Chapter 8
The Structure and Evolution of City System in the Philippines

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Abstract The recent economic growth in the Philippines has been accompanied by a rising rate of urbanization. While some places are able to benefit from the economic expansion and increasing urbanization, others are left behind. To better understand the problem of widening spatial disparity and craft policies that would make urbanization more inclusive, it is vital to look at how cities are organized and how that affects socio-economic conditions. This study analyzes the structure of the city system within the provinces in the Philippines from 1990–2020. In general, the structure of the city system in provinces has remained almost unchanged for the past three decades. Cities or municipalities were able to preserve their sizes and rank in the system. This study also explores the link between the city system and socio-economic conditions. Provinces with a city system, where cities are geographically adjacent to one another and where the population is concentrated, typically have superior socioeconomic conditions. While provinces with a city system in which both population and cities are relatively dispersed, tend to have an inferior socio-economic condition. This study also classifies provinces based on the link between the city system and socio-economic conditions and outlines appropriate policy recommendations.

Keywords City system · Socio-economic development · Spatial inequality · Urbanization

8.1 Introduction

Half of the world's population now lives in urban areas and this trend is expected to continue rapidly. The relationship between urbanization and economic growth has been widely documented. In particular, Henderson (2000) pointed out that a simple correlation coefficient between the degree of urbanization and GDP per capita (log) is as high as 0.85. While urbanization is inevitable in the development process, it poses a struggle for the lagging areas, particularly in developing countries. The World

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T. Ishikawa and D. Nakamura (eds.), *Industrial Location and Vitalization of Regional Economy*, https://doi.org/10.1007/978-981-19-8128-9_8

Development Report 2009 argues that prosperity will not occur across geographical spaces at the same time, but this does not necessarily mean that lagging areas should be left behind (World Bank, 2009). Thus, policies that foster the growth of the leading areas and facilitate the integration or catch-up of lagging areas are essential.

While cities are seen as the primary engine of growth, they do not exist on their own and they are embedded in a wider network. Any development in one city would unavoidably impact the other cities. Thus, it is important to consider the overall structure of the system of cities as well as the general equilibrium nature of urban policy (Desmet and Rossi-Hansberg, 2014). The existing literature on the city system is often based on the case of developed economies and very few analyzed the urban system in the context of developing countries. However, the structure of the city system as well as urban development experiences can vary in different countries, particularly between developed and developing economies. Given the fact that urbanization has accelerated fast in developing economies, studies that focus on their case are indispensable. This paper aims to contribute to the understanding of the city system in developing countries by examining the case of the Philippines.

Inclusive growth has been the cornerstone of the development policy in the Philippines over the past years. Despite the impressive 6–7% annual economic growth rate in recent years, a huge disparity remains, particularly in terms of spatial inequality. The capital Metro Manila is a mega-city of 13 million population and accounts for almost 40% of the country's economic output. On the other hand, regions in Mindanao remain sparsely populated and account for about 1–3% of the total output. To address the widening spatial gap and make urbanization inclusive, it is imperative to understand the structure of the city system and how it relates to socio-economic conditions. In doing so, distinct types of city systems can be identified, and appropriate policy measures can be recommended.

This study has three main objectives. First, this study examines the structure of the city system at the subnational level, specifically, at the provincial level. Second, this paper analyzes the evolution of the structure of the city system in the provinces from 1990–2010. Third, this study explores the link between the structure of the city system and the level of socio-economic-development in the provinces. Moreover, this study classifies provinces based on the link between the city system and socio-economic conditions and outlines appropriate policy recommendations. This study is organized as follows: Sect. 8.2 presents related literature on the structure of the city system and its relationship with socio-economic development; Sect. 8.3 discusses the data and methodology; Sect. 8.4 examines the structure of the city system and its link with socio-economic conditions. Section 8.5 summarizes the study and outlines areas for further study.

8.2 Review of Related Literature

8.2.1 Spatial Concentration and City System

Central to the understanding of the city system is the rationale behind the concentration of economic activity in a geographical space. Marshall's theory of agglomeration is often referred to when explaining the existence of concentration of economic activity. According to Marshall (1920), there are three factors that attract the firms to cluster in the same location and in the process, fostering further expansion of a particular area: presence of skilled labor, availability of specialized inputs services, and knowledge of technological spillovers.

Meanwhile, the new economic geography (NEG) explains that the spatial configuration of economic activities is a result of two opposing forces: agglomeration (centripetal) forces, and dispersion (centrifugal) forces (Fujita, 2007). Agglomeration forces are basically factors that attract firms and people to a location, such as geophysical features (first-nature), increasing returns (second-nature), historical conditions, or public policies. Dispersion forces are essential factors that drive away firms and people such as congestion, high price of land and rent, slums, and environmental problems.

As pointed out earlier, cities are not standalone entities, thus it necessary to look at how cities relate to other cities in a system. The central place theory explains how cities are organized into a system based on size and functions (Christaller, 1933; Losch, 1940). The central place theory describes a hierarchy of locations in which there are few higher-order cities and low-order cities. The few higher-order cities typically have a larger population, more widely spaced, and provide more variety of variety and functions. Meanwhile, the low-order cities are smaller in size and perform limited functions.

On the other hand, there are several studies that challenge the validity of central place theory in the actual city systems (Camagni, 1993; Camagni, & Capello, 2004). Some functions that are traditionally performed by higher-order cities are also found in the lower-order cities. There are also horizontal linkages between similar cities. Given these new developments, new thinking such as the city network model has surfaced. The city network theory model emphasizes the importance of network integration with other cities to achieve increasing returns and scale economies (Camagni et.al, 2013). With economic efficiency gained through external cooperation with other cities, single cities can upgrade their functions, without expanding their individual sizes. Similar to the concept of city network theory is the concept of "borrowed size" from Alonso (1973). "Borrowed size" pertains to a small city that performs functions that are usually carried out by larger cities. Second-order cities who have access to the functions and networks of first-rank cities can offer high average location benefits (Camagni et.al, 2013).

8.2.2 Measurement of City System

There are several ways to quantify the city system and among the widely used methods are the primacy index and rank-size distribution. The definition and measurement of the primacy of the city varies. Primacy can be measured as the proportion of the city with the largest population to the second-largest city in a country (Jefferson, 1939). The city is defined as a primate city when ts ratio to that of the second city exceeds two. While this method is easy to measure, it is deficient as it does not consider the size distribution of the cites below the two largest. Thus, some studies extend the analysis to the proportion of the population of the first city to the next two or to an even larger number of cities (Rosen, 1980). Some studies measured primacy by looking at the share of the population of the largest city in reference to the total population (Moomaw, 1996). Meanwhile, some studies used the ratio of the largest city to the total urban population of a country (El-Shakhs, 1972).

