanoi. Vung Tao, Dong Nai and Binh Duong accounted for more than 30% of the country's FDI, whereas HCM and Hanoi together of 28% in 2010 (General Statistics Office, 2011). However, the concentration of employment in Vietnam is highly influenced by the presence of numerous industrial parks across Vietnam, and national and local authorities incentive firms to establish their activities to those predetermined sites in order to have a sustainable country's industrial growth.

This section was mainly devoted to detect the concentration of economic activities within Vietnamese provinces and the five municipalities using location quotient of

employment. It emerged that Vietnam was characterized by high economic inequality among locations where the migration flows enforced this disparity. Moreover, there is a tendency of dwellers and employment's polarization within few Vietnamese locations and urban centers, which played a predominant role in the country's economic development in 2010. However, the measures proposed in this section do not take into account the influence played by neighbors' locations. Therefore, the next part will be devoted to detected significant spatial associations among Vietnamese provinces and the five municipalities in Vietnam in 2010.

5.2 SPATIAL AUTOCORRELATION AMONG PROVINCES AND FIVE MUNICIPALITIES IN VIETNAM IN 2010

This section is devoted to investigate the global and local autocorrelation and the detection of significant clusters between provinces and the five municipalities in Vietnam in 2010. Therefore, the univariate global Moran's *I* and LISA statistics will be computed employing the queen spatial weight matrix based on the first-order contiguity. The result shows a positive global autocorrelation of 0.13 with a significant p-value of 5%. This allows to reject the null hypothesis of randomness distribution and the positive Moran's *I* value let to infer that the employment is more spatially clustered than would be expected ($I_m > E(I_m)$). The Moran's *I* statistics is a global measure and it allows the identification of an overall spatial pattern expressed by a single coefficient. Therefore, the global Moran's *I* does not detect local patterns spatially distributed. Hence, it has been implemented by the Moran scatterplot and LISA statistics. The former allows the classification of 4 different spatial associations, and the latter detects significant clusters positively and negatively autocorrelated.

[Figure 4 about here]

The figure 4 shows the univariate LISA cluster map based on conditional permutation approach with 999 permutations. It exhibits an agglomeration bell (hot spots) in the South Vietnam, which includes four locations: Long An, Dong Nai, Binh Duong with a significant p-value of 0.01 and HCM with a p-value of 0.05. These locations show high value of LQ employees surrounded by observations with high value of employment concentrated. This spatial association can be explainable as the strength of economic externalities in HCM influences its neighbors, and also because the economic aggregations may be sprawled among more than one administrative unit. Long An, Dong Nai, Binh Duong and HCM had a positive net immigration due to job availability, low poverty ratio and high labour income in 2010

(General Statistics Office, 2011) and this fostered the market size and consequently further aggregation of economic activities and employment. The configuration of high economic agglomeration in proximity favors an integrated region in the South of Vietnam. By contrast, the map also highlights low-low value clusters (cold spots) as follows: Ha Giang, Lao Cai, Yen Bai and Lai Chau with a p-value of 0.05 in the North; and Can Tho with a p-value of 0.05, Soc Trang with a p-value of 0.01 in South of Vietnam. In this case, these locations show a low concentration of employment themselves surrounded by low locational values. Finally, the LISA cluster map identifies a significant low-high value association in the South Vietnam as Tay Ninh with a p-value of 0.01 and Tieng Giang with a p-value of 0.05. They show a low LQ of employment surrounded by locations with high value of agglomeration of employees as they are in proximity to the agglomeration bell (hot spots). Therefore, the hot spots are only identifiable in the South Vietnam as the country is characterized by high economic inequality North-South where gran part of the country's economic activities is drawn within the South of Vietnam.

5.3 INDUSTRIAL CONCENTRATION OF TWO-DIGIT MANUFACTURING IN VIETNAM IN 2010

The previous parts highlighted the polarization of dwellers and economic activities in certain areas in Vietnam, whereas this section aims to identify the concentration of two-digit manufacturing industries using the locational Gini coefficient. Before investigating the industrial concentration, a brief overview of the role of industries within the country's economy is necessary to provide. The Vietnamese government largely influenced the economy as the state firms contributed by 34% of the GDP in 2010. Whereas, private local businesses and foreign direct investments contributed to 47% and 19% of GDP respectively in 2010 (General Statistics Office, 2011). Furthermore, agriculture, forestry and fishing generated 21% of the country's GDP and manufacturing produced 20% in 2010. It is notable that the manufacturing industries created 80% of the country's gross output and it employed more than 40% of all workforce in Vietnam in 2010 (General Statistics Office, 2011). In addition, the manufacturing industries contributed for more than 65% of the country's exportations in 2010, of which more than 50% is derived from foreign direct investments. The table 1 shows the industrial concentration of two-digit manufacturing industries in Vietnam in 2010 using the locational Gini coefficient.