Rank-size rule or Zipf's law (1949) describes a city system based on the size of the city and its rank in the system. This concept presents a regularity wherein the population size of a city is equal to the population of the largest city divided by the rank of the given city. Hence, the population of the second-largest city would be one-half of the largest and the population of the third-largest city would be one-third of the biggest city, and so on. Plotting the natural logarithms of the rank and of the city in the graph would yield a log-linear pattern. If the slope of the line is equal to 1, the size of cities perfectly fit to the rank-size rule. If the slope is > 1, the actual size of the largest city is bigger than predicted which means implies primacy and higher concentration of the population in the biggest city. If the slope of is < 1, the actual size of the middle-rank cities is higher than predicted which implies dispersion and relatively balanced population distribution.

The two prior techniques, while extensively used and somewhat simple to estimate, only study the population distribution and do not account for the spatial distribution of the cities. Ishikawa (2012) proposes a city system index that captures both the distribution of population and locations: coefficient of divergence (CD) of the population; and spatial converge of city distribution (SC). The CD component of the city index is based on Sheppard (1982), which is a hierarchical index based on the proportion of the total urban population in the largest city and weighted by the rank of the city. On the other hand, spatial convergence of city distribution is based on the average least distances. The low value of the city system index signifies a city system in which the population is concentrated on the primary cities and other cities geographically located close to the largest cities. The high value of the city system index indicates a city system in which there is a relatively even distribution of population among cities and cities are located relatively far from each other.

8.2.3 Structure of City System and Development

The link between the city system index and socio-economic performance has been examined using the case of different countries: Japan (Ishikawa, 2012), Germany (Ishikawa & Oh, 2015), and Japan and Sweden (Ishikawa & Wall, 2015). In the case of Japan (Ishikawa, 2012), there is an inverse relationship between the economic base and city system index. The economic base includes variables such as income per capita, the value of manufactured goods, unemployment rate, regional difference index of consumer prices, index of financial potential, starting salary of senior high school students, and salary of the female part-time worker. This implies that prefectures with an urban system, in which characterized where the population is concentrated in the biggest city and cities are located close to each other, are most likely to have a good economic condition. On the other hand, there is a positive relationship between the city system index and welfare (homes for the aged, rehabilitation facilities for physically disabled persons, child welfare institutions, welfare expenditure per capita, social welfare per capita, social welfare expenditure for aged person). This means that prefecture with relatively dispersed population and cities tend to have better welfare conditions. Meanwhile, social health which the aggregate value of all the variables (economic base, education, dwelling, health, welfare, and safety, and social unrest), is found to be positively correlated with the city system. This finding suggests that prefecture with city system characterized by relative dispersion of population and cities have better overall social conditions.

In the case of Germany (Ishikawa & Oh, 2015), there is also a negative correlation between various socio-indicators and city system indexes. Socio-economic indicators such as gross regional production, number of factories, income and expenditure, GDP per capita, number of full-time and part-time worker are found to have a negative relationship with the city system index. This means that prefectures in Germany where the population is concentrated in the biggest city and cities are located close to each other are relatively well-off than prefectures which is relatively dispersed. Similar finding is found in the case of Sweden (Ishikawa and Wall, 2016), where the city system index is negatively associated with gross regional product and the number of doctors. This implies that the concentrated urban system in Sweden tends to have higher economic output and better medical conditions.

8.3 Data and Methodology

8.3.1 Data

This study employs two sets of data. The first set of data is used for estimating the city system index: population of cities and municipalities (1990 and 2020) and GPS coordinates of cities and municipalities. As of June 2022, there are 81 provinces in

Table 8.1 List of data

Category	Variable	Years
1. City system structure		
Population	Population: City and municipalities	1990 and 2020
Distance	GPS coordinates	2015
2. Socio-economic development		
Category	*Variable*	*Years*
Economic	Annual average family income	2009
	Annual average family expenditure	2009
	Proportion of working population (15–64)	2010
	Poverty incidence	2009
	Unemployment rate	2009
	GINI index	2010
Education	Academic degree holder	2010
	Mean years of schooling	2008
	Expected years of schooling	2008
Governance	Total provincial income	2012
	IRA allotment	2012
	Social services expenditures	2012
	% SS expenditures to total expenditures	2012
Health	Life expectancy at birth (years)	2009
	Total health workers	2011
	Number of household with access to sanitary toilet	2011
	Number of household with access to safe water	2011
Infrastructure	Length of national roads	2013
	Length of national bridges	2013

Source Author's own construction

the Philippines. However, this study includes 79 provinces[1] and the capital, Metro Manila, or the National Capital Region (NCR). The second set of data is utilized for constructing the socio-economic index of the provinces. The variables are grouped into five categories: economic, education, governance, health, and infrastructure. Since these variables' publication years varied, this study used the most recent between 2009 and 2015. The Countryside in Figures and Provincial Quickstat publications from the Philippines Statistical Authority are the main sources of the data (PSA). The list of data used in this paper is shown in Table 8.1.

[1] This study did not include the following provinces: Compostela Valley used to be part of Davao del Norte until 1998; Dinagat Island which used to part of Surigao del Sur until 2012; Davao Occidental, the youngest province which was created in 2013.

8.3.2 Methodology

This study uses three different methods to quantify the city system in the provinces in the Philippines: Primacy Index, Rank-Size Rule, and City System Index. To measure the socio-economic development, this study constructs a socio-economic index.

8.3.2.1 Primacy Index

This study adopts two methods of estimating the primacy index: the share of the largest population (P1); and the two-city index which is the population ratio of the largest city compared to the second-largest city (P2).

The share of the largest city is calculated using the formula below (Eq. 8.1). The higher the value means the concentration of the population in the primary city.

$$P1 = \frac{Pop(largest)}{Population(total)} \tag{8.1}$$

The two-city index is estimated using the formula below (Eq. 8.2). If P2 > 2, the population is highly concentrated in the primary city. If P2 < 2, the population distribution is relatively dispersed.

$$P2 = \frac{Pop(City1)}{Pop(City2)} \tag{8.2}$$

8.3.2.2 Rank-Size Distribution

The rank-size rule is estimated first by looking at the relationship between population size and rank of the city.

$$Pr = \frac{P1}{r} \tag{8.3}$$

where Pr = population of the largest city ranked r, P = population of the largest city, and r = rank of the city R.

The logged values of the rank and size are then regressed using the formula below. The q coefficient provides information about the structure of the city system. The higher the value of q implies that primacy or concentration of the population in the biggest city. The lower the value of q, the more dispersed the population distribution.

$$LnPk = lnP1 - qLnk \tag{8.4}$$

where P1 is the population of the largest city, Pk is the population of the kth town by rank, and q is the coefficient which gives information about population distribution.

8.3.2.3 City System Index

This study utilizes Ishikawa (2012) city system index (CSI) to analyze the structure of urban system in the Philippines. The CSI has two components: Coefficient of Divergence (CD) of the population distribution towards the primary city; and Spatial Convergence (SC) of city distribution in a region.

The coefficient of Divergence (CD) indicates the distribution of urban population in a city system is derived as follows:

Suppose that there are N cities in a region and p_r represents the population share of a city for all urban populations in the region.

$$1 = \sum_{r=1}^{N} pr \tag{8.5}$$

In case that there is no prior information on the cities, it is rational to assume that every city has the same share, $p_r = 1/N$. This inference is derived by maximizing equation (Eq. 8.2) with reference to the equation (Eq. 8.1).

$$H = -\sum_{r-1}^{N} p_r L_N(p_r) \tag{8.6}$$

Since there is prior information about cities in the Philippines, the coefficient of divergence of the population can be established as follows: *r* indicates the rank of a city accordingly to its population size, and multiplying size, and multiplying the value of $\log_e(r)$ by its share as a weigh and them summing up these values and finally dividing it by N.

$$CD = \left(\frac{1}{N}\right) \sum_{r=1}^{N} p_r L_N(r) \tag{8.7}$$

If the population of the region is distributed equally between cities, the coefficient of the divergence is given by the equation below.

$$CD = N|^{-2} \sum_{r=1}^{N} L_N(r) \tag{8.8}$$

A low CD value suggests that the population is concentrated in a small number of cities or municipalities, whereas a high CD value suggests that the population is distributed fairly evenly throughout cities in the provinces.

Spatial Convergence (SC) which represents the spatial distribution of the city system is estimated as follows:

If there are N_i (i-1,2, 3…. N) cities in a region, of which land area is denoted by M. The distance from a city N_1 to the nearest city is denoted as d_1 or the least distance of the city N_1. The least distance or the nearest neighbor analysis is calculated for each city and then the average least distance is derived as below.

$$AD = \left(\frac{1}{N}\right)\sum_{i=1}^{N} d_i \tag{8.9}$$

The spatial convergence of the city distribution in a region is derived using the equation below. The smaller the value of SC indicates that the cities are geographically closer, whereas the higher the value of SC implies that cities are spatially dispersed.

$$SC = \frac{AD}{2\left(\frac{N}{M}\right)^{0.5}} \tag{8.10}$$

The values of CD and SC are then combined to construct the urban system index (USI). USI is expressed in the equation below, where α and β are both positive parameters and assumed at $\alpha = 20$, and $\beta = 0.5$.

$$USI = ((\alpha CD)^2 + (\beta SC)^2)^{0.5} \tag{8.11}$$

The low value of the city system index signifies a city system in which the population concentrated on the primary cities and other cities geographically located close to the largest cities. The high value of city system index indicates a city system in which there is a relatively even distribution of population among cities and cities are located relatively far from each other.

8.3.2.4 Socio-Economic Index

Similar to other developing countries, data availability at the subnational level is quite problematic. This study attempts to provide a more holistic approach by collecting data that would adequately represent the socio-economic condition of the provinces.

The socio-economic index is computed using various variables that fall into five categories: economic, education, governance, health, and infrastructure.

These variables are standardized using Eq. 8.8,

$$S_{IVP} = \frac{(X_{IV} - AVE_{IV})}{ST_{IV}} \tag{8.12}$$

$$(I = a, b, e; V = 1, 2, 3, 4 \cdots n; P = P1, P2, P3 \cdots P80)$$

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where X_{Iv} is the value of the indicator of I of a province P; AVE_{Iv} is the mean value; and ST_{Iv} is the standard deviation of the indicator I of variable E.

The score of the indicator I was obtained using Eq. 8.9,

$$S_{IV} = \left(\frac{1}{n}\right) \sum_{I=VP}^{In} S_{IVP} \tag{8.13}$$

The socio-economic index was computed based on equation (Eq. 8.10),

$$SEI_P = \left(\frac{1}{6}\right) \sum_{I=a}^{e} S_{IV} \tag{8.14}$$

The higher the value of the socio-economic index indicates that the provinces have relatively better socio-economic conditions, whereas the lower the value of the socio-economic index signifies unfavorable socio-economic conditions.

8.4 City System in the Philippines

8.4.1 Spatial Development in the Philippines

The Philippines is an archipelago located in Southeast Asia. It is composed of 7,107 islands which total to 300,000 square kilometers, the second biggest archipelagic country in the world. The Philippines is divided into three main islands: Luzon, Visayas, and Mindanao. As of 2022, the country is divided further into 17 regions,[2] 81 provinces, 146 cities, 1,488 municipalities, and 42,026 barangays. The provinces, cities, municipalities, and barangays are classified based on income. Meanwhile, cities were further classified as highly urbanized cities(HUCs), independent components, and component cities.[3]

[2] With the exception of regions, all other units are considered as official local governments units. Regions are used only for administrative management or statistic reference by the Executive branch.

[3] Highly Urbanized Cities (HUCs) are autonomous from the province and have a minimum population of 200,000 and latest annual income of PhP50 million; 2) Independent Component Cities (ICCs) are also autonomous and have charters that prohibit their residents in voting for provincial officials; and 3) Component Cities which do not meet the requirements for HUCs and ICCs and still considered a part of the provinces.

The Philippines is classified as a lower middle-income country by the World Bank with a gross domestic product (GDP) per capita of 3,412 dollars (constant 2015 US$). The Philippines have experienced an average of 5–7% growth over the past years, particularly between 2012–2019. The services, mainly through the information technology-business processing outsourcing, accounts for more than half of the economic output. As of 2020, the country has a total population 109 million inhabitants which makes it as the 13th largest country in the world in terms of population. Around 40 percent of the population lives in Metro Manila and its neighboring regions of Region IV-A (CALABARZON) and Region III (Central Luzon). The annual population growth rate as of 2020 is 1.63 percent, a bit lower than 1.72 percent during 2010–2015. The median age of the population is 24.3 years old.