[Table 1 about here]

It is notable that the three highest industrial concentrations are with low technology intensity such as the manufacture of wearing apparel, the manufacture of leather and related products, and the manufacture of food products with the locational Gini of 0.470, 0.377 and 0.251 respectively. This could be explainable as these industries choose a location with thick labour force and close to the final market. Therefore, in some locations in Vietnam there was disproportional presence in 2010 of those economic activities. Moreover, manufacture of wearing apparel, manufacture of leather and related products, and manufacture of food products played a paramount role in the country's economy in 2010 as they generated around 30% of the total manufacturing value added. By contrast, medium-high technological intensity industries showed a relative low concentration of employment such as manufacture of other transport equipment, manufacture of chemicals and chemical products, and manufacture of electrical equipment with the locational Gini of 0.091, 0.093 and 0.093 respectively. Besides, the industries with high technology intensity showed a relative low employment concentration such as manufacture of pharmaceuticals, medicinal chemical and botanical products with Gini of 0.109, and manufacture of computer, electronic and optical products with Gini of 0.099. In addition to the low concentration of technology intensity industries, they showed a relative low number of establishments in 2010. It could be explained as Vietnam is lack of trained and qualified workers, and this does not encourage the establishments and growth of technology intensity industries. Furthermore, it is notable that the resource-intensive industries had a relative high concentration of employment such as the manufacture of other non-metallic mineral products, manufacture of coke and refined petroleum products, and manufacture of tobacco products with Gini of 0.144, 0.127 and 0.121 respectively. This concentration is due as those industries localized their activities in locations where the natural resources are located.

6 CONCLUSIONS AND FURTHER RESEARCH

The paper investigated the employment distribution and spatial dependence among Vietnamese locations, and the industrial concentration of two-digit manufacturing industries in Vietnam in 2010 using discrete and continuous-space statistics. The evidence showed that there is a tendency of polarization of economic activities and dwellers in the country, where Hanoi, HCM, Long An, Dang Nang, Binh Duong and Dong Nai led the country's economic development. This polarization inevitably generated socio-economic asymmetry among Vietnamese provinces and cities.

Moreover, the research highlighted a significant agglomeration bell in the South of Vietnam given by a positive and significant autocorrelation. This could be explainable as the favorable economic externalities in HCM fostered the economic growth of its surrounding provinces and also because local economic agglomerations may be sprawled in the neighbours. This promotes a regional integration in the South of the country. Furthermore, evidence showed that Vietnam was characterized by low technology intensity industries concentration such as manufacture of wearing apparel, the manufacture of leather and related products, and the manufacture of food products. By contrast, medium-high and high technology intensity industries showed a relative low concentration of employment such as manufacture of other transport equipment, manufacture of chemicals and chemical products,. Furthermore, it is notable that the resource-intensive industries had a relative high concentration of employment as the manufacture of other non-metallic mineral products, manufacture of coke and refined petroleum products, and manufacture of tobacco products. Overall, the manufacturing industries concentration is influenced by the presence of numerous industrial parks across the country, and the governmental and provincial policies incentive such industrial concentration in predetermined locations in order to have a sustainable country's industrial growth. However, it is possible to identify an important limitation of this research as in order to deeply investigate the economic agglomeration and concentration in Vietnam is necessary to adopt a more disaggregated geographical scale, which represent a further research.