Similar to the case of archipelagic countries, most villages have developed alongside the shorelines or the along riverbanks during the pre-colonial era. There was no central authority at that time and these villages function as independent political units composed of 30–100 families (Boquet, 2017). The arrival of the Spanish colonial rule would significantly alter the development of the pattern of settlements in the country. The Spanish government initially set up their base in Cebu but later moved to Manila in 1571 to better facilitate trade with the neighbors within South China. (Doeppers, 1972). The Philippines, like all other colonies, were primarily used by the Spanish empire as a source of raw materials. Because of this, the majority of the population and economic activity was concentrated in cities like Manila and the traditional agricultural districts of Visayas, Bicol, and Ilocos that were close to trade routes (Pernia, 1982). A hierarchy of settlements was established during the Spanish colonial period (1565–1898): (1) Capital City with Manila; (2) Provincial Centers (Ciudades and Villas)- center of military, political, and ecclesiastical control (Cebu, Naga, Nueva Segovia, all ciudades and villas in Panay and Fernandia(Vigan); (3) Central Church Villages or Cabeceras- focal points of activity and cultural change. Even after the change of colonial power (American: 1898–1946; and Japanese: 1944–195) and the transition to independence, this spatial pattern would continue throughout the next centuries.

During the post-war period in 1950s, nearly 70 percent of the population still lives in the rural areas. The Philippines experienced a severe balance of payments and foreign exchange crisis during this time, which led to the implementation of an import-substitution-industrialization (ISI) policy. Furthermore, the Filipino First Policy of the current administration has strongly encouraged economic nationalism. This shift toward ISI had a significant impact on the geographical development of the country since it allowed the capital-intensive industries in Metro Manila and Southern Luzon to expand quickly relative to resource-based industries (Sicat, 1968, cited in (Mercado, 2002). Consequently, this led to an increase in rural to urban migrations. However, from late 1960s onwards, the supply of jobs and adequate housing in urban areas could not keep pace with rapid population growth and this resulted to classic urban diseconomies such as congestion, slums, urban poverty, and pollution (Boquet, 2017). From late 1960s-1980s, there are several notable government policies that focused on the spatial aspects of development. These policies include the

establishment of Regional Development Authorities(RDAs) to manage local development; the creation of the export processing zone in 1972; the organization of the provinces into regions based on geographical and cultural characteristics; and the formation of the National Capital Region in 1975, the only metropolitan area with governance functions.

The increase in the number of people living in urban areas would continue in 1990s-onwards. In particular, the level of urbanization would increase from 30 percent in 1960 to 47 percent in 1995. The number of newly established cities would significantly grow after the enactment of the Local Government Code (LGC) of 1991, an act which aims to empower the local governments units. Particularly, the rise in the internal revenue allotment (IRA) portion of the national taxes has encouraged some municipalities to convert into cities. The Philippines have implemented trade liberalization, privatization, and deregulation policy reforms to conform to the dominant market-oriented global landscape and to benefit from the country's rising economic integration to the global market. Specifically, the Special Economic Zones Act of 1995, which permitted private sector involvement in the creation and administration of special economic zones. Due to this act, there were more economic zones established, most of which were in the Southern Luzon provinces of Cavite, Batangas, and Laguna. From 2000 onward, the nation would witness the IT-BPO industry's astounding growth. Numerous IT-BPO companies have host locations in the highly urbanized regions of Metro Manila, Cebu, Baguio, Davao, and Davao.

8.4.2 Structure of City System in Provinces

Using different methods, this study uses a different method to analyze the structure of the city system in the Philippines. The results of the primacy index 1 or the share of the population of the largest to the total population in the province shows that the Davao City, the largest city in Davao del Sur has the most number of residents. Meanwhile, the biggest city in Pangasinan has the lowest share of the population. On average, the share of the largest city within a province is around 22 percent (Table 8.2).

Meanwhile, the results of primacy index 2 or the ratio of the population of the biggest city to the next biggest city indicates a similar finding, Davao City in Davao Del Sur is the most primate city in the country. On other hand, North Cotabato have the lowest primacy ratio. On average, the average ratio of the primary city to next biggest city is 2 and there is wide variation among provinces as evidenced by a standard deviation of 1.354. The results of the analysis of the rank-size reveals that same finding as well, Davao del Sur emerged as the most concentrated province in the Philippines. Meanwhile, Zamboanga Sibugay is considered as with the most dispersed city system. The average q coefficient stood at 0.775 and there is relatively variation among the provinces. The estimation of the CSI shows that Davao del Sur has the most concentrated city system in the Philippines. On the other hand, Guimaras has the most dispersed city system. The average value of CSI among the provinces is around 2.050.

Table 8.2 Top 10 highest and lowest[4]

Primacy Index 1		Primacy Index 2		Rank-Size q		CSI	
Province	Primacy index 1 (2020)	Province	Primacy index 2 P1/P2 2020	Province	Rank-size q zipf 2020	Province	CSI(2020)
Concentration							
Davao del Sur	0.7231	Davao del Sur	9.4330	Davao del Sur	1.4408	Davao del Sur	0.9414
Kalinga	0.5272	Misamis Oriental	5.3285	Benguet	1.2647	Leyte	1.0706
Batanes	0.5054	Lanao del Norte	4.9454	Laguna	1.2441	Maguindanao	1.1445
Agusan del Norte	0.4904	Surigao del Norte	4.7486	Kalinga	1.2317	Misamis Oriental	1.2927
Zamboanga del Sur	0.4819	Iloilo	4.6455	Cavite	1.2294	Lanao del Sur	1.2967
Benguet	0.4430	Zamboanga del Sur	4.6435	Rizal	1.1987	Laguna	1.3517
Camiguin	0.4428	Agusan del Norte	4.6408	Palawan	1.1883	Bohol	1.3903
Misamis Oriental	0.4322	Lanao del Sur	4.1101	Agusan del Norte	1.0982	Isabela	1.3949
South Cotabato	0.4169	Palawan	3.5941	Davao del Norte	1.0860	Pangasinan	1.4179
Lanao del Norte	0.3344	South Cotabato	3.5687	Batanes	1.0829	Ilocos Sur	1.4332
Dispersion							
Pangasinan	0.0649	North Cotabato	1.0044	Zamboanga Sibugay	0.3463	Guimaras	3.5321

(continued)

[4] For conformity, the top highest for CSI value is reversed as the low value indicates concentration.

Table 8.2 (continued)

Primacy Index 1		Primacy Index 2		Rank-Size q		CSI	
Province	Primacy index 1 (2020)	Province	Primacy index 2 P1/P2 2020	Province	Rank-size q zipf 2020	Province	CSI(2020)
Bohol	0.0753	Antique	1.0205	Compostela Valley	0.3705	Tawi-Tawi	3.5102
Ilocos Sur	0.0870	Camarines Norte	1.0225	Apayao	0.3974	Palawan	3.3711
Isabela	0.0932	Aurora	1.0268	Sarangani	0.416	Sarangani	3.3243
Negros Oriental	0.0936	Mountain Province	1.0274	Sultan Kudarat	0.4328	Marinduque	3.3169
Camarines Sur	0.1011	Compostela Valley	1.0347	Marinduque	0.4558	Apayao	3.1754
Antique	0.1063	Nueva Vizcaya	1.0372	Ifugao	0.4686	Batanes	3.1515
North Cotabato	0.1109	Sarangani	1.0387	Guimaras	0.4794	Aurora	3.1439
Masbate	0.1150	Marinduque	1.0474	Capiz	0.5052	Siquijor	3.0412
Compostela Valley	0.1224	Cavite	1.0580	Antique	0.51	Quirino	2.9886

Source Author's own construction

While variation in results is expected due to the difference in measurements, some similarities can be observed. In particular, as noted earlier, all four methods points to Davao Del Sur having the most concentrated city system structure. Davao del Sur is home to Davao City, the largest city in terms of land area and 3rd most populous city in the Philippines. While Davao City is geographically located in the province of Davao del Sur, as it is a highly urbanized city, it has its own independent local government. Misamis Oriental is another province that is found by all analyses as highly concentrated. Similar to the case of Davao del Sur, Misamis Oriental is also home to a highly urbanized city, Cagayan de Oro which is considered to be a major economic center of Northern Mindanao. Meanwhile, similarities are also found among provinces with relatively dispersed city systems. In particular, Sarangani, Marinduque, Compostela Valley, and Aurora are found to be highly dispersed using the three methods of primacy index 2, rank-size rule, and CSI. These provinces are all far from the capital and relatively economically-developed areas in the region.

However, the analysis also reveals some strikingly different results. In particular, the provinces of Bohol and Pangasinan are found in top 10 highest of the CSI ranking but the biggest city of both provinces have the lowest share of the total population. Pangasinan located in Northern Luzon is the most populous provinces in 2020, while Bohol, an island province in Visayas, ranks as the 17th most populous provinces. The low share of the population of the biggest city can be explained by the fact that both provinces have a high number of cities and municipalities.[5] Bohol have 1 component city and 47 municipalities, while, Pangasinan have 1 independent city, 4 components cities, and 44 municipalities.

Different outcomes can be seen in the cases of the island provinces of Palawan and Batanes. These two provinces are found in the top 10 lowest CSI ranking which means relatively dispersed city system, but they are also found to be among the top 15 highest rank-size rule and primacy index 2 which signifies a highly-concentrated city system. Palawan is the biggest province in the Philippines with a land area of 14,650 sq.km, while Batanes is the smallest province with 209 sq.km. While both provinces are significantly different in terms of land area, both provinces are among the most sparsely populated provinces. Palawan ranks third with a population density of 64 persons per sq.km and Batanes ranks twelve with 93 persons per sq.km. This results highlight the importance of the inclusion of the spatial dimension in the analysis. The inclusion of geographical distance in the analysis provides a more accurate representation of the city system. The estimation of the city system without geographical dimension is most likely biased towards the cities with big population.

8.4.3 Evolution of City System

The evaluation of the share of the largest city to the total population of the provinces from 1990–2020 reveals an increasing trend. The average increase in the share of the

[5] The average number of cities per province is 1.3 and the municipalities per city is 18.

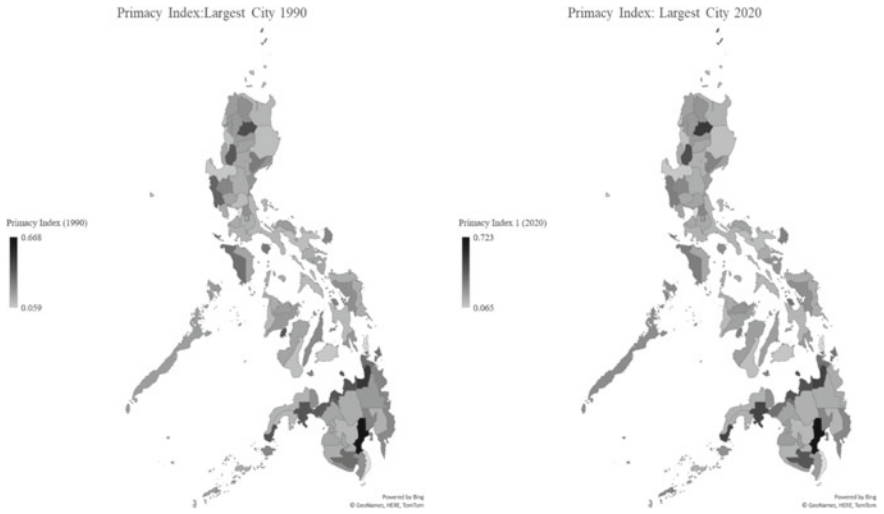

Fig. 8.1 Evolution of primacy index: Largest city share. *Source* Author's own construction

largest city is 9% from 1990–2020. The provinces with the largest increase share of the largest city include Bulacan (86%), Tawi-Tawi (59%), Sorsogon (48%), Palawan (41%), and Batanes (33%). On the other hand, some provinces have seen decline in their share of their largest city: Surigao del Sur (−39%), Guimaras (−28%), Agusan del Sur (−21%), Cebu (−19%), and Zambales (−16%). There are several possible explanations for the decline of the primacy city: faster growth in smaller cities than the biggest cities such as in the case of Cebu and Zambales which both have a metropolitan area; or gerrymandering, the practice of creation new political units such as provinces or cities in order to gain an advantage in the election and extend political power. For example, the province of Dinagat Island is carved out from the province of Surigao del Sur in 2012 (Fig. 8.1).

The analysis of primacy index 2 or the ratio of the biggest city to the second biggest city from 1990–2020 also shows an increasing dominance of the largest city. In general, the ratio of the biggest city to the second largest city increased to 12%. The provinces which experienced the biggest increase in the ratio of their biggest city to the second biggest city include: Palawan (126%), Tawi-Tawi (120%), Bulacan (98%), Batanes (98%), Maguindanao (58%), and Sorsogon (58%). Meanwhile, the provinces in which the ratio of the biggest city to the second biggest city include: Surigao del Sur (−47%), Zambales (−44%), Cebu (−43%), Agusan del Sur (−19%), and Marinduque (−19%) (Fig. 8.2).