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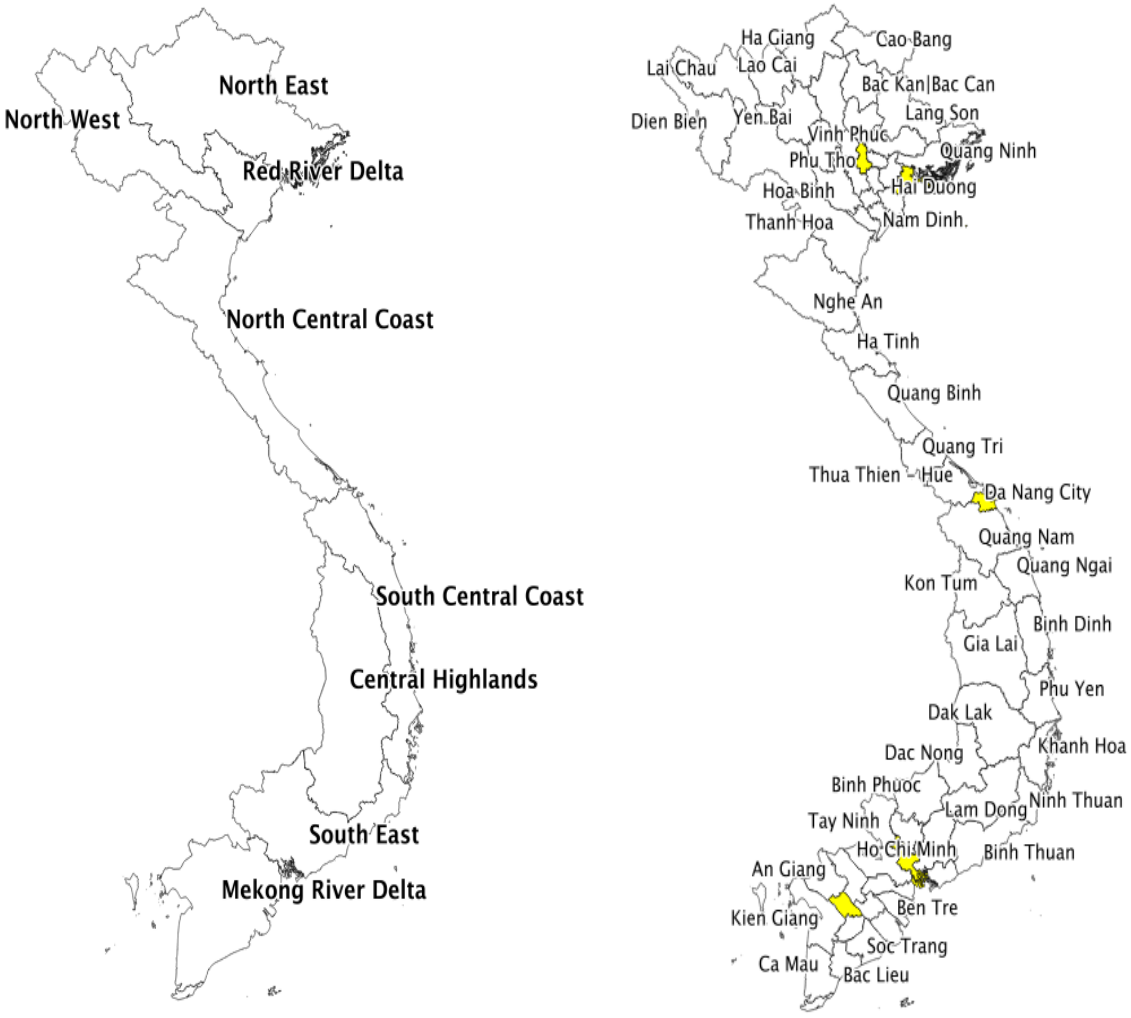
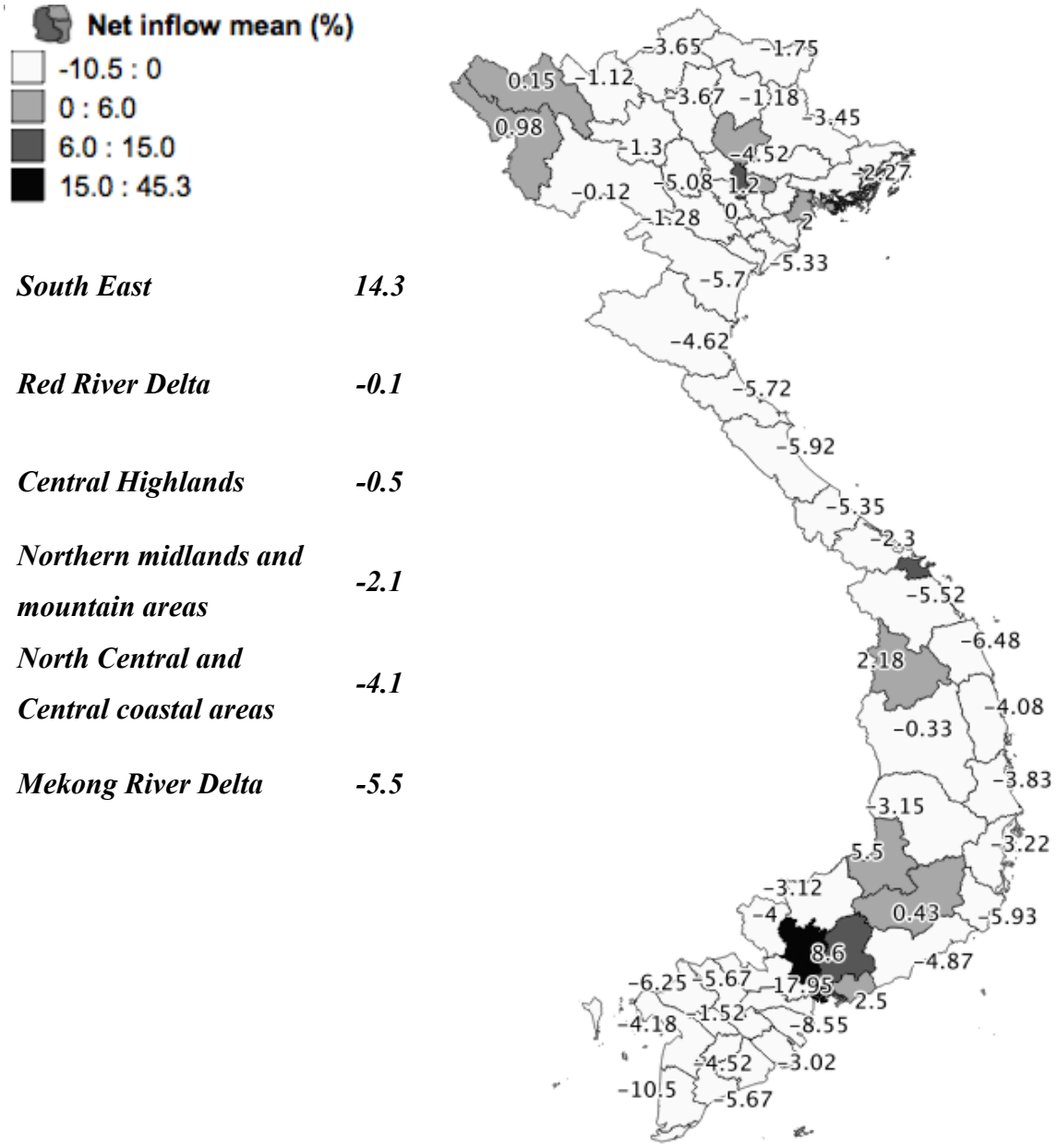
FIGURES AND TABLES