Meanwhile, the examination of the rank-size rule distribution suggests growth in secondary cities or municipalities from 1990–2020. However, the average percent change is relatively low at −2%. The provinces which experienced an increase in the q-coefficient include Mountain Province (59%), Kalinga (38%), Cavite (36%), Biliran (35%), and Sorsogon (23%). On the other hand, provinces with the

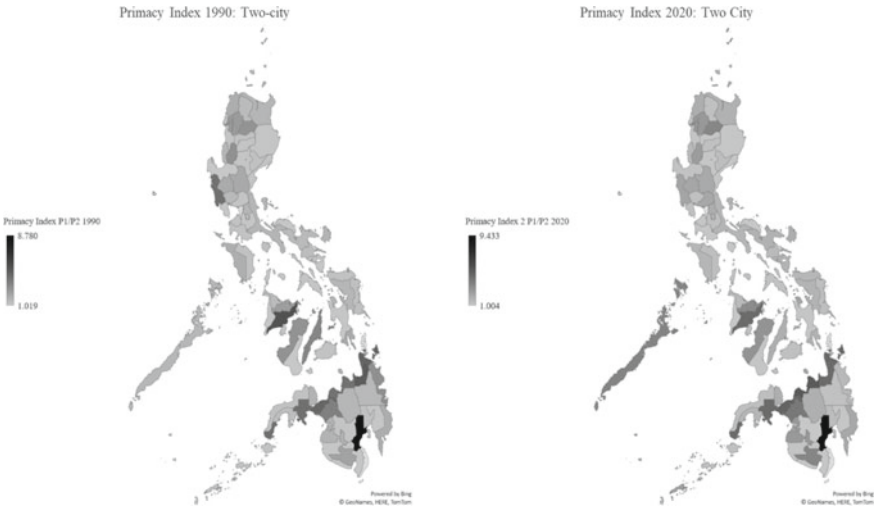

Fig. 8.2 Evolution of primacy index: Two-city. *Source* Author's own construction

highest decline in q-coefficient include Basilan (−88%), Maguindanao (−84%), Davao Del Norte (−76%), Ifugao (−74%), and North Cotabato (−55%). The three provinces of Basilan, Maguindanao, and Tawi-tawi are part of the Bangsamoro Autonomous Region in Muslim Mindanao(BARMM), which experienced a series of reorganizations in cities and municipalities (Figs. 8.3 and 8.4).

The assessment of the city system index (CSI) indicates almost a change from 1990–2020 with only an average percent change of −1%. This suggests that the cities or municipalities have maintained their population size and retain their rank

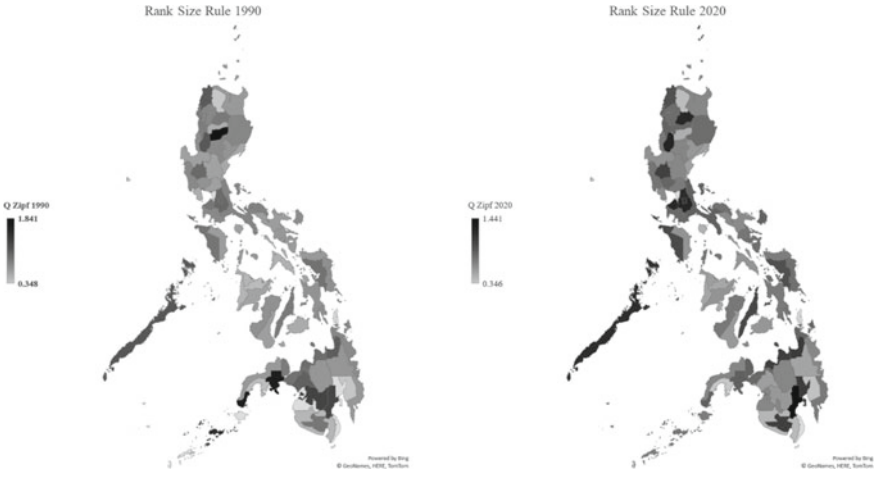

Fig. 8.3 Evolution of rank-size-rule. *Source* Author's own construction

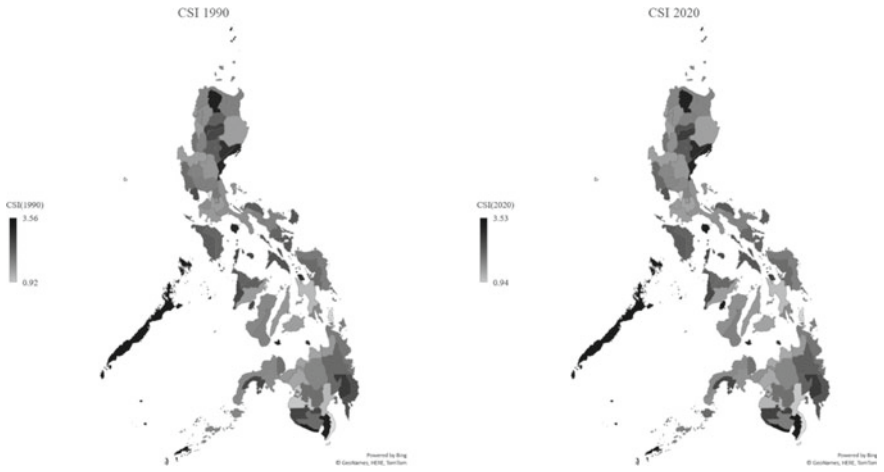

Fig. 8.4 Evolution of city system index. *Source* Author's own construction

in the system. The primary cities have remained big, while small cities or municipalities have not expanded significantly. The provinces with the biggest decline in CSI which means the city system is becoming more concentrated include Kalinga (−19%), Davao del Sur (−14%), South Cotabato (−11%), Mountain Province (−9%), Benguet (−9%), and Cavite (−9%). On the other hand, provinces with increasing CSI or provinces which are becoming more dispersed include Guimaras (38%), Maguindanao (25%), Metropolitan Manila (25%), and Basilan (20%) (Table 8.3).

8.4.4 Relationship Between City System and Socio-Economic Index

A simple correlation analysis is conducted to check the relationship between CSI and specific socio-economic indicators. The correlation values can range from 1 (perfectly positive linear relationship) to −1 (perfectly negative relationship). As expected, most indicators have a significant negative relationship with CSI. According to the findings, provinces with low CSI or a dense urbanization pattern are more likely to have excellent socioeconomic conditions. Provinces with a higher CSI or a more dispersed city system, on the other hand, tend to have adverse socioeconomic conditions (Table 8.4).

As compared to the earlier studies, the result of this study is similar to the case of Sweden and Germany where the city system index is negatively correlated with indicators such as GDP per capita, number of factories, number of full-time and part-time workers, and number of doctors. On the other hand, in the case of Japan, the overall social health estimate has a positive relationship with the city system.

Table 8.3 Highest and lowest change

Primacy index 1		Primacy index 2		Rank-size rule		CSI	
Province	Primacy 1% change (%)	Province	Primacy 2% change (%)	Province	Rank-size % change (%)	Province	CSI %change (%)
Concentration							
Bulacan	86	Palawan	126	Mountain Province	59	Kalinga	−19
Tawi-Tawi	59	Tawi-Tawi	120	Kalinga	38	Davao del Sur	−14
Sorsogon	48	Bulacan	98	Cavite	36	South Cotabato	−11
Palawan	41	Batanes	83	Biliran	35	Mountain Province	−9
Batanes	33	Maguindanao	58	Sorsogon	23	Benguet	−9
South Cotabato	31	Sorsogon	58	Laguna	22	Cavite	−9
Maguindanao	29	South Cotabato	55	Rizal	21	Rizal	−8
Biliran	28	Metropolitan Manila	54	Pampanga	21	Biliran	−8
Bohol	27	Biliran	42	Bataan	21	Batanes	−8
Kalinga	26	Northern Samar	33	Masbate	20	Bulacan	−7
Province	Primacy %Change	Province	%Change	Province	Rank-Size %Change	Province	CSI %change
Dispersion							
Surigao del Sur	−39	Surigao del Sur	−47	Basilan	−88	Guimaras	38
Guimaras	−28	Zambales	−44	Maguindanao	−84	Maguindanao	25
Agusan del Sur	−21	Cebu	−43	Davao del Norte	−76	Metropolitan Manila	25
Cebu	−19	Agusan del Sur	−19	Ifugao	−75	Basilan	20

(continued)

Table 8.3 (continued)

Primacy index 1		Primacy index 2		Rank-size rule		CSI	
Province	Primacy 1% change (%)	Province	Primacy 2% change (%)	Province	Rank-size % change (%)	Province	CSI %change (%)
Zambales	−17	Marinduque	−19	Tawi-Tawi	−74	Marinduque	6
Marinduque	−16	Mountain Province	−14	North Cotabato	−55	Agusan del Sur	6
Lanao del Norte	−9	Iloilo	−13	Sulu	−49	Ifugao	6
Sarangani	−8	Pampanga	−13	Lanao del Sur	−49	Davao del Norte	5
Nueva Vizcaya	−7	Occidental Mindoro	−12	Zamboanga del Sur	−48	Lanao del Norte	4
Aurora	−6	North Cotabato	−11	Marinduque	−26	Sulu	4

Source Author's own construction

Table 8.4 Correlation of city system index and socio-economic index

Variables	Correlations
Income (family)	−0.135
Expenditure (Family)	−0.104
% of Working population	−0.179*
Poverty rate	−0.051
Unemployment rate	0.217**
Gini index	0.024
Number of degree holders	−0.436**
School years (mean)	−0.183*
School years (expected)	0.111
Provincial income	−0.419**
IRA Allotment	−0.477**
Social services (SS) expenditure	−0.443**
% of SS to total expenditure	−0.128
Life expectancy	−0.303**
Number of health workers	−0.503**
Family with sanitary toilet	−0.510**
Family with safe water access	−0.509**
Length of national roads	−0.429**
Length of bridges	−0.423**

**$p < 0.01$ level (2-tailed), * $p < 0.05$ level (2-tailed)
Source Author's own construction

This variation in the result is expected due to possible differences in country-specific conditions.

Based on the relationship between SEI and CSI, there are four distinct types of provinces than can be identified (Figs. 8.5 and 8.6). Type 1 Provinces: High SEI, Low CSI, or provinces with the good socio-economic condition but highly concentrated city system. Type 2 Provinces: High SEI, High CSI, or provinces with good socio-economic condition but relatively dispersed city system. Type 3 Provinces: Low SEI, High CSI, or provinces with inferior socio-economic conditions but dispersed city system. Type 4: Low SEI, Low CSI, or provinces with poor socio-economic conditions but highly concentrated city systems. Various policy suggestions might be offered based on the type of the province. High or low index category is distinguished based on the average. An index value higher than average is classified as high, index value lower than average is categorized as low.

For the Type 1 provinces, there are two subgroups that can be identified. The first subgroup is the provinces located adjacent to Metro Manila such as Batangas, Cavite, Rizal, and Laguna. The second subgroup is the provinces that have metropolitan areas such as Cebu, Davao, Iloilo, Negros Occidental, and Pangasinan. For Type 1

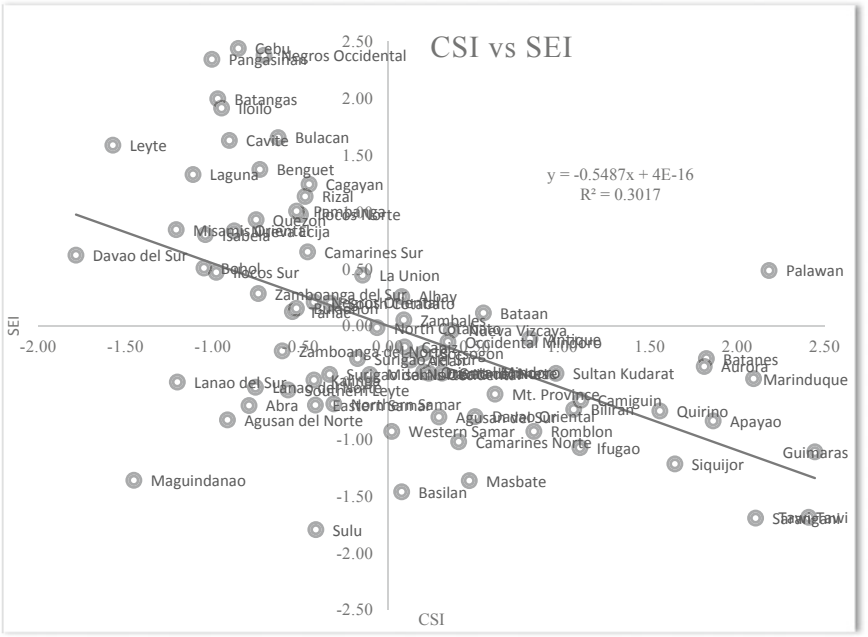

Fig. 8.5 Relationship between city system index and socio-economic index. *Source* Author's own construction

provinces, policies that can sustain economic density and manage possible congestion problems should be promoted. Type 1 provinces can also be considered as good alternative locations and hold potential to absorb economic activities or investments that might be driven out from the capital. The Philippines government has already taken into consideration the development of these secondary centers and has implemented policy measures. The Digital Cities Program, a public and private sector effort which aims to develop second and third-tier cities to host IT-BPO investments. With regard to the metropolitan areas, there is no established metropolitan governance system except for the Metro Manila Development Authority (MMDA). Provinces with metropolitan areas should also consider establishing an intergovernmental network that would facilitate planning and management (Ortega et. al., 2015).