Figure 1. Vietnamese Regions (on the left) and Vietnamese provinces (on the right, where the five municipalities are highlighted in yellow)



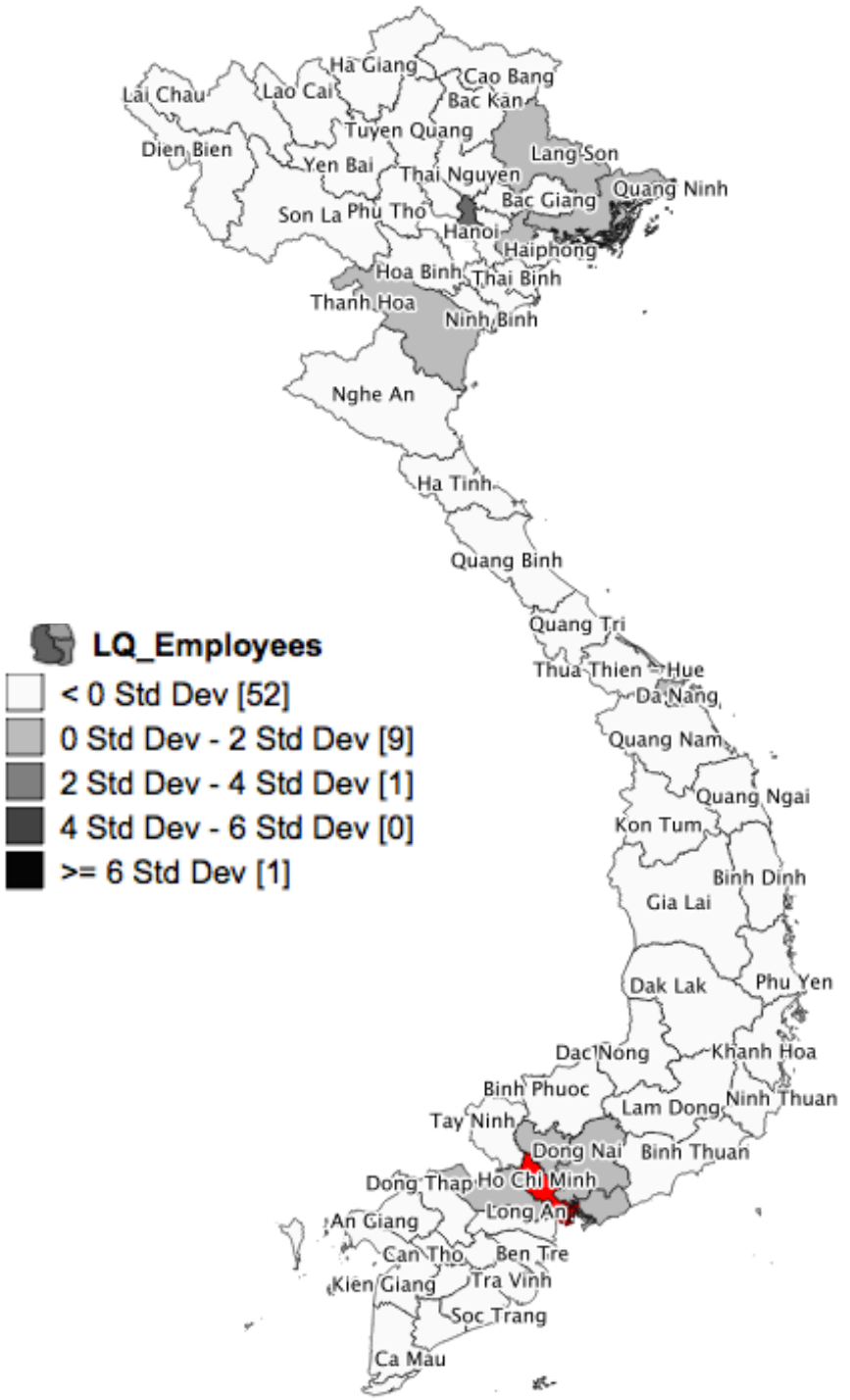
Source: Author's elaboration.

Figure 2. The average of the net migration expresses in percentage by regions, provinces, and five municipalities in Vietnam between 2005 and 2011.



Source: Author's computation based on 2005-2011 data from the General Statistic Office (GSO) of Vietnam.