There are very few provinces that can be categorized as Type 2 provinces: Albay, Bataan, Palawan, and Zambales. For type 2 provinces, policies that can maintain good socio-economic conditions or expand economic density or functions through a network should be encouraged. Following the logic of city network theory, these provinces have the potential to "borrow size" in which they can perform functions traditionally carried out by large and dense provinces if they are linked to other provinces. Connectivity to other provinces can be enhanced mainly through infrastructure development or intergovernmental cooperation.

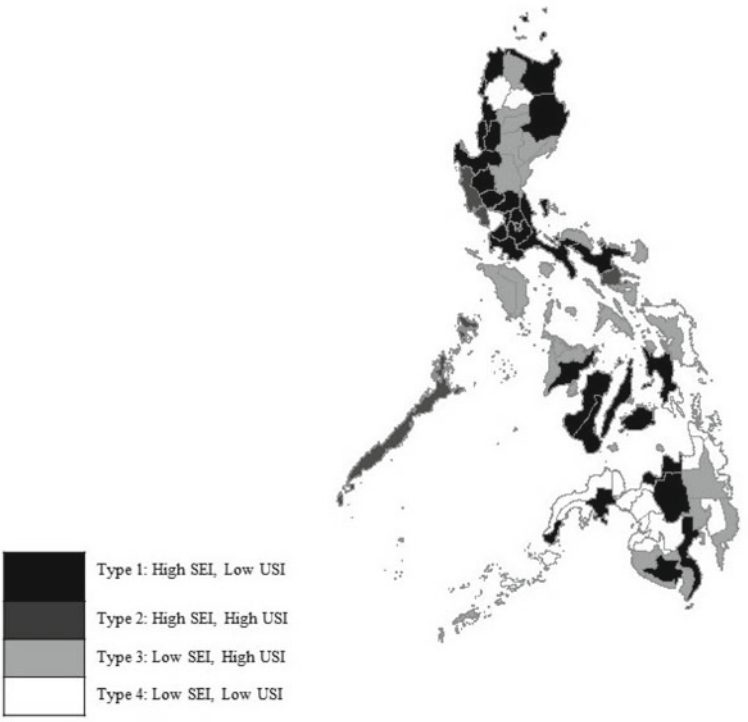

Fig. 8.6 Types of provinces

For type 3 provinces, there are two distinct subgroups that can be identified under type 3 category: island provinces such as Masbate, Sarangani, Tawi-tawi, Siquijor, and Guimaras; and landlocked provinces such as Apayao, Ifugao, and Mt. Province. Most of the provinces under this category are also often found at the bottom of the ranking in some socio-economic indicators. For type 3 provinces, policies that can create economic mass and overcome geographical distance should be promoted. The policy framework of the World Development Report 2009 for lagging areas is applicable to this category. Based on the framework, these provinces should prioritize "spatially-blind" policies such as effective land market, education and health programs, safe water, and sanitation. In the case of the Philippines, the provision of several basic social services is devolved to local government such as health, education, local infrastructure, and environmental management. However, there is an apparent mismatch between the cost of devolved functions and the availability of resource funding, thus further posing development hurdles for type 3 provinces. In particular, provinces were assigned with 37 percent of the cost but were given only 23 percent of the IRA; municipalities 38.5 percent of the total cost and 34 percent of IRA share, cities, 5.7 of the total cost and 23 percent of IRA share (Manasan, 2007).

There are various proposals that call for the re-evaluation of IRA to reflect a more equitable intergovernmental transfer.

Type 4 provinces have unfavorable socio-economic conditions but a highly concentrated urban system. The majority of the provinces are in Mindanao: Basilan, Maguindanao, Lanao del Sur, Agusan del Note, and Sulu. With the exception of Agusan del Norte, all of these provinces are located in Bangsamoro Autonomous Region in Muslim Mindanao (BARMM). BARMM is the only autonomous region in the country, however, prolonged period of conflicts poses significant development challenges. Similar to type 3 provinces, many of these provinces have consistently fare poorly in several socio-economic indicators. For type 4 provinces, policies that can improve the socio-economic condition and manage density and congestion should be prioritized. The WDR 2009 policy framework for densely populated lagging areas is useful for this category. The policy framework recommends spatially blind institutions such as basic social services and spatially-connective infrastructure such as infrastructure and information and communication services.

8.4.5 Summary and Conclusion

This study shows the structure of the urban system in provinces from 1990–2020 using different techniques. The evaluation of the share of the largest city to the total population of the provinces from 1990–2020 reveals an increasing trend with an average increase in the share of the largest city of 9%. The analysis of primacy index 2 or the ratio of the biggest city to the second biggest city from 1990–2020 also shows an increasing dominance of the largest city with an average increase 12%. Meanwhile, the examination of the rank-size rule distribution suggests growth in secondary cities or municipalities from 1990–2020 but the average percent change is relatively low at −2%. The assessment of the city system index (CSI) indicates almost a change from 1990–2020 with only an average percent change of −1%.

This study also establishes the link between the city system and socio-economic conditions. Provinces with a city system in which the population and cities are concentrated tend to have better socio-economic conditions. While provinces with an urban system in which population and cities are dispersed are likely to have an inferior socio-economic condition. This study also outlines policy recommendations based on the relationship between the urban system and socio-economic conditions.

Given the limitation of the current study, future tasks and research areas can be identified. First, this study only employs data from the 1990s-2020, longer time frame can be considered to better capture the transformation in both the urban system and socio-economic conditions. Second, this study provides a description the structure of the city system in the Philippines, however, it would be noteworthy to conduct a study which examines the possible determinants of the city system structure. Third, this study focuses on only one country, a comparative study between or among countries can also be carried out. For example, a comparative study between countries that share some similarities, like the island nations of the Philippines and Indonesia.

Fourth, the link between the urban system and resiliency can also be explored. The study of resiliency is a relevant topic, particularly in the context of an island nation like the Philippines, which are highly susceptible to natural calamities. And lastly, the dynamics between the city system and economic zones can also be examined. Economic zones are often as a regional development tool in many countries and have implications on the structure of the urban system.

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