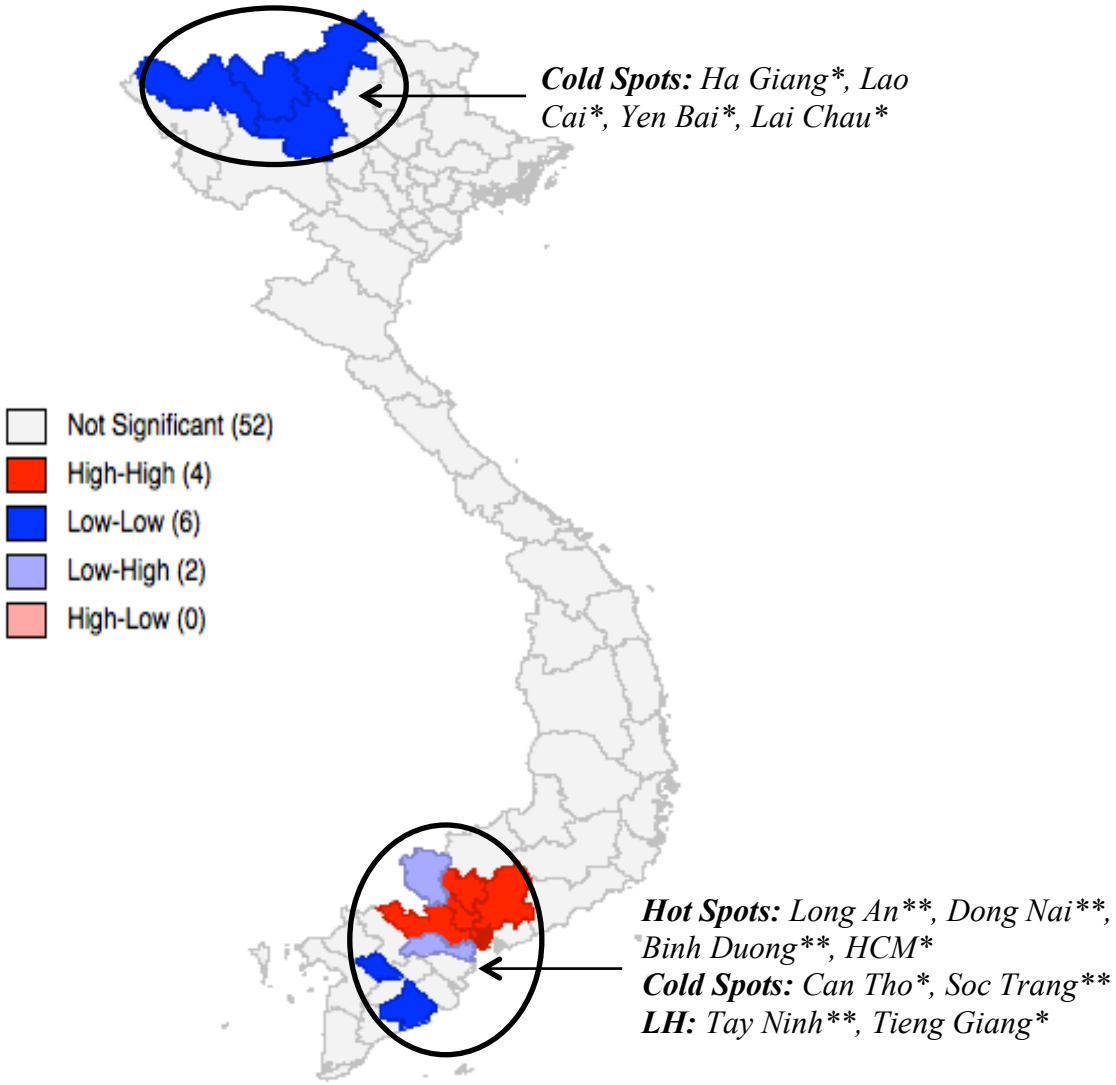
Figure 3. The standard deviation of location quotient of employment by province and five municipalities in Vietnam in 2010.



Source: Author's computation based on 2010 data from the General Statistic Office (GSO) of Vietnam.

Figure 4. Univariate LISA cluster map (999 permutations) of LQ employment by province and five municipalities in Vietnam in 2010.

Global Moran's I: 0.13



** P-value at 0.05, ** p-value at 0.01*

Source: Author's computation based on 2010 data from the General Statistic Office (GSO) of Vietnam.

Table 1. Locational Gini of employment and technology intensity classification of two-digit manufacturing industries in Vietnam in 2010.

VSIC 2007	Industry	Gini Empl.	Technology intensity*
14	Manufacture of wearing apparel	0.470	Low
15	Manufacture of leather and related products	0.377	Low
10	Manufacture of food products	0.251	Low
23	Manufacture of other non-metallic mineral products	0.144	Medium low
31	Manufacture of furniture	0.137	Low
19	Manufacture of coke and refined petroleum products	0.127	Medium low
12	Manufacture of tobacco products	0.121	Low
25	Manufacture of fabricated metal products (except machinery and equipment)	0.119	Medium low
33	Repair and installation of machinery and equipment	0.114	Medium low
21	Manufacture of pharmaceuticals, medicinal chemical and botanical products	0.109	High
22	Manufacture of rubber and plastics products	0.107	Medium low
11	Manufacture of beverages	0.104	Low
13	Manufacture of textiles	0.104	Low
28	Manufacture of machinery and equipment n.e.c	0.101	Medium high
18	Printing and reproduction of recorded media	0.099	Low
26	Manufacture of computer, electronic and optical products	0.099	High
29	Manufacture of motor vehicles; trailers and semi-trailers	0.096	Medium high
24	Manufacture of basic metals	0.095	Medium low
27	Manufacture of electrical equipment	0.093	Medium high
20	Manufacture of chemicals and chemical products	0.093	Medium high
17	Manufacture of paper and paper products	0.092	Low
16	Manufacture of wood and of products of wood and cork (except furniture)	0.092	Low
30	Manufacture of other transport equipment	0.091	Medium high
32	Other manufacturing	0.091	-

**OECD classification for manufacturing industries.*

Source: Author's computation based on 2010 data from the General Statistic Office (GSO) of Vietnam